

Analysis of *Disaster Risk Management in Colombia*

A Contribution to the Creation
of Public Policies

Coordinators and Editors

Ana Campos G., Niels Holm-Nielsen, Carolina Díaz G., Diana M. Rubiano V., Carlos R. Costa P., Fernando Ramírez C. and Eric Dickson



THE WORLD BANK
COLOMBIA



GFDRR
Global Facility for Disaster Reduction and Recovery

Analysis of *Disaster Risk Management in Colombia*

A Contribution to the Creation
of Public Policies

Coordinators and Editors

Ana Campos G., Niels Holm-Nielsen, Carolina Díaz G., Diana M. Rubiano V.,
Carlos R. Costa P., Fernando Ramírez C., and Eric Dickson



THE WORLD BANK
COLOMBIA



GFDRR
Global Facility for Disaster Reduction and Recovery



THE WORLD BANK
COLOMBIA

Analysis of Disaster Risk Management in Colombia: A Contribution to the Creation of Public Policies

Copyright © 2011 by International Bank for Reconstruction and Development /
The World Bank.
1818 H Street, N.W.
Washington, DC 20433, USA
Internet: www.worldbank.org/co

All Rights Reserved

This book was originally published by The World Bank in Spanish as *Análisis de la gestión del riesgo de desastres en Colombia: un aporte para la construcción de políticas públicas*.

The findings, interpretations, and conclusions expressed in this book are entirely those of the authors and should not be attributed in any manner to the World Bank or Global Facility for Disaster Reduction and Recovery (GFDRR), to its affiliated organizations, or to members of its Board of Executive Directors or the countries they represent.

The World Bank and Global Facility for Disaster Reduction and Recovery (GFDRR) do not guarantee the accuracy of the data included in this publication and accept no responsibility for any consequence of their use. The boundaries, colors, denominations, and other information shown on any map in this volume do not imply on the part of the World Bank Group any judgment on the legal status of any territory or the endorsement or acceptance of such boundaries.

Rights and Permissions

The material in this publication is copyrighted. The World Bank and Global Facility for Disaster Reduction and Recovery (GFDRR) encourage dissemination of its work and normally will promptly grant permission to reproduce portions of the work. For permission to reprint individual articles or chapters, please fax a request with complete information to Fernanda Zavaleta, Communications Officer – The World Bank Colombia and Mexico, fax (55) 5480-4222. All other queries on rights and licenses should be addressed to the Communications Officer.

The World Bank

Design: Marcela Godoy

Proofreading and editing: Zuzana Johansen, Carolina de Los Angeles Ferrer.

Cover photo: Floods. Municipality of Chia (Cundinamarca, Colombia), 2011.

Image credit: Regional Autonomous Corporation of Cundinamarca.

Photos: Gabriel J. Arango Z., Nilson Correa B., Colombian Geological Survey, Colombian Ocean Commission.

Analysis of Disaster Risk Management in Colombia: A Contribution to the Creation of Public Policies. -- Bogota, Colombia: The World Bank: GFDRR, 2012.

402 p. : il.

333.3109861/A56

1. Resettlement prevention – Natural disasters – Colombia – Public policies – 2. Natural disasters – Resettlement prevention – Colombia – Public policies. – 3. Colombia – Resettlement prevention – Natural disasters – Public policies

PREFACE

LIKE MANY COUNTRIES IN LATIN AMERICA, Colombia faces great challenges that seriously threaten its development. Factors such as population displacement from rural to urban areas, environmental degradation, and rapid changes in land use amplify these challenges. These socioeconomic conditions, together with the country's tendency to be affected by natural phenomena such as earthquakes, floods, and landslides, among others, aggravated by human activity and varying climate conditions, confirm a continuous construction process and risk accumulation. The materialization of these risks on disasters affects the country's development, obstructing and delaying the achievement of the social welfare goals set by the Government.

As a result of the immense losses caused by the La Niña phenomenon in 2010-2011, and within the scope of the agenda on disaster risk management that the World Bank has maintained since 1999 with the Colombian Government, the National Planning Department requested the support of this institution to conduct a comprehensive assessment of the risk management policies and make short- and long-term strategic recommendations to help reduce the disaster's impact on the population and the economy.

This is the first time that a Disaster Risk Management Analysis is carried out in Latin America within the context of development policies in a country where traditionally the Bank has conducted these types of studies from an environmental perspective or from the different sectors.

This report, which is not limited to analyzing the risk causes or measuring their growth, is the result of a joint effort with multiple public and private agents. It goes into depth in the institutional advances in risk management at different government levels, and explains how this issue has been incorporated in the territorial and sectoral public administration. Additionally, it indicates the immense opportunities to articulate disaster risk management in current planning, investment, monitoring and control instruments, and makes evident the need to define public and private responsibility as part of the strategy in reducing the State's fiscal vulnerability.

In summary, the study shows that if the country does not want stagnation in its economic growth due to more frequent losses and at a greater scale, a radical change is essential in development policies and in territorial and sectoral management practices. Therefore, this document defines a set of recommendations so that disaster risk management becomes a State policy, emphasizing that improving land use and land occupation conditions is a priority in reducing the impact of disasters.

We wish to express our gratitude on behalf of the World Bank to the Government of Colombia for the trust given to us in requesting that we carry out this study. Likewise, I am grateful to everyone who contributed in one way or another with their formulations and comments. Special thanks as well to the Global Facility for Disaster Reduction and Recovery (GFDRR) for their financial support in making this study possible.

I invite State authorities, responsible for policy and development processes, to incorporate the criteria for risk reduction in all their practices, to encourage the participation of those who have not traditionally been involved in this problem, and to technically and financially join the local and regional governments in creating new intervention strategies in order to build a country based on safety criteria in facing disaster risks.

GLORIA GRANDOLINI

Director for Mexico and Colombia

World Bank

ACKNOWLEDGMENTS

Analysis of Disaster Risk Management in Colombia: A Contribution to the Creation of Public Policies is the result of World Bank work started in March 2011 at the request of the Colombian government through the National Planning Department. Numerous entities and professionals interested in the subject participated and an important group of collaborators made possible the materialization of the current document. The team especially wishes to thank Gloria M. Grandolini (Country Director, Colombia and Mexico - World Bank), Ede Jorge Ijjasz-Vásquez (Sector Manager for the Sustainable Development Department for Latin America and the Caribbean Region - World Bank), Guang Zhe Chen (Sector Manager for Urban, Water and Sanitation, and Disaster Risk Management for Latin America and the Caribbean Region - World Bank), Geoffrey Bergen (Resident Representative in Colombia - World Bank) and Daniel Sellen (Sector Manager for the Sustainable Development Department for Colombia - World Bank) for their unconditional support.

Project Coordinators

The project was developed under the leadership of Niels Holm-Nielsen (Disaster Risk Management Coordinator for Latin America and the Caribbean Region - World Bank) and Eric Dickson (Project Manager for Colombia).

Leading Authors and Editors

The paper was prepared by a groups of World Bank specialists in disaster risk management led by Ana Campos García, Carolina Díaz Giraldo, Diana Marcela Rubiano Vargas, Carlos Rufino Costa Posada, and Fernando Ramírez Cortés - World Bank.

Team

The complete work team included: OSSO Corporation's Andrés Velásquez, Fernando Ramírez Gómez, Cristina Rosales Climent, Nayibe Jiménez Pérez, Diana Mendoza González, William Burbano, Natalia Díaz Ayala, Jorge Eduardo Mendoza Cifuentes, Henry Adolfo Peralta Buriticá, and Mauricio Bautista Arteaga. Individual consultants in different disciplines: Víctor Manuel Moncayo Cruz, Carmenza Saldías Barreneche, María Isabel Toro Quijano, Amparo Velásquez Peñaloza, Juanita López Peláez, Jaime Iván Ordoñez Ordoñez, Jorge Alberto Serna Jaramillo, José Edier Ballesteros Herrera, Carlos Eduardo Vargas Manrique, Doris Suaza Español, Leonardo Morales Rojas, Elvira Milén Agámez Cárdenas, Ernesto Betancourt Morales, Ana María Torres Muñoz, and Alejandro Vega; and the following World Bank officials: María Clara Ucrós, Daniel Alberto Manjarrés, Karina M. Kashiwamoto, and Ana F. Daza.

Reviewers

The team received support and comments from Daniel Sellen (World Bank), Diego Arias Carballo (World Bank), Lars Christian Moller (World Bank), Mauricio Cuéllar Montoya (World Bank), Andrew Maskrey (UNISDR), Ricardo Mena (UNISDR), Allan Lavell (Senior Consultant in Disaster Risk Management), Omar Darío Cardona Arboleda (Senior Consultant in Disaster Risk Management), and Lizardo Narváez Marulanda (Consultant in Disaster Risk Management).

National Government Collaborators

The Colombian Government through the National Planning Department (DNP), National Unit for Disaster Risk Management (UNGRD), and the following Ministries: Environment and Sustainable Development (MADS); Housing, Cities, and Territory

(MVCT); Agriculture and Rural Development (MADR); Transportation (MT); Mines and Energy (MME); Health and Social Protection (MSPS); Finance and Public Credit (MHCP); and National Education (MEN), helped the team to carry out the present study. In addition, entities such as the Colombian Geological Survey (SGC); the Colombian Institute of Hydrology, Meteorology, and Environmental Studies (Ideam); the Colombian Ocean Commission (CCO); the National Statistics Department (DANE), and the Agustín Codazzi Geographic Institute (IGAC), offered fundamental contributions in preparing the study and actively participated in its review. It is important to mention the contribution of some officials of these institutions and other entities: Hernando José Gómez Restrepo (DNP), Mauricio Santa María Salamanca (DNP), Juan Mauricio Ramírez Cortés (DNP), Carolina Urrutia Vásquez (DNP, from July 2011), Giampiero Renzoni Rojas (DNP, up to July 2011), Alexander Martínez Montero (DNP), Nilson Correa Bedoya (DNP), Claudia Patricia Satizabal Robayo (DNP), María Salomé Ruíz Alvarado (DNP), Jean Philippe Penning (DNP), Pedro Luis Jiménez (DNP), José Alejandro Bayona (DNP), Augusto César Pinto (DNP), Nicolás Pérez Marulanda (DNP), Samuel Zambrano (DNP), Camilo Jaramillo (DNP), Katty De Oro (DNP), Julio César Jiménez (DNP), Carlos Iván Márquez Pérez (UNGRD), Richard Alberto Vargas Hernández (UNGRD), Perla Haydee Rueda (UNGRD), Jairo Enrique Bárcenas Sandoval (UNGRD), Marta Lucía Calvache Velasco (SGC), María Mónica Arcila Rivera (SGC), María Luisa Monsalve Bustamante (SGC), Iván Darío Gómez (IGAC), Camila Romero Chica (CCO), Ricardo Lozano (Ideam), Ernesto Rangel Mantilla (Ideam), Omar Franco (Ideam), Claudia Milena Álvarez Londoño (Ideam), Dorotea Cardona Hernández (Ideam), María Constanza García (MT), Gloria Sánchez (MT), Juan Camilo Granados (MT), Carla Viviescas (MT), Magda Constanza Buitrago Ríos (MT), Lyda Milena Esquivel Roa (Invías), Carlos Castaño (MADS), Luis Alfonso Sierra (MADS), Javier Pava (MADS), Luis Roberto Chiappe (MADS), Claudia Lucía Ramírez (MVCT), Carlos Ariel Cortés (MVCT), Claudia Mora (ex-Water Viceminister), Augusto Ardila (MSPS), Luis Eduardo Arango (MHCP), Sandra Rodríguez (MHCP), Lina Marcela Tami (MADR), Samira Alkhatib (MADR), Elizabeth Arciniegas (MADR), Eudes de Jesús Velásquez (MADR), Juan Carlos Ortega (Agrarian Bank), Mara Bigitthe Bravo (MEN), Dinora Carolina Cortés (MEN), Juan Pablo Morales (MEN), and Andrés E. Taboada (MME).

Likewise, the study included the participation of many other representatives from the entities mentioned above during the course of the interviews and the workshops.

Collaborators

Organizations such as the Colombian Federation of Municipalities (FCM), the Association of Regional and Autonomous Sustainability Corporations, the Colombian Agrarian Society (SAC), the Colombian Construction Chamber (Camacol), the Colombian Federation of Insurers (Fasecolda), and the Colombian Infrastructure Chamber (CCI), aided in the collection of data, offered important contributions in its preparation, and actively participated in the study. The team is especially grateful to Fernando Enciso Herrera (FCM), Ramón Leal Leal (Asocars), Maria I. Vanegas (Asocars), Rafael Mejía López (SAC), Luis Fernando Forero Gómez (SAC), Camilo Congote Hernández (Camacol), Carlos Varela (Fasecolda), Juan Martín Caicedo Ferrer (CCI), and Sandra Silva Serna (CCI).

The team would also like to extend its appreciation to those who provided valuable input for the information they received from interviewing numerous public and private entities in case studies in the following cities: Bogotá, Cali, Medellín, Barranquilla, Manizales, and Cucuta, and regions such as La Mojana and Canal del Dique, as well as the Sinu and Bogotá River basins.

Funding

Finally, special thanks to the Global Facility for Disaster Reduction and Recovery (GFDRR) for funding the base studies of this report.

CONTENTS

| | |
|--|------------|
| PREFACE | <i>v</i> |
| ACKNOWLEDGMENTS | <i>vii</i> |
| INTRODUCTION | <i>1</i> |
| | |
| 1. PERFORMANCE OF DISASTER RISK MANAGEMENT IN COLOMBIA | <i>11</i> |
| 1.1. Overall Aproximation to Risk Management in Colombia | <i>13</i> |
| 1.2. Exposure and Vulnerability as Main Factors in the Growth of Geological Risks | <i>21</i> |
| 1.2.1. Geological phenomena, infrequent events of great impact | <i>21</i> |
| 1.2.2. Seismic and volcanic risks are increasing due to the growth of exposed infrastructure and the lack of strategies to diminish the existing vulnerability | <i>23</i> |
| 1.2.3. Geographic distribution of the hazard, exposure, vulnerability, and relative risk in facing earthquakes | <i>25</i> |
| 1.2.4. Losses caused by volcanic phenomena, a risk not yet estimated | <i>30</i> |
| 1.3. Gaps in Land Use Planning in Basins and Urban Zones, and Exposure Growth are the Main Factors in Hydrometeorological Risk | <i>35</i> |
| 1.3.1. Landslides and floods accumulate the greatest percentage of loss of life and housing destroyed respectively | <i>35</i> |
| 1.3.2. Factors such as climate variation and deficits in land use planning processes at the rural and urban level lead to an increase in susceptibility to floods and flash floods | <i>36</i> |
| 1.3.3. Geographical distribution of hazard, exposure, vulnerability and relative risk in facing floods | <i>42</i> |
| 1.3.4. Geographic distribution of hazards, exposure, vulnerability, and relative risk in facing landslides | <i>47</i> |
| 1.3.5. Climate change and El Niño and La Niña phenomena | <i>50</i> |

| | |
|---|---------------|
| 1.4. The Impact of Historical Disasters in Colombia | 53 |
| 1.4.1. Geographic distribution of registered historical events and loss of life by region | 53 |
| 1.4.2. Historical losses by productive and service sectors | 56 |
| 1.4.2.1. <i>Housing sector</i> | 56 |
| 1.4.2.2. <i>Transportation sector</i> | 59 |
| 1.4.2.3. <i>Agriculture sector</i> | 61 |
| 1.5. Conclusions of Risk Performance in Colombia | 63 |
| 1.6. Recommendations to Face the Risk in Colombia | 69 |
| 2. DISASTER RISK IN PUBLIC ADMINISTRATION | 73 |
| 2.1. Public Administration Elements Applied to Disaster Risk Management: Conceptual Framework | 75 |
| 2.1.1. Disaster risk management as a fundamental strategy for development sustainability | 75 |
| 2.1.2. Disaster risk management and adjustment to climate change as complementary approaches for sustainable development | 76 |
| 2.1.3. The institutionalism of public administration in disaster risk | 77 |
| 2.1.4. The absence of a national policy in risk management | 77 |
| 2.1.5. Spheres of action in territorial and sectoral risk management | 79 |
| 2.1.6. Planning as the principal instrument in territorial and sectoral risk management | 81 |
| 2.1.7. The need to rely on a monitoring and control system in disaster risk management | 82 |
| 2.1.8. The importance of results-based management | 83 |
| 2.2. Disaster Risk Management Regulatory Support | 85 |
| 2.2.1. The National System for Disaster Prevention and Response (SNPAD), its main regulatory body, and the Constitution of 1991 | 85 |
| 2.2.2. Structural norms for disaster risk management | 90 |
| 2.3. SNPAD Institutional Mechanisms, Structures, and Capacities | 94 |
| 2.3.1. Local government responsible for territorial management, thereby, the main actor in disaster risk management | 97 |
| 2.3.2. The regional/departmental level as a coordination and intermediation agency between the nation and the municipalities | 107 |
| 2.3.3. The nation as a policy and strategic orientation promoter | 111 |

| | |
|---|----------------|
| 2.4. RISK management planning | 121 |
| 2.5. Financial Instruments and Investment in Risk Management | 126 |
| 2.5.1. Instruments and financial resources | 126 |
| 2.5.2. Analysis of investments at the different territorial levels | 127 |
| 2.6. A Compulsory Step: the Evolution of the System Toward a Process Approach | 132 |
| 2.6.1. Articulation among systems | 132 |
| 2.6.2. Integral vision of the processes by type of risk | 138 |
| 2.6.2.1. <i>Regulated seismic risk, even though there is no policy for its reduction</i> | 138 |
| 2.6.2.2. <i>The risk of floods, without sufficient policies or regulations to control them and without a clear role for those responsible for managing them</i> | 140 |
| 2.7. Recommendations and Great Challenges to Strengthen Risk Management Governance | 143 |
| 3. THE ROLE OF TERRITORIAL ADMINISTRATION IN DISASTER RISK MANAGEMENT | 159 |
| 3.1. Territories in Disaster Risk Management: Fundamental Concepts | 161 |
| 3.2. Incorporation of Risk Management in Territorial Administration at the Local Level | 165 |
| 3.2.1. Characteristics of urban territories | 165 |
| 3.2.2. Causes and consequences of generation and accumulation of risk conditions | 165 |
| 3.2.3. Social agents in the generation and reduction of risk conditions | 170 |
| 3.2.4. Use and effectiveness of public administration and risk management instruments in local territorial administration | 172 |
| 3.2.4.1. <i>Use and effectiveness of policy and planning instruments</i> | 172 |
| 3.2.4.2. <i>Use and effectiveness of financing instruments</i> | 174 |
| 3.2.4.3. <i>Use and effectiveness of instruments for monitoring and control</i> | 177 |
| 3.2.4.4. <i>Knowledge and information for risk management</i> | 178 |
| 3.2.4.5. <i>Reduction of risk conditions</i> | 179 |
| 3.2.4.6. <i>Disaster management</i> | 182 |

| | |
|--|----------------|
| 3.3. Risk Management Incorporation in the Administration of Territory at the Regional Level | 188 |
| 3.3.1. Characterization of the regional territories in function of their water systems | 188 |
| 3.3.2. The causes that generate and accumulate risk conditions in the basins | 193 |
| 3.3.3. Social agents in the generation and reduction of regional risk conditions | 198 |
| 3.3.4. Use and effectiveness of risk management and public instruments in the administration of regional territories | 201 |
| 3.3.4.1. <i>Use and effectiveness of public administration instruments</i> | 201 |
| 3.3.4.2. <i>Use and efficiency of risk management instruments</i> | 203 |
| 3.4. Recommendations to Strengthen Territorial Management | 208 |
| 4. DISASTER RISK MANAGEMENT IN SECTORAL ADMINISTRATION | 215 |
| 4.1. The Impact and Causes of Risk in Sectors and its Significance in the Economy and Society | 217 |
| 4.1.1. The housing sector: loss of life and family patrimony | 218 |
| 4.1.2. The agriculture sector: great potential in employment, foreign currency, and rural development at risk | 221 |
| 4.1.3. The transportation sector: the largest direct losses to the State's patrimony | 226 |
| 4.1.4. Safe drinking water and basic sanitation sector: indirect impacts difficult to calculate | 230 |
| 4.1.5. The education sector: long-term socioeconomic impacts | 235 |
| 4.1.6. Health and social protection sector | 236 |
| 4.2. Risk Management in Sectoral Public Administration | 238 |
| 4.2.1. Risk management in regulation and sectoral policies | 238 |
| 4.2.2. Sectoral institutions in risk management | 244 |
| 4.2.3. Sources of risk management financing at the sectoral level | 245 |
| 4.2.4. Information and knowledge of risk at the sectoral level | 248 |
| 4.2.5. Risk reduction in sectors | 249 |
| 4.2.6. The role of sectors in creating a culture of responsibility in facing risk | 254 |
| 4.2.7. Sectoral administration in disaster response | 255 |

| | |
|--|-----|
| 4.3. Financial Protection: The Responsibility of the Government | |
| Finance Sector | 259 |
| 4.3.1. Advances and limitations in financial protection in Colombia | 260 |
| 4.3.2. Examples of instruments used by the Colombian government to increase risk transfer to private sector | 266 |
| 4.3.3. Funding needs for the State's response to disasters | 267 |
| 4.3.4. Progress and considerations in the creation of a fiscal management strategy for the State's response to disasters | 271 |
| 4.4. Recommendations for Strengthening Public Sectoral Management | 275 |

5. PUBLIC AND PRIVATE RESPONSIBILITY IN DISASTER RISK MANAGEMENT 283

| | |
|---|-----|
| 5.1. The Need to Establish Limits Between Public and Private Responsibility | 285 |
| 5.1.1. The current gray area between public and private responsibility | 286 |
| 5.1.1.1. <i>Responsibility of the government</i> | 286 |
| 5.1.1.2. <i>Responsibility of private agents as generators of public risk</i> | 288 |
| 5.1.1.3. <i>Responsibility of citizens in managing their own risk</i> | 290 |
| 5.1.2. Government fiscal contingencies related to lack of clarity in policy frameworks | 290 |
| 5.1.2.1. <i>Contingencies in post-disaster assistance and recovery programs due to lack of clarity in policies</i> | 290 |
| 5.1.2.2. <i>Fiscal contingencies in lawsuits against the government due to lack of clarity in regulations concerning public and private responsibility in risk management</i> | 292 |
| 5.2. Colombian Citizens and Risk Management | 293 |
| 5.2.1. Citizens' perception of risk | 294 |
| 5.2.2. The perception of citizens and the Government's responsibility | 296 |
| 5.3. The Colombian Private Sector Facing Risk Management | 302 |
| 5.3.1. The private sector as risk generator and the responsibility for risk management | 302 |
| 5.3.2. Private sector and its own risk management | 303 |
| 5.3.2.1. <i>Institutional and regulatory development for occupational risks is effective for workers</i> | 303 |
| 5.3.2.2. <i>An important part of the physical infrastructure of the production sector is at risk</i> | 303 |
| 5.3.2.3. <i>The agriculture sector has a modest management of its risk, despite being one of the most vulnerable</i> | 304 |

| | |
|--|------------|
| 5.4. Recommendations to Achieve a Balance Between Private and Public Responsibility for Risks and Disasters | 307 |
| 6. FINAL CONCLUSIONS AND RECOMMENDATIONS TO STRENGTHEN DISASTER RISK MANAGEMENT | 311 |
| APPENDIXES. FROM PLANNING TO IMPLEMENTING DISASTER RISK MANAGEMENT IN COLOMBIA | 343 |
| A.1. Investments in Disaster Risk Management | 345 |
| A.1.1. The State's investment in disaster risk management | 345 |
| A.1.2. Regional investment in disaster risk management | 351 |
| A.1.3. Local investment in disaster risk management | 356 |
| A.2. Progress in Disaster Risk Management | 361 |
| A.2.1. Progress in risk management at the national level | 361 |
| A.2.2. Progress in risk management at regional level | 369 |
| A.2.3. Progress in risk management at local level | 371 |
| A.3. Perception of Progress at Each of the Territorial Levels | 374 |
| BIBLIOGRAPHY | 381 |
| ABBREVIATIONS AND ACRONYMS | 395 |

FIGURES

CHAPTER 1

| | |
|--|----|
| Figure 1.1. UBN and GDP Distribution | 17 |
| Figure 1.2. Distribution of the hazard, population exposure, vulnerability, and relative risk facing seismic activity | 28 |
| Figure 1.3. Distribution of recent volcanism in Colombia | 31 |
| Figure 1.4. Exposure to volcanic risk. North segment: Cerro Bravo-Machin Volcanic Province | 32 |
| Figure 1.5. Exposure to volcanic risk. Medium segment: Coconucos-Doña Juana Volcanic Province | 32 |
| Figure 1.6. Exposure to volcanic risk. South segment: Cauca-Patia Inter-Andean Depression | 33 |
| Figure 1.7. Comparison of land use in 1970 and 2000 | 39 |
| Figure 1.8. Social processes in creating risk as adopted from the PAR model | 42 |
| Figure 1.9. Zones susceptible to floods, exposed population, vulnerability, and relative risk | 44 |
| Figure 1.10. Landslide hazards, population exposure, vulnerability, and relative | 48 |
| Figure 1.11. Housing destroyed and affected per 100,000 inhabitants 2001-2010 | 55 |
| Figure 1.12. Housing destroyed by hydrometeorological phenomena, according to UBN | 65 |
| Figure 1.13. Vulnerability, rurality indices, and Millennium Development Goals | 66 |

CHAPTER 2

| | |
|--|-----|
| Figure 2.1. Conceptual outline of the articulation of public administration and risk management | 80 |
| Figure 2.2. Monitoring stages in public interventions | 84 |
| Figure 2.3. Structural norms for disaster risk management | 91 |
| Figure 2.4. National System for Disaster Prevention and Response (SNPAD) | 95 |
| Figure 2.5. Municipal organization | 101 |

| | |
|---|-----|
| Figure 2.6. Overall average rating of risk management by territorial level | 131 |
| Figure 2.7. Outline of those responsible for risk management in public administration, horizontal articulation in Committees and vertical articulation in sectors or systems | 137 |
| Figure 2.8. Process for seismic risk management | 139 |
| Figure 2.9. Ten steps to design, create, and support a results-based monitoring and evaluation system | 150 |

CHAPTER 3

| | |
|---|-----|
| Figure 3.1. Colombia's hydrographic zoning | 188 |
|---|-----|

CHAPTER 4

| | |
|--|-----|
| Figure 4.1. Road sections with frequent emergency attention | 229 |
|--|-----|

APPENDIXES

| | |
|--|-----|
| Figure A.1. Incorporation of risk management in land use planning | 368 |
|--|-----|

GRAPHS

CHAPTER 1

| | |
|--|----|
| Graph 1.1. Area and population exposed to landslides, earthquakes and floods in Colombia | 13 |
| Graph 1.2. Urban population growth | 15 |
| Graph 1.3. Loss of life and housing per 100,000 inhabitants, 1970-2011 | 20 |
| Graph 1.4. Losses (deaths and destroyed housing) per hydrometeorological and geological event, 1970-2011 | 22 |
| Graph 1.5. Relation between destroyed housing and loss of life, 1970-2011 | 23 |
| Graph 1.6. Comparison of the areas constructed in the country's capital cities | 24 |
| Graph 1.7. Possible maximum losses caused by seismic activity in the whole country for different return periods | 26 |

| | |
|---|----|
| Graph 1.8. Losses for Colombian cities resulting from seismic activity for a return period of 500 years for | 27 |
| Graph 1.9. Losses per type of event, 1970-2011 | 35 |
| Graph 1.10. Housing destroyed and loss of life per 100,000 inhabitants, by municipal population, 2001-2010 | 36 |
| Graph 1.11. Probable maximum losses in the agriculture sector caused by floods for a return period of 500 years, by department | 46 |
| Estimate of economic losses caused by floods | 46 |
| Graph 1.12. La Niña and El Niño phenomena vs annual histogram of losses registered by hydrometeorological phenomena | 50 |
| Graph 1.13. Distribution of losses by department according to number of registries, loss of life, destroyed and affected housing | 54 |
| Graph 1.14. Invías investments in emergencies | 60 |

CHAPTER 2

| | |
|--|-----|
| Graph 2.1. Comparison of the total national, departmental, and municipal investment in risk management, 1998-2010 | 128 |
| Graph 2.2. Investment in risk management for each priority area by governmental level | 129 |

CHAPTER 3

| | |
|---|-----|
| Graph 3.1. Distribution of urban and rural population. Case studies, 2010 | 167 |
| Graph 3.2. Unsatisfied Basic Needs. Case studies, 2010 | 167 |
| Graph 3.3. Number of disaster events registered in cities under study, 1970-2011 | 169 |
| Graph 3.4. Percentage of disaster events in cities under study, 1970-2011 | 169 |
| Graph 3.5. Number of events registered in recent years in the cities under study | 170 |
| Graph 3.6. Investments in risk management by category. Case studies, 2002-2008 | 176 |
| Graph 3.7. Quantitative and qualitative housing deficit. Case studies, 2010 | 180 |
| Graph 3.8. Number of houses in nonmitigable high-risk areas. Case studies, 2010 | 180 |

| | |
|--|-----|
| Graph 3.9. Urban-rural population distribution. Case study, 2010 | 193 |
| Graph 3.10. Regional Unsatisfied Basic Needs. Case studies (UBN as of December 31, 2008) | 193 |
| Graph 3.11. Quantitative and qualitative regional housing deficit. Case Studies, 2010 | 195 |
| Graph 3.12. Register of disaster events by number. Case studies, 1970-2011 | 197 |
| Graph 3.13. Register of disaster events by percentage. Case studies, 1970-2011 | 198 |
| CHAPTER 4 | |
| Graph 4.1. Percentage of destroyed housing vs. loss of life per 100,000 inhabitants | 219 |
| Graph 4.2. Housing started per year in the country | 220 |
| Graph 4.3. Agriculture sector contribution to the national GDP, 2001-2009 | 221 |
| Graph 4.4. Agriculture sector participation in exports (tons), 2002-2009 | 221 |
| Graph 4.5. Hydrometeorological emergencies in the agriculture sector, 1970-2011 | 223 |
| Graph 4.6. Event distribution and departments with affected roads, 1970-2011 | 227 |
| Graph 4.7. Disaster events impacting water and sewage systems, by decade | 230 |
| Graph 4.8. Water Use Index (IUA) in Colombia | 233 |
| Graph 4.9. Evolution of the installed capacity and the maximum demand for power, 1998-2009 | 240 |
| Graph 4.10. Composition of power generation, 2008-2010 | 240 |
| Graph 4.11. Cumulative losses, natural disaster annual average, and FNC resources (US\$ million) | 262 |
| Graph 4.12. Estimation of the probable maximum losses due to earthquakes across the country for different return periods | 269 |
| Graph 4.13. Loss exceedance hybrid curve exclusively for Colombia's fiscal portfolio | 270 |

CHAPTER 5

| | |
|--|-----|
| Graph 5.1. Perception of major hazards to which households are exposed | 294 |
| Graph 5.2. Perception of losses resulting from disasters (cities) | 296 |
| Graph 5.3. Perception of losses resulting from disasters (strata) | 296 |
| Graph 5.4. Relationships among taking measures, risk perception, and other variables | 297 |
| Graph 5.5. Taking measures to reduce disaster risk by socioeconomic stratum | 298 |
| Graph 5.6. Types of measures for earthquake risk reduction as reported by the citizens of Bogota and Pasto | 299 |
| Graph 5.7. Social agents responsible for taking prevention and/or assistance measures | 300 |
| Graph 5.8. Performance of insurance penetration for industry and trade from 2005 to 2009, expressed as the total value of insurance premium | 305 |

CHAPTER 6

| | |
|--|-----|
| Graph 6.1. Ten steps to design, create, and support a results-based monitoring and evaluation system. | 329 |
|--|-----|

APPENDIXES

| | |
|---|-----|
| Graph A.1. Public investment in risk management at the national level by priority area | 346 |
| Graph A.2. Public investment in governance by national entity | 347 |
| Graph A.3. Public investment in knowledge and information by national entity | 347 |
| Graph A.4. Public investment in education and communication by national entity | 349 |
| Graph A.5. Public investment in risk reduction by national entity | 350 |
| Graph A.6. Public investment in risk management by national entity | 351 |
| Graph A.7. Public investment in risk management at departmental level by action axes | 352 |
| Graph A.8. Departmental investment in risk management by funding source | 352 |
| Graph A.9. Per capita investment in risk management by department | 354 |

| | |
|--|-----|
| Graph A.10. Departmental scale of risk management responsibility indicator and the number of disasters recorded | 355 |
| Graph A.11. Departmental scale of disaster response indicator and disaster occurrence | 355 |
| Graph A.12. Public investment in risk management at municipal level, by action axes | 357 |
| Graph A.13. Municipal investment in risk reduction | 357 |
| Graph A.14. Municipal investment in disaster management | 359 |
| Graph A.15. Municipal investment in risk management by funding source | 359 |
| Graph A.16. Risk management effectiveness by action axes and indicators for each territorial level | 375 |
| Graph A.17. Effectiveness of disaster risk management at national level | 376 |
| Graph A.18. National Progress Report on the Implementation of Hyogo Framework for Action, Colombia | 377 |
| Graph A.19. Effectiveness of disaster risk management at departmental and CAR levels | 377 |
| Graph A.20. Effectiveness of risk management at municipal level | 378 |

TABLES

CHAPTER 1

| | |
|---|----|
| Table 1.1. of population in Colombia by municipality size | 15 |
| Table 1.2. Registers and losses by decade | 19 |
| Table 1.3. Populations of municipal centers exposed to volcanic hazards | 33 |
| Table 1.4. Ranges of deforested areas and average anual deforestation, 2000-2007 | 37 |
| Table 1.5. Suitable land use and conflicts arising from land use | 38 |
| Table 1.6. Change of high and very high erosion, 1998-2004 | 40 |
| Table 1.7. Economic assessment of losses in the housing sector in seven disasters, 1970-2010 | 57 |

| | |
|--|----|
| Table 1.8. Estimation of economic losses in the housing sector in more than 7,000 intermediate and minor disasters, 1970-2010 | 58 |
| Table 1.9. Total economic losses, 1970-2010 | 59 |
| Table 1.10. Transportation infrastructure affected and damaged by La Niña phenomena 2010-2011 | 61 |
| Table 1.11. Accumulated losses caused by minor events in the agriculture sector | 61 |
| Table 1.12. Risk index by destroyed housing in municipalities according to the UBN | 64 |
| Table 1.13. Diagnosis of risk conditions and institutional capacity | 71 |

CHAPTER 2

| | |
|---|-----|
| Table 2.1. Responsibilities of territorial entities in disaster risk management processes pursuant to Decree Law 919 of 1989 | 100 |
| Table 2.2. Municipalities by category, 2007-2008 | 102 |
| Table 2.3. Departments by category and maximum participation of functioning expenditure in current incomes, 2011 | 109 |
| Table 2.4. Human resources by institution | 115 |
| Table 2.5. Summary of the main reconstruction processes in Colombia, 1990-2011 | 117 |
| Table 2.6. Comparative matrix between PNPAD and Conpes 3146 | 122 |
| Table 2.7. Matrix of commitments and responsibilities for disaster risk management according to the regulations and planning spheres | 123 |
| Table 2.8. Main components of action lines or HFA subject areas | 125 |
| Table 2.9. Survey data sheet for self-evaluation of the risk management progress | 130 |
| Table 2.10. Risk management processes, people responsible and, coordination among systems | 135 |
| Table 2.11. Disaster risk management strategies for high-risk municipalities | 155 |

CHAPTER 3

| | |
|---|-----|
| Table 3.1. Biophysical characteristics. Case studies | 166 |
| Table 3.2. Local socioeconomic characteristics. Case studies | 166 |

| | |
|--|-----|
| Table 3.3. Synthesis of the public administration instruments and disaster risk management at local level | 185 |
| Table 3.4. Characteristics of the hydrographic areas and zones in Colombia | 189 |
| Table 3.5. Physical characteristics and institutionalism | 191 |
| Table 3.6. Regional socioeconomic characteristics. Case studies | 192 |
| Table 3.7. Synthesis of public administration and disaster risk management instruments at regional level | 205 |

CHAPTER 4

| | |
|---|-----|
| Table 4.1. Precarious settlement areas | 220 |
| Table 4.2. Agriculture sector exports (tons), 2002-2009 | 222 |
| Table 4.3. Land use conflicts in the Sinu River basin | 225 |
| Table 4.4. Water rationing and/or water shortages caused by El Niño in 1997-1998 and 2009-2010 | 231 |
| Table 4.5. Events that have produced problems in the rendering of public services | 233 |
| Table 4.6. Damage caused by the rainy season in the education sector, 2010-2011 | 236 |
| Table 4.7. Types of interventions by effect on the health sector infrastructure, 2010-2011 | 237 |
| Table 4.8. SICIED exposure of the education infrastructure by type of risk | 250 |
| Table 4.9. Allocation of subsidies by Fonvivienda. 2003-2011 | 252 |
| Table 4.10. Coffee Growing region's reconstruction financing, by source | 264 |
| Table 4.11. Financing sources facing the 2010-2014 La Niña phenomenon | 265 |
| Table 4.12. Additional sources and uses of the 2011 budget | 265 |
| Table 4.13. Scheme of fiscal management strategy for the State's response to disasters | 272 |

CHAPTER 5

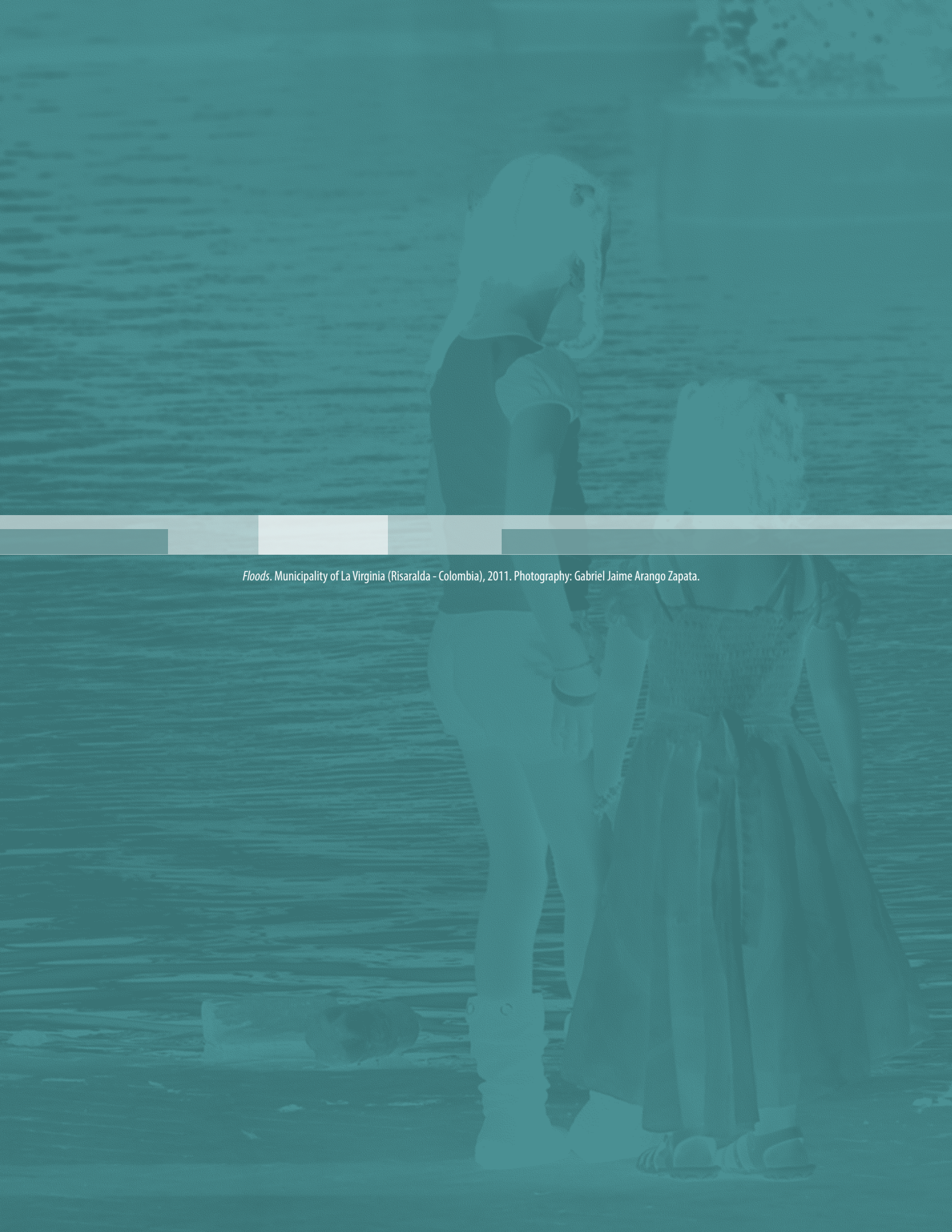
| | |
|--|-----|
| Table 5.1. Insurance penetration, expressed as total value of insurance premium per capita and as percentage of GDP, by country | 304 |
|--|-----|

CHAPTER 6

| | |
|---|-----|
| Table 6.1. Recommendations to strengthen public administration in disaster risk management in Colombia | 322 |
|---|-----|

APPENDIXES

| | |
|--|-----|
| Table A.1. Per capita investment in risk management by municipal category in Col\$(2010) | 358 |
| Table A.2. Municipalities with most investment in risk management in Col\$(2010) during the period of 2002-2008 | 360 |
| Table A.3. Data sheet of self-assessment surveys of risk management progress | 374 |



Floods. Municipality of La Virginia (Risaralda - Colombia), 2011. Photography: Gabriel Jaime Arango Zapata.

*I*ntroduction



Disasters happen all over the world, but their economic, social, and environmental repercussions have continuously increased and they have had greater overall impacts in developing countries. Disasters can overshadow years of investment in developing countries, but at the same time the risks caused may be rooted in errors and problems arising from the same processes that impede the countries development (World Bank, 2006)

Colombia has been a pioneer in Latin America in developing a comprehensive vision in risk and disaster management, which has resulted in a relative decrease in casualties. However, damage to property, infrastructure, and livelihoods continues to increase and makes it evident that disasters are not natural events per se, but the result of applying inappropriate models of development that do not consider the relationship between society and nature. In spite of the efforts to contribute to territorial safety, social welfare and environmental sustainability, the conclusions of this report show that these efforts have not been effective enough due to an increase of vulnerability conditions. Natural phenomenon hazards are among a wide range of factors that should be considered in order not to jeopardize the development, the global economic crises, climate change, environmental degradation, social inequality and armed conflicts.

Based on the above, it is important to make changes in the approaches to incorporate into the land-use planning the restrictions and potentialities in accordance with the existing hazards. These new approaches should incorporate a tightly controlled land use against the pressure from urban expansion, and the use of technologies for ecosystem. Otherwise, the economic losses and the effects on

the population will continue to grow as they have done so far.

Cumulatively, over the past forty years, disasters in Colombia have caused losses amounting to US\$7.1 billion¹, that is, an average annual loss of US\$177 million. Between 1970 and 2011, the country has registered more than 28,000 disaster events, of which about 60% were reported since the 1990s. Additionally, during 2010 and 2011, in just 15 months an equivalent figure amounted to one-quarter of the fatalities registered in the previous decade. There has been a noticeable increase in the occurrence of disaster events, increasing from 5,657 registered between 1970 and 1979 to 9,270 registered between 2000 and 2009. This increase results not only from the availability and quality of the information sources, but mainly from the increase in population and property exposed. At present, the exposure level distribution in Colombia indicates that 36% of the territory is in a high seismic hazard situation, 28% has high flooding potential and 8% as in high landslide hazard. While geological events cause great losses concentrated in a region and in a relatively short time, hydrometeorological

¹ Corresponds to economic losses in housing (millions of constant dollars of 2010) due to geological and hydrometeorological events between 1970 and 2010 (OSSO Corporation, 2011).

phenomena generate localized impacts of high frequency, which cumulatively over time mean even greater losses than those associated with seismic events and volcanic eruptions.

The government of President Santos has faced from the beginning of his term one of the greatest disasters in the country's history, in terms of both size and impact on population and economic damages, and has identified, among other things, the need a full review of the country's risk management policies. Consequences of La Niña 2010-2011 reflect in a striking way the complexity of the risk conditions in the country and the gaps and weaknesses in disaster risk its management, which have caused economic losses estimated at Col\$8.6 billion (IDB and ECLAC, February 2011). Likewise, the National Planning Department (DNP) makes visible the need for a short- and long-term strategy that would substantially reduce disaster impacts on the population and the economy.

In this context, the Government decided to fully review its risk management policies, requesting through the DNP to the World Bank, an analysis of the evolution that the country has had in this area. Based on the existent risk factors that have not been reduced to admissible levels in Colombia, it is essential to consolidate an effective policy on disaster risk management, articulated to the development planning, environmental sustainability and territorial security. Therefore, in early 2011, the Government requested the World Bank's support for the preparation of an *Analysis of Disaster Risk Management in Colombia*. The Bank then managed a grant jointly with the Global Facility for Disaster Reduction and Recovery (GFDRR) in order to carry out this study.

This collaboration was carried out as part of the risk management agenda framework that the Colombian government has had with the World Bank since 1999. The Bank has

been working in risk management-related issues in Colombia since the late 1990s, when the Comprehensive Reconstruction Program was carried out after the earthquake of the Coffee Growing region and since 2002 through the Program for the State Fiscal Disaster Vulnerability Reduction (DVRP, APL 1), a subnational component for Bogota (APL 2), and the Development Policy Loan with a Catastrophe Deferred Drawdown Option (CAT DDO). Currently, the second phase of the National Disaster Vulnerability Reduction Program (DVRP) and a new CAT DDO are being planned, for which the outcome of this work is considered as an input.

The objective of the analysis is to evaluate the progress of risk management in Colombia and to propose recommendations that will enable the Government to set up public policies in this area on a short-and long-term basis. This is a contribution that occurs in an important political moment for the institutional, organizational and regulatory reforms that are being developed. The document is a pioneering effort in Latin America and the Caribbean, constituting a complementary work to encourage compliance with the National Development Plan 2010-2014 and to advance in the recovery and reconstruction process associated with the La Niña 2010-2011 phenomenon.

The report shows four factors by which the risk is increasing, pointing out that this is more a consequence of an improper territorial, sectoral, and private management than of external factors such as climate change. It outlines six strategies to enhance governance in disaster risk management, based on the consolidation of a State policy on disaster risk management. These strategies should consider strengthening of local capacity for land administration, specifying of the different agents responsible for watershed manage-

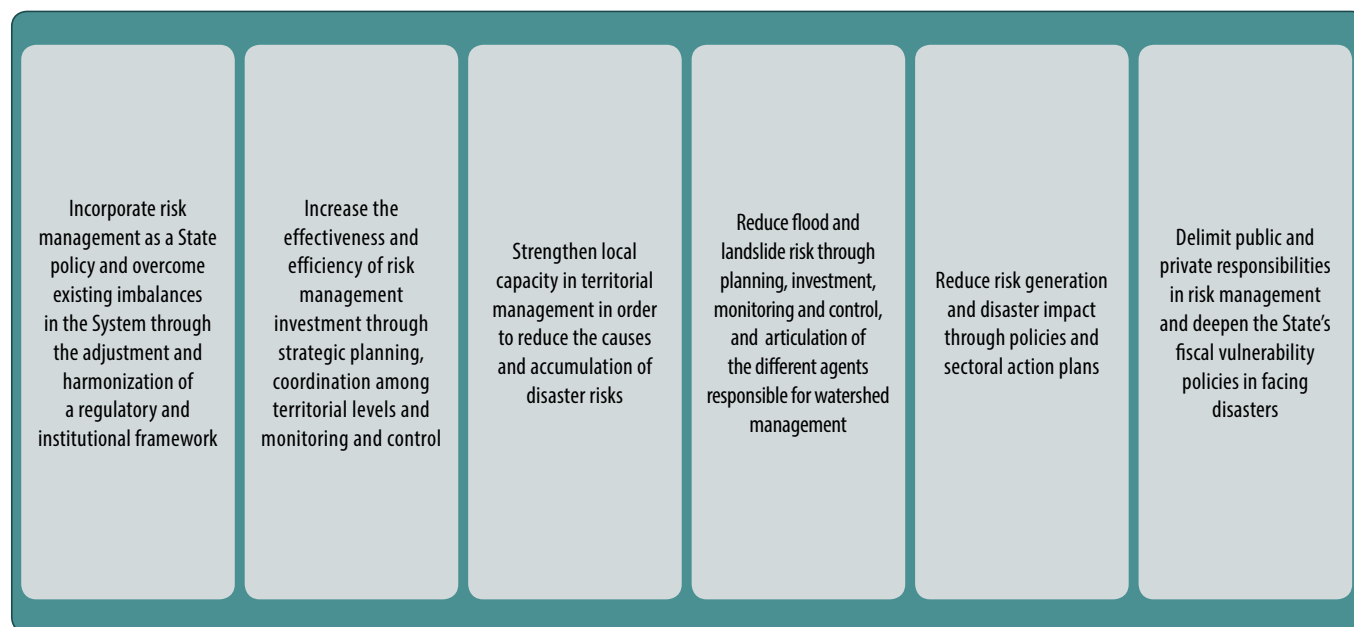
ment, defining of the responsibilities of the different development sectors, and promoting the participation of all public and private stakeholders, thereby contributing to reducing the State's fiscal vulnerability to disasters.

The report *Analysis of Disaster Risk Management in Colombia* is the result of an inter-institutional and intersectoral work coordinated by the National Government, through the National Planning Department and the National Unit for Disaster Risk Management (UNGRD) in association with the GFDRR and the World Bank. The technical team that prepared the study was formed by a group of national and regional experts in disaster risk management. In addition, the project has received support and collaboration from the Ministries of Mines and Energy, Education, Agriculture and Rural Development, Transportation, Environ-

ment and Sustainable Development, Housing, City and Territory, Finance, and Health and Social Protection. Likewise, the following entities participated: the Colombian Federation of Municipalities, the Association of Regional Autonomous Corporations (Asocars), the Agricultural Society of Colombia (SAC), the Colombian Chamber of Construction (Cama-col), the Colombian Federation of Insurers (Fasecolda), the Colombian Chamber of Infrastructure (CCI) and the National Roads Institute (Invias), as well as national entities-including the National Statistics Administration Department (DANE), the Colombian Geological Survey (SGC, previously Ingeominas), the Colombian Hydrology, Meteorology and Environmental Studies Institute (Ideam), and the Agustin Codazzi Geographical Institute (IGAC).

Four factors that set trends both in risk growth and in the increase of the State's fiscal responsibility in Colombia





Multiple strategies were used to carry out this work in order to evaluate advances in risk management, the perception of the State and civil society related to the results achieved and the main challenges to be faced in the future. Previously developed conceptual approaches and other innovative approaches that sought ways to describe what should *be* the articulation between disaster risk management and governance, provided a conceptual framework to guide the structure of the report. Furthermore, various research instruments were designed based on fields of application at regional, territorial and community levels, including the collection and evaluation of specialized documents, workshops, interviews and case studies in eight sectors and ten territorial areas. Self-assessment surveys were conducted with representatives from 173 municipalities, 12 provincial governments, 23 Regional Autonomous

Corporations (CAR), 17 national entities and risk perception surveys were collected from 1,150 people from eight of the most important cities in the country. This material was used in documenting and analyzing the evolution of risk management concepts, policy and regulatory frameworks, institution and organization structures, investments, advances and insights on the subject.

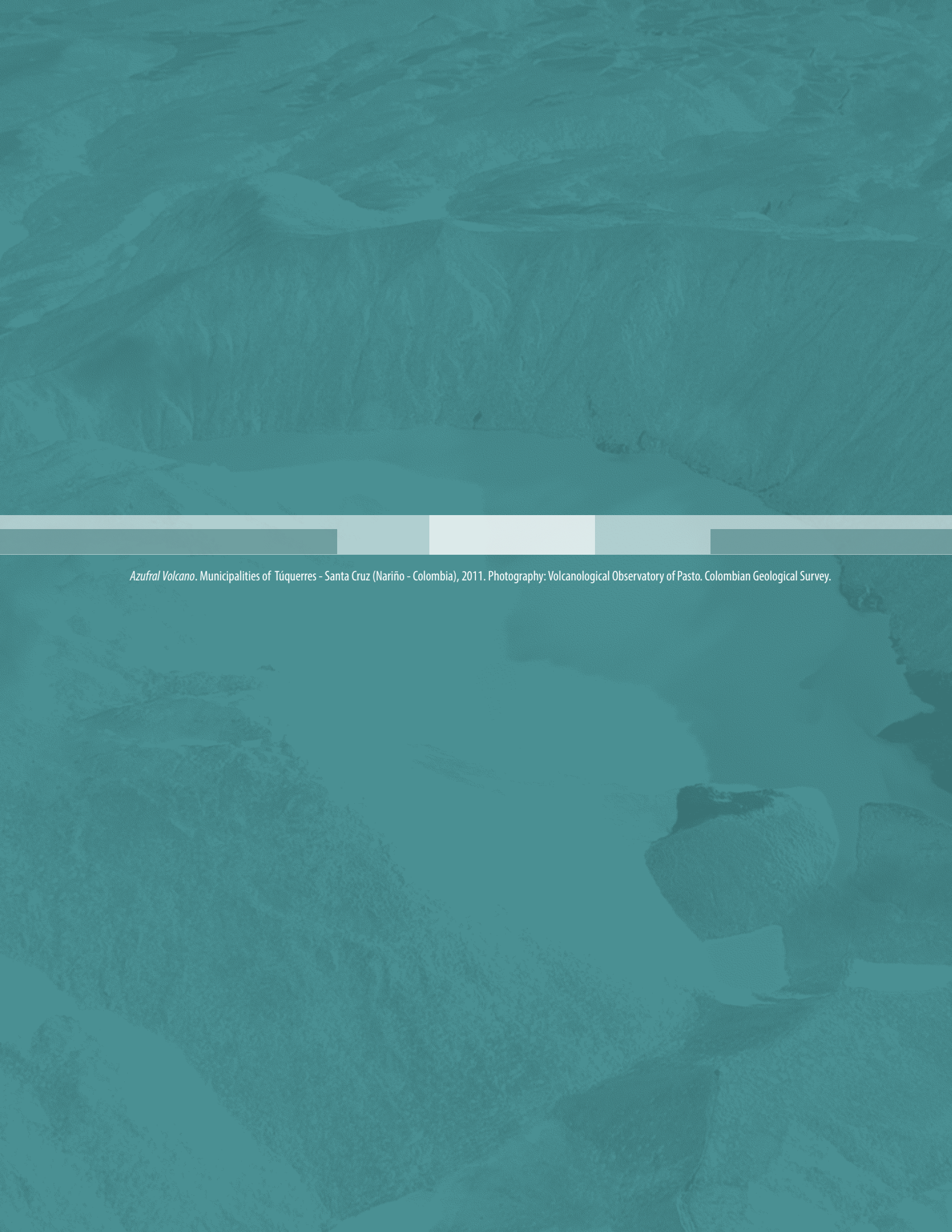
Analysis of Disaster Risk Management in Colombia is structured in two different formats. An *Executive Summary*, which presents a summary of key findings and recommendations, is targeted primarily at national, regional and local authorities and decision makers, national and international organizations, as well as civil society and the private sector that support disaster risk management in Colombia. The present Report is a detailed and comprehensive publication structured into six chapters, which include a techni-

cal analysis intended for those responsible for implementing disaster risk management policies, as well as professionals, researchers, and experts in the subject. **Chapter 1, Performance of Disaster Risk Management in Colombia**, presents a look at the situation of risk approach, the growth factors in disaster risk due to geological, and hydrometeorological phenomena, and the analysis of historical impact of existing and future models at the sectoral and territorial levels.– **Chapter 2, Disaster Risk in Public Administration**, provides an analysis of the institutionalization of risk management in the country, conceptual framework of public administration, regulatory support, institutional mechanisms, structures and capacities of the SN-PAD, and an analysis of the System, as well as the management of phenomena such as earthquakes and floods, from the process approach. **Chapter 3, the Role of Territorial Administration in Disaster Risk Management** analyzes through case studies land management and its relation to the risk concept at the local and regional levels. **Chapter 4, Disaster Risk Management at the Sectoral Administration**, identifies the causes of disasters and their economic and social implications. It also discusses the progress and limitations in risk management at the sectoral level and financial protection as the responsibility of the government finances. **Chapter 5, Public and Private Responsibility in Disaster Risk Management**, examines the balance between the responsibility of the public and private spheres under the Constitution and current legislation, from the standpoint of judicial decisions, while it analyzes the perception of the public and private entities of the risk of disasters. Finally, **Chapter 6, Final Conclusions and Recommendations to Strengthen Disaster Risk Management**, includes the conclusions and strategic recommendations as a result of the analysis carried out, both at the level of the chapters, as well as from a comprehensive study perspective. Also, the Report includes the **Appendixes titled,**

From Planning to Implementing Disaster Risk Management in Colombia which are a synthesis of the territorial levels, the progress in planning and investments, additionally analyzing the institutional actors' perceptions of the subject.

While the scope of this study is quite broad, the extension of the subject has not allowed a more comprehensive and detailed assessment of the different processes of risk management (knowledge, risk reduction and disaster management), the various phenomena (geological and hydrometeorological) and sectoral realities (municipalities and departments by category). In this context, the conclusions and recommendations can only be seen as the highlights from the viewpoint of the authors, interviewees and respondents, from which one is to extract elements that will help to strengthen risk management in the country. As the implementation of these conclusions and recommendations advances, more specific studies will be required to suit each sector or territory without losing the comprehensive and holistic concept. The need to articulate this implementation with priority areas such as adaptation to climate change, environmental sustainability and development should be explicitly recognized.

It is hoped that this publication, as well as the Executive Summary version, will meet the expectations of the Colombian government. Achieving an improvement and effective consolidation of risk management as public policy required that the analysis be critical and in turn offering proposals. In this regard, comments on the gaps and existing limitations should be understood in the way they have been formulated, recognizing them as an invitation and a suggestion for a permanent improvement of disaster risk management, where the World Bank is willing to provide the support required by the country, giving continuity to the efforts that have been developing in the last 12 years.



Azufraal Volcano. Municipalities of Túquerres - Santa Cruz (Nariño - Colombia), 2011. Photography: Volcanological Observatory of Pasto. Colombian Geological Survey.

Performance of Disaster Risk Management in Colombia

Ana Campos G., OSSO Corporation, Diana M. Rubiano V.,
Carolina Díaz G., and Carlos R. Costa P.

1

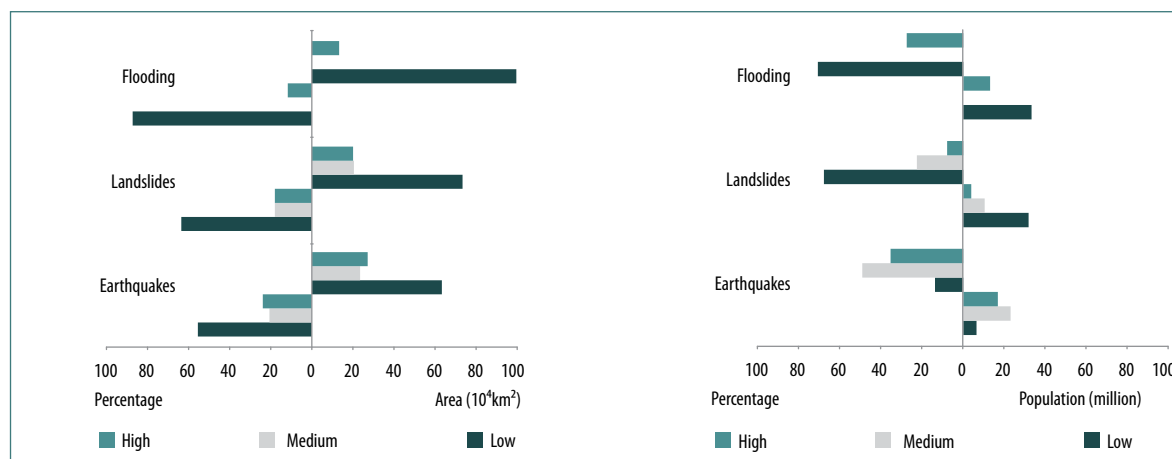


1.1. OVERALL APROXIMATION TO RISK MANAGEMENT IN COLOMBIA

Colombia is characterized by an extensive geological, geomorphologic, hydrological and climatic diversity. This diversity is exhibited in the many phenomena that are a potential hazard to the social and economic development of the country. Colombia is located in the northwest corner of South America, in an area of 1,141,748 km², of which 35% is located in the Andes Mountain Chain. This has had in a long evolution during which large cortical blocks (lithospheric plates) collide into each other resulting in a complex mountainous system that runs from south to north and that is apparent in its intense seismic and volcanic activity. The country's low humid tropical location, under the influence of the Intertropical Confluence Area, represents a single

modal pattern in the regions of Amazonia, Orinoquia, and the greater part of the Caribbean, and a bimodal distribution of the Andean regions with heavy and frequent rains. This condition is powerfully altered by the presence of El Niño and La Niña phenomena, in which rainfalls cause hydrometeorological events such as droughts, floods, flash floods and landslides, among other events. In Graph 1.1, there is a summary of the exposure distribution level of the territory and the population to floods, earthquakes, and landslides. From this summary, it can be concluded that 86% of the population is exposed to high and medium seismic activity, 28% is exposed to high flooding and 31% to high and medium landslide hazards.

GRAPH 1.1. Area and population exposed to landslides, earthquakes and floods in Colombia¹



Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011

¹ Quantification of area and population exposed to floods, according to flood zone maps in Ideam (2010), Ingeominas and Ideam (2010b), and the national map of relative hazards caused by landslides and seismic hazard zones of the Seismic Resistant Regulation, (2010).

Colombia has attained a predominant urban situation over a period of 100 years. The urban population in the last 60 years has increased from 4.4 million to 34.7 million inhabitants, which means that it has grown from 37% to 74% in relation to the total population of the country (*Graph 1.2*). Colombia is considered an exception among Latin American countries that have undergone a phenomenon known as “urban primacy”. In other words, urban concentration was not only centered in one city, but it was distributed in four departmental capitals: Bogotá, Medellín, Cali, and Barranquilla (*Table 1.1*). Bogotá is home to 21% percent of the urban population of the country, whereas Lima, Santiago de Chile and Buenos Aires have 40%, 39%, and 34% of their countries’ respective urban populations.

Hazards deriving from geological factors such as seismic activity and volcanic eruptions may be considered as invariable in time, whereas susceptibility to floods, landslides,² and flash floods³ in extensive areas of the country have increased due to human intervention in the territory resulting in environmental deterioration. Economic development, in spite of the efforts made to strengthen ecological planning and protection processes, has caused the intervention in the territory to be accompanied by the drying of wetlands and watersheds, and loss of forests and vegetation⁴ with the consequences that those factors have in erosion and increase of runoffs. It has also affected fresh water resources and land stability⁵, which makes these territories susceptible to landslides, floods, and flash floods in areas that were not previously at risk.

Population growth and property located in areas exposed to hydrometeorological phenomena are determining factors in risk growth. Knowledge deficiencies include incorporating environmental restrictions and risk conditions in

urban and regional land use planning processes, as well as lack of capacity to cover housing needs (on the average, housing construction per year starts at about 140,000 in the formal market, an amount that only covers 60% of the demand [DNP, 2010a]). Consequently, this produces an increase in settlements in unsuitable areas and the growth of informal neighborhoods associated with a deficient infrastructure. According to the OSSO Corporation and the Universidad Eafit (2011), between 1970 and 2010, the population exposed to high hazards by seismic activity and landslides increased 1.7 times, whereas exposure to medium hazards doubled.

These risk conditions are strongly linked to poverty conditions. The Unsatisfied Basic Needs (UBN) is one of the indicators that has traditionally been used to measure poverty in Colombia. The UBN makes evident the fragile conditions of the population in terms of the physical make-up of housing and its resilience, and the ability to recover in relation to the economic characteristics of the homes⁶. The municipalities with a greater UBN percentage have basic sanitary deficiencies, inferior schooling and health levels and a deficient overall productive and service infrastructure (*Figure 1.1*).

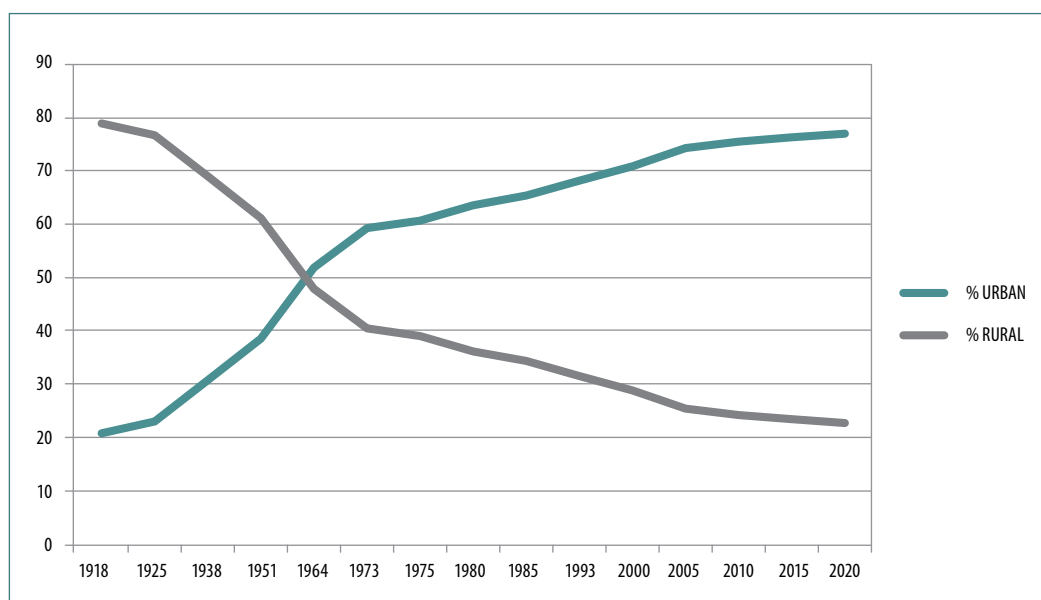
2 The term landslide refers to mass movements of earth or rock sliding down the slope of a hillside due to the action of gravity (rotational or translational). There are different ways of referring to these phenomena, such as *mass movements* or *mass land removal*. Throughout the document the term landslide has been used as a generic expression to describe the different mechanisms in slope faults.

3 Flash floods refer to a violent flow of water from a river basin, sometimes reported as a crescent (a rapid rise) or as a torrent. A flash flood transports along its route tree trunks and/or abundant fine sediment to boulders. Flash floods may be produced by rain, a rupture in a dam or abundant landslides over a watershed.

4 Annual average deforestation estimated for the period 2000-2007 is 336,581 ha/year (Ideam, 2009a).

5 According to the 2010-2014 National Development Plan “85% of the productive systems in Colombia are located in areas vulnerable to desertification and 48% of the country is prone to erosion. These factors degrade approximately 2,000 hectares a year in the Andean region” (NP, 2010a).

6 Resilience is understood to be the ability to anticipate, absorb or recover quickly and efficiently from the effects of a dangerous event.

GRAPH 1.2. Urban population growth

Source: DANE, 2010.

TABLE 1.1. Distribution of population in Colombia by municipality size

| Population | 1951 | 1973 | 1985 | 1993 | 2005 | 2010 |
|--|------------|------------|------------|------------|------------|------------|
| National total | 11,548,172 | 22,915,229 | 30,062,198 | 37,664,711 | 42,890,642 | 45,508,205 |
| Urban population | 4,468,437 | 13,548,183 | 19,628,428 | 25,849,387 | 31,889,299 | 34,388,013 |
| % Urban population | 38.69% | 59.12% | 65.29% | 68.63% | 74.40% | 75.60% |
| # Municipalities >1,000,000 inhabitants | 0 | 2 | 3 | 4 | 4 | 4 |
| Municipality's population > 1,000,000 inhabitants | 0 | 4,025,781 | 7,145,898 | 10,080,022 | 12,320,927 | 13,138,110 |
| <i>Bogota</i> | 715,250 | 2,861,913 | 4,236,490 | 5,413,484 | 6,840,166 | 7,363,782 |
| <i>Medellin</i> | 499,757 | 1,163,868 | 1,480,382 | 1,793,491 | 2,214,494 | 2,343,049 |
| <i>Cali</i> | 292,694 | 991,549 | 1,429,026 | 1,798,465 | 2,119,908 | 2,244,639 |
| <i>Barranquilla</i> | 300,541 | 703,488 | 927,233 | 1,074,572 | 1,146,359 | 1,186,640 |
| # Municipalities between 500,000 and 1 million inhabitants | 1 | 2 | 2 | 1 | 3 | 5 |
| Municipalities between 500,000 and 1 million inhabitants | 715,250 | 1,695,037 | 1,491,181 | 725,057 | 1,998,733 | 3,148,636 |
| # Municipalities between 100,000 and 500,000 inhabitants | 5 | 19 | 26 | 37 | 49 | 51 |
| Municipalities with population between 100,000 and 500,000 inhabitants | 1,158,000 | 3,462,896 | 5,371,981 | 8,144,202 | 10,519,551 | 10,784,485 |
| # Municipalities between 10,000 and 100,000 inhabitants | | 497 | 563 | 598 | 618 | 620 |
| Municipalities with population between 10,000 and 100,000 inhabitants | | 10,902,206 | 13,511,119 | 14,881,408 | 15,484,843 | 15,904,652 |
| # Municipalities < 10,000 inhabitants | | 483 | 434 | 403 | 424 | 422 |
| Municipalities with population < 10,000 inhabitants | | 2,912,725 | 2,665,709 | 2,440,115 | 2,566,588 | 2,532,322 |

Source: Authors' table from DANE, 2010

The UNDP's National Human Development Report (INDH) of 2011 confirms the gaps between what is urban and rural in relation to the variables in the UBN and housing quality, among other indicators, outlined for each Millennium Development Goal (MDG)⁷. According to the three conglomerates established in the INDH (urban centers, intermediate centers, and highly rural municipalities), there is an inverse relationship between the rurality index and MDG progress. Where there is more rural life, there is more underdevelopment. This is stated in higher UBN percentages and in the number of households that have a qualitative deficit. Municipalities with high rurality show an average of 74.66% people living in poverty by UBN standards, and 61.85% households having qualitative deficit, especially due to serious restriction in housing materials and the availability of public services (UNDP, 2011), whereas in urban centers poverty indicators are 2.3 times lower. The poorest municipalities and those with the highest rurality are located in the Llanos Orientales, Amazonia and in the south of the country, followed by the Pacific and the Caribbean coasts. The departments considered to have the lowest poverty indices and the highest urban development are located in the center of the country.

There is a direct relationship between poverty levels and institutional capacities, factors that also affect the design and the implementation of risk reduction and disaster recovery. According to an analysis presented by the National Development Fund 2010-2014, it is possible to identify Bogota, the departments of Cundinamarca, Valle del Cauca and the Coffee Growing region, parts of Antioquia, and southern Boyaca as areas that have the largest institutional capacities. Likewise, Barranquilla and Pasto's area of influence in the Nariño Department exhibits high institution-

al capacities, even though to a lesser degree of development. These refer to the performance in managing the Development Plans (PD), public investment, financial sustainability, compliance with the budget's legal requirements, the execution of General Participation System's resources (SGP), and administrative capacities. There is greater strength in municipalities with low poverty levels, which also have accessible risk management strategies.

The departments where troubling poverty indicators and low institutional capacity are the common denominator are the Amazonas, Guaviare, Guainia, Vaupes, and Vichada, in addition to the majority of municipalities on the Pacific coast, in particular the department of Choco and some in Cauca and Nariño. Likewise, most of the municipalities on the Caribbean coast have low levels of institutional capacity and are equally related with elevated poverty indicators. This condition is more prevalent in the municipalities of the departments of La Guajira, Magdalena, Sucre, and Cordoba, but it is not present in their capitals since these have better institutional performance, or in the District of Barranquilla, which is similar to the other large cities in the country (DNP, 2010a).

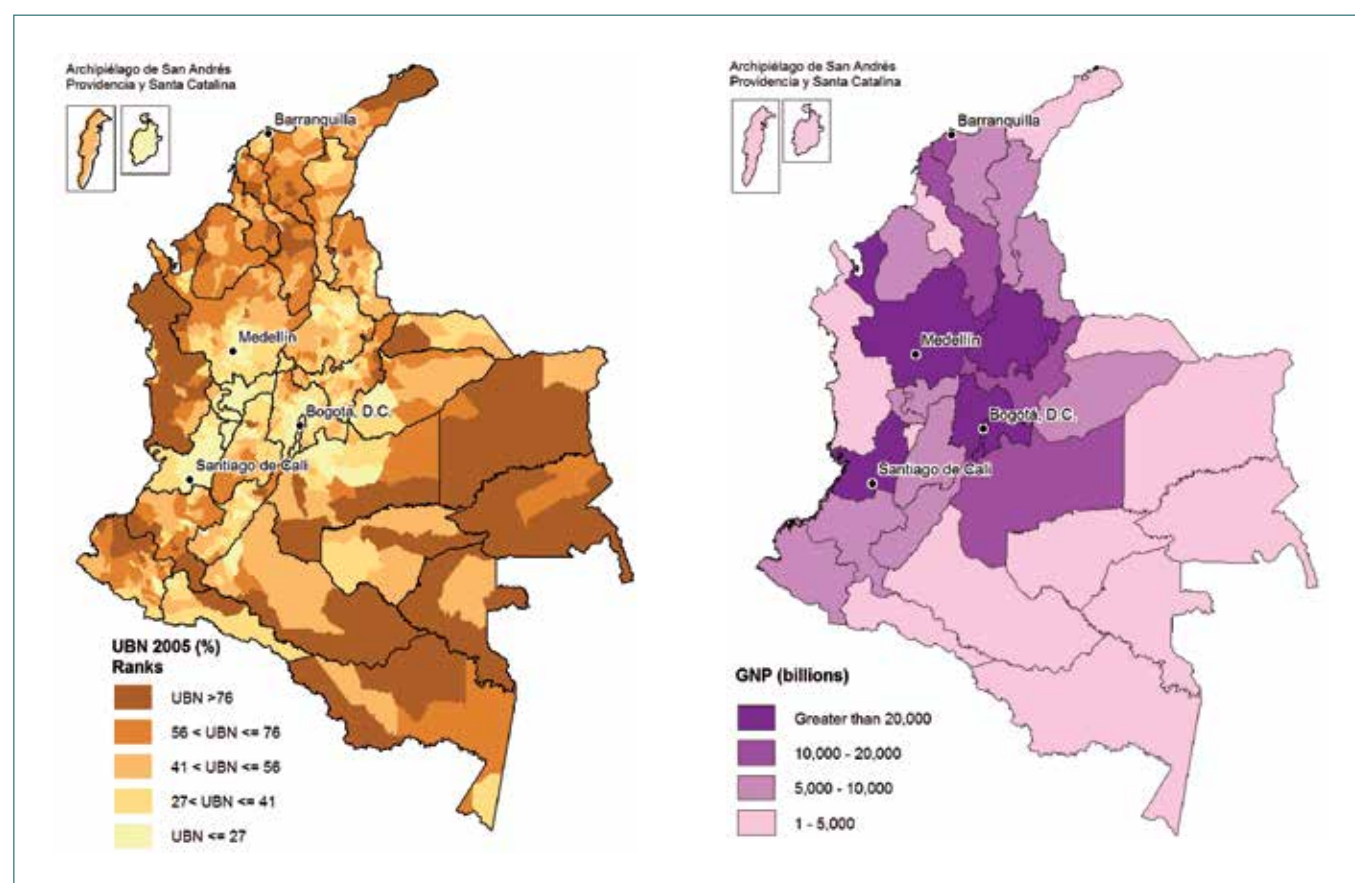
Not all existing risks result in losses or disasters. However, when they do occur, they are assumed to be a performance risk indicator caused by frequent social-natural phenomena. This is especially valid in the case of losses due to

⁷ In 2000, at the United Nations Millennium Summit, 189 nations including Colombia committed themselves to eight Millennium Development Goals (MDG): (1) eradicate extreme poverty and hunger; (2) guarantee basic universal education; (3) promote gender equality and empowering of women; (4) reduce infant mortality; (5) improve maternal health; (6) combat HIV/AIDS, malaria and other diseases; (7) guarantee sustainability in the environment; and (8) promote a global partnership for development. Colombia made the commitment through the Conpes Document 091 of 2005 that defined the goals and indicators related to the MDG, to be completed by 2015.

floods, landslides, or flash floods. For phenomena such as earthquakes and volcanic eruptions, the risk remains latent during relatively long periods and generally it is manifested only occasionally. Changes in loss performance are a reflection of the transformation and accumulation of risks that underlying in the dynamics of a society. In this sense, the DesInventar⁸ database has been analyzed, which has systematically registered events that have resulted in losses since 1970.

Systematic registers of losses and damages are fundamental for measuring the real impact of disasters. The possibility of visualizing the impacts that recurrent and minor events are having on the public infrastructure, private patrimony and loss of life, is a fundamental instrument for understanding the dimensions of the problem. It also justifies the main political priority that the subject needs and it provides better elements for the decision-making process and for the definition of economic and social priorities.

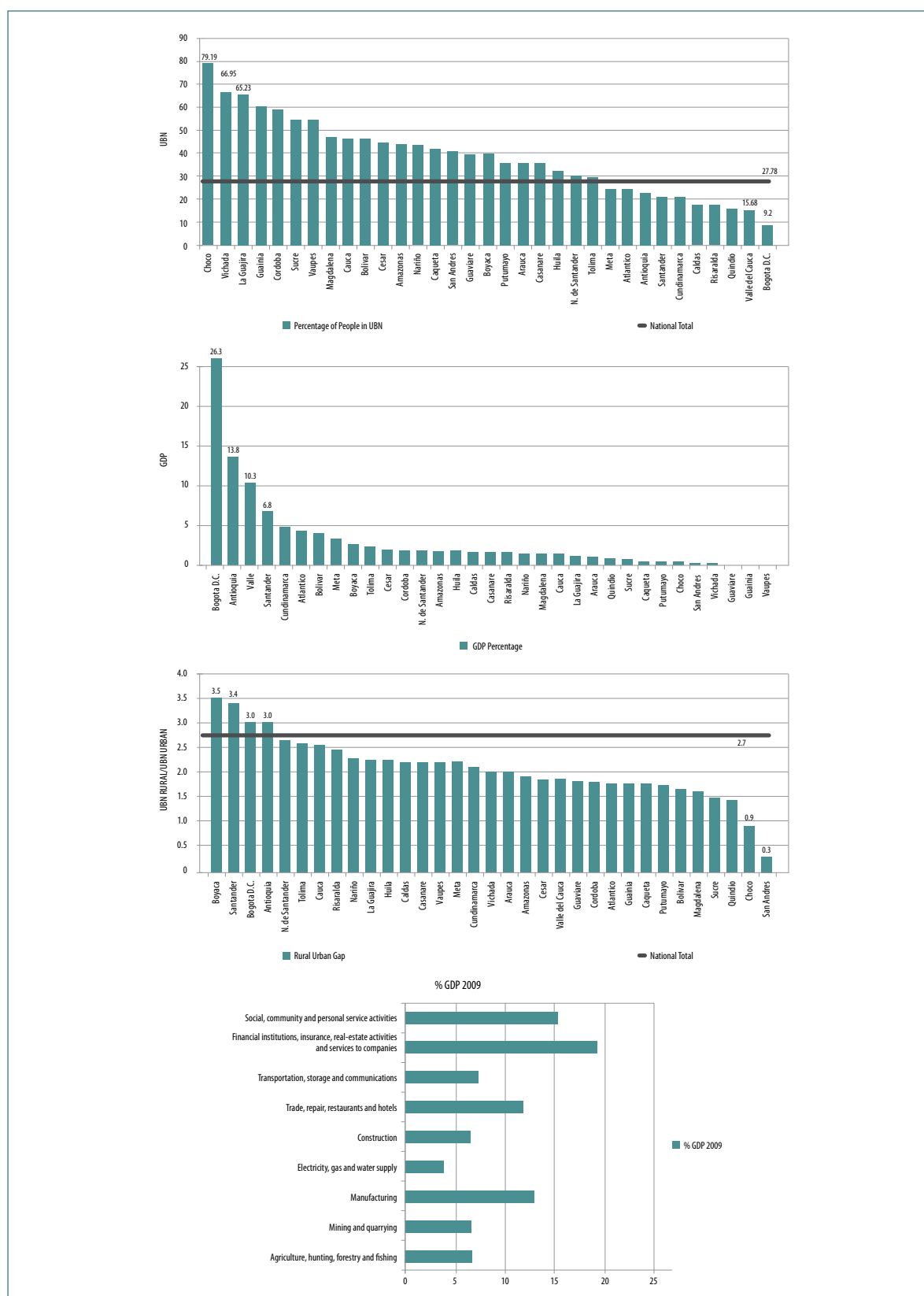
FIGURE 1.1. UBN and GDP Distribution



⁸ Database on losses caused by disasters in Colombia (OSSO Corporation-EAFIT, 2011), may be found at www.online.desinventar.org. The registers relate the losses caused by different types of social-natural phenomena such as seismic activity, floods, landslides, and fires, among others. The data is principally taken from journalistic sources (articles from magazines or newspapers) up to 1992, and up

to 2011 from the official registry from the Risk Management Office (DGR) of the Ministry of Interior and Justice predominates. In order to identify patterns and tendencies in loss performance, this database was analyzed in relation to the impact it had on human lives, housing and some sectors, compiled at the municipal level for the 1970-2011 period (up to March 5).

FIGURE 1.1. UBN and GDP Distribution (continued)



Source: OSSO Corporation, 2011 from DANE, 2010.

TABLE 1.2. Registers and losses by decade

| Main source of information | Decade | Registers | Deaths | Victims or affected | Housing destroyed | Housing affected |
|----------------------------|--------------|---------------|---------------|---------------------|-------------------|------------------|
| Journalistic | 1970 – 1979 | 5,657 | 4,025 | 1,710,541 | 23,060 | 25,584 |
| | 1980 – 1989 | 5,123 | 28,316 | 4,727,790 | 29,317 | 15,873 |
| Official (DGR since 1992) | 1990 – 1999 | 6,465 | 3,957 | 9,204,412 | 88,956 | 191,828 |
| | 2000 – 2009 | 9,270 | 2,180 | 9,284,073 | 41,689 | 470,987 |
| | 2010 – 2011 | 2,187 | 519 | 2,823,885 | 7,403 | 358,378 |
| | Total | 28,702 | 38,997 | 27,750,701 | 190,425 | 1,062,650 |

Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011.

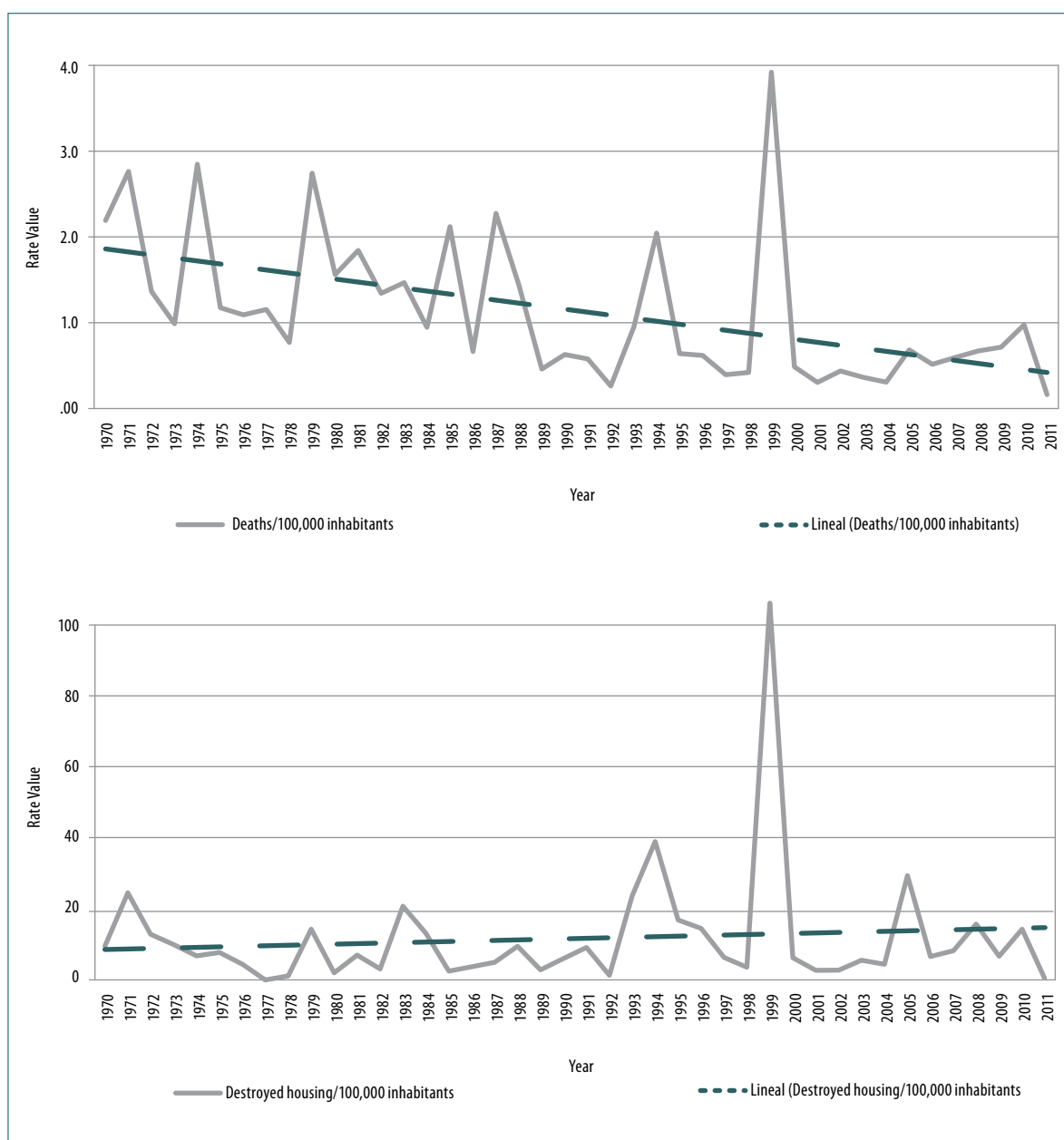
Between 1970 and 2011, more than 28 thousand events have been registered that have caused losses of which nearly 60% were reported since 1990 (Table 1.2). Data by decade show an evident increase, which is related to growth of population and property exposed, apart from a greater availability and quality of the principal information resources.

During 2010 and 2011, in only 15 months, one-fourth of the registers and deaths of the previous decade (2000-2009) were reported, one-third part of the victims/affected and more than a half of the housing damaged. These losses are related to the strong impacts caused by the La Niña phenomenon. An analysis made of the period from

1990 to 2011 confirms that for the decade of the 1990s there are 6,465 reports, while 9,279 disaster events were registered during the following decade, which is equivalent to an increase of 40%.

Between 1970 and 2011, of the loss of life tended to diminish, whereas there was an increase in housing destroyed. As it can be seen in the following Graph, mortality rates were reduced in comparison with the size of the population, whereas, in spite of the efforts to make progress in risk management, housing damages increased much more than demographic growth. The peak year, in which both the Coffee Growing region earthquake and a La Niña episode occurred, was 1999 (Graph 1.3).

GRAPH 1.3. Loss of life and housing per 100,000 inhabitants, 1970-2011



Note: Excludes loss of lives (close to 24,000) and housing as a result of the Nevado del Ruiz volcanic eruption in 1985.

Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011 and DANE, 2010.

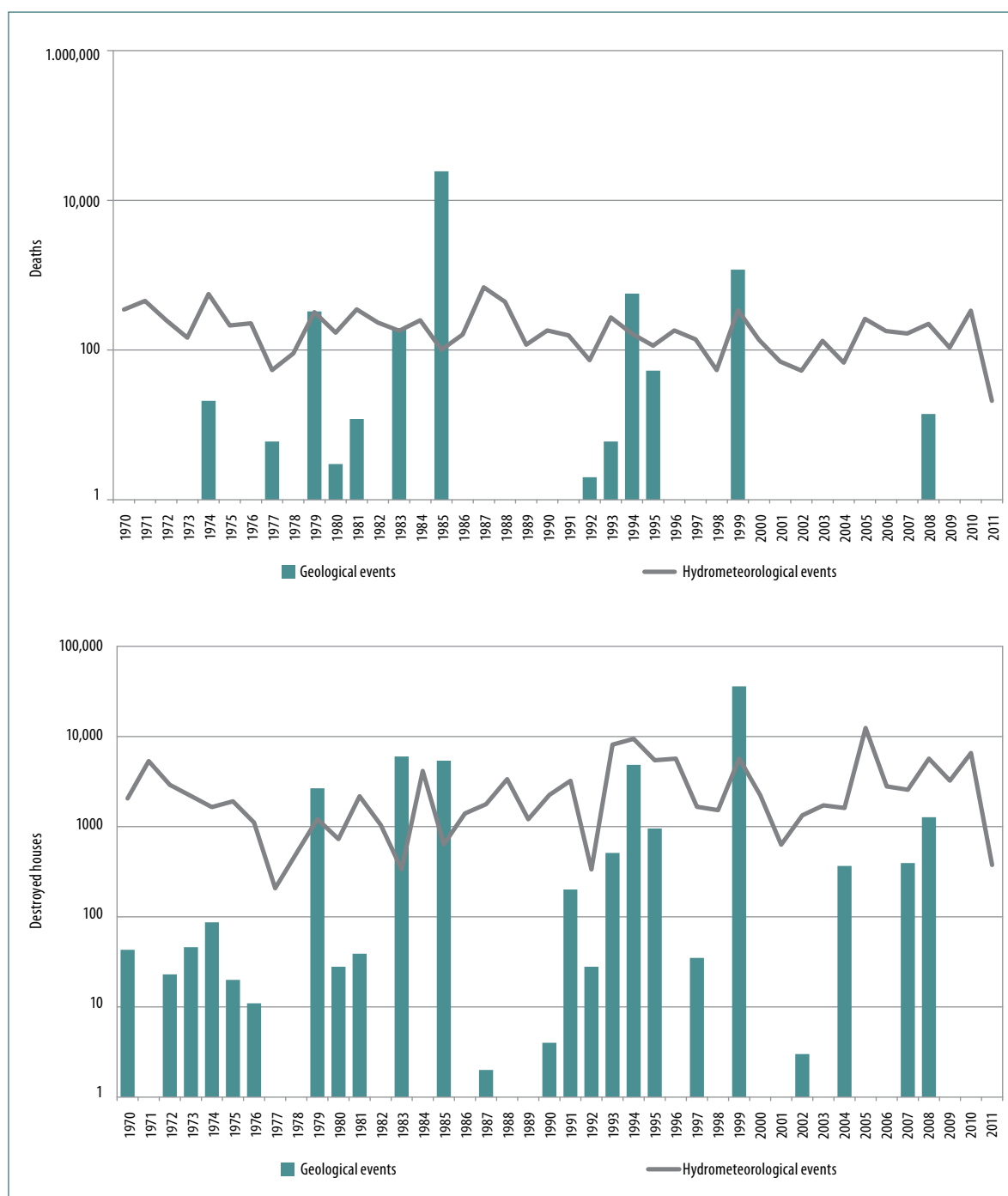
1.2. EXPOSURE AND VULNERABILITY AS MAIN FACTORS IN THE GROWTH OF GEOLOGICAL RISKS

1.2.1. Geological phenomena, infrequent events of great impact

Phenomena such as strong earthquakes and severe volcanic eruptions, on the whole, cause great losses concentrated in a territory and last a relatively short time; that is why they are called intensive risks (UNISDR, 2011). These events may be infrequent but produce great impacts, such as those of the Popayan (March 31, 1983), the megadisaster caused by the eruption of the Nevado del Ruiz volcano and the avalanche that destroyed Armero (November 13, 1985), earthquakes in the Atrato Medio (October 17 and 18, 1992), the Tierra-dentro –known as the Paez earthquake– (June 6, 1994), and the Coffee Growing region earthquake (January 25, 1999). As shown in the following graph, these events caused severe loss of life and housing destruction (*Graph 1.4*).

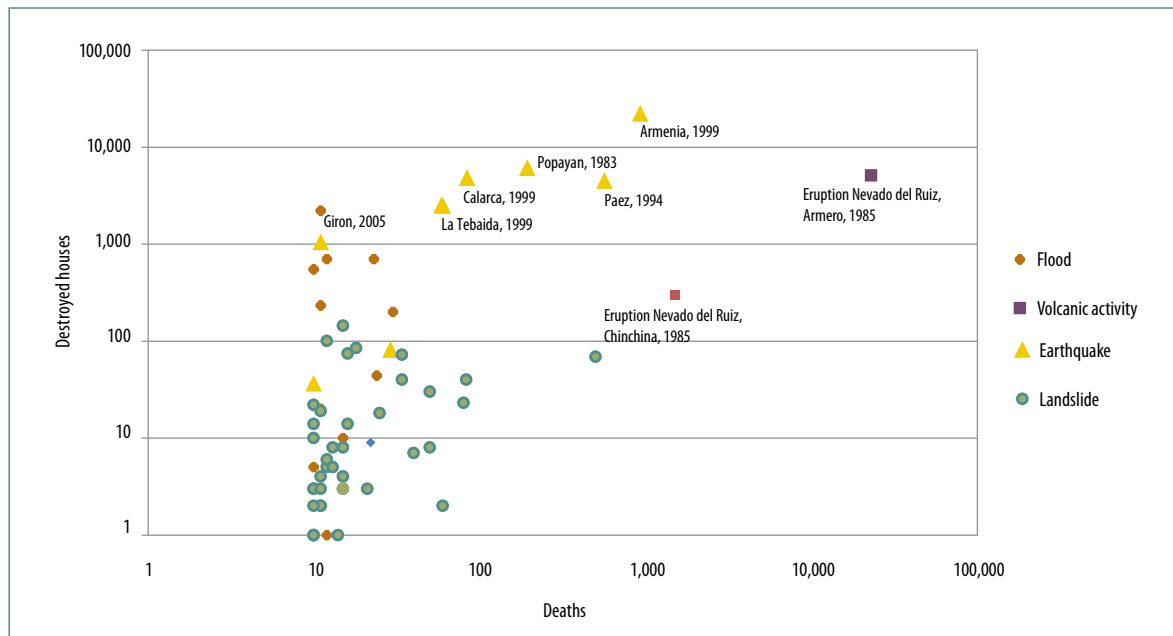
Volcanic eruptions and earthquakes result in the highest index of losses per event, in terms of housing destroyed and loss of lives. Loss of lives resulting from volcanic eruptions reached 24,456 fatalities for the period 1970-2011, whereas earthquakes during the same period resulted in 2,219 fatalities. The next graph shows a relation between housing destroyed and loss of lives, which confirms that volcanic eruptions, followed by earthquakes, have the greatest indices per event. However, landslides, even though their effects are normally local, cumulatively have produced a larger number of fatalities than earthquakes (5,252). The Villa Tina landslide (1987) stands out as an individual event causing great impact. Floods occur more often and have a larger number of registers, but individually and cumulatively produced a smaller loss of lives (1,499) for the period 1970-2011 (*Graph 1.5*).

GRAPH 1.4. Losses (deaths and destroyed housing) per hydrometeorological and geological event, 1970-2011



Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011 and DANE, 2010.

GRAPH 1.5. Relation between destroyed housing and loss of life, 1970-2011



Source: OSSO Corporation 2011 from OSSO-EAFIT Corporation, 2011 and DANE, 2010.

1.2.2. Seismic and volcanic risks are increasing due to the growth of exposed infrastructure and the lack of strategies to diminish the existing vulnerability

Given that geological activity which produces seismic activity and volcanic eruptions is considered relatively stable, the increase of risk confronting these phenomena is a result of exposure growth associated with population and infrastructure growth. In 1938, the country had 8,701,816 inhabitants, of which 70% were localized in rural areas and 30% in urban areas. Currently, there are 46 million inhabitants and the values of urban and rural localization have been inverted. This fact is attributable to the dynamics of modern social demographics combined with forced displacement and armed conflict; therefore, the level of exposure has been increasing. The displaced population is notably concentrated informally in the outskirts and marginal

areas of the main cities, and these areas are not in condition to be suitably developed. Cities such as Bogota, Medellin, Cali, and Barranquilla contain 28% of the population and almost 70% of the area constructed in the capitals of the country (Graph 1.6).⁹

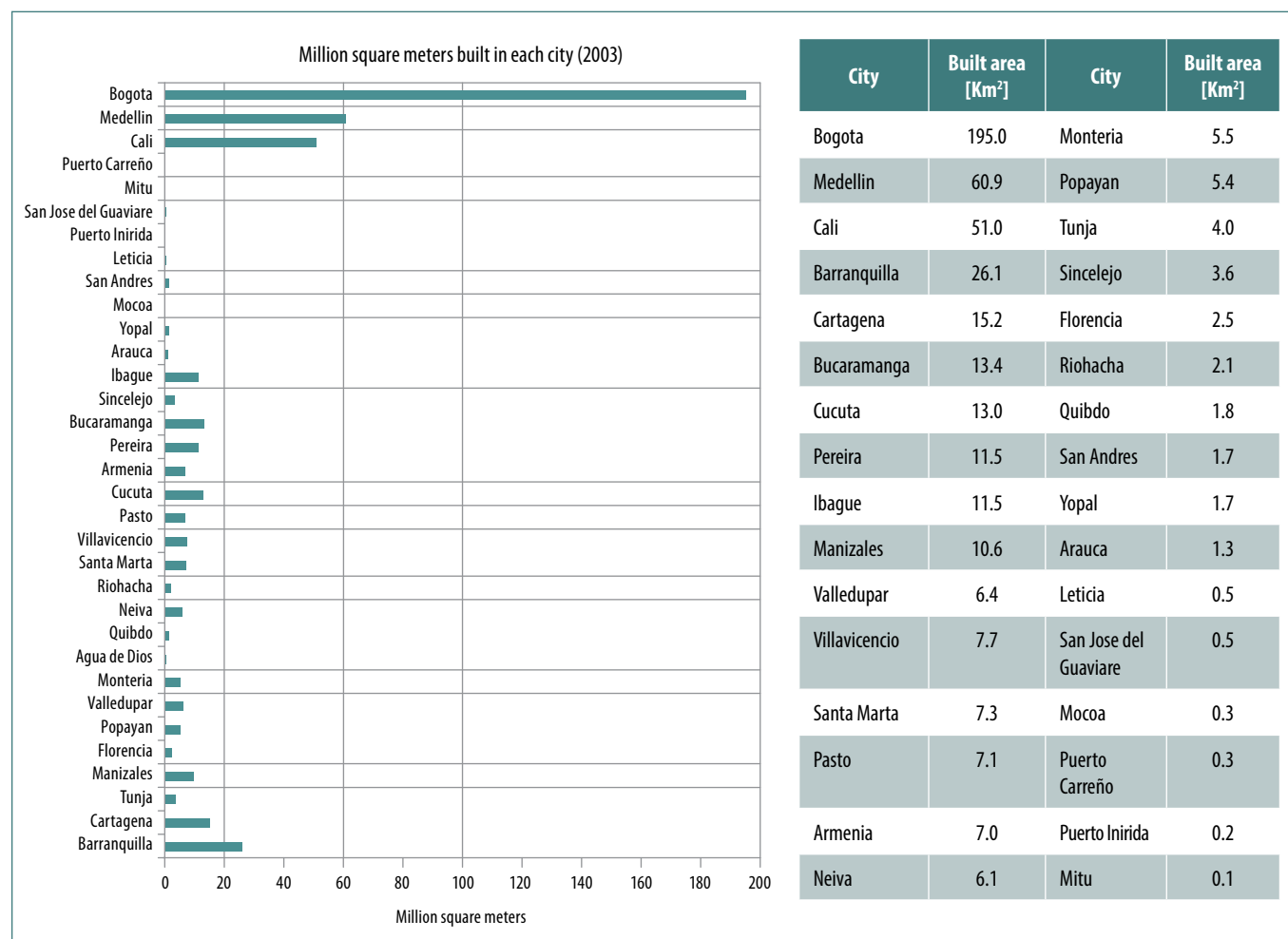
Inadequate practices in urbanization and development processes, added to the deficiencies in construction techniques, increase the vulnerability of the communities. The cities have had rapid population growth along with accelerated urbanization processes without due planning. Likewise, experiments in the rural areas in implementing disarticulated production systems to the aptitudes of the territories generate conflicts in land use. Housing and infrastructure constructed on hillsides and/or in landfill zones that do not offer optimum stability conditions and that intensify seismic

⁹ Unless otherwise specified, "capitals" should be understood to mean not only Bogota, but also the country's 32 departmental capital cities.

waves produced by earthquakes, construction processes prior to the implementation of the Seismic Resistant Regulation, and the lack of control in applying this regulation, result in a powerful increase in construction's vulner-

ability. The aforementioned, along with low or limited investment in corrective measures that would reduce the existing fragility, are among the causes of other factors, the causes of the vulnerability accumulation and growth.

GRAPH 1.6. Comparison of the areas constructed in the country's capital cities



Source: Cardona, et ál., 2005, IDB and ECLAC, 2005.

1.2.3. Geographic distribution of the hazard, exposure, vulnerability, and relative risk in facing earthquakes

Currently, 86% of the Colombian population lives in high and medium seismic activity areas (*Figure 1.2*). Some 44% of the Colombian territory is under exposure to high and medium seismic activity, namely in the Pacific and Andean regions, which means that 960 municipalities are exposed and most of them have the largest populations in the country. At a municipal level, Cali represents the largest population exposed to high seismic activity, followed by other capitals such as Cucuta, Bucaramanga, Pereira, Villavicencio, Pasto, and Manizales.

The municipalities having the highest concentration of relative risk, from an economical point of view with respect to the GDP and exposure to seismic hazard, include to Cali, Bogota, Villavicencio, Medellin, and Bucaramanga¹⁰. On the following level, there are other municipalities that are notable: Santander, Norte de Santander, Choco, western Antioquia, Valle del Cauca, Coffee Growing region, parts of Cauca and Nariño and the municipalities in the Eastern Mountain Range (*Figure 1.2*).

The municipalities with the largest UBN are located near the Pacific coast, in the Nariño, Cauca, Choco, Santander and Norte de Santander departments. They have the greatest level of vulnerability relative to seismic hazards¹¹. These municipalities have inadequate basic sanitation infrastructure coverage, insufficient levels of schooling, health, and production infrastructure, and deficient services, low incomes, weaknesses in institutional performance, and lastly, inferior capacity to recover economically and socially. Given a greater possibility of a tsunami on the Pacific coast, the municipality having the largest exposed popu-

lation and possibility of losses caused by this phenomenon is Tumaco (Nariño).

Among the events that can be most critical for the country is the possibility of an earthquake. The estimated losses due to seismic activity with a return period of 500 years would be: for Bogota, US\$12.7 billion, for Medellin US\$7.5 billion, for Cali US\$6.4 billion, for the Coffee Growing region US\$2 billion (Cardona, et ál., 2004 a and b), and for the nation in general US\$44.9 billion (Ingeniar Ltda., 2011) (*Graph 1.7*). For this same scenario, the number of persons injured in Bogota is around 48,000 and 20,000 fatalities. The economic losses in millions of dollars for the different capital cities in Colombia are shown in *Graph 1.8*, for a return period of 500 years. The values for moderate events are presented, these having a return period of 100 years and for extreme events a return period of 1000 years. Seismic activity for which buildings are designed according to the seismic resistant regulations in force, NSR-10, correspond to a return period of 475 years. This event has a 10% probability of exceeding the life span of a building's useful life, which is estimated to

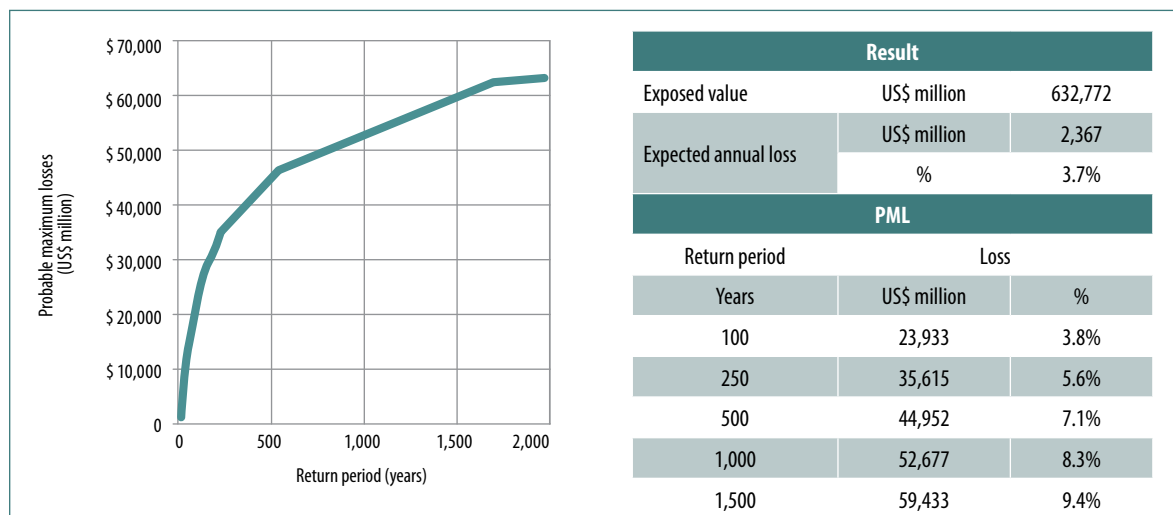
10 The relative risk index was defined as the result of the GDP by municipality exposure to different hazard levels according to the following equation: $rRI = GDP \times E(Z)$, where rRI is the relative Risk Index, GDP is the indicator that shows the concentration of goods and capital and $E(Z)$ is the exposure to the different levels of hazard. According to this indicator, municipalities that have a high GDP and high exposure to hazard tend to have more probabilities of economic losses. Exposures to each level of hazard correspond to the municipal capital, but it is represented on the maps in the whole polygon of the municipality. In other words, since the percentage of the Colombian urban population is around 80%, an acceptable margin of error for this analysis is 20%, which corresponds to the rural population.

11 The relative Vulnerability Indicator rVI is calculated from the UBN, as the vulnerability proxy and the exposure to different levels of hazards $E(H)$. $rVI = UBN \times E(H)$. According to the relative Vulnerability Indicator rVI , the most vulnerable municipalities are those that have the greatest percentage of UBN population and are exposed to higher levels of hazards. In principle, municipalities with low percentage of UBN population have a greater capacity of overcoming a disaster. (more resilience).

be 50 years. It is worth pointing out that the Coffee Growing region earthquake (1999) was very close to the parameters established by the Seismic Resistant Regulation and its registered losses amounted to US\$1.5 billion,

which was close to the stated scenario of US\$2 billion. The risk resulting from an aggregate earthquake for the entire country, for a return period of 500 years, is US\$44.9 billion (Ingeniar Ltda, 2011).

GRAPH 1.7. Possible maximum losses caused by seismic activity in the whole country for different return periods

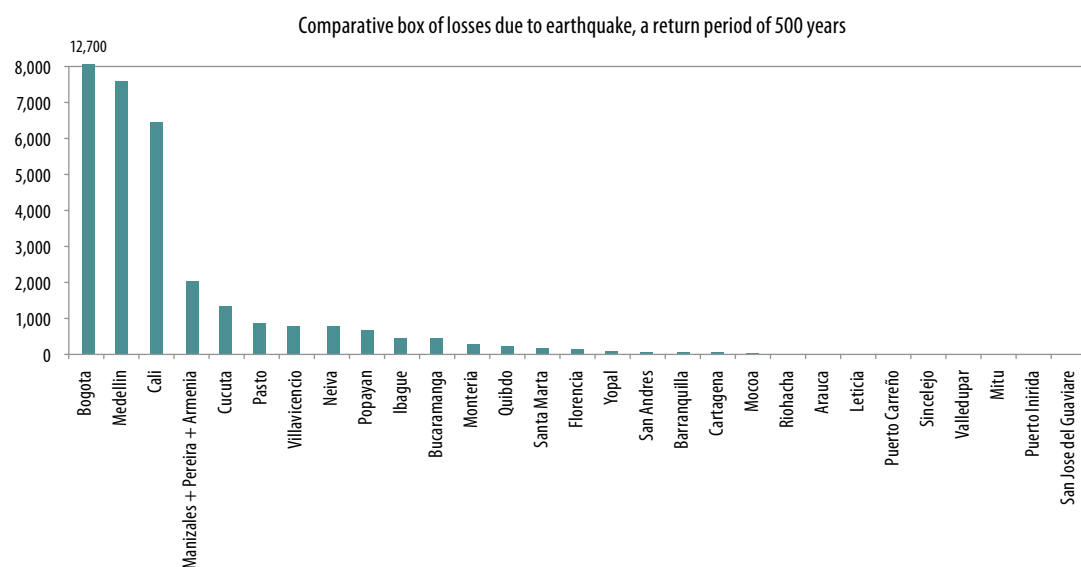


Source: Ingeniar Ltda., 2011.



Landslides. Municipality of Pereira (Risaralda - Colombia), 2011. Photography: Javier Garcia Jaramillo.

GRAPH 1.8. Losses for Colombian cities resulting from seismic activity for a return period of 500 years for

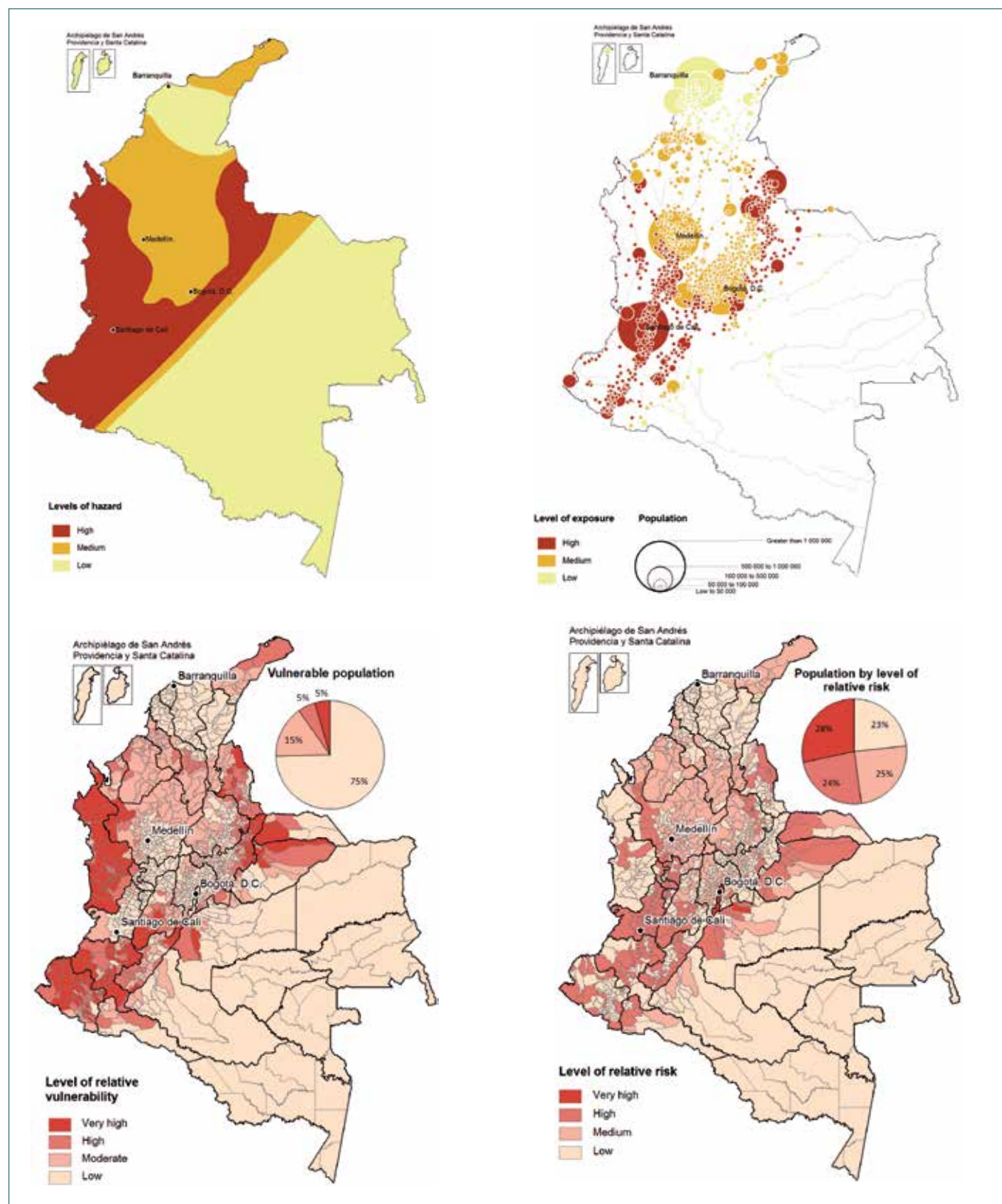


Economic losses due to earthquakes for the main cities in Colombia

| City | Exposed value (US\$ million) | PML (US\$ million) for different return periods | | | PML [%] for different return periods | | |
|-------------------------------|---------------------------------|--|--------|--------|---|-----|-------|
| | | 100 | 500 | 1,000 | 100 | 500 | 1,000 |
| Bogota | 85,442 | 3,501 | 12,668 | 23,294 | 4 | 15 | 27 |
| Medellin | 26,473 | 1,728 | 7,566 | 10,86 | 2 | 9 | 13 |
| Cali | 21,704 | 1,089 | 6,427 | 9,474 | 1 | 8 | 11 |
| Pereira + Armenia + Manizales | 9,700 | 241 | 2,049 | 3,106 | 0 | 2 | 4 |
| Cucuta | 4,184 | 107 | 1,339 | 2,33 | 0 | 2 | 3 |
| Pasto | 2,398 | 186 | 851 | 1,306 | 0 | 1 | 2 |
| Villavicencio | 2,695 | 107 | 804 | 1,464 | 0 | 1 | 2 |
| Neiva | 1,923 | 85 | 787 | 1,322 | 0 | 1 | 2 |
| Popayan | 1,841 | 163 | 651 | 949 | 0 | 1 | 1 |
| Ibague | 3,529 | 50 | 446 | 760 | 0 | 1 | 1 |
| Bucaramanga | 5,109 | 68 | 417 | 736 | 0 | 0 | 1 |
| Tunja | 1,360 | 33 | 280 | 405 | 0 | 0 | 0 |
| Montería | 1,634 | 29 | 228 | 436 | 0 | 0 | 1 |
| Quibdo | 406 | 68 | 199 | 254 | 0 | 0 | 0 |
| Santa Marta | 2,836 | 12 | 176 | 493 | 0 | 0 | 1 |
| Florencia | 596 | 8 | 115 | 206 | 0 | 0 | 0 |
| Yopal | 399 | 5 | 95 | 150 | 0 | 0 | 0 |
| San Andres | 499 | 6 | 76 | 126 | 0 | 0 | 0 |
| Barranquilla | 11,591 | 21 | 69 | 122 | 0 | 0 | 0 |
| Cartagena | 5,089 | 13 | 49 | 85 | 0 | 0 | 0 |
| Mocoa | 77 | 5 | 38 | 53 | 0 | 0 | 0 |
| Riohacha | 528 | 2 | 32 | 90 | 0 | 0 | 0 |
| Arauca | 374 | 2 | 28 | 73 | 0 | 0 | 0 |
| Leticia | 139 | 2 | 26 | 42 | 0 | 0 | 0 |
| Puerto Carreño | 73 | 1 | 17 | 28 | 0 | 0 | 0 |
| Sincelejo | 915 | 2 | 15 | 41 | 0 | 0 | 0 |
| Valledupar | 1,964 | 3 | 13 | 25 | 0 | 0 | 0 |
| Mitu | 46 | 0 | 4 | 7 | 0 | 0 | 0 |
| Puerto Inírida | 60 | 0 | 4 | 7 | 0 | 0 | 0 |

Source: Cardona, et ál., 2004 a and b.

FIGURE 1.2. Distribution of the hazard, population exposure, vulnerability, and relative risk facing seismic activity¹²



Source: OSSO Corporation, 2011 from AIS, 2010 and DANE, 2010.

Box 1.1. Seismic activity

Colombia is situated at the convergence of three lithospheric plates: the Nazca, the Caribbean, and South America plate, as a result, it is affected by a variety of seismic sources associated with the Pacific subduction zone as well as superficial faults related to the accumulation of efforts in the continent (OSSO Corporation, 1998). The seismic hazard is expressed through direct movements of seismic vibrations, that act on the surface and affect the infrastructure. These vibrations depend on the characteristics of the terrain, such as magnitude and depth as well as the soil and subsoil characteristics. The vibrations may produce secondary effects such as landslides and liquefaction of soil.

The Pacific region of the country is exposed to high seismic hazards associated with the subduction zone of the Pacific ocean, which has the greatest capacity to free the largest amounts of seismic energy in Colombia. The earthquakes of 1906 and 1979 occurred from this source. These stand out, because they also caused a tsunami that mainly affected the population of Tumaco, a municipality located on the Nariñense Pacific coast. In the Andean region, high seismic hazard zones are associated with superficial fault activity such as Romeral, Cauca, Palestina and the front of the Eastern Mountain Range, which has the characteristic of producing superficial seismic activity of great destructive power, such as the quakes of the Suaza (1827), Huila (1967), Popayan (1983), Paez (1994), Tauramena (1995), and the Coffee Growing region (1999), among others. Some of this seismic activity has stood out due to the generation of significant mass movements, which are explained by the topographic and geological characteristics of the region. In the north of the Valle del Cauca, southern Choco and the Coffee Growing region, there is an intermediate depth seismicity (between 66 and 300 km), with events of the magnitude of around 6.0 to 6.5. These have produced severe damages in Cali (in 1925), as well as in Manizales and Pereira, and in other populations between southern Antioquia and the north of the Valle del Cauca (in 1938, 1961, 1962, 1973, 1979 and 1995).

Some 95% of the land area of the departments of Huila, Choco, Valle del Cauca, Nariño, Risaralda, Cauca, and Quindio is exposed to high seismic hazards. All of these departments have a history of undergoing at least one severe seismic event has caused very serious losses. These events have been documented since 1566, the year when the first seismic activity was reported in the country's history.

Tsunamis, unchained by immense earthquakes, may occur both on the Pacific as well as on the Caribbean coast. However, the greatest disasters resulting from this phenomenon have occurred on the Pacific coast, since the main source of this hazard to Colombia is located in said region. Since tsunamis are normally the result of seismic activity with magnitudes greater or equal to 7.5, their recurrence is compared to earthquakes having these characteristics that may originate close to the Colombian coasts or be distant in origin, produced along the Pacific Fire Belt. The departments most exposed, to tsunamis are Cauca, Nariño, Choco and Valle del Cauca in the Pacific and La Guajira, Bolivar, Atlantico, Magdalena, Sucre, Cordoba, Antioquia and Choco in the Caribbean. Apart from the insular areas in both oceans, the population living in the coastal municipalities is close to 7 million inhabitants (6 million in the Caribbean and 1 million in the Pacific), which represents 6% of the total population of the country. Given that there is a greater possibility of tsunami occurrence in the Pacific, the municipality with most population exposed and the greatest possibility of losses resulting from this phenomenon is Tumaco (Nariño).

12 Level of seismic hazard

High. Defined for those regions where very intense earthquakes are expected to reach effective peak acceleration values greater than 0.20g.

Medium. Defined for those regions where there is the probability of reaching effective peak acceleration values greater than 0.10g or less than or equal to 0.20g.

Low. Defined for those regions where the seismic activity does not exceed effective peak acceleration of 0.10g.

Level of relative vulnerability

Very high. Municipalities having a UBN population greater than 76% exposed to high seismic activity.

High. Municipalities with a UBN population between 57% and 76% exposed to high seismic activity.

Moderate. Municipalities with a UBN population between 28% and 56% exposed to high seismic activity or a population exposed to moderate seismic hazard with an UBN population greater than 40%.

Low. Municipalities with a population exposed to low seismic activity or with population exposed to any level of hazard with an index of UBN less than 27%.

Level of relative risk

Very high. Municipalities exposed to high hazards with a GDP greater than Col\$4 billion.

High. Municipalities with a population exposed to high hazard with a GDP less than Col\$4 billion or with a population exposed to moderate hazards with a GDP greater than 9 billion.

Moderate. Municipalities with a population exposed to low hazard with a GDP of Col\$9 billion or municipalities exposed to moderate hazard with a GDP of between Col\$4 and 9 billion.

Low. Municipalities with an exposed population to low hazard with a GDP below Col\$9 billion or with a population exposed to moderate hazards with GDP less than Col\$4 billion.

In order to calculate the level of relative risk the GDP was used at 2009 constant prices (based on 2005) at departmental level. The GDP value was distributed in each municipality adjusted to the size of the population. The resulting values were reclassified in order to operate them based on exposure values related to defined hazards. GDP distribution = (Municipal population * departmental GDP)/total municipal population.

1.2.4. Losses caused by volcanic phenomena, a risk not yet estimated

This type of geological hazard is produced by a series of active or potentially active volcanoes distributed along three mountain ranges and inter-Andean valleys. There are more than 20 potentially active volcanoes in the country,¹³ of which 12 are monitored by the Volcanological Observatories under the supervision of the Colombian Geological Survey in Manizales (Nevado del Ruiz, Nevado del Tolima, Nevado de Santa Isabel, Cerro Machin, and Cerro Bravo), Popayan (Nevado del Huila, Purace and Coconucos, and Sotara), and Pasto (Galeras, Doña Juana, Cumbal, Azufral, and Chiles) (*Figure 1.3*).

The most disastrous volcanic effects in Colombia have been the result of lahars or volcanic mud flow,¹⁴ concentrated in the zones of influence of the Ruiz, Galeras, and Huila volcanoes. Some of the volcanoes in Colombia are above 4,600 m, a factor that determines for many of them the presence of permanent glaciers or seasonal snows, and they therefore have the potential of producing lahars. In the last few years, active volcanoes that have generated eruptive episodes started with the Nevado del Ruiz factor, when on November 13, 1985, the volcano erupted, causing around 23,000 fatalities (Monsalve, 2011). The Galeras volcano started its current activity in 1989 with small explosions, ash emissions, block emissions (ballistic projectiles), and fires (Monsalve, 2011). It was followed by activity in Nevado del Huila, which is the highest and largest volcanic edifice in Colombia and contains the largest glacier volume. Its basins drain toward the Magdalena (OSSO Corporation, 2009a), and its reactivation since 2007 has been characterized by the presence of sludge flow and dome extrusion. As a result of this volcano's activity, more than 10,000 indigenous people were

displaced from the Nasa village, which was located in the surroundings of the volcano. Furthermore, there are other volcanoes that have registered historic eruptions and thus priority must be given to evaluating their threats and risk intervention: Nevado del Tolima, Purace, Doña Juana, and Cumbal (Monsalve, 2011).

The exposure of cities and populations to phenomena such as volcanic eruptions, lahars, and avalanches have not been estimated for all of the volcanoes in terms of possible human and economic impacts. However, partial data on the volcanoes that have hazard maps indicate that there are at least 1.9 million persons in their zone of influence and approximately 240,000 living in high-risk zones¹⁵ (*Table 1.3*). Presently, there are hazard maps for 11 volcanoes in the country. However, the only accurate information is related to the infrastructure and the population exposed, as well as detailed vulnerability studies¹⁶ for the Ruiz, Huila, and Galeras volcanoes. Taking into account the recent volcanic distribution in Colombia in the three main segments (north, central, and south), a first estimate of the exposed population was carried out for this

13 A volcano is potentially active if it has registered eruptive geological activity in the last 10,000 years, historical activity, the presence of thermal manifestations (fumaroles, thermal sources), or if there is the presence of well conserved landforms (Monsalve, 2011). Active and potentially active volcanoes identified in Colombia are: Chiles, Cerro Negro, Cumbal, Azufral, Galeras, Doña Juana, Animas, Sucubun, Sotara, Purace, the eruptive hills that make up the Volcanic Chain of the Coconucos, Nevado del Huila, Cerro Machin, Nevado del Tolima, Quindio, Cerros de Alsacia, Cerro Bravo, Nevado de Santa Isabel, Nevado del Ruiz, and possibly el Paramillo de Santa Rosa and Mar de San Diego (Colombian Geographical Survey 2011).

14 Lahars are avalanches formed by ice and snow caused by eruptive processes (effusive and explosive) or by sudden liberation of water masses accumulated on the volcano or close to it. Mudslides may be formed due to the abundant fall of pyroclastic material after explosive eruptions.

15 Corresponds to the calculated population under exposure to the volcanoes Galeras, Huila, Machin, Ruiz, Cumbal Cerro Negro, Chiles, Purace, Santa Isabel, and Tolima (OSSO Corporation, 2011; Colombian Geographical Survey, 2011).

16 For this study herein, estimation was done calculating the exposed population in the regional municipality, and its effects/impacts, depending on the exact location and topography. Therefore, these values may vary once detailed studies are made.

FIGURE 1.3. Distribution of recent volcanism in Colombia



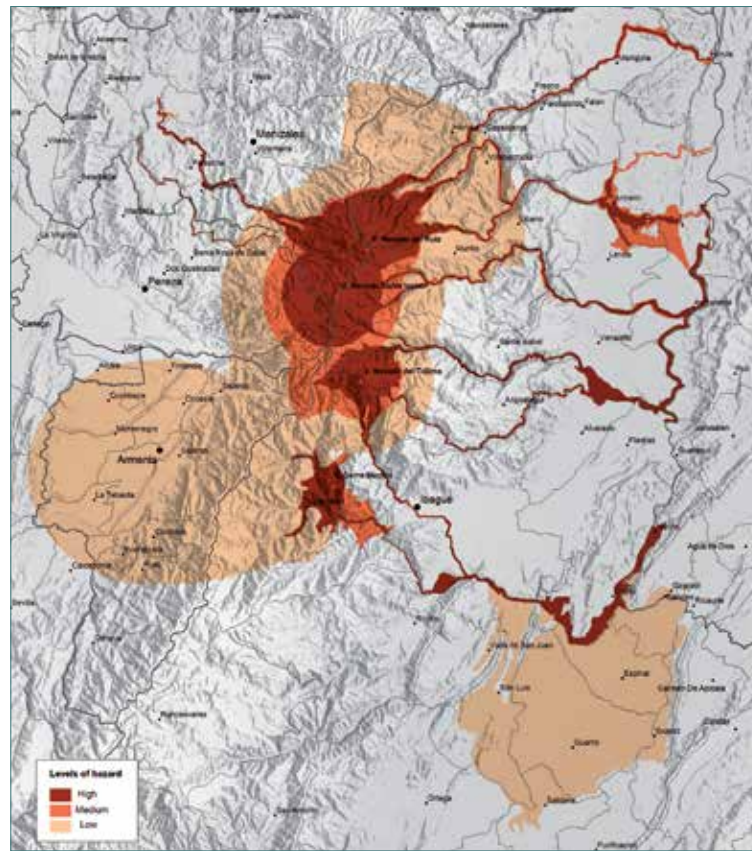
Source: OSSO Corporation, 2011 from the Colombian Geological Survey, 2011.

document. In the Central Mountain Range, the north segment (*Figure 1.4.*), comprising the population around the Cerro Machin, there are close to 31,000 inhabitants exposed to high risk; at the Nevado del Ruiz, 26,000; at Santa Isabel 9,000; and at Tolima, more than 127,000. In the medium segment of the Central Mountain Range, the population associated with the Nevado del Huila volcano, includes approximately 33,000 inhabitants exposed to high hazards (*Fig-*

ure 1.5). Finally, the south segment has 10,000 inhabitants¹⁷ under high risk in the immediate area of the Galeras volcano (*Figure 1.6*) (OSSO Corporation, 2011; Monsalve, 2011; Colombian Geological Survey, 2011).

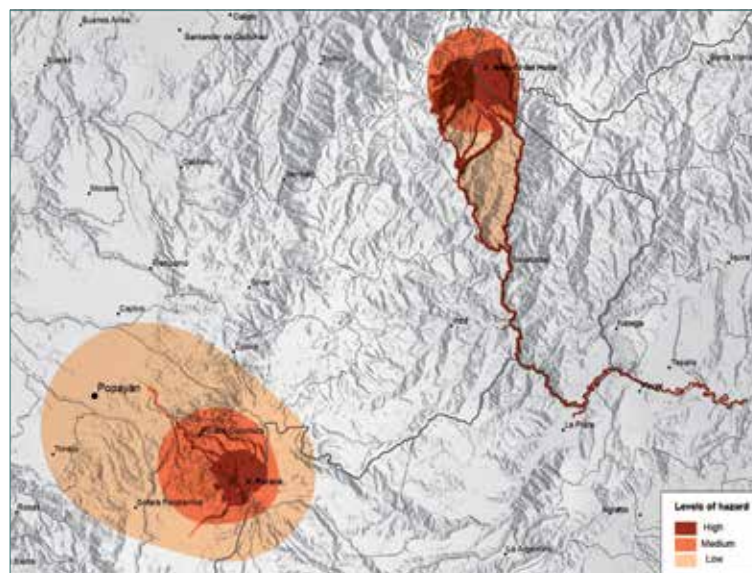
¹⁷ According to the Pasto Volcanological Observatory, the population exposed to the Galeras volcano is located, in the municipalities of Pasto, Nariño, La Florida, Sandona, Yacuanquer and Tangua.

FIGURE 1.4. Exposure to volcanic risk. North segment: Cerro Bravo-Machin Volcanic Province



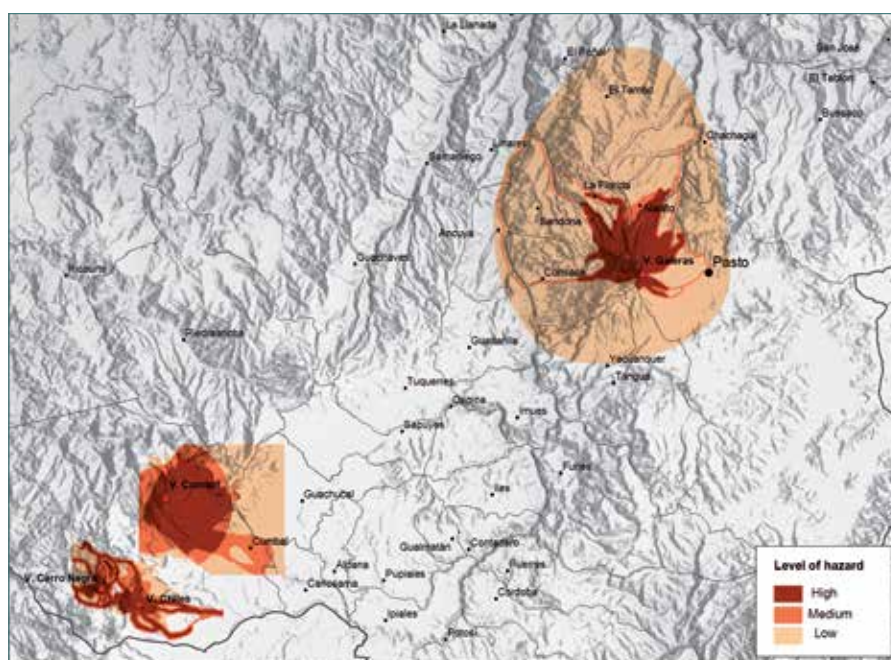
Source: OSSO Corporation, 2011 from information provided by the Colombian Geological Survey, 2011.

FIGURE 1.5. Exposure to volcanic risk. Medium segment: Coconucos-Doña Juana Volcanic Province



Source: OSSO Corporation, 2011 from information provided by the Colombian Geological Survey, 2011.

FIGURE 1.6. Exposure to volcanic risk. South segment: Cauca-Patia Inter-Andean Depression



Source: OSSO Corporation, 2011 from information provided by the Colombian Geological Survey 2011.

TABLE 1.3. Populations of municipal centers exposed to volcanic hazards *

| Segment | Exposed Population 2010 | | | Total 2010 | % |
|-----------------------------|-------------------------|---------------|------------|------------|-------|
| | High Hazard | Medium Hazard | Low Hazard | | |
| North | | | | | |
| Cerro Machin Volcano | 31,236 | - | 690,328 | 721,564 | 38.0% |
| Nevado del Ruiz Volcano | 26,010 | 33,154 | 66,033 | 125,197 | 7.0% |
| Nevado Santa Isabel Volcano | 9,314 | - | - | 9,314 | 0.5% |
| Nevado Tolima Volcano ** | 127,000 | - | - | 127,000 | 7.0% |
| Center | | | | | |
| Nevado del Huila Volcano | 33,214 | - | - | 33,214 | 2.0% |
| South | | | | | |
| Galeras Volcano | 10,295 | 4,518 | 491,994 | 506,807 | 27.0% |
| Cumbal Volcano | - | 34,186 | - | 34,186 | 2.0% |
| Purace Volcano | - | 15,163 | 313,784 | 328,947 | 16.5% |
| Total | 237,069 | 87,021 | 1,562,139 | 1,886,229 | |

* Estimation calculating the population exposed in municipal centers. The values may vary once more detailed studies are carried out.

** Estimation calculating the projection of the population exposed according to Ingeominas, 1988.

Source: OSSO Corporation, 2011 from information provided by the Colombian Geological Survey, 2011.

The Colombian Geological Survey (before Ingeominas), different Autonomous Regional Corporations, and universities have warned that one of the most critical scenarios from a volcanic point of view may be related to a Cerro Machin explosion. The volcano is located in the Tolima department and there are approximately 700,000 people exposed in its zone of influence. In addition, it is of geo-strategic importance to the country. According to the Manizales Volcanological and Seismological Observatory¹⁸ the effects associated with different phenomena and activity processes of Cerro Machin include: 240 km² of area potentially affected by pyroclastic flows that include the head municipalities of Cajamarca and Coello, the township of Anaime, and the villages of Toche and Tapias in Tolima. The zone threatened by lahars, at the basin of

the Magdalena River, corresponds to more than 1,000 km², principally located along the Coello River and the plains on the left bank of the Magdalena River between Saldaña and Nariño. Toward the western part of the Central Mountain Range, there are other hundreds of square kilometers threatened by these types of phenomena, but thus far these have not been accurately identified. Another threatened zone is related to falling pyroclast and it covers an area of around 2,000 km² located to the west of the volcano. Temporarily, in the trajectory of an avalanche produced by landslides in the basin of the Combeima River, melting of glaciers from the Nevado del Tolima volcano or due to its eruption may affect the city of Ibagué, which is located at the mouth of an alluvial fan in which the Combeima river converges.

18 Manizales Volcanological and Seismological Observatory at: <http://www.ingeminas.gov.co/Manizales/Volcanes/Volcan-Cerro-Machin/Mapa-de-amenazas.aspx>.

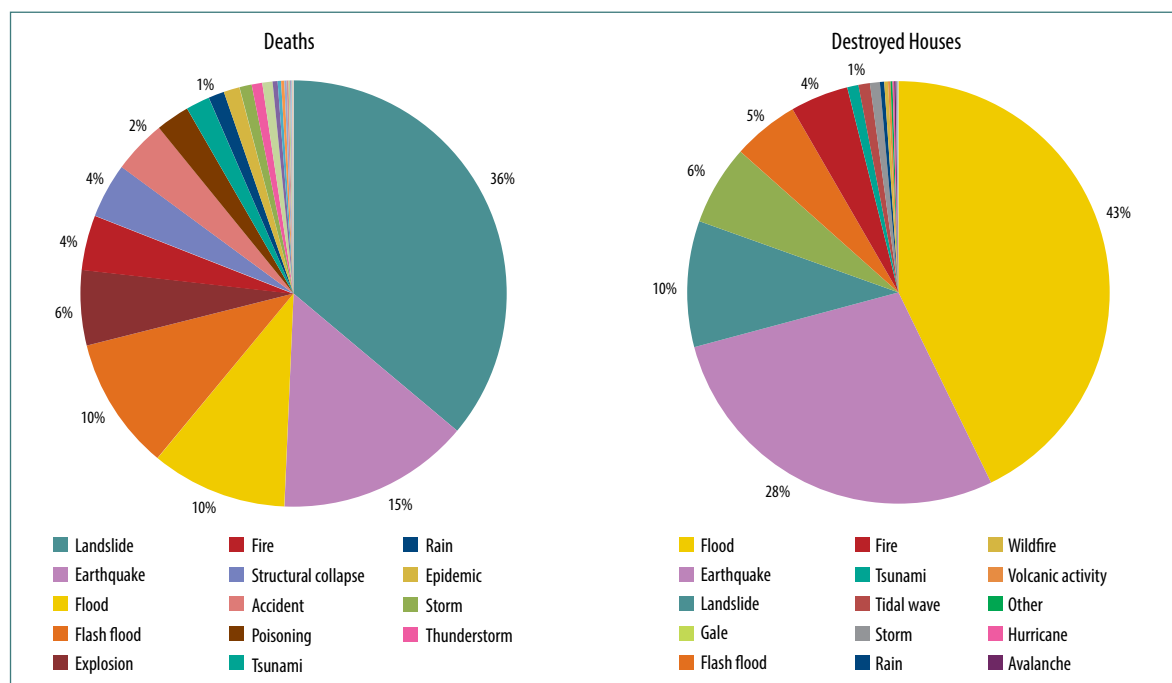
1.3. GAPS IN LAND USE PLANNING IN BASINS AND URBAN ZONES, AND EXPOSURE GROWTH ARE THE MAIN FACTORS IN HYDROMETEOROLOGICAL RISK

1.3.1. Landslides and floods accumulate the greatest percentage of loss of life and housing destroyed respectively

The great losses associated with the Nevado del Ruiz volcanic eruption in 1985 are excluded, the greatest percentage accumulated for loss of life and housing destroyed for the period 1970-2011 corresponds to landslides and floods respectively (*Graph 1.9*). Analyzing by the type

of event, hydrometeorological phenomena generate more localized impacts, but have higher frequency, which accumulatively over time denote even greater losses than those caused by geological events. The DesInventar database (OSSO Corporation-EAFIT, 2011) concludes that floods have caused 43% of housing destroyed and 10% of loss of life, whereas landslides have caused 10% of housing destroyed and 36% of deaths during the period studied.

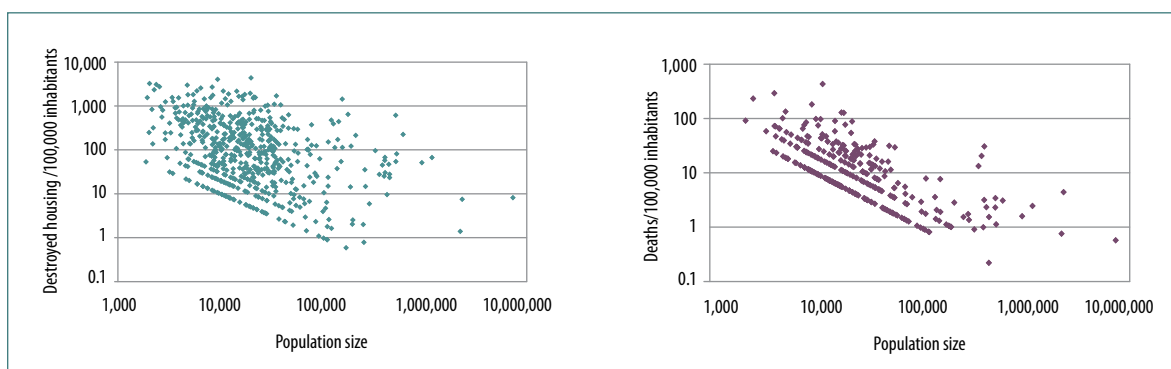
GRAPH 1.9. Losses per type of event, 1970-2011



Note: Excludes loss of life (close to 24,000) and destroyed housing caused by the Nevado del Ruiz volcanic eruption in 1985.

Source: OSSO Corporation 2011 from OSSO-EAFIT Corporation, 2011.

GRAPH 1.10. Housing destroyed and loss of life per 100,000 inhabitants, by municipal population, 2001-2010



Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011.

The data for losses incurred during the last decade, normalized according to the size of the municipal population, indicate that both housing destroyed as well as loss of life are concentrated in smaller territorial entities that have between 10,000 and 50,000 inhabitants. (Graph 1.10). Furthermore, the distribution of impacts on housing and population, according to the socioeconomic characteristics of the municipalities affected, indicate that the majority of their inhabitants are located in rural zones and more than 50% of the population is in UBN conditions.

1.3.2. Factors such as climate variation and deficits in land use planning processes at the rural and urban level lead to an increase in susceptibility to floods and flash floods

The tendency of hydrometeorological registers confirms an increase of precipitation in some of the country's zones, which is interpreted as an important change in one of the triggering factors

that contribute to generating flood and landslide hazards. According to the Ideam study (2009b) on precipitation tendencies historically registered in the period between 1970 and 2000, it can be concluded that in some zones, climate variability has significant effects on the risk conditions in the country. This does not indicate that overall increases are being produced in the intensity of precipitations and their recurrence. In order to have better information and control of these variations, it is necessary to strengthen monitoring and to continue with the analysis models that are currently being developed in Colombia.

It is calculated that between 2000 and 2007, more than 2,000 forest hectares were lost in the country. The average deforestation is more than 330,000 ha per year, which is an important soil degradation factor and makes soil susceptible to floods and landslides. In spite of the regulations related to the forest subject, which are very extensive at the national level and some of which have been in force for more than 50 years, the control mechanisms have not been sufficient and the extraction levels exceed the legally granted licenses. The greatest loss of forested land is evident in the Amazon region with an

TABLE 1.4. Ranges of deforested areas and average anual deforestation, 2000-2007

| Region | Deforestation for period 2000 – 2007 (ha) | | | Deforestation annual average (ha/year) | | |
|--------------|---|------------------|------------------|--|----------------|----------------|
| | Low | Medium | High | Low | Medium | High |
| Andean | 462,902 | 578,627 | 694,353 | 66,129 | 82,661 | 99,193 |
| Pacific | 376,718 | 470,897 | 565,076 | 53,774 | 67,217 | 80,660 |
| Orinoquia | 204,394 | 255,493 | 306,592 | 29,199 | 36,499 | 43,799 |
| Amazonia | 585,088 | 731,360 | 877,632 | 83,584 | 104,480 | 125,376 |
| Caribbean | 256,054 | 320,068 | 384,082 | 36,579 | 45,724 | 54,869 |
| Total | 1,885,156 | 2,356,445 | 2,827,734 | 269,265 | 336,581 | 403,897 |

Note: Figures subject to validity from high-resolution remote sensors or field data.

Source: Ideam, 2009b.

average of 570,000 hectares, followed by the Andean region with more than 570,000 hectares (*Table 1.4*). However, in relative terms, the Caribbean region was the most affected one between 2000 and 2007, given that 12% of its forest coverage disappeared in that period (Ideam, 2009b). Deforestation constitutes an important factor in soil degradation and this impact is not compensated by reforestation projects, since the cultivated areas are smaller and the processes are mainly concentrated on protecting the basins that supply safe drinking water, and not on controlling erosion. However, it is indirectly acknowledged that reforestation in basins may have minimum positive impacts on the territory²⁰.

Efforts to progress in land use planning through Law 388 of 1989 have been very important, but they have not yet been sufficient or achieved the impacts desired in urban or rural areas. Conflicts between land use and land vocation have transformed the territories' natural conditions. The great wealth of country's ecosystem has been diminished due to the inadequate land use and occupation, which has generated, among other things, changes in the hydraulic dynamic of the rivers, deforestation, drying wetlands, contami-

nation, and overexploitation of natural resources. Human settlements near rivers, mines, and agriculture and livestock zones are the principal man-induced interventions having influence in this transformation. According to *Table 1.5*, 17% of the country's territory undergoes overexploitation. In other words, land use exceeds its capacity, while 15.9% is underutilized, 47.2% is for conservation, and 19.9% does not have any type of conflict. As an example, it can be pointed out that the surface dedicated to agriculture and agrisilviculture (simultaneous husbandry of forest tree crops and food crops) is close to 4.9 million hectares, though it is estimated that 21.5 million may be used for this purpose. In other words, only 22.7% of the surface land area that is suitable for this purpose is used for cultivation. However, the

19 Actions to protect Colombian forests began with the issuance of Decree 1454 of 1942, in which regulations were established to protect forest zones and for the first time definitions were set for forests in the public interest and for public forests. Furthermore, provisions were made related to forest harvesting and forest development (Ideam, 2009b).

20 Reforestation projects have been focused on the protection of basins and not in controlling erosion. Caldas, Antioquia, and Cundinamarca are among the regions that have invested in erosion control during many decades.

opposite occurs in livestock activity, which uses 39,200 hectares to maintain the herds, whereas only 21 million of the land used is suitable for this activity (UNDP, 2011).

Changes in land use and the corresponding loss of vegetation coverage in practically the entire country may be observed by comparing land use maps from 1970 and 2000 (Figure 1.7). In zones such as the Pacific, the Caribbean, and the Orinoquia, losses have extended territori-

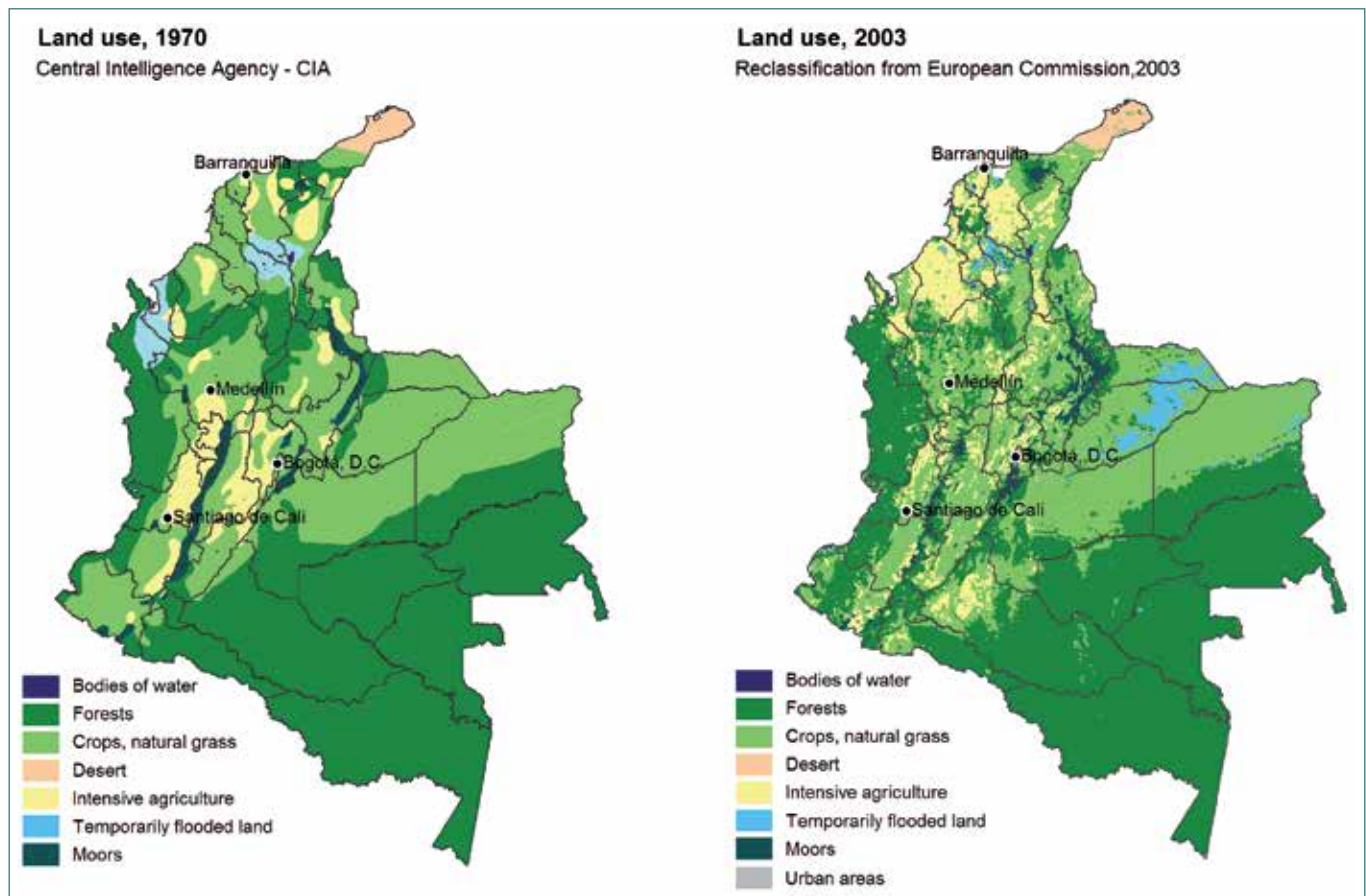
ally in line with changes in land use. For example in the foothills of the Eastern Mountain Range, in the Middle Magdalena, in the Low Magdalena, in the Low San Jorge and Cauca, in the Sinu basin, and in the Pacific region are areas where intensive agriculture has grown by approximately 23%, resulting in decrease of forest areas. During the period of 1990-2005, Colombia increased the number of heads of cattle by 1,315,895.

TABLE 1.5. Suitable land use and conflicts arising from land use

| Type of conflict | Description | Area | |
|---------------------------------|--|-------------|------|
| | | Hectares | % |
| None | Current use is compatible with its usability | 22,669,659 | 19.9 |
| Underutilization (total) | | 17,790,116 | 15.7 |
| • Light | Current use is close to its usability | 5,192,171 | 4.6 |
| • Moderate | Current use is below its usability | 7,829,533 | 6.9 |
| • Severe | Current use is considerably below its usability | 4,767,866 | 4.2 |
| Overutilization (total) | | 19,652,641 | 17.2 |
| • Light | Current use is close to its usability | 6,303,463 | 5.5 |
| • Moderate | Current use is above its usability, with unsustainable production processes | 5,635,580 | 4.9 |
| • Severe | Current use is considerably above its usability, causing an accelerated land degradation | 7,713,598 | 6.8 |
| Land under conservation | Natural forests, wasteland vegetation , mangroves | 65,538,892 | 47.2 |
| National total | | 125,651,308 | 100 |

Source: World Bank (2006b) from information provided by the IGAC, Ministry of Agriculture and Corpoica (2002)

FIGURE 1.7. Comparison of land use in 1970 and 2000



Sources: CIA, 1970; Eva, et al., 2003.

Soil without ground vegetation is exposed to being dragged by water, and if we add the loss of infiltration due to human activity, the result may be an increase of the temporary flow of waters, which may produce floods or avalanches. The levels of erosion have increased in all of the regions of the country, but especially in the Caribbean region, where it is estimated that the number of hectares affected by erosion is 35.9%, followed by the Orinoquia and the Pacific regions. Out of the 32 departments in Colombia, 12 (one-third or more of the total land area) undergo a high degree of erosion, principally in the Caribbean region, in the departments of Atlántico, Cesar, Cordoba, La Guajira, and Sucre, and two in the

Orinoquia region, Casanare and Meta, with more than 50% of the land having high levels of erosion (World Bank, 2006b). Table 1.6 indicates how high and very high levels of erosion increased by 16 million hectares between 1988 and 2000, which represents 14% of the total surface of the country, and demonstrates that land degradation policies have been inefficient²¹

21 The analysis made by the World Bank in the document *Environmental priorities to reduce poverty* (2006b) indicate that only four Regional Autonomous Corporations (CAR) greatly invest in land conservation, although these are below the needs required: The Regional Autonomous Corporation for the Defense of the Bucaramaga Plateau (CDMB), Corantioquia, Corpoboyaca, and the Valle del Cauca Regional Autonomous Corporation (CVC). It also demonstrates that 54% of the CAR invest insufficient amounts in relation to the size of this problem.

TABLE 1.6. Change of high and very high erosion, 1998-2004

| Region | Total Area (ha) | High and Very High Erosion | | | | | |
|--------------|--------------------|----------------------------|-------------------|-------------------|----------------|-----------------|-------------|
| | | Hectares | | | Percentage | | |
| | | 1998 (IGAC) | 2004 (Ideam) | Change | 1998 (IGAC) | 2004 (Ideam) | Change |
| Amazonia | 18,977,000 | 0 | 157,590 | 157,590 | 0.0 | 0.8 | 0.8 |
| Andean | 21,927,700 | 3,410,125 | 4,369,974 | 959,849 | 15.6 | 19.9 | 4.4 |
| Caribbean | 13,194,400 | 1,469,900 | 6,205,975 | 4,736,075 | 11.1 | 47.0 | 35.9 |
| Orinoquia | 46,954,000 | 4,825,125 | 13,982,990 | 9,157,865 | 10.3 | 29.8 | 19.5 |
| Pacific | 12,931,300 | 0 | 1,292,308 | 1,292,308 | 0.0 | 10.0 | 10.0 |
| Total | 113,984,800 | 9,705,150 | 26,008,837 | 16,303,687 | 8.5 | 22.8 | 14.3 |

Source: World Bank, 2006b from IGAC, 1988 and Ideam 2004.

thus far. The estimated land loss is 145,132,500 tons/year. As a result, these sediments are mostly deposited in riverbeds, in natural buffer areas, or lastly they may end up in the sea (ECLAC and GTZ 2008).

Additionally to the degradation factors of the basins that generate changes in susceptibility or the probability of flood or landslide occurrences (increase of the hazard), demographic growth, urban concentration, and greater levels of exposure without any significant decrease in vulnerability factors also contribute to the equation of greater risk growth. The current weaknesses in the land management processes, the lack of knowledge of the phenomena²², the disarticulation in the Watershed Management Plans (POMCA) and the Land Use Plans (POT), technical specifications in infrastructure design and construction, and urban control mechanisms result in new human settlements being set up in inappropriate and unsafe zones from the point of view of risk. On the other hand, low investment to apply corrective measures such as constructing mitigation works, integral improvement of neighborhoods, and resettlement processes in

nonmitigable high-risk zones is, among other factors, causing accumulations and growth of exposure and vulnerability, thus of the risk of floods and landslides in Colombia.

Inadequate coordination among entities and poor coherence between planning and public administration instruments influence the increase of institutional and policy vulnerability, consequently putting the Colombian population at risk. The ambiguity of regional competencies in planning and land use planning, the disarticulation of the POT with the departmental and municipal PD, and the lack of risk management in public administration show that the current structure is inappropriate for a real reduction of disaster risk in the country.

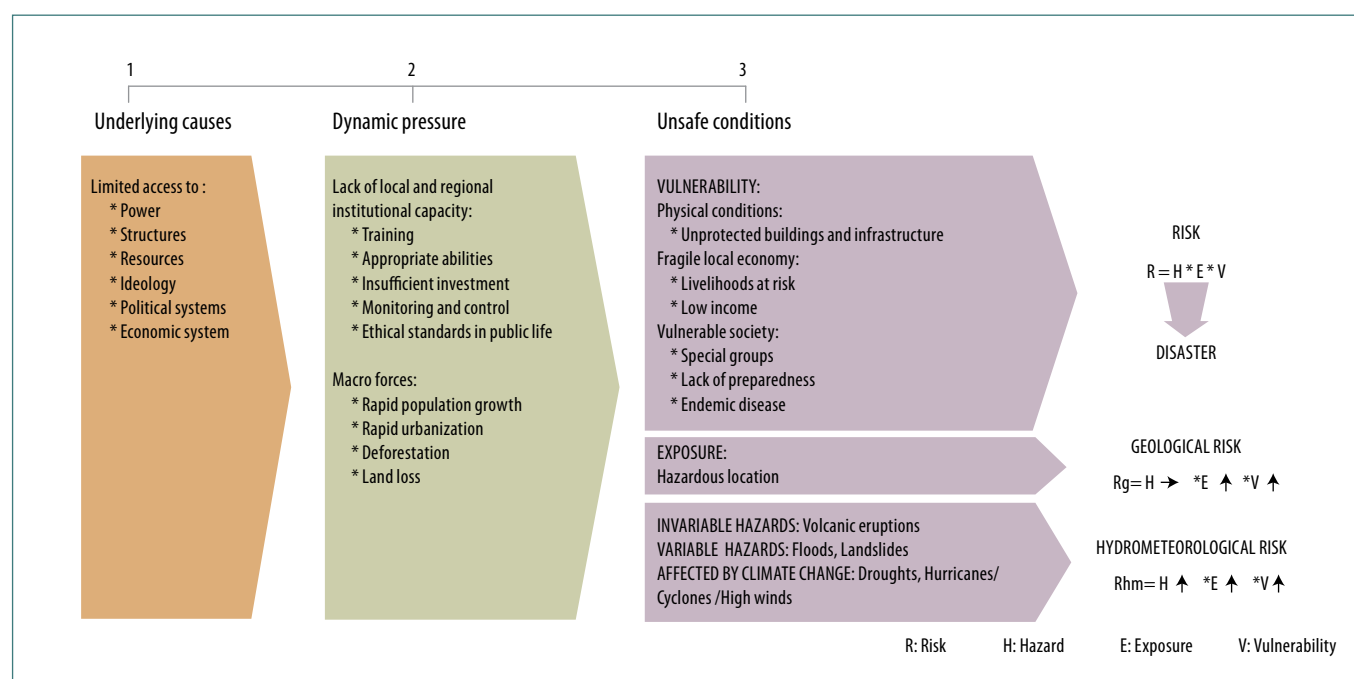
22 On a regional scale, there are few studies related to specific hazards. These include, in the case of the Sinu flood hazard or the Combeima landslides and the geological hazard study in Cundinamarca. Overall, municipalities have carried out hazard studies in order to comply with the POT regulation that requires its inclusion, but these studies have been developed without adequate reference terms and do not provide an effective input for the planning processes. Cities such as Bogotá and Manizales have executed more rigorous technical risk studies which have been helpful in decision making as far as disaster risk management at the local level is concerned..

The ideology and political and economic structure that serve as a base for the development model generate institutional weaknesses or strengths and determine the performance of growth dynamics, which may result in environmental degradation, accelerated population growth, and urbanization, otherwise known as macro forces that affect risk performance. If it is assumed that the concept of risk is a product of *hazard* (probability of an occurrence of a phenomenon), *exposure* (localization in zones where hazard or danger may generate effects), and *vulnerability* (weakness or susceptibility for being affected by hazards), it is possible to understand risk performance resulting from the variation of these three factors. Hazards are invariable for phenomena such as seismic activity and volcanic eruptions, since people cannot intervene in their dynamics. But phenomena such as deforestation, soil loss, and bad practices in land use planning, named by some authors as dynamic pressures, have influence in increasing susceptibility or the probability of a phenomenon oc-

currence (increase of hazards) and exposure to the same (a house located in a safe place may in the long run be affected by landslides or floods, due only to deforestation processes or improper water management in its surroundings). The lack of institutional capacities also contributes to the increase of the three risk factors, since inadequate controls and the absence of creating a community awareness strategy allow not only an increase in the hazard and its exposure, but also an increase in vulnerability, which is related to physical aspects (bad quality in the construction, for example) and social, political, and economic aspects (bad capacity to access income, chronic illnesses in the population, etc.). In the Pressure and Release model, proposed by Blaikie et al. in 1996, underlying causes are identified as the source of vulnerability in society. Dynamic pressures are those processes that “translate” the effects of the underlying causes into unsafe conditions. Finally, unsafe conditions are the concrete forms in which hazard, exposure, and vulnerability are expressed (figure 1.8).²³

23 The Pressure and Release model is introduced in this chapter as a relatively simple tool that indicates how the disaster arises when natural hazards affect vulnerable persons. Their vulnerability is ingrained in social processes and root causes that eventually may be completely unrelated to the event that triggers the disaster. It is a means to understand and explain the causes of risk and thereby of disasters.

FIGURE 1.8. Social processes in creating risk as adopted from the PAR model



Source: Adopted from the *Disaster Pressure and Release*, Blaikie, et al., 1996.

1.3.3. Geographical distribution of hazard, exposure, vulnerability and relative risk in facing floods

In Colombia, the presence of low plains and alluvial valleys, combined with precipitation conditions, makes possible the occurrence of floods. Some of them are produced slowly, affecting large areas of territory and others are produced more rapidly and associated with intense rain in the high parts of the basins characterized by steep slopes. A flood hazard is understood to be the probability of an overflowing of rivers as a result of heavy or continuous rainfall that increases the water level to a point where the river overruns its natural course in a determined period causing negative impacts in a population, in the agriculture sector, and the infrastructure (Campos A. et ál, 2009). In

addition, increasingly there are more frequent urban floods related to a deficient maintenance of the sewage system or the absence of rain or sanitary drainage.

Some 12% of the national territory is located in areas that are susceptible to floods. These areas are mainly located (i) in the east of the country, in the low plains of the basins of the Orinoco and Amazon rivers; (ii) in the alluvial valleys of the Caribbean and Pacific regions, associated to the Magdalena river, the Momposina depression, the valleys of the Sinu and Alto San Jorge rivers, the lowlands close to the Atrato river, in Choco, and the deltas of the San Juan, Telembi, Patia, and Mira rivers; and (iii) in the inter-Andean valleys, mainly on the Cauca and Magdalena rivers, as well as on the Sabana de Bogota (Figure 1.9).

The populations located in zones having the greatest potential of floods are distributed in 79 municipalities, which represent 28% of the total national population. The departments most exposed to floods are Valle del Cauca, Atlantico, Cundinamarca, Magdalena, Antioquia, Cordoba, Cesar, Cauca, and Meta. At the municipal level, Bogota, Cali, and Barranquilla are the municipalities with the highest populations and are located in zones that have the highest possibility of being flooded, followed by Apartado (Antioquia), Chia (Cundinamarca), and Jamundi (Valle del Cauca).

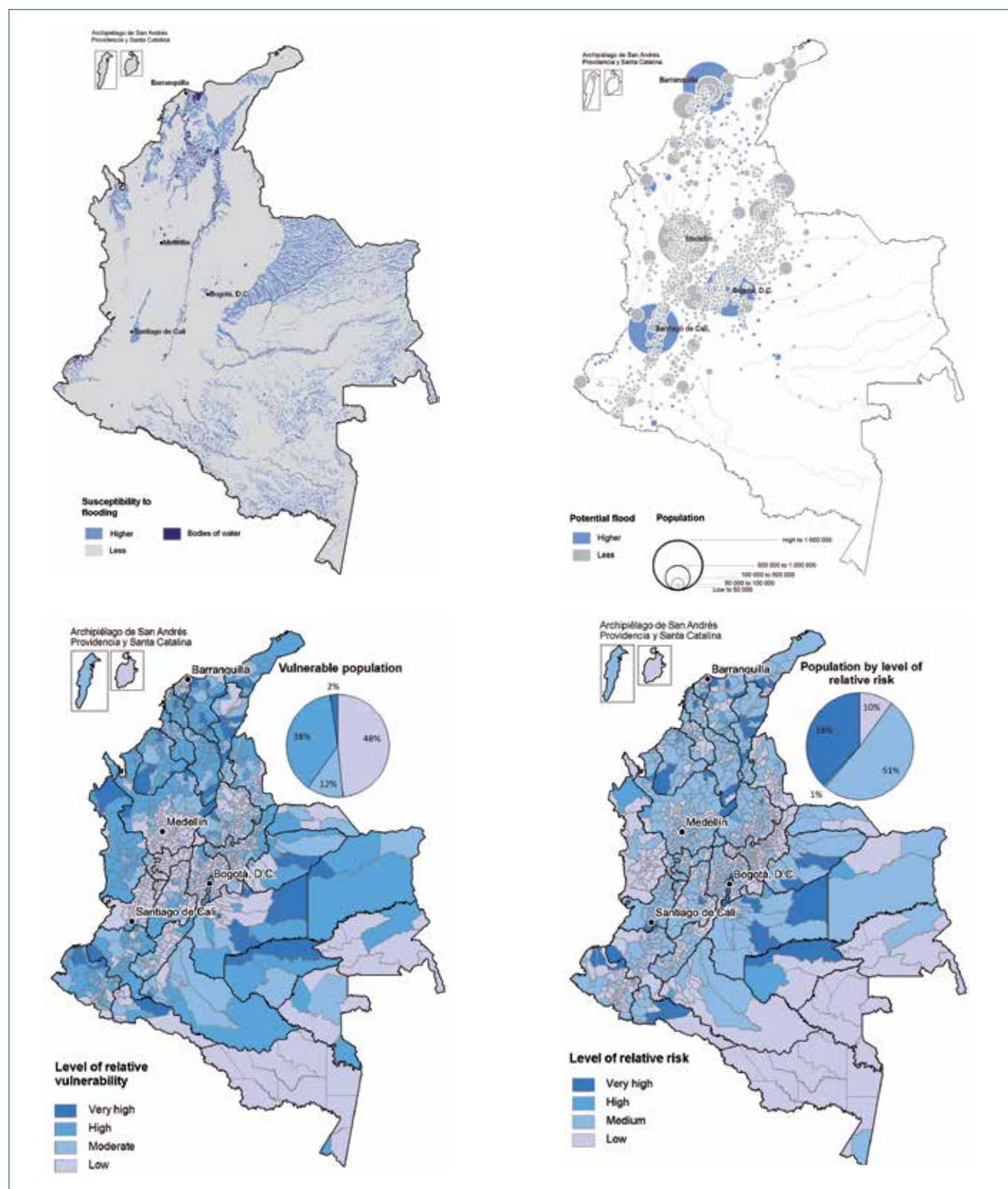
Vulnerability related to floods, with respect to the UBN indicator per municipality indicates that 48% of the population is classified at a high level of vulnerability (Figure 1.9). The regions having the greatest potential for floods are the Pacific and the Caribbean, the tributaries of the Magdalena River, and the municipalities of the Orinoquia and the Amazon regions, which also have the highest indices in poverty, qualitative housing deficits, lowest coverage of water supply and sewage, and highest backwardness and rurality indices. Additionally, due to the absence of institutional and economic capacity, their potential for recuperation in case of a disaster is deficient.

The relative risk or economic loss indices caused by floods, with respect to the GDP, highlights some cities such as Cali, Bogota, Medellin, Barranquilla, Monteria, Cartagena, and Villavicencio (Figure 1.9). A very high relative risk index is identified related to flood zones with the greatest economic concentration in the largest cities and metropolitan areas. Formal housing construction covers only 60% of demand (DNP, 2010a), and the displaced population coming from rural areas has been accumulated in the largest cities, on the outskirts or in marginal zones of these cities that are not conditioned to have appropriate development and lack sew-

erage, which creates more susceptibility to the occurrence of flood phenomena due to inadequate land use and occupation.

There are not many models to estimate probable losses caused by floods. However, some of the existing models confirm that the greatest losses, as far as departments, may happen in the Caribbean region and the Llanos Orientales (Eastern Planes). The existing models have estimated the losses in the agriculture sector based on number of hectares under cultivation by department and the assessment of the area for each type of crop that could be affected (*Graph 1.11*). The spatial distribution of the damages is coherent with what was observed during the last La Niña 2010-2011 phenomenon, but the estimated values are considerably lower than what is presented in reality due to the information limitations on land registries, among other factors. It is necessary to improve the precision of these types of models in order to have a better definition and implementation of risk management policies. However, even with the flood and climate precipitation models, there will always be considerable levels of uncertainty. Therefore, it is necessary to consider control and management measures that are robust and ample to cover different scenarios.

FIGURE 1.9. Zones susceptible to floods, exposed population, vulnerability, and relative risk²⁴



Source: OSSO Corporation, 2011 from Ideam, 2010.



Floods. Municipality of La Virginia (Risaralda - Colombia), 2011. Photography: Gabriel Jaime Arango Zapata.

24 Range of susceptibility to floods

Greater potential. Those areas, whose topographic conditions in the large valleys of Colombia make them more prone to being flooded.

Minor potential. Those areas where there are probabilities of floods, but these are not caused by topographic conditions, but may be caused by human interactions.

Level of relative vulnerability

Very high. Municipalities having a UBM population greater than 56% exposed to potentially major floods.

High. Municipalities with a UBM population between 27% and 56% and exposed to potentially major floods.

Moderate. Municipalities having a UBM population less than 27% exposed to potentially major floods.

Low. Municipalities having a UBM population less than 56% exposed to potentially major floods.

Level of relative risk

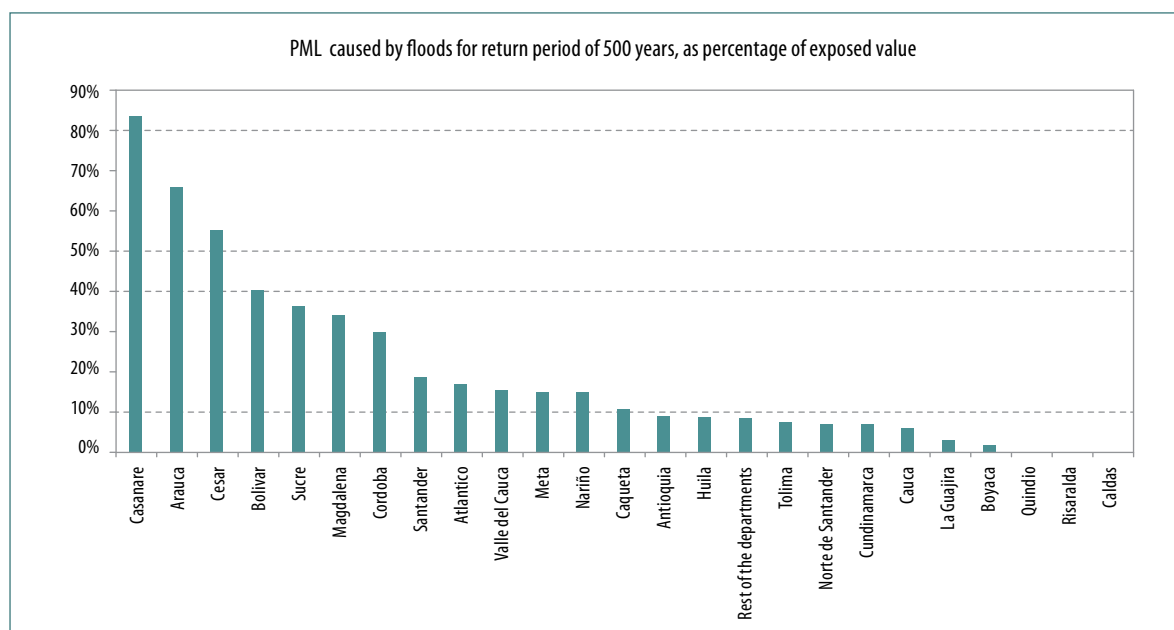
Very high. Municipalities with a population exposed to potentially major floods with a GDP greater than or with a population exposed to potentially minor floods with a GDP greater than Col\$9 billion.

High. Municipalities with a population exposed to potentially minor floods with a GDP between Col\$4 and 9 billion.

Moderate. Municipalities with a population exposed to potentially minor floods with a GDP between Col\$1 million and 4 billion.

Low. Municipalities with a population exposed to potentially minor floods with a GDP less than Col\$4 billion or with a population exposed to greater floods with a GDP of less than Col\$100 million.

GRAPH 1.11. Probable maximum losses in the agriculture sector caused by floods for a return period of 500 years, by department



Estimate of economic losses caused by floods

| Department | Exposure (US\$ million) | PML (%) Return Period | | | PML Value (US\$ million) Return Period | | |
|-------------------------|-------------------------|--------------------------|-------|-------|---|-----|-----|
| | | 50 | 100 | 500 | 50 | 100 | 500 |
| Antioquia | 1,295 | 2.28 | 4.10 | 9.12 | 30 | 53 | 118 |
| Atlantico | 84 | 4.28 | 7.71 | 17.14 | 4 | 7 | 14 |
| Arauca | 448 | 16.47 | 29.65 | 65.89 | 74 | 133 | 295 |
| Bolivar | 510 | 10.07 | 18.12 | 40.27 | 52 | 93 | 208 |
| Boyaca | 564 | 0.47 | 0.84 | 1.87 | 3 | 5 | 11 |
| Caldas | 294 | 0.0 | 0.01 | 0.01 | 0 | 0 | 0 |
| Caqueta | 1,091 | 2.74 | 4.94 | 10.97 | 30 | 54 | 120 |
| Cauca | 545 | 1.49 | 2.68 | 5.96 | 8 | 15 | 33 |
| Cesar | 641 | 13.86 | 24.95 | 55.45 | 89 | 160 | 356 |
| Cordoba | 607 | 7.42 | 13.36 | 29.69 | 45 | 81 | 180 |
| Cundinamarca | 677 | 1.74 | 3.13 | 6.96 | 12 | 21 | 47 |
| Huila | 521 | 2.20 | 3.95 | 8.79 | 11 | 21 | 46 |
| La Guajira | 529 | 0.68 | 1.22 | 2.71 | 4 | 6 | 14 |
| Magdalena | 571 | 8.50 | 15.30 | 33.99 | 49 | 87 | 194 |
| Meta | 1,484 | 3.74 | 6.73 | 14.97 | 56 | 100 | 222 |
| Nariño | 364 | 3.73 | 6.71 | 14.92 | 14 | 24 | 54 |
| Norte de Santander | 413 | 1.76 | 3.16 | 7.02 | 7 | 13 | 29 |
| Quindio | 104 | 0.01 | 0.02 | 0.05 | 0 | 0 | 0 |
| Risaralda | 147 | 0.01 | 0.01 | 0.02 | 0 | 0 | 0 |
| Santander | 733 | 4.69 | 8.45 | 18.77 | 34 | 62 | 138 |
| Sucre | 282 | 9.17 | 16.50 | 36.67 | 26 | 47 | 103 |
| Tolima | 749 | 1.85 | 3.32 | 7.39 | 14 | 25 | 55 |
| Valle del Cauca | 612 | 3.91 | 7.04 | 15.64 | 24 | 43 | 96 |
| Casanare | 1,038 | 20.81 | 37.45 | 83.22 | 216 | 389 | 864 |
| Rest of the departments | 2,710 | 2.10 | 3.78 | 8.41 | 57 | 103 | 228 |

Source: Cardona, et al., 2005.

1.3.4. Geographic distribution of hazards, exposure, vulnerability, and relative risk in facing landslides

In Colombia, the topographic conditions make up an appropriate scenario for landslides, a situation that is accentuated by anthropic processes that take place in the mountainous zones. Landslide occurrence is controlled by the concurrence of geological, geomorphologic, structural, and climatic and geotechnical factors interacting in the territory. The change from stable conditions to unstable conditions may be triggered by natural variables such as earthquake vibrations caused by seismic activity, by the natural properties of the land, by water that can act as a lubricant in zones where it filters, or by the dragging of particles. Likewise, landslides may be influenced by anthropogenic interventions that generate erosion processes, such as those previously mentioned, and by other factors, such as cuts for constructing roads, inadequate management of hillsides for urbanization, installation of network infrastructure, water infiltration by leaks in the water and sewage system, absence or deficient systems in rainwater collection systems, deforestation, and mining.

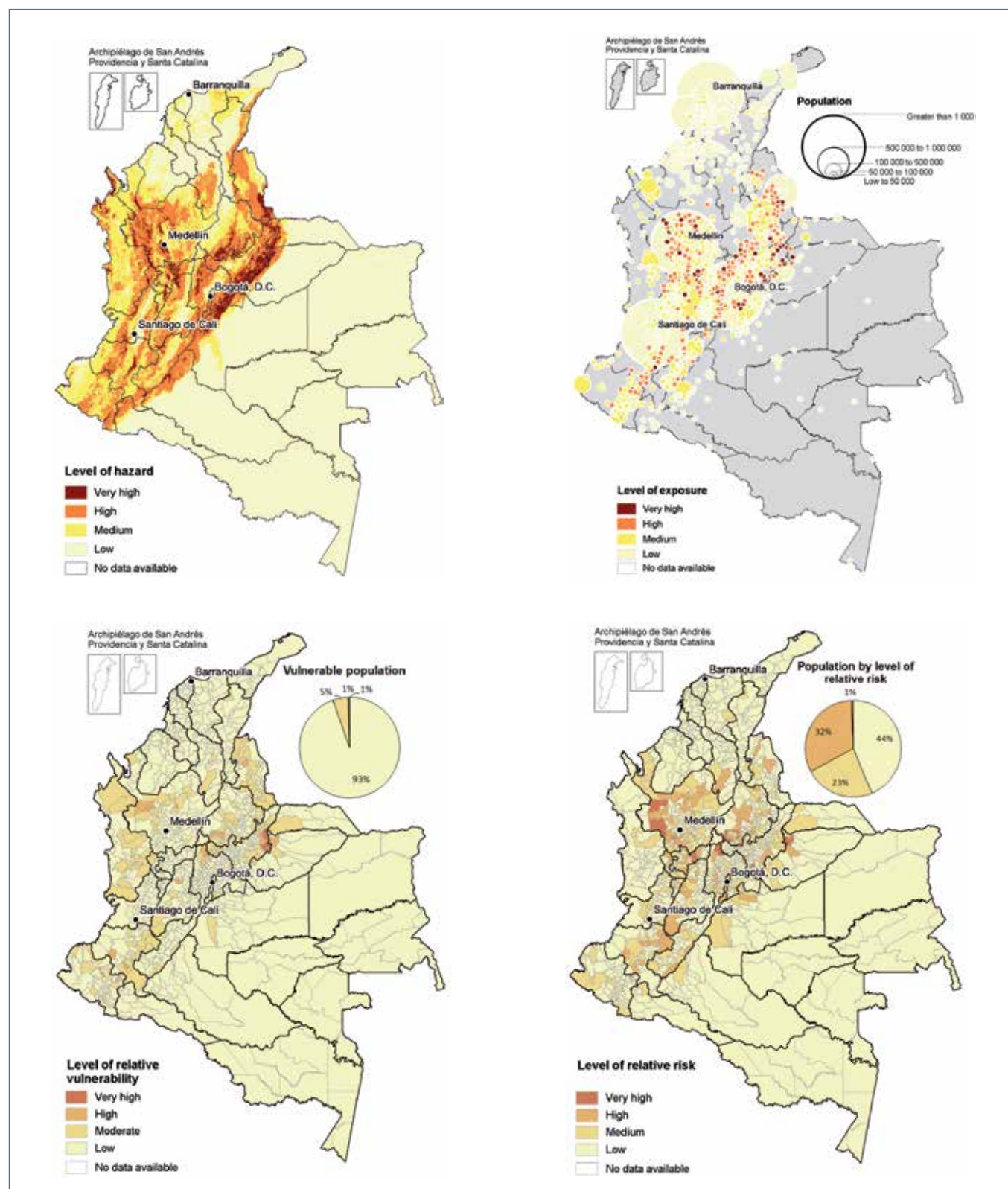
Various institutions in the country, such as Ideam, SGC (before Ingeominas), and some universities, have carried out studies on hazard zoning due to landslides. The first inventory of landslides was done by the Colombian National University in 1989. Since 1997, the SGC has been cataloging landslides, which served as a base for zoning that was published in 2003, in relation to the regional classification of relative hazards of landslides in Colombia. From this inventory, five categories are established according to density, frequency, and recurrence. The latest inventory that was developed in this

regard was in 2010, when SGC and Ideam updated the national hazard map relative to landslides at a scale of 1:500,000.

Some 18% of the national territory is located in very high-and high-hazard landslide zones, mainly in the departments located in the Andean region, which have a great percentage of their area exposed to this phenomenon, such as Boyaca (74%), Cundinamarca (65%), Risaralda (61%), and Caldas (59%) (*Figure 1.10*). A very high level of hazard is mainly concentrated in the brooks of the Cauca and Patia rivers, the northern part of the Eastern Mountain Range, and the Western Mountain Range. In the Eastern Mountain Range, instability is obvious in the zone, due to fracturing of material due along. The high level of hazard is especially concentrated in some sectors of the Central Mountain Range, Santa Marta's Sierra Nevada, in the Quetame and Santander massifs, and in the foothills of the Eastern Mountain Range. The low hazard, which affects 50% of the national territory, is located primarily in the Orinoquia and the Amazonia regions. The Caribbean and Pacific regions overall have low levels of exposure hazards. The medium hazard rate (10% of the national territory) is mainly located in valleys among the three mountain ranges.

As far as landslides, the greatest exposure is identified in 353 municipalities that are located in high-and very high-risk zones, where 8% of the national population resides. As far as moderate exposure, there are 346 municipalities that correspond to 23% of the population. The departments that are prominent as having the largest populations exposed to high and very high risk are Antioquia, Cundinamarca, Cauca, Santander, Boyaca, Caldas, and Tolima, followed by Norte de Santander, Nariño, Huila, Risaralda, and Bolivar. At the municipal level, the largest populations exposed to high and very high landslide risks are located in

FIGURE 1.10. Landslide hazards, population exposure, vulnerability, and relative risk²⁵



Source: OSSO Corporation, 2011 from information provided by Ingeominas and Ideam and DANE, 2010.

the municipalities of Villamaria (Caldas); Bolivar, La Vega, Piendamo, and Cajibío (Cauca); Yarumal and Urrao (Antioquia); Libano (Tolima); Santa Rosa del Sur (Bolívar); and San Vicente de Churquí (Santander) (Figure 1.10).

Vulnerability relative to unsatisfied basic needs and the exposure to hazards caused by landslides are prevalent in the Andean region. In particular, this occurs on the Cauca River slopes, in western Antioquia, on the western slopes of the Eastern Mountain Range (Magdalena slope), on the Eastern slopes of the Eastern Mountain Range, and in some Andean municipalities in the departments of Huila, Cauca, and Nariño.

The relative risk index with respect to GDP and the hazard due to landslides is the greatest in

Antioquia, the Coffee Growing region, Santander, and North Santander, and on the eastern slopes of the Eastern Mountain Range and in the Huila and Cauca municipalities.

No probabilistic models were identified that estimate economic losses and loss of life in the event that landslides occur nationally or regionally. However, there have been significant advances in some municipalities at a local level. Since the infrastructure that is most affected by these types of phenomena is mainly transportation and housing, it is necessary to develop future models, at least as a first stage at the national scale, and promote greater implementation of the models in housing at the municipal scale.

25 Landslide hazard levels

Very high. Zones with very unstable hillsides and steep slopes and intensive human intervention, where massive landslides and erosion are very frequent and numerous.

High. Zones with unstable slopes where there is an accumulation of erosion due to intensive anthropic intervention, in which landslides are less frequent and less numerous.

Medium. Zones where there is no evidence of existing instability and slope areas with low instability generated by insignificant erosion processes predominated by soil creep processes.

Low. Flat areas or areas with generally stable low steep slopes and vegetation and not very populated areas where there exists low instability in the land.

Level of relative vulnerability

Very high. Municipalities exposed to high risk with a UBN factor higher than 56% or municipalities with very high risk greater than 41%.

High. Municipalities exposed to medium risk with a UBN factor higher

than 56% or with a population exposed to a high risk with a UBN lower than 56%.

Moderate. Municipalities exposed to medium risk with a UBN factor between 27% and 56%.

Low. Municipalities exposed to low risk with a UBN factor lower than 27% or a population exposed to any hazard level with a UBN lower than 27%.

Level of relative risk

Very high. Municipalities exposed to medium risk exposed to high and very high risk with a GDP greater than Col\$100 million.

High. Municipalities with a population exposed to medium hazards with a GDP of between Col\$100 and 4,000 or exposed to high hazards with a GDP below Col\$100 million.

Moderate. Municipalities with a population exposed to low hazards with a GDP below Col\$4 billion or exposed to medium hazards with a GDP below Col\$100 million.

Low. Municipalities with a population exposed to very low hazards with a GDP below Col\$4 billion.

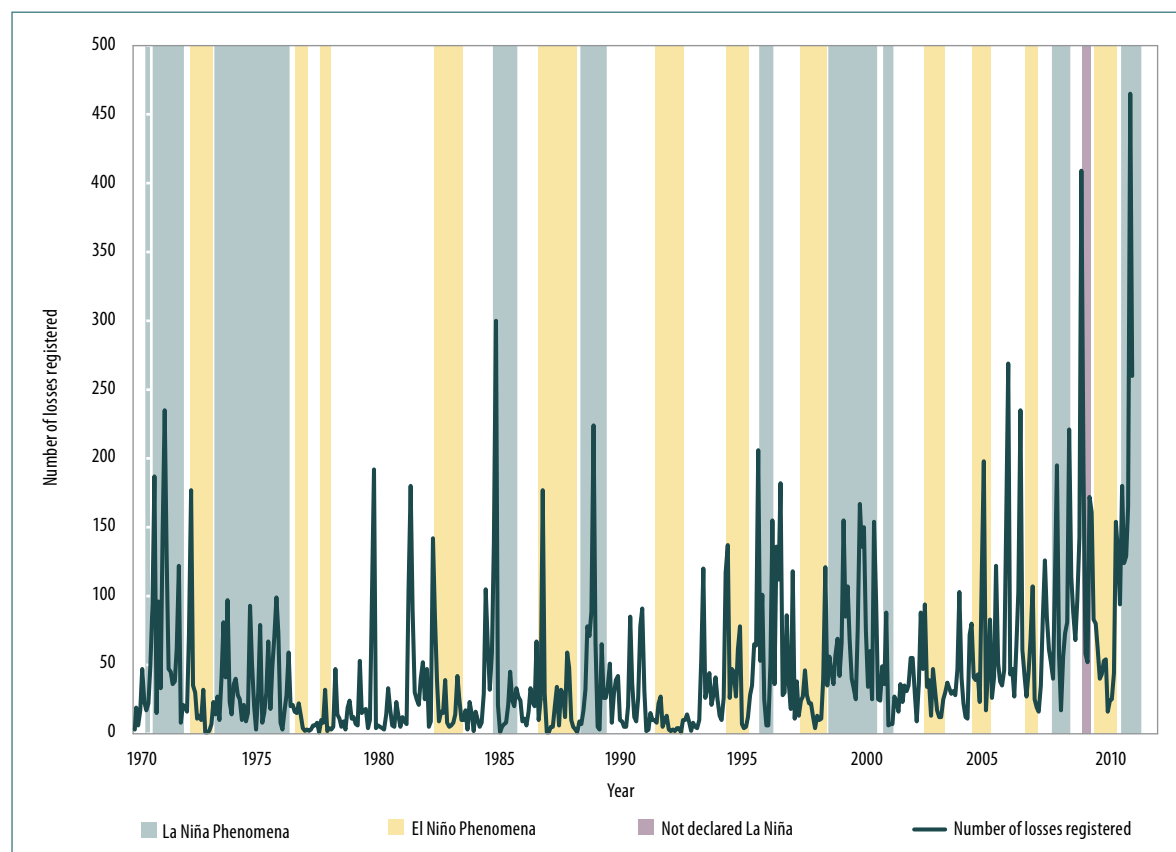
1.3.5. Climate change and El Niño and La Niña phenomena

Hazard phenomena such as floods, landslides, flash floods, windstorms, droughts, among others, are connected to an inter-annual variation in weather, dry and rainy periods depending on each region of the country that have increased considerably with the incidence of the El Niño and La Niña phenomena. When there are warm episodes in the ENSO phenomenon (El Niño/La Niña-Southern Oscillation), El Niño, there is a shortage of precipitations in Colombia, which results in droughts, lack of safe drinking water and a notable increase in forest fires. When there is an occurrence of cold episodes, which

in this case is called La Niña, rainfall increases and consequently there are more floods. There is more slope instability due to the landslides affecting human life, roads and the agrarian sector, among others.

There has been reliable information related to the occurrence of El Niño and La Niña phenomena since 1950, and so it can be confirmed that this phenomenon will continue to take place in the future. Likewise, it may be concluded that if no pertinent actions are taken, losses and those affected will continue to increase. Both El Niño and La Niña are frequent phenomena given that they take place between every two and seven years. Between 1950 and 2011 there have been 15 El Niño episodes and 13 La Niña

GRAPH 1.12. La Niña and El Niño phenomena vs annual histogram of losses registered by hydrometeorological phenomena



Source: OSSO Corporation, 2011 from NOAA, 2011 y OSSO-EAFIT Corporation, 2011.

(Graph 1.12). Even though the rainy season associated to La Niña 2010-2011 produced what may be considered as one of the greatest losses incurred upon the country, other episodes such as La Niña at the end of 2008 and the beginning of 2009²⁶ had very similar effects to the last one registered as far as number of municipalities affected and type of principal losses (agrarian, housing, land routes).

Even though there is no empirical evidence that can correlate the effects of climate change to the frequency of disasters in the country, there is concluding evidence from phenomena such as glacier loss. It is expected that for the 2011-2040 period, the ecosystems of the elevated parts of

the three Colombian mountain ranges may undergo very intense and intense impacts in more than 70% of the total area, foremost in the departments of Boyaca, Tolima, Nariño, Cauca and Cundinamarca. This is especially important when taking into consideration population concentration and production systems that depend on these ecosystems. The vulnerability scenarios show that the natural or almost non-intervened ecosystems are less sensible to climate change than those spaces transformed in the rural environment (MAVDT, Ideam, UNDP and GEF, 2010). Ideam confirms that according to its investigations, there are tendencies to climate variation in the country. (Box 1.2).

Box 1.2. Historical climatic registers tendency conclusions for the 1971-2000 period

The analysis of the **tendencies** on a long term basis in the historical climate registers taken from different regions of the country indicate the following evidence in climate change:

1. The **average temperature** increased at a rate of 0.13 °C per decade during the 1971-2000 period. The departments that have the largest increases are: Cordoba, Valle del Cauca, Sucre, Antioquia, La Guajira, Bolivar, Choco, Santander, Norte de Santander, Cauca, San Andres, Tolima and Caqueta. This somehow indicates that these are areas that have primarily felt global warming in the national territory.
2. The tendencies for the 1971-2000 total annual **precipitation** period indicate an increase in some sectors and a decrease in others. In particular, the most significant decreases in total annual rainfall have been registered in Atlantico, Arauca, Guaviare, Boyaca and Cundinamarca, whereas the rates of increase registered at the regional level are in Quindio, San Andres, Cesar, Cauca, Vaupes, Guainia, Antioquia, Choco and Caldas.
3. **Relative humidity** has not shown any significant changes in this period of study. In other words their numbers remain stable.
4. The **glaciers** have been losing annually between 3 and 5% of their glacier area and there is a retreat of the glacier front of between 20 to 25 m per year. For the years 2002-2003, the total glacier area was 55.4 km², whereas from the years 2006-2007 the surface decreased to 47.1 km².
5. The **average sea level** has had a tendency to increase. It may vary between 2.3 and 3.5 ml per year in the Colombian Caribbean sea and 2.2 per year on the Pacific coast.

Source: MAVDT, Ideam, PNUD y GEF, 2010.

26 The ENSO episode is declared La Niña when the ONI (its acronym in English) (El Niño Oscillation Index) accumulates five or more consecutive quarters with temperatures in the surface of the Pacific Ocean equal or are below the normal temperatures of 0.5 °C. Between October of 2008 and April of 2009 this condition continued during four quarters, which in practice, due to the affects in the increase of rainfall in Colombia, may be interpreted as condition close to a Niña. The previous quarter to this period temperatures were lower by 0.3 °C under normal.

Subsistence farming is and will continue to be more vulnerable and at the same time will be more affected by climate variation. This situation is especially prevalent in the departments of Nariño, Boyaca, Cesar, and Cauca. The department of Bolivar has the largest bodies of natural water that simultaneously are the most vulnerable and likely to have greater impacts, and under intense pressure caused by the advance of the agricultural boundary.

The frequency of heavy rainfall has increased in the land zones, in line with warming and an increase of atmospheric water vapor (IPCC, 2007). According to the Second Colombian Communication before the United Nations Macro Convention on Climate Change (MAVDT, Ideam, UNDP, and GEF, 2010), in the high plateaus, heavy rainfalls (associated with rainstorms) have been more moderate, contrary to the evidence in thermal grounds, without taking into account whether the annual precipitation decreases or increases in the majority of stations: warm (0 to 1,000 m.s.l.), mild (1,001 to 2,000 m), and cold (2,001 to 3,000 m), there is a tendency toward an increase in heavy rainfalls (Benavides, Mayorga and Hurtado, 2007). This confirms that there is an increase in extreme events caused by rainfall, as has been reported in the Fourth IPCC Report. To illustrate this situation, hydrometeorological registers were taken at the Ernesto Cortissoz International Airport station in the municipality of Soledad, in the metropolitan area of Barranquilla,

in which it is evident not only that the annual precipitation has increased by approximately 72%, but that the number of rainstorms or heavy rainfalls has almost doubled annually.

Disaster risk is increasing due more to an inadequate territorial, sectoral and private management than to external factors such as climate change. While in the last few years there has been a tendency to register variations in the weather, it cannot be concluded that these weather changes have increased the risk in the country. On the other hand, factors that do increase risk include exposure and vulnerability resulting from an inadequate use of territorial planning and development instruments, land degradation, sectoral activity disarticulation with the actions required in order to reduce and control risk, and the absence of shared responsibility from the private sector. If a public policy in risk management is not implemented and appropriately articulated in the development processes, it is assumed that disaster events may generate more critical scenarios in terms of financial impacts and loss of life. This possibility could occur in the event of an earthquake near the largest cities with losses estimated for Bogota at US\$12.7 billion, for Medellin US\$7.5 billion, for Cali US\$6.4 billion and for the Coffee Growing region US\$2 billion (Cardona, et ál. 2004 a and b). The following chapters of this document complement the analysis related to the risk increase factors in Colombia and the recommendations to reduce them.

1.4. THE IMPACT OF HISTORICAL DISASTERS IN COLOMBIA

1.4.1. Geographic distribution of registered historical events and loss of life by region

Given that floods are the most frequent events in Colombia the largest number of historical registries for losses in almost all of the Colombian departments is associated with this phenomenon (*Graph 1.13*). According to the DesInventar database (OSSO Corporation and EAFIT, 2011), the historical registries of losses in most of the national territory that have predominated are caused by floods. The exception to these historical registries are the departments in the Andean region including Antioquia, Tolima, Caldas, Nariño, Boyaca, Cauca, Cundinamarca, Risaralda, and Quindio, where the greatest number of events are landslides, although a large number of floods have also been reported. The areas that have the largest number of volcanoes are Nariño, Cauca, Huila, Tolima, and Caldas, whereas the largest registered number of seismic activities that have produced any type of losses between 1970 and 2011 have been in Valle del Cauca, Antioquia, Boyaca, Cauca, Choco, Nariño, Risaralda, Caldas, Quindio, Santander, Tolima, and Norte de Santander.

The departments with the greatest loss of life accumulated in the last 40 years are Tolima and Caldas (*Graph 1.13*). Due to the Armero avalanche and a large number of landslides, apart from the effects of seismic activity and floods, Tolima and Caldas have the highest indicator of loss of life. Antioquia reports the greatest number of loss of life resulting from landslides

(1,712) and from floods (200), while in Quindio there is the highest number of victims resulting from seismic activity (1,350), followed by Cauca (1,116), Nariño, Valle del Cauca, Norte de Santander, Risaralda, Cundinamarca, and Bogota. Each accumulated in the period of 1970-2011 more than 300 fatalities. Sucre, Cesar, Atlantico, and Choco, have more than 240 fatalities mainly caused by landslides.

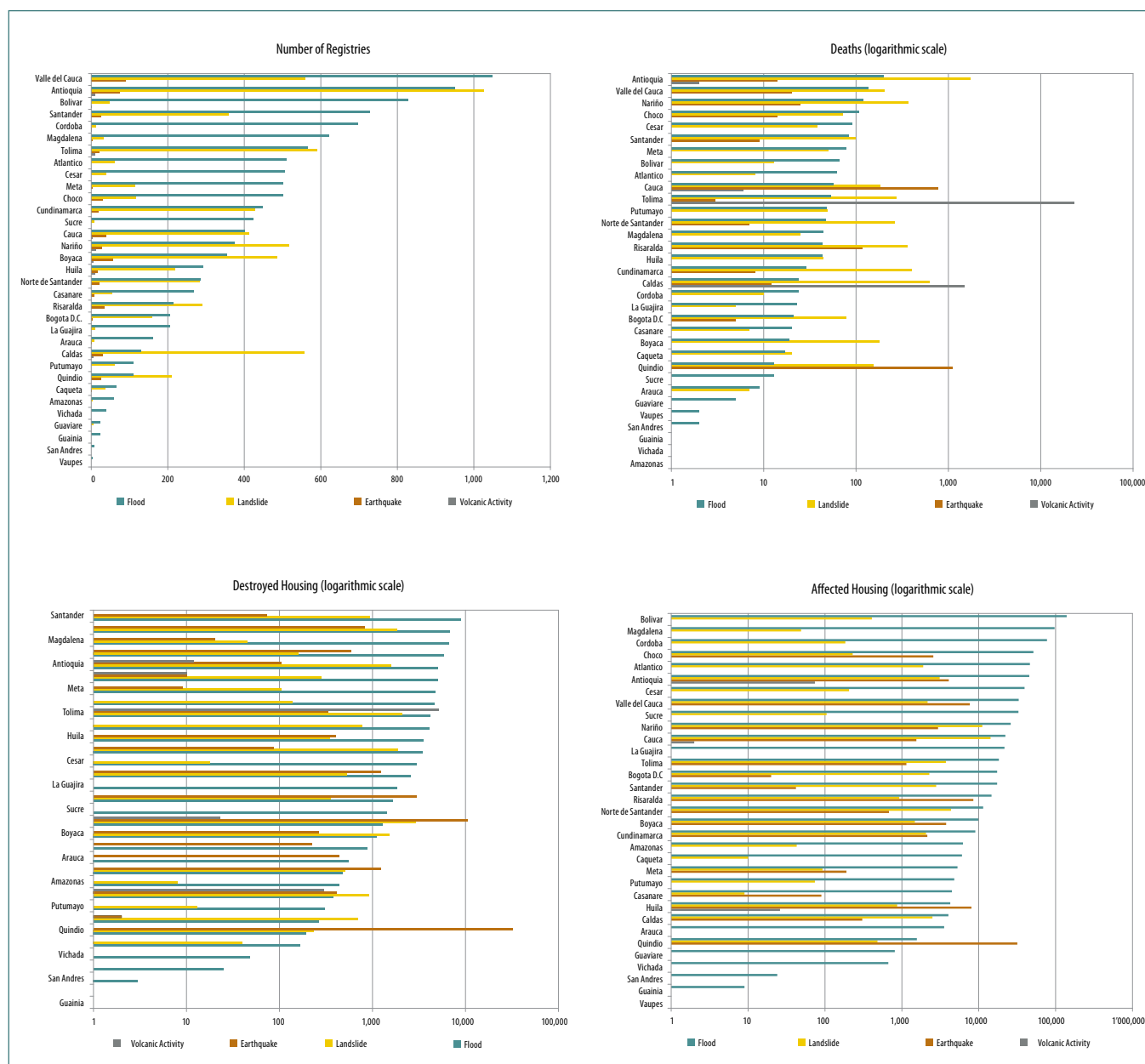
In the last 40 years more than one million dwellings have been affected by the occurrence of different phenomena: 73% due to floods, 7% due to seismic activity, 5% due to landslides, and 15% caused by other phenomena. As much as 48% of the housing affected on the Caribbean coast is in the departments of Bolivar, Magdalena, Cordoba, Atlantico, Cesar, Sucre, and La Guajira, followed by Antioquia and the departments located on the western slopes of the Western Mountain Range including Choco, Valle del Cauca, Nariño, and Cauca, all of these having more than 20,000 dwellings which have been affected. Tolima, Santander, Risaralda, Norte de Santander, Boyaca, Cundinamarca, and Bogota have had between 9,000 and 20,000 dwellings damaged by floods. Cauca and Nariño are the departments that have the largest housing damage caused by landslides, registering more than 10,000 units.

Of the 190,000 dwellings destroyed during the period of 1970-2010, the majority (33,372) occurred in Quindio, followed by Cauca (17,270) and Tolima (13,770). The damage to this housing was mainly caused by seismic activity and volcanic eruptions, whereas in Nariño, Santander, and Antioquia, there were approximately 10,000

units destroyed in each one of these departments caused by hydrometeorological phenomena. If the loss of housing is analyzed in absolute terms, it can be concluded that the capitals of the departments and the largest cities are concentrated in the Andean region: Bogota, Cali, Medellin,

and Bucaramanga. In the Pacific region and in the north of the country, on the other hand, housing destroyed is located in small and medium-size municipalities, such as those located in the river basins of the Sinu and Magdalena Rivers and the Mira and Telembi Rivers respectively.

GRAPH 1.13. Distribution of losses by department according to number of registries, loss of life, destroyed and affected housing

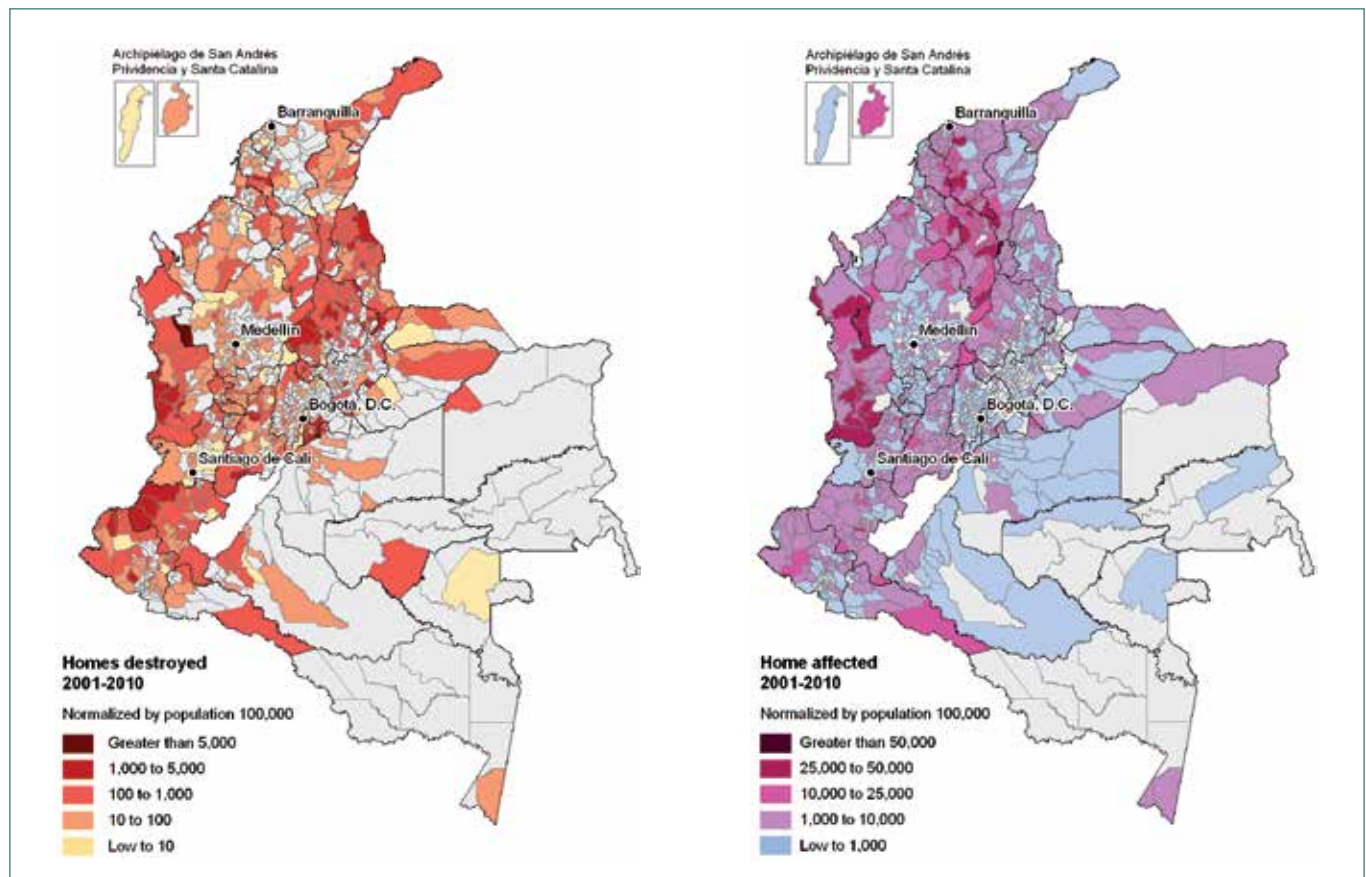


Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011.

The housing damages and losses during the last decade, updated according to the size of the municipal population, are concentrated in municipalities with less than 100,000 inhabitants and high UBN percentages. Even though the losses are distributed all over the country, the majority of housing destroyed for each 100,000 inhabitants is not only identified in

the municipalities of the Andean region, but also in the municipalities of the Pacific region. Rates of housing partially affected are mainly concentrated in the Caribbean and Pacific departments where the majority of municipalities are located. Additionally, these have the largest percentage of UBN population and are the most susceptible to floods (Figure 1.11).

FIGURE 1.11. Housing destroyed and affected per 100,000 inhabitants 2001-2010



Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011 and DANE, 2010.

1.4.2. Historical losses by productive and service sectors

The lack of methodologies and responsibilities previously established to evaluate sectoral damages as well as articulation mechanisms between municipal and departmental Secretariats and Local and Regional Committees for Disaster Prevention and Response results in losses in the sectors not being registered systematically, not being completely reliable, and thus being undervalued. The affected sectors, data is very limited and there are no systematic evaluations available in this sense. The housing reports are consistent and divided between destroyed and affected housing. However, they make no reference to the level of damage or the areas or socioeconomic stratification, since this information is normally collected by the Disaster Prevention and Response Offices, which are responsible to the Government Secretariats. The municipal and departmental Secretariats that represent different sectors overall do not rely on previously established methodologies or coordination with the respective Ministries, and do not actively participate in the CLOPAD. Even though the information available is very limited, an analysis reporting losses is made here from information found in the DesInventar database and other reports.

Only economic assessment of losses for disasters causing great impact is available. The National Government has twice requested support from the Economic Commission for Latin America and the Caribbean (for the Coffee Growing region 1999 earthquake and for the 2010-2011 La Niña phenomena) in order to assess the socioeconomic losses with the aim of having information that would orient decision making when facing reconstruc-

tion and recovery processes. Additionally, through the Andean Development Corporation (CAF), the governments of the member countries of the Andean Community requested an assessment of the losses associated with the El Niño 1997-1998 phenomenon. Therefore, there are economic estimations for these three disasters, along with another three disasters that have had a significant impact. These estimations have been made by the Natural Risk Evaluation Consortium (ERN) Colombia in the framework agreement entered into by the World Bank, the Colombian International Cooperation Agency, and the National Planning Department (Cardona et ál, 2004b).

1.4.2.1. Housing sector

On average, 4,650 houses are lost and another 25,911 are damaged due to disasters, which indicates that housing is one of the sectors that register the largest number of impacts due both to natural phenomena and man-induced events. Between 1970 and 2011, 190,000 dwellings were destroyed. Floods cumulatively caused the greatest losses with more than 79,000 units (42%) destroyed, whereas seismic activity destroyed a total of 51,000 (27%), landslides nearly 18,000 (9%), volcanic eruptions 5,400 (3%), and other events such as gale storms and fires, 35,000 (19%) (*Graph 1.13*). The number of houses affected was 1,062,361, of which more than a third were associated with floods and gale storms.

Between 1970 and 2010, there were seven enormous disasters for which there is an economic assessment of housing losses. Four of these disasters took place in the same decade, 1990s, in which three earthquakes and the El Niño phenomenon of 1997-1998 were registered (*Table 1.7*).

The Coffee Growing region earthquake in 1999 and the La Niña episode 2010-2011 are the events that report the greatest losses in the sector, with amounts in the same order of magnitude of approximately US\$900 million adjusted to 2010 currency valuation (Table 1.7). However, the amount of economic losses associated to the La Niña phenomenon 2010-2011 is partial, since the reported values go only until March 2011. In other words, housing losses resulting from this event may have been even higher than those caused by the Coffee Growing region earthquake.

TABLE 1.7. Economic assessment of losses in the housing sector in seven disasters, 1970-2010

| Disaster | Housing losses (US\$[2010] million) | |
|---|--|-----|
| Popayan earthquake, 1983 | 51.09 | (1) |
| Nevado del Ruiz volcanic eruption, 1985 | 31.72 | (1) |
| Atrato Medio earthquakes, 1992 | 15.42 | (1) |
| Paez earthquake, 1994 | 76.88 | (1) |
| El Niño phenomenon 1997-1998 | 40.67 | (2) |
| Coffee Growing region earthquake, 1999 | 943.31 | (3) |
| La Niña phenomenon 2010-2011 | 886.02 | (4) |
| Total | 2,045.11 | |

Sources: OSSO Corporation, 2011 from available assessments:

(1) Cardona, et ál., 2004a; (2) CAF, 1998; (3) CEPAL, 1999; (4) CEPAL, 2011.

It is important to estimate the losses in the housing sector related to intermediate and minor disasters, since collectively these are greater than the losses associated with large events. Since there is no economic assessment for these types of events, an overall assessment was made that would allow having a minimum approximation, using registered data from the national invento-

ry of disasters under the following assumptions: the loss of a dwelling is equivalent to the cost of the construction of social interest housing (VIS) (excluding the cost of the plot and urbanization costs), and the effect of the damage to a house is equivalent to one-fourth the cost of constructing a VIS²⁷. This estimate was made for 7,000 registers corresponding to intermediate and minor disasters related to both hydrometeorological and geological phenomena (Table 1.8).

Losses in the housing sector associated with intermediate and minor disasters correspond to 96% of hydrometeorological phenomena surpassing the annual losses of US\$223 million during the 1990s, and US\$315 million annually between 2001 and 2010. During the 1990s and 2000s, the housing losses due to minor and intermediate disasters associated with hydrometeorological events grew by 330%; cumulatively it is estimated that approximately US\$4.9 billion has been lost over the last 40 years (Table 1.8). Exceptions to these annual averages were recorded during the last two decades in 1992 and 1998, when there was a reduction in rainfall caused by El Niño episodes, and in 2008 and 2010, when the presence of La Niña phenomena caused losses to surpass US\$540 million..

Between 1970 and 2010, accumulated losses in this sector associated with all types of disasters (large, intermediate, and minor) amounted to US\$7.1 billion and average annual losses were US\$177 million. The large disasters (OSSO Corporation, 2011) have resulted in losses of approximately US\$2 billion (Table 1.7). Intermediate and minor disasters have caused housing losses of approximately US\$5 billion (Table 1.8).

²⁷ The estimations are considered to be conservative since not all of the destroyed houses are VIS. Many have larger areas and higher values and secondly the housing affected may have greater affect percentages.

TABLE 1.8. Estimation of economic losses in the housing sector in more than 7,000 intermediate and minor disasters, 1970-2010

Millions of dollars in the year 2010. Excluded are the seven great disasters shown in Table 1.7

| Period | Hydrometeorological Phenomena (Hm) | | Geological Phenomena (G) | | Hm and G | |
|-----------|--|-----------------------------|--|-----------------------------|--|-----------------------------------|
| | No. of Housing Destroyed – D Affected – A | Losses (US\$[2010] million) | No. of Housing Destroyed – D Affected – A | Losses (US\$[2010] million) | No. of Housing Destroyed – D Affected – A | Total Losses (US\$[2010] million) |
| 1970-1979 | 19,352 – D 22,723 – A | 217.78 | 2,892-D 2,420-A | 27.65 | 22,244 – D 25,143 – A | 245.43 |
| 1980-1989 | 17,035 – D 14,136 – A | 164.71 | 69-D 145-A | 1.12 | 17,104 – D 14,281 – A | 165.83 |
| 1990-1999 | 42,325 – D 114,972 – A | 1,038.34 | 1,793-D 9,255-A | 70.94 | 44,118 – D 124,227 – A | 1,109.19 |
| 2000-2009 | 34,542 – D 461,975 – A | 3,430.72 | 2,039-D 7,322-A | 63.48 | 36,581 – D 469,297 – A | 3,494.21 |
| 2010 | 60 – D 5,807 – A | 42.98 | 0-D 15-A | 0.11 | 60 – D 5,822 – A | 43.09 |
| TOTAL | 113,314 – D 619,613 – A | 4,894.54 | 6,793 – D 19,157 – A | 163.32 | 120,107 – D 638,770 – A | 5,057.77 |

Source: OSSO Corporation, 2011 from Cardona, et ál., 2004a

The numbers confirm that the effects of damages and losses caused by minor and intermediate events in housing are greater (250%) than those produced by large disasters, which represent 1.75% of the national GDP for the year 2010. These calculations, even though conservative, demonstrate that the impact caused by accumulation of events considered minor or moderate, generally produced by environmental degradation and the inappropriate use and occupation of land, mainly by the most fragile socioeconomic strata, requires a strong policy to reduce the vulnerability of the population in the housing sector. This affirmation coincides with the result of the study done by Cardona et ál, (2004b) where the total amount of losses relative to the hous-

ing and agriculture sectors, caused by low-intensity events over a period of 30 years (1970-2000), represented 2.3% of the national GDP for 2000. This is a significant number, taking into account that losses caused by the Coffee Growing region earthquake represented between 1.5% and 1.8% of the national GDP for 1999. Thus, it is confirmed that in Colombia, losses caused by minor events, when added, are similar to those caused by a disaster of great magnitude, with the difference that these events are not visible in the mass media or politically relevant, and therefore they do not result in government efforts to reduce risk (Table 1.9).

1.4.2.2. Transportation sector

The reconstruction of one kilometer of road may cost up to five times the cost of executing adequate preventive maintenance (DNP, 2010b), and the indirect costs of suspending traffic may amount up to COP\$2 billion daily²⁸. Therefore, it is fundamental to fortify prevention strategies in the transportation sector. Annually Invias, from the resources of the “Emergency construction work for the national road network” account invests an average of COP\$50 billion, even though in La

Niña episodes, this amount may be higher than COP\$120 billion (Ministry of Transportation 2011). These resources go mainly to emergency response, so there is little left for risk prevention and mitigation (*Graph 1.14*). Of the annual investments, 91% is allocated to response and rehabilitation and only 9% to prevention (Invias, 2009), which means that if there is no change in the strategy to improve preventive and corrective maintenance, losses will continue to increase.

TABLE 1.9. Total economic losses, 1970-2010

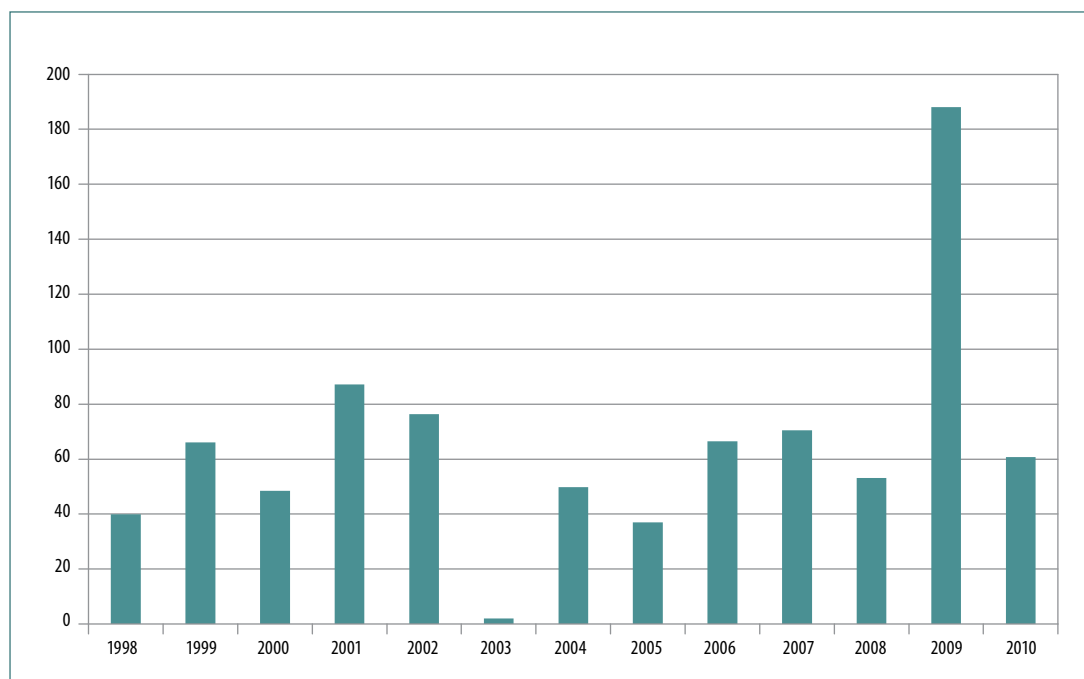
| Period | Economic assessment of moderate and minor disasters (US\$[2010] million) (Table 1.8) | | Estimated losses of seven large-scale disasters with their economic assessment (US\$[2010] million) (Table 1.7) | | Total (US\$[2010] million) |
|-----------|--|------------|---|------------|----------------------------|
| | Hydrometeorological | Geological | Hydrometeorological | Geological | |
| 1970-1979 | 217.78 | 27.65 | | | 245.43 |
| 1980-1989 | 164.71 | 1.12 | | 82.82 | 248.65 |
| 1990-1999 | 1,038.34 | 70.94 | 40.67 | 1,035.60 | 2,185.55 |
| 2000-2009 | 3,430.72 | 63.48 | | | 3,494.2 |
| 2010 | 42.98 | 0.11 | 886.0 | | 929.09 |
| Total | 4,894.53 | 163.3 | 926.67 | 1,118.42 | 7,102.92 |

Source: Authors' table from information registered in Tables 1.7 and 1.8

28 Strategic roads such as the Buenaventura and La Llanos highways have obtained these values (Pontificia Universidad Javeriana, 2004).

GRAPH 1.14. Inviás investments in emergencies

Col\$(2010) billion



Source: Ministry of Transportation, 2011.

According to the DesInventar database (OSSO Corporation-EAFIT, 2011), the departments that report the largest numbers of road damage registries are Antioquia, Valle del Cauca, Tolima, Boyaca, Santander, Cundinamarca and Cauca, which together have over 50% of the total of events. One-quarter of the registries (6,975) in DesInventar presents different types of effects on the roads at the national, departmental, and municipal levels. The effects on the road network are mainly associated with phenomena such as landslides (54%), floods (30%), and flash floods. Although the data is very limited and it is necessary to broaden the information with more detailed studies, the aforementioned suggests that strategies to control and manage landslides, especially

in the Andean region, would result in reducing the greatest part of the problems that have affected the roads in the country.

The La Niña phenomenon 2010-2011 affected more than 1,600 kilometers of road infrastructure, equivalent to 9.7% of the primary network, 24.7% of the tertiary network, and 0.9% of the network granted in concession. Likewise, 90 bridges of the national network were affected and response was required for approximately 500 emergencies and rehabilitation for more than 53 national road sections. The emergency response required intervention in works for flood control in La Mojana and Canal del Dique regions. These actions have been estimated at eleven times the annual investment

budget for emergencies, since it increased up to Col\$628 billion (Ministry of Transportation, 2011). Estimated indirect losses in freight transportation resulting from the La Niña episode increased to Col\$344 billion, represented in lost profits, cash benefits, and wages (*Table 1.10*). Additionally, 30% of industries related to the sector, such as lodging, auto repair shops, tire change services, and gas stations, were affected (Asocarga, 2011).

TABLE 1.10. Transportation infrastructure affected and damaged by La Niña phenomena 2010-2011

(Millions of constant pesos, 2011)

| Item | Losses (Col\$[2011] million) |
|-----------------|------------------------------|
| Roads | 3,236,619 |
| Railways | 68,133 |
| Air Transport | 60,410 |
| River Transport | 23,119 |
| Ports | 2,873 |
| Total | 3,391,154 |

Source: Ministry of Transportation, based on IDB-ECLAC, 2011.

1.4.2.3. Agriculture sector

Some 15% of the registries taken by DesInventar indicate losses in crops, grasslands, and forests, and half of these impacts are due to flooding.

In the period between 1970 and 2011, there were 4,898 registries of damages and losses in the agriculture sector. The number of hectares affected was approximately 3,250,000, for an average of 79,500 ha/year. When comparing this information with reports from only one event, such as La Niña 2010-2011 or the effects caused by the rainy season in 2008, it may be confirmed that there is a systematic data subregistry of hectares lost. Therefore, it is possible to estimate that the real number of hectares affected may be at least four or five times the number indicated.

Losses in GDP in the agriculture sector are increasing as a result of hydrometeorological phenomena (Table 1.11). This growing tendency of the losses is explained by environmental degradation factors already mentioned, the growth of planted areas, and the minor measures to reduce risk in the sector adopted by public and private actors, as indicated in Chapter 4 of this document (*Box 1.3*).

TABLE 1.11. Accumulated losses caused by minor events in the agriculture sector

| Period | Hectares of crops affected | Current value of crop losses (constant) | GDP in the agriculture sector for the last current period (constant) | Loss of the sectoral GDP |
|-----------|----------------------------|---|--|--------------------------|
| 1971-1980 | 327,497 | 98.25 (172.64) | 6,466 (11,352) | 1.52% |
| 1981-1990 | 738,743 | 295.50 (689.50) | 6,539 (15,257) | 4.52% |
| 1991-2000 | 964,450 | 578.67 (758.38) | 10,330 (13,358) | 5.6% |

Note: Values listed for millions of dollars and average GDP.

Source: Cardona, et ál., 2004b

Box 1.3. Historic losses in the agriculture sector caused by
El Niño 1997-1998 and La Niña 2010-2011 episodes

El Niño 1997-1998 manifested itself in having a generalized precipitation deficiency in the main producing regions of the country, thus generating plant health problems and a reduction in the output of the sector, with estimated damages of US\$101 million, adjusted to 2000 currency (CAF, 2000). Additionally, it is estimated that indirect losses produced by the negative effects in the balance of payments and the nonexistence of exports had an approximate value of US\$124 million. A huge part of the damage was concentrated in the departments of Tolima, Huila, Sucre, Bolivar, Cesar, Santander and Norte de Santander.

La Niña 2007-2008 affected the output and production of coffee and flowers, two of the main driving forces in exports in the country. Coffee production underwent losses of 28% or US\$340.5 million in lost exports. Some 848 municipalities were affected with losses in transitory crops worth Col\$86.9 billion. Losses inflicted on permanent crops were Col\$49.5 billion and losses in livestock were Col\$8.7 billion. Overdue loans to small producers were refinanced for the amount of Col\$2 billion and a Rural Capitalization Incentive (ICR) was applied (Col\$2.7 billion). Furthermore, direct support was given for the amount of Col\$150,000 per hectare to identified producers with the aid of the Technical Agrarian Aid Municipal Units (UMATA). For this concept, the Agrarian Fund disbursed a total of Col\$569 million. In recovery activities, the principal interest was to promote employment and this represented an investment of US\$ 1.5 million (MADR, 2011).

La Niña 2010-2011 produced the greatest impact in the agriculture sector related to hydrometeorological phenomena. In total, 1,324,000 hectares were affected. The National Federation of Coffee Growers reported that 190,580 hectares were affected resulting in crop damage to 221,567 coffee producers. Furthermore, it is estimated that 1 million sacks of coffee were not produced in 2010, which is equivalent to Col\$500 billion. Plagues and illnesses such as coffee rust (*Hemileia vastatrix*), root wilt disease (PC) in the coconut palms, moniliasis in cacao, and other diseases spread more quickly. As many as 98 key roads were affected impeding transport of food from the provinces to consumer centers. Livestock affected at the national level was estimated at 130,000 dead cattle and 1.5 million mobilized from 60,500 farms. An additional 1.5 million cattle that were not moved resulted in having nutrition deficiency with different impacts in the Caribbean and the Cundiboyacense plateau. The aquaculture lost their young fish. Some 13 million square meters of agrarian infrastructure were affected including greenhouses, sheds for rearing or fattening cattle, barns, stables, corrals and, crochet and wood stockyards, pigsties, and other buildings for different agrarian production systems. The La Niña phenomenon culminated in May 2011 having affected the Cundiboyacense plateau, the Atlantic coast, the Eastern Plains, and the departments of Santander and Santander North and influenced the Cauca River in the south of the country (MADR, 2011).

1.5. CONCLUSIONS OF RISK PERFORMANCE IN COLOMBIA

The information available for the last 40 years related to risk materialization, as well as to growth of population exposed to the phenomena studied suggests that there are existing factors that could have modified the current risk conditions in the country or generated new risks primarily those associated with floods, landslides, and flash floods. These factors include (a) susceptibility to floods, landslides and, flash floods in extensive areas of the country mainly due to human intervention in the territory and consequently causing environmental deterioration; (b) the increase of the exposure of goods and people to different hazards without any significant decrease in vulnerability; and (c) institutional factors that have not permitted an adequate and integral intervention in risk management.

Inequalities in social and economic processes lead to the creation of new vulnerability conditions and the increase of the existing risk conditions. In order to establish differences between impacts observed in municipalities with fewer resources and weaker development dynamics and those with greater income and more development, a risk index was prepared using the information related to destroyed housing and the total of the population using different ranges from the Unsatisfied Basic Needs Index. This index shows that as the percentage of UBN population increases, the municipality becomes more vulnerable. Poverty measured by the UBN represents a vulnerability indicator, since persons with scarce resources cannot purchase good quality hous-

ing. They live in informal settlements, in areas prone to different phenomena such as floods and landslides. The fulfilled risk index with respect to housing destroyed in the last 11 years was obtained by dividing the percentage of destroyed housing by the percentage of the population in the municipalities according to each UBN range (*Table 1.12*). On the other hand, losses generated by disasters in the municipalities with highest UBN ranges affect education and health and deepen poverty factors due to the low recovery capacity of smaller local governments and the population affected.

Municipalities with critical conditions of relative vulnerability due to greater UBN indices are found mostly in the Pacific and Caribbean regions in the departments of Nariño and Cauca in the south, and Santander and Norte de Santander in the northeast of the country. Susceptibility to floods, landslides, and flash floods in these areas of Colombia has grown due to the processes of deforestation, soil erosion, and inadequate processes of occupation. Vulnerability factors (physical, political, economic, etc.) are also increasing in more rural areas where the implementation of disarticulated productive systems in relation to the capacities of the land often lead to land use conflicts. This can be proved in municipalities that have high percentage of UBN population, underdevelopment, and large rural population, where high indices of environmental degradation are evident.

TABLE 1.12. Risk index by destroyed housing in municipalities according to the UBN

| UBN range | Number of municipalities | % events registered | % destroyed housing | % population | Irv* |
|------------------------|--------------------------|---------------------|---------------------|--------------|--------------|
| UBN <= 27 | 247 | 34.02 | 39.22 | 63.22 | 0.62 |
| Between > 27 and <= 41 | 262 | 19.43 | 11.35 | 11.82 | 0.96 |
| Between > 41 and <= 56 | 253 | 20.00 | 27.85 | 11.98 | 2.32 |
| Between >56 and <= 76 | 201 | 19.18 | 12.70 | 9.26 | 1.37 |
| > = 76 | 57 | 5.86 | 7.07 | 2.90 | 2.44 |
| No information | 23 | 1.50 | 1.80 | 0.82 | 2.19 |
| Total | 1,043 | 100 .00 | 100 .00 | 100 .00 | Average 1.65 |

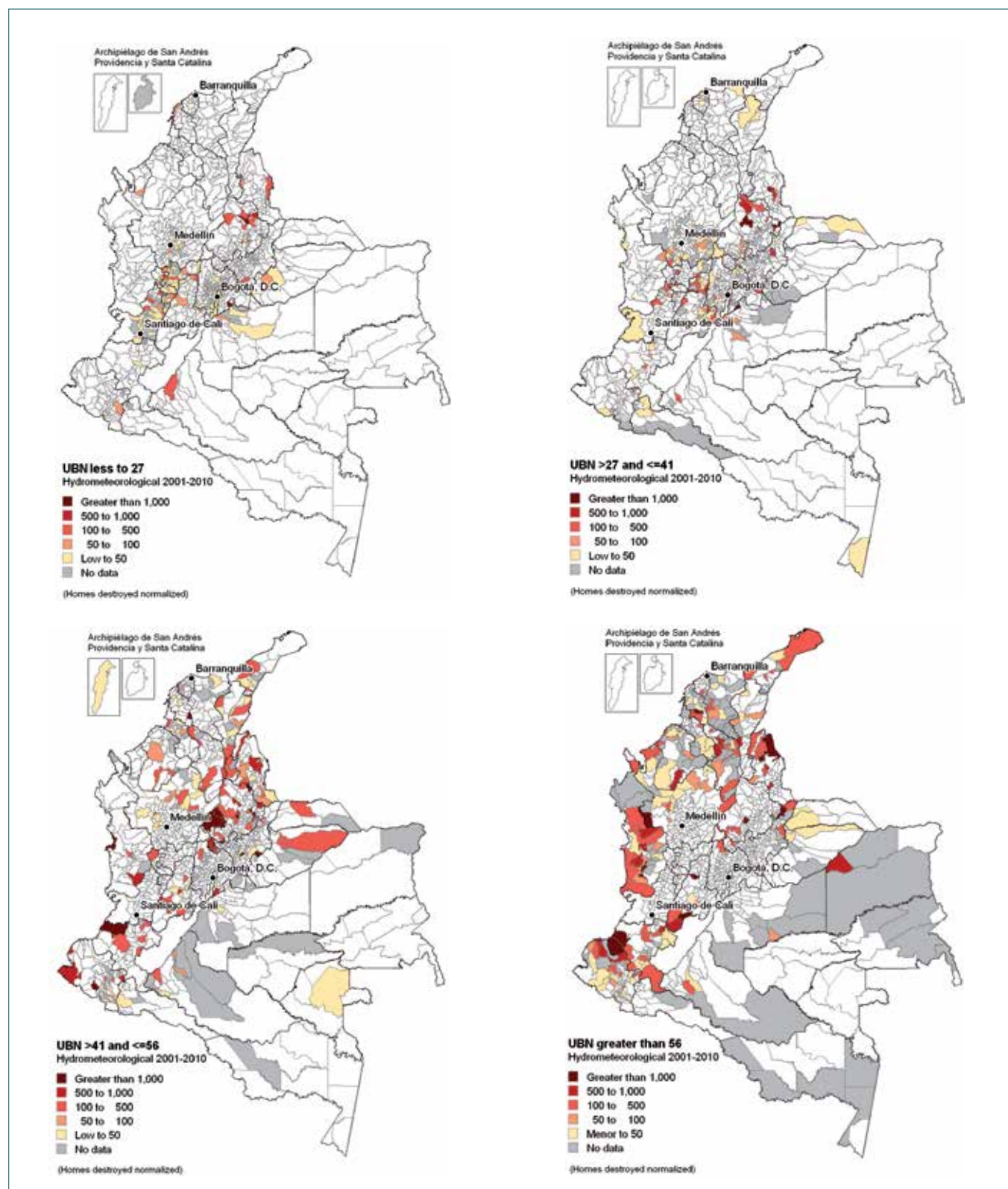
Note: * Irv: Risk index by housing destroyed.

Source: OSSO Corporation, 2011 and DANE, 2010.



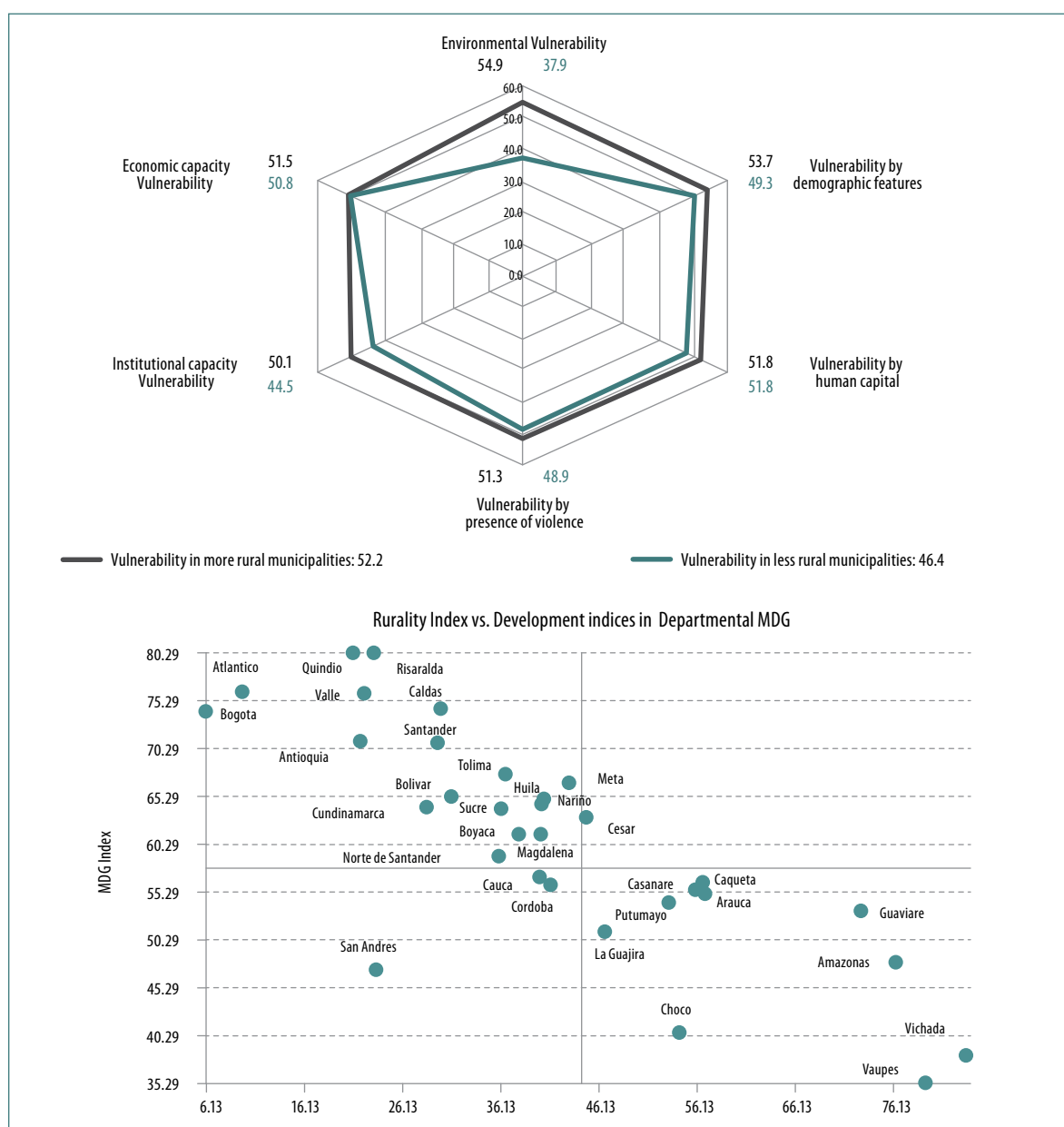
Housing destroyed by landslides. Municipality of Gramalote (Norte de Santander – Colombia), 2011. Photography: Gabriel Jaime Arango Zapata.

FIGURE 1.12. Housing destroyed by hydrometeorological phenomena, according to UBN



Source: OSSO Corporation, 2011 from information provided by OSSO-EAFIT Corporation, 2011 and DANE, 2010

FIGURE 1.13. Vulnerability, rurality indices, and Millennium Development Goals



Source: UNDP, 2011

The greatest vulnerability in the most rural municipalities is confirmed in the National Human Development Report 2011²⁹. The report points out the inequality that exists between the most rural municipalities and the most urban areas by using indicators that point out environmental vulnerability in more rural municipalities to be 54.9 in contrast to the less rural municipalities, where it is 37.9.

29 The Report has initiated a proposal to estimate vulnerability levels in municipalities in function of six dimensions: (a) violence (homicides, murders, political, massacres); (b) economic capacity (municipal income and concentration of property); (c) institutionality (fiscal performance and administrative capacity); (d) human capital (illiteracy, working age population, economically active population); (e) environmental (UNDP environmental vulnerability index Colombia); and (f) demography (female-headed households with children less than 5 years old and adults older than 65 years old).

Relative risk indices in relation to GDP identify zones (municipalities and departments) where the largest potential losses in relation to infrastructure and economic production exposure are concentrated, in particular in the largest cities in the country (Bogota, Medellin, Cali, and Barranquilla), located in high or medium seismic, landslide, and flood hazards. Additionally, the largest percentage of the population is located in the Andean region, which has resulted in a significant increase in vulnerability factors that add to the presence of various types of convergent hazards, resulting in great losses³⁰.

Demographic growth, urban concentration, and higher levels of exposure without any significant reduction in vulnerability are the main causes of risk increases resulting from seismic activity and volcanic eruptions. On the one hand, cities have had rapid population growth along with accelerated urbanization without any adequate planning. On the other hand, in the rural areas, disorganized productive systems have been developed in relation to the capacities of the land, leading to land use conflicts. Additionally, there is housing and infrastructure constructed in slopes, hillsides, and/or in landfill zones that do not offer optimum stability conditions and that amplify seismic waves caused by earthquakes. There are also construction processes that precede the implementation of the Seismic Resistant Regulation, and the lack of application of this regulation has resulted a strong increase of the construction's vulnerability. The aforementioned, together with minimal investment in corrective measures that would reduce the current fragility, are among other factors that result in vulnerability accumulation and growth.

Events that can generate the most critical scenarios from the point of view of their financial and loss-of-life impact, based on historical

registries and on information available in studies done up to now are a destructive earthquake, a volcanic eruption, and the presence of the La Niña episode. Earthquakes, even though they are not frequent events, have the greatest potential impact on the country. However, an eruption of great magnitude, even though it may have recurrence periods of more than 500 years, would represent a crisis scenario of national proportions. The largest effect in terms of the number of municipalities with significant impacts over all sectors, but especially in the agriculture sector, may be generated by accumulated intense rainfall caused by the La Niña phenomenon, which can cause great flooding and widespread landslides in a significant percentage of the national territory, causing serious damage to crops of owners of large extensions of land and the livelihoods of small farmers, as well as to housing, transportation, and other sectors.

In conclusion, losses and damages generated by climatic events do not only depend on intensity of the events but also on the exposure and vulnerability. The severity of the damages and losses associated with extreme climatic events is influenced by natural weather variations

30 During the 1970s and under the premises of a development model, important dynamics were presented in terms of society-nature relations associated to urbanization, industrialization, service infrastructure development, agrarian activities and the exportation sector (Marquez, 2001). These dynamics stressed regional imbalances that were continuously arising in the resettlement processes in some areas of the country (Caldas, Tolima, Boyaca, Cundinamarca, and Chocoo). Other areas, mainly in urban centers were consolidated as development hubs and thus attractive to population immigration: [before 1973] in areas such as Bogota, Valle, Atlantico, Antioquia, and Risaralda. These were departments that based on preexisting infrastructure, their geographic locations, and other adequate conditions for development in agrarian or industrial activities, could have directly taken advantage of economic and social improvement stages experienced in the country by the end of the 1950s. The capital of the country and the capitals of the departments—Cali, Barranquilla, Medellin, and Pereira respectively—had attained significance as main cities in the country in terms of population and economic activity" (Martínez 2001).

(ENSO phenomenon, among others) and anthropic events, such as an increase of exposure and vulnerability that mostly depend on the assumed socioeconomic development models. In this sense, disaster risk management in hydrometeorological phenomena and the adaptation to climate change have common scopes and challenges, since they must concentrate on reducing exposure and vulnerability and increasing the capacity for resilience (recuperation) on facing impacts from extreme climatic phenomena. Additionally, hydrometeorological phenomenon must always be a priority for

the country, since the annual precipitation rate in Colombia is 3,000 mm with an average annual runoff of 1,830 mm (Ideam, 2010b). Some 61% of this amount is converted into surface runoff, generating an average flow of 67,000 m³/sec, equivalent to an annual volume of 2,084 km³, that runs off to five large hydrological regions that characterize the continental territory: 11% in the Magdalena–Cauca regions, 5% in the Caribbean regions, 18% in the Pacific regions, 34% in the Amazonian regions, and 32% in the Orinoquia regions (MAVDT, Ideam, UNDP, and GEF, 2010).

1.6. RECOMMENDATIONS TO FACE THE RISK IN COLOMBIA

| RECOMMENDATION | PRIORITY High (H), Medium(M) | RESPONSIBLE |
|---|---------------------------------|---|
| Strengthen local capacity for territorial management in order to reduce disaster risk generation and accumulation | | |
| Adopt a national strategy to strengthen municipal risk management that responds to different existing capacities. | H | UNGRD, DNP, MVCT, MADS, DANE, CAR, Colciencias Ideam, SGC, IGAC, Departmental governments |
| Structurally review the capacity limitation to risk evaluation, in order to give effective response to the knowledge demand for the POT and Development Plans. | | |
| <ul style="list-style-type: none">• Improve probabilistic risk models. | | |
| <ul style="list-style-type: none">• Increase the systematic registration of efficiency and effectiveness of losses and damages, since they are fundamental in evaluating the real impact of disasters. | | |
| Reduce flood and landslide risk by planning, investment, monitoring and control, and articulation of different agents responsible for watershed management | | |
| Adopt a regulation to control and manage floods and landslides that includes the definition of the highest acceptable risk, technical standards for risk evaluation and mitigation, and a strategy for their implementation, monitoring, and control. | H | MADS and the Permanent Committee for the hydraulic management of rivers and water bodies |
| Articulate specific policies/strategies by incorporating variables related to climate change in decision making at the sectoral and territorial level. | H | Presidency, DNP, UNGRD, with the support of the National Committee for Disaster Prevention and Response/GRD |

Strengthen local capacity for territorial management in order to reduce disaster risk generation and accumulation

Adopt a national strategy to strengthen municipal risk management that responds to different existing capacities (Table 1.13). It is necessary to define and implement complementary and subsidiary strategies and criteria between the national, regional, and local actors in order to strengthen those municipalities that have high poverty indicators and low institutional capacity levels, aiming to improve performance in risk evaluation, the POT management, the Development Plans, public investment, and administrative and technical resources available in risk management.

Structurally review capacity limitations for risk evaluation with the aim of providing

an effective knowledge response to the POT and the Development Plans. Whereas there is appropriate development in seismic activity hazards that is presently a part of the Colombian Seismic Resistant Regulation, this requires detailed studies related to seismic microzon- ing in municipalities for decision making. The same does not occur in relation to knowledge about landslides and floods. Ingeominas –currently Colombian Geological Survey– and the Ideam have carried out investigations in order to obtain national hazard maps. However, few of these maps have been taken into account as inputs to identify specific projects at other de- tailed regional levels or to plan infrastructure projects. Likewise, national regulations have not been incorporated as a base to guide high- er-scope development studies.

Improve probabilistic risk models. If there has been a significant effort to carry out hazard and risk studies in the country, there is a lack of results at the different territorial levels that would permit adequate decision making in risk reduction. Risk assessment must follow a prospective approach in considering the possibility that a highly destructive event may occur in the future. Therefore, risk assessment orientation must be focused toward the application of probabilistic models, for which there is insufficient available information to predict possible catastrophic scenarios, and where there is a major uncertainty involved in the analysis³¹.

Increasing the systematic registration in the efficiency and effectiveness of losses and damages is fundamental in evaluating the real impact of disasters. The possibility of visualizing recurrent and small impacts that are affecting the public infrastructure, private patrimony, and loss of life, would be a fundamental instrument in order to understand the dimensions of the problem, justify the most important policy priority that the subject needs, and have better elements in decision making and the definition of economic and social preferences. If there has been some progress, there are significant gaps in information, inconsistencies, and insufficient time series that limit the development of systematic indicators. Therefore, to strengthen the capacity to generate these databases (applying standardized methodologies), the following steps are necessary: (1) evaluate the existing damage report instruments including the CLOPAD, CREPAD, Damage and Needs Evaluation (EDAN), the existing sectoral mechanisms, and review international experiences; (2) progressively design and implement methodologies and instruments to evaluate sectoral damages; (3) implement information systems that would allow online registries to be incorporated; (4) define those responsible and

corroboration mechanisms; and (5) strengthen the technical capacities of territorial and sectoral entities, so that they may be implemented.

Reduce flood and landslide risks by planning, investment, monitoring and control, and articulation of different agents responsible for watershed management.

Adopt a regulation to control and manage floods and landslides that include the definition of highest acceptable risk, technical standards for risk evaluation and mitigation, and a strategy for its implementation, monitoring, and control. It is necessary to overcome existing imbalances from the environmental perspective that generate susceptibility to floods and landslides, which requires adjusting and articulating the policy, regulation, and institutional framework in environmental management and risk management, strengthening aspects such as issue management and control. This would include deforestation, soil degradation, strengthening the technical and financial capacity of the CAR and the participation of the private sector in environmental management activities that would contribute to risk reduction. Likewise, it is necessary to articulate policies and strategies by incorporating variables related to climate change in decision making at the sectoral and territorial level. Additionally, it is also essential to strengthen sectoral institutions, policies, and plans, so that their infrastructure and production are more risk-resilient and simultaneously so that their development mechanisms contribute to safety and sustainability.

31 CAPRA-Wiki, At <http://www.ecapra.org>.

TABLE 1.13. Diagnosis of risk conditions and institutional capacity

| INSTITUTIONAL / RISK CAPACITY | HIGH RISK (By economic concentration and/or relative vulnerability) | LOW RISK |
|-------------------------------|--|--|
| HIGH CAPACITY | <p>Municipalities in high seismic risk:</p> <ul style="list-style-type: none"> • Special Category: Bogota, Medellin and, Bucaramanga. <p>Municipalities in high high volcanic risk:</p> <ul style="list-style-type: none"> • Category 1: Manizales, Pereira <p>Municipalities in high flood risk:</p> <ul style="list-style-type: none"> • Special Category: zones of Bogota, Medellin and Barranquilla. <p>Municipalities in high landslide risk:</p> <ul style="list-style-type: none"> • Special Category: Medellin zones, Bucaramanga, Barranquilla • Category 1: Manizales zones | <p>Municipalities in low seismic risk:</p> <ul style="list-style-type: none"> • Special category: Barranquilla <p>Municipalities prone to high volcanic risk and economic concentration:</p> <ul style="list-style-type: none"> • Special Category: Bogota, Medellin, Barranquilla, Bucaramanga, Cucuta. |
| MEDIUM CAPACITY | <p>Municipalities in high seismic risk:</p> <ul style="list-style-type: none"> • Special Category: Cali and Cucuta • Category 1: Villavicencio, Pereira, and Armenia. • Category 2: Santa Marta, Tunja, Coffee Growing region's municipalities and, some municipalities in Valle and Antioquia. <p>Municipalities in high volcanic risk:</p> <ul style="list-style-type: none"> • Category 2: Pasto, Popayan, and Ibague. <p>Municipalities in high flood risk:</p> <ul style="list-style-type: none"> • Special Category: Cali zones • Category 1: Villavicencio zones, Monteria, Cartagena. • Category 2: Santa Marta zones, some municipalities in Antioquia and Valle. <p>Municipalities in high landslide risk:</p> <ul style="list-style-type: none"> • Special Category: Cucuta, Cali • Category 1: Pereira • Category 2: Armenia, Coffee Growing region's municipalities and, some municipalities in Antioquia and Valle | <p>Municipality in low seismic risk:</p> <ul style="list-style-type: none"> • Category 1: Cartagena <p>Municipalities in low volcanic risk:</p> <ul style="list-style-type: none"> • Special Category: Cali • Category 1: Cartagena <p>Municipalities in low flood risk:</p> <ul style="list-style-type: none"> • Category 2: Coffee Growing region's municipalities <p>Municipality in low landslide risk:</p> <ul style="list-style-type: none"> • Category 2: Tunja |
| LOW CAPACITY | <p>Municipalities in high seismic risk:</p> <ul style="list-style-type: none"> • Category 2: Quibdo, Riohacha. • Category 3-6: Municipalities of the Pacific coast, Nariño, Cauca, Valle del Cauca, Choco, Santanderes and some municipalities in Antioquia and the Piedemont Plains. <p>Municipality in high volcanic risk:</p> <ul style="list-style-type: none"> • Category 3-6: Municipalities of Cauca, Nariño, Tolima, Huila and Caldas. <p>Municipalities in high flood risk:</p> <ul style="list-style-type: none"> • Category 3-6: Departments of the Pacific coast region, Caribbean coast, Orinoquia, and Amazonas. <p>Municipalities in high landslide risk:</p> <ul style="list-style-type: none"> • Category 3-6: Municipalities in Santanderes, Piedemont Plains, Huila, Cauca, and Nariño. | <p>Municipalities in low seismic risk:</p> <ul style="list-style-type: none"> • Category 3-6: Departments such as Orinoquia, Amazonas and, Vichada. <p>Municipalities in low volcanic risk:</p> <ul style="list-style-type: none"> • Category 3-6: Departments such as Orinoquia, Amazonas, Vichada, Cesar, Valledupar, Cordoba and Santanderes, among others. <p>Municipalities in low flood risk:</p> <ul style="list-style-type: none"> • Category 3-6: Vaupes, Guaviare, Guainia, and some municipalities in Caquetá. <p>Municipalities in low landslide risk:</p> <ul style="list-style-type: none"> • Category 3-6: Vaupes, Guaviare, Guainia, Amazonas and Orinoquia. |



Gaitan settlement. Municipality of Manizales (Caldas - Colombia), 2011. Photography: Nilson Correa Bedoya.



Disaster Risk in *Public Administration*

Ana Campos G., Carolina Díaz G., Diana M. Rubiano V.,
Víctor Manuel Moncayo



2.1. PUBLIC ADMINISTRATION ELEMENTS APPLIED TO DISASTER RISK MANAGEMENT: CONCEPTUAL FRAMEWORK

Conceptual progress in the relationship between risk management and development has not been completely carried out in practice, nor has it been entirely understood as an integral part of public administration. The conceptual framework presented below has provided guidance in the preparation of this report. This report attempts to assemble the most modern approaches in both risk management and public management and explain, from the point of view of the team that wrote this report, how the articulation of both elements was conceived. Therefore, a conventional analysis of risk management that shows progress and challenges is not made in subjects such as governance, knowledge and information, education and communication, risk reduction, or disaster management. On the contrary, priority has been given to public administration as an element that provides structure and the risk management processes as cross-cutting aspects. This section describes a theoretical-conceptual perspective, which is considered the approach toward which modern public administration should involve, and in which risk management is incorporated as an instrument for its sustainability.

2.1.1. Disaster risk management as a fundamental strategy for development sustainability

Understanding the problems of risk and disasters as a development subject, related to its use, occupation, and transformation of the territory, determines the success of the efforts carried

out for the construction of sustainable development¹. There is increasingly more awareness that disasters are not events of nature per se, but the result of applying inappropriate development models or styles that do not take into account the interrelation between society and nature and that manifest themselves in increasing vulnerability conditions. In these terms, the relationship between disaster risk and development is proposed as twofold. On the one hand, risk causes are rooted in errors and problems in addressing the models, where some factors are not taken into account, such as those related to the restrictions and potentialities of the territory, the economic and social context in planning, the definition of land use and the implementation of projects, the pressure for urban expansion, inappropriate technical and technological interventions in the dynamics of the ecosystems. On the other hand, insofar as the problems created by and inappropriate development processes are not corrected, the risks will materialize in disasters. This not only ends up affecting the population, production, and infrastructure, but it delays the welfare of the country, which then has to redirect resources that were allocated to new investments to activities related to reconstruction and recovery. Hence, it is fundamental to incorporate

¹ According to Law 99/93, sustainable development is understood as “that which leads to economic growth, an increase in quality of lifestyle and social welfare, without exhausting the renewable natural resources that it depends on, or deteriorating the environment or the right of future generations to use it for satisfying their own needs”.

risk management in development processes starting from the institutional platform that is available to the State to comply with said end.

2.1.2. Disaster risk management and adjustment to climate change as complementary approaches for sustainable development

Disaster risk management and adjustment to climate change offer many multiple complementary approaches that on a long-and short-term basis contribute to being a major challenge to sustainable development. Both of the Colombia's First and Second National Communications before the United Nations Framework Convention on Climate Change (UNFCCC) made evident that the country is highly vulnerable to the effects of weather variations and climate change. If the levels of uncertainty when facing impacts of said processes is high, a risk management policy demands comprehensive actions in climate change phenomena and its adaption strategies connected to the sectoral and territorial sphere. In this context, risk management also requires articulation in planning and developing coordinated actions in the field of climate change.

The challenge to disaster risk management and the mitigation and adaptation to climate change suggests that decision making should be based in not only facing the existing climate risks, but also in future ones avoiding high-risk investment that may result in catastrophic losses (Cardona, 2009). This vision generates different benefits derived from a multicriterion and long-term approach, contributing to the project investments, the welfare and safety of the population, and the

functionality of the ecosystems. In order to achieve this, it is essential that interventions and projects to be executed rely on specific criteria in technical feasibility in harmony with disaster risk management principles, whether they are financed by international cooperation, with resources from bilateral or multilateral agreements, fresh resources, or through the Adaptation Fund.

The shortage of information for making decisions, uncertainty, and institutional disarticulation indicate the lack of an integral approach to climate change and disaster risk. One of the main concerns, both in the field of adaption to climate change and in disaster risk management, is the need to identify probable impacts associated with the alteration of the intensity and frequency of damaging or disastrous hydroclimatic events. With this approach, measures can be designed and implemented to reduce risk conditions, prevent factors that generate vulnerability, and minimize the potential effects of disaster (Lavell, 2010). In this sense, disaster risk management and adaption to climate change have a common purpose, and thus policies that are constructed around both issues should implicitly acknowledge this correlation with the aim of orienting planning actions, setting up coordinated organizational structures, and maximizing the use of assigned resources for these work areas. The effectiveness of their articulation demands acknowledging the causes of vulnerability and generating intervention actions in the country's political, social, economic, and environmental spheres.

Colombia lacks an institutional structure in which the sectors and territories evaluate their vulnerability and capacity to face impacts, thus reducing the effectiveness of the actions developed. Risk management and environ-

mental management do not appropriately integrate to formulate adaption and mitigation strategies of facing climate change, and even though programs and initiatives have been developed in the country, there still exists the challenge of cross-cutting climate change and risk management with the purpose of not losing a program orientation of the country that responds to the multidimensionality of these phenomena (Cardona, 2009). Among the main advances in this subject, Conpes 3700 was established with the purpose of integrating the problems of economic and social development caused by climate change in the sectors' and territories' planning and investment processes. In the National Development Plan 2010-2014, priority is given to strategies addressing the subject of climate change², that likewise demands an institutionalism to coordinate existing initiatives, resulting in the formation of the National Climate Change System (SNCC).

2.1.3. The institutionalism of public administration in disaster risk

The concept of institutionalism of risk management refers both to the functional organization of all government agencies and the legal regime applicable in this field. The institutional concept comprises the regulatory system which is applicable to risk management, the system or a functional set of institutions and processes, and to the organization of entities that comply with determined functions. Understanding the logical and strategic order on how the State³ is organized in terms of its mission (should be), of its functions (should do), of its organizational format (who does it), and of the instruments (what does it) required to

achieve its end, the risk management criteria are incorporated more effectively in the different territorial and sectoral spheres of public administration. All of the public and private actors can be risk generating agents, by action or omission, and at the same time be potentially affected by the disasters, making it a cross-cutting subject and of joint responsibility. For this reason, the institutional response, both in Colombia and in many other countries, has been the creation of platforms or systems that include, to a greater or lesser degree, all of the State entities and the society in general to address this subject. The National System for Disaster Prevention and Response and its organization is analyzed in detail further ahead, in section 2.3 of this chapter.

2.1.4. The absence of a national policy in risk management

The State organizes the fulfillment of its mission by regulating, fomenting, and controlling the institutional framework of public policies and instruments through public administration. This may be defined as a joint action between the State and the community to achieve the development objectives by means of a dynamic, integral, systematic, and participative process. It articulates plan-

2 Some of these strategies are: National Plan for Adapting to Climate Change, Colombian Strategy for Low-Carbon Development; Financial Disaster Protection; National Strategy for Emission Reduction due to Deforestation and Forest Degradation in Developing Countries; and Conservation Function, Sustainable Forest Management, and Increase of Forest Reserves of Carbon in the Developing Countries.

3 The State, from a systemic viewpoint is defined as a kind of organizational form with social, economical, environmental, and institutional dimensions, which adequately orients, disposes, relates to, and is empowered by public policies and their instruments, which contribute to the common goal of nation development, this last conformed by the population, the territory, and the State (Vega Mora, 2004).

ning, execution, monitoring, evaluation, and control of economic, social, cultural, technological, environmental, and political strategies (DNP and ESAP, 2007). Since the Constitution of 1991, public administration has evolved toward a more decentralized, participative, and democratic arrangement and a results-oriented organization. In its cycle, public administration requires a combination or mobilization of resources, building consensus spaces and clear coordination mechanisms.

Public policies constitute fundamental declarations or principles from which the State decides to undertake, on a long-term basis, a subject of general interest, consider major objectives, and the means to attain them. Public policy formulation and the design of instruments imply a rational process in decision making related to orientation, formulation, design, regulation, rules, and programming, by which the what (policies) and the how (mission strategies, functional, jurisdictional, and instrumental solutions) of public administration (DNP and ESAP, 2007) are designed).

In absence of a disaster risk management policy that establishes the impacts that are to be achieved in this field, documents such as the National Plan for Disaster Prevention and Response (PNPAD) or Conpes 3146 serve as guiding instruments, although they leave significant gaps. Currently, there is no national disaster risk management policy. Therefore, the actions of the State in this issue have only been directed by planning instruments such as the PNPAD and some Conpes Documents, as will be seen in detail in section 2.2. However, said instruments, even though they emphasize the definition of programs and activities, do not have the sufficient hierarchy to adopt substantive decisions on the results that are desired in risk management. Neither do they define the scope of public and private responsibility at the territorial and

sectoral level, nor the responsibilities that the State acquires in facing risks generated, be it by individuals or by itself.

A modern risk management policy should be formulated so that it integrates risk knowledge and information, risk reduction and disaster management, as well as the strategies to assure governance on the subject and its contribution to territorial safety, welfare, quality of life, and sustainable development. From a methodical point of view of risk management as public policy, three large components are identified: (i) risk knowledge and information, (ii) risk reduction, and (iii) disaster management. These components are also sub-divided as follows: *risk knowledge and information* integrate (a) identifying disaster risk factors (hazard, exposure, and vulnerability), which include underlying factors, their origins, causes, and transformation; (b) disaster risk analysis and estimation as well as monitoring and control of its different factors; and (c) communicating risk with the purpose of informing and, providing perception and awareness to the public. *Risk reduction* comprises (a) prescriptive and corrective risk intervention through early mitigation actions that modify the existing conditions; (b) restrictive and prospective risk intervention through anticipated preventive actions that avoid the generation of new risks in facing present or future hazards such as those that can be produced by climate change; and (c) disaster risk retention and transference, or the expected definition and the use of financial protection instruments to cover immediate assistance, rehabilitation, and reconstruction (e.g: reserve funds, contingency credit insurance, catastrophe bonuses, etc.). *Disaster management* includes (a) preparation, understood as *ex ante* related to early warning systems and generating response and recuperation capaci-

ties; (b) the response defined as *expost* actions carried out to aid the affected population by an imminent disaster or the occurrence of one; and (c) the rehabilitation and reconstruction of the socioeconomic, environmental, and physical conditions, taking into account safety criteria with the explicit purpose of not reconstructing the preexisting risk (Ingeniar Ltda., 2011).

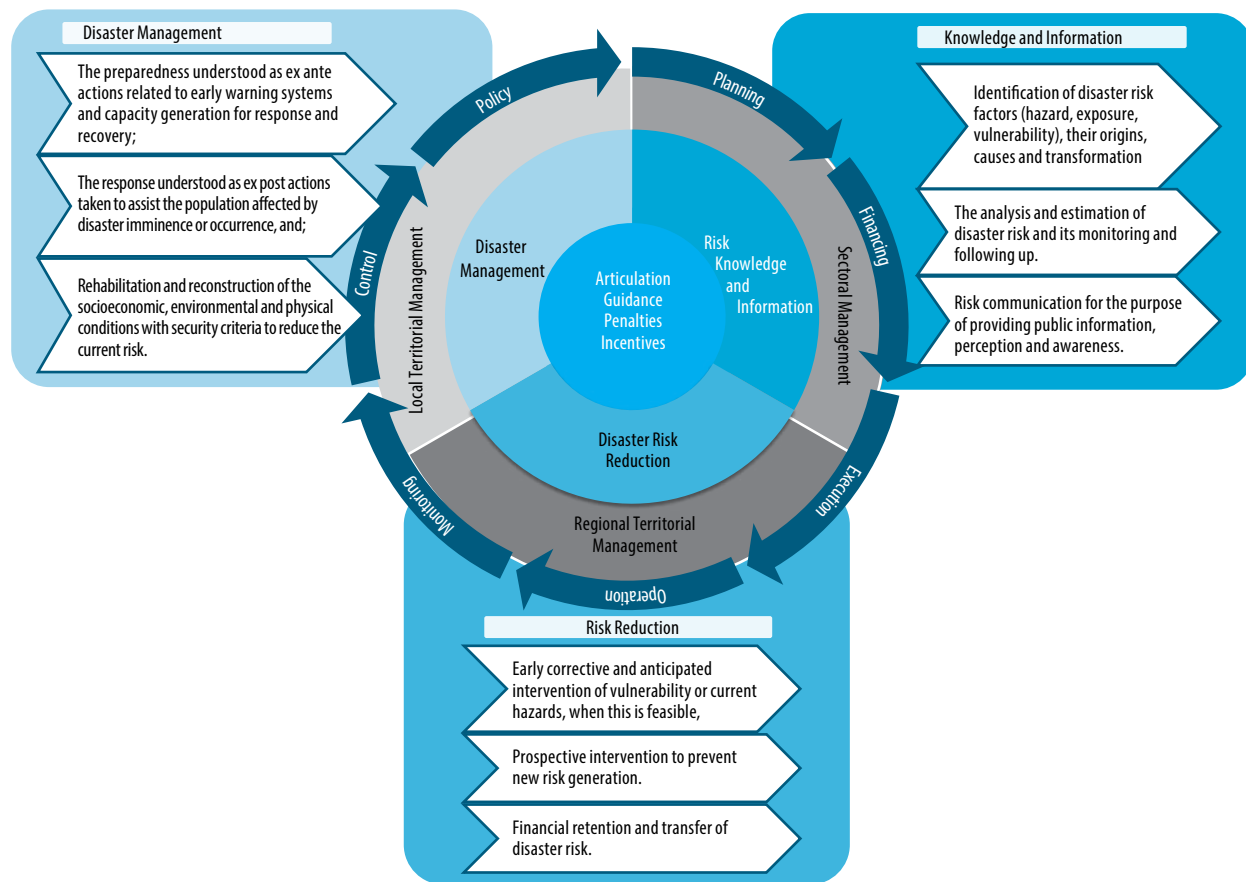
2.1.5. Spheres of action in territorial and sectoral risk management

Under the perspective of public administration, risk management should adapt both to the territorial and to the sectoral sphere. (Figure 2.1). Risk management is linked to development requirements so that it contributes to assuring survival and reducing structural factors that create and sustain poverty. This means that political instruments and strategies have to be incorporated in order to stimulate territorial and sectoral development, control aspects of risk management, as well as formulate and execute specific projects to reduce risk. The implementation of processes should begin by evaluating and knowing the risk, from the project's prefeasibility phase, promoting with this a prospective vision and avoiding the generation of new risks. Additionally, in maintenance and in different operational initiatives, there is a need to incorporate a corrective vision to reduce existing risks. Finally, it is important to complement with financial protection strategies, to formulate plans, and to generate capacities to manage disasters in case they occur.

Risk management in the territorial sphere refers to mid-term and long-term specific processes, strategies, and projects executed by ter-

ritorial entities: municipalities, departments, and/or regions of the country. Risks always materialize in the territory, but their causes may be local as well regional, national, or even international. In the cases where the risk originates locally, as for example in certain specific landslides, risk management can (and must) be assumed by the municipal administration. But there also exist other types of associated risks. For example, phenomena such as floods or volcanic eruptions, can transcend a political-administrative division, making it necessary to set up projects that comprise several municipalities, departments, watersheds, and social agents. This implies the construction of regional concentration spaces and cooperation mechanisms among municipalities, governorships, Regional Autonomous Corporations (CAR), regional entities, if they exist, and the national government. Land use planning as a guiding instrument in appropriately managing land and water is the most valuable instrument to orient development aimed at complying with sustainability and safety objectives, since it permits establishing a physical-spatial reference that sustains coordinated economic, social, and political development actions among the different actors in the country, a region, or a location. Given the strategic importance of territorial management, this component is addressed in detail in chapter 3 of this document.

FIGURE 2.1. Conceptual outline of the articulation of public administration and risk management



Source: Authors' figure, 2011.

Sectoral risk management refers to prospective, corrective, or reactive type policies and projects in the different economic and social sectors. Each sector should be responsible for the safety of its infrastructure, for minimizing loss of life, its economic impacts, and for its means of production when facing present and future disasters. Likewise, it should also continue to be responsible for the rendering of its services. In order to comply, it is necessary to rely on instruments that regulate technologies, design criteria and the construction and operation of sectoral investments, while equally respecting the territorial occupation processes as set forth by the law and the POT. In other words, from a sec-

toral perspective, precedence should be given to promoting localization, construction, and the safe operation of the infrastructure and of the projects, fostering a culture of responsibility in facing risk and promoting the strengthening of capacities in order to respond to emergencies generated by each one of the specific sectors or in which one of them could be involved. Such processes require agreements among multiple productive and service spheres, which include public and private actors at different territorial levels. It is essential to formulate clear policies that lead to efficient and effective risk management with the participation of all social agents, and to define coordination mechanisms such

as sectoral committees and other types of inter-ministry agencies and agendas in order to analyze risks and specific processes in each sector. Since the subject of sectors denotes a large gap and a broad complexity and importance to the country, it is evaluated in depth in chapter 4 of this report.

2.1.6. Planning as the principal instrument in territorial and sectoral risk management

National, territorial, or sectoral public policies are implemented by means of diverse planning instruments. Planning becomes the first step in disaster risk management, given that through it, a set of selected participative and concerted strategies to accomplish certain goals are identified, ordered, and harmonized, depending on the problems and opportunities. Risk management, being a fundamental element in sustainable development, should be incorporated by all responsible public administration actors in their planning instruments, regardless of the territorial and/or sectoral jurisdiction, while simultaneously assuring an adequate and congruent coordination. Included in the principal planning instruments are land use plans (at the watershed and municipal level), which in their regulatory component define restrictions and conditions to appropriately manage risk, and in their pragmatic component, they offer a great opportunity to incorporate a set of projects aimed at consolidating strategic objectives related to building and infrastructure localization and construction, as well as safe territorial activities (Ramírez and Rubiano, 2009a). On the other hand, the PD are instruments linked to a programmatic vote by which the territorial authorities define investment priorities and

in consequence they have a greater probability of being executed, since these have to rely on quantifiable indicators and goals related to knowledge, risk reduction, and disaster management with the aim of monitoring, controlling, and evaluating its progress (DNP and ESAP, 2007).

The successful execution of a territorial or sectoral PD depends on the projects' aim in complying with their objectives and goals. The Bank projects are support instruments in planning, in which all the interest aspects are registered and follow the projects' cycle phases: (i) preinvestment that covers programming, identification, and the formulation of the project; (ii) investment that addresses financing and execution; and (iii) postinvestment and operation, which includes evaluation and monitoring (Von Hesse and De la Torre 2009). Additionally, for the risk management projects-monitoring and phenomena warning, preparing risk evaluation studies and executing mitigation works, etc. the incorporation of specific criteria (safe localization, construction, and functioning) is required. The convention in analyzing public investment is to consider the environmental variable as a potential field for impacts generated by the project. This is the reason why its contents include an *environmental impact evaluation*, but not explicitly the possibility that the projects generate risk situations. Thus, the inverse relation should be considered, namely the *evaluation of the impact that the environment can have on the project* (Campos and Narváez, 2011), such as the opportunity to harmonize risk management and sustainability concepts when setting up a potential disaster scenario.

Public investment projects make up the last sequential stage of the planning process, since they are a phase of the operation of public policies. It is appropriate to detail risk management in different

investment instruments, so that its incorporation is effective. Following the political/plans/projects sequence, public investment through projects should theoretically articulate land use planning as an orienting and regulating framework ensuring a safe location, subsequently followed by the PD as a policy guide for a specific period, the strategic sectoral plans, and the investment plans. Furthermore, in order to confirm the effectiveness of risk management articulation, instruments such as laws and regulations should be accessible to determine minimum content studies in preinvestment, general and specific methodologies to analyze and evaluate the projects, training processes, registration forms, and system tools of the investment projects' banks. Likewise, the norms regulating technologies and design criteria, the construction and monitoring of public investment implementation, and territory occupation are the instruments to be used to integrate risk reduction criteria in the investment and postinvestment stages, both in the public and private sector (Campos and Narváez, 2011). The General Adjusted Methodology, which relies on the Public Investment Projects' Bank in Colombia has made some initial progress in incorporating the risk issue in its *Module 2: Preparation*, in which there is a section called "Disaster studies and risk analysis". The objective of these studies and analysis is to identify and analyze risks that may affect the project's design and development, and/or the risks that it may generate in its surroundings and its operation by applying the Risk Analysis Format PE-10. However, this analysis is not coordinated with the other preparation modules of the projects (Von Hesse and De la Torre, 2009).

2.1.7. The need to rely on a monitoring and control system in disaster risk management

The monitoring and evaluation of policies and management are instruments that contribute to a continuous improvement in public administration. Monitoring provides information of the progress of a policy, program or entity in order to compare progress in facing proposed goals-coherence between what is formulated and what is executed-. The evaluation examines the causality between the State's investments, and its effects (positive, negative, expected or unexpected) in order to determine their relevance, efficiency, effectiveness, impact, and sustainability (Conpes Document 3294 of 2004, Public Administration Renovation: Results-Oriented Management and National Evaluation System Reform.) It is important to define the baselines that provide a perspective for existing risk levels and the state of progress in sectoral and territorial risk management. The monitoring and evaluation reports of the entities' activities at different territorial levels have to be consolidated so as to comply with the proposed goals and give feedback to the risk management process, given the cross-cutting nature of the subject and the necessary participation of the multiple actors from local, regional, and national governments. Even though chapter 1 of this report points out that there is indisputable evidence that risk is increasing, no baseline exists in each municipality that enumerates the number of persons or the number of houses that are exposed, nor the risk levels to the State's infrastructure, which makes it difficult to establish clear control methods and the identification of investment priorities. Therefore, it

is impossible to carry out an adequate evaluation of risk management performance and the success of public investments, as shown in the appendixes of this document herein.

There are different types of controls: internal, disciplinary, fiscal, and social. In order to help the entities comply with their goals and to develop their institutional management, Law 87 of 1993 regulated the creation of an Internal Control System, giving responsibility to every civil servant headed by the legal representative of each entity. This System, taken from Decree 1599 of 2005, received the name of Internal Standard Control Model (MECI) and should be implemented by every entity. Fiscal control is a set of legal, technical, and administrative mechanisms used by the State and overseen by General Comptroller's Office of the Republic and the territorial Comptrollers' Offices to watch over the State's resources. Control and social vigilance is a citizen's right and duty, and as its name indicates it is exercised by citizens over the public administration or similarly by individuals who carry out public functions (DNP and ESAP, 2007).

The role of the authorities in some aspects of risk management is exercised by different entities, but a comprehensive evaluation that identifies gaps in authority and control has not been made. Entities such as Municipal Planning Offices and the Curators are in charge of supervising some aspects related to behavior of private and public entities in the subject of risk management, specifically in urban development, but supervising subjects such as risk generation resulting from formal and informal activities that transform the environment is very weak (see local and regional case studies in chapter 3 of this publication). It is necessary to review the different activities that cause risk generation as well as the management processes of these activities, and

to clearly identify the roles of each one of the entities, including control and verification of the public entities' responsibility, so that they comply with their assignments in this area.

2.1.8. The importance of results-based management

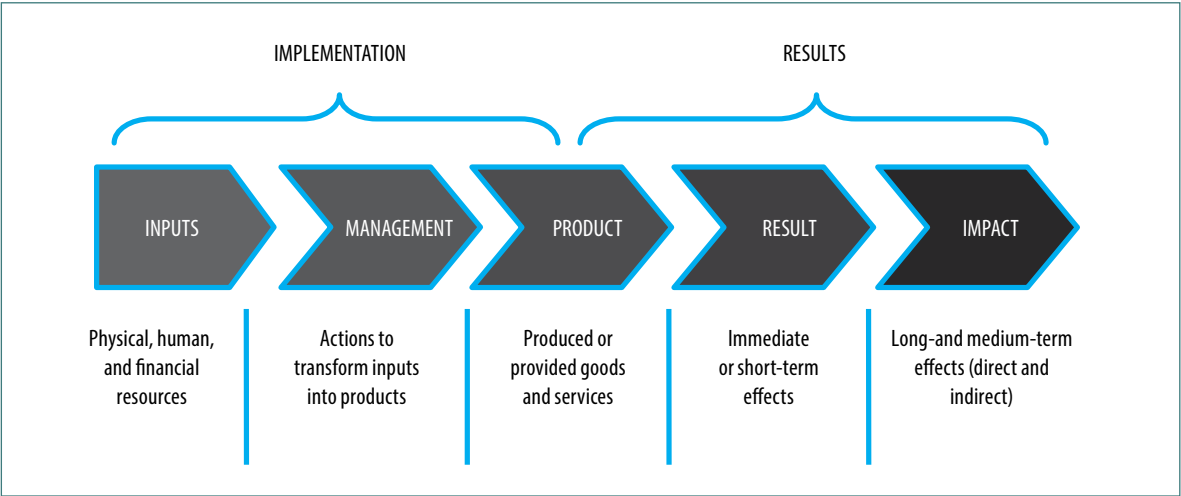
One of the principles of administrative functions, within the framework of the Constitution and the law, establishes that every management process should be converted into concrete results. This is essential in the subject of disaster risk, not only in incorporating the Management System and the Government Goal Monitoring (Sigob) at entity levels, but additionally to ensure coordination and consistency among the territorial and sectoral agencies. Effectiveness in risk management implies coordinating and harmonizing public administration at all levels, always bonded to public policies and regulations having a superior character, thus assuring a subsidiary rigor. In order to achieve these results, it is essential to create an organization with a systematic character that complies with every function and administrative principle in the framework of the provisions of the Constitution and the law. This systematic character requires that the different entities and groups with different competencies, responsibilities, and functions interact in order to attain the results sought.

The concept of *results-based management* introduces a change in the way of implementing plans and budgets, and offers an opportunity to establish clear roles and responsibilities in generating products and results by those involved in risk management in State institutions and programs. Strategic budget programming overcomes the limitations of weak territorial, sectoral, and institutional

coordination. It helps prevail over the complexity of managing disarticulated regulation, the underdevelopment of performance indicators, and the need to consolidate a system that is able to contribute to the population's and territorial safety objectives, and in general to reducing risk, as is required by the Colombian State. *Results-based planning and budgeting*

provides the opportunity to determine appropriate performance indicators, which should offer answers to questions such as In which population will the required change take place?, What is the magnitude of the change?, What does the change consist of?, and others (World Bank, 2000) (Figure 2.2).

FIGURE 2.2. Monitoring stages in public interventions



Source: Adapted from World Bank, 2000.

2.2. DISASTER RISK MANAGEMENT REGULATORY SUPPORT

2.2.1. The National System for Disaster Prevention and Response (SNPAD), its main regulatory body, and the Constitution of 1991

The first regulatory advances in disaster risk management in Colombia were related to the creation of relief agencies, the existence of public sanitation management problems, and functions established by the Police Code. In 1948, Law 49 created the National Red Cross, making it responsible for aiding victims in emergency situations. In 1965, the National Civil Defense Bureau was created (Decree 3398). At the end of the 1970s, the National Sanitation Code was approved (Law 9 of 1979) to protect the environment and human health and the first National Committee and Local and Regional Emergency Committees were instituted and attached to the Ministry of Public Health. In 1970, the National Police Code (Article 216 of the Code, Decree 1355 of 1970) granted mayors and governors, as Police chiefs, significant functions, including those related to aiding those affected by a disaster or calamity. In 1984, the National Disaster Relief Fund was created (Decree 1547), which formally incorporated the SNPAD in Article 70 of Decree Law 919 of 1989. In this context, it may be said that all of these regulations are fundamentally focused on what is today known as “response preparation in disaster relief”, acknowledging some preventive elements, even though these may be limited (OSSO Corporation, 2009b).

The organization of the SNPAD regulatory system has not been strategically modified since 1989. Events such as the Popayan earthquake in 1983 and the destruction of Armero in 1985 initiated the creation of the SNPAD and resulted in the consolidation of the principal body of the current regulations. Law 46 of 1988, which created SNPAD, extended the sphere of intervention in disasters in “their different phases”: prevention, management, rehabilitation, reconstruction, and development (Law 46 of 1988, Article 1; Decree 919 of 1989, Article 1), and it established a system focused on disasters. Decree Law 919 of 1989 defined the functions and the members of the SNPAD, articulating public and private efforts and incorporating the subject as part of the development planning process (*Box 2.1*). However, lack of clarity in the prevention concept has created ambiguities in its interpretation: sometimes it is understood as preparedness to the response, and at other times it is identified as anticipated measures to reduce damages caused by a disaster. This is one of the reasons why some of the actors do not integrally take for granted the responsibility in disaster risk management. According to a survey done for this study, many municipalities believe that they have a policy document or a risk management strategy, because they have formulated the municipal Emergency and Contingency Plan (PLEC), thus being prepared when a dangerous event occurs; however, they do not necessarily know how to prevent disasters or how to incorporate safety criteria in their development models.

Box 2.1. Scope of Decree Law 919 of 1989

a. It defines SNPAD functions and members.

b. In the planning area,

- It orders the issuance of a National Plan for Disaster Prevention and Response, involving public and private entities and organizations in its preparation and execution.
- It provides the inclusion of a disaster prevention and response component in regional, departmental, and municipal plans.
- It contemplates the preparation of contingency plans.
- It regulates the planning of operations in case of disaster situations.
- It arranges the organization of an information system and equipment, an early warning and communication system and a first aid system.
- It contemplates the possibility of requiring a vulnerability analysis and protection measures.

c. It defines a disaster situation regime that includes:

- A classification of situations that distinguish, according to the seriousness and its effects, between a disaster situation and a public calamity, whose declaration, in its order, is made by the President of the Republic, and the National Unit for Disaster Risk Management, formerly the National Disaster Assistance Office. It includes the formalities in its declarations and their effects. Both types of situation may have a different territorial scope (national, departmental, municipal and district).
- Its own regulatory system that can operate during a disaster situation and that covers to specific subjects such as contracting, occupation, and demolition of real estate, imposition of easements, conflict resolution, acquiring and expropriating, moratoria or debt refinancing, fiscal control, and donations.

d. As far as the organization, the administrative structure is composed of:

- A National Office for Disaster Prevention and Response, previously attached to the Presidency of the Republic, thereafter known as Directorate for Risk Management (DGR) under dependency of the Ministry of the Interior and Justice and currently the National Unit for Disaster Risk Management (UNGRD), assigned to the Administration Department of the Presidency of the Republic.
- A National Committee and two additional National Committees, one operational and one technical.
- Regional and Local Committees for Disaster Prevention and Response.
- A National Calamity Fund and the possibility of funds in central administration entities and organizations, and in decentralized entities.
- An administrative scheme that defines the specific functions as far as dependencies and organizations in the central administration and the decentralized entities at the national level.
- Functions concerning territorial entities.
- National networks in specific areas (communications, seismic, volcanological and hydrometeorological alerts, reserve centers, and other relevant information).
- Reorganized Civil Defense and the National Red Cross Relief.
- Professionals that are considered paramedic personnel.

e. As far as territorial entities:

It explicitly authorizes the competent organs to adopt their own system in their respective jurisdictions when facing disaster or calamity situations.

In the Political Constitution of 1991, apart from a state of emergency due to a serious public calamity (Article 215 CP), there are numerous provisions that support the State's responsibility in disaster risk management (Box 2.2). The mission of the State establishes the protection of the individual's life, honor, and property; it guarantees a spectrum of individual, social, and collective liberties as well as the principle of solidarity including the right to decent housing (Article 51 CP), a healthy environment (Article 79 CP)

and the very principle of solidarity (Article 95 CP). Education stands out in providing training in aspects related to environmental protection (Article 67 CP). Likewise, specific instruments are provided to protect the rights that may be affected or threatened, and it insists on the planning management and exploiting the natural resources in order to guarantee sustainable development and the prevention and control of factors that cause environmental deterioration (Articles 80 and 88 CP).

The conceptual evolution undergone by the SNPAD, from the point of view of policies, constitutes the approval of the PNPAD, ten years after the creation of the SNPAD, passing from the concept centered on disaster, as stated in Decree 919 of 1989, to the notion of risk as it exists in Decree 93 of 1998. The PNPAD is based on three objectives: (i) risk

reduction and disaster prevention, (ii) an effective response in case of disaster, and (iii) the rapid recovery of the affected areas. For the first time, it established as a basis for government action in “risk reduction and sustainable development of vulnerable communities” (Decree 93 of 1998, Article 1), and defined decentralization as one of its guiding

Box 2.2. Main provisions related to risk management established in the Political Constitution of 1991

a. The mission of the State to protect the population. It is proclaimed in the preamble (“to assure its members life, coexistence, work, justice, equality, knowledge, liberty, and peace”) and materialized in the objective (“to protect all persons residing in Colombia, in life, honor, property, beliefs, and other rights and liberties in order to assure the compliance of the social duties of the State and individuals.”) Without a doubt this supports all institutions in disaster risk management intended to protect the citizens and their property from the consequences of risk situations.

b. Social state of law. The Colombian State establishes and guarantees an ample spectrum of individual, social, and collective rights as well as the principle of solidarity.

As far as rights, it encompasses substantial or fundamental rights, those considered as second generation related to minimal socioeconomic conditions and those of the third generation that assure community living as far as conditions of subsistence, environment, protection of natural resources, and preserving public space. All of these are within the concept of “general welfare” and “improvement in the quality of life of the population”.

With respect to solidarity, it is the duty of all the members “to act according to the principle of social solidarity, responding with humanitarian actions in situations that put in danger the life or health of any individual.”

c. Protection means. The Constitution establishes specific instruments to protect rights that may be affected or threatened, that, as it is obvious, make up part of the set of regulations related to disaster risk management. They are as follows:

- Protective action, established to protect fundamental rights (or those related to jurisprudential development) violated or threatened by a State action or omission, or by individuals responsible for rendering public services, or whose conduct seriously and directly affects the collective interest.
- The action of fulfillment oriented to achieve by court order the compliance of the law or an administrative act by public authorities or individuals complying with public functions.
- Popular actions for the protection of the collective rights and interests related to patrimony, space, safety, and public health, administrative ethics, the environment, free economic competition, and others of similar nature. Its objective is to “avoid contingent damage, put an end to danger, threats, vulnerability or grievances over the collective rights, and interests or to reestablish things to their prior state whenever possible” (Article 2 of Law 472 of 1998), that is feasible for the public authorities as well as for individuals and whose relevance in situations of risk is very significant.
- Group actions conceived to claim compensation for damages inflicted on many people.

d. The responsibility of the State. Pursuant to Article 90 of the CP “The State will respond economically to unlawful damages for which it is liable, resulting from an action or omission of the public authorities.” Moreover, it is established that “no State authority may carry out functions different from those assigned by the Constitution and the Law” (Article 121), that public servants are liable for infringing the Constitution and the Law and “for omission or overstepping in the exercise of their functions” (Article 6), and that “the Law shall determine the responsibility of the public servants and the method to carry out these responsibilities effectively” (Article 124). Additionally, the Constitution authorizes the Law to define cases of objective responsibility for damages caused to collective rights and interests (Article 88). Further comments are made on this subject in Chapter 5 of this study, where public and private responsibilities are covered.

e. The functions of the different State agencies. The Congress of the Republic, aside from the general legislative competence, has the authority to regulate by statutory Law “the fundamental rights and duties of the people and the procedures and resources for their protection”, as well as states of emergency as provided in Article 215 CP. Both subjects are of particular relevance in risk management, as will be indicated further in this chapter and in chapter 5.

- The President of the Republic is vested with the power to declare a state of emergency resulting from a public calamity, as provided for in Article 215 CP, as well as to exercise regulatory power or act as a legislator in exercising extraordinary powers.
- Collegiate bodies are territorial entities that outside of their general competence are empowered in functions such as police, control of land use and construction or preservation and defense of the ecological and cultural patrimony.
- Governors and mayors have relevant competencies as executive and police authorities in their respective territories.

principles. From this more integral notion of facing risk, the principal characteristics of the Plan may be summarized as follows: planning as an essential instrument; emphasis on local power and authority, since they are close to the population and the physical elements that contribute to risk; and the expression, in the majority of cases, of the norms that regulate land use and urban activity. The PNPAD is constructed more around the notion of risk than on the idea of disaster or calamity.

Conpes Document 3146, adopted in December 2001, formulated a strategy to consolidate the implementation of PNPAD in the short and medium term. This document seeks to improve the development of the four strategies or programmatic lines referred to in PNPAD⁴ in the absence of elements associated with temporality and territoriality contributing to the definition of those responsible and establishing an implementation period of three years (2002 -2004). Thus, the Conpes Document 3146 exposes the following aspects: an overall framework of risk in the country, the progress of PNPAD to date, and the financial aspects of SNPAD. Unfortunately, these exercises have not been made on a recurring basis, nor have monitoring and evaluation mechanisms been designed at different territorial levels, where they can articulate actions, guide priorities, and make adjustments according to needs and progress. This document was subjected to a quick assessment that provided information on the efficiency and effectiveness in its implementation, and UNGRD is currently conducting an assessment of the PNPAD's thirteen years. In this context, the authors of this document considered it appropriate to conduct an analysis of developments in risk management and investments in the field, whose main results are shown in the appendixes.

At least 24 Conpes documents dealing directly or indirectly with disaster risk management have been issued between 1971 and 2011 (Box 2.3). The majority are triggered by specific events, counseling

on preventing and mitigating potential impacts, articulating actions for different Government entities, and setting financing sources and mechanisms. The lack of a clear institutional and financial strategy in disaster management reflects on the need to formulate policy guidelines and funding mechanisms when catastrophic events have occurred (phenomena such as El Niño in 1971 and La Niña in 1997-1998; earthquakes in Tumaco in 1979, Popayan in 1983, Uraba in 1992, the Coffee Growing Region in 1999; and volcanic activities in Galeras in 2007 the Nevado del Huila volcano in 2010). On the other hand, we have comprehensive Conpes documents highlighting the importance of prevention (Strengthening the Implementation of PNPAD and Guidelines for the Overall Improvement of Neighborhoods) and those related to the State's fiscal vulnerability reduction program on natural disasters⁵ at the national level and in Bogota. Likewise, as well as the recent Conpes, the National Climate Change System was created and there is also a proposal for the creation of a National Plan for this subject. One initiative of interinstitutional articulation that should be developed for the various processes of risk management is The Strengthening Strategy of Science, Technology, and Education for Risk Reduction and Disaster Response. It allows the rapprochement between those entities belonging to SNPAD, the National Environmental System (SINA), and the National Education System that was encouraged by Conpes 3146 of 2002.

4 The four strategies are: (i) knowledge of the originated natural and anthropogenic risks, (ii) risk prevention and mitigation in planning, (iii) institutional strengthening of SNPAD, and (iv) socializing the risk and disaster prevention and mitigation.

5 Structured in five basic components: (i) identifying and monitoring risk, (ii) risk reduction, (iii) policy development and institutional strengthening, (iv) information and awareness in risk management, and (v) financial transference of residual risk. These components are related to the four main strategies of the PNPAD and the strategy for financial risk management in the PND 2002-2006, "Moving toward a Community State."

Box 2.3. CONPES documents related to risk management

| Conpes Document | Title |
|---------------------|---|
| 759 May 1971 | Flooding effects on Colombian territory: Actions taken by the national government * |
| 1737 December 1980 | Concept of a foreign loan operation to be entered into between Colombia and the IDB (Pacific Coast disaster)* |
| 2017 August 1983 | Negotiation of two foreign loans by Colombia with the IDB to partially finance an emergency program for the reconstruction of La Universidad del Cauca* |
| 2045 October 1983 | Foreign loan that is planned between the national government and the IBRD to partially finance the reconstruction project of Popayan and Cauca * |
| 2399 October 1988 | Program for the liquidation of the "Resurgence" Reconstruction Fund |
| 2559 October 1991 | National government authorization of foreign debt with the German government for 50 million DM (Note: among others funded were Reserve Centers and Valle de Aburra Emergency Network) |
| 2609 August 1992 | Authorization to apply for a German loan of up to 13.5 million DM for the Comprehensive Improvement Program of Marginal Neighborhoods in Medellin (Primed) |
| 2948 August 1997 | Guidelines for preventing and mitigating the potential effects of El Niño 1997-1998 |
| 2985 February 1998 | Monitoring progressive actions to mitigate the effects of the Pacific phenomenon (El Niño), Conpes 2948 of 1997 |
| 3038 May 1999 | Authorization to the nation to grant a guarantee for a foreign loan for the municipality of Medellin of up to US\$5.2 million or its equivalent in other currencies, to partially finance the Comprehensive Improvement Program of Marginal Neighborhoods in Medellin (Primed) |
| 3131 September 2001 | Financing plan for the Coffee Growing region's reconstruction and FOREC's closure |
| 3146 December 2001 | Strategy to strengthen the implementation of the National Plan for Disaster Prevention and Response (PNPAD) in the short and medium term |
| 3180 July 2002 | Program for the reconstruction and sustainable development of Uraba in Antioquia and Choco, and lower and middle Atrato. Enlargement of Conpes 3169 "Policy for the Afro-Colombian population" |
| 3305 August 2004 | Guidelines for optimizing urban development policy |
| 3318 November 2004 | Authorization to the nation to apply for foreign loans from multilateral banks for up to Col\$260 million to finance part of the Program for Reducing the Fiscal Vulnerability of the State in confronting natural disasters |
| 3398 November 2005 | Nation's guarantee to Bogota, D. C. to contract a foreign loan from multilateral banks for up to US\$80 million, or its equivalent in other currencies, to partially finance the Program to Reduce Fiscal and Physical Vulnerability of the Capital District in confronting Natural Disasters |
| 3501 December 2007 | Policy guidelines to implement a process of comprehensive risk management in the high-risk volcanic area of the Galeras volcano |
| 3570 February 2009 | Strategy of risk mitigation in the Combeima River basin to guarantee water supply in the city of Ibagué |
| 3604 August 2009 | Guidelines for consolidating the policy of comprehensive improvement of neighborhoods |
| 3667 June 2010 | Policy guidelines to reduce risk against hazard of mudflow (avalanche) in the Nevado del Huila volcano |
| 137 January 2011 | Distribution of the general system of participations (education, drinking water, general purpose, and special allocations): Fiscal year 2011 |
| 3700 July 2011 | Institutional strategy for the articulation of policies and actions in the field of climate change in Colombia |

* Documents are not available in digital version.

Source: DNP, available at www.dnp.gov.co.

Overall, it may be concluded that risk management has not really become state policy and therefore, there is a possibility to continue fluctuating between what is important (risk reduction) and urgent (response and reconstruction) in the mandates of different governments. A more holistic view on risk management in PNPAD, Conpes document 3146, in the last four National Development Plans (see appendixes), and in a set of instruments and “guidelines” for local risk management was done by including this subject in the planning, strategies, and investments for governance strengthening, risk knowledge, and risk reduction by the SNPAD actors. However, the strategies are still irregular, fluctuating, and limited as can be seen in more depth in the appendixes, where the effectiveness of progress in disaster risk management is analyzed in terms of investments.

2.2.2. Structural⁶ norms for disaster risk management

Twenty-two years after the Decree Law 919 was issued, it has gone from a single regulatory body, encoding every subject, to a large number of rules that in one way or another make reference to the subjects of risks and disasters. The main norms including aspects related to risks and disasters are: (i) Law 9 of 1989 (urban reform) and Law 02 of 1991 amending Law 9 (among other things, the inventory of settlements in risk areas); (ii) Law 3 of 1991 (social housing system) and Decree 0004 of 1993 (regulatory of Law 3 of 1991); (iii) Law 99 of 1993 (establishing the SINA); (iv) Law 152 of 1994 Development Law or Plan (regulating the National Planning System); (v) Law 136 of 1994 (municipal modernization); (vi) Law 388 of 1997 (regulating the issue of land use and amending Law 9 of 1989); (vii) Law 400 of 1997 and its Decree regulations on seismic-resistant buildings; (viii) Decree 1729 of 2002 on land use planning and watershed man-

agement; and (ix) Decree 1469 of 2010⁷ (urban permits), Decree 2015 of 2001 (permits in case of disasters) and the recently adopted Land Use Planning Law that gives alternatives to strengthen municipal function in risk management. These norms are closely linked to disaster regulation, establishing a set of functions and responsibilities to territorial entities that are not explicitly formulated in the main regulatory body and require unification as well as harmonization and updating, both conceptually and politically⁸. There are other regulatory or sectoral norms that are directly or indirectly linked to risk management or some of its components. Figure 2.3 shows the structural norms for disaster risk management, relating to risk knowledge, risk reduction, and disaster management.

In addition to structural norms for risk management, the current situation needs to visualize the policy framework and implementation of interventions related to climate change adaptation, to the extent that so far these have not been seen as complementary, nor have these been coordinated in terms of scope and responsibility. The country has a lot of initiatives on climate change that have not necessarily been formulated as complementary to the subject of disaster risk management, and are carried out by a variety of entities and actors. To achieve reconciliation and improve outcomes of these and other initiatives, and taking into account the complexity of the problem, it is necessary to

6 In this document, “structural norms” is the name given to those structures created for general purposes in public planning and development management, which through the inclusion of the elements of risk knowledge, risk reduction, and disaster management assure achieving the goals and adapted strategies in safety and sustainable development.

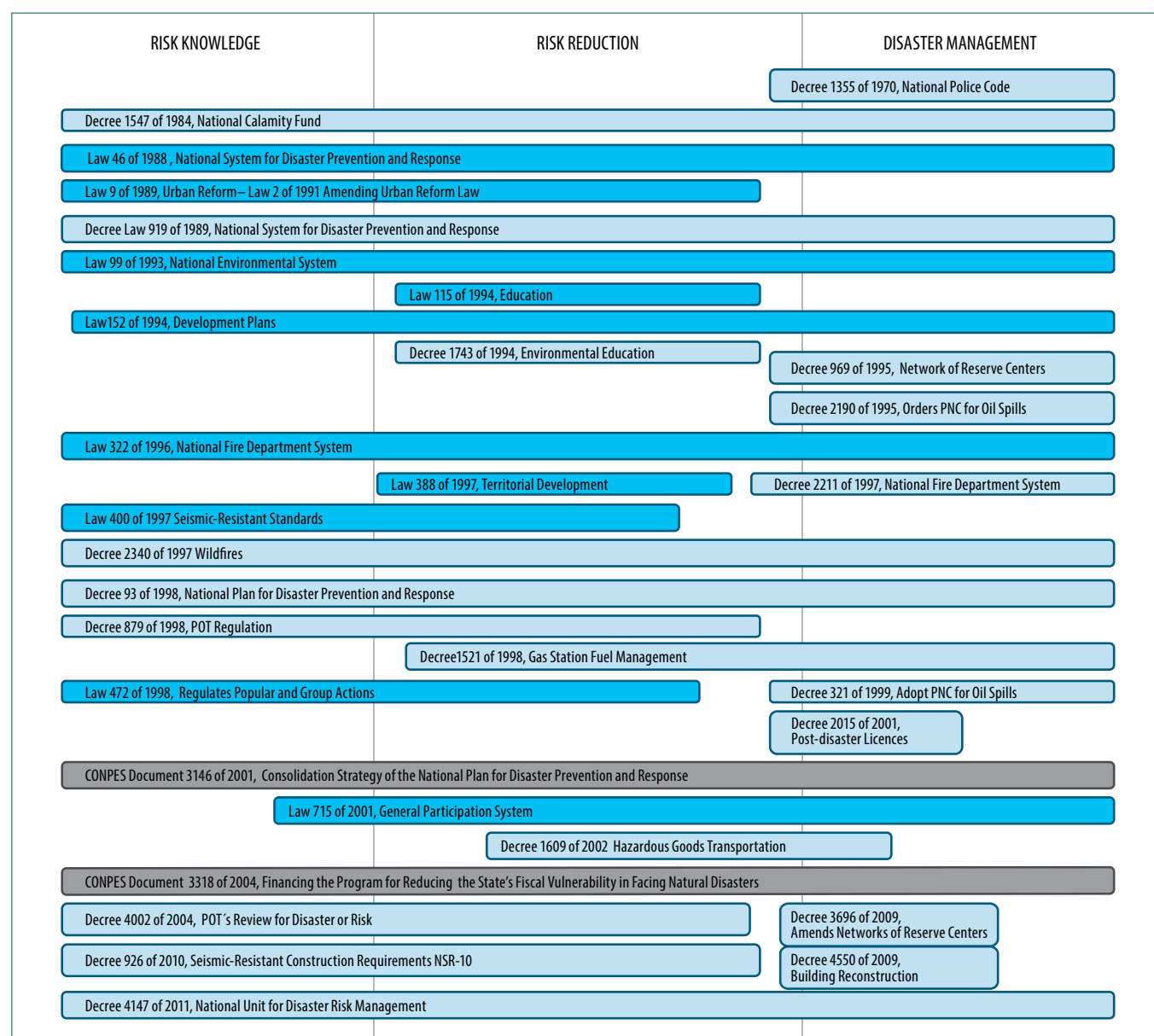
7 It replaced Decrees 1052 of 1998, 1600 of 2005, 564 of 2006, 097 of 2006, 4397 of 2006, 4462 of 2006, 990 of 2007, 3600 of 2007, 1100 of 2008, 1272 of 2009, and 2810 of 2009, by which relative provisions were regulated for urban permissions, building’s assessment, public functions that city curators perform, legalizing of human settlements constituted for social housing, and other factors.

8 Parallel to the preparation of this report, a process of discussing a Draft Law was being debated in Congress that is coherent with the SNPA, the 1991 Constitution, and the new vision of risk management (Ingeniar Ltda., 2011).

form an articulation platform that prevents the duplication of efforts, investments, and provides support to high-level decision making and planning in the country with criteria of both adaptation to and mitigation of climate change. In this sense, the

new Conpes 3700 on climate change provides an opportunity for interinstitutional action in order to guide decision making under an integrated approach that links three managing steps: risk, climate change, and environment (Box 2.4).

FIGURE 2.3. Structural norms for disaster risk management



Source: Adapted from SNPAD and World Bank, 2010.

Box 2.4. Policy response and initiatives for climate change in the national context

| | |
|---|--|
| UNFCCC Approval in Colombia (Law 164 of 1994) | Finding ways to address climate change issues. In order to ratify this instrument, the country had to meet its commitments acquired according to the principle of common but differentiated responsibilities, and in consideration of its specific national development priorities. |
| Approval by Colombia of the Kyoto Protocol (Law 629 of 2000) | Developed countries were imposed the goal of reducing their greenhouse gas emissions (GHG) by 5% between 2008 and 2012 in relation to 1990 levels. The continuity of this commitment is currently being negotiated and involves agreeing to new goals for the reduction of GHG emissions, the means to achieve this and the mechanisms for its measurement, reporting, and verification. Currently, some developed and developing countries have expressed their intention to assume voluntary commitments on this subject in order to contribute to the stabilization of GHG in the atmosphere. |
| First National Climate Change Communication at UNFCCC of 2001 | An Ideam publication analyzed and exposed the national GHG inventory for 1990 and 1994. More susceptible ecosystems to climate change were identified and adaptation measures for the country were raised. The Ministry of Environment, Housing and Territorial Development (MAVDT) published a study to define the National Strategy for the Implementation of the Clean Development Mechanisms (CDM), which aimed to evaluate the potential of Colombia in the new markets, the identification of potential restrictions for these markets, and the development of strategies to overcome them, as well as the promotion of potential benefits for the country. |
| Climate Change Policy Guidelines of 2002 | The MAVDT and the DNP prepared these guidelines, where the main strategies were outlined for the mitigation of climate change in the framework of the UNFCCC, the Kyoto Protocol, and the First National Communication on this subject. |
| Creation of the Colombian Climate Change Mitigation Office in 2001 | This Office was the national authority on this issue and was under the auspices of the MAVDT. It was the appointed entity to promote and evaluate all Clean Development Mechanism (CDM) projects in the country, favoring the consolidation of competitive and efficient economic projects traded on the world market in reducing CO ₂ emissions. In 2005, under the resolution 340 of 2005 of MAVDT, this Office was eliminated to make way for the Climate Change Mitigation Group (GMCC), which is housed within the Vice Ministry of Environment of the MAVDT. |
| Conpes 3242 of 2003 | National Strategy for the Sale of Environmental Services of Climate Change Mitigation complemented the work already advanced and generated essential guidelines to introduce CDM projects within mitigation measures for climate change in the national context. |
| Resolutions 0453 and 0454 of 2003 and Resolution 0283 of 2006 | In 2003 the MAVDT issued resolutions 0453 and 0454, aimed at the adoption of principles, requirements, and criteria, and the establishment of procedures for the approval of national projects to reduce GHG emissions that opt for the CDM. In addition, those resolutions provide the functioning regulation of the Intersectoral Technical Committee of Climate Change Mitigation that created the National Environment Council to assess CDM projects. Thus, with Resolution 0283 of 2006 issued by MAVDT, the Global Change Working Group was created at Ideam and attached to the Environmental Studies Department, with the purpose of carrying out studies and research relating to environmental, economic, and social impacts caused by climate change, and to establish adaptation measures and mitigation options. |
| National Board for Education, Training, and Raising Awareness of the General Public on Climate Change in 2008 | This board was created with the aim of designing, implementing, monitoring, and evaluating a Strategy in Education, Training, and Raising Awareness of the General Public on Climate Change and promoting the participation of different institutional and social actors. |
| MAVDT Resolutions 2733 and 2734 of 2010 | Resolutions 0453 and 0454 of 2003 were repealed to introduce improvements in the national approval procedure. Later, in 2010, the MAVDT issued Resolutions 2733 and 2734, which repealed the resolutions of the previous year (551 and 552 of 2009), with the aim of reducing response times, streamlining the internal evaluation process and regulating the procedure for national approval of Activity Programs under CDM. |
| Board for Reducing Emissions from Deforestation and Degradation (REDD) in 2008 | The purpose of this board is to contribute to strategies, policies, plans, and timely actions development at REDD, in line with local communities' rights, sustainable forest management, and generation and distribution of benefits. |

Box 2.4. Policy response and initiatives for climate change in the national context (continued)

| | |
|---|--|
| Interagency Network on Climate Change and Food Safety (Ricclisa) in 2009 | Created to facilitate interinstitutional collaboration on scientific information, identification of training requirements, and to promote actions to ease access to said information in terms of decision making in confronting climate change. It was created as an instrument to ensure the availability of food. |
| Colombia's Second National Communication to the UNFCCC of 2010 | It presented the GEI national inventory of sources and drain pipes for the years 2000 and 2004. It carried out an analysis of physical-biotic and socioeconomic characteristics to determine Colombia's vulnerability in facing the adverse effects of climate change based on the main hydrometeorological changes related to the phenomenon. It also presented actions that have been carried out on the subject of adaptation and targets, and strategic lines were outlined to diminish climate change impacts and to determine action priorities. |
| National Plan of Adaptation to Climate Change (PNACC) of 2010 | It seeks to influence territorial and sectoral environmental planning processes so that the decision-making process is based on accurate information that takes into account key factors and weather forecasts. Thus, it aims to effectively reduce vulnerability to this phenomenon in both the population, and the ecosystems, as well as in productive sectors, and likewise, increase social, economic and ecosystem capacity in responding to events and climatic disasters. |
| Program in Climate Change Adaptation of 2008 | Comprises National Pilot Program in Adaption to High Mountain Ecosystems, Colombian Caribbean Islands, and Human Health (INAP) and Joint Program of 'Ecosystems' Integration and Climate Change in the Colombian Massif. |
| Regional Comprehensive Plan on Climate Change (PRICC) Region's Capital in 2011 | Created to implement the link between territorial management and the need to confront climate variability challenges for the Region's Capital development. |
| Colombian Strategy for Low-Carbon Development (ECDBC) of 2010 | Long-term planning initiative allowing the country to identify the potential for GHG mitigation and measures, and appropriate projects which should be executed in productive sectors, without affecting the long-term growth of the economy. |
| National Strategy for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries, and the Role of Conservation, Sustainable Management of Forests, and the Increase of Forest Carbon Reserves in Developing Countries (ENREDD+) of 2011 | Set of five actions to reduce GHG emissions caused by deforestation of natural forests in developing countries, as follows: (i) reduction in deforestation, (ii) reduction of the degradation of natural forests, (iii) conservation of forest carbon reserves, (iv) increase in forest carbon reserves, and (v) sustainable management of forests. All this under the financial support of industrialized countries. |
| Decree 4819 of 2010 | This decree created the Adaptation Fund, whose objective is the recovery, construction, and reconstruction of the areas affected by La Niña. This Fund has legal status, budget and financial autonomy, and is ascribed to the Ministry of Finance and Public Credit. |
| Conpes 3700 of July 2011 | Institutional strategy to articulate policies and actions in the field of climate change in Colombia. |

2.3. SNPAD INSTITUTIONAL MECHANISMS, STRUCTURES, AND CAPACITIES

Disaster risk management requires the participation of various social, public, and inter-institutional entities. At the international⁹ level, interinstitutional articulation mechanisms, called platforms or systems, have been promoted, in which it is important to define the roles that the different agents should undertake and their interrelationship, in order to comply with the objectives and proposed outcomes. Each member of the system retains its autonomy and specific rationale, but shares a common purpose related to the management of safe development. Therefore, local, regional, and national governments, civil society, and generally all public and private entities should accept their own role and responsibility so that their actions are effective.

Since 1988, Colombia has established a National System for Disaster Prevention and Response that has been considered a model in Latin America. The SNPAD is constituted by all public and private entities that carry out plans, programs, projects, and specific actions for disaster prevention and response, and has the following objectives (Decree Law 919 of 1989, Article 1): (i) define the responsibilities and functions of all agencies and public entities, private entities, and communities, at the stages of prevention, management, rehabilitation, reconstruction, and development in disaster or calamity situations; (ii) integrate public and private efforts for adequate disaster or calamity prevention and response; and (iii) ensure timely and efficient management of all human, technical, administrative, and economic resources that are essential to disaster or calamity prevention and response.

Although in recent years significant efforts have been made to review the SNPAD, it is outdated and inconsistent with new realities within the national context. Economic and social impacts, damages and losses, and the need to mobilize resources to advance recovery processes associated with the occurrence of disaster events led to the creation of SNPAD in 1988. In principle, it operated with a notable welfare approach, although the incorporation of its role of prevention is recognized. Subsequently, with the formulation of the National Plan for Disaster Prevention and Response (PNPAD) in 1998, progress was made toward a broader conceptual approach, or transition, although comprehensive interventions remain limited. Other factors such as the need for congruence with the Constitution of 1991, its articulation with the SINA and other systems, land use planning frameworks, strategies for adaptation to climate variability, and conceptual evolution of the subject promote the need of updating the SNPAD.

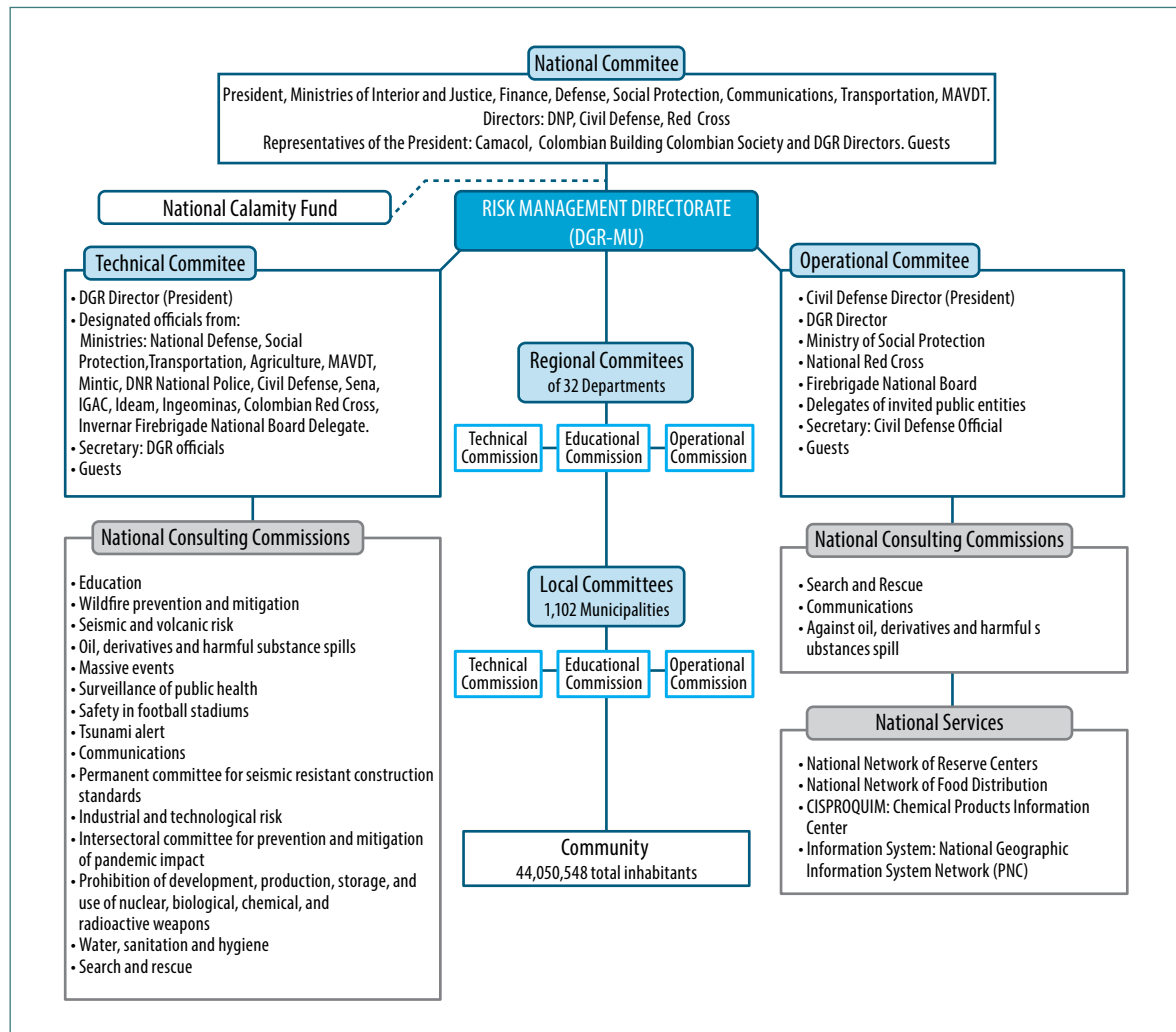
The SNPAD structure is articulated from the top down, through a series of committees for the different territorial levels (*Figure 2.4*). The SNPAD (Law 46 of 1998 and Decree Law

9 In 1999, the Economic and Social System of the United Nations, in its resolution 1999/63, “makes an appeal to all governments to maintain and strengthen national and multisectoral platforms already established for disaster reduction of natural origin, with the aim of achieving goals and objectives of sustainable development, using all the technical and scientific mechanisms. It is of interest for each government to decide on the form and structure of the multisectoral platform in its own territory. Due to the great success of the national committees and focal points during the decade in a great number of countries, the Secretary General firmly exhorts the governments to apply the measures necessary to implement this petition.”

919 of 1989) is organized vertically and hierarchically, where the maximum level of coordination belongs to the National Committee, followed by the Regional Committees and the Local Committees for Disaster Prevention and Response. These committees are chaired by the chief executive of each level (President of the Republic, Minister of the Interior and Justice, Governor and Mayor, respectively). Territorial levels have assimilated the composition and

structure of the national component, the National Committee, Technical and Operational Committees, and the Directorate for Risk Management (Office of Disaster Prevention and Response), which currently is ascribed to the Ministry of Interior and Justice (at the local level, offices or civil servants are appointed for this purpose, and in most cases, depend on the Government Secretaries of the Departmental and Municipal administrations).

FIGURE 2.4. National System for Disaster Prevention and Response (SNPAD)



Sources: Law 46 of 1998 and Decree Law 919 of 1989.

Although the main body of the aforementioned norms described establishes a decentralized system, it has not been fully adapted to principles, structure, and functioning as provided in the Constitution of 1991. Since the SNPAD was created before the Constitution, the decentralization subject has a partial scope and it is a problem not yet completely resolved in the System. On the one hand, in the vertical structure, the municipal levels depend functionally and structurally on the regional and national levels; while the Local and Regional Committee structures are part of the SNPAD, their duties and responsibilities are assigned in parallel, as if they were different organizations than the territorial entities headed by mayors and governors, generating confusion and duplication (Ingeniar Ltda., 2011). The fact that there are Local and Regional Committees, or that the role of the governor or mayor is recognized as “The President” to such committees, does not constitute the application of the decentralization principle. Evidence of this is the SNPAD scheme, where territorial entities are relegated to support planning and information duties that are assigned to the National Committee and the National Directorate, and to response activities in health, education, transport, and infrastructure matters (Decree Law 919 of 1989, Article 62).

The autonomy, coordination, concurrence, subsidiarity, and participation principles as provided in the Constitution of 1991 are critical factors, which have not been fully incorporated to SNPAD and thus limit its operation. Such principles¹⁰ do not exist in all their extension in Law 46 of 1988, but they do in Decree Law 919 of 1989, making it necessary to adapt to the new way of exercising politics, planning, and public administration within the framework of the Social Rule of Law. With regard to municipal autonomy, it implies the need that an entity, a population, and a territory have effective control

of their present and future decisions and that they can assume their own attitudes, policies, and norms in compliance to their competencies. Local and regional levels sometimes perceive that the SNPAD corresponds solely to the national entities, situation expressed by its low sense of belonging (OSSO Corporation, 2009b). On the other hand, citizen participation, in current regulations, evidences an administrative relationship (with a unilateral, paternalistic, and authoritarian vision), and therefore, making it necessary to make changes that will allow people to have adequate participation in committees or in the SNPAD organizational structure, and to be able to make decisions about their respective situations and interests.

Since the creation of the SNPAD more than twenty years ago, the only changes in its institutional organization have been related to the entity in charge of coordinating it. Its transference from the Presidency of the Republic to the current Ministry of Interior and Justice in 1991 has prevented the entity from exercising its leadership capacity, and has focused its role on emergency response. The transfer of the Office/Directorate in charge of the SNPAD coordination from the Presidency of the Republic, where it was initially ascribed during its first years, to the Ministry of Interior and Justice, has meant the decline of its convening and coordinating capacity. The few regulation changes in the institution have been at the hier-

10 According to what is established in the Constitution, competencies that have been attributed to each territorial entity should be performed according to coordination, concurrence, and subsidiary principles. *Coordination* refers to the existence of consistency and coherence of activities performed locally and their relation with the other territorial levels for the proper fulfillment of the goals of the Nation. *Concurrence* is given when two or more levels should develop joint activities in pursuit of a common purpose, better efficiency and mutual respect in grounds for jurisdiction. Finally, *subsidiarity* appears when the authorities of a higher level transiently support others on a lower, at their request, in carrying out their own activities at this level.

archical level of the current Directorate for Risk Management (National Office of the Presidency, National Directorate, Special Administrative Unit, or just the Directorate of the Ministry of Interior), as well as in some of its responsibilities.¹¹ In addition, in November 2011, the DGR was modified again, creating the National Unit for Risk Management ascribed to the Administrative Department of the Presidency of the Republic, with the aim of improving and updating the SNPAD management performance and coordination (Decree 4147 of 2011). There is also a draft bill filed in Congress to restructure the SNPAD¹², which includes a more comprehensive vision of risk management, a definition of new structures and functions of the different territorial levels under the management approach by processes, and more explicitly recognizes the need to be in coherence with the Constitution of 1991 and oriented toward sustainable development.

2.3.1. Local government responsible for territorial management, thereby, the main actor in disaster risk management

Despite the centralist vision emphasizing in emergency response, which defines the SNPAD, great responsibility is assigned to municipalities to respond to risk management challenges. Decree Law 919 of 1989 assigns broad responsibilities in risk management to the municipalities, especially in the emergency management component, as well as in other management processes. Table 2.1 shows that municipalities are responsible for activities related to risk knowledge, risk reduction, and disaster management.

According to the Constitution of 1991 and the legal system in force,¹³ municipalities

are responsible for guiding and implementing development processes in the territory, which are effective and sustainable to the extent that risk management is considered an essential factor to their development. Municipalities are the basic entity in the political-administrative division of the country, being politically, fiscally, and administratively autonomous, within the limits provided by the Constitution and the Law, and their objectives are the general welfare and the improvement in the quality of life of the population in their territory (CAF and DNP-DDTS, 2005). Thus, municipal administrations in their function of guiding, protecting, and executing development should regulate the use of soil, surveillance and control activities related to construction, as well as defending and controlling the municipality's ecological and cultural patrimony. This implies incorporating risk management as a leading principle of their planning and safe management, through guidance and performance interventions to prevent future risk, reduce existing risk, and manage disasters in case these occur.

11 Decree 1680 of 1991 reorganized the Administrative Department of the Presidency of the Republic and transferred the National Office of Prevention and Response to the Ministry of Interior. Pursuant to Decree 2035 of 1991, the Ministry of Interior was restructured and the name of the National Office was changed to the National Directorate of Disaster Prevention and Response, under the auspices of the office of the Vice Minister. In 1996, during the reform of the Ministry of Interior, the Special General Directorate Administrative Unit for Disaster Prevention and Response was created. Its present name is National Unit for Disaster Risk Management.

12 Senate Draft Law No. 158 of 2011, 050 House of Representatives "By which the National Disaster Risk Management Policy is adopted and the National Disaster Risk Management System is created and other provisions are introduced".

13 The main norms that regulate organization and functioning of the municipalities are prescribed in the Constitution of 1991 in Articles 311 to 321, in the Municipal Code Regime (Decree 1333 of 1986), of which a great part has been modified in subsequent regulations, chiefly in Laws 136 of 1994, 617 of 2000 and 715 of 2001.

Under the decentralization model established by the Constitution, local governments should have greater autonomy, responsibility, and decision-making power in facing the future of their territory. Therefore, the responsibility of performing risk management actions should clearly fall on the local level. A more decentralized organization, that respects the municipalities' autonomy should be promoted, understanding that the ultimate management level is the local one, pursuant to provisions in Article 311 CP, which characterizes the municipality "as a **fundamental** entity of the political-administrative division" (emphasis added). Therefore, in compliance with these principles, the legal framework should be adjusted and this responsibility should be clearly assigned to the municipal government. In this manner, the existent dichotomy between Local Committees and municipal administration can be resolved making it possible that the same Municipal Government Council be constituted as the Local Committee, as it is stated in the draft law in Congress (Senate Draft Law 158 of 2011, House of Representatives 050), in which other public and private actors related to risk management are invited to participate. Therefore, the regional level would only intervene when risk management processes or disasters affect more than one municipality or when the local capacity is exceeded, and when both local and regional capacity is surpassed, then the national level would be called on to perform operational or executive functions in the exercise of the concurrence and subsidiarity principles (Constitution, Article 288).

Urban land use planning, the main strategy to reduce risk in the municipal sphere, has been proposed since 1989, but unfortunately in the majority of cases it has not been taken advantage of and it has not been appropriately implemented. Law 9 of 1989 (Urban reform)

included key elements of urban planning, which were taken into account later in Law 388 of 1997. Law 9 was the first initiative, that obligated the municipalities to prepare an inventory of human settlements in high-risk areas and transfer them to appropriate areas. Furthermore, it urged the municipalities to take the necessary measures and precautions so that evacuated risk zones were not newly used for housing. This obligation has been commissioned to Mayor's Offices, but it has been narrowly implemented. Therefore, the National Development Plan 2010-2014 establishes that the MVCT should generate a methodology to prepare risk zone inventories. On the other hand, the POT, according to Law 388, has a long-term scope and aims to improve the quality of life and complement the economic and social planning within the territorial dimension. Its objectives are to rationalize the interventions and guide development and sustainable exploitation through the formulation of land management restrictions and conditions, which includes the preparation of studies and inventories of high-risk zones, the definition of zones subject to risks which admit some kind of intervention (risks able to be mitigated),¹⁴ and those which do not allow any kind of intervention (nonmitigable risks) (SNPAD and World Bank, 2010). In the planning framework, municipalities are responsible for incorporating in their POT and PD the specific provisions and recommendations for risk reduction and comprehensive risk management, as well as their necessary allocations in the annual budgets. Nevertheless,

14 Mitigation can be understood to be a condition in which it is feasible to intervene technically, economically, socially, and politically in a territory to reduce risk so that the population, infrastructure and economic activities can continue functioning within reasonable and socially accepted margins of safety (Ramírez and Rubiano, 2009a).

assessments performed by MAVDT in over more than 50% of the country have found that municipalities do not have the necessary studies, nor have they regulated territorial usage, including the risk subject and the definition of an assistance and accompaniment program for this purpose.

According to Law 136 of 1994, municipalities should solve the unsatisfied needs in health, education, environmental sanitation, drinking water, home public utilities, housing, recreation and sports, directly applying the principles of concurrence, complementarity, and coordination with other territorial and national entities in the terms defined by law. In this sense, the projects to be carried out, regardless of the financing source, shall be executed taking into account the restrictions and conditionings arising from current risk situations regulated in the POT and other effective technical regulations, ensuring the projects' safe location, construction, and operation.

The Departmental Comptrollers' Offices are responsible for fiscal control duties, except when the law determines the creation of a Municipal Comptroller's Office. Organizations such as the Comptrollers' Offices and the Ombudsman Offices also have an important role in monitoring and assessing risk management processes. Law 617 of 2000, Article 156 provides that only municipalities and districts classified in Special and first category, and those of the second category, which have more than 100,000 inhabitants, may create and organize their own Comptrollers' Offices. In municipalities where there is no Municipal Comptroller's Office, the Ombudsman will act as a public treasury controller, ensuring the compliance with the administrative contracting principles, will evaluate public works execution, and will request reports to the officers responsible for the municipality's funds or goods (CAF and DNP-DDTS, 2005).

TABLE 2.1. Responsibilities of territorial entities in disaster risk management processes pursuant to Decree Law 919 of 1989

| | Policies and regulations | Planning | Execution | Monitoring and control |
|---------------------|--|--|---|---|
| RISK KNOWLEDGE | These functions are subject to national policies | Include a component of disaster prevention in territorial entities' Development Plans, especially in urban land use planning, risk zones and human settlements, as well as allocations needed in their annual budgets. Prepare and elaborate the Development Plans through the Planning Offices, in coherence with regulations and plans on disaster prevention and response, and coordinate the institutions in programs and budgetary matters related to disasters. | <ul style="list-style-type: none">Contributing to the organization and maintenance of the Comprehensive Information SystemCarrying out historical studies and research on disaster eventsImplementing studies on hazards, analysis of vulnerability conditions and risk assessmentCoordinating and administering early warning systemsEnsuring compliance of systems and equipment regulations for the purpose of the Comprehensive Information SystemPromoting and coordinating training and public information programsOrganizing information and documentation centersPreparing the community, through the Education Secretariats, on prevention, response, and recovery in disaster situations | |
| RISK REDUCTION | These functions are subject to national policies | Seek the incorporation of risk prevention in the Development Plans. | <ul style="list-style-type: none">Requiring public or private entities, which perform large works in the territory of their jurisdiction to review previous on possible effects which a disaster may originate or cause, and on how to prevent these effects | |
| DISASTER MANAGEMENT | Issue special regulations in order to allow repairing and reconstruction activities on buildings affected by disaster. Establish posterior tax control over expenses aimed at the execution of activities. | The CLOPAD will prepare contingency plans based on vulnerability analysis to facilitate prevention or to adequately and timely respond to possible disasters. | <ul style="list-style-type: none">Directing, coordinating, and controlling all administrative and operative activities essential for responding to regional or local disaster situations, through the respective Mayor's Office or the person in chargeDeveloping activities related to transport service, infrastructure works, damage assessment, demolition, and cleaning tasks, through the Public Works SecretariatsEvaluating the health aspects, coordination of medical actions, victims' transportation, classification the injured, provision of medical supplies, basic sanitation, medical care shelters, nutritional surveillance, as well as epidemiologic surveillance and control, through the Health Secretariats | Controlling, through the head of the respective City Hall, all administrative and operational activities essential for responding to regional or local disaster situations. |

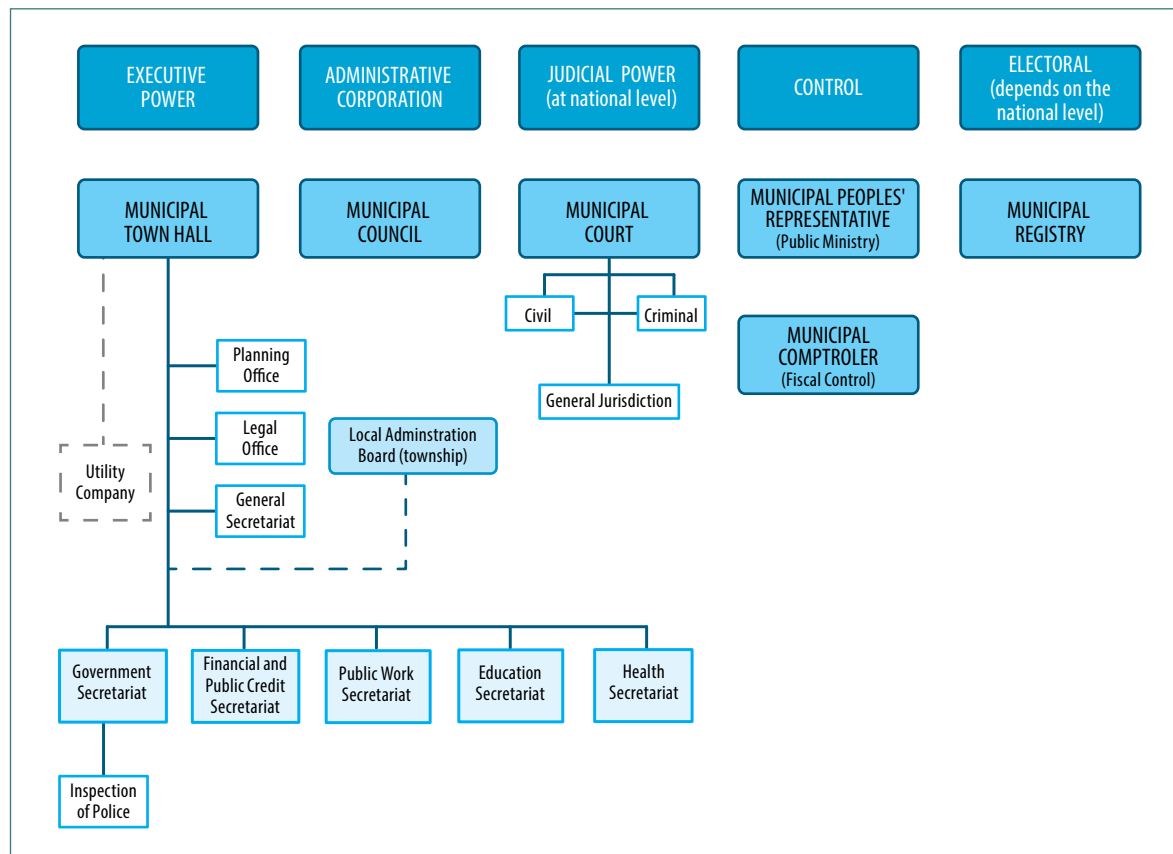
Source: Authors' Chart, 2011

Municipalities' Organization and Capacities

Municipalities have a basic administrative structure to comply with their functions and competencies, which vary depending on categories, as provided by Law 617 of 2000, which express their functioning capacity (Figure 2.5). All municipalities of the special, first, and second categories with more than 100,000 inhabitants are composed of a City Council, a

Mayor and a Cabinet, a Treasurer, an Ombudsman, a City Comptroller, and the Local Administrative Board. The Constitution and the law grant them administrative autonomy and freedom to determine their administrative structure, provided that it is within the established legal framework. In this sense, entities expand their structure as the needs for the provision of services grow and in function of their population growth.

FIGURE 2.5. Municipal organization



Source: CAF and DNP-DDTS, 2005.

The capacity of municipalities to assume commitments provided by law depends on implications imposed by the fiscal framework to regular and exceptional activities in the system, so that their actions are consistent with the overall objectives of fiscal sustainability, led by the national government. The set of regulations and fiscal norms governing the actions of municipalities and departments cannot be ignored; for example, Law 358 of 1997, through which the national government establishes the traffic lights system, consists of quantitative measures that restrict the territorial debt to their payment capacity. Law 617 of 2000 incorporates quantitative criteria to control functioning expenditure growth. This law is complemented by Law 488 of 1998, which strengthens the income of the territorial entities. It also provides a classification

system of subnational governments according to their population and current income in terms of minimum salaries.

The law imposes on departments and municipalities the maximum amounts of their operating expenses in proportion to the current income of free destination. The share of operating expenses is on average about 70% of current revenues. Although some changes in the classification of the municipalities have been adopted when Law 617 of 2000 came into force, it can be concluded that the majority of noncapital cities (84%) fall in category 6. In this sense, it is expected that there are still more important restrictions in reassigning operating resources to investments in disaster risk management (Ingeniar Ltda., 2011) (Table 2.2).

TABLE 2.2. Municipalities by category, 2007-2008

| Category | Population between | | Income between | | Municipalities by category | No. | Maximum % functioning |
|----------|--------------------|---------|----------------|---------|---|-----|-----------------------|
| Special | > | 500,001 | > | 400,000 | Bogota, Medellin, Cali, Barranquilla, Bucaramanga, Cucuta | 6 | 50% |
| 1 | 500,000 | 100,001 | 100,000 | 400,000 | Cartagena, Pereira, Manizales, Villavicencio, Ibagu, Dosquebradas, Yumbo, and 7 municipalities in the metropolitan area of Valle de Aburra. | 14 | 65% |
| 2 | 100,000 | 50,001 | 50,000 | 100,000 | - | 14 | 70% |
| 3 | 50,000 | 30,001 | 30,000 | 50,000 | - | 19 | 70% |
| 4 | 30,000 | 20,001 | 25,000 | 30,000 | - | 22 | 80% |
| 5 | 20,000 | 10,001 | 15,000 | 25,000 | - | 25 | 80% |
| 6 | < | 10,000 | < | 15,000 | - | 931 | 80% |

Source: Authors' chart from information provided by the DNP at: www.dnp.gov.co.

Municipalities with less than 50,000 inhabitants depend almost completely on the General System of Transfers (SGP). National transfers represent over 80% of current income. In case of municipalities with more than 500,000 inhabitants, transfers represent 40% of their income, which is increased to 55% in the category of municipalities from 100,001 to 500,000 inhabitants, and to 68% in the category of 50,001 to 100,000 inhabitants. The SGP is regulated by Law 715 of 2001, which according to the Constitution, divides transfers into three large parts as follows: (a) participation for education, which represents 58.5% of resources; (b) participation for health, which corresponds to 24.5%; and (c) participation for general purposes, representing 17%. These three are among the 17 general purpose budgetary items in which disaster prevention and response are included (ECLAC 2005).

Although Decree Law 919 of 1989 empowered municipalities to organize their own disaster prevention and response systems, only some cities have used this power. According to Decree-Law 919 of 1989, Article 51, municipalities can organize their own disaster prevention and response systems, but most municipalities have simply created the CLOPAD, which have only one official appointed as coordinator. In the smallest municipalities the situation is more critical, since the CLOPAD coordinator is at the same time Secretary of Government, Planning, or Public Works (World Bank, 2011a).

Some municipalities, especially those which are stronger in technical, financial, and human resources, (for instance, Bogota or Medellin), have been equipped with their own “district or municipal systems” for disaster prevention and response, which go far beyond the existence of a district or local committee and a person in charge of subject in the administration. The conditions of complexity of current risks and the political decision to face them

have resulted in the establishment of their own structures, coordination, and implementation, which in the majority of cases has led to important results involving different municipal agencies, private actors, academia representatives, guilds, and other organizations related to disaster risk management (Ingeniar Ltda., 2011). Manizales, as a separate example, has chosen to give risk management a cross-cutting character in the local public administration. It has not created a municipal system, but the municipality itself acts to reduce risks and the municipal cabinet is in charge of coordinating and convening the different actors. Such a situation can be more feasible and desirable for most of the medium and small municipalities in the country. It is essential to recognize and capitalize on such experiences learned, so those lessons can be adapted to other territorial areas (see Chapter 3 for further details on this subject).

The obvious inequality in the development of different Local Committees is due, among other things, to limited access and availability of financial, technical, and human resources. While in most of the municipalities CLOPAD exists formally, they are convened and function only when there is an emergency or disaster. There are few technical, financial and human resources for pertinent actions, and these have minor infrastructure capacity. Additionally, there is no clear political postulation on this subject (Ingeniar Ltda., 2011). On the other hand, a minimal or no of participation by the community and its different representatives from civil society limits the sustainability of actions taken by the institutions.

The interrelationship of CLOPAD coordinators with different municipal agencies or Secretariats is limited. The public servants or small offices responsible for coordinating Local Committees are attached, in most municipalities, to the Government’s Municipal Secretariat,

following the model developed so far by the National Unit for Risk Management, although there are some exceptions, where they depend on the Planning Secretariat or directly on the Mayor. Coordinators mainly interact with relief agencies, public order entities, and health organizations, but with the rest of the municipal administration, the relationship is limited and they do not have the necessary support from the Mayor and the Cabinet to make decisions (OSSO Corporation, 2009b). The above reduces the effective incorporation of policies and strategy instruments related to the subject (PD, POT, budgetary and investment definitions). In practice, many Local Committees comply more with an intermediary role to get resources, to the extent that the census of the affected population and initial impact assessments should be certified by them to obtain such resources. This situation has led to the current proposal to transform the SNPAD so that CLOPAD would be the same Government Council and therefore, the highest authority in the disaster risk management process would be the Mayor (Ingeniar Ltda., 2011).

Local entities with minor technical capacity claim greater support from national entities (World Bank, 2011a). The majority of municipalities lack adequate technical staff and they do not have the necessary elements to undertake studies demanded by current norms, which are the fundamental input for land use planning. Unlike other countries, such as the United States and most European countries, Colombia does not have geological and hydrometeorological equipment at a regional or local level that would support risk monitoring and assessment activities. Therefore, it is necessary to consider the strengthening of capacities at this level, under a strategy combining more presence of national entities in the territory through decentralization processes, the articulation with universities

and research centers, the presence of adequate technical profiles, and the training of personnel working in governmental departments, the CAR, and municipalities.

According to Decree Law 919 of 1989 and Law 99 of 1993, the CAR will advise and cooperate with the territorial entities in incorporating the risk subject into planning. In the Decree Law 919 of 1989, Article 64, the CAR have to provide support in incorporating disaster prevention components in the PD of territorial entities, especially in land use planning, risk zones, and human settlements, through the preparation of an inventory, analysis of high-risk zones, and designing solution mechanisms. Subsequently, this provision was ratified by Law 99 of 1993, which in Article 31 establishes the CAR responsibilities as “Performing analysis activities, monitoring, prevention, and control of disasters in coordination with other competent authorities, and assisting them in environmental matters to prevent and respond to emergencies and disasters and to carry out jointly with municipal or district administrations adequacy programs for urban areas in high-risk zones, such as erosion control stream course management, and reforestation”.

The CAR support to disaster risk management has been heterogeneous, both due to restriction of resources and to differences in interpreting regulations. In Chapter 3 of this document, it is evident how this function has been unevenly fulfilled. Although some CAR offer timely support to the territorial entities in matters of information, technical support, and cofinancing, a great number of them provide limited support. In general, it is agreed that CAR should contribute information and technical support in matters of risks associated to environmental variables, as well as in making investments in prevention and miti-

gation, provided they are in environmental restoration. On the other hand, some CAR believe that it is not within their competence to invest in infrastructure works. Additionally, there are no methodological standards for monitoring, analysis, and constructing for risk cartography, which is why the support offered by CAR to territorial entities is heterogeneous and many times incompatible. The new Ministry of Environment and Sustainable Development¹⁵ (former Ministry of Environment, Housing, and Territorial Development) in its restructuring and regulation of the CAR functions has the opportunity to clarify responsibilities, and also to explain the existent confusions and generate clear guidelines on the articulation in environmental management and risk management within the framework of public administration, in such a way that SINA and the new National Unit for Risk Management are able to work closely in supporting disaster risk reduction.

On the other hand, Decree 507 of 1999 recognizes the low technical capacity of municipalities with less than 50,000 inhabitants to address their land use planning. This Decree, which modifies Law 388 of 1997, in recognition of delays and difficulties of some municipalities in implementing their POT, states that the National Government should implement a technical assistance plan through interinstitutional coordination of the corresponding Ministries and governmental entities, the Departmental Planning Offices, and the CAR, to train and give technical assistance in the formulation and articulation processes of the POT, especially to those municipalities that have the greatest difficulties in the process. The governmental entities involved in this process would make available to the municipalities and districts the necessary information and technical assistance resources for the

success of the POT. The law also states that the Departmental Planning Offices can request technical support from the Ministry of Interior, the Vice Ministry of Housing, Urban Development and Drinking Water, Inurbe, IGAC, Ideam, SGC, and metropolitan areas which are part of their municipalities. Likewise, they are able to make the corresponding agreements with the CAR or the environmental authorities having jurisdiction in those municipalities on matters of their competence.

The municipal institutional capacities have a strong interrelationship with poverty levels. Therefore, the implementation of risk reduction and recovery projects facing a disaster at this level are limited. According to assessments carried out by the DNP and submitted in the PND 2010-2014, the best institutional capacities at municipal level related to performance when managing PD, public investments, financial sustainability, and fulfillment of legal budgetary requirements and performance of SGP resources are concentrated in the center of the country, especially in Bogota, in the department of Cundinamarca, parts of Antioquia, the south zone of Boyaca, in the departments that compose the Coffee Growing region, and in the Valle del Cauca. Likewise, the district of Barranquilla and the zone of influence of the municipality of Pasto in the department of Nariño have some institutional advances in this field (DNP, 2010a).

The main technical reason for decentralization is productivity and effectiveness improvement in providing services under the hypothesis that such objectives are achieved by identifying the users' needs. However, in the subject of risk management, these have not been abided by.

15 According to Decree 3570 of September 27, 2011.

Only to the extent where territorial entities have technical, administrative, and financial capacities will they be able to perform quality and efficient risk management activities. Samples of the above can be seen in Chapter 1, where it is indicated that municipalities with populations between 10,000 and 50,000 inhabitants have the highest loss of life and housing index for every 100,000 inhabitants, which coincides with their weaker technical and financial capacities. Therefore, it is necessary to review the support given to different municipalities and departments, and define methodologies and different strategies according to complexity of risk scenarios and existing capacities. The support from the departments and the nation to strengthen the incorporation of disaster risk management in planning and development processes in municipalities has been based on technical assistance strategies and not on strengthening capacities or more permanent accompaniments. Recent assessments show that the intervention effectiveness has been limited, since recommendations are not implemented due to the lack of resources

or the adequate technical knowledge, and even the lack of awareness of the impact that these measures can have (Bohorquez, 2011).

Taking into account important problems related to resource transfers from the nation through the SGP and the capacities of the territorial entities, municipal certification processes have been taking place in other sectors to render services related to education and health. Investments, historically done in risk management by the State, have been addressed mainly to manage emergencies, humanitarian aspects, and reconstruction processes after a declaration of national disaster, as can be seen in the appendixes. A change is required in the priority given to risk reduction. It is necessary to accompany it with more resources, in which case it would be convenient to consider the possibility of defining a “municipal certification” process to manage risks, acknowledging that this certification is a sectoral recognition of the municipality’s capacity to exercise its autonomy as a basic unit of society (Box No. 2.5).

Box 2.5. Municipal certification

Under the territorial decentralization process, the same competencies have been assigned almost always to all municipalities and departments in Colombia, without establishing differences based on their characteristics or capacities and without demanding the compliance of specific requirements to receive transfers. Nevertheless, from the process called certification of capacities of the territorial entities there has been progress in identifying capacities of territorial entities in the fulfillment of their competencies, and the establishment of procedures to improve their governance in relation to the administration of transferred resources. The first reference to a certification process is found in Law 10 of 1990 (Reorganization of the National Health System), distributing competencies among government levels and ruling that the sector's resources administered by the nation shall be transferred to departments, districts, and municipalities. To that end, municipalities should meet requirements as provided in Article 37 of said Law where the existence of some indispensable institutional conditions is guaranteed to provide adequate rendering of services.

This approach was retaken by Law 60 of 1993, which regulates the distribution of competencies and resources of fiscal transference for education and health among government levels, defining two stages in the accreditation processes. First, accreditation of departments and districts, as provided in Articles 14 and 15 of said Law, consisted in demonstrating the existence of resources or processes for an appropriate administration of the following services: information systems, planning methodologies and the preparation of sectoral plans, plans to assume the provision of services, rules and procedures approved by the Departmental Assembly to distribute resources within the department, and organizing the administrative structure and the staff. The Law provided for a term of four years for the accreditation of departments and districts. Second, the accreditation was set up of departments performing this exercise in their municipalities, abiding by the provisions in Article 16 having similar elements to those mentioned above. In case of breach by the municipalities, the departments could, with the authorization of the Ministry of Health and Education, subordinate the exercise of duties to the fulfillment of performance plans.

In 2001, the existent transfer system was modified (Legislative Law No 1), allowing the participation of municipalities in the nation's current income and in the fiscal appropriation to finance education and health in the country's departments and districts, so the General System of Participations was created to establish a participation in education, another for health and a third one for general purposes. These new Constitutional mandates were remodeled by Law 715 of 2001 and the distribution of competencies and resources among government levels was reorganized. In Article 20 of said Law, departments and districts were certified by the mandate of the regulation. Likewise, it stated that the State would certify municipalities, with more than 100,000 inhabitants before the end of 2002. Municipalities with less than 100,000 inhabitants would be able to be certified should they so desire and should they meet the requirements indicated by the government. The departments would be responsible for granting the certification, for which they would have six months from the time the municipality submits the request.

Regarding the educational sphere, requirements to be met by municipalities with less than 100,000 inhabitants to obtain the certification, as provided in the Decree 2700 of 2004, issued by the National Ministry of Education, are the following: (i) municipal Development Plan coherent with national policies, (ii) educational establishments organized to offer the complete basic education cycle, (iii) staff that meet national parameters, and (iv) Institutional capacity to assume processes and the information system of the education sector. Departments have to provide support to municipalities to perform their certification process.

Source: ECLAC, 2005.

2.3.2. The regional/departmental level as a coordination and intermediation agency between the nation and the municipalities

Departments are natural coordination units of the municipalities that make up their territory, and they have the concurrence and subsidiarity jurisdiction competencies within the scope of such territories, including those related to disaster risk management. Pursuant to provisions in the Constitution (Article 298) and laws¹⁶, departments impart administration in sectoral matters, economic and social development planning and promotion, coordi-

nation and complementarity of municipal actions, intermediation between the nation and municipalities, and the provision of services. Decree 1188 of 2003, which defines procedures to coordinate administrative functions between national and territorial levels, provides the following: (i) The Governor of each department should coordinate and articulate the development of national sectoral policies among different entities at the national level

16 The main norms that regulate organization and competencies of the departments are found in the Political Constitution (Articles 297 to 310), the Departmental Regime Code (Decree-Law 1222 of 1986), and Laws 617 of 2000 and 715 of 2001.

in its territory, using planning and interinstitutional coordination instruments (Article 1); and, (ii) Governors, in coordination with the corresponding Mayors will promote to the nation the management of projects initiated by municipal initiative or interest, which have an articulated regional or subregional impact on national sectoral policies within their territory, adjusted to the corresponding PD, without prejudice to the respective autonomy assigned to each entity (Article 5).

Although the Law 715 of 2001 does not specifically establish direct competencies in the matter of disaster risk management for departments, it does generally provide their competencies in thereof in other sectors. In this sense, they should be responsible for the integration and articulation in the development planning processes and the prospective, corrective, and reactive interventions in facing risk disaster. They should also project and reflect in the sphere of their territorial competence each one of the policies related to risk management, and taking into account knowledge and information processes, risk reduction, and disaster management.

Pursuant to Article 302 of the Constitution, the law may establish for one or several departments various capacities and competencies for administrative and tax management different from those provided for them in the Constitution, in order to comply with the need to improve management or public service rendering, according to their population, economical and natural resources, and their social, cultural, and ecological circumstances. In developing the above, the law will be able to delegate to one or several departments attributions pertaining to national public organizations or entities.

Organization of the Departments and their capacities

Like the municipalities, departments have a basic administrative structure, which varies in accordance with the categories provided in Law 617 of 2000 (Table 2.3). The departmental administration is constituted by a collegiate and deliberative body, which is the Departmental Assembly, and by an executive body, which is the Departmental Government. Likewise, the Constitution foresees the existence of a Departmental Comptroller's Office in charge of exercising tax surveillance in the management of both departmental and municipal goods and incomes for those departments with less than 100,000 inhabitants. In addition, there are other offices such as Secretariats, public establishments, State industrial and commercial companies, and semipublic companies, in accordance to the organizational structure as determined by the respective Assembly. As in the case of municipalities, there is a defined classification by the resident population in their jurisdiction and by current incomes of free destination, which at the same time establishes limits for the functioning expenditure in departmental administration. Most of the country's departments (78%) correspond to categories 2, 3, and 4, which have functioning expenditure caps of 60% and 70% of their current incomes.

TABLE 2.3. Departments by category and maximum participation of functioning expenditure in current incomes, 2011

| Departments by category | Population | Minimum salary incomes (Col\$) | Maximum % of functioning expenditure | Examples of some departments |
|-------------------------|-------------------------------|--------------------------------|--------------------------------------|---|
| Special | > 2,000,000 | More than 600,000 | 50% | Antioquia |
| 1 | Between 700,001 and 2,000,000 | Between 170,001 and 600,000 | 55% | Atlántico, Boyaca |
| 2 | Between 390,001 and 700,000 | Between 122,001 and 170,000 | 60% | Cordoba, Norte de Santander |
| 3 | Between 100,001 and 390,000 | Between 60,001 and 122,000 | 70% | Cesar, Cauca, Huila, Tolima, San Andres Archipelago, Casanare, Quindío, Choco |
| 4 | = or <100,000 | = or < 60,000 | 70% | Guaviare, Amazonas, Putumayo, Arauca, Caqueta |

Source: Authors' Table from the information provided by DNP at: www.dnp.gov.co.

Functions and responsibilities of Regional Committees for Disaster Prevention and Response (CREPAD) are defined from a very centralist point of view. The functions of the Departmental Governments and the CREPAD, according to Decree-Law 919 of 1989, are determined in function of the PNPAD, of the Comprehensive Information System, as a part of the PNPAD in relation to disaster situations, and in the Specific Action Plans, formulated after a disaster occurrence. It is necessary to improve legislation in this sense, so that a clear vision of regional responsibilities is offered according to risk situations in their territories and the municipalities' needs. Additionally, there is also the need to apply complementarity, concurrence, and subsidiarity principles, and to comply with the role that departmental governments have in planning and promoting sustainable development as indicated in the Constitution.

In general, departments have not been able to develop a policy and an organization for disaster risk management and show important restrictions in technical, human, and financial resources.

The capacity of action and coherence at the departmental level in risk prevention, and reduction, as well as in disaster management is conditioned by critical factors similar to those identified in the municipal scenario (financial, judicial, administrative and technical areas). The Regional Committees' performances are specially focused on response and reconstruction (with some exceptions), and their relationships with other offices from departmental administrations are limited.

Similar to the restrictions found at the municipal level, an imbalanced development in the CREPAD is also identified. In the planning instruments framework, the principal gaps identified in the regions are the low capacity of preparation and execution of Departmental Plans in Disaster Risk Management. Additionally, articulation is evaluated critically in the higher and lower vertical levels (nation and municipalities) and horizontal levels, that is, in the same territorial sphere. In particular, there is negligible cohesion with the CAR, which is manifested in the lack of consistency between regional environmental management

and development management, thus the subject of disaster risk is also affected¹⁷.

In spite of weaknesses in planning and organizing, there are departments that have made interesting advances in instrument and strategy development that have contributed to governance in risk management. The departments, which have taken on their role with greater responsibility, have formulated Departmental Plans on Risk Management or Disaster Prevention and Response. Similar to a navigational chart, said plans identify priority activities and those responsible for these activities. Likewise, they have created executive offices in charge of this subject and have actively integrated the CAR and other public and private social agents. Departments such as Nariño, Caldas, Antioquia, Valle del Cauca and, Cundinamarca are some of those that demonstrate greater strengths and capacities in these areas.

The training of people in charge of this subject should be improved, and the Disaster Prevention Offices should be recognized within the hierarchy in the departmental administration, in order to get a more active participation in Government Councils that depend directly on the Governor. An available budget composed of a fixed percentage of the total investment is also necessary, which will permit long-term planning. For disaster risk management to be articulated in the development processes, as it is outlined in draft law (Draft Law 158 of 2011 Senate, 050 House of Representatives), the Regional Committee will be the same Government Council where all the cabinet members participate, and may include decentralized entities, academia, aid agencies, and other social agents in accordance with the outlined priorities and necessities. Those in charge of coordinating the subject inside the administration should be at the same level of

the office secretaries and depend directly on the governors in order to guarantee the articulation and coordination among the different responsible persons in the government's agencies, and to be able to convene agents who do not belong to the departmental administration, for the purpose of working with them. Also, the Regional Committees should have technical support units or disaster risk management offices, and these offices should have the resources and necessary capacity to provide indispensable technical supplies so that the authorities (Governor and Government Council) may make the appropriate decisions. Risk management then can be reconciled with the planning processes and territorial management and assure the functioning of instruments such as departmental information systems, in such a way that knowledge, risk reduction, and disaster management work comprehensively and transversely.

The recently approved Organic Law of Land Use Planning offers alternatives to strengthen the territorial entities' function in risk management, especially in departments where the common denominator is disturbing poverty indicators and low levels of institutional capacity. This situation is more prevalent in the Amazonas, Guaviare, Guainia, Vaupes, and Vichada, most of the municipalities in the Pacific Coast (Choco, Cauca, and Nariño), and most of the municipalities in the Caribbean region (La Guajira, Magdalena, Sucre, Cordoba, with the exception of the departmental capi-

17 It is worth highlighting the fact that the CAR are the only ones that are outside of the three levels of government established for public management (nation, department, and municipalities). In many cases the covered territory does not coincide with administrative limits and thus it makes it difficult to have any consistency.

tals). The Land Use Planning Law (Law 1454 of 2011) had been proposed since the adoption of the Constitution of 1991. The Constitution likewise recognizes as territorial entities departments, districts, municipalities, and indigenous territories, and provides for the creation of regions and provinces as territorial entities and the conformation of associative figures for development promotion. A preliminary analysis of the recent Law content indicates as positive for risk management the following:

- Associative processes are authorized and promoted among territorial entities (Article 9), which may refer to “policies and modes of regional and subregional management.” Such processes can connect the administrative and planning regions, departmental associations, and metropolitan areas, special district associations, administrative and planning provinces, and municipal associations (Article 10). It is important that the objectives of these associations encompass the compliance of planning functions, as well as endeavor a comprehensive development of their territories (Article 11).
- This law promotes a larger transfer of functions and competencies from the national to the territorial level, thus eliminating duplication among the central and decentralized administration and territorial entities. Moreover, the law also promotes the strengthening of the following: administration and planning; the departments as an intermediate level of government; the municipalities as a fundamental entity of the political-administrative division of the State; the joint and articulated action of the different government levels through alliances, associations, and delegation agreements; the design of the regional modalities of administration for special projects’ de-

velopment; and the increase of productivity and the modernization of municipal administration (Article 20).

- The regulation requires certain principles for the nation and territorial entities to exercise their competencies, such as coordination, concurrence, subsidiarity, and complementarity (Article 26).
- A highly detailed identification of functions of the nation and territorial entities in land use planning (Article 27) as well as a complete system for resolving jurisdictional conflicts that may arise (Article 28 and those following).

2.3.3. The nation as a policy and strategic orientation promoter

The existing institutionalism for risk management at the national level, in spite of its extensive background, implies a protectionist makeup, duplicating assigned functions and low articulation levels with other territorial agencies. The hierarchical and vertical approach, which has characterized the SNPAD, causes the UNGRD and other entities at the national level to be assumed as core components of the System, leading to confusion between UNGRD and SNPAD, which reflects the poor recognition of the strategic importance of the local and regional levels. On the other hand, the national government is not acting as an articulating axis of the System, as there are limited processes of dialogue, coordination, and coherence between the national and territorial agencies (Ingeniar Ltda., 2011) in the development of risk knowledge, risk management and reduction, with the only exception being the management of large disasters.

The National Committee for Disaster Prevention and Response, as the highest agency of

the SNPAD, has only met when disaster situations occur. This Committee is designed to comply with an orienting function (providing directives and guidelines), a consultant role (providing advice on disaster declaration to the Executive Branch, its classification according to the national, departmental, or local level, and the return to normality), and the competence in decision making (approving and recommending the PNPAD adoption by decree, among others). Nevertheless, it does not have the presence of some strategic Ministries, such as Education, Environment and Sustainable Development, and Housing, City and Territory nor has it frequently met, and in the few exceptions when it has, it has met for different subjects to those related with emergency management.

The National Technical Committee provides consultancy and coordination, without having specific functions established by law. The National Technical Committee can comply, by expressed assignment, with some functions of the National Committee (except those referred to in the standards and guidelines for the formulation of the Plan and its approval, and the corresponding attributions of the National Committee in disaster situations). The institutions, which comprise this Committee (or at least most of them), have functions specifically established in the Decree 919 of 1989, Articles 63 and 64. Nonetheless, there is no explicit relation between these tasks and the activity of the same Committee.

The National Services have been the most active and empowered agencies in the last years. In the latest Development Plans, there have always been programs and projects aimed at fortifying monitoring and risk knowledge networks, such as the National Seismological Network, Volcanological Observatories, Hydrometeorological Warning Systems, Tsunami or Seismic Wave Detection Networks, Satellite Networks for Hurri-

cane Surveillance, and equipment and experts for controlling hydrocarbon and harmful substance dumping. This makes the National Services rely on better capacities and instruments so that they can comply with their functions.

The National Operative Committee is one of the most active committees. However, the emergency generated by the La Niña phenomenon in 2010-2011 made it evident that there are no clear instruments or a role definition for the different tasks related to national emergency management. The National Operative Committee consists of the Civil Defense Director, a Red Cross Representative, a representative from the Ministry of Social Welfare, and the Risk Management Director¹⁸. Unfortunately, the law does not provide this Committee with the responsibility of formulating plans, tasks, and role definition, or the standardization of procedures or fundamental activities for effective emergency coordination. Among the National Commission Consultants of the National Operative Committee are: (a) Search and Rescue, (b) Communications, and (c) Hydrocarbons, its Derivatives, and Harmful Substances. This last one has been the most active and has generated the only existing National Plan of Contingencies, through Decree 321 of 1999. Other Contingency Plans should be formulated for different kinds of risks, under unified and coordinated criteria.

The Consulting Commissions of Committees have worked erratically and they have even ceased to function during long periods of time. The Consulting Commissions, initially constituted as work groups for specific and dependent issues, according to each case, of the National Technical Committee or the National Operative Committee, have ceased to func-

¹⁸ This also includes delegates from other national entities "with voice but without vote", who are invited by DGR on account of the nature of the disaster.

tion, weakening articulation among the different national entities. Commissions, such as the Seismic and Volcanic Risk Commission, have met around 60 times since 1993, SGC being the entity that coordinates and is secretary of the Commission. However, convening these committees became intermittent and cyclical. Meetings were reported for 2003, 2004, 2008, and 2009, which had the specific aim of proposing scenarios to update seismic hazard maps. Subsequent to this process, they have not convened. On the other hand, the Commission for Seismic-Resistant Construction has been one of the most active and permanent commissions, while some other commissions were re-activated about three years ago in seeking their institutionalization, which they have accomplished in specific situations. Such is the case of the Forest Fires Commission and the Water and Education Commission, and the assumption on the part of some entities of national order of the coordination functions of the same.

The National Unit for Disaster Risk Management is an entity with multiple functions and great responsibilities. According to Decree-Law 919 of 1989, its functions are closely linked to four instruments which invigorate the SNPAD: the National Plan, the Comprehensive Information System, the Disaster Situation Declaration, and Specific Action Plans. In addition, it manages the National Technical Committee and has other duties if a disaster is declared. On the whole, its general duties are preparing plans and policies that are submitted to other agencies, promoting and encouraging the application of policies in certain fields, orienting and coordinating the activities of other entities at the national level, and supporting the activities of territorial entities. In the case of a national disaster declaration, the Unit has “to lead the coordination of all the necessary activities in response to a decla-

ration of a disaster situation”, a function also assigned to the National Operative Committee, which generates dualities and disputes.

Ensuring the coherence of public policies, planning, and articulation between risk management organizations requires an entity with sufficient political authority and technical capacity to influence strategic decisions related to national, territorial, and sectoral planning and investment. The emergency management can no longer be a priority of the UNGRD, because this weakens the SNPAD’s functioning. Issues such as policy regulation, updating and monitoring the implementation of the PNPAD, the programs and actions at sectoral, national, regional, and local level have not been consolidated, either. Neither has the SNPAD organized or kept a Comprehensive Information System, which would provide knowledge and geographically locate the existing risks in the country, as well as the corresponding vulnerability analysis. The UNGRD should be consolidated as the technical agency of articulation, leadership, and control. Its direct responsibility should be orienting and promoting interinstitutional work, and ensuring that different government entities and agencies comply with their functions and responsibilities assigned in the current legislation for such effect as stated by Decree 4147 of 2011, which created the UNGRD. The function of this new Unit, inside the Presidency of the Republic, should be focused on orientation, coordination, and surveillance, so that departmental governments through their regional agencies take charge of effective intermediation between municipalities, and the nation, and on the strengthening of their capacities so that local governments can take over in incorporating planning and performance of actions aimed at risk management.

Under the comprehensive approach to risk management, all entities have responsibilities and powers in the various components of management, although this is not reflected in the current regulations. As shown in the conceptual framework, each entity has to be liable for the formulation and adoption of policies and sectoral guidelines, norm design, and development. They have to ensure their implementation and performance, monitor and control their mission processes with sustainability criteria, and guarantee security in the infrastructure under their responsibility. In current regulations, not all Ministries and Administrative Departments are explicitly mentioned, nor have they defined their competencies and duties. A special emphasis is made on the Ministry of Interior, the Ministry of National Defense, the Ministry of Social Protection, the Ministry of Public Works and Transport (current Ministry of Transport), the Ministry of National Education, the Ministry of Agriculture and Rural Development, the Ministry of Communications (current Ministry of Technologies and Communication), and the National Department of Planning. There are many ministries whose duties are not mentioned or specified.¹⁹

Ministries and decentralized organisms mostly do not have a dependency or officials that have the duty of coordinating or articulating risk management activities, thereby disregarding provisions in law and Development Plans. According to Decree 919 of 1989, Article 4, “Each Ministry, Administrative Department, territorial and decentralized entities, or legal entities mentioned in this regulation should appoint the dependency and/or person who is specifically given these responsibilities in carrying out indispensable activities in order to ensure their preparation and execution in the Plan” (understood to mean PNPAD). The above has been reiterated in the Conpes Document 3146 and in the PND 2006-2010, and is currently retaken in Draft Law

No. 158 of 2011 Senate, 050 House of Representatives. However, only entities such as the Ministry of Social Protection and Inviás have offices responsible for this subject, although their role is more focused on emergency management. Many important entities, the DNP among them, do not have within their structure adequate units or officials to take responsibility for this subject (*Table 2.4*). Due to the aforementioned, reviewing the State’s contracting processes and the regularization of positions currently outlined by the Ministry of Labor offer an opportunity for the functions being performed by contractors and responsibilities to be clearly established within the different entities.

On the other hand, responsibilities provided by Decree-Law 919 of 1989 to the different Ministries and decentralized organisms are very limited. The Decree emphasizes activities in emergency management, but it does not mention or incorporate institutions that have a comprehensive vision as required by risk management. The Decree highlights the responsibilities of the Armed Forces, the National Police, and the Ministry of Social Protection, the Ministry of Public Works and Transportation, the Ministry of Education, the Ministry of Communications, the DNP, the Regional Planning Councils, and decentralized entities such as the SGC, Ideam, Civil Defense, IGAC, Inderena (functions assumed by the MADS), Telecom, and Invias. As it may be concluded, many of the have been restructured, liquidated, or merged, which makes evident the need to update them beyond the management of emergencies toward the wider scope needed by risk management in its relationship to sustainable development with a commitment by all entities and under the current vision of the Constitution.

19 Bill no.158 of 2011, 050 House of Representatives under discussion is seeking to correct these SNPAD difficulties.

TABLE 2.4. Human resources by institution

| Institution | Human resources |
|---|---|
| DPAD | 36 officials and 62 contractors |
| DNP | 1 official and 4 professional contractors |
| Ministry of Agriculture and Rural Development | 1 professional in the Rural Development Directorate |
| Ministry of Social Protection | Office for emergency management. No information on the number of persons working there |
| Ministry of Environment, Housing, and Territorial Development | 8 professional contractors in the Territorial Development Directorate |
| Ministry of National Education | 1 professional under the coordination of the Environmental Education Program |
| Ministry of Communications | No information |
| Ministry of Finance and Public Credit | Contingent Liabilities Division, Risks Subdirectorate |
| Ministry of Foreign Affairs | 1 official in the International Cooperation Directorate |
| Ministry of Transport | No staff for this purpose |
| Invias | Office for the management of emergencies. No information on the number of persons working there |
| Dimar | No information |
| Ideam | 112 professionals and 216 technicians |
| Ingeominas | 38 professionals from the Geological Hazards Subdirectorate and Surrounding Environment |
| IGAC | No information |
| Colciencias | 1 professional Coordinator for the National Program of Environment and Habitat Sciences |
| Colombian Civil Defense | No information |
| Colombian Red Cross | 93 persons including coordinators, instructors, and facilitators |
| National Fire Department System | No information |
| Sena | No assigned staff |
| Telecom | No information |
| Social Action | Subdirectorate of Official Aid to Development |

Source: Adapted from Vásquez, 2006.

The Ministry of Environment and Sustainable Development (MADS) is one of the few entities that have specific duties in risk management, and because it is the entity with the greatest connection to this subject, it would have even greater intervention in risk reduction. The Law 99 of 1993, Article 5 assigns the former Ministry of Environment the function of carrying out, in coordination with other authorities, monitoring and controlling risk factors. In complying with these functions, the Ministry is in charge of prevention and preparedness actions in wild-fire management in cooperation with Ideam. It monitors and issues hydrometeorological haz-

ard warnings. As far as risk reduction, Law 99 of 1993 provides that Ministry of the Environment has to “Promote, in coordination with the Ministry of Interior, environmental programs and projects in disaster prevention so that these are in coherence with the activities of the Environmental National System and those of the National System in Disaster Prevention and Response” (Article 5, numeral 41). The development of this function, on the contrary, has been quite limited, so there is an opportunity for a true articulation between both systems.

One of SNPAD’s main weaknesses is that the Executive Branch has the ability to put aside

the SNPAD's structure, responsibilities, and possibilities, and to rely on a mechanism of emergency declaration due to severe public calamity, as provided by Article 215 of the Constitution. Such possibility, performed in several ad hoc solutions, implies the following: (i) it undermines the authority of the SNPAD in the population, in Public Administration and its different components; (ii) it employs exceptional measures,

which should be reserved for extreme situations, in which the society's stability, its institutions, or national independence and sovereignty are endangered; (iii) it opens the door to "tailored" solutions, which only serve to solve the current disaster and prevent the consolidation of a stable system for risk management and a response to an abnormal situation as described in Table 2.5.



Municipality of Medellín (Antioquia, Colombia), 2011. Photography: Gabriel Jaime Arango Zapata.

TABLE 2.5. Summary of the main reconstruction processes in Colombia, 1990–2011

| Criterion | Description |
|---|--|
| State's response | <i>Event: Tierradentro earthquake/avalanche (June 1994)¹</i> The creation of a new public organization to handle governmental and social solutions facing a disaster - Nasa Kiwe corporation – under the declaration of “ecological emergency.” One of the main features of the process was the minor participation of the private sector and not using international funding in the reconstruction process (although a development program was later started in the area with funds from the EU and Colombian counterparts). A new tax stimulus law was issued. |
| Scope | The Nasa Kiwe corporation, was in charge of the reconstruction of destroyed houses and roads, as well as new settlements in the relocation areas, education and health areas, promotion of productive projects and environmental recovery. |
| Organization | The corporation enabled the affected communities to have one interlocutor in the government. Its organizational structure was based on a Board of Directors, made up of representatives from the Presidency of the Republic, governors from Cauca, Huila, representatives from the Cauca's Regional Indigenous Council (CRIC), representatives of the surrounding community areas like Tierradentro, representatives from nonindigenous communities and personalities from the area (religious and business sectors, NGOs, academia and social process managers). |
| Entities | The following entities participated on the reconstruction process: Nasa Kiwe Corporation, Inviás, Caminos Vecinales, Rural Development Fund (DRI), Inurbe, Caja Agraria, Antioquia Presente, Ministry of Environment, Ministry of Health, Findeter, Colombian Development Foundation Services (FIS), National Rehabilitation Plan (PNR), Telecom, Cabildos Indígenas, municipalities, NGOs, Belalcázar Hospital, Plante, Incora, Cristian Children, Secretary of Agriculture, Spanish Embassy, Cauca Government, Fonade, EPSA Community, Cxhab Wal Program. |
| Damage costs | US\$ 150,152,358 (0.184% GDP, 1994) (US\$1.00 = Col\$827) |
| Emergency and rehabilitation costs | There are no specific count values earmarked for disaster prevention but, according to DGPD data for 1994, the Calamity Fund provided Col\$5.4 billion to respond to emergencies that occurred in this year. Most of the resources were applied to disaster relief while the corporation was taking shape. About Col\$2 billion were invested in construction of temporary accommodations to help those affected and those who were constantly provided with food and household goods. In addition, there is no data as to the real costs of the hundreds of helicopter flights executed, which were not calculated. |
| Reconstruction/replacement | US\$ 129,621,444 (0.159% of GDP, 1994) (US\$1.00 = Col\$827) |
| Time | Triggering event: 15 seconds /Aftershocks: 4 days Damage evaluation: 4 days/ Research: 10 months Founding of the organization: 17 days Response: 14 days Reconstruction: 11 years |
| Main activities | Social recovery program in education Environmental recovery program Economic recovery program: productive projects, institutional standardization, and strengthening Physical reconstruction: road infrastructure, vital lines, housing, equipment, and public works (health and sanitation) |

TABLE 2.5. Summary of the main reconstruction processes in Colombia, 1990–2011 (continued)

| Criterion | Description |
|---|---|
| <i>Event: Coffee Growing region earthquake (January 1999)²</i> | |
| State's response | The government created the Fund for Reconstruction and Social Development for the Coffee Growing Region (FOREC), a special public entity encompassing legal capacity and budgetary autonomy to finance and carry out economic, social, environmental, reconstruction and, rehabilitation activities in the affected area. The fund was partially financed with resources from Loan Contracts granted by the International Bank for Reconstruction and Development (IBRD) and the Inter-American Development Bank (IDB). |
| Scope | <p>The FOREC was responsible for helping the community with demolitions and the removal of debris, providing temporary shelter, repairing educational establishments, supporting land use and reconstruction plans, as well as repairing, reconstructing, and relocating houses, and buildings, doing research, designing and reconstruction of physical infrastructure and public services, and the beginning of economical, ecological and social recovery in the Coffee Growing Region.</p> <p>An administrative structure in FOREC was not created, but it was authorized to contract all the reconstruction works with nongovernmental organizations and to provide response to the affected communities. Its model is Neoliberal with the purpose of reducing the State's size and distributing its functions to the private sector. FOREC divided the region in zones based into the damage level, their extension and location. In order to progress in reconstruction plans in each zone, the most representative NGOs in the country were convened, through the National Confederation of Nongovernmental organizations. Some 31 management zones were established. Each NGO had under its responsibility the preparation and subsequent implementation of a plan of action (PAZ). Those plans included the physical infrastructure and the social and economic reconstruction of the zone. The reconstruction process actions were divided in four stages: (i) emergency response; (ii) consolidation and planning; (iii) reconstruction; and (iv) dismantling and liquidation.</p> <p>FOREC contracted a University Network composed by the CIDER, the University of Quindío, and the Technological University of Pereira to carry out a permanent monitoring of the reconstruction process. The Board of Directors was composed by a governor appointed by the president, who would represent all the governors from the five affected departments (Risaralda's governor), a mayor who would represent all the mayors from 28 affected municipalities (Armenia's mayor), representatives of the national government and, personalities from the sector. The President of the National Industry Association (ANDI) was appointed as the president of the institution. Neither the representatives from the social organizations of the region, nor those from the affected communities participated on the Board.</p> |
| Organization | According to the management zones, the main entities that participated in the reconstruction process were: Cajamarca (Fedevivienda); Roncesvalles (Tolima Architects Society); Chinchina (Galdas Development Association); Pereira (Life and Future); Dosquebradas (Dosquebradas Chamber of Commerce); Santa Rosa (Santa Rosa Chamber of Commerce, Santa Rosa Bolivarian Society); Marsella (Coffee Farmers Cooperative, Risaralda Development Foundation, Famiempresa); Armenia (Restrepo Barco Foundation, Universidad de Antioquia, Concreto, Codesarrollo, ACODAL, Comfama, FES, Cenaprov, Armenia Chamber of Commerce, Carvajal Foundation, Solidary for Colombia, Minuto de Dios Foundation, National University, Fedevivienda, Funde Comercio); Valle municipalities (Valle Solidarity Foundation); Salen and Circacia (Fundempresa); Finlandia and Quimbaya (Junior Chamber); Pijao (Manizales Chamber of Commerce); Córdoba, Buenavista, and Genova (Cetec, AVP); Calarca (Fenavip); Barcelona (Coffee Farmers Cooperative); La Tebaida (Antioquia Present); Montenegro (Compartir, Governor of Cundinamarca); coffee and noncoffee rural area (Colombian Coffee Growers Federation). |
| Damage costs | US\$ 1.5 billion (1.837% of 1999 GDP) (US\$1.00 = Col\$1,757) |
| Emergency and rehabilitation costs | US\$45 million (0.0053% of 1999 GDP) (US\$1.00 = Col\$1,757) |
| Reconstruction/ replacement | US\$ 1 Billion (1.215% of 1999 GDP) (US\$ 1.00 = Col\$1,757) |
| Time | <p>Triggering event: 20 seconds /Aftershocks: 30 days</p> <p>Damage evaluation: 2 years</p> <p>Beginning of the organization: 5 days</p> <p>Response: No information</p> <p>Reconstruction: 3 years</p> |

TABLE 2.5. Summary of the main reconstruction processes in Colombia, 1990-2011 (continued)

| Criterion | Description |
|-------------------------|---|
| | <i>Event: Coffee Growing region earthquake (January 1999)</i> ² |
| Main activities | <p><i>Housing support.</i> Recovery, reconstruction and, housing relocation</p> <p><i>Repair and reconstruction of social infrastructure.</i> Health, education, community child care centers, nursing homes, recreation, culture and sport sectors.</p> <p><i>Repair and reconstruction of public infrastructure.</i> Infrastructure works of government's buildings, urban equipment, public utilities, air and road transport.</p> <p><i>Strengthening of institutional prevention and disaster management capacity.</i> Classifying information, vulnerability analysis research, equipment and land use planning (POT) research.</p> <p><i>Reconstruction of the social order.</i> Social Assistance and intervention in the population's emotional recovery.</p> <p><i>Economic reactivation and job creation.</i> It financed innovation projects and productive chains.</p> <p><i>Environment.</i> Environmental plan for the Coffee Growing region's reconstruction (sustainable use of reconstruction materials and environmental feasibility for sectoral projects)</p> <p>Rural area reconstruction</p> <p>Temporary response to the affected population</p> <p>Reconstruction project management.</p> |
| | <i>Event: Rainy Emergency. La Niña phenomenon 2010-2011</i> ³ |
| State's response | <p>The National Government guided "Humanitarian Colombia" to administer response and rehabilitation stages associated to La Niña phenomenon 2010-2011 as a subaccount of the National Calamity Fund. Additionally, the Adjustment Fund is created to leverage financial and technical resources to construct and reconstruct affected zones, and mitigate and prevent risk at national, departmental and municipal level ("economic, social and environmental hazards") coming from phenomena similar to La Niña, and the economic recovery of farming, livestock and, fisheries sectors.</p> |
| Scope | <p>The purpose of the Adjustment Fund is to identify structuring and project management, the execution of contracts, the allocation and transfer of resources with the aim of recuperating, constructing, and reconstructing the infrastructure in transportation, telecommunications, environment, agriculture, public utilities, housing, education, health, water systems and sewage, wetlands, strategic flood areas, building and reconstruction. Moreover, said Fund deals with the economic rehabilitation of the agricultural, livestock, and fisheries sectors affected by the rainy season, and any action resulting from the La Niña phenomenon as well as preventing the permanence of its effects, mitigating and preventing risks and protecting the population from the economic, social, and environmental threats.</p> <p>The Fund is under the auspices of the Ministry of Finance and Public Credit. It has legal, financial and budgetary autonomy. This fund has the following organizational structure:</p> <ul style="list-style-type: none"> (i) The Board of Directors responsible for its administration and management. It is composed of representatives from the Presidency of the Republic, the Ministry of the Interior and Justice, the Ministry of Finance and Public Credit, from the project's consideration area, the Administrative Department of the President of the Republic, the National Planning Department (DNP), and five members from the private sector. (ii) The Fund Management exercises its legal representation and is in charge of executing and monitoring plans and projects approved by the Board of Directors, entering of the contracts and, monitoring the appropriate execution of resources. (iii) The sectoral committees in charge of providing consultancy in specific topics where more knowledge is required (private sector, civil society, NGO or multilateral agencies). <p>The fund will obtain resources from items allocated by the national budget, credits managed internally or externally, donations, national or international cooperation, the National Calamity Fund, as well as from resources made available by the transfer of 10% of Ecopetrol's shares that are provided by the National Government (pending approval by Congress). The resources coming from the State should be allocated through the national budget and the corresponding implications should be undertaken. The fund shall transfer resources to public entities at the national and territorial level and to private entities, so that resources can be managed and invested in the recovery, construction, and reconstruction stages of the areas affected by "the La Niña" phenomenon. The National Government may use the Fund's resources to conclude agreements with foreign governments, whose main purpose is related to recovery, construction and reconstruction activities required for the definitive surmounting of La Niña phenomenon. Territorial cooperation schemes are allowed; for example, territorial entities can contribute resources through cofunding schemes for the project's development that are identified, structured, and administered by the Fund.</p> |
| Entities | <p>Disaster Risk Management Unit, Humanitarian Colombia, Ministry of Housing, City and Territory, Ministry of Environment and Sustainable Development, Departmental Water Plan, Findeter, Invias, Ministry of Agriculture and Rural Development, Ministry of Education, Ministry of Social Protection, Bancolombia, CBF.</p> |

TABLE 2.5. Summary of the main reconstruction processes in Colombia, 1990-2011 (continued)

| Criterion | Description |
|--|---|
| <i>Event: Rainy Season Emergency. La Niña Phenomenon 2010-2011³ (continued)</i> | |
| Damage costs | |
| Emergency and rehabilitation costs | Assistance and rehabilitation costs: US\$ 3.2 billion (US\$1.00 = Col\$1,936.29) Resources intended for assistance and rehabilitation: US\$ 3,491,735.53 (US\$1.00 = Col\$1,936.29) |
| Reconstruction/replacement | Reconstruction costs : US\$ 5 billion (US\$1.00 = Col\$1,936.29) Resources intended for reconstruction and adaptation: US\$39,938,016.50 (US\$1.00 = Col\$1,936.29) |
| Time | Emergency: 4 months after the event Rehabilitation: 2 years Reconstruction and adaptation: from 4 to 6 years |
| Main activities | The general guidelines for disaster's situation management, comprise ten lines of action: (1) humanitarian assistance to the affected families such as feeding and bedroom items, cleaning and kitchen items for the duration of the emergency and an additional time necessary for the recovery process; (2) administration and management of shelters and/or temporary lease arrangements for the evacuated families; (3) drinking water and basic sanitation; (4) comprehensive health, control, and epidemiological surveillance; (5) repossession of houses (broken and destroyed); (6) incentives for the agricultural sector; (7) economic and social reactivation of the area according to the guidelines established by the PND; (8) land use regulation; (9) early warnings; (10) emergency works (embankment reinforcement, control works) and mitigation and prevention works. The risks to be covered are those produced by the La Niña phenomenon. The types of activities or projects related to the Fund are: infrastructure construction and reconstruction in the following areas: transportation, telecommunications, environment, agriculture, utilities, housing, education, health, aqueducts and sewerage, and strategic flood areas; the economic rehabilitation of the farming, livestock and fisheries sectors affected by the rainy season. insurance contracting. |

Sources:

⁽¹⁾ Cardona, et al., 2005.⁽²⁾ Cardona, et al., 2005; FOREC. *Operative Regulation*, 1999.⁽³⁾ *Adaptation Fund*, 2011. *Developing key strategy, structure and processes; Comprehensive and specific action plan for emergency management produced by The La Niña Phenomenon 2010-2011*; Decree 4819 of 2010.

2.4. RISK MANAGEMENT PLANNING

Since the adoption of Law 46 of 1988 and Decree 919 of 1989, which created and organized the SNPAD, the National Government has been adopting measures to guarantee appropriate and efficient risk management. Nevertheless, many of these measures have not been integrated or articulated, resulting in their difficult implementation at different territorial levels and in the possible minor impact they may have in the reduction of risk. Ten years after the creation of the SNPAD, the PNPAD was formulated, a document constituted as a SNPAD policy instrument which establishes as an objective the elimination and reduction of casualties and the effects that can result as a consequence of existing risks and disasters. The Plan strategies are based on risk knowledge, prevention and mitigation planning, institutional strengthening of the SNPAD, and the socialization of risk prevention and mitigation, which are developed by defining programs, lines of action, and appointing responsible agents.

In order to strengthen the Plan's impact and promote its implementation, Conpes document 3146 was formulated as a PNPAD complementary instrument. This document defines and gives priority to some activities and establishes terms and resources. This document provides a better hierarchy and relationship among the programs (action lines) with defined strategies, as shown in the following table, making a clear differentiation between the competencies at the national and territorial level and the responsibilities of different sector competencies. Additionally, it defines time and cost estimations of some priority projects.

In spite of the existence of normative and planning instruments, it has not been possible to consolidate a real disaster risk management policy comprehensively implemented and articulated with the public administration. Several entities thought that the Conpes document 3146 would generate an additional resource allocation in the national budget and bigger efforts in risk management commitment compliance. Nevertheless, according to an evaluation made by the DNP (2009)²⁰, the implementation efficiency is around 77% where results have been achieved above the execution parameters and the SNPAD strengthening strategy only attains 8% efficiency. So Conpes achieved only 29% efficiency, SNPAD strengthening strategies and the socialization of risk prevention and mitigation being the two most inefficient areas (4% and 5% respectively). Therefore, it has been a policy framework applied incompletely, assorted and disarticulated with other planning and investment instruments.

²⁰ An evaluation was made of the results for the strategies raised in Conpes document 3146, which evaluates the progress made between 2002 and 2009, when indicators were developed to compare the initial situation with the final situation: *Indicator of effectiveness (E)*. It evaluates policy during the period 2002-2009, comparing the planned activities of Conpes 3146 with carried out activities. If E=100%, execution of the strategy was efficient; if E>50%, implementing the strategy was highly efficient; if E<50%, implementation was not efficient. *Indicator of efficiency (IE)*. It evaluates the efficiency during the period 2002-2004, comparing activities programmed by Conpes 3146 with activities carried out at the scheduled time. If IE=100%, implementation of the strategy was efficient; if IE>50%, implementation of the strategy was highly efficient; if IE<29%, the strategy implementation was not efficient.

TABLE 2.6. Comparative matrix between PNPAD and Conpes 3146

| PNPAD programs | Strategies | Conpes 3146 action lines |
|---|--|--|
| <ul style="list-style-type: none"> Consolidating networks, procedures, and detection and alert systems for surveillance and early warning to the population Risk assessment | Knowledge of nature- or man-induced risks | <ul style="list-style-type: none"> Progress in knowledge Development of an integrated information system Consolidation of monitoring and alert networks |
| <ul style="list-style-type: none"> Incorporation of preventive and safety criteria in development plans Managing and providing help to human settlements and infrastructure located in risk areas Organization of environmental policy and disaster prevention | Prevention and mitigation of risk in the planning process | <ul style="list-style-type: none"> Risk management inclusion in territorial planning processes: technical support and orientation in formulation and development of the POT, PD, and PLEC Risk management inclusion in sectoral planning processes: support and monitoring in all health sectors, safe drinking water and basic sanitation, environment, agrarian development, industrial safety, and dangerous products |
| <ul style="list-style-type: none"> Strengthening National SNPAD institutions Improvement of regional and local committees in disaster prevention and response Optimization of operational entities; protective and contingency measures in infrastructure works; development and updating of Emergency and Contingency Plans Efficient mechanism design and preferential treatment of reconstruction projects Integrated information systems | Strengthening National SNPAD institutions | <ul style="list-style-type: none"> Interinstitutional coordination and articulation Institutional and SNPAD improvement at national, regional, and local levels |
| <ul style="list-style-type: none"> Public information for opportune community prevention and appropriate reaction in a disaster situation Incorporating disaster prevention and environmental protection concepts in the formal education system Developing a national training system for civil servants and community trainers Implementing activities with civil society organizations | Socialization of risk and disaster prevention and mitigation | <ul style="list-style-type: none"> Preparation and training of civil servants and communities Communicating information for decision making Citizen awareness |

Source: DNP, 2009.

It is known that the explicit incorporation of disaster risk management in the most recent National Development Plans is an important argument that provides political support and relevancy to this subject. However, the main goals are still weak and they do not reflect the established objectives in the descriptive documents. Since the formulation of the PNPAD, the subject has been incorporated in the last four government terms in development plans, emphasizing risk knowledge, the strengthening of SNPAD, reduction of fiscal vulnerability, and risk transfer. For each of these fields, there is a description about the commitments acquired during the last four terms of government. However, although the

description of the activities and the challenges is very clear and coherent with the needs, the definition of goals and the established indicators for each one of these fields does not reflect the proposals and it allows a partial coverage of the exposed proposals in the descriptive component of the document. For example, in the last Development Plan, although the proposed goals are very broad, the only objectives incorporated in the Plan and in the Sigob are the number of municipalities supported in incorporating risk management in the POT and the percentage of victims that have received support from the National Calamity Fund (*Table 2.7*).

TABLE 2.7. Matrix of commitments and responsibilities for disaster risk management according to the regulations and planning spheres

| PNPAD DECREE 93/98 | PND | | | | PND "PROSPERITY FOR ALL" 2010-2014 |
|-----------------------|---|---|---|------------------------------------|---|
| | "CHANGE TO CONSTRUCT PEACE" 1998-2002 | "TOWARD A COMMUNITY STATE" 2002-2006 | "COMMUNITY STATE: DEVELOPMENT FOR ALL" 2006-2010 | | |
| Risk knowledge | Consolidation of phenomenon monitoring networks | Strengthening risk assessment | Progress in risk knowledge, hazard and vulnerability analysis, risk evaluation and monitoring extending and updating monitoring and warning systems (seismic, volcanic and hydrometeorological) | Improvement in risk investigation | Updating the Comprehensive Information System Implementing the National Education and Training Plan in the GRD, and its incorporating in formal and informal education to a civil servant training system Extending monitoring and warning systems and updating local and regional maps Designing and implementing methodology instruments for zoning and evaluating hazards, vulnerability, and risks |
| | Communication systems for CLOPAD and CREPAD | Design and implementation of the comprehensive information system | Preparation of three national maps indicating scenarios of susceptibility to hazards (flooding, landslides and fires), on a scale of 1:500,000; updating national seismic hazard maps and creating a new map indicating volcanic hazards | | |
| | Formal and non-formal education programs | Expansion and updating of monitoring and warning systems | Integration of territorial entities to the Comprehensive Information System | | |
| | Information campaigns | | Invias progress in the comprehensive risk management system of the Colombian transportation network Incorporation of the GRD in education Strengthening of basic research according to territorial needs | | |
| Risk reduction | Planning and land use, promotion of hazard identification and risk evaluation | Promotion of territorial and sectoral planning | Advancing in prevention and mitigation measures: incorporation of the GRD in the POT, Environmental Management Plans and the POMCA; formulation of precarious settlement management policies for high-risk zones; formulation of risk management measures in the municipalities; proposal to incorporate risk management in the PD. This will be strengthened by the SNPAD regional institutions in defining responsibilities, competencies, and possible identification of resources to guarantee the needed technical formation that facilitates the incorporation of risk knowledge in planning and land use | Sectoral planning of disaster risk | GRD construction of capacities and plan formulation and municipal emergency plans GRD incorporation in the POT, Environmental Management Plans, and the POMCA Designing criteria to incorporate the GRD in formulating public investment projects Adoption and implementation of the National Risk Management Plan for Tsunami and the Action Plan for the Cerro Machin Volcano Implementation of risk management policies for the Galeras and Nevado del Huila volcanoes Promoting a long-term solution to confront the effects of the La Niña phenomenon |
| | Control over occupation in high-risk zones | Risk reduction of tsunamis, flooding, and seismic activity | | | |
| Risk reduction | Formulation of resettlement policies | Population resettlement in risk zones: relocation subsidies and structural reinforcement; reinforcement of vital structures such as hospitals, according to Law 400 of 1997 and Law 715 of 2001 | | | |
| | Economic incentives to promote buildings that abide by Colombian seismic-resistant and construction standards | Preventing occupation and use of unplanned areas | | | |
| Risk reduction | Improvement of precarious settlements and resettlement areas | | | | |
| | | | | | |

TABLE 2.7. Matrix of commitments and responsibilities for disaster risk management according to the regulations and planning spheres (continued)

| PNPAD DECREE 93/98 | PND "CHANGE TO CONSTRUCT PEACE" 1998-2002 | PND "TOWARD A COMMUNITY STATE" 2002-2006 | PND "COMMUNITY STATE: DEVELOPMENT FOR ALL" 2006-2010 | PND "PROSPERITY FOR ALL" 2010-2014 |
|--|---|--|---|---|
| Institutional development | Institutional strengthening of the CLOPAD, the CREPAD and emergency organizations | | <p>Strengthening of SNPAD governance: the SNPAD and DPAD will be institutionally and legally stronger so that they can carry out their functions independently, promptly and, efficiently; priority in assigning projects aimed at preventing flooding in the Low Magdalena and in La Mojana region</p> <p>Endorse national entities to institutionalize the subject in their organizations and allocate the resources that guarantee their sustainability and the fulfillment of the mission</p> <p>SNPAD integration with other systems such as SINA, SNC&T, the educational systems and, the DNP</p> | Strengthening of policies: GRD National policy, minor and medium-intensity disaster management, high-risk zone management policies, reconstruction mechanisms |
| Socializing the community risk prevention, training risk awareness | Education programs in risk prevention oriented at communities | | Improvement of providing information and its disclosure; institutionalization of public information strategies on confronting hazards | |
| Note: Financial protection was not included in the PNPAD | | Risk financial strategies | Increase financial capacity when disasters occur as well as in financing their prevention | Formulation of financial protection policies |

Source: Authors' table, 2011.

The actions proposed in the different development plans are coherent with the international policies and the commitments assumed by Colombia in the United Nations. The Hyogo Framework for Action (HFA) 2005-2015: *Building the Resilience of Nations and Communities to Disasters*, signed by 168 states including Colombia, as a global reference document to be implemented by the countries, regions, the organizations of the United Nations, and civil society, and accepted at the Worldwide

Conference for Disaster Risk Reduction, proposes as a first strategic objective “a more effective integration of disaster risk considerations in policies, plans, and sustainable environmental programs at all levels” especially emphasizing disaster prevention, mitigation, preparedness, and vulnerability reduction. Presented below are the relationships between the main components of action lines in function of the HFA and the PNPAD (Table 2.8).

TABLE 2.8. Main components of action lines or HFA subject areas

| HFA LINES OF ACTION | MAIN COMPONENTS | PNPAD |
|---|---|---|
| Strengthening institutional capacities at all levels so that achieving disaster risk reduction becomes a national and Andean subregional priority | <ul style="list-style-type: none"> • Policies and plans • Legal and regulatory frameworks • Sources and capacities • Integration or articulation with the development processes • Institutional mechanisms, capacities, and structures • Political commitment • Accountability and management indicators | <ul style="list-style-type: none"> • Institutional development |
| Promoting research, and awareness in order to identify, monitor and evaluate disaster risk in order to improve early warning systems | <ul style="list-style-type: none"> • Hazard and risk data analysis • Vulnerability and possible impact information and indicators • Early warning systems • Scientific and technical innovation • Information and disclosure management | <ul style="list-style-type: none"> • Risk knowledge |
| Promoting education, communication, and participation to construct a culture of safety and resilience at all levels | <ul style="list-style-type: none"> • Education and training • Public awareness • Learning and investigation | <ul style="list-style-type: none"> • Inform the community about the conditions related to risk prevention, risk training, and risk awareness |
| Reduction of underlying risk factors | <ul style="list-style-type: none"> • Planning processes and territorial land use • Structural and technical measures • Natural and environmental resource management, adaption to climate change • Sustainable production • Social protection • Financing instruments • Instruments financiers | <ul style="list-style-type: none"> • Risk reduction |
| Strengthening joint preparation, response, and relief mechanisms at all levels in case of a disaster | <ul style="list-style-type: none"> • Emergency organization and coordination • Plan emergency preparations and their management • Emergency respond mechanisms • Participation and volunteering | <ul style="list-style-type: none"> • Institutional development |

Source: Translated and adapted by Benson and Twigg, 2007.

2.5. FINANCIAL INSTRUMENTS AND INVESTMENT IN RISK MANAGEMENT

2.5.1. Instruments and financial resources

The National Calamity Fund (FNC), being a principal SNPAD financial tool, has focused mainly on providing resources for disaster management activities and it lacks strategies for promoting projects in risk reduction and strengthening capacities. For many years, this Fund was the nation's special account, endowed, with patrimonial, administrative, countable and statistical independence. Its main goal was to provide social assistance. It was created with the objective of providing economic support for disaster prevention and relief and to provide environmental sanitation in the affected community as well as to finance the installation of information systems and equipment. Subsequently, it became an account assigned to the Ministry of Interior and Justice, which changed part of its characteristics. This transformation was made to cover DGR operating costs, since its budget in the Ministry is very unstable. Additionally, it has covered mostly humanitarian aid expenses and emergency relief with 69%, and only 31% of its resources have been allocated to prevention and mitigation (OSSO Corporation, 2009b). The FNC does not count on standardized procedures for the presentation, assessment, and monitoring of projects and its financial strategy is not a part of a financial transfer and risk withholding tactic.

Law Decree 919 of 1989 establishes that all central administration organizations and dependencies and all national decentralized

entities should include in their budget special allocations for disaster prevention and relief. In addition to the resources in each national entity, as established in the National Budget, according to Article 66 of Law Decree 919 of 1989, funds could be placed in a trusteeship in the National Calamity Fund for disaster prevention and relief and for rehabilitation, reconstruction, or development with prior authorization from the DGR.

The territorial entities have basically three types of income: ordinary, capital resources, and transfers, where there are resources that could be used for risk management. Ordinary incomes are the resources on which municipal and government bodies depend for daily administration and investment operations. These can be taxed or untaxed. In the untaxed resources, there are the shares in royalties and the compensations for the exploitation of nonrenewable resources, which according to the new royalty law, signed on July 18, 2011, should be used by mayors and governors to implement projects that benefit their communities. The capital resources are composed of internal, external, or suppliers' credits, for the sale of assets, capital shares, and a positive balance result. The debts cannot exceed the payment capacity of the territorial entities, as it is established in the Constitution and the Territorial Indebtedness Law (Law 358 of 1997). As far as transfers, these are the resources that the municipalities receive from the national budget as fiscal appropriation, the participation of the nation's

current revenue, the national joint financing system, etc. The subject of disaster prevention and relief is covered in the general purpose resources that make up 11.1% of the General Participation System (Conpes 137 of 2001). Its objective is to create adequate urban and rural areas in high-risk areas, resettlement of populations, and disaster prevention and relief. The National Cofinancing System manages additional complementary resources. It is conditioned to the formulation of projects and the availability of compensatory money by the territorial entities, and backed up with non-refundable resources for local and regional construction projects that are in line with national development policies. The main funds are: Cofinancing Fund for Urban Infrastructure, Territorial Development Finance Agency (Findeter), and National Environmental Fund (FONAM) (Ghul, et ál., 1998).

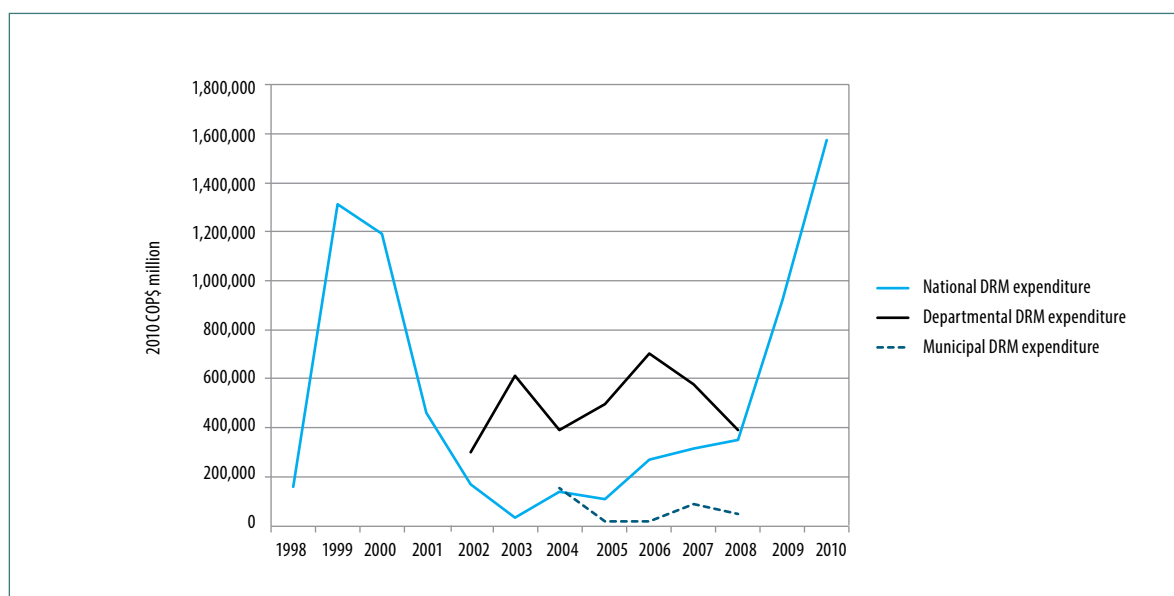
The competent organizations of the territorial entities can establish fiduciary administration systems for the management of their resources or their decentralized entities intended for disaster and calamity prevention and relief. The municipal and government bodies have not used this option due to the scarce availability of resources in small municipalities. There are just a few exceptions in the use of this alternative. The most prominent example is the Bogota Fund for Emergency Response (FOPAE), which assigns the “five per thousand” of the current income of the District for risk management activities. This subject matter has not been regulated in other regions. Alternatives should be proposed to formulate fiscal restrictions compatible with the compliance with the obligations established in the law and open possibilities to use sources such as the Royalty Fund to generate new perspectives.

2.5.2. Analysis of investments at the different territorial levels

In order to study national, regional, and local investments in risk management, the analysis begins with the five HFA priority areas: governance, knowledge and information, education and communication, risk reduction and, disaster management. From the information on investments, provided by the DNP Subdirectorate of Sustainable Environmental Development, which was reclassified according to HFA priority areas for this publication, it is evident that upon comparing national, departmental, and municipal investment in risk management there is a predominance of the national expense in disasters of great magnitude, such as the ones that occurred in 1999 and 2010, and an expenditure decrease in the absence of disaster events. For the period 2002-2008, the years where there is information on municipal expenses in risk management, the municipalities’ accumulated investment is greater than that at the national and departmental level. Even though the analysis period is short, apparently when the nation’s expense rises due to great disasters, municipal-level expenditure is discouraged (*Graph 2.1*).

21 For 2011, according to Decree 017 of 2001, the distribution was as follows: education 58.5%, health 25%, drinking water and basic sanitation 5.4%, and general purpose 11.1%.

GRAPH 2.1. Comparison of the total national, departmental, and municipal investment in risk management, 1998-2010

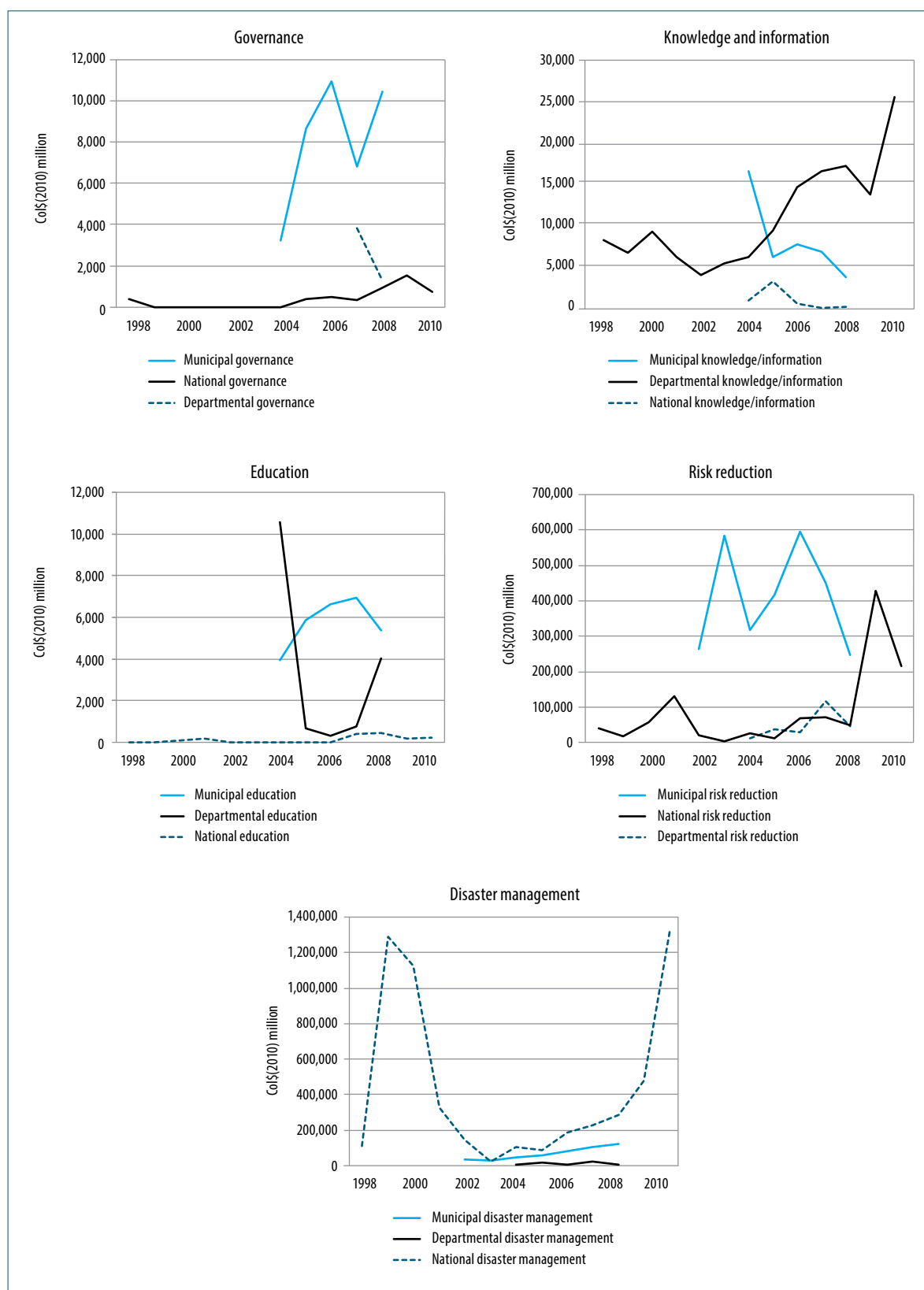


Source: Authors' graph from information provided by DNP-SDAS, 2010.

Observing the resources allocated for each HFA priority area by government levels, it can be said that there exist basic differences in investment in risk management as executed by the nation and the municipalities. While the nation has concentrated its resources on disaster management and risk knowledge, being the principal financial entity in these activities, the municipalities have done so in risk reduction. Whereas at the national level, investments in governance and education have relatively low values, it is the municipalities that make the greater effort in this area. In any case, departments show considerably lower investments (Graph 2.2).

“Conceptual progress on the relation between risk management and development has not been able to be incorporated in State policies, nor have they been integrated as an essential part of public administration, thus contributing to an increase in risk”

GRAPH 2.2. Investment in risk management for each priority area by governmental level



Source: Authors' graph from information provided by DNP-SDAS, 2010.

The difference in risk management budgets among the government levels is in part explained by the availability of resources that the territorial entities have in comparison to the nation. In general, municipalities present a relatively high expense in risk management, whereas it is much lower in the departments. This is mainly because risk management responsibility is focused locally, where the municipalities in the special category and in category 1 execute important amounts, so that in cumulative terms these represent large investments in comparison to the departments. Moreover, both for the departments, and for the municipalities, operating expenses are relatively high compared to total expenditures, which leaves few resources for disaster risk management²². In the appendixes, an analysis is presented in detail of the investments and progress made by national entities under the Nation's General Budget (period 1998-2010), and data is given of the investments annually made and reported by territorial entities, at departmental (period 2004-2008) and municipal level (period 2002-2008).

A reflection on the perception of actions executed taking as a reference the priority lines from the Hyogo Framework for Action is also shown in detail in the appendixes. To accomplish this, self-evaluations were conducted through a total of 225 surveys from the following entities: national institutions pertaining to SNPAD, Regional Autonomous Corporations, and Regional Committees for Disaster Prevention and Response belonging to departmental capitals and other municipalities. The surveys comprise five areas or subjects, similar to the instrument "HFA Monitor" (UNSIDR 2009)²³ from the Hyogo Framework for Action and a total of 15 indicators, accompanied by qualitative scales to measure risk management progress levels (level 1= low / level 2=incipient / level 3=acceptable / level 4=outstanding / level 5=optimum) (Table 2.9).

TABLE 2.9. Survey data sheet for self-evaluation of the risk management progress

| Total surveys | 225 surveys |
|---|--|
| Surveys according to population objective | National entities: 17 surveys CAR: 23 surveys Departments: 12 surveys Municipalities in special category and category 1: 14 surveys Municipalities from categories 2 to 6: 159 surveys |
| Instrument design | 5 sections 15 indicators |
| Collection method | Virtual (through Survey Monkey*) |
| Date | From April 30, 2011, to June 20, 2011 |

*Survey Monkey is an online software tool that allows users to create surveys and questionnaires.

It can be concluded that there is a certain correspondence between investment expenditures made in risk management at different government levels and their perception of the actions implemented in disaster risk reduction. The results obtained from the investment analysis coincide and verify certain tendencies that are extracted from the observations of officials from different government entities and

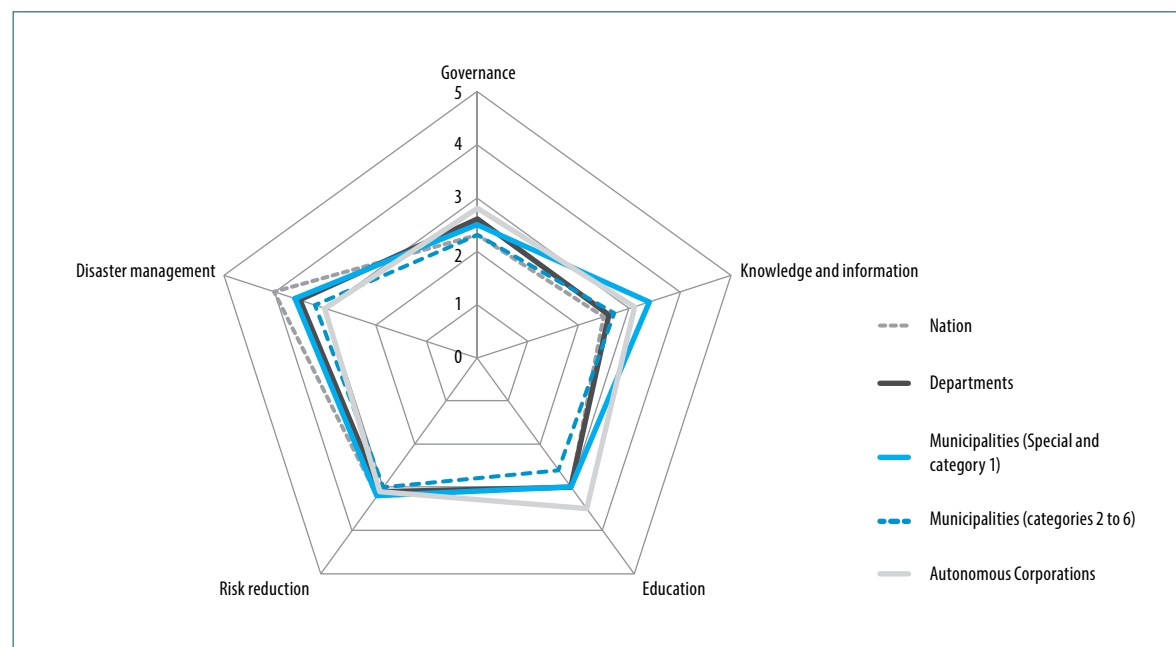
22 For the departments, risk management is located between 70% and 80%, while for the municipalities it is between 60% and 70% (Ingeniar Ltda., 2011) and it is higher for territorial entities of lower category because these, owing to their lower income, can spend a larger portion for their functioning.

23 The "HFA Monitor" is an online instrument that provides information related to achieved progress when executing the HFA, generated through a multisectoral review process. The main purpose of this instrument is to assist countries in monitoring and reviewing their progress, the challenges of implementing risk reduction, and recovery actions undertaken in the national area in accordance with the priorities of HFA. With this, national consultations are undertaken to obtain pertinent information related to the actions of risk management; the official report for Colombia for 2009-2011 is available at http://www.preventionweb.net/english/hyogo/progress/reports/index.php?p=pol_year&o2=DESC&ps=50&hid=2010&cid=37&x=8&y=10.

the CAR. In particular, the nation has the tendency to concentrate its resources on disaster management, whereas the municipalities and the departments place them in reduction of existing risk. Likewise, national entities that were surveyed consider that risk management

has become one of the strongest areas and they grade it as outstanding (4), while in the departments and municipalities it is graded and seen as acceptable (3). The efforts in risk reduction coincide with the resources allocated to this sphere (*Figure 2.6*).

FIGURE 2.6. Overall average rating of risk management by territorial level



Source: World Bank, 2011a.

2.6. A COMPULSORY STEP: THE EVOLUTION OF THE SYSTEM TOWARD A PROCESS APPROACH

The process approach in risk management combines the orientation by results, the appropriation of strengthened policies, and the association and articulation among social agents, so that the achievements obtained are comprehensive and sustainable over time. Modern entities are going through a transition from a traditional format of management by *functions* to other by *processes*²⁴. Many advantages have been identified in this orientation, such as achieving greater efficiency, integration, and understanding of the institutional mission and the clear identification of the suppliers and beneficiaries. The aim of working from a process approach in risk management is due to the need to optimize the spheres of knowledge in risk, risk reduction, and disaster management linked to the public administration cycle.

When all the functions and responsibilities of all the social agents are well defined and aligned in relation to the different processes, their joint action provides the most effective measure to address the challenges in disaster risk management. Local, regional, and national governments, civil society and overall, all public and private actors should acknowledge their respective roles and responsibilities. “Only when everyone starts working together, listening to different perspectives, creating alliances, involving each one of the actors, engaging everyone, (...) will changes be achieved. No individual or group can independently make the change happen” (Tewfwe, 2011).

2.6.1. Articulation among systems

Different systems of great importance have been created for risk management in the country, after the formulation of the SNPAD, and they have to be articulated. These systems include the National Environmental System (SINA), created by Law 99 of 1993; the National Planning System, created by Law 152 of 1994; the National Science and Technology System, created by Law 29 of 1990, which is specifically related to the promotion of scientific research and technological development; the National Education System, and the National Climate Change System, recently proposed by the Conpes 3700. Said systems need the construction of mechanisms and agendas among the coordinating entities to achieve better articulation in their missions and objectives and with different actors and activities.

In theory, there are common elements in the systems that facilitate their articulation. However, in practice they reflect an incoherent work and are somewhat uncoordinated. Planning systems, risk management, environmental management, and education use the country's decentralization model and present intervention spheres in the three territorial levels where the local/municipal is the principal space for the implementation of actions. However, the

24 *Process* is understood as the sum of activities undertaken in a sequence or a somewhat logical order to achieve a product or result and through which some inputs are transformed (material or information), and to which they in turn are adding value in each activity until achieving a desired product or result (Narvaez, Lavell and Pérez, 2009).

systems as well as the entities that make them up are not articulated in the way they work and do not achieve adequate assimilation in disaster risk management (*Box 2.6*).

Following the process approach, it is possible to identify the most important profiles and entities responsible in the spheres of governance, awareness and information, risk reduction, and disaster management, additionally taking into account articulation among the other systems mentioned. On Table 2.10, a synthesis is made of functions and the levels of articulation in the process framework for risk management. Figure 2.7 presents, as an example, what the vision of the system could be and where those responsible for risk management in Public Administration participate in each one of the government's levels. Furthermore, aspects already mentioned are identified on how the entities that create knowledge disappear regionally and locally and how the SINA has another structure that does not depend on departmental government or municipalities, which means a challenge for the articulation objective.

From the legal perspective, the system that has the closest relationship to the SNPAD is the environmental system, which is logical, since the

greater part of risk situations are due to people creating imbalances in their relationship with the ecosystems. However, there is a need to unify criteria and to take on a more generalized practice.

Law 99 of 1993 created the SINA and the Ministry of Environment as a “governing body for environmental management and renewable natural resources, in charge of promoting a relationship of respect and harmony between men and nature. It also has to define, in the terms of the current Law, the policies and regulations that will govern the recuperation, conservation, protection, arranging, managing, using, and taking advantage of the country's renewable natural resources and environment in order to assure sustainable development” (Article 2). Furthermore, it established the CAR as public corporate entities entrusted by the Law to manage, within their jurisdiction, the environment and the renewable natural resources, and to make possible their sustainable development, pursuant to the legal provisions and policies of the Ministry. Likewise, pursuant to Article 5 of this Law, its function is to “Promote, in coordination with the Ministry of Interior, the execution of environmental management programs and projects for disas-

Box 2.6. Limitations in articulation among planning, risk management, environmental management, and education systems

- There is no solid consistency among the block of environmental regulations and those regulations relative to risk and disasters. There are some specific contacts that do not involve real joint action.
- There are insufficient knowledge levels in specific risk management subjects among civil servants in the educational sector in different territorial levels.
- The Comptroller's Office and the Attorney General's Office have sufficient power to carry out efficient control of the public entities at different levels, especially in environmental and risk issues that are not duly utilized.
- The subject of risk management in education is hardly taken into consideration.
- There are very few comprehensive training programs in risk management.
- There is an absence of a culture that incorporates risk management. The mass media are vaguely used in raising awareness.
- Intellectual production, as far as research, continues to be incomplete, so it is necessary to seek mechanisms to support and sustain already existing groups and to create new groups in this area.

Source: Ingeniar Ltda., 2011.

ter prevention and to coordinate such activities with the National Environmental System and the National System for Disaster Prevention and Response (created by Law 46 of 1988 and regulated by Decree Law 919 of 1989”) Additionally, Article 31 of the same Law assigns the CAR, among other functions, those of “Carrying out analysis, monitoring, disaster prevention, and control in coordination with other competent authorities, and aiding them in their environmental aspects in disaster and emergency prevention and response. It also, in coordination with municipal or district administration, should carry out res-

toration programs in high-risk urban areas such as erosion control, and watershed and reforestation management. Equally, it should provide counseling to the territorial entities in the preparation of environmental projects that have to be developed with resources provided by the National Royalty Fund or with others of similar allocation. The development of these functions has provided a first level articulation between both systems and some CAR. However, this articulation should be standardized and delved into deeper, generating more explicit guidelines that will not permit heterogeneous interpretations.



Municipality of Medellín (Antioquia, Colombia), 2011. Photography: Gabriel Jaime Arango Zapata.

TABLE 2.10. Risk management processes, people responsible and, coordination among systems

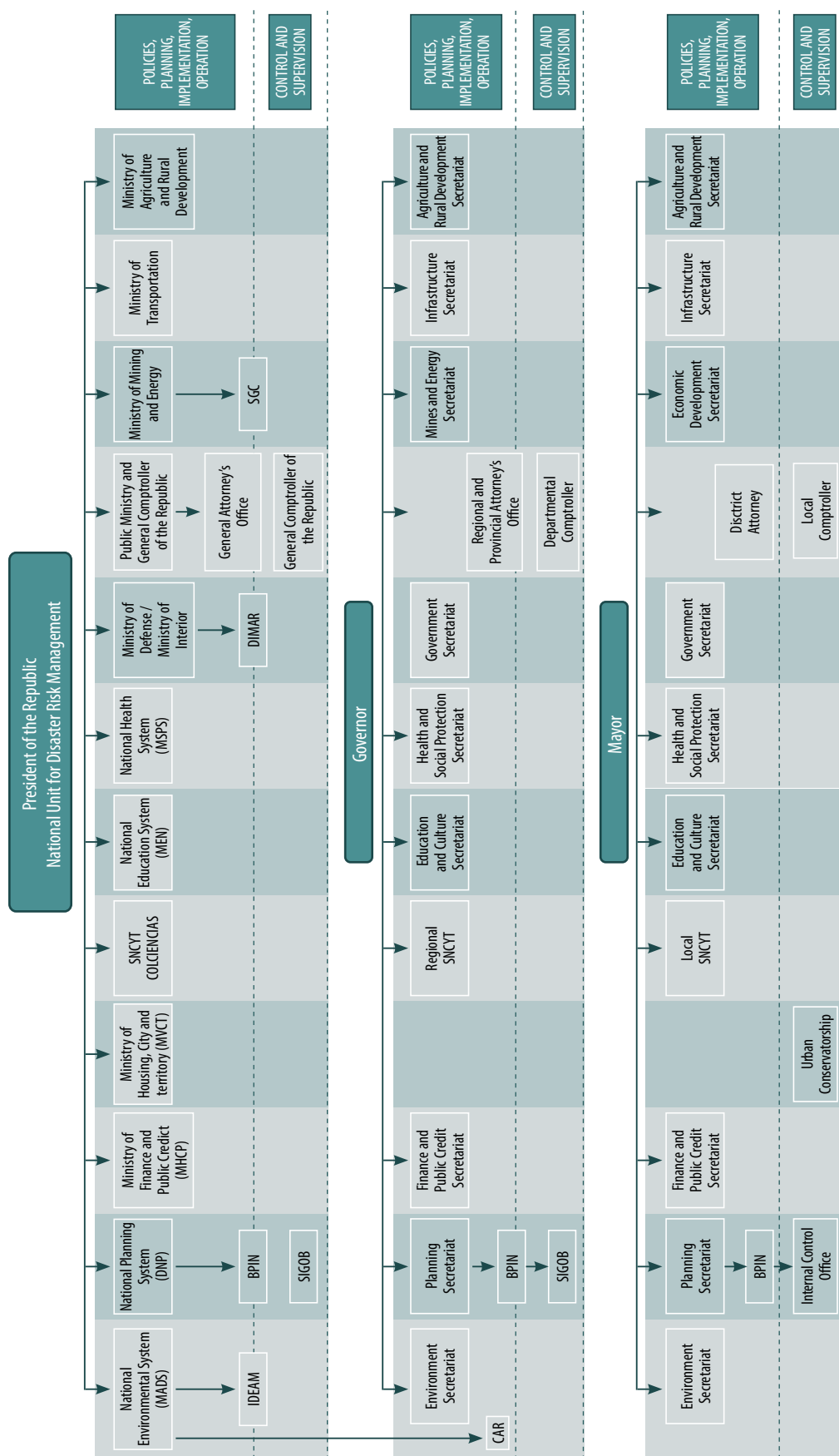
| RISK MANAGEMENT PROCESSES | | PROFILES AND RESPONSIBLE ENTITIES | COORDINATION AMONG SYSTEMS |
|---|--|--|--|
| GOVERNANCE <ul style="list-style-type: none"> • Formulate policies and plans for disaster risk management • Develop legal and regulatory frameworks for risk management • Define institutional and structural mechanisms to provide support to disaster risk management processes • Provide resources and generate capacities for disaster risk management • Integrate or articulate disaster risk management in development processes • Assure commitment and priority for disaster risk management in the political agenda • Monitor, evaluate and, control risk management • Define a strategy for financing disaster risk management | | <ul style="list-style-type: none"> • Coordinating entities, SNPAD disaster risk management promoters: UNGRD, Departmental Governments, City Halls, National, Regional and, Local Committees for Disaster Prevention and Response • Planning entities, strategic orientation for development: DNP, Departmental Planning Offices, Municipal and Sectoral Planning Offices • Control entities over public spending and achieving development goals: Comptroller's Office, Prosecutor, Ombudsman, etc • National entities in charge of finance management, providing and managing resources: MHCP, Departmental and Municipal Finance Secretaries • Congress, Department Assemblies, Councils | <ul style="list-style-type: none"> • National Risk Management System • National Planning System • National Control System • National Public Investment System |
| RISK KNOWLEDGE AND INFORMATION <ul style="list-style-type: none"> • Identify disaster risk factors (hazard, vulnerability and exposure), which also include underlying factors, their origin, causes and, transformation • Analyze and estimate disaster risk as well as its monitoring and supervision • Communicate risk perception and awareness in public information services | | <ul style="list-style-type: none"> • Coordinating, addressing and, articulating the National Information System: UNGRD, CREPAD, CLOPAD • Technical-scientific entities that raise awareness: Ideam, SGC, IGAC, DANE, Dimar • Academic organizations, research institutes, social monitoring networks and organizations, dangerous physical phenomenon observatories and entities dedicated to social and environmental problems: Colciencias, CAR, universities and, research centers • Entities in charge of environmental administration at different territorial levels: MADS, CAR, departmental governments and municipalities, NGOs • Educational entities: MEN, Departmental and Municipal Education Secretaries, teachers' networks (social communicators) • Sectoral entities, Ministries in the sphere of their competencies • Support organizations in educational, communication and, public information processes | <ul style="list-style-type: none"> • National Risk Management System • National Environmental System • Colombian Spatial Data Infrastructure • National Education System |

TABLE 2.10. Risk management processes, people responsible and, coordination among systems (continued)

| RISK MANAGEMENT PROCESSES | | PROFILES AND RESPONSIBLE ENTITIES | COORDINATION AMONG SYSTEMS |
|--|---|--|--|
| RISK REDUCTION <ul style="list-style-type: none"> • When it is feasible, take corrective and advanced actions on facing vulnerability or existing hazards • Intervene in new risks prospectively (or risks that may be created), by the prevention processes generated by exposure and vulnerability facing current or future threats, such as the ones that can be generated by climate change • Retain and transfer disaster risk Define and use financial protection instruments to cover immediate relief, rehabilitation and reconstruction (for example, reserve funds, contingent credits, insurance, CAT bonds, etc) | DISASTER MANAGEMENT <ul style="list-style-type: none"> • Preparation, understood to be <i>ex ante</i> actions related to early warning systems and capacity generation for response and recovery • Response, defined as <i>ex post</i> actions executed with the aim of assisting the population affected by the proximity or occurrence of disasters • Rehabilitation and, reconstruction of the socioeconomic, environmental and physical conditions using safety criteria with the explicit aim of not reconstructing the preexisting risk | <ul style="list-style-type: none"> • Municipal and departmental governments, headed by their mayors and governors: the CLOPAD and the CREPAD • Planning and territorial and sectoral development organisms (land use) • Sectors: Ministries and the corresponding departmental and municipal actors in the sphere of their competencies • Finance organisms in charge of financial protection strategies • Entities in charge of environmental administration at different territorial levels: MADS, CAR, departmental governments and municipalities, NGOs • Nonprofit social organizations and support and cooperation entities that promote specific risk reduction in exposed zones | <ul style="list-style-type: none"> • National Risk Management System • National Environmental System • National System for Public Investment Programs and Projects • National Housing System • Budgetary System (Finance and Public Credit, National Planning, Calamity Fund) • Different sectors and their systems |
| | | <ul style="list-style-type: none"> • Municipal and departmental governments headed by their mayors and governors: the CLOPAD and the CREPAD • President of the Republic, National Committees, UNGRD (only for emergencies that surpass local/regional levels) • Search and rescue entities responsible for the primary response: Red Cross, Civil Defense and, Fire Departments • Health service provider entities • Entities in charge of security: National Police and Armed Forces • Entities providing public services (energy, water, sanitation, telecommunications, gas, etc) • Organizations in charge of protecting the population and its livelihood • Sectoral entities in the sphere of their competencies, responsible for responding to disaster situations (transportation, environment, social) • Monitoring and alert technical-scientific entities: SGC, Ideam, Dimar, Corporation OSSO, etc. • Nonprofit social organizations and support and cooperation organizations (United Nations System, NGOs, private sector) in response activities and humanitarian aid in case of disaster | <ul style="list-style-type: none"> • National Risk Management System • National Fire Department System • National Civil Defense System • National Red Cross System • National Health System • Armed Forces • National Environmental System • National Housing System • Different sectors • United Nations System |

Source: Authors, 2011.

FIGURE 2.7. Outline of those responsible for risk management in public administration, horizontal articulation in Committees and vertical articulation in sectors or systems



Source: Authors, 2011.

2.6.2. Integral vision of the processes by type of risk

The mission processes in risk management, knowledge and information, risk reduction, and disaster management require managerial processes such as policy, regulatory, and planning formulation that orient their implementation and assure governance, as well as support processes that guarantee human, technical, and finance resources needed for their execution. With the purpose of looking into the current state of risk management policies on phenomena such as seismic activity and floods, a preliminary analysis is done for each one of the processes based on the existing policies and regulations.

2.6.2.1. Regulated seismic risk, even though there is no policy for its reduction

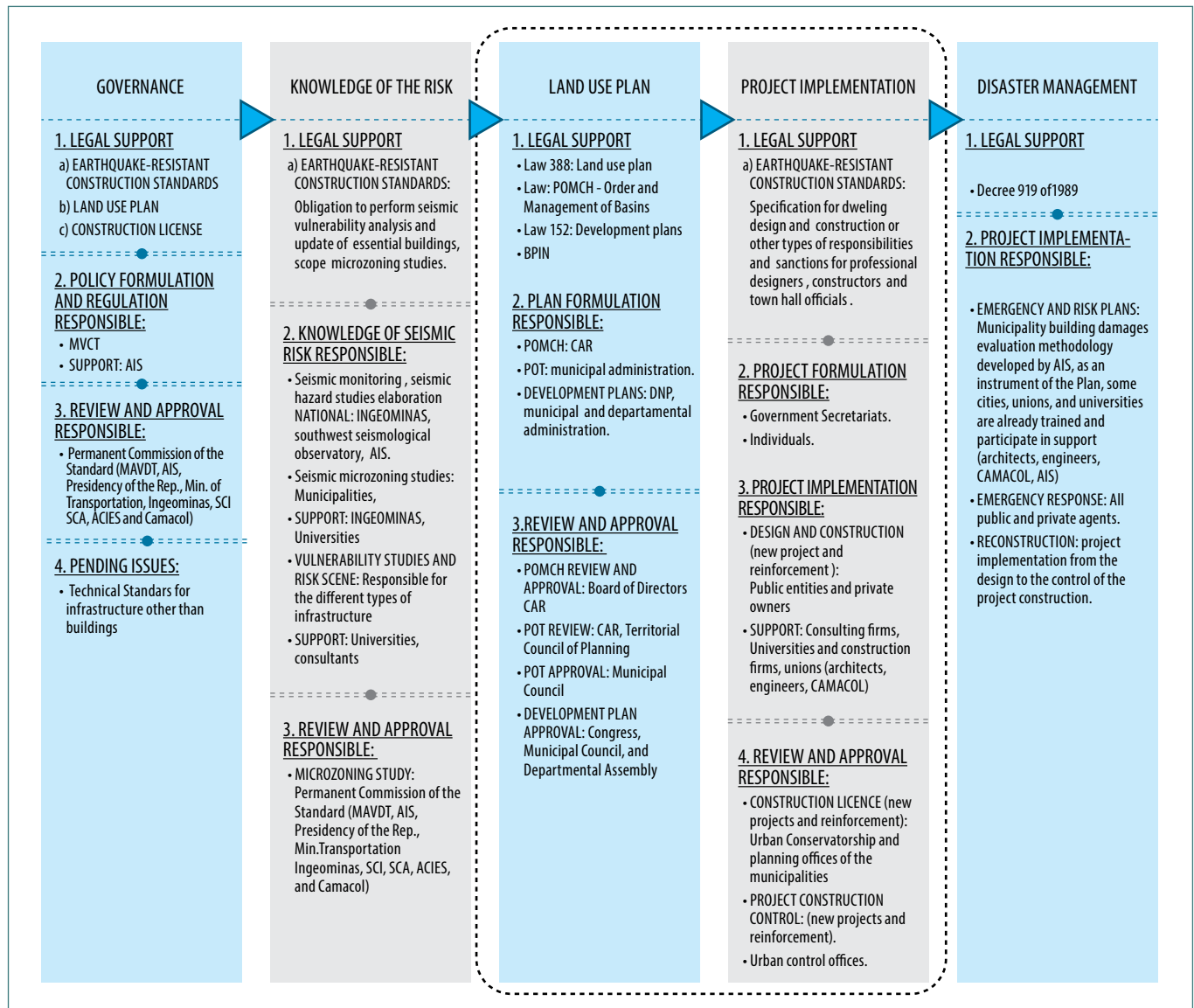
Seismic risk management is one of the best structured processes and it relies on the most judicial and institutional instruments. In analyzing the seismic issue, from the point of view of the public administration processes, it is possible to observe that it relies on seismic resistance regulations that define the minimum requirements that to some extent guarantee and comply with the primary objective of safeguarding human life in the event of a severe earthquake. And since it is a subproduct, it attains to property protection. Law 400 of 1997 (Colombian Seismic-Resistant Construction Regulations) created a Permanent Consulting Commission for the Seismic Resistance Construction Regime²⁵, ascribed to the MVCT. The Commission was assigned functions such as answering official and individual inquiries, providing direction and supervision for investigations executed within the Regulation, sending study commissions to where earthquakes have occurred, organizing seminars and refresher

courses, directing research on the causes of structural failures, and directing and providing consulting in carrying out microzoning of cities. (Figure 2.8).

Law 400 of 1997 also regulates other essential aspects so that the country progresses in reducing its physical vulnerability to seismic events. The seismic-resistant norms establish minimum criteria and requirements for the technical design, construction, and supervision of new buildings, as well for evaluating those constructions that are indispensable for the community's recuperation after the occurrence of an earthquake, so that they will be able to withstand seismic activity or others imposed by nature; increase its resistance to the effects that these produce, reduce to a minimum the loss of human life and the State's and the citizens' patrimony. The regulations additionally establish aspects such as (a) responsibilities and penalties incurred by professional designers, constructors, official civil servants, and city halls for breaching the Law; (b) the obligation to analyze seismic vulnerability, renovate indispensable buildings that provide service to the community and meet compliance deadlines (Seismic-Resistant Regulation-NSR 10, Titles IX y X, Articles 50 to 56); (c) the definition of the scope of the seismic microzoning studies; (d) determining the need to review designs and studies to obtain the planning permission, which should be executed by the Curators and Planning Offices; and (e) the need to rely on technical supervision processes during the construction.

25 Integrated by representatives of the following institutions: Presidency of the Nation, the MADS, MVCT, SGC, Ministry of Transport, Colombian Association of Seismic Engineering (AIS), Colombian Society of Engineers, Colombian Society of Architects, Colombian Association of Structural Engineering (ACIES), organizational unions related to the construction industry (Camacol), and a delegate from the National Consulting Committee, according to Law 361 of 1997.

FIGURE 2.8. Process for seismic risk management



Source: Authors, 2011.

The planning permissions provide an opportunity to verify the design compliance according to the seismic-resistant regulation, location, and abundance according to the POT regulations. The Planning Permissions Decree 1469 of 2010 regulates the provisions relative to planning permissions, understood as prior authorization, issued by the urban curator or by the competent municipal or district authority

in order to proceed with the urbanization work, zoning, or subdivisions of the lots. In addition, it also establishes norms related to construction work, expansion, adequacy, structural reinforcement, modification, building demolition, and the intervention and occupation of public space in complying with urban and building regulations adopted in the POT. These are the instruments that develop and complement it and the laws

and other provisions issued by the National Government. As far as the issuance of planning and building permissions for those real estate projects intended to be executed after a public disaster or calamity declaration, these are governed by Decree 2155 of 2001. Finally, Decree 0019 of 2012 in Articles 191 and 192 regulates the requirements to apply for a planning permission and the special regime in planning permissions.

2.6.2.2. The risk of floods, without sufficient policies or regulations to control them and without a clear role for those responsible for managing them

The historical lack of long-term policies and regulations that define technical guidelines on hazards and flood risk concepts have resulted in a generalized problem for a large percentage of the population and the infrastructure. The regulations for defending watersheds and the restrictions defined to protect water springs, pursuant to Decree 2811 of 1974²⁶, have not been adequate, nor do they constitute a comprehensive policy for flood management. It is necessary to regulate the return periods so that different projects should be designed and constructed and minimum criteria defined for works in flood protection and control, as has been established in other countries such as the United States and the Netherlands and the European Union Directive relative to flood risk evaluation and management.²⁷

Comprehensive management of floods requires the combination of land use planning and management to regulate and control land use, in addition to structural and community measures. Land use planning and management is the most effective measure in flood management. This strategy consists in defining compatible activities with the existing

types or levels of flooding risks and establishing environmental protection zones in those high-risk areas or on the rivers' borders. There are also physical and structural measures to reduce risk, including: erosion control and reforestation; the implementation of mitigation works such as retaining walls, drainage systems, dikes, spillways, or reservoirs; the definition of wetlands and swamp areas as flood buffering zones; likewise, joint development projects with communities, awareness campaigns to appropriately manage solid waste, drainage clearing, or implementing early warning systems. Some actions such as dike construction have relocated the problem to other zones (neighborhoods or municipalities) due to a failure of a comprehensive vision of the watersheds. Thus, it is necessary that design and construction criteria are regulated and that the competent authorities supervise watershed hydraulic activities in order to control the impact of different individual projects. There are other types of interventions to reduce vulnerability to exposed elements; for example, design and construction of buildings that are resistant, resilient, and prevent flooding; waterproofing strategies; placing structures above the level the water is estimated to reach; and construction of small retaining or relief structures that obstruct water from directly going into the building. Even though all of these are easy to implement, they have

26 A forest protector is only allowed in a radius of up to 100 m, and forced removal of natural waterways of water currents at a distance of up to 30 m, measured from the highest maximum water flow level within the minimum recurring period of 15 years.

27 The Water Framework Directive (Directive 2000/60/CE of the European Parliament and the Council of October 23 of 2000) was complemented with Directive 2007/60/CE, on the evaluation and flood risk management entered into force in November 2007. This Directive introduces a new approach which changes the focus of attention of policy, putting aside the defensive works against floods to focus on comprehensive risk management.

been insufficiently used, even in some regions where the indigenous or native populations had these practices and where they have since been lost due to the processes of colonization.

Watershed Use Planning and Management (POMCA), as a superior hierarchical regulation determining for the POT, is an essential instrument in watershed degradation prevention and risk management due to flooding and other hazards (Law 388 of 1997, Article 10). It is an instrument which definitely has not been taken advantage of. The regulations on management and utilization of renewable natural resources, as established in a watershed management plan, have precedence over the general provisions established in other administrative plans in regulating river currents or those established in permissions, concessions, licenses, and other environmental authorizations granted prior to the respective POMCA going into force. According to Law 1729 of 2002, the watershed²⁸ management plans' main objective is planning the use and sustainable management of renewable natural resources so as to be able to maintain or re-establish an appropriate balance between taking advantage of the economic resources and conserving the physical-biotic structure of the watershed, in particular its water resources. These are the principles and guidelines, among others: (a) the special protection nature of the high plateau, subplateaus, headwaters, and recharging aquifers, since these are considered areas of considerable ecological importance for the conservation, preservation, and recuperation of renewable natural resources; (b) the use of water resources, where human consumption will have priority over any other use and should be taken into account in the respective watershed planning; (c) *the prevention and control of the watershed's degradation*; and (d) *the consideration of hazards, vulner-*

ability, and environmental risk conditions, which may affect the watershed planning. Planning conceived as such constitutes the framework to plan the sustainable use of watersheds and the execution of specific programs and projects addressed to conserve, preserve, protect, and prevent deterioration and/or restore the watersheds. According to the PND 2010-2014, to date, 83 POMCA have been approved, none of which have adequately incorporated the risk component.

Urban licenses require the presentation of mitigation studies, but these are not regulated at a national level. Decree 1469 of 2010 in its Article 22 determines that when a plot of land is located in a risk zone and in a high- or medium-risk zone of geotechnical or hydrological origin, permit applications for new housing developments should attach detailed hazard and risk studies of landslide and flood phenomena that allow to determine the feasibility of future development, provided that hazard and/or risk mitigation is guaranteed. These studies should include mitigation design measures and these will be prepared and signed by skilled professionals in this area, who jointly with the developer will be responsible for the correct execution of the mitigation works. In all cases, mitigation works should be executed by a responsible developer and by default by the holder during the term of the license.

28 Known as hydrographic basin, a watershed is the area of superficial or underground waters that flow into a natural network with one or several natural channels, in continuous or intermittent volume, which flow into a larger course and which in turn can end in a main river, in a natural water deposit, in a swamp, or directly in the sea.

Multiple actors, uncoordinated actions, and lack of clarity in responsibilities are factors that result in improper interventions in watersheds, thus increasing the existing risk. Among other entities, the different CAR, municipalities, and departments intervene in managing the

majority of watersheds in the country. Hence, POMCA is required to orient the required coordinated actions, which congregate the budget participation of the actors involved. Box 2.7 presents a case study in the medium and high watershed management of the Bogota River.

Box 2.7. Role of the different social actors involved in the medium and high watershed management of the Bogota River

The entities that have the responsibility of controlling and managing floods in the medium, and high watersheds of the Bogota River are part of the District Capital entities: the Bogota Water Company (EAB), the DAMA, the Bogota Power Company (EEB) and the Fund for Emergency Prevention and Relief (FOPAE), and at the national level there is the Autonomous Cundinamarca Corporation (CAR). Only two of them, CAR and EAB, comply with water regulation functions. Since 2004, the Cundinamarca Administrative Court ruled that the CAR is responsible for the hydraulic suitability of the River, which includes the dredging of the riverbed, its extension, the construction of dikes on both sides and the adequacy of the numerous bridges that cross the river. In turn, EAB has the responsibility of the environmental sanitation of the river, including the construction and operation of the wastewater interceptor systems and the open canal systems as well as the operation of the Wastewater Treatment Plant (PTAR) El Salitre, as specific operating elements of the city's drainage system.

The river's water and the reservoirs are used as supply aqueducts to cities such as Zipaquirá and Bogota. The water is also used, for irrigation in the CAR La Ramada irrigation district and in numerous farms and private companies for agrarian, industrial, and recreational use. In addition the river is the final emissary of all the storm and sanitary sewer systems of all the populations of La Sabana. It is contaminated to the highest degree all along the length of its course from the town of Villapinzón (Cundinamarca), where leather crafts industries contaminate with tannins and dangerous chemicals.

The CAR exercises flood control functions by means of pumping the Bogota River to the Tomine reservoir. The other two existing reservoirs, El Neusa and the Sisga, have much less capacity and control very small parts of the watershed, even though to a lesser extent they also obviously contribute to controlling floods. Cleaning up the river was finally started with a competent megaproject led by CAR in the second semester of 2011.

EEB is a very important user owing to a hydroelectric generation chain initiating from the Salto del Tequendama. Furthermore, the Tomine reservoir operates with the same purpose that, however, is responsible to the CAR in flood control, by pumping up to 16 m³ per second from the Bogota River. With so many actors involved, EEB has thought about selling the Tominé reservoir to another user (CAR or EMGESA), since recently this company does not own all of the storage space, though it is accountable for all the infrastructure maintenance.

Until very recently, there were very evident conflicts among District Capital entities and the CAR. The latter entity, having regional scope in all the watersheds, is the one that has the greater administrative capacity to regulate river waters, since it has the environmental authority to control water resources. Furthermore, it has the necessary budget to carry out works. The CAR relies on a Hydrological Committee related to water resource planning with the District's entities, but it does not make decisions on behalf of the CAR, thus being very limited in its efficiency. The FOPAE in 2006 created the Emergency Hydrological Committee that only operates in case there is a significant increase in the water level.

In summary, in the case of the Bogota River basin, social, economic, and political pressures are identified which have contributed to an inadequate planning process for the city and the region, being fundamental to implementing regulatory and monitoring actions and control to reduce conflicts of use and territorial expansion disarticulated to the reality of the territory.

2.7. RECOMMENDATIONS AND GREAT CHALLENGES TO STRENGTHEN RISK MANAGEMENT GOVERNANCE

| RECOMMENDATION | PRIORITY High(H), Medium (M) | RESPONSIBLE |
|--|---------------------------------|--|
| Convert risk management into a State policy and overcome existing imbalances in the System by adjusting and providing uniformity to the regulation and institutional framework | | |
| <p>Adopt a national policy in disaster risk management that is comprehensively articulated in the public administration and that provides support to the territorial entities and promotes the creation of policies and specific sectoral action plans.</p> <ul style="list-style-type: none"> Disaster risk management should solve social problems and be politically visible, so that it can be anchored in the public agendas at the different territorial levels, and so it can lead to collective learning and coexistence with the natural environment through development planning instruments. Formulate and implement specific policies/strategies so that it acts as a general regulation policy for each one of the geological and hydrometeorological phenomena, hence giving priority to the most recurrent ones. Articulate specific policies/strategies by incorporating variables related to climate change in making decisions at a sectoral and territorial level. | H | Presidency, DNP, UNGRD, with the support of the National Committee for Disaster Prevention and Relief /GRD |
| Create a risk management statute that is consistent with the current regulation and deals with the identified gaps as far as defining public and private responsibilities. | H | UNGRD with the support of the National Committee for Disaster Prevention and Relief /GRD |
| <p>Reorganize the System by technically and financially strengthening the managing capacity at the different territorial levels and the participation of the private sector.</p> <ul style="list-style-type: none"> Declare the local level as the base of the System and its principal space of intervention. Strengthen the departmental level in its articulatory role between national and local governments and among the municipalities under its jurisdiction. Strengthen the national level in its strategic role of formulating and implementing policies based on the needs and capacities of the territorial entities seeking to balance the knowledge process, risk reduction, and disaster management. Strengthen the institutional order and the individual capacities of the different entities to implement the knowledge processes, risk reduction, and disaster management. | H | Presidency, DNP, UNGRD with the support of the National Committee - PAD/GRD |
| Give priority to strategic orientation, technical leadership, authority, and control among the functions that the National Unit for Disaster Risk Management has as head of the System. | H | Presidency |
| Increase the effectiveness and efficiency of investments in risk management through strategic planning, coordination, monitoring, and control among territorial levels | | |
| <p>Promote the adoption of Territorial Risk Management Plans (PTGR) as long-term instruments to orient the POMCA, POT, and PD, and to articulate the investments made by public and private actors.</p> <ul style="list-style-type: none"> Strengthen the knowledge process and information disclosure in the sectors and at all territorial levels in order to accomplish responsible risk intervention. Implement permanent technical assistance strategies in small municipalities in order to advance in knowledge of hazards and risks at an adequate scale to make decisions. Articulate the spheres of risk management, science and technology, education, and environment systems to provide continuity and sustainability to proposed actions. Implement professional training skill strategies to effectively progress in disaster risk reduction. Advance toward an approach that transcends emergency response in disaster management. | H | DNP, UNGRD, MVCT, MADS |
| Constitute a national cofinancing (fund) mechanism to encourage disaster risk management investment and capacity creation programs at territorial and sectoral levels. | H | UNGRD, MHCP, DNP |
| Adopt risk reduction objectives in policies and plans and assure their fulfillment by implementing progressive strategic planning based on results. | H | UNGRD, DNP |

| RECOMMENDATION | PRIORITY High (H), Medium (M) | RESPONSIBLE |
|---|----------------------------------|--|
| Increase the effectiveness and efficiency of investments in risk management through strategic planning, coordination, monitoring, and control among territorial levels (continued) | | |
| Strengthen the mandatory incorporation of disaster risk management criteria when formulating public investment projects (BPIN). | H | DNP |
| Adopt a strategy to monitor risk management responsibilities and investments at the different territorial levels. | H | Presidency, UNGRD, DNP |
| Strengthen local management's territorial capacity with the aim of reducing disaster risk generation and accumulation | | |
| Adopt a national strategy to strengthen municipal risk management that responds to the existing differences in municipal capacity. | H | Presidency, DNP, UNGRD, with the support of the National Committee - PAD/GRD, Governorships |
| Strengthen the capacity of departmental governments as natural coordinating agencies of the municipalities by clarifying their competencies in disaster risk management according to concurrence and subsidiary criteria as established in the Constitution and the possibilities offered by the Territorial Land Use Planning Organic Law. | H | Presidency, DNP, UNGRD, with the support of the National Committee - PAD/GRD, Governorships |
| Reduce flooding and landslide risk by planning, investment, monitoring and control, and the articulation of different agents responsible for watershed management | | |
| Assign responsibility for the rivers and water bodies management to a State entity and establish roles and coordination mechanisms of the different agencies involved. | H | Presidency, DNP, MADS, MT |
| Adopt a regulation to control and manage flooding and landslides, including the definition of the highest acceptable risk, technical standards for risk evaluation and mitigation, and a strategy for its implementation, monitoring, and control. | H | MADS and the Permanent Committee for hydraulic management of rivers and water bodies |
| Understand the depth of the risk management role and its link to environmental management, development management, and adaption to climate change so as to be able to incorporate it in the decision-making process at municipal and territorial levels. | H | Presidency, DNP, UNGRD, with the support of the National Committee for Disaster Prevention and Relief /GRD |
| Regulate the addition of a master control plan for floods and landslides as an integral part of the POMCA. | H | MVCT, MADS, Ideam, Permanent Committee for hydraulic management of rivers and water bodies |
| Reduce risk generation and disaster impact through policies and sectoral plans | | |
| Adopt risk management policies and plans in every Ministry. | H | All of the Ministries |

Incorporate risk management as a State policy and overcome existing imbalances in the System through the adjustment and coordination of a regulatory and institutional framework

Adopt a national policy in disaster risk management that is comprehensively articulated in the public administration, provides support to the territorial entities, and promotes the creation of policies and specific sectoral action plans. The risk management policy, as a comprehen-

sive part of public administration, should be articulated in planning, execution, monitoring, evaluation, and control of the economic, social, cultural, technological, environmental, and political strategies. It should be more decentralized, participatory, democratic, and results-oriented. This policy should consider risk knowledge and information, risk reduction, and disaster management as well as its contribution to homeland security, social welfare, quality of life, and sustainable development, starting from creating regional consensus spac-

es and cooperation mechanisms among municipalities, governments, the CAR, regional bodies, if any, sectors, and other National Government agencies. Likewise, the policy would be in charge of promoting policy creation and sectoral action plans so that each sphere defines its responsibility in the security of its infrastructure, minimizes loss of life and the impacts on the means of production facing disaster risks, and ensures the ongoing rendering of service. Last, but not least, it should support the strengthening of capacity and the promoting of complementary and subsidized strategies that endorse municipalities in territorial risk management policy.

- **Disaster risk management should solve social problems and be politically visible, so that it can be anchored in the public agendas of the different territorial levels, and so it can lead to collective learning and coexistence with the natural environment through development planning instruments.** This means that it should be realized that the local capacity for risk management is limited (in the availability of economical, technical, and human resources). Priority should be to encourage focusing on a complementary and subsidiary approach by using the process of gradual decentralization for determined management actions. In the same manner, by establishing control actions on departmental levels, it would allow said territorial agencies to give substantial support to risk management. This should be done through articulation processes between levels and instruments, and clearly stating the terms of the functions, responsibilities, and scopes.
- **Formulate and implement specific policies/strategies as an overall policy regulation for each one of the geological and hydrometeorological phenomena, giving priority to the most recurrent ones.** Specific policies/strategies for

phenomena should include definitions for all the processes of risk management and public management for each kind of risk, identifying and defining the goals and expected results. These policies and strategies should identify the needs related to knowledge and information, the articulation with planning and land use planning, implementing risk reduction projects, disaster management, and monitoring and control mechanisms. The formulation of these policies/strategies demands the establishment of processes and subprocesses including their activities and responsibilities, clearly defining roles and legal, technical, and financial instruments in order to ensure adequate implementation of these activities.

- **Articulate specific policies/strategies by incorporating variables related to climate change in making decisions at a sectoral and territorial level.** Promoting the articulation between disaster risk management and adaptation and mitigation of climate change demands clarifying new institutional agreements, developing and making available information with an effective resolution for decision making, defining criteria in order to incorporate it in the planning instruments, and developing monitoring and control mechanisms.

Create a risk management statute that is consistent with the current regulation and deals with the identified gaps in the definition of public and private responsibilities. A legal reorganization of all regulation related to risk management is required, through a statute which will also allow complementing other aspects that are not yet regulated. For each of the different phenomena, processes involved in knowledge, risk reduction, and disaster management should be defined. This should include the actors who will be called to participate at the different territorial levels, their

specific functions and responsibilities, and how they can articulate efforts, according to their capacities and resources, assuring the fulfillment of the principles of concurrence, subsidiarity, and complementarity as established in the Constitution. As far as the materialization of risk situations, it is indispensable to regulate clearly the different types of situations (emergencies, disasters, calamities). The serious calamity concept that is dealt with in Article 215 of the Constitution should be made compatible with the hypothesis of the occurrence of relevant events defined in the existing regulation, on which the President of the Republic can base his disaster declaration decision as is established in Decree Law 919 of 1989, and the responsibilities and mechanisms in the process of recovery have to be regulated (rehabilitation and reconstruction). Contact points between sectoral legislation and the disaster risk issue should be strengthened, as will be seen in Chapter 4. Participation and intervention of private persons in risk management require specific regulations, as will be explained in detail in Chapter 5.

Reorganize the System by technically and financially strengthening the managing capacity at the different territorial levels and the participation of the private sector. A normative as well as structural transformation of the System is needed in relation to its mission, vision, and the goals of the State's and society's actions regarding risk and disasters. Within the framework of politics and regulation elements, it is necessary for the System to be coherent with the Constitution, by taking into account the need to adapt the principles and orientations included therein. Moreover, it is indispensable to introduce concepts for a clearer vision of risk management and substitute the present idea of disaster²⁹, by reducing duplication of functions and inefficiency.

Mechanisms that will guarantee coordinated efforts should also be established, so that all the actors clearly understand where the System is going and what their contribution will be to achieve the proposed goals.

- **Declare the local level as the SNPAD base and as its principal space of intervention.** The development of autonomous and participative principles established in the Constitution of 1991 should propose flexible structures that are adjustable to territorial conditions and that can establish not only vertical relations (toward higher territorial levels), but especially horizontal ones (toward other units of the same territorial level). It should specify what are the regular channels and the participative functions of the citizens on this issue. Creating administrative branches specialized in risk management seems to be an important condition toward success in this management. The formal structure of the Committees should be replaced by the normal structure of local and regional administration, through which management and decision making are oriented by planning. The Mayor should include in the Development Plan, which is based on government planning, the investment components of the POT with regard to risk management.
- **Strengthen the departmental level in its role as articulator between national and local governments and among municipalities under its jurisdiction.** The departments have to coordinate the action of two or more municipalities with common risks, bridging the local levels with the national level

29 Per the proposed Draft Law filed in Congress of the Republic in July 2011 (Ingeniar Ltda., 2011).

of government. Applying concurrence and subsidiary principles is the closest level to the municipalities and therefore their first resource to produce action.

- **Strengthen the national level in its strategic role of formulating and implementing policies based on the needs and capacities of territorial entities seeking to balance the knowledge process, risk reduction, and disaster management.** The issue has not received enough importance and has not been taken by different sectors, or actors at different territorial levels. In spite of the constant manifestations of different kinds of events, effective policy directives have not been proposed for recurrent issues like flooding. Addressing the topic reveals lack of information, analytical deficiency, and lack of goals and adequate instruments. It is necessary to promote the actions of different national organs and through these the different territorial levels. Technical and financial support should be given to regional and local levels of the system by evaluating development and applying a clear national policy. This would guarantee the existence and functioning of a Comprehensive Information System that would facilitate efficient decision making.
- **Strengthen the institutional order and the individual capacities of the different entities to implement the knowledge processes, risk reduction, and disaster management.** Strengthening mechanisms should be generated for improving capacities, technical assistance, cofinancing, and incentives to promote a better and more efficient risk management by territorial authorities. It cannot continue formulating institutional strengthening policies without detailed information on the situation of its local capacity and without active participation of its executors and the direct beneficiaries (departments and mu-

nicipalities), or without referring to concrete problems that are intended to be solved or modified in each location or region.

Give priority to strategic orientation, technical leadership, authority and control, and other functions that the UNGRD has as the manager of the System. The UNGRD should assume transparent strategic leadership, maintain its main coordinating role in risk management policy at the national level, and assume related functions with authority and control. Likewise, it should have human resources that possess advanced technical skills and strengthen its internal operating procedures. Leadership in risk management policy not only implies coordinating activities performed by national entities, but also being the interlocutor agency between all government levels, fulfilling the principles of coordination, concurrence, and subsidiarity. The complexity of risk management demands advanced technical ability and requires formulation of integrated policies through sectoral limitations. Administration based on inputs should be replaced by accountability based on production and results. Furthermore, it should work on making visible the accomplished projects carried out by the Unit and the different entities at national and territorial levels. The Information System has to be strengthened so it becomes a support instrument in all the processes. Success of management depends on the skills and the coordinating and convening mechanisms they generate. Its functions and activities should be concentrated on leadership and strategic guidance, transferring the operational responsibilities and the emergency management efforts to other actors. Its responsibility is also to generate incentive systems for the different entities of SNPAD, which are linked to strategies and priorities established and agreed to in

the National Plan for Risk Management. It is essential to focus on management strategies, financial resources, and organization in critical success factors.

Increase the effectiveness and efficiency of investments in risk management through strategic planning, coordination among territorial levels, and monitoring and control

Promote the adoption of Territorial Risk Management Plans as long-term instruments to orient the POMCA, POT, and PD, and to articulate the public and private actors' investments. For a Risk Management System, planning instruments are essential for several processes. This implies formalizing, by means of a regulation, the planning process at a necessary stage in all fields of institutional action, including formulating the National, Departmental, and Municipality Risk Management Plans, and the way they are linked to the national and territorial Development Plans. In this manner, they assure the incorporation of programs and projects in the respective institutional investment plan, and also complement the different financial sources so that investment can be more effective. Said Plans should be dynamic instruments and should be frequently updated, and incorporate not only the related activities with the mission processes of risk management (knowledge, risk reduction, and disaster management), but also the strengthening of the SNPAD and its support system capacities, such as financing and the use of relevant information for risk management. This should be complemented by a systematic monitoring of the Plans as a control element for the implementation of actions developed by the National Risk Management System.

- **Strengthen the knowledge process and information disclosure in the sectors and at all territorial levels in order to accomplish responsible risk intervention.** It is fundamental to delve deeply into studies of hazard risk and analysis by prioritizing the hydrometeorological phenomena with the objective of clarifying their scope on making effective decisions (about land use planning, regulating mitigation projects, and Risk Management Plans) by government agencies. The requirements for updated information with the appropriate details, and the criteria and standard methodologies to prepare studies are some of the recommendations that should be followed immediately by local agencies.
- **Implement a permanent technical assistance strategy in small municipalities in order to advance in knowledge of hazards and risk at an adequate scale for decision making.** Taking into account that detailed studies are required to understand and take needed measures for reducing risk, managing land use planning, and identifying projects for risk management, it is necessary to promote the understanding of risk conditions by implementing a strategy where regional and national entities support the municipalities in the knowledge of their surroundings.
- **Articulate the spheres of risk management, science and technology, education, and environmental systems in order to provide continuity and sustainability to proposed actions.** The National Science and Technological System demonstrated in 2002 a significant advance made by formulating the Strategy to Strengthen Science, Technology, and Education for Risk Reduction and Disaster Response in coordination with the National System for Disaster Prevention and Response and the National Environmental System. All these were meant to identify strategies for risk reduction. The

reordering of the strategic components and strengthening of the coordination and monitoring mechanisms are the inputs for sustainability of risk management in the country. On the other hand, prevention culture should be promoted, in which governments have to actively support the right to information, and likewise in assisting the population in knowing their rights and responsibilities related to this information. This will transcend the ability of decision making.

- **Implement professional skill formation strategies to effectively advance in disaster risk reduction.** Designing and adopting training strategies on risk management will improve the feasibility to effectively implement risk reduction actions. This should be totally managed with the university sector and it has to identify the training and knowledge needs of the target population (personnel linked to the subject in the territorial and sectoral agencies), context, and risk conditions.
- **Advance toward an approach that transcends emergency response in disaster management.** According to SNPAD decentralization, response begins at the local level. Small municipalities should have an organization, coordination, protocols, and the required endowments for correct response. This information is included in the Municipal Emergency Plans. Even if some cities and towns have said Plans, they still lack adequate implementation. The same occurs at the departmental and at the national level. Strategies and organization for disaster management are very weak in coordination, logistics, communication, and capacities. It is imperative to start from the risk scenarios, planning, defining responsibilities, instruments and mechanisms for disaster management as well as for the rebuilding processes. Emergency action responses in themselves are not able to reduce the factors that

constitute risk. For this reason it is necessary to consolidate a more integrated approach of risk management with the due articulation of planning spheres, land use, development, and adaptation to climate change, as mentioned in this chapter. Specifically in the disaster management field, it is necessary to advance in constructing instruments such as the National Emergency Plan (this refers to its interinstitutional structure, functions, and responsibility definition, coordination, and communication mechanisms, and implementing, activating, and control actions). Additionally, clarity is needed for the actors responsible for the acting protocols, delving into the EDAN exercises to articulate them in the recovering and rebuilding activities, and also to integrate them with the rest of the instruments designed for disaster risk management.

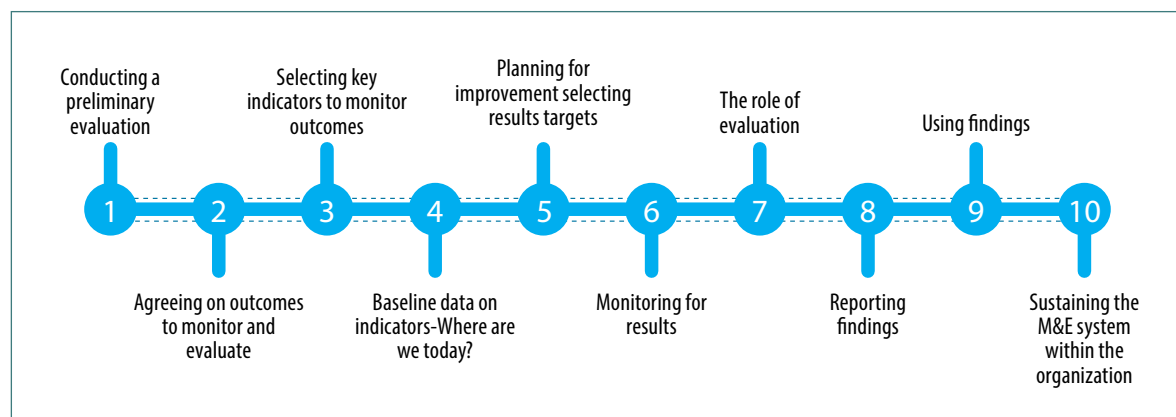
Constitute a national cofinancing (fund) mechanism to encourage disaster risk management investments and capacity creation programs at territorial and sectoral levels. The National Calamity Fund, as the main financing instrument of SNPAD, should move toward being a Fund for Risk Management and be articulated in such manner that activities prioritized by the Committees or Commissions of the different processes of risk management can be cofinanced. The priority is to strengthen projects in territorial and sectoral capacity in order to be able to change paradigms and practices in this sense, and encourage through cofinancing projects that strategically contribute to risk reduction and with the support of other sectoral funds help reduce financial gaps that exist in territorial entities. It is necessary to standardize procedure for the presentation and approval of projects related to knowledge and information, risk reduction, and disaster management. This fund should be part of a financial strategy which allows risk transference and retention.

Adopt risk reduction objectives in policies and plans and assure their fulfillment by the implementation of progressive strategic planning based on results. Modern risk management is being challenged to move toward strategies that allow more transparency and effectiveness in investments. The viewpoint of monitoring and evaluation, based on results, makes it possible and can be applied at the level of projects, programs, and policies. This methodology requires role and responsibility definition when generating products and results by those involved. It allows the establishment of a clear, controllable relation between the achievements expected and the means assigned to this end. It strengthens articulation of investments and territorial, sectoral, and institutional coordination. It requires definition of baselines and appropriate performance indicators making easy the use of incentives in terms of performance recognition. It has to be admitted that this is not an easy task; it needs commitment, time, and effort, but international experiences show it is worth the while for its proven successful performance.

Strengthen the mandatory incorporation of disaster risk management criteria when formulating public investment projects (BPIN). For risk

management to be incorporated effectively in the planning and execution processes of public investment, it is important to be explicit when formulating projects filed at the Public Investment Project's Bank (BPIN). Even though there are some initial advances to incorporate the subject, the General Adjusted Methodology should be reviewed, as this determines the minimum contents of preinvestment studies, examines the analytical components, project evaluation, and registration cards. This method should identify and evaluate the kind of damage and probable loss that could affect the investment. It takes into consideration different alternatives presented and potential hazards in land, material, construction techniques, etc. Its purpose is to ensure choosing the safest and most cost-effective alternatives. It should evaluate the impact the project could have in creating new risks and the results of these analyses should be included in the different preparation modules of the project. This process is to be accompanied by training and technical assistance at sectoral and territorial level with the aim of reinforcing the most important concepts of risk management, thus assuring its adequate implementation. This initiative is currently proposed as a goal of PND 2010-2014.

FIGURE 2.9. Ten steps to design, create, and support a results-based monitoring and evaluation system



Source: Translated from Zall and Rist, 2006.

Adopt a strategy for monitoring risk management responsibilities and investments at the different territorial levels. Strengthening of policies and plans, clarification of roles and those responsible, and definition of baselines and performance indicators should accompany the strengthening of monitoring and control processes. Its importance lies in the fact that authorities and civil society should perform these monitoring and control tasks during the whole process of public management, and not only in the final result, where the relevancy of a joint effort is required to guarantee articulation and continuity of action for territorial planning and risk management.

Strengthening local capacity for land use management, in order to reduce the creation and accumulation of disaster risks

Adopt a national strategy to strengthen municipal risk management that responds to the existing differences in municipal capacity. There is a need to revise and discuss the convenience of assigning equal functions in all municipalities dealing with risk management, considering the possibilities of executing activities in municipalities with less than 50,000 inhabitants and category 3 and 4 departments. This is due to the limited capacity to function and act by these organizations, also due to restrictions of their professional personnel, their technical training, and restricted access to available technology (Ghul, et al., 1998). As a result, it is imperative to analyze the possibility of upgrading management ability in the framework of concurrence, complementarity, and subsidiarity as described in the Constitution through the following actions: (i) redefine assigned responsibilities according to the potentials and requirements found in different typologies of the municipalities and departments, in a sphere (if a transversal issue like risk management may be so called) that Law 715

of 2001 did not take into consideration; (ii) reflect on the possibility of applying certification mechanisms in the municipalities through risk management procedures, giving priority to issues such as risk knowledge, planning, and land use planning; (iii) expand the responsibilities and competencies of the departments and the CAR to provide support to risk management at the municipal level; (iv) provide more coordination between the different levels of government by completely developing the principles of concurrence, complementarity, and subsidiarity; (v) identify and analyze successful association experiences in rendering risk management service in order to adapt them in horizontal cooperation processes among territorial entities; (vi) study information and risk knowledge strengthening mechanisms through decentralization of technical-scientific organisms, such as SGC, Ideam, and the articulation of universities and research centers through the National Science and Technological System. Additionally, clearly define the responsibilities of the CAR, departmental governments, and other national and municipal entities, and strengthen the capacities of the municipalities to cover information needs that are required for risk management as part of management and territorial planning.

Some strategies have been listed in Table 2.11 differentiated according to municipal capacity, by identifying key aspects to strengthen risk management governance. To identify differentiated strategies, it was necessary to carry out a diagnosis of risk conditions and institutional capacities according to the information presented in Chapter 1.

Strengthen the capacity of departmental governments as natural coordinating agencies of the municipalities by clarifying their competencies in disaster risk management according to the concurrence and subsidiary criteria as established in the Constitution and the possibilities offered by the Territorial Land Use

Planning Organic Law. Recent approval of this law offers alternatives to strengthen the function of territorial entities in risk management. This applies especially to the departments where the common denominator of almost all the municipalities is extreme poverty and very inadequate institutional capacity. Some of these departments are Amazonas, Guaviare, Guainia, Vaupes, and Vichada, the majority of municipalities in the Pacific Coast departments (Choco, Cauca, and Nariño), and also a large part of the Caribbean municipalities (La Guajira, Magdalena, Sucre, and Cordoba, with the exception of the capitals of these departments). This law also promotes more delegation of functions and competencies at national level in territorial order, elimination of duplication in the central administration, and decentralizing territorial entities, strengthening regional administrations and planning, the department as an intermediate level of government, the municipality as the fundamental entity of the political-administrative division of the State, joint and articulated action of the different government levels through alliances, associations, and delegation agreements, and the design of regional administration models to develop special projects, increase productivity, and modernize the administration of the municipalities.

Reduce flooding and landslide risks by planning, investment, monitoring, control, and the articulation of different agents responsible for watershed management

Assign responsibility for river and water bodies management to a State entity and establish roles and coordination mechanisms of the different agencies involved. It is necessary to define a responsible authority for the hydraulic management of rivers, so that said as-

signed entity may perform functions in policy and regulation formulation, define responsibilities and roles, and coordinate through the Permanent National Consulting Committee for the Hydraulic Management of the Rivers³⁰. This Committee will be in charge of providing technical advice to the competent authority, responding to queries both official and private, complying with the functions assigned by the authority in administering and monitoring of investigations carried out, sending study groups to affected areas, organizing seminars and refresher courses and orienting and providing advice in carrying out flood studies.

Adopt a regulation to control and manage floods and landslides including the definition of the highest acceptable risk³¹ and technical standards for risk evaluation and mitigation, and a strategy for its implementation, monitoring, and control. It is necessary to unite parameters for acceptable risk with the purpose of establishing technical standards to produce zoning maps and evaluate susceptible places or flood and landslide threats (return periods, safety factors, etc.) in order to define territorial land use, review criteria that establish urban and rural protected zones, define the minimum

30 The Permanent Consulting Committee for Hydraulic Management of the Rivers, just like the Permanent Committee for Seismic Resistance, could be formed by the Presidency of the Republic, Ministry of Housing, City and Territory, Ministry of Environment and Sustainable Development (in the past these Ministries were MAVDT), Ministry of Transport, Ideam, IGAC, Colombian Society of Engineers, Colombian Association of Hydraulic Engineers, Asocars, a representative of the departmental government, and another one from the academia.

31 Accepted risk is that which the community is willing to undertake in exchange for a determined rate or level of benefits. In the design of engineering works, it has been a common practice to use this concept implicitly in order to achieve a level of protection and safety that justifies the investment, taking into account as reference the useful lifespan of the works. For this effect safety factors are used that in probable terms "reasonably" cover the uncertainty of the potential magnitude of external actions, the imprecision of the analytical model, and the approximation of a simplified hypothesis (Cardona, 1990).

needed guidelines for design and making of structural control measures, lessen the impact of less vulnerable buildings, depending on the kind of flood, the recurrence period, the estimated height of water level, its extension, and when appropriate the current's velocity or the flow of water, among other factors. It should also establish those responsible and the implementation methods, and monitoring and control of said regulation, depending on the kind of structures or projects.

Understand the depth of the risk management role and its link to environmental management, development management, and adaption to climate change to be able to incorporate it in the decision-making process at municipal and territorial levels. Institutional mechanisms and existing problems between risk issues and climate change should be incorporated in the planning processes of public development and investment. This requires a definition of guidelines and action spheres to clarify responsibilities and their scope in each area, avoiding overlapping roles that are incompatible in terms of the ecosystem, watersheds, or government entities. In addition, efforts to strengthen disaster risk management should go hand in hand with actions to fight poverty, in such a manner that there will be real intervention that will reduce vulnerable conditions.

Regulate the inclusion of a master control plan for floods and landslides as a comprehensive part of the POMCA. Land use through the definition of protected zones and the strict regulation for their use is the main and most effective tool to reduce or control the impact of floods, landslides, and other phenomena. That is why the POMCA are of vital importance as instruments of the highest hierarchy and most determinant in territorial land use planning (Decree 1729 of 2002, Article 17). In the framework of the POMCA guidelines, where preventing and

controlling degradation of the basin and taking into account hazardous conditions, vulnerability and environmental risks that could effect the basin's land use planning, makes it necessary to regulate and issue technical guides to formulate master control plans for floods and landslides as mandatory elements for the formulation and implementation of the POMCA. Regulation of these plans should establish (i) reduction and risk management as an integrated part of the objectives and goals to guarantee the safety and sustainability of the basin; (ii) definition of the scope and orientation of the most recent and accurate methods for zone delimitations, using as a starting point hazard threat evaluations, in case the of minor, medium-, or high-probability phenomena, and risk maps that show the possible effects of floods, and determining the amount of inhabitants and the type of economical activities in that area that could be affected,³² (iii) regulation of restrictions and conditions for land use for each hazard/risk zone; (iv) formulation of sanctions for noncompliance; (v) mentioning programs and projects for risk reduction and control, and the protection of human lives, economic activities, ecosystems, and cultural heritage, as well as strategies for implementation and monitoring.

Reduce risk generation and disaster impact through policies and sectoral action plans

Adopt policies and sectoral risk management plans in each Ministry, assigning responsible units for their execution and monitoring. The review done of the sector participation, as

32 Examples of European countries, United States, and Japan can be consulted at http://ec.europa.eu/environment/water/flood_risk/flood_atlas/index.htm, Handbook of Good Practices in Flood Mapping (Good Practice manual for preparing flooding maps).

presented in Chapter 4, shows that there are very few specifically formulated policies at the level of Ministries, UNGRD, and DNP. Fundamental institutions for the SNPAD do not have personnel to work in risk management, such as the DNP, the MADS, the MVCT, and the majority of the Ministries. It is necessary to create units or offices with personnel who are skilled in the subject, and who should directly coordinate with the planning department and orient different divisions or entities linked to the sector. They should also function as a

connection between national strategies and the autonomy of the departments and municipalities, including monitoring and aligning performance goals. For more administrative efficiency and effective management, it is desirable that these units or offices regulated by different Ministries and dependencies articulate their environmental issues, risk management, and climate change adaptation, and adopt and execute sectoral policies and programs. Strategies for zones and municipalities located in high risk areas. (Table 2.11)

TABLE 2.11 Disaster risk management strategies for high-risk municipalities

| Institutional capacity of municipalities /cities | Institutional strengthening | Technical strengthening | Financial strengthening |
|--|--|---|-------------------------|
| <p>High capacity</p> <p>High capacity is seen in municipalities of Special category and some municipalities in category 1. The majority of them have more than 500,000 inhabitants and in very exceptional cases more than 100,000 inhabitants.</p> <p>The strategy used in these municipalities is continual institutional strengthening using policies and strategies for their implementation in the processes of planning, execution and, control of all the municipal investments.</p> <p>Work should be carried out institutionally and in coordination with local Committees in Disaster Prevention and Response, formulating Risk Management Plans and Emergency Contingency Plans.</p> <p>Establish a baseline with measurable indicators in order to have constant monitoring in municipal risk management progress.</p> | <p>Continue advancing in the knowledge of phenomena, fortifying the implementation of early warning systems and consolidating information and educational processes, especially by involving the community and the private sector in favor of reducing existing risk and avoiding creation of new risks.</p> <p>Review and improve some risk mitigation processes especially, when facing integrated neighborhood improvement programs, relocation of nonmitigable high-risk families and controlling mitigation works (containment, reinforcement, etc.) to be able to perform actions to correct current processes.</p> <p>Prepare and periodically update Risk Management Plans and Municipality Emergency Plans accompanied by technical and operational entities in the municipality.</p> <p>Promote spaces that will allow municipalities to share instruments of departmental capital cities, or other instruments used successfully in risk reduction.</p> | <p>Strategically review the resources the municipality has in order to optimize the investments in risk management actions.</p> <p>Cofinance through multilateral organizations.</p> | |
| <p>Medium capacity</p> <p>Medium competence is reflected in Special category municipalities and in some municipalities in categories 1 and 2. Some cities with more than 500,000 inhabitants have not been able to consolidate risk management plans but have the necessary funds to accomplish them, while a few other towns with populations between 100,000 and 500,000 that have fewer resources, have achieved a medium institutional competence to cover this issue.</p> <p>Departmental capital cities should assume the responsibility they have by incorporating risk management in the processes of municipal planning and finances.</p> <p>Establish a strategy to work closely with the national technical entities and the CAR in the appropriate preparation of reference terms in knowledge, risk reduction, and emergency management. On the other hand, form strategic alliances with universities and research centers in order to execute the projects.</p> | <p>Advance in knowledge and phenomenon hazards and risks understanding in order to concretely define actions that tend to reduce risk and manage emergencies. The POMCA play an important role in generating knowledge of hydrometeorological phenomena threats and risks. This will allow the municipalities to incorporate programs and projects that will include risk management in the POT. Special strategic alliances are required with the SGC, especially in geological phenomenon knowledge.</p> <p>Implement or strengthen early warning systems that are shared with several neighboring municipalities, optimizing resources for acquiring equipment and for network operation.</p> <p>Periodically prepare and update Risk Management Plans, Municipal Emergency Plans, accompanied by technical and operative entities of the municipality.</p> <p>Promote spaces that will allow municipalities to share instruments or tools used successfully in risk reduction with neighboring municipalities or metropolitan areas.</p> | <p>Seek to optimize existing resources between departmental capitals and the annexed municipalities in categories 1 and 2 (which sometimes make up the metropolitan areas) to solve problems of risk reduction that are common in the territorial area they belong to.</p> <p>Execute agreements with neighboring municipalities and departmental governments.</p> <p>Cofinance projects through agreements with the National Government.</p> | |

TABLE 2.11. Disaster risk management strategies for high-risk municipalities (continued)

| Institutional capacity of municipalities / cities | Institutional strengthening | Technical strengthening | Financial strengthening |
|---|---|---|---|
| Medium capacity | <p>In meetings where there is participation of metropolitan municipalities or municipalities territorially in proximity to metropolitan areas, identify existing resources and needs in order to form "Horizontal Corporation" type alliances.</p> <p>Work institutionally and in coordination through the CLOPAP, to formulate Risk Management Plans and Emergency Contingency Plans.</p> <p>Establish a baseline with measurable indicators to have constant monitoring of the advancement of district risk management.</p> | <p>Understanding the existing phenomena is a priority to enable effective incorporation of territorial and municipal planning instruments. The POMCA play a fundamental role in creating knowledge of hazards and risks that will enable the municipalities to include programs and projects for the inclusion of risk management in the POT. Moreover, they need to form strategic alliances with national entities such as SGC, especially to obtain information on geological phenomena that provide inputs for territorial planning.</p> <p>Periodically prepare and update CLOPAD, Risk Management Plans, and Municipal Emergency Plans.</p> | Cofinance projects through agreements with the National Government. |
| Low capacity | <p>Low competence is found in categories 3 to 6.</p> <p>Municipalities with less than 50,000 inhabitants constitute 95% of the municipalities in the country. Due to the lack of information and resources, they have not been able to include risk management in public municipal management.</p> <p>Even if territorial administration and inclusion of risk and financial management is the responsibility of the municipality, it requires an interinstitutional strategy in order to support the progress in knowledge of hazards and risks as fundamental inputs for the POT and PD.</p> <p>It is imperative to form a stronger and convincing alliance with departmental and local governments, so that these municipalities may compose instruments that will allow the strengthening of public and territorial management.</p> | <p>Understanding the existing phenomena is a priority to enable effective incorporation of territorial and municipal planning instruments. The POMCA play a fundamental role in creating knowledge of hazards and risks that will enable the municipalities to include programs and projects for the inclusion of risk management in the POT. Moreover, they need to form strategic alliances with national entities such as SGC, especially to obtain information on geological phenomena that provide inputs for territorial planning.</p> <p>Periodically prepare and update CLOPAD, Risk Management Plans, and Municipal Emergency Plans.</p> | Cofinance projects through agreements with the National Government. |



Floods. Municipality of La Virginia (Risaralda - Colombia), 2011. Photography: Gabriel Jaime Arango Zapata.

The Role of *Territorial* *Administration* in Disaster Risk Management

Diana M. Rubiano V., Carolina Díaz G., Fernando Ramírez C.,
Carmenza Saldías B., Jaime Iván Ordoñez O., María Isabel Toro O.,
Amparo Velásquez P., Juanita López P.

3



3.1. TERRITORIES IN DISASTER RISK MANAGEMENT: FUNDAMENTAL CONCEPTS

Knowing and administrating territories¹ requires a multidisciplinary interest and focus.

Territorial spatiality is the capacity of human actors to change or modify their social reality and environment or contextual structuring. As a result, each space should be seen as the result of collective human action and intent, which is therefore subject to modification and transformation. Developing knowledge about the causes and consequences of risk associated with natural and socio-natural phenomena contributes to elevating awareness in society of its responsibilities to control different agents in the generation and accumulation of risk, and adequately bringing together the efforts to face general and specific risk issues, both preventively and correctively.

In order to approach the manner in which risk is managed at the territorial level, it is necessary to have an integrated focus that takes into account local- and regional-level management. Urbanization is understood to be a process by which cities are structured in situ, but at the same time, it is clear that this urbanization has a regional or interurban dimension, by which city systems are structured. Urban territories, seen as a regional network of settlements, have a hierarchical structure and are made up of settlements of different sizes and degrees of interdependence, within which there is a dominating urban center. On the other hand, the causal influences, which underlie the origin of cities (Soja, 2008), include: 1) administrative requirements of large-scale irrigation and technology for flood control; 2) economic opportunities arising out of commerce and

trade with remote locations; and 3) creation of a more dependable and continuous food surplus, which clearly should be handled at the regional level. Furthermore, there is a growing need to reduce demographic vulnerability and pressure created both by the increase in population and environmental degradation, which is typical of urban conglomerates. As a result, municipal and regional authorities are structurally empowered to provide conditions of physical safety, environmental sustainability, and food provision. These authorities should work together under the principle of coherent cooperation among cities in a regional context. This chapter discusses the use and effectiveness of urban and regional territorial administration instruments for risk management.

To facilitate analysis, it was necessary to start by selecting local and regional case studies that accurately represented the current risk conditions of the country. Based on their relevance in terms of concentration of population, goods, and services, their importance from an economic standpoint, and their positive and negative record in risk disaster management, the decision was made to analyze the experiences of the cities of Barranquilla, Bogota, Cali, Cucuta, Manizales, and Medellin. On the other hand, based on their importance as an ecosystem and the importance of their economic activities, a selection was made of regions that have been af-

¹ In the context of the present document, “territory” is understood as a defined area (including lands and water) where there is a relationship between society and the environment. Space is the medium through which social relations are materialized and developed.

affected frequently by flooding—namely, the basins of the Bogota and Sinu Rivers, the La Mojana region, and the Dique Canal. The aforementioned analysis allows for trends, specialties, and differences to be identified at a local and regional level but, more importantly, it allows for recommendations to be made to the government of Colombia, which can inform and guide actions taken to reinforce the inclusion of disaster risk management in territorial administration.

The municipality is the basic unit of territorial management and, therefore, of risk management. In Colombia, decentralization and autonomous territorial entities are significant components of the government organization. In particular, municipalities are considered the basic unit of the political and administrative division of the country and their functions include regulating development. To that end, they should regulate the use of land and, within the limits established by law, supervise and control activities related to construction and transfer of property to be used as housing, as well as issue regulations for controlling, preserving, and defending the ecological and cultural heritage of the municipalities. It is clear that emergencies occur at a local level insofar as local physical and social characteristics determine the existence of hazards and vulnerabilities, i.e., risks. Therefore, municipalities are called upon to act as the main agents in a risk management system, which means including the concept of a risk management system as a guiding principle for municipal and district planning and financial policy.

Financial policy depends on the structure of the territory in which the different uses and the ownership of land determine tax burdens and establish guidelines for government intervention. The land use plan for the territory is specified by (i) assigning land functions and uses² in which intervention of the

territory is made possible by general urban and urbanization policies; (ii) taxation based on ownership and use; and (iii) the different types of public actions for investment. Therefore, the scope of action that local and regional authorities have over the land is of the utmost importance, because the land is a source of revenue for them and is also the source of a critical part of their responsibilities, in particular, a rational and functional land use plan (Saldías, 2007). If risk is managed adequately through planning at the local level, the availability of resources will be optimized and investments can be made in a timely and appropriate way.

Risk management is not limited to the geographic area where emergencies occur and does not end at the political and administrative boundaries of the municipality. In order to perform effective risk management, it is necessary that both urban centers and regional urban spaces operate in a systemic fashion. Therefore, coordination among the authorities of municipalities, metropolitan areas, basins, and departments is required, covering aspects such as awareness and understanding of existing hazards and risks, coordinated planning processes, joint interventions, and interconnected emergency plans.

Ambiguity in the jurisdiction of regional authorities for land use planning increases risk. Considering that no single regional planning authority exists and that there is no harmonious system for integrating instruments of different types and levels, there is an increase in municipal risk, both in urban and rural areas, as a result of decisions and interventions related to the uncoordinated use and occupation of the territory by various actors. Regional planning functions are shared between a department and a Regional

2 Land functions and uses include all the different levels: urban (housing, commercial, industrial, public space), rural (housing, environment, protection), and expansion.

Autonomous Corporation (CAR). The department is in charge of guiding local planning in a supra-municipal context and coordinating the formulation and execution of Development Plans (PD) and Departmental Water Plans (PDA). A CAR is in charge of (i) formulating development and management instruments for basins, which do not always coincide with departmental limits; (ii) regulating the use of rural land by way of permits for use and disposal of water, which interferes with the constitutional duties of municipalities to regulate the use of land; and (iii) approving the environmental plan of the municipal Land Use Plan (POT), which is handled occasionally by the CAR when issuing permits. Planning, organization, and use of rural land are poorly stipulated in the POT and these factors are subject to the decisions of a CAR or national sectoral entities. The responsibility for regional territorial management is diluted among various actors, not just national and regional actors, but also private entities that intervene in the corresponding geographical space.

Handling emergencies is a systemic responsibility. Faced with the undeniable probability of occurrence of emergencies, because risk will never be zero, a Risk Management System should involve various types of actors, processes, and instruments, and integrate them into the Emergency Plan, so that they can respond in a coordinated manner during all phases of emergency management (preparation, alert, response, and recovery). This Plan binds all personnel of municipal, district, departmental, and national authorities, as well as volunteer organizations attached to a Local Committee for Disaster Planning and Prevention (CLOPAD). The Plan should also be a reference for individuals and entities from other municipalities and departments, even the national government and the general public, who

at a certain time may wish to support emergency management in a specific territorial unit.

Monitoring, assessment, control, and feedback are essential for performing timely and effective risk management. The Office of the General Comptroller and the Office of the Attorney General have sufficient powers to perform an effective control of public entities at different levels and specifically regarding environmental and risk issues. In most cases, control has been based on circumstances and widely discussed by the media. On the other hand, urban inspection is very deficient and municipal authorities usually do not have the resources to carry it out. In consequence, it is limited to police intervention in extreme cases.

Planning in Colombia has not advanced from the formulation of instruments to a harmonious and integrated implementation system. Planning is not always a guarantee for execution according to plan. The priorities established by these instruments are usually relegated by those of other interests, urgent needs, and requirements, and investment resources may end up being assigned to objectives that are clearly at odds with planning. There are no effective mechanisms or instruments for monitoring, controlling, evaluating, and providing feedback for planning such activities, which are usually performed *ex post* and not in a systemic fashion.

In essence, the goal is to acknowledge that in Colombia risk is accumulating permanently in cities and rural areas, due to lack of application and control of policies and instruments of public administration, lack of municipal land use planning, and inadequate hydrographic basin management. Therefore, focused analyses were performed on local and regional spaces, seeking to show the interaction of territorial entities (departments and municipalities) with regional

environmental authorities, considering that in the aforementioned territories there are numerous social, environmental, geographic, and cultural relations which rely on organization for planning, managing, executing, assessing, and

controlling the processes established there. These processes should, in principle, guarantee optimum exploitation of natural resources and of land use and occupation processes.

3.2. INCORPORATION OF RISK MANAGEMENT IN TERRITORIAL ADMINISTRATION AT THE LOCAL LEVEL

3.2.1. Characteristics of urban territories

According to organizations of the United Nations system and other international entities, there is an evident increase in the conditions of vulnerability to diverse physical events. This situation is a result of urbanization and industrialization processes, expansion of cities, population growth, socio-economic exclusion, land use conflicts, construction of infrastructure, environmental degradation, the effects of climate variability, and other factors (UNISDR 2007). In this context, it is possible to state that there is a two-way relationship between the creation of risk conditions and development processes, insofar as no corrective measures are taken and the restrictions, determining factors, and potential of each territorial unit are unknown.

Incorporating disaster risk management in territorial administration is a key component of safety and sustainability at the local level. With the purpose of offering recommendations to the government of Colombia in connection to territorial administration at the local level, six department capitals were selected. Although they may have similar risk conditions, there are differences in the way they have incorporated hazards and risks in their public administration and planning instruments. The selected cities were Bogota, Medellin, Cali, Barranquilla, and Cucuta, which are in a Special category, plus Manizales, which is in category 1 (see *Box 3.1*).

The case studies are similar with respect to risk and disaster issues, but they exhibit differences and peculiarities, which should be considered independently when formulating recommendations in agreement with the reality of the territory. With the purpose of providing suggestions and guidelines that contribute to reinforcing the inclusion of disaster risk management in local-level administration, below are the results of the comparative analysis of the case studies, which shows similarities, differences, and peculiarities.

3.2.2. Causes and consequences of generation and accumulation of risk conditions

The 1950s was a decade of urbanization and industrialization processes. It was a historic milestone in which population growth, the flow of migration, and violence contributed to an increase in density of Colombian cities and the unplanned occupation of peripheral areas. The trend in self-construction of housing was considered to be temporary by local governments, which had significant consequences in terms of the construction of inadequate housing and the consolidation of risk zones, which have been impossible to correct. Starting in 1950, population growth and the social needs of the population generated a demand on, and a transformation of, the natural environment that supported it (availability of land for housing, public areas, hydrological resources, food, etc.), although processes of illegal appropriation, fraud, and subnormality were not so evident

Box 3.1. Case studies at a glance

Big cities in Colombia have consolidated themselves as territories due to a set of factors that have increasingly allowed and enabled the generation of risk and disaster issues. The biophysical context of Colombia includes numerous factors determined by its intertropical geographical location, as well as geological, organic, climatic, and ecosystem processes, which give rise to great complexity and offer environmental potential, but also favor the existence of hazards that can be exacerbated or intensified by anthropic action.

TABLE 3.1. Biophysical characteristics. Case studies

| City | Altitude ⁽¹⁾ (mamsl) | Geomorphology ⁽²⁾ | Ecosystem ⁽²⁾ | Climate ⁽²⁾ | Precipitation ⁽¹⁾ (mm/year) |
|--------------|------------------------------------|--|-------------------------------|------------------------|---|
| Bogota | 2,630 | Cundinamarca-Boyaca plateau, in lacustrine materials, Eastern Branch of the Andes | Lower mountain dry forest | Cold dry land | 972 |
| Medellin | 1,490 | Aburra Valley, Central Branch of the Andes | Premountain moist forest | Mild moist land | 1,698 |
| Cali | 900 | Intermountain valley, alluvial plain of the Cauca River | Tropical dry forest | Warm dry land | 850 |
| Barranquilla | 14 | Alluvial plain, left slope of the Magdalena River | Tropical very dry forest | Warm very dry land | 835 |
| Cucuta | 250 | Alluvial valley of the Cucuta River, Eastern Branch of the Andes | Tropical very dry forest | Warm very dry land | 874 |
| Manizales | 2,062 | Mountainous, fluvio-erosional topography, western slope, Central Branch of the Andes | Premountain very moist forest | Cold very moist land | 2,000 |

Sources:

(1) MAVDT and Ideam (2005).

(2) Cortés (1982).

(3) Cuatrecasas (1989).

TABLE 3.2. Local socioeconomic characteristics. Case studies

| City | Size (km ²) | Population ⁽¹⁾ | Households ⁽¹⁾ | Unemployment ⁽²⁾ % | Poverty ⁽¹⁾ UBN (%) |
|--------------|-------------------------|---------------------------|---------------------------|----------------------------------|-----------------------------------|
| Bogota | 1,636 | 7,363,782 | 1,762,685 | 9.9 | 9.2 |
| Medellin | 381 | 2,343,049 | 596,528 | 11.9 | 12.4 |
| Cali | 562 | 2,207,994 | 513,842 | 15.4 | 11.1 |
| Barranquilla | 198 | 1,186,640 | 232,798 | 7.8 | 17.7 |
| Cucuta | 1,176 | 618,310 | 139,358 | 16.2 | 23.2 |
| Manizales | 508 | 388,525 | 103,978 | 14.5 | 10.0 |

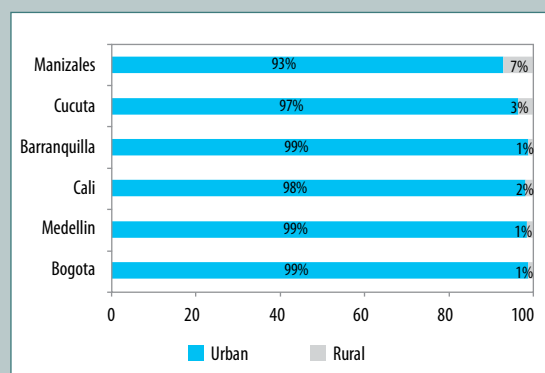
Sources:

(1) DANE, 2005a.

(2) DANE, 2010.

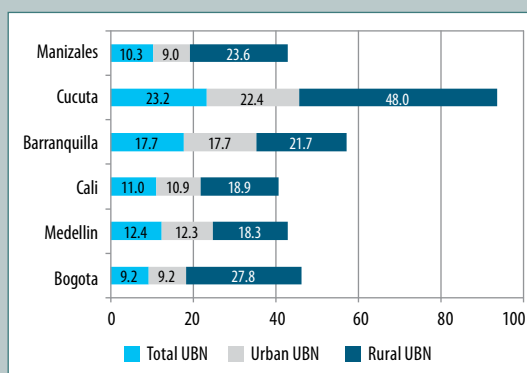
Box 3.1. Case studies at a glance (continued)

GRAPH 3.1. Distribution of urban and rural population. Case studies, 2010



Source: DANE, 2005a.

GRAPH 3.2. Unsatisfied Basic Needs. Case studies, 2010



Source: DANE, 2010.

at the time. However, the following factors of economic and social disparity contributed to the dislocation between growing population groups and their environment and, therefore, to the creation of risk conditions in a context of accelerated and chaotic urbanization: (i) population groups were forced to occupy portions of territory that had serious biophysical limiting conditions; (ii) low availability of economic and technical resources led to inadequate forms of occupation (houses on slopes and floodplains, anthropic landfills with inadequate compaction, poor construction techniques, etc.); and (iii) exclusion from planned sectors of a city had an impact on the access to utilities, public areas, and transportation. This situation was aggravated insofar as the city was not able to meet other basic needs of the population (health, employment, education, recreation) (Díaz, 2007) (see Box 3.2).

There are factors related to policies, territorial planning, and control mechanisms that influence how risk has been configured and how emergency and disaster situations have occurred throughout the history of Colombian cities. Some of these factors are weaknesses in planning

processes; absence of control policies; land speculation; monopoly over construction materials and supplies; and peculiarities in the administration of local territories, which were given jurisdiction over land use only after the Constitution of 1991. The needs to occupy territories under an unplanned city model force natural habitability limits to be exceeded and, as a result, more interventions are required in order to ensure the stability of the territories. The absence of urban-regional land policies and the presence of late regulatory and control interventions generate an expansion process that is not coordinated with the reality of the territory and its biophysical, social, and economic conditions. As a result, there are spontaneous interventions, on a lot-to-lot basis, which are evidence of the difficulty in responding with effective housing solutions and providing more and better public infrastructure. Exploitation of natural construction materials in the absence of appropriate planning, control, and recovery have contributed significantly to the physical instability of hillsides and to environmental degradation, especially in peripheral areas of cities.

Box 3.2. Territorial occupation process and risk conditions

| Bogota | Medellin |
|---|--|
| Occupation of the fluvio-lacustrine plain of the Bogota River with gentle inclines and a mountainous area east of the city, with steep inclines, extending continuously until filling all the space between the mountains and the right-hand bank of the Bogota River. Risk conditions due to earthquakes, landslides, floods, and other events. | Occupation of the territory along the valley of the Medellin River, along a deep and elongated valley. Expansion of settlements to the hillside areas, especially in the center and northeast, and the center and northwest portions of the city. Intermediate seismic hazard levels, but high risk conditions due especially to floods, flash floods, and landslides. |
| Cali | Barranquilla |
| Occupation of the territory on the flood plain of the alluvial valleys of the Cali and Cauca Rivers, which determines high levels of risk due to flooding. Higher levels of exposure toward the eastern part of the city. On the other hand, Cali is located in an area of high seismic hazard, and it is the only municipality in the country with a population of more than one million that has this risk condition. | Occupation of two slopes on which the city is located: the eastern slope, which includes the oldest part of the city and a low floodplain, which runs along the Magdalena River; and the western slope, which has narrow courses and drains into the Leon creek. This slope is one of the city's growth areas. Risk conditions are represented by landslides in hillside areas and the so-called <i>arroyos</i> (tributaries of a river or streams that run through the streets due to intense rainfall) in the city, which have been consolidated due to the lack of storm drainage infrastructure. |
| Cucuta | Manizales |
| Occupation of the valleys of the Pamplonita and Zulia Rivers, expanding toward the slopes of these rivers. Risk conditions due to landslides and floods. Area of high seismic hazard. | Initial location of the city on a plateau in the interfluvial area between the Chinchina River and the Olivares stream. Subsequently, slopes with steep inclines were occupied, especially in the western part of the city. Configuration of high risk due to landslides and floods, as well as high seismic hazard. |

In some cities, accumulation of risk has also been observed in formal construction areas, as well as in upper-class areas. Environmental problems generated by land speculation and conflicting land use within suburbanization processes have been revealed.³ In Medellin, Cali, and the Bogota Savannah, there have been emergencies in formal construction areas, which is evidence that risk is created not only in illegal settlements built without appropriate construction techniques, but also in developments that have not undergone any type of local or regional planning. Additionally, the desire for economic gain by landowners has taken precedence over the planning and investment required for preparing and installing the service infrastructure and equipment needed for construction in suburban areas.

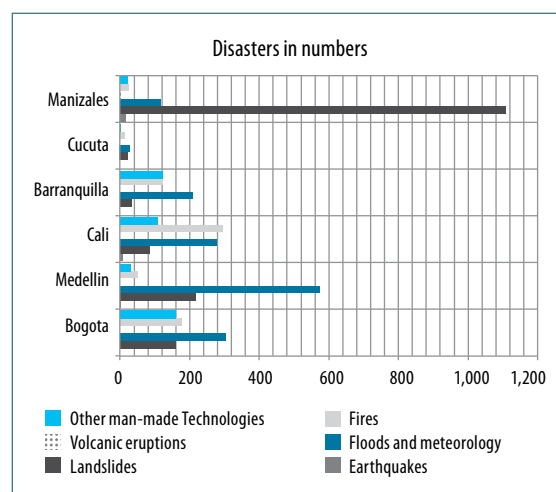
There is evidence of a cause-effect relation between economic and social exclusion and the existence of subnormal and highly vulnerable human settlements. A high exposure to diverse and potentially dangerous phenomena has been identified in Colombian cities. In these cities, there has been a gradual increase in the occupation of areas that are unsuitable for ensuring sustainable development. As a result, the population is under elevated hazard levels. However, in addition to spatial exclusion factors, economic and social exclusion factors are also observed, which are found to correlate with an accumulation of risk conditions. Municipal territorial entities are expected

3 Known as the growth process of the cities, by which suburban areas are created. From the spatial point of view, these areas are adjacent to continuous construction in strictly urban spaces and are usually transition spaces between the cities and the rural zones, where the functions of both areas compete.

to respond to variations in quality of life, both in urban and rural areas. However, many of these entities are not prepared to meet the basic needs of their inhabitants with regard to housing, employment, availability of utilities, education, health services, and transportation. Indicators such as the Unsatisfied Basic Needs (UBN) Index and the Poverty Line Index, or overcrowding levels, support the aforementioned statements. Furthermore, the quantitative and qualitative housing deficit is concentrated on the poorest classes⁴, which gives rise to a vicious cycle regarding access to housing for the most vulnerable population groups.

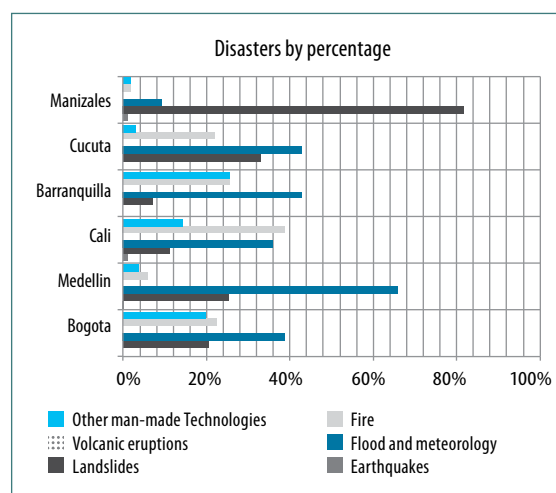
Colombian municipalities exhibit a growing trend in occurrence of disasters, although in some cases significant progress has been made in reducing their impact and frequency. Numerous vulnerabilities with disastrous consequences throughout the history of Colombian cities have been generated by (i) biophysical and geographical factors in municipalities that determine vulnerability to certain types of hazards; (ii) inadequate procedures for territorial intervention; (iii) marginal human settlements; and (iv) social and economic segregation. The cases of Cali, Medellin, Cucuta, or Barranquilla show that risk conditions are accumulating in cities and materializing in a greater number of events and a greater concentration of damages. In the cases of Manizales and Bogota, the impact of disasters has been reduced thanks to preventive and corrective risk management interventions, and the application of various policies and instruments has produced positive results; however, there are risk levels that have not been reduced to acceptable levels and full deaccumulation of risk conditions is not guaranteed yet. The graphs below show all the events in the case studies, according to type of phenomenon by number and percentage (*Graphs 3.3 and 3.4*). The events registered by the Geographical Information System for Disaster Prevention and Management (SIGPAD) from 2000 to 2010 are also shown (*Graph 3.5*).

GRAPH 3.3. Number of disaster events registered in cities under study, 1970-2011



Source: Authors' graph based on information provided by OSSO-EAFIT Corporation, 2011.

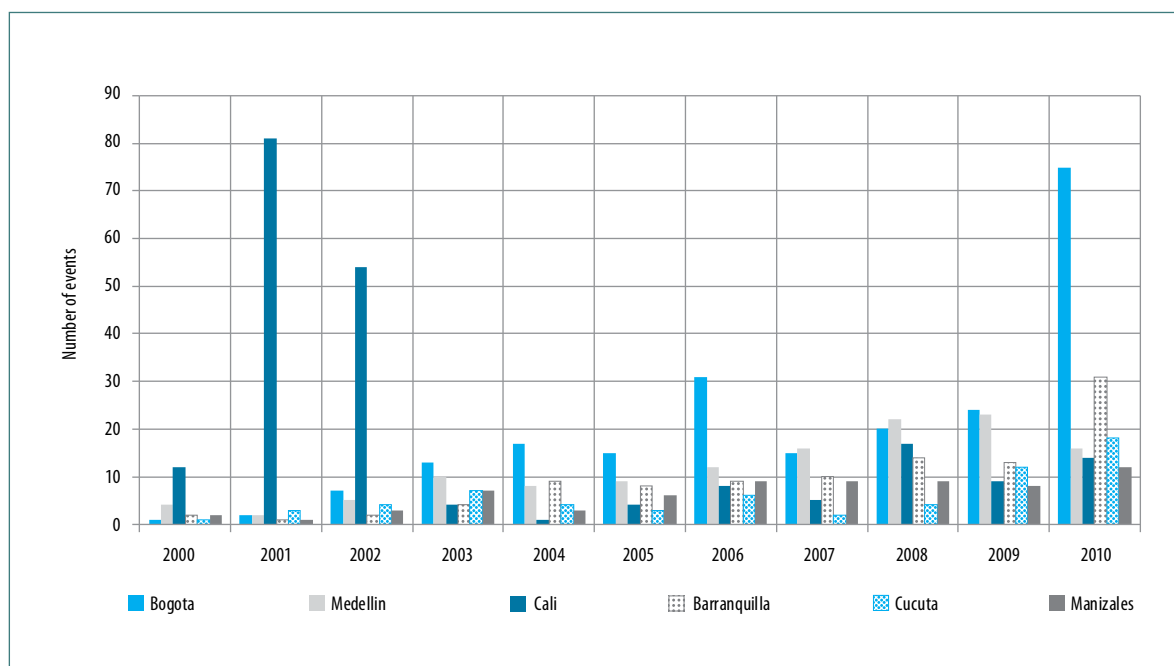
GRAPH 3.4. Percentage of disaster events in cities under study, 1970-2011



Source: Authors' graph based on information provided by OSSO-EAFIT Corporation, 2011.

4 "Socioeconomic stratification in Colombia is a real estate classification used as an instrument for geographical targeting for differential charging of household utilities, in a cross-subsidy scheme. Historically, six strata have been established that are identified according to the characteristics of dwellings and their surroundings, as an indirect indicator of the economic capacity of its inhabitants" (http://www.dnp.gov.co/Portals/0/archivos/documentos/DEPP/Evaluacion_Políticas_Públicas/Serie_EPP10_Estratificación_Socioeconomica.pdf). Stratus 1 has the lowest value and 6 the highest.

GRAPH 3.5. Number of events registered in recent years in the cities under study



Source: Authors' graph based on information provided by SIGPAD for 2000-2010.

The factors in disaster risk generation have multiple causes, not just those linked to the occurrence of hazardous events, but also those related to various components of economic and social dynamics, which have allowed the configuration and concentration of risk. The losses from disaster events are increasing due to the rapidly growing exposure of vulnerable elements (population, infrastructure, goods, services, etc.). This situation is more apparent in big cities. Although some efforts are made in Colombia to improve the social and economic conditions of these cities, it seems they are not able to compensate for the rapid increase in exposure and vulnerability of the population to various potentially harmful phenomena. Given the current state of affairs, there is a requirement to identify different approaches and instruments that have been applied successfully in territorial

entities, as well as to take a critical look at past errors, in order to achieve a real improvement in disaster risk management.

3.2.3. Social agents in the generation and reduction of risk conditions

It has been pointed out that there are actors who have a bearing on the generation of disaster risk issues at the territorial level. Social agents who participate directly and indirectly in the generation and accumulation of risk conditions have been identified, but no account has been taken of the effects that these agents may have on society, either in the form of disasters (agents who generate risk), or reduction or prevention in development of risk

scenarios (agents who regulate risk) (Herzer and Gurevich, 1996), taking into account that both categories exist and overlap in a territory. Agents who generate risk include political, institutional, private, and community agents who have acted permissively, and have made specific and uncoordinated, even intentional, interventions, regarding the occupation of areas unsuitable for development (promoters of informal settlements, illegal developers and constructors). Furthermore, compliance or noncompliance with local-level planning, regulatory, and control functions may be a factor affecting the configuration of risk conditions (actors with a relevant role are city Planning Secretariats, Urban Curatorships and Municipal Councils, the CAR, and the people themselves through different public participation mechanisms). On the other hand, although the reasons vary widely, there is evidence that community pressure by way of Housing Committees and Community Action Committees creates a relationship with different institutional and political actors that seeks to vindicate the right of the community to housing, utilities, and urban infrastructure, which may in turn affect risk conditions if there is no awareness of the forms of occupying and intervening in territories. Furthermore, conflicts of governance when managing informal settlements are one of the main aggravating factors in the development of risk, especially in the case of Medellín, which reports the most critical conditions because of the critical roles that armed groups play, which explains most of the governance problems in the hillsides of the city.

At the local level, there are differences in the relationship with social agents who intervene in the prevention and regulation of risk conditions or, more accurately, agents who regulate risk. At the territorial level, all municipal administrative agencies are in charge of handling, in one way or another, matters re-

lated to the territory; however, organization, planning, and control are highly specialized functions that correspond to agencies like the Planning Secretariat or the Government Secretariat and the offices that execute public works. In the municipalities under the Special and type 1 categories that were included in the case studies (Bogotá, Medellín, Cali, Barranquilla, Cucuta, and Manizales), there are offices and/or agencies attached to the Mayor's Office in charge of coordinating emergency reduction and management actions as well as the activities of the CLOPAD. However, this is not common in the rest of the country. It is assumed that operative and protective actions are concentrated on local entities, and coordination between social entities at the same territorial level and superior levels is low. In category 2 to 6 municipalities, CLOPAD have low participation or no participation at all in other planning processes, which need to be coordinated with risk management (POT, PD, Environmental Agendas, etc.). The lack of technical, economic, and financial resources aggravates the situation.

The cases of Bogotá, Medellín, and Manizales show that risk management is the result of joint action by different social agents at the local and regional levels. Technical and scientific entities, the academic community, and other social actors have worked together on risk prevention and disaster management, and have completed numerous research initiatives and works regarding the environment and risk management. They have also supported processes for hazard monitoring and warning systems and, in general, have contributed detailed knowledge for decision making (studies in seismic microzoning, floods, and landslides in the big cities in Colombia, and progress in studies in physical vulnerability and damage scenarios in cities like Bogotá, Manizales, Cali, and Medellín).

3.2.4. Use and effectiveness of public administration and risk management instruments in local territorial administration

3.2.4.1. Use and effectiveness of policy and planning instruments

The POT is an essential public administration instrument that guides the municipality in the use and occupation of territories; for this reason, it is important that it be coordinated with risk management. The POT contains definitions of policies and strategic objectives, a regulatory component for the use and occupation of land (restrictions and preconditions), a program component that establishes investment programs and projects over different planning horizons in order to correct existing risks and prevent new risks, and a set of management instruments to enable implementation of the POT. Within this framework, criteria for developing safe activities according to the reality of each territorial unit are established.

In this regard, the efforts of cities like Bogota and Manizales have allowed risk management to be incorporated into the POT. In the case of Bogota⁵, the starting point was a detailed analysis of hazards and vulnerabilities, which led to an assessment of risks, accompanied by updated cartographic information about the regional and urban hydrodynamics, landslides, seismic microzoning studies, forest fires, and technological events. Based on this information, restrictions and determinants were defined for each area of the city and for certain productive activities. Special note should be given to investments for reinforcing the structure of utilities and equipment infrastructure, and the resettlement of families from nonmitigable high-risk zones in the city⁶. These programs are

highly complex because the interventions are interinstitutional in nature and the programs are highly efficient in improving quality of life, reducing public contingencies, and controlling informal and illegal development⁷. However, the response of the municipalities surrounding Bogota to the conditions and restrictions of their territories has been weak. In the case of Manizales, the decisions, which guide the POT, are related to the availability of technical studies (studies of hazards, vulnerabilities, and risks due to landslides, floods, fires, and earthquakes). The POT also contains a careful inventory of homes in high-risk zones⁸; it presents decisions regarding restrictions and determinants for building in zones with medium or low landslide risk and in flood zones; it establishes regulations concerning construction, utilities networks, and partial plans; finally, it offers recommendations for awareness, reduction, and management of risk.⁹

The land use planning process is not recent in the country. However, the progress of municipalities in this regard is very uneven. Obstacles such as a low level of awareness of risk scenarios and their management needs; a lack of

5 Territorial Land Use Planning of Bogota, reviewed 2003 (Decree 469 of 2003).

6 Mitigation is a condition in which it is feasible to make technical, economical, social, and political interventions in a territory to reduce risk in order for the population, its infrastructure, and its economic activities to remain within the reasonable and socially safe acceptable margins (Ramirez and Rubiano, 2009a).

7 In Bogota, between 1997 and 2008, 1,386 neighborhoods were legalized, of which 611 (160,368 properties) received the following DPAA technical concepts: 1,277 conditioned use properties due to high hazards and 2,918 conditioned use properties due to high mitigation risk; 3,654 restricted use properties due to high hazards and 6,128 restricted use properties due to nonmitigable high risk, and 146,391 properties with feasibility for urban use.

8 In Manizales 8.4% of the population (28 neighborhoods and 32,745 persons) are in high-risk zones due to potential landslides. Some 2,243 properties should be relocated and comprehensive improvement should be made on 5,304 more.

9 Land Use Planning of Manizales. Municipal Agreement 508 of October 12, 2001, adjusted by Municipal Agreement 573 of December 24, 2005.

knowledge of hazards and vulnerabilities; a lack of coordination with investment instruments; and weak mechanisms for monitoring and controlling the implementation of the POT reduce the effective incorporation of risk management into land use planning. In the case of Barranquilla¹⁰, the POT has determined that creating a flood hazard map is a priority that should be included in the POT, but no progress has been made in this regard so far. The terms of reference defined by the POT for development and construction in areas of low and medium risk of landslides and floods have not been adopted either, and the Office of Disaster Prevention and Management, which is in charge of preparing these, is waiting for the Colombian Geological Survey (formerly *Ingeominas*) to update the hazard map for mass removal hazards. Regarding Medellín¹¹, although planning policies and instruments have been adopted since the 1980s, risk conditions have continued to accumulate due, in large part, to the difficulty in integrating land uses with methodologies for assessing risk (seismic and flooding); other reasons include: the lack of coordination with investment instruments (regarding formulation of supplementary projects in zones that are restricted due to high risk); the lack of intervention and control criteria in formal construction zones in the city, where occupation has not been subject to conditions or restrictions; and a recent increase in the occurrence of disasters (especially in the hillsides in the southwestern part of the city). Considering that this is the situation evident in big cities, the outlook for category 5 and 6 municipalities is much more critical¹².

Municipal development plans are instruments for advancing from disaster management policy to practice by providing guidance for territorial planning and, simultaneously, executing necessary actions. PD are political in nature; therefore, incorporating risk

management requires the agreement of various social agents. The starting point for the planning process is having a coherent and updated diagnosis (which includes the institutional, organizational, regulatory, and financial framework for risk management, as well as information about specific risk conditions). From this point on, preventive, corrective, and reactive risk management actions should be incorporated into all the other dimensions of development, by formulating policies, strategies and, most importantly, prioritized programs within annual investment plans, and ensuring that objectives and indicators for facilitating follow-up and monitoring are established. The experiences of Bogota and Manizales show an extensive record of incorporating risk management in development instruments. Even the 2008-2011 PD for Barranquilla has new developments: a significant change in political will and financial resource availability for including projects related to the CLOPAD; the creation of the Emergency, Calamity, and Disaster Prevention and Management Fund; the priority given to risk reduction studies and actions; and finally, the interest in formulating a Disaster Prevention and Management Master Plan; all these developments will help the municipality make up for lost time in this regard. Although there are specific programs that assign resources to risk management (for example, “*Cali Sismo Segura y Asegurada*” [“Seismic-Safe and Seismic-Insured Cali”]), no comprehensive

10 Land Use Planning of Barranquilla. Decree 154 of 2000, Municipal Agreement 003 of 2007, and Decree 0404 of 2008.

11 Land Use Planning of Medellín. Municipal Agreement 46 of 2006.

12 Therefore, efforts have been made through the Fiscal Vulnerability Reduction Program for Natural Disasters, through which the National Government, between 2006 and 2011, gave technical assistance to 792 municipalities (equivalent to 72% of the total of municipalities in the country), for the inclusion of risk analysis in the POT and in the Municipal Development Plans, and of which 379 already have action plans. Moreover, 36 municipalities also have hazard/risk zoning studies.

disaster awareness or management actions have been identified. On the other hand, risk reduction has received a low efficiency rating in terms of achievement of objectives (between 21% and 40%), according to reports by the Planning Department for 2011¹³.

Considering that municipalities have restrictions for risk management investments, it is indispensable to ensure that their actions are prioritized according to the reality of each territory, orchestrated among different social agents, and developed in a coordinated fashion so that they are not diluted and can be monitored and controlled easily. Some cities limit themselves to incorporating risk management in conventional planning instruments, such as the POT and the PD (Barranquilla, Cali, Medellin, and Cucuta), or formulating instruments that lack a time horizon and contain actions of a general nature, which are hardly useful for decision making, and are not supported by investments or social agents in charge of their execution. Such weaknesses have been identified in the following instruments: the Land Use and Management Plan for the Aburrá River basin; the 2020 Strategic Housing Plan for Medellin, which is included in the POT, but does not indicate how the investment will be made; the Hydrographic Basin Management Operating Plan (POMCA); the 2005 Municipal Environmental Management Plan for Cali, which lacks any real coordination with the land use and development instruments of the city; the Management and Land Use Plans for the Julia and Pamplonita River Basins for Cucuta, which are deficient in assessing risk and defining scopes, timelines, and budgets; and the 2002 Environmental Management Agenda for the Municipality of Manizales, which is an instrument that acknowledges the issue of risk management, but is irrelevant to the agents who bear responsibility. Given

the situation of limited resources for investment, there are alternatives for improvement and progress in the territorial entity: making the issue of risk and disasters visible in the working agendas of all entities and agencies of each municipal administration, establishing coherent goals, and monitoring the achievement of goals by each agency. Furthermore, in cases such as Bogota, there are reports of effective use of other instruments such as the District Plan for Emergency Prevention and Management, the Action Plans for Risk Prevention and Mitigation, the Regional Risk Management Agenda, Risk Management in Integral Handling of Bodies of Water, the Family Resettlement Program for families located in nonmitigable high-risk areas, etc.

3.2.4.2. Use and effectiveness of financing instruments

Instruments for financing and investment are not used very much in risk management. The first source of financial resources is the current revenue of the municipalities (37%), followed by transfers from the General Participation System (SGP) (21.1%), although some successful cases have been identified in Bogota. An analysis of the case studies reveals that risk management is a strategic criterion in medium-term financial instruments in Bogota, which is sufficient evidence of the commitment of the city administration to the concept of risk management and the responsibility they should assume for achieving its goals. Risk management is relevant to the financial monitoring and evaluation to which the city is subject due to the participation of the city in the world financial system-the Bogota Emergency Prevention

13 Plan and Program Efficiency Indicators, Administrative Planning Department, March 2011.

and Management Fund, which is attached to the Government Secretariat, receives resources from the Bogota District's own sources; namely, from taxes. Regarding economic processes, loans from multilateral banks, as well as a percentage of the resources the District receives from its share of the current revenue of the country (0.5% of the current tax revenues of the city) have been secured. It is important to point out that, in order to avoid irregular and discretionary assignment of resources for different types of risk management expenditures, it is required that a percentage of the current revenue of the District be turned over to the FOPAE, which has led to a constant growth of this item since 1995, as a result of the city's financial strategy.

Various experiences regarding financing instruments for risk management have been identified in Manizales. Examples include: the Municipal Agreement of December 3, 2009, which established a 0.02% environmental surcharge for municipal environmental management during the fiscal years 2010-2019; a protection program for essential, historical, and vital public buildings and even for private buildings, which is based on incentives in case of seismic events; and finally, a collective insurance program; all these programs are evidence of political will, judicious technical studies, and a shared commitment between the government and the private sector, which makes Manizales a successful municipality whose experiences can be replicated (see Box 3.3).

Box 3.3. Financial strategies for disaster risk management in Bogota and Manizales

In Bogota, significant progress has been made in fiscal planning and management, which guarantees that risk management is consolidated and emphasized as a policy of the District of Bogota's government. With the support of the World Bank, the city developed a "Strategy for transferring, retaining, and mitigating seismic risk in buildings that are indispensable and serve the community of the District of Bogota", which represents a significant advance in actions for managing seismic risk. In order to complete the aforementioned program, the Finance Secretariat and the DPAE, the two entities in charge of the program, carried out a process of mutual coordination, education, and learning process, which allowed the Finance Secretariat to incorporate natural and anthropic emergency risk into the financial risk program handled by its Office for Risk Analysis and Control as part of the asset and liability management project:

Decree 109 of 2006, issued by the District of Bogota, which partially modifies the organizational structure of the Finance Secretariat, assigned new functions to the Office for Risk Analysis and Control, including: to propose a financial strategy that provides coverage for the District of Bogota when natural disasters occur. This provision formalizes past legal, planning, and management actions which incorporate the subject of risk management in the financial and planning structure of the city (IRG, 2007, p. 257).

Source: IRG, 2007.

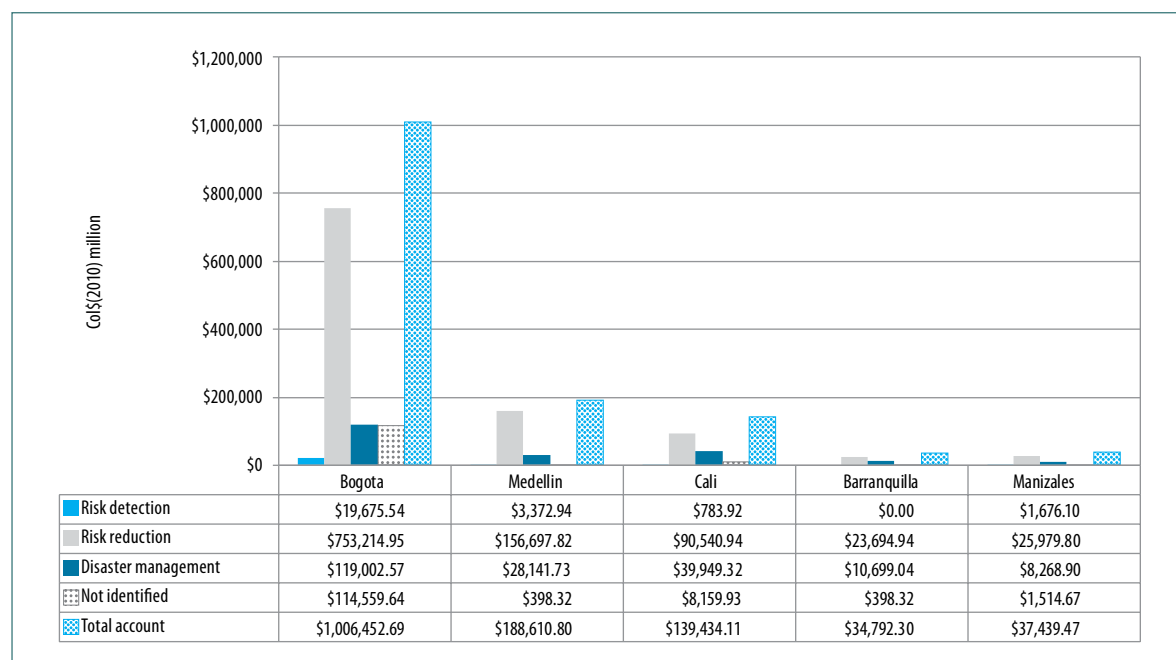
"Manizales: A Safe Place" is evidence of political will, judicious technical studies, and a shared commitment between the government and the private sector, and it is an experience that can be replicated. Manizales has a voluntary group insurance policy for protecting the lowest-income population groups. The municipal administration facilitates charging and collecting a disaster damage premium according to the assessed value of the property. Payment, which is voluntary, has been made through the unified real estate tax invoice, which is prepared either bimonthly or yearly in Manizales. The social appeal and benefit of this group insurance stemmed from the fact that after 30% of insurable lots in the municipal area had paid their premium, the insurance protection would be extended to those lots that were exempt of the property tax due to their value or socioeconomic category, with the understanding that, actuarially, the corresponding cost would be included in the premium for the lots that did pay the insurance. Unfortunately, during the five-year existence (1999-2004) of this mechanism, the percentage required for exonerating lots was not reached (due to poor campaigns, restrictions for payment in installments, and problems with calculations). Adjustments were made under a new group insurance program called "Manizales: Safe Place", which has been in place since 2006. The benefit of this instrument is that all properties exempt of the real estate tax will be insured when 20% of the "insurable value" of the set of lots that are required to pay the unified real property tax participate in the program by paying their respective insurance premium. However, in case the 20% threshold is not reached, the insurance company will provide partial coverage for the exonerated properties.

Source: Cardona, 2007.

The municipalities with the highest investments in risk management from 2002 to 2008 were Bogota, Medellin, and Manizales, with approximately 43% of the total investments at the municipal level¹⁴. The per capita investment in risk management was Col\$21,238 in Bogota and Col\$16,981 in Manizales. In turn, during this period, Medellin invested Col\$14,712 per capita and Cali, Col\$10,713, in contrast to a city like Barranquilla where the per capita investment was Col\$5,278. In particular, it has been established that risk management investments did not have a significant impact in Cali and Barranquilla, because they were not only less in comparison to other urban centers in the same category, but they were made in an uncoordinated and piecemeal fashion. For example, from the perspective

of the share of total municipal investments that are assigned to risk management, a downward trend has been observed in Cali: the city went from investing 5% of the municipal budget's resources in 2002 to 3.2% in 2008. In Barranquilla, on the other hand, investments have varied, from very low levels between 2002 and 2004 (Col\$3.7 billion), rising in 2005 and 2006 to Col\$24.6 billion for constructing canals and cleaning *arroyos*; between 2007 and 2008, an investment of Col\$6.2 billion was assigned exclusively to disaster management; and finally, between 2009 and 2010, there was a significant investment of Col\$53.0 billion, which was equivalent to 1.8% of the total budget for investment. Below are the risk management investments in the case studies (Graph 3.6).

GRAPH 3.6. Investments in risk management by category. Case studies, 2002-2008



Note: The information available for Cucuta does not allow categorization of risk management investments.

Source: Graph by the authors based on information provided by DNP-SDAS, 2010.

14 Information for the investment analysis in disaster risk management for this publication is supported by the database provided by the DNP with its Directorate for Sustainable Territorial Development (DDTS), which includes data on investments made at municipal levels (period 2002-2008).

In general, protection and insurance mechanisms for buildings and private property are not used in municipalities, which increases public pressure and risk (fiscal vulnerability). According to information from Fasecolda [Federation of Colombian Insurers] (2011), only 7% of the victims of the 2010-2011 La Niña phenomenon had insurance. In Bogotá, 4.5% of all horizontal property has insurance, and the percentages may be lower in the rest of the cities that were studied. In the 1999 earthquake in the Coffee Growing region, only 10% of direct losses were covered by insurance.

3.2.4.3. Use and effectiveness of instruments for monitoring and control

The agencies of municipal administrations are the first link for monitoring and control, which enables the construction of safe territories. In order to evaluate the risk management performance of territorial entities, different instruments are available and should be useful for monitoring the effectiveness of government actions. The annual monitoring of the programs (indicators and goals) and the investment plans (resources) of each Development Plan is a function of the Planning Secretariat. However, when analyzing risk management performance, this approach is inadequate because it is limited to verifying that product and financial indicators are met, without delving into the impact of the actions that were carried out. In other words, a rendering of accounts does not allow for a systemic evaluation of risk management as a government policy. On the other hand, the lack of human, technological, and financial resources of planning agencies at the municipal level does not allow the actions established in the POT to be evaluated with the same level of detail. Therefore, the Urban Files, estab-

lished by Law 388, are important for improving management, monitoring, and evaluation functions in land use planning. According to the results of perception surveys¹⁵, the performance of monitoring and control functions is evaluated as incipient. These functions are seen as more critical in category 2 to 6 municipalities than in municipalities that belong to the Special category or category 1.

Urban control is a responsibility of municipal curators, comptrollers, attorneys, and inspectors. It is a mechanism with a corrective approach. The aforementioned entities have technical, staffing, and financial deficiencies in risk management. With the exception of Bogotá, where a high level of control of illegal and informal settlements has been achieved, the other case studies report gaps and limitations with respect to the functions and effectiveness of urban control. In this regard, in order to have effective control at the local level, it is essential to have precise, clear, and timely rules and regulations, which are based on rigorous determinants, respected at all levels of government, and have adequate resources and instruments. It is also necessary to evaluate the relevance, economic soundness, effectiveness, and efficiency of each Local Mayor's Office as far as urban control, and to review the attributes of the corresponding Police Department. An example of this deficiency has been observed in Barranquilla, where the

15 In 2011, the World Bank organized 225 self-evaluation surveys of the following entities: institutions at national level belonging to the SNPAD, the Autonomous Regional Corporations, the Regional Committees for Disaster Prevention and Response, and the Local Committees for Disaster Prevention of the department capitals and of other municipalities (Table A.3). The surveys consisted of five areas or thematic axes similar to the "HFA Monitor" instrument (UNISDR 2009) of the Hyogo Framework for Action and a total of 15 indicators, with their qualitative scales to measure risk management progress level (level 1=low / level 2=emerging / level 3=acceptable / level 4=notable / level 5=optimum) (see information presented in the appendixes).

District Secretariat for Urban Control and Public Spaces is in charge of, among other functions, supervising and controlling constructions and works, which are carried out in the District, in accordance with Law 388 of 1997 and the Construction Code. It also performs the function of supervising and controlling compliance with urban standards on the part of urban curators, even though this Secretariat has no strategies for timely control, especially with respect to illegal occupation and construction that does not meet technical standards. Similar situations have been observed in Cucuta, Cali, Medellin, and Manizales. On the other hand, Municipal Comptrollers are in charge of supervising the fiscal performance of territorial entities and presenting an annual report to municipal councils about the state of natural resources and the environment, which includes the topic of disaster prevention and management. Even though these entities exist, the results of their reports are mixed and do not reflect the use of a detailed methodology that facilitates a real evaluation of risk management. A clear reflection of the gaps in monitoring and control mechanisms can be found in the area of citizen participation which, with some exceptions in big cities, is only a response to the demands of the community and does not constitute preventive actions when risk conditions exist.

3.2.4.4. Knowledge and information for risk management

Progress has been made regarding studies and research into restrictions and determinants of risks in municipalities. However, depending on the subject and territory, there are differences in the availability and scope of the studies and research, which lead to gaps in the decision-making process. The basis for identifying and evaluating hazards, vulnerabili-

ties, and risks is an awareness of their causal factors, dynamics, and evolution, which contributes to creating a technical-quality framework of characteristics of existing scenarios. Using the framework, it is possible to prioritize and establish intervention measures for prevention or reduction of risk conditions, from territorial planning to land use planning to environmental management. The situation is more critical in category 2 to 6 municipalities, due to limitations for accessing and generating updated information with the required details, gaps in methodologies for evaluating hazards and risks, and technical, staffing, and financial deficiencies. However, this issue also exists in big cities. Barranquilla, for instance, lacks hydrometeorological networks and, therefore, it has no input for modeling phenomena. Partial studies have been carried out and they have not offered any solution to the problem of urban *arroyos*, leading to interventions that have probably increased risk conditions. Cucuta, on the other hand, has no seismic microzoning, and flood analysis has not helped to create instruments that regulate the occupation of land. It is worth noting that Bogota and Manizales are leaders in acquiring knowledge through seismic microzoning, which allows them to calculate possible loss scenarios, use the seismic instrumentation laboratory in Manizales, monitoring of hazardous and risky polygons that may be subject to illegal occupation in Bogota, and varied research into landslides, floods, forest fires, and technological hazards. This knowledge has been included in planning instruments (the POT with updated regulations, standards, blueprints, programs, and projects, and the programmatic and investment components of the PD).

During the last decade, major efforts have been made to systematically monitor phenomena and consolidate historical information about disasters that have occurred.

There are experiences in implementing and operating meteorological stations for disaster prevention, with the coordination of municipal administrations and the support of technical or academic entities¹⁶. Medellín has an Early Warning System (SIATA), which was created in 2007 to integrate the administration of three networks: the Medellín Accelerograph Network (RAM), the hydrometeorological network with 46 pluviometers, and the air monitoring network (*Red Aire*), which until then had been administered by different entities; currently, a weather forecast radar is being installed. The goal is to guide decisions about the territory, establish priorities, and link them to the early warning systems. There are meteorological stations in Bogotá and Manizales with the purpose of evaluating, among other things, the hydric hazard associated to severe precipitation and its effect on slopes. Accelerograph networks have been installed at strategic locations in order to monitor and characterize zones with a similar seismic response and establish specific regulations for designing and constructing seismic-resistant buildings.

Information systems are essential inputs for risk management. Bogotá, Medellín, and Manizales have information systems that consolidate data on studies, concepts, and emergencies related to disaster risk. Barranquilla recently began using a Geographic Information System (GIS) with basic information layers and up-to-date topics, in order to support the administration in decision making and real estate and property registry organization. However, it is not set up as an instrument for consolidating reports on emergencies and their impacts. For the Inventory of Historical and Everyday Disasters, there are important initiatives by the OSSO Corporation, DPAD, the Red Cross, and the Civil Defense. Nevertheless, although the tools exist, they have not been standardized and therefore, databases at the municipal level are heterogeneous. They

depend on the territorial entities' own initiatives and are not comparable among each other.

3.2.4.5. *Reduction of risk conditions*

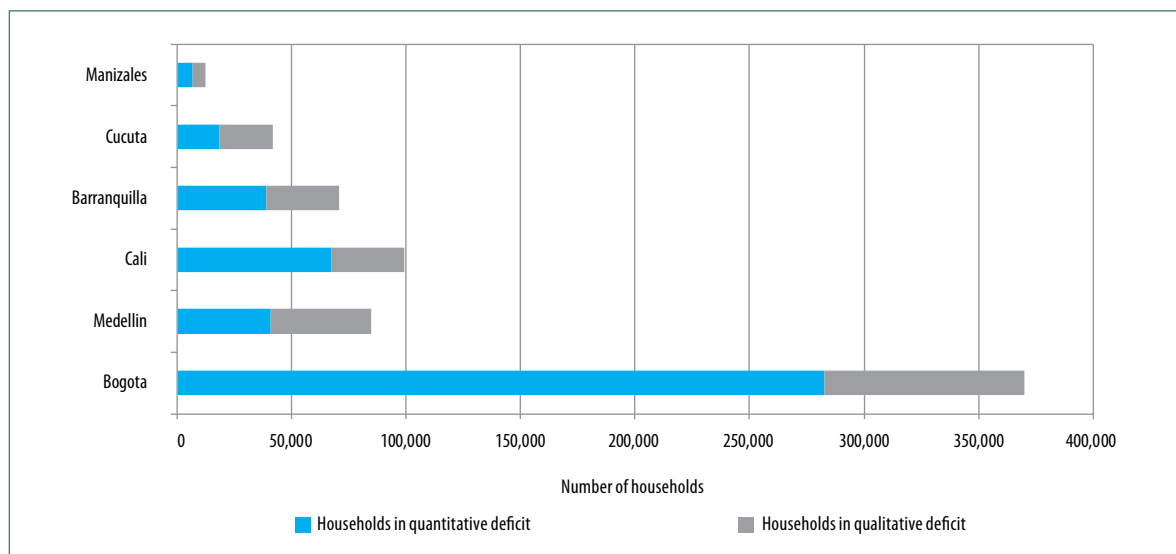
Municipal administrations set trends in the reduction of risk conditions. Bogotá and Medellín are leaders in this regard, both in terms of programs and executed investments. In the case of Bogotá, there is a program for resettling families located in nonmitigable high-risk areas. The program focuses on moving persons from strata 1 and 2 exposed to landslides and floods. The DPAAE is in charge of evaluating the lots, the District of Bogotá purchases the lots and arranges for the construction of housing, and the FOPAAE and the office of the mayor of the locality are jointly responsible for the rehabilitation and change in use of the zones that have been vacated and are undergoing resettlement. Approximately 9,043 families are included in this program, 43% of which have been resettled and the rest are finalizing resettlement. Bogotá also has a program for integral improvement of neighborhoods, which performs actions for supplementing, reorganizing, or adapting illegal settlements, with the purpose of achieving acceptable levels of safety and security. Medellín, on the other hand, has pioneered the integral improvement of neighborhoods with a focus on risk reduction. PRIMED, an integral program for improving subnormal neighborhoods, was implemented from 1992 to 1998. Recently, the city conducted a pilot program for housing consolidation and environmental recovery of the Juan Bobo gorge focused on intervention in microbasins and reduction of hydrological risk, under the Integral

¹⁶ The topic of knowledge and information has been strengthened thanks to the participation of the university academic sector and the technical-scientific sector, through institutional research (own funds), interinstitutional agreements with municipal and department authorities, as well as management of resources for national and international cooperation to develop research (unofficial cooperation).

Urban Project (PUI) for the northeastern part of the city. In spite of the efforts of Medellín, a long-term policy is not in place that produces significant changes in the dynamics of risk zones, which have

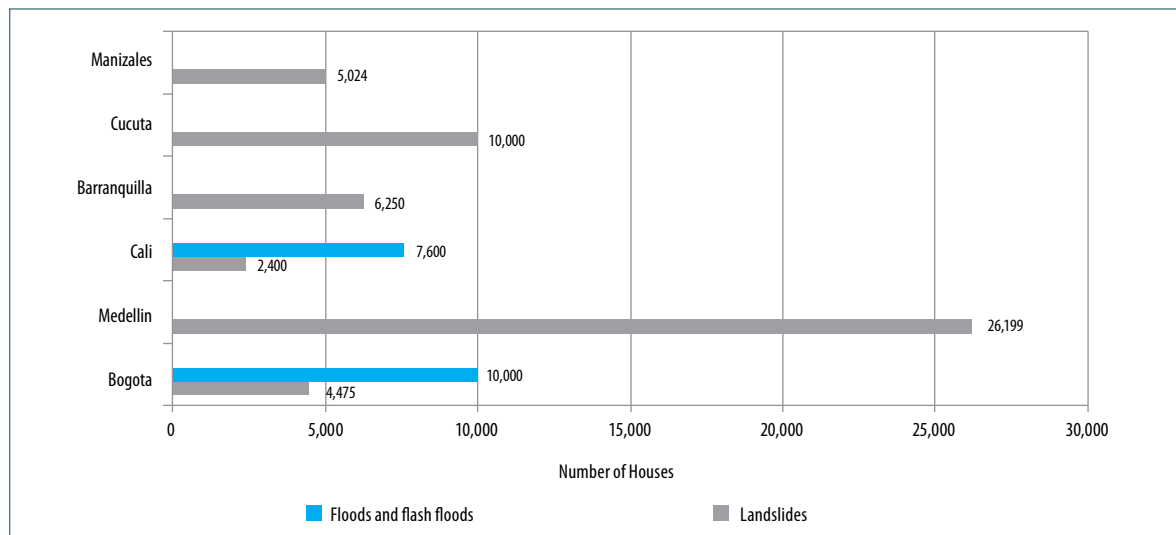
continued growing. According to a report by the Planning Department, the urban area went from 25,399 homes in nonmitigable high-risk areas in 2006 to 26,199 in 2010 (*Graphs 3.7 and 3.8*).

GRAPH 3.7. Quantitative and qualitative housing deficit. Case studies, 2010



Source: DANE, 2005b.

GRAPH 3.8. Number of houses in nonmitigable high-risk areas. Case studies, 2010



Sources:

Bogota: Bogota Mayor's Office, District Secretariat for the Habitat (SDHT), 2008 and 2007.

Medellin: Planning Department, 2010.

Cali: Municipal Planning Department, 2010.

Barranquilla: Barranquilla Comptroller's Office, 2009.

Cucuta: Local Technical Commission of Disaster Prevention and Management Committee, 2011.

Manizales: Local Disaster Prevention and Management Committee, 2008.

Illustrative experiences in mitigation works, structural reinforcement, and building protection that go beyond safe construction and the execution of engineering projects have been observed in Manizales and Bogota. These actions are visible in the execution of the Manizales Program for the Protection of Hillsides, which receives approximately 65% of the resources invested in risk management, and it is a response to the serious instability problems of the territory. However, the landslides that occurred in October and November 2011, which had a major impact on the city, revealed that although measures have been taken to improve the stability of hillsides, there are still some aspects left to consider. Mitigation works in unstable zones require analysis through detailed models, and the insertion of higher security factors than those currently used is probably necessary in order to take into account not only the uncertainty associated with the parameters that were used, such as the intense precipitation caused by the La Niña phenomenon. On the other hand, the Program for Protection of Public Assets, which was executed in 2004, began with a complete analysis of the potential of losses in all of Manizales government's public buildings and took out a single insurance policy for all its public properties. In Bogota, mitigation works, especially in the eastern mountains, have been carried out as a result of detailed risk analysis, which determines mitigation conditions. Furthermore, structural reinforcement interventions (in buildings that are indispensable and serve the community) have been carried out since 1995 with the purpose of reducing the socio-economic impact of a large-scale event. In this regard, the Finance Secretariat of the District of Bogota has spearheaded a project for reducing the fiscal vulnerability in disaster situ-

ations and the FOPAE provides the technical coordination. Carrying out these types of successful experiences requires detailed studies, political resolve, and financial resources for their execution.

Education and communication, which are part of the actions for reducing risks, have not been a priority at the municipal level, even though there have been some interventions that have advanced the culture of prevention. In order to reduce risk, interinstitutional and social coordination is essential for developing various strategies that promote including the subject of risk in educational and community environments. In this regard, interesting experiences have been identified; for example, campaigns like “Bogota with Its Feet on the Ground,”¹⁷ “A Culture of Prevention and Early Warning ‘Catedra Galeras’” in Pasto, “Advancing toward Citizens’ Awareness in Environmental Education” in Quindio, “Good Citizenship Is Our Common Commitment” in Sandona (Nariño), the Hillside Guardians Program, or the Risk Management Platform in Manizales¹⁸, which contains information on public policies and main developments regarding risk management in the city. On the other hand, the perception survey of the “*How are we doing in Medellin 2009*”¹⁹ project is one of the few recent studies on the perception of risk by society. It provides information about exposure levels, capacity for action, and recognition of the performance of entities who are responsible for risk management.

17 More information on this campaign is available at <http://www.sire.gov.co>.

18 For more information on this platform go to http://www.manizales.unal.edu.co/gestion_riesgos/introduccion.php.

19 For more information, see Ipsos Public Affairs, 2009.

3.2.4.6. Disaster management

The amount of resources invested in disaster management has been increasing permanently due not only to the increase in the number of events and the care of the affected population groups, but also to the progress of the entities that are responsible for disaster management. Bogota and Medellin are the cities that have assigned the most resources to this sphere. Advances in disaster management are evident in the programs that are included in the PD: in Bogota, for example, there has been an improvement in technical and social capabilities for effectively handling emergency situations, the Fire Department has been modernized, and the 123 Sole Security and Emergency Hotline (NUSE) has been established. In Medellin, the most important efforts have been directed toward training the members and updating the infrastructure of the Fire Department, as well as developing related documents and handbooks. In Manizales, agreements for handling emergencies have been made with humanitarian and emergency organizations (Red Cross, Volunteer Firefighters Corps, and Civil Defense). There are significant territorial differences between big cities and the rest of the municipalities in the country, which, according to surveys, tend to perceive that their disaster management actions are less effective because they have problems guaranteeing a sustained emergency response capacity.

An Emergency Prevention and Management Fund is an essential instrument for developing and consolidating over time the work that is needed for providing real protection to municipalities faced with catastrophic events. In 1987, the Emergency Prevention and Management Fund was created in Bogota. Its resources are directed solely at funding processes that protect the city by mea-

suring and evaluating risks, and executing programs and projects dealing with prevention and mitigation, as well as the improvement of its organizational structure. This represents an unprecedented milestone for the country, signaling that the protection of a city is highly feasible. It is a requirement that a sum not less than 0.5% of the current tax revenues of the central government be included in the annual budget of the District of Bogota. In Manizales, on the other hand, the Municipal Office for Disaster Prevention and Management has access to exclusive resources amounting to 1% of the current revenues of the municipality and decentralized entities. In Medellin, the program for disaster prevention and management (created by Agreement 14 of 1994) focuses exclusively on disaster management. There is a contrast with the situation in Barranquilla, where, even though the Fund for the Prevention and Management of Emergencies, Calamities, and Disasters was created in 2008 (Decree 0419 of 2008) with the purpose of serving the public interest and providing social assistance, to date there have been limited resources available strictly for emergency management. In Cali, the situation is even more critical because even though the Revolving Fund for Safety, Emergencies, and Disasters was established by Agreement 0203 of 2001, it is not yet in operation. In consequence, the humanitarian and assistance organizations that used to have the permanent support of the local government through the Municipal Surveillance and Safety Fund (Visecali), which disappeared in 1996, are facing financial difficulties in guaranteeing a sustained capacity for emergency response.

A Local Emergency and Contingency Plan (PLEC) is an essential instrument for effective disaster management. In some cases, even central government entities have provided guidance for the preparation and imple-

mentation of PLEC in order to ensure technical quality, which depends, on the one hand, on information that is available at the municipal level regarding disaster scenarios and definitions of functions, tasks, and resources when faced with such scenarios, and, on the other hand, on coordination with early warning systems and coherence with other planning instruments. However, not all territorial entities, especially Category 5 and 6 municipalities, are capable of preparing high-quality documents. Interesting experiences have been identified, such as the Manizales Emergency Plan, which was developed in 2003 and includes a Basic Plan (with a purpose, objectives, an operating concept, an organizational structure, a resource inventory, and mechanisms for updating the document), appendixes, and attachments specifying functions. Since the Plan was adopted, several drills have been carried out, and the Plan has been activated during events held in the city. The Bogota Emergency Plan, which was prepared in 2007 and updated in 2008, establishes policies, organizational systems, and general procedures for facing calamity, disaster, or emergency situations in the city in a timely, efficient, and effective fashion. A structured system of matrices, plans, and protocols contains provisions for classifying emergencies, functions, and activities, responsible parties, procedures, organization, coordination, and resources that are applicable to emergency management. Furthermore, there are sustainable post-event rehabilitation, reconstruction, and development plans that provide guidance for joint, coordinated, and orchestrated intervention by SPDAE entities, according to their competencies, for the recovery of a geographic area that has suffered a serious public calamity, a disaster, a public calamity, or an emergency. Cali was one of the first cities to have a PLEC. A new version is recently available, which was

adopted by Decree 411.0.20.0744 of 2010 and serves as a procedural guide for coordinating municipal government and institutional actions in order to prepare and organize for two possible risk scenarios: flooding due to breaching of the Cauca River levels and earthquakes. Recently, Cucuta completed its 2010 PLEC, which demands the commitment and actions for improvement of institutional actors in the face of changes and the elevated degree of intervention and destruction of natural resources. Barranquilla does not have the necessary instruments for coordinating responses to emergencies and has a low reaction capacity. Currently, the city is working on a PLEC, but a progress report indicates that, as of 2010, it was only 30% complete.

In conclusion, and according to the research done for the case studies, there is evidence of major differences in disaster risk management by municipal and district administrations. Large cities like Bogota and Medellin have incorporated integral risk management into their development in different ways. Although the risk reduction in several fields is evident in Bogota, more work is required in Medellin in order to better harmonize risk management with municipal instruments. On the other hand, it has not been possible to permeate the municipal administration in Cali and Barranquilla so that they include policies, programs, and projects for mitigating existing risk, preventing potential risk, and managing emergencies. However, the elevated exposure to seismic hazard in the case of Cali, and urban *arroyos* in the case of Barranquilla, is well known and has been well studied. With respect to Cucuta, risk management seems to be focused on preparation for emergencies, and it has not been effectively included in municipal instruments for prevention and mitigation. Manizales, on the other hand, is characterized by its exposure

to mass removal phenomena, earthquakes, and volcanic eruptions. The city has managed to congregate entities like Corpocaldas and universities in the region to actively participate in programs and projects focused on integral disaster risk management that include advances in knowledge, education, information, risk reduction, and disaster management.

Although case studies have concentrated on big cities in the country, which are in the Special category or in category 1, it can be inferred that if they have deficiencies in including risk management in planning and public administration instruments, the problems are even greater in category 2 to 6 municipalities and aggravated by their lack of capacities. As discussed in Chapter 2 of this report, it can be inferred that, in general, Special category municipalities have a high capability

of incorporating risk management into their planning, finance, and operations; category 1 municipalities have a medium capability, although, in most cases, they have the resources to duly incorporate risk management into the territorial administration. In category 2 to 6 municipalities, they have a very low capability to adequately incorporate risk management. Therefore, it is necessary to implement differential strategies in order to provide institutional and technical support in land use planning and public administration to municipalities with fewer capacities. Undeniably, an essential element for progress is a detailed knowledge of hazards and risks, which is a basic input for formulating risk reduction actions and incorporating them into municipal planning instruments (*Table 3.3*).

TABLE 3.3. Synthesis of the public administration instruments and disaster risk management at local level

| Case studies | Instruments for public administration | Instruments for risk management |
|--------------|--|---|
| Bogota | <p>Policies and planning. Bogota has had emergency prevention and management policies since 1987 when the FOPAE was created. The POT establishes restrictions and determinants based on the knowledge of hazards and risks to the city as well as the roles of entities and the requirements for regulating land use planning in the city. With the purpose of providing action and intervention guidance for the District of Bogota, a city decree has established a District Plan for Disaster Prevention and Management (PDPAE), which is currently being implemented.</p> <p>Investment and financing. The amount of 0.5% of the current tax revenues of the city is available for disaster risk management. Investments in risk management have been made since the creation of the Emergency Prevention and Management Fund in 1987. Resources for supporting risk management are assigned according to the mission and functions of each entity.</p> <p>Monitoring and control. The Planning and Finance Secretariats monitor risk management actions through the FOPAE, the entity that coordinates the SDPAE. The Office of the Comptroller exercises control after the investments have been made and accompanies the investment process in specific cases.</p> | <p>Organization. Bogota has a District System for Emergency Prevention and Management (SDPAE), which was established by decree in 1999. All the responsibilities of district entities were defined and revised by Decree 332 of 2004. The FOPAE has in-house staff and contractors and is currently attached to the Government Secretariat of the city.</p> <p>Knowledge and information. Hazard and threat information is available and is used as input for decision making. Furthermore, there is a hydrometeorological network for monitoring the Bogota and Tunjuelito Rivers. The city also has an accelerometer network, which helps to calibrate the information on zones included in seismic microzonning. The Bogota Emergency and Risk Management Information System (SIRE) is an essential instrument for all the entities in the SDPAE.</p> <p>Reduction of risk. Mitigation works for landslides and floods, antiseismic reinforcement for essential infrastructure, resettlement of families from nonmitigable high-risk areas, and the integral improvement of neighborhoods are some of the actions that have reduced risk in Bogota.</p> <p>Disaster management. In Bogota, the PLEC is an essential tool for organizing the entities of the District of Bogota in order to respond to events that are classified by impact, coverage, requirements, and other variables.</p> |

TABLE 3.3. Synthesis of the public administration instruments and disaster risk management at local level (continued)

| Case studies | Instruments for public administration | Instruments for risk management |
|--------------|--|---|
| Cucuta | <p>Policies and planning. Risk management is deficient in municipal policies. The POT includes hazards and vulnerabilities due to floods and landslides and restricts construction on riverbanks.</p> <p>Investment and financing. Investments are inconsistent with risk management requirements.</p> <p>Monitoring and control. The Office of the Mayor carries out a study of achievement of goals and percentage of investment, without measuring the impact of the actions that were executed.</p> | <p>Organization. There is a CLOPAD in the city; however, it has not been possible to permeate all the municipal entities with their roles and responsibilities in risk management.</p> <p>Knowledge and information. Information regarding hazards and vulnerabilities due to floods and Landslides is available, but a detailed analysis is required in some areas of the city. Even though Cucuta is a city with one of the highest seismic hazards in the country, a seismic microzonning study has not yet been carried out.</p> <p>Reduction of risk. The determinants and/or restrictions stipulated by the POT in regard to riverbanks are not observed. Uncoordinated interventions are performed and, as a result, their impact on risk reduction cannot be measured.</p> <p>Disaster management. There has been a PLEC since 2010. In addition to showing the high exposure and vulnerability of the city to existing phenomena, it explains risk management needs.</p> |

TABLE 3.3. Synthesis of the public administration instruments and disaster risk management at local level (continued)

| Case studies | Instruments for public administration | Instruments for risk management |
|--------------|--|---|
| Medellin | <p>Policies and planning. The subject of risk management has been incorporated into city policies for almost two decades. The methods for evaluating landslide and flood hazards have been improved and seismic microzonning studies are available. The new results of the aforementioned studies have not been incorporated in the POT yet because the best way to include them is still being analyzed.</p> <p>Investment and financing. Including a specific “Disaster prevention and management” item in the municipal accounts has permitted the continuous assignment since 1995 of resources for risk management in different PD. Investments have been focused mainly on disaster management and represent a low share of total investments (on average, specific allocations through the “Disaster prevention and management” item have been approximately 1.6%); however, many actions directed at risk management are included in PD. Currently, a Risk Management Fund that seeks to increase the resources for various processes is under development.</p> <p>Monitoring and control. The Office of the Mayor monitors the execution of the PD. Some of the main causes for the increase of risk in Medellin are a lack of enforcement of the provisions of the land use plan and the technical codes, as well as governance problems on the hillsides. The city has implemented a Risk Management Index of its own initiative in order to monitor risk management activities. It is currently restructuring its institutions for risk management.</p> | <p>Organization. The Emergency Operating Committee (COME) was created in 1996 for coordinating emergency response. It was later restructured as an executive, regulatory and, coordinating body for the policies and actions of the Municipal Disaster Management and Prevention System (SIMPAD). It is currently attached to the Environment Secretariat.</p> <p>Knowledge and information. Information is available about hazards and risks due to landslides, floods and, earthquakes. However, the studies have been carried out without calibrating and optimizing the proposed evaluation methods. In consequence, the manner in which the studies should be incorporated into the POT is under review. Furthermore, there is a hydrometeorological network and an accelerometer network.</p> <p>Reduction of risk. Two trends in risk reduction have been implemented in the city: resettlement and integral neighborhood improvement. However, a long-term policy has yet to be established in order to effectively reduce the population at risk.</p> <p>Disaster management. The SIMPAD has stood out with its programs for improving the Disaster Prevention and Management Community Network which was created with the SIMPAD in 1994, and has had an Emergency Plan since 2005.</p> |

3.3. RISK MANAGEMENT INCORPORATION IN THE ADMINISTRATION OF TERRITORY AT THE REGIONAL LEVEL

3.3.1. Characterization of the regional territories in function of their water systems

Throughout history, human settlements have developed around water systems, due to the search for a safe and permanent supply of drinking water, as well as access to means of transport for mobilization or exchange of products. Most global populations, not just large cities, but small urban centers, are located near rivers, lakes, or ports. The way in which they grow and the safety standards that are applied or not applied, are largely dependent on the decisions made and the use and occupation of the territory, environmental management, and ecosystem protection strategies.

Colombia is listed as one of the richest countries in water resources (see Box 3.4) and has many policies aimed at the protection and conservation of different ecosystems. National Policy for Interior Wetlands in Colombia (2002) identifies 20 million hectares of wetlands, but all regions have gone through dynamic hydraulic changes in the ecosystems, so as to change the use and/or occupation of the land. The lack of comprehensive actions in environmental protection, the use of inappropriate techniques in activities in agriculture, fishing, and livestock handling, the lack of control in the use of soils and disarticulation of the actors involved have generated deterioration processes, in which the ecological and hydrological systems of the country have been altered.

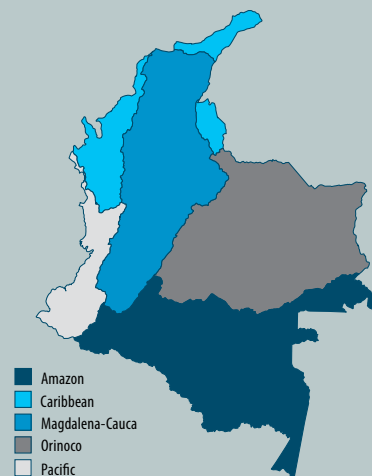
Box 3.4. Hydrographic areas in Colombia

Colombia's watershed zoning has three levels. The first is composed of five hydrographic areas, the second has 41 hydrographic zones, and the third level has 309 hydrographic subzones (Ideam, 2010). The five hydrographic areas are: Amazon, the Caribbean, Magdalena-Cauca, Orinoco, and the Pacific. Each hydrographic area comprises large drainage systems that flow into the Pacific, the Caribbean Sea, and the Magdalena, Orinoco, and Amazon Rivers. These zones, characterized by drainage systems, are larger than 10,000 km² in area, and the subzones have areas larger than 5,000 km².

Of the five hydrographic areas, the Caribbean is of great importance, since it has 71% of permanent and semipermanent wetlands, standing in order of importance as follows: the Momposina Depression complex, the Middle Magdalena, and the Atrato River (according to the National Policy for Interior Wetlands in Colombia). The largest number of the municipal capitals is concentrated in the Magdalena-Cauca hydrographic area, with 708 municipalities, followed by the Orinoquia and the Caribbean areas, with 130 and 121 municipalities respectively (Figure 3.1).

The characteristics of each hydrographic area are seen in the following tables:

FIGURE 3.1. Colombia's hydrographic zoning



Source: Ideam, 2010

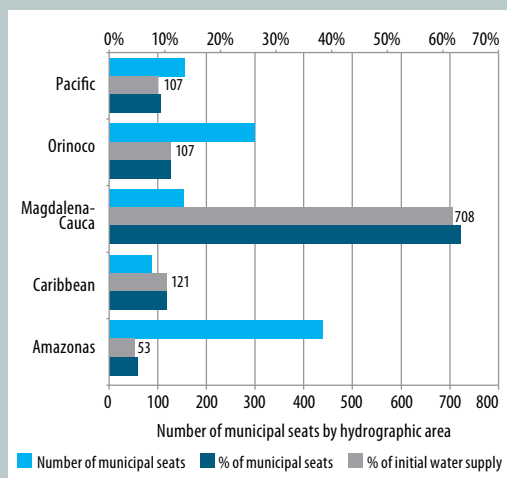
Box 3.4. Hydrographic areas in Colombia (continued)

TABLE 3.4. Characteristics of the hydrographic areas and zones in Colombia

| Hydrographic area | Hydrographic zone | Area (km ²) |
|-----------------------|-----------------------------------|-------------------------|
| Magdalena-Cauca | High Magdalena | 34,596 |
| | Saldaña | 9,963 |
| | Mid Magdalena | 59,689 |
| | Sogamoso | 23,249 |
| | Low Magdalena/Cauca/ San Jorge | 25,921 |
| | Cauca | 40,986 |
| | Nechi | 14,613 |
| | Cesar | 22,931 |
| | Low Magdalena | 27,243 |
| Magdalena-Cauca total | | 269,129 |

| Hydrographic area | Hydrographic zone | Area (km ²) |
|-------------------|---------------------------|-------------------------|
| Pacific | Mira | 5,870 |
| | Patia | 23,995 |
| | Amarales/Dagua/ Direct | 20,795 |
| | San Juan | 16,412 |
| | Baudo/Direct/Pacific | 5,964 |
| | Pacífico/Direct | 4,252 |
| | Pacific islands | |
| Pacific total | | 77,289 |

| Hydrographic area | Hydrographic zone | Area (km ²) |
|-------------------|-------------------|-------------------------|
| Orinoco | Inirida | 53,95 |
| | Guaviare | 84,570 |
| | Vichada | 26,212 |
| | Tomo | 20,301 |
| | Meta | 82,720 |
| | Casanare | 24,013 |
| | Arauca | 11,619 |
| | Orinoco Direct | 43,713 |
| | Apure | 264 |
| Orinoco total | | 3,477,208 |



| Hydrographic area | Hydrographic zone | Area (km ²) |
|-------------------|--|-------------------------|
| Caribbean | Atrato Darien | 37,810 |
| | Caribbean/Uraba | 8,601 |
| | Sinu | 18,478 |
| | Caribbean/Coast | 1,992 |
| | Caribbean/La Guajira | 21,419 |
| | Caribbean Islas (San Andres, Prov., Sta Cat.) | 49 |
| | Catatumbo | 16,472 |
| Caribbean total | | 104,821 |

| Hydrographic area | Hydrographic zone | Area (km ²) |
|-------------------|-------------------|-------------------------|
| Amazonas | Guania | 31,284 |
| | Vaupes | 37,694 |
| | Apoporis | 53,509 |
| | Caqueta | 99,969 |
| | Yari | 37,127 |
| | Caguan | 20,757 |
| | Putumayo | 57,930 |
| | Amazonas Direct | 3,269 |
| | Napo | 456 |
| Amazonas total | | 341,994 |

Source: Ideam, 2010

The country's great hydrological and ecosystem wealth is diminished with the inappropriate use and occupation of the land, which has generated the alteration of the hydraulic capacity of rivers, deforestation, drying of wetlands, pollution and overexploitation of natural resources. Conflicts between the use and vocation of the soil have transformed natural conditions in the territory; human settlements in the rivers' surrounding areas and activities such as agriculture and livestock make up some of the major anthropic interventions that affect this transformation.

La Niña phenomenon in 2010-2011 caused flooding of large areas of land. In May 2011, flooding area in the country corresponded to 2,091,819 hectares, linked to 1,488 independent events. Starting from the matrix of *La Niña phenomenon 2010-2011, Damage Evaluation* of the General Risk Directorate of the Ministry of Interior and Justice, floods and landslides, as major events, affected approximately 3,310,000 people, and caused 447 deaths, 524 injured, and 72 missing. Damages to housing at a national level are approximately 8,000 destroyed and 354,000 damaged homes.

The incorporation of disaster risk management in the regional public administration of the territory, and in particular, the planning and comprehensive intervention of watersheds, was analyzed by means of four pilot study cases. Some regions or basins were selected, taking into account their relevance in terms of the ability of buffering rising tides, the use and occupation of the territory and emergency events, especially allowing for frequent floods that would affect part of their territories, among other factors. Therefore, the analysis focused on the following case studies: the region of La Mojana, the ecoregion of the Canal del Dique, the Sinu River basin and the Bogota River basin, and above all in the area of the Bogota Savanna.

Although case studies show some similarities in terms of disaster risk conditions and intervention and occupation processes, they also reflect differences and particularities so that recommendations can be offered according to territorial reality (see Box 3.5). A reading of selected regional case studies makes it possible to identify the characteristics of each territory, and from there, establish recommendations that favor the articulation between territorial administration and disaster risk management.



Floods. Municipality of Montería (Córdoba, Colombia), 2011. Photography: María Isabel Toro Quijano.

Box 3.5. Regional case studies. Summary

Case studies include the La Mojana region, the Canal del Dique, the Sinu River, and the Bogota River basin. Each of them have specific features and they are subject to different phenomena, especially those of hydrometeorological origin (Table 3.5).

TABLE 3.5. Physical characteristics and institutionalism

| Case | Departments involved | Municipalities involved | CAR in charge | Main physical characteristics |
|---------------------------|--|---|--|---|
| La Mojana region | Antioquia, Cordoba, Sucre, and Bolivar | 11 municipalities: Nechi, San Jacinto del Cauca, Ayapel, Guaranda, Majagual, San Benito Abad, San Marcos, Achi, Caimito, Sucre and Magangué. | Corpomojana, Corantioquia, CSB (Southern Bolivar Regional Autonomous Corporation), CVS (Valles del Sinu and San Jorge Regional Autonomous Corporation), and Cormagdalena | From the municipality of Nechi, the Cauca River forms a cone or internal delta of approximately 100 km in length to its mouth in the Magdalena, forming a large flooded plain, which in its middle reaches 75 km in width and is traversed by numerous streams, where there are more than one hundred wetlands. The topography is almost flat (South at 36 mamsl and to the North at 16 mamsl) favoring the retention of water. Only 10.38%, which is, 52,031 hectares of the whole area, represents free flood zones. |
| Canal del Dique ecoregion | Atlantic, Bolivar, and Sucre | 26 municipalities: insular area, Arjona, Arroyohondo, Calamar, Campo de la Cruz, Carmen de Bolivar, Cartagena (Pasacaballos), Luruaco, Mahates, Manati, Maria La Baja, Piojo, Repelon, Sabanalarga, San Cristobal, San Estanislao de Kotska, San Jacinto, San Juan Nepomuceno, San Onofre, Santa Lucia, Soplaviento, Suan, Turbaco, Turbana, Usiacuri and Villanueva. | CRA (Atlantic Regional Corporation), Carsucre, Cardique, and Cormagdalena | The region of Canal del Dique goes from the western portion of the Magdalena River delta to its mouth in the Caribbean Sea. The area contains water bodies of salt marshes and brackish marshes, over 21,300 hectares are mirrors and swamps of great ecological importance, and other 87,000 hectares are flooded low-lying areas, whose floors are renewed annually with the overflow of solid materials from the Canal. This delta zone has been abandoned by the Magdalena River, but remains a floodable area, with a tendency of sea water to penetrate inland and sporadic invasions of fresh water from the river during periods of flooding ⁽¹⁾ . |
| Sinu River basin | Cordoba, Antioquia, and Sucre | 16 municipalities: San Carlos, Chima, Momil, Purisima, Cotorra, Monteria, Cerete, Cienaga de Oro, San Pelayo, Lorica, Planeta Rica, Sahagun, Chinu, San Antero, Sincelajo, and Sampues. | CVS | The Sinu River basin has an area of approximately 1,395,244 hectares, of which 93 percent corresponds to Cordoba Department; the total length of the main riverbed is 437.97 km from its source, in the Nudo de Paramillo to 3,500 mamsl, to its mouth in the Tinajones delta. The highest part of the basin is typical of a mountain environment, rapidly changing to an alluvial valley, which begins approximately near Angostura de Urra, with an average width of 26 km to the city of Monteria. The flanks of the Valley are determined by a series of hills belonging to the mountain ranges of Abibe and San Jeronimo. In the area, the river is rambling, meandering, with some straight sections partially structurally controlled, and shows a large amount of riverbeds and abandoned meanders. From Monteria, the Valley has an average width of 40 km, the river changes its pattern of high sinuosity and it becomes straighter, continuing with the same pattern until it arrives in the municipality of Lorica. There the width of the Valley is significantly reduced and it changes its course to the West, as well as the main channel, to the mouth of the river in the current delta. In the upper part of the basin, the Sinu River flow serves to produce electrical energy in the Urra I dam. |

Box 3.5. Regional case studies. Summary (continued)

TABLE 3.5. Physical characteristics and institutionalism (continued)

| Case | Departments involved | Municipalities involved | CAR in charge | Main physical characteristics |
|--------------------|----------------------|--|--|--|
| Bogota River basin | Cundinamarca | 41 municipalities, (not including Bogota), Villapinzon, Choconta, Suesca, Sesquile, Gachancipa, Tocancipa, Zipaquira, Cajica Sopo, Chia, Cota, Nemocon, La Calera, Cogua, Guatavita, Guasca, Tabio, Tenjo, Funza, Mosquera, Soacha, Sibate, Subachoque, El Rosal, Madrid, Facatativa, Bojaca, San Antonio del Tequendama, Tena, La Mesa, El Colegio, Anapoima, Apulo, Tocaïma, Agua de Dios, Ricaurte, Girardot, Zipacon, Cachipay, Anolaima, and Viota. | Car (Cundinamarca Regional Autonomous Corporation) | The Bogota River is in the Guacheneque moorland, near Villapinzon, about 3,300 mamsl, and its waters flow southeast until ending in the Magdalena, in Girardot, at 280 mamsl. Its length is 375 km. The basin splits into three main parts, according to its topographic and climatic characteristics: high basin between its origin and its flow into the urban perimeter of Bogota; the middle basin is from the beginning of the urban perimeter up to the floodgates of the municipality of Alicachin, near the Salto del Tequendama; and the low basin, from Alicachin up to its mouth in the Magdalena River, for a total area of 1,691 km ² . The first two basins cover an area of 4,305 km ² . The case study focused on the problems of the Bogota Savannah. |

⁽¹⁾ The Canal del Dique, opened in 1650, initially connected the river with the old Bahía de Matuna (and this with Cartagena through the so-called Caño del Estero), until 1934, when the needs of navigation and the availability of equipment for the cutting of hard materials connected the Canal directly with the Cartagena Bay due to the cut of the Paricuica near the town of El Recreo. Three rectifications and dredging of the Canal have been done to improve the waterway from 1934 to date. The last intervention was carried out in 1984, which resulted in a 116 km long channel of approximately 80 to 90 meters wide and with variable depths of between 3 and 10 meters and with an average flow 540 m³/s greater than 540 m³/s than it previously had.

Both in rural and urban areas, the relationship between disaster risk and poverty grows as environment degradation increases. Natural ecosystems (wetlands, forests, mangroves, and river basins) play a key role in the regulation of the frequency and the intensity of hazards such as flooding and landslides. Frequently, they are also an important source of additional income for the poor. The degradation of ecosystems diminishes their capacity to provide these services and thus increases hazards and vulnerability. Communities in developing countries are often disproportionately dependent on contributions from their ecosystems (UNISDR 2009, p. 10).

TABLE 3.6. Regional socioeconomic characteristics. Case studies

| Study area | Size (ha) | Population ⁽¹⁾ | Housing ⁽¹⁾ | Poverty ⁽¹⁾ (UBN) |
|---------------------------|-----------|---------------------------|------------------------|------------------------------|
| La Mojana region | 500,963 | 463,372 | 76,362 | 70.9 |
| Canal del Dique ecoregion | 500,000 | 677,159 | 122,118 | 59.5 |
| Sinus River basin | 1,395,244 | 1,068,204 | 244,327 | 62.3 |
| Bogota River basin | 600,000 | 1,201,345 ⁽²⁾ | 400,830 | 24.5 |

⁽¹⁾ DANE, 2005a.

⁽²⁾ This data does not include Bogota. According to the 2005 census, Bogota has a total population of 7,363,782 habitants.

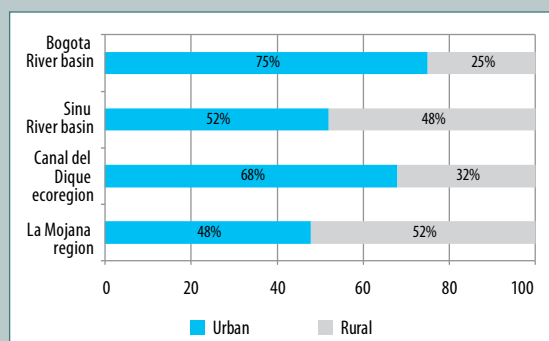
“In low-income rural areas, poverty leads to disaster risk due to the vulnerability of rural livelihoods. Limited access to productive land, technology, loans, and other productive assets means that poor rural households largely depend on agriculture for their livelihood and subsistence. Difficulties in accessing the markets, unfavorable trade policies, and the lack of investment in infrastructures amplify the vulnerability” (UNISDR 2009, p. 10). In 2003, poverty was a characteristic of the La Mojana region. However, the sectorization coincides with the natural characteristics of flooding. The same year, the UBN indicator corresponded to 85.1% (Aguilera, 2004). Poverty was mainly linked with the problem of access to land and common property, as well as the decline in farming and fisheries production. When analyzing two typical areas of La Mojana, it is noticed that the north area, or flooded area, is poorer and more vulnerable than the southern area, or terrestrial area. In the northern area, more than 70% of the families are poor, have limited access to land, and its population depends on hunting and fishing activities, making evident a major interdependency of subsistence and the state of the ecosystems.

Box 3.5. Regional case studies. Summary (continued)

The graph below shows urban and rural population percentages for each case study. It is important to state that although the average rural population in La Mojana accounts for 52.2% of the total population of 11 municipalities of the ecoregion, due to Magangué's figures that make a difference in the average value, this value is much higher in most of the municipalities. For example, Achi's rural population is 83%, in San Jacinto del Cauca's is 76.29%, and San Benito Abad's is 75.86%.

GRAPH 3.9. Urban-rural population distribution.

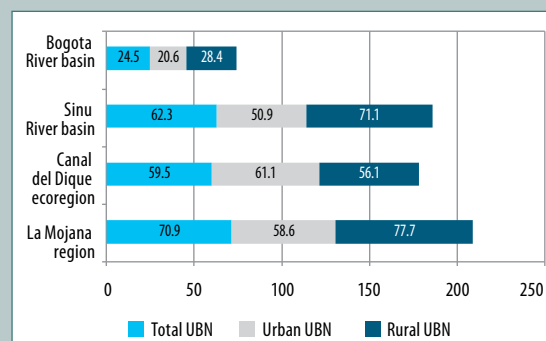
Case study, 2010



Source: DANE, 2005a.

GRAPH 3.10. Regional Unsatisfied Basic Needs. Case studies

(UBN as of December 31, 2008)



Source: DANE, 2010.

Poverty conditions, in which the large majority of the population lives in the Sinu River basin and in La Mojana and Canal del Dique regions, make it impossible to have economic growth, social equality, and environmental sustainability of the basins. While people do not have access to decent employment, social and public services, adequate nutrition, and decent housing, the stagnation of human and regional capital as well as social conflicts will continue to increase. It is necessary to emphasize the strong link between difficult environmental conditions in the basins and the precarious living condition that a great number of the population undergoes, considering that the high demand of natural resources for subsistence and poor basic sanitation manifested in high levels of pollution, landfills, and invasion of water bodies and environmentally important areas, among other aspects, that produce environmental degradation of the basins, and likewise this environmental deterioration acts as a detriment to the quality of life of the population.

3.3.2. The causes that generate and accumulate risk conditions in the basins

Use and occupation of the territory in areas near alluvial plains result in the reduction of natural buffer zones in rivers. This loss in the storage capacity in the river flow is one of the principal causes of floods in Colombia. Each of the wetland system components is subject to major anthropogenic pressures that tend to modify both its structure and operation, making it vulnerable and fragile. In the past 40 years, the left bank wetlands of the Sinu River, located in La Caimanera sub-basin, went from an area of 26.46 km² to 6.61

km² in 1981. Within the subbasin, the most serious case is the Rendona, Martinica, Garzal, Juncal, and Pozo Bonito system of marshes, which were reduced from 18.7 km² in 1961 to 1.8 km² in 1984, equivalent to a 90.6% reduction, despite having been declared a Wildlife Reserve of the State in 1974. In March (dry season), during the period from 1973 to 1991, La Mojana basins²⁰ went from 391 hectares to 279 hectares, involving a loss of 111 thousand hectares of the buffer area in that period, that is 38% of the basin areas, behavior similar to

²⁰ Flood basins, also called flooded depressions or basins (Martínez, 1992 Villota, 1991), are receiving depressions of surplus water overflow and fine sediments.

that of the spouts (Diaz-Granados, 2003). Only the number of sandy banks in Majagual (Sucre) increased significantly, having changed from 52,000 hectares in 1987 to 80,000 hectares in 2001. It was mainly due to land adaption and basin drying resulting from agricultural activities. On the other hand, in the Bogota River basin in 1972, when studies were carried out for Bogota's Sewage Master Plan, more than 50% of the area at risk was purely agricultural, whereas today more than 75% of the area is urban or suburban.

In recent decades in Colombia, as in most countries in Latin America and the Caribbean, there has been a direct relationship between the expansion of livestock and deforestation. Colombia increased the number of livestock to 1,315,895 during 1990-2005, and its forest coverage decreased 711,000 hectares in the same period. The estimated loss of soil, caused in part by deforestation, is 145,132,500 tons per year, resulting in sediments mostly deposited in river basins, in natural buffer areas, or ending up in the sea (ECLAC and GTZ, 2008).

There is a clear and obvious difference between the current use and soil suitability in the Sinu River basin, as well as in the La Mojana region. Extensive livestock farming in the Sinu River basin ranges between 51.75% and 62.6% of the total area depending on the climate regime, while soils suitable for livestock in the basin increase up to 7.1%. Agriculture takes place in an area that can range from 75,000 hectares up to 130,000 hectares, but soils with agricultural potential are around 378,000 hectares (due to the profitability of this economic activity) (CVS and Fonade 2004, CVS and National University of Colombia-Bogota 2005). In the La Mojana region, it is reported that only 10.38%, that is 52,000 hectares, is flood-free areas (Diaz-Gra-

nados, 2003). However, at least 260,000 heads of bovine cattle that need dry land remain in La Mojana throughout the year, and these cover an area equivalent to 213,000 hectares (Aguilera, 2004).

Informal connections between marshes, water bodies, canals, and river bypasses that transport or simply store the water, contribute to ponding. In the Canal del Dique, La Mojana region, and the wetland complex of the Sinu River basin, most of the marshes and water bodies in the surrounding areas are connected. Only recently have these connections been studied and these are largely controlled by the owners of nearby farms, who completely or partially close them so that they can use the basins in agriculture or livestock activities. Nevertheless, the Canal del Dique fishermen try to keep these connections open and as a consequence, there are frequent violent conflicts between farmers and fishermen.

Poverty conditions and lack of infrastructure services, in which the majority of the population of the Sinu River basin and the regions of La Mojana and Canal del Dique live, have not allowed an adequate economic growth, and affect the environmental sustainability of the watersheds. It is necessary to emphasize the strong link between the harsh environmental conditions of the basins and the precarious living standards that the majority of their residents are subject to. Furthermore, it should be taken into account that there is a high demand for natural resources for the population to subsist on, deficient basic sanitation, which is confirmed by high levels of pollution, the filling and invasion of water bodies and environmentally important areas, among other aspects, which generates environmental degradation and which in turn decreases the population's quality of life.

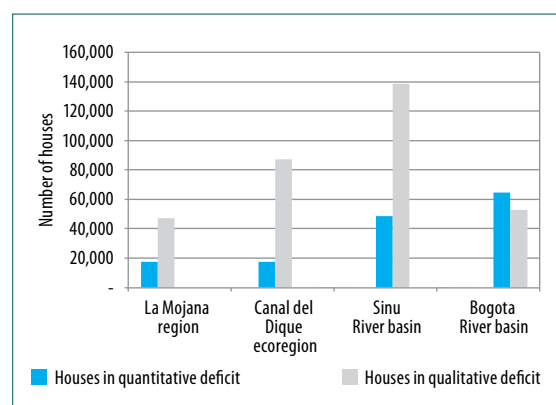
Box 3.6. Territorial occupation processes and risk conditions

| Sinu River basin | La Mojana region |
|--|---|
| The Sinu River, in its floodplain, includes large areas historically prone to flooding. In the past, the river poured its excess flow into the floodplain, where the excess of water was stored in large swampy areas, which were interconnected with surplus natural canals. These canals slowly led the water toward buffer systems. Conditions today are radically opposite; natural buffer systems and principal canal banks are characterized by intense human intervention and ranching. Among the municipalities most affected by flood events in the Sinu River basin are Lorica and Montería (Córdoba). | La Mojana is a large floodplain resulting from the buffering of liquid and solid basins from the Magdalena, Cauca, and San Jorge Rivers, arranged in a flood delta. The most important feature is an area so small that it occupies flood-free zones, corresponding to only 10% of the total area of this region. La Mojana has changed drastically, leading to a decrease in flood zones and an increase in the plains. This area is characterized by agrarian activities. The 11 municipalities that make up the region are constantly affected by periodic floods. |
| Canal del Dique ecoregion | Bogota River basin |
| The Canal del Dique is a delta area at the mouth of the Magdalena River and although not covered by the river, it still retains the character of a low flood zone, with the tendency to let seawater and some sporadic invasions of fresh water penetrate from the river during flood periods. From 1934 to date, there have been three rectifications and dragging into the canal in order to improve the waterway. Agriculture and fishing have been especially developed in this region. There have been flood and erosion events in 19 municipalities that make up the region. | The river runs along 46 municipalities in the department of Cundinamarca. Wetlands and buffer zones have been reduced through human intervention. For activities related to agriculture, livestock, floriculture, and housing, school, and infrastructure construction, the Bogota River constantly impacts the region because of the floods caused by its overflow during the rainy season. The repercussions are particularly concentrated in the municipalities bordering the Bogota River in the Ubaté Valley and Lake Fuquene. |

The lack of planning and inadequate implementation of land use planning instruments has resulted in growth of human settlements near the rivers. The effects of forced displacement and migration in Colombia as well as other factors that generate social, economic, and political pressure, added to inadequate planning and territorial control, have resulted in the increase of population in informal settlements located close to rivers, contributing to an increase of the population at risk. In the case of the Bogota River basin, large urban centers have expanded to the wetlands and river rounds, especially in the upper and medium basins, where there has been much construction of farms, country clubs, golf courses, and schools in unsuitable areas. The result has been the modification of land conditions making it difficult to provide maintenance to the drainage infrastructure, such as dredging and eradicating vegetation (hyacinth). These development circumstances do not generate only the need to construct civil

works designed to provide adequate safety on facing recurrent periods of disaster events, but also the urgent implementation of policy planning and control to prevent construction of new developments (*Graph 3.11*.)

GRAPH 3.11. Quantitative and qualitative regional housing deficit. Case Studies, 2010



Source: DANE, 2005b.

Human intervention in the upper and middle parts of the Cauca and Magdalena River basins generate variations in the hydrological behavior of the area, thus increasing the chances of flood threats in the La Mojana region. It must be remembered that La Mojana hydrology reflects the behavior of the upper and middle basins of Cauca and Magdalena Rivers. Upstream human activities such as deforestation, which increase surface erosion rates and increase the relation of runoff-infiltration and uncontrolled mining dramatically influence solid flows, potentially increasing floods in La Mojana. On the other hand, an increase in the occupation of the area affects the regulatory features and natural buffers in the region, thus these become a threat to its population and its productive activities.

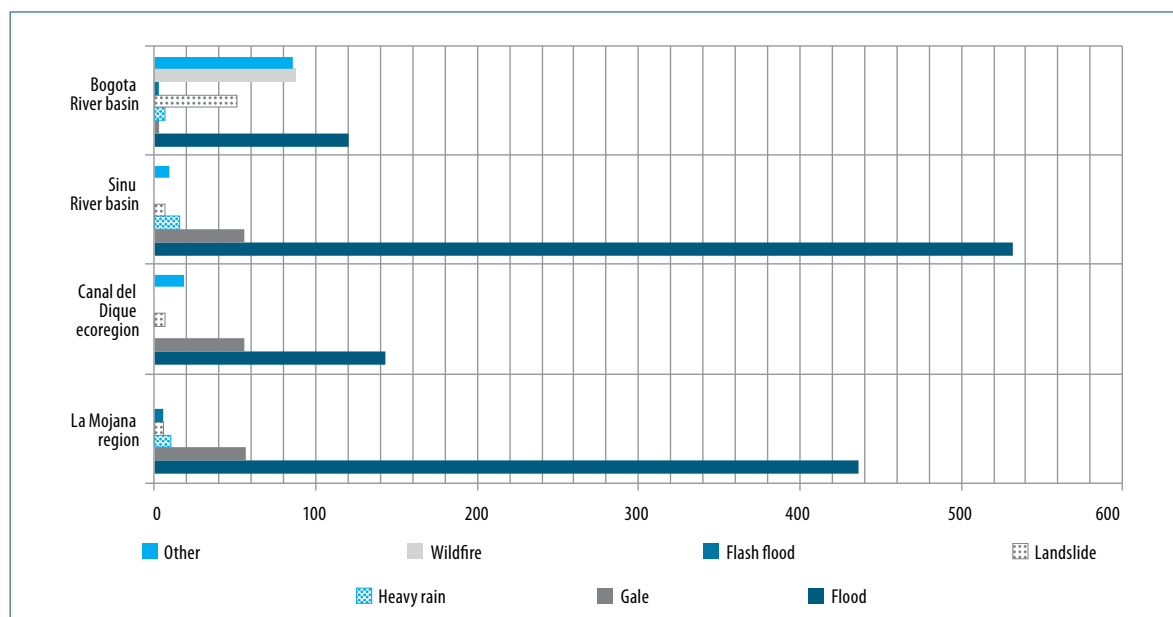
Some actions generated by different entities lead to making isolated decisions, which do not solve the need to integrally develop a specific area. It is very common in Colombia that for the same hydrographic basin, different authorities, such as the CAR, territorial authorities, and national organizations converge with the aim of planning and executing works and environmental or development projects. This congregation of entities results in disorganization, inadequate management, and ineffective control. Corantioquia, Southern Bolivar Corporation (CSB), El Valle del Sinu and San Jorge Corporation (CVS), and Corpomojana have jurisdiction in the La Mojana region. Cormagdalena has authority in navigation issues and other aspects. In addition, there are the departmental governments of Antioquia, Cordoba, Sucre, and Bolivar, and city halls from more than 11 municipalities. However, when viewed as an ecoregion and considering the immediate area of influence of regional strategic ecosystems (DNP-DPAD and UNDP, 2008), La Mojana is

extended to 17 other municipalities, for a total of 28 in the same four departments. Separately, in the ecoregion of the Canal del Dique, the following authorities have participated: the Ministry of Transport, through Cormagdalena; environmental authorities such as Cardique, the Atlantic Regional Autonomous Corporation (CRA), and Carsucure, in addition to Sucre, Atlantico, and Bolivar governments, and the city halls of 19 municipalities.

Decisions that do not seek to fully solve problems and that do not have a consensus among public and private interests are contributing to increasing risk. Although studies conclude that the main problems in the Canal del Dique are not sediments, different interest groups insist on dredging, putting aside work required to control floods. Moreover, it was evident that during the last episode of La Niña in 2010-2011, the risk situation was not limited to the population of the lower socioeconomic strata residing in the middle basin of the Bogota River, both in Bogota and in Chía. This situation made obvious the conflicts of interest between public and private sectors and the lack of adequate criteria in territorial planning, especially in suburban and rural areas.

The most frequent events in case studies of the Caribbean coast are floods and windstorms, and in the Andean region and in the Bogota River basin, the most frequent events are floods, forest fires, and landslides. The following graphs show the number of registers of disaster events in numbers and percentages (*Graphs 3.12 and 3.13*).

GRAPH 3.12. Register of disaster events by number. Case studies, 1970-2011



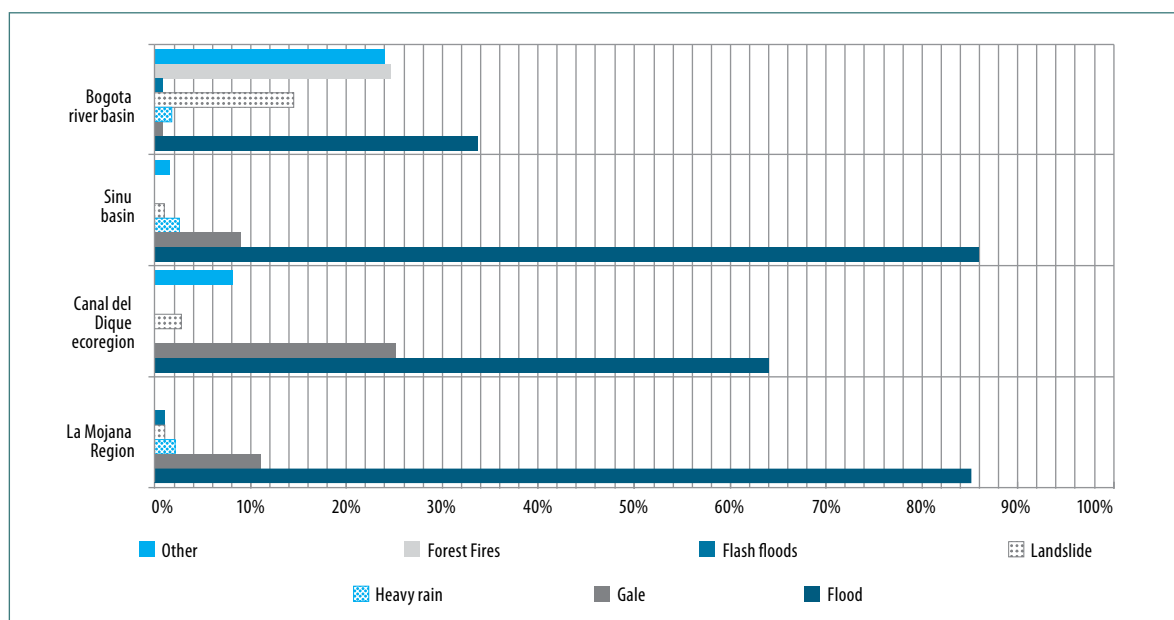
Source: Author's graph from the information provided by OSSO-EAFIT Corporation and DesInventar, 2011.

According to the 2010 General Comptroller Office report, there is no reliable information on areas with suitable irrigation works done by the private sector in Colombia. The audit, prepared for Incoder in 2009, reports that there are 310,000 hectares with land adaption infrastructure for agricultural purposes in Colombia, of which 181,000 hectares are irrigated, and that these correspond to 27 medium and large scale districts, and 40,000 hectares that have small-scale irrigation. The paper asserts that there is no reliable information related to areas adopted with irrigation works and done by the private sector. Incoder estimates that there are between 900,000 and 1,135,300 total hectares with land adaption works in the country (irrigation, drainage, and/or flood control), indicating weak control of the appropriation or modification of the natural buffer systems.

La Mojana sustainable Development Program (PDSM) classifies, among the structural problems of the region, the mismanage-

ment of wetlands. Despite the efforts made by different political and administrative actors, there are many problems to be solved in this ecoregion, among others: deterioration and mismanagement of wetlands, lack of hydrological and mapping information, concentration of land ownership and property title problems, which restricts their use by the local population, extreme poverty, agrarian production still carried out with conventional technologies and not appropriate to the environment, inefficient administrative capacity to plan and manage development; and finally, but not less importantly, weakness in public and private institutions, and a fragile social organization. In addition to these factors, there are those related to hazards and risks, environmental planning, inferior development of regional weather warning systems, the disordered dredging and cleaning of the spouts, rehabilitation of rural roads, and poor monitoring and evaluation of the current processes (see Box 3.7).

GRAPH 3.13. Register of disaster events by percentage. Case studies, 1970-2011



Source: Author's graph from information provided by OSSO-EAFIT Corporation, 2011.

Box 3.7. The importance of the La Mojana ecosystem

It is important and necessary for the country to recognize La Mojana as a National Patrimony Water Regulating Region. La Mojana is defined in numerous documents as a strategic ecosystem that influences the natural balance of the country. This area complies with very important ecological and environmental functions, which include flow regulation, buffering of river water tides, and accumulation of sediments from the three major rivers of Colombia: Magdalena, Cauca, and San Jorge, which makes it a region with rich biodiversity and numerous wetlands⁽¹⁾. Human activities in this region influence and are inversely influenced simultaneously by the dynamics of the La Mojana system of which some may be negative, thus resulting in the progressive decline of the system. This deterioration should be mitigated by actions that seek recovery, and preservation of ecosystems and sustainable development in socioeconomic production activities, taking into account the nature of the wetland region, which implies a proper management of the ecosystem (Díaz-Granados, 2003, p. 323).

(1) The total annual volume of sediment that reaches the Composing Depression is estimated to be 165,000,000 tons, of which 14% is deposited in the swamp system (Cormagdalena and Ideam, 2001).

3.3.3. Social agents in the generation and reduction of regional risk conditions

Entities responsible for providing and supplying clean drinking water for human consumption and waste water management, power generation companies, and Regional Autonomous Corporations are the main ac-

tors that manage and control water systems in the country. The case of the Bogota River basin, where the Bogota Power Company (EEB), the Bogota Aqueduct and Sewerage Company (EAAB), the Electric Power Generation Company S.A. (EMGESA), and the Cundinamarca Regional Autonomous Corporation (CAR) and other public and private companies operate, is one of the best examples of concurrence of dif-

ferent actors and interests in the same territory. CAR and the EAAB meet flood control and water regulation functions. Some reservoirs belonging to the basin are operated by different entities: CAR (Neusa and Sisga reservoirs), EEB (Tomine reservoir), and the EAAB (Tunjuelo River system, Los Tunjos, Chisaca, La Regadera, and Cantarrana reservoirs). Proper management of flows and river levels requires that all entities related with the basin work jointly, not only for the optimization of water resources, but to control growth levels and prevent flooding in the area in the rainy season.

The CAR, as entities responsible for the preparation of the Watershed Management Plans, play a key role in planning and management. They promote and perform works in irrigation, drainage, flood control, regulate the flows, water streams, and land recovery needed for the defense, protection, and proper management of watersheds in the territory under their jurisdiction. However, actions required for environmental control and risk reduction are weakened by lack of coordination among the various entities involved. In fact, entities such as Cardique, CRA, and Carsucre are involved in the Canal del Dique management. Moreover, the CRA has some responsibility for the Mallorquín swamp, the Caribbean Sea, and the Magdalena River. While joint committees have been created for regulation and watershed management, there is no doubt that it needs comprehensive coordination with the necessary resources to advance in actions and investments identified in various planning instruments.

Departments and municipalities have direct responsibilities in guaranteeing the provision of drinking water. Law 142 of 1994 served as a guide for the adoption of a safe drinking water and basic sanitation policy. The sector is based on separation of functions, so formu-

lation of policies, regulation, and control are exercised by the National Government, while municipalities are responsible for providing efficient services. Departments are responsible for designing and implementing Departmental Water Plans (PDA), as set forth in planning strategies and interinstitutional coordination, with the aim of achieving full harmonization of resources and implementation of sustainable and efficient schemes in the provision of home-based public services of drinking water and basic sanitation. All of this implies proper coordination between local authorities with the CAR in the optimization of water resources.

Large landowners have put pressure on land use, especially in the development of livestock and agriculture. Studies carried out by the National University of Colombia (CVS and National University of Colombia in Medellin, 2006) indicate that historically the structure of land ownership in the territory, including the “Marshy Complex” watershed of the Lower Sinu, has been a model for large states, and in which in the majority of cases their principal activity was extensive livestock farming. This type of farming continues to absorb small land holdings and introduces land belonging to the marshy complex area through land adaption processes by means of constructing drainage channels, pumping systems, and dikes. In addition to impacting the ecosystem, this situation creates a social problem in that it breaks the cultural pattern of relationship between fishermen and farmers in the dynamics of the natural ecosystem from which they earn their livelihood. Lack of public administration and lack of application of existing regulation for land use planning, as well as the perception of the population, who consider the swamp as a vacant lot, a territory not belonging to anyone and not valued as a public good, increase the problems caused by land tenure.

Some social agents such as farmers, fishermen, and farm workers trying to earn their livelihood, develop activities that produce continuous draining of swamps and mangrove degradation in the territories. In the last two decades, there has been an important shrimp industry in the Canal del Dique, which has had little respect for environmental regulations and has greatly affected the wealth of the mangrove area, which supposedly had to be protected by international treaties signed by Colombia. On the other hand, the process of adapting illegal land use to increase the agricultural frontier is a detriment to the marshes and the wetlands, which are areas assigned for public use. The practice of adopting illegal land blocks the outlets to the Canal and the connecting streams.

Universities have accompanied the processes related to knowledge of hydrological and hydraulic characteristics of the basins. The National University of Colombia, La Universidad del Norte, and Los Andes University, among others, have participated by implementing advanced instruments and technologies in watershed modeling and providing counseling and support to regional and local governments in decision making. Joint work between academia and local and environmental authorities should continue in implementing cooperation strategies and inter-agency agreements.

In the La Mojana region, the institutional actors are uncoordinated and there are major environmentally sensitive conditions with enormous socioeconomic transformation processes, thus it is necessary to know the relationship between these two components. Despite national efforts to promote the region, there is very little administrative capacity to plan and manage development in La Mojana. The area needs rural development policies that address appropriate technologies for the environment.

According to the functions established by National Law (Act 13 of 1990, Act 41 of 1993, Act 160 of 1994, and Decree 3759 of 2009), Incoder has the primary objective of **implementing agrarian policy and rural development, facilitating access to production factors, strengthening local authorities and their communities, and promoting coordination of the institutional activities in rural areas.** These actions should be executed under the principles of competitiveness, equality, sustainability, multifunctionality, and decentralization in order to help improve the quality of life of the rural population and the country's socioeconomic development. Among Incoder's responsibilities, the one that most stands out is the promotion of economic and social consolidation in rural development areas in having a common purpose and joint objectives in agriculture, forestry, and fishery production programs. Furthermore, these should address the specific realities of the rural and ethnic communities. Secondly, the Institute has also the function of clarifying, delimiting, and restoring sandy banks, "madre-viejas", dried river areas, lakes, and wetlands as property of the nation; regulating the use and management of the sandy banks and communal savannahs; and protecting the river basin protection areas. Technical coherence in the compliance of these two main functions should ensure the proper use and occupation of natural buffer areas without creating conflict with the development of agrarian activities in the country.

Currently, leadership for the work implementation for the Bogota River basin is defined by a court ruling, issued by the Cundinamarca Administrative Tribunal in 2004, ordering the CAR to manage hydraulic adaptation throughout the area, including the Capital District. This gave rise to the Investment Fund for the Hydraulic Adequacy of the Bogota

River (FIAB), in 2004, and District Agreement 17 of 2007 between the District entities and the CAR. The FIAB since then relies on compensation resources and loans to meet project development, providing effective protection for events with a recurrence period of up to 100 years. The mentioned court ruling and District agreement between the entities determine that the EAAB should perform most of the River's Environmental Sanitation Program. It has to construct sewer interceptors and the Canoas treatment plant, whereas the CAR executes the adaption of the river and the optimization of the El Salitre plant and those of other municipalities in the Bogota Savannah. According to CAR, these river project activities, including the El Salitre plant, should be finished in 2013, and the Canoas Residual Treatment Plant and the other 22 municipal Waste Water Treatment Plants (PTAR) should be finished in 2015.

3.3.4. Use and effectiveness of risk management and public instruments in the administration of regional territories

3.3.4.1. Use and effectiveness of public administration instruments

Colombia has different structural instruments at a regional level for environmental and land use planning. In 2002, delineations were defined and regulated for the use of watersheds through Decree 1729, which ordered the preparation of Plans for Management of Watersheds (POMCA) by the environmental authorities. Currently, a good part of the POMCA initiatives are long-term plans that include analysis of the watersheds, planning scenarios, sustainability criteria in patterns

and rules in watershed management, appropriate zoning in land use, and protection of natural resources that support the basins. They also include institutional, administrative, financial, and economic strategies to carry out the plan, as well as monitoring and controlling instrumental plans. Regional Environmental Management Plans (PGAR) are typical environmental planning instruments of the CAR. Their strategic and long-term²¹ character provides guidelines to strengthen environmental management, and provides guidance to various regional actors in order to protect and sustainably exploit the use of natural resources. The Regional Environmental Management Plans (PGAR), regulated by Decree 1865 of 1994, cover at least four main components: environmental diagnosis, regional environmental vision development, strategic lines, and monitoring and evaluation instruments. The PGAR contain the CAR strategic guidelines and they constitute its navigation map to intervene in the regions. Therefore, regional environmental planning is built around the guidelines arising from POMCA preparation as a decisive instrument for land use planning and the PGAR. Action Plans were created through Decree 1200 of 2004, together with the Income and Expenditure Budget in the CAR. These plans materialized the PGAR strategic visions, and those are the instruments that define and guide environmental investments, which will be developed by the CAR in their jurisdictions.

The POMCA are decisive for the preparation of the municipalities' POT, and should provide guidelines to orient land use planning processes, as being a normative hierarchy of other legal provisions available to the entities.

²¹ Ten-year validity.

However, on many occasions, the POMCA take the opportune hazard information provided by the municipal POT, but do not provide a comprehensive watershed analysis. In most POMCA, only the current phenomenon in the basins is mentioned, but they do not expose a spatial analysis of the hazard and much less of the risk. Many of them, instead of contributing to the POT, gather information related to these, to the point that some of them mention that, while the municipal POT does not have any hazard information, neither do they include that information in the watershed management plans. The 2007 POMCA, developed by the CAR, associated with the ecoregion of the Canal del Dique, includes the same concepts related to hazards existing in the region's POT. It does not have a comprehensive vision of the flooding hazards, which are more relevant and require greater attention in the watersheds. The same can be said about the Bogota River Basin POMCA, where excepting the Capital District, no other municipal POT has duly incorporated the problem of flooding. Fragile inclusion of elements for risk management in regional planning instruments, which should be guiding and determining for the POT preparation, weakens integration between the two instruments, and in turn integration with the municipal and departmental PD. However, cases such as the Sinu River basin and La Mojana POMCA stand out, where hazard analysis was properly developed, but the information was not taken into account in the municipal POT or in the PGAR.

In addition to the weakness in the incorporation of a risk management approach in planning instruments, there is likewise the absence of real articulation of environmental instruments. Environmental planning instruments have only included some elements of risk management due to fragmented information and to being highly dependent on the

interests of the individual actors. General mention of natural phenomenon hazards only appears in general framework components, in the PGAR diagnosis, in Actions Planning, and the POMCA, as well as in the regional vision and the environmental synthesis of the instruments. This particular way of dealing with the subject is the result of the absence of a comprehensive perspective that would group and articulate other complementary approaches, favoring an environmental management sectoral vision, rather than a more comprehensive and holistic vision, associated with risk control and management of natural phenomena. Although the PGAR are more integrated to the Action Plans, since the latter put in place strategies and action lines of the former, there is not a clear link with the POMCA. In other words, the PGAR and Action Plans are not articulated with the POMCA. Although the POMCA nature exceeds the CAR jurisdictions, the PGAR and the Action Plans become complementary instruments in allocating resources and improving watershed planning and management. The absence of articulation between instruments prevents the strategies developed by these three instruments from articulating efforts and providing greater impact in the regions.

The lack of integration of the CAR planning instruments with the POT and PD at municipal and departmental levels reduces the possibility of having strategies and actions for local and regional disaster risk reduction, and makes ineffective incorporation of risk management into development planning and processes of land use planning and land occupation. As a result, local and regional development projects, interventions of public policies in the regions, and the actions of public and private actors are not articulated, nor are they able to incorporate risk management criteria to promote coordinated actions that reduce disaster risks.

It is clear that in the analyzed regions, **risk continues accumulating due to lack of policy implementation and monitoring, and land use planning and watershed management instruments.** Although there are important technical documents to advance in flood risk management, the weakness of environmental authorities and territorial entities in incorporating them in the baseline, in the watershed planning, and management in the POT, favors the gradual deterioration of the original characteristics of natural buffer systems, and at the same time increases the risk of floods. This shows it is necessary to implement a land use plan that defines conditions and/or restrictions imposed by territory's characteristics. These may include actions related to population resettlement from high-risk areas, implementation of appropriate works to correct the existing risk, and promoting techniques that develop economic activities with a rural development policy and which do not involve territorial modification.

Although the CAR have achieved significant progress in the exercise of environmental authority, the inadequate growth of economic and productive activities in the ecosystems has made it evident that the majority of the CAR do not have the capacities to penalize and deter legal and illegal activities that threaten the protection of strategic ecosystems, the care of watersheds, and biodiversity resources. Regarding punitive interventions, there is no appropriate institutional coverage in the department or region that guides punitive measures. Furthermore, a weakness persists in police instruments and a frequent lack of sustainability in the actions exercised by environmental authorities²². This situation does not allow a proper protection of environmental resources; on the contrary, it contributes to shelter factors that generate disaster risk.

The heterogeneous manner in which the CAR exercise their role as an environmental authority contributes in some regions to deepening the causes that trigger disasters. An example that illustrates this problem is watershed deforestation that is a result of scarcely sustainable productive and extractive activities. These activities contribute to the erosion processes and destabilization, which in turn increases the probability of floods and landslides, the reduction of the quantity and quality in water production, sediment accumulation, and other serious imbalances in the ecosystems. The CAR do not possess the appropriate infrastructure or logistics to carry out strict control operations and penalize those responsible for activities that adversely affect the ecosystems. Inadequate surveillance definitely motivates productive activities that harm strategic environmental resources, which obviously contributes to factors that create disaster risk.

3.3.4.2. Use and efficiency of risk management instruments

The articulation of authorities is important to achieve not only inclusion of risk management in planning, but also in the execution of measures that guarantee adequate development, without increasing vulnerability or weakening the natural systems. There is a clear disarticulation among the State's entities causing the measures implemented in La Mojana and in the Sinu River basin to increase vulnerability in some communities. According to the priority regional action plan for sustainable development of La Mojana, the infrastructures cannot produce development by themselves. They will have greater multiplication

22 It should be pointed out that many of the strategic regions are inhabited by actors outside the law.

effects if they are designed and complemented as basic components of territorial development systems, which articulate the structural elements for the organization and improvement of the ecoregion (Diaz-Granados, 2003). In the specific case of the Bogota River, it is observed that delay in decision making is caused in part by a lack of uniformity in criteria of the different entities involved in the basin. This same problem is surely evidenced in many other regions of the country, in which adequate risk management is obstructed, since the entities are not liable for not executing the plans into effective action in order to mitigate risk at acceptable levels for the community.

There are multiple studies to understand and comprehend the basin. However, there are few technical documents that make a comprehensive analysis of hydrological behavior of the rivers and the flood hazards. As there is no adequate development and territorial planning, there is no definition of structural and nonstructural measures needed for risk pre-

vention and mitigation. The municipal planning instruments of La Mojana have a partial view of the territory, but in no case with the basin or ecoregion criteria. Thus, the implemented measures, which in the majority of cases are risk corrective, lack technical support, as well as the required articulation among entities. In the Canal del Dique ecoregion, studies are focused on resolving the sediment issue and navigability of the Magdalena River, but not on analyzing and proposing solutions to control floods. In the Sinu River basin, the CVS is almost exclusively in charge of risk management actions. However, resources are primarily addressed to structural measures. Between 2007 and 2009, works were executed at a cost of close to Col\$85.3 billion, which was invested in optimizing works of the hydraulic sections of canals, construction of canals, and bank protection works in the entire Cordoba department. The economic loss figures associated with subsequent floods show the efficiency of the invested resources.

TABLE 3.7. Synthesis of public administration and disaster risk management instruments at regional level

| Case studies - cities | Public administration instruments | Risk management instruments |
|-----------------------|---|--|
| Sinu River basin | <p>Policies and planning. The POMCA was adopted in 2004. In the PGAR (2002-2012) and the Triennial Plan (2007-2009), the CVS proposed the territory land use planning program (with projects aimed at the rational use of the natural resources, support for land-use planning, and the preparation of wetlands and environmental sustainability management plans) and the environmental planning program (with projects to control floods and erosion). Even though the CVS rely on the POMCA and have carried out activities to strengthen the CLOPAD in the hazard evaluation to be incorporated in the POT, articulation has not been possible between the planning instruments of the basin and the municipality.</p> <p>Investment and financing. Resources are allocated to projects proposed by CVS. Sucre's PD proposes actions and investments for 11 critical points on the San Jorge and Sinu Rivers.</p> <p>Monitoring and control. According to some auditing that has been done, monitoring and control activities are not carried out by the municipalities and departmental governments in relation to the drying up of the swamps and controlling the occupation of vacant lots.</p> | <p>Organization. The monitoring of POMCA is performed by a joint Committee made up of the CVS, the Special Administrative Unit of the National Natural Parks System (UAESPNN) and Carsure.</p> <p>Knowledge and information. There are more than 90 studies related to flood problems in the basins. They have information on hazards and flood controls, a Comprehensive Master Plan and Occupancy Plan and, planning of works, among others. CVS has a Geographic Information System.</p> <p>Risk reduction. Timely works of risk reduction have been carried out, but they have not been executed comprehensively for hydrological management and basin protection.</p> <p>Disaster management. The CVS is part of CREPAD and supports different CLOPAD.</p> |
| La Mojana region | <p>Policies and planning. Different documents of the Nation show the definition of policies to provide solutions to the problems of La Mojana. There are numerous technical studies. Nevertheless, the information has not been incorporated in the municipal POT.</p> <p>Investment and financing. Different government entities such as Invias and the CAR involved in the region have made investments in the region.</p> <p>Monitoring and control. Control is diluted in various entities. There is no knowledge of any existing monitoring process.</p> | <p>Organization. Due to the different actors related to the region, coordination is one of the institutional weaknesses for adequate decision making in La Mojana.</p> <p>Knowledge and information. There are more than 100 studies for the region of La Mojana. However, the majority does not include a systemic evaluation of the region.</p> <p>Risk reduction. The efforts in La Mojana have mainly been concentrated on periodic flood control through successive designs of a dam marginal to the Cauca River, which has been analyzed since 1960. There are different studies and designs that have resulted in works but the problem of the zone has not yet been solved. There is no definition of structural and nonstructural measures for risk reduction.</p> <p>Disaster management. Once a problem has occurred, it is addressed locally by the proprietors of the entities affected. The population is vulnerable for some time until the Emergency Committees and institutions begin to act. Then their situation is precarious and prolonged.</p> |

TABLE 3.7. Synthesis of public administration and disaster risk management instruments at regional level (continued)

| Case studies - cities | Public administration instruments | Risk management instruments |
|---------------------------|---|--|
| Canal del Dique ecoregion | <p>Policies and planning. The POMCA, published in 2007 by the CAR involved, assembled the same concepts on existing threats in the municipal POT and these do not really contain the result of a comprehensive analysis of the region.</p> <p>Investment and financing. Different government entities such as the Ministry of Transport and the CAR involved in the region have made investments in the region.</p> <p>Monitoring and control. Due to the lack of adequate coordination, environmental control is diluted among various entities.</p> | <p>Organization. Considering the diverse public and private institutions and territorial entities involved, inter-institutional coordination is one of the existing weaknesses for adequate intervention in the Canal del Dique.</p> <p>Knowledge and information. Several studies have been developed in order to orient solutions to control sediment. On the designing level, there is not enough information to make decisions on flood management and control.</p> <p>Risk reduction. The interventions in the Canal have been focused on sediment control rather than on reducing flood risks.</p> <p>Disaster management. The interventions are local and timely, and the proprietor entities are generally in charge of the affected goods/services. The affected inhabitants receive assistance from the Emergency Committees. Nevertheless, precarious conditions continue to persist.</p> |
| Bogota River basin | <p>Policy and planning. The POMCA includes information on hazards and vulnerabilities in a very general way making it difficult for the municipalities to include them in decision making in land use planning.</p> <p>Investment and financing. Resources to finance aspects of risk management are found in the CAR, the EAAB, and the District entities. Municipalities can have small budgetary items allocated for risk reduction.</p> <p>Monitoring and control. There are no clear responsibilities or functions regarding monitoring and control of the actions. Moreover, there is minimum coordination among entities.</p> | <p>Organization. There are several public institutions that are associated with the Bogota River: CAR, EEB, EAAB, and the District of Bogota and the neighboring municipalities of the river. Whereas some clearly know their competence in facing risk prevention and mitigation, others work independently, resulting in disarticulated actions.</p> <p>Knowledge and information. The majority of the required studies to quantify flood problems, and even studies made for decision making and construction works principally exist for the region between the Puente del Común and Alicachin.</p> <p>Risk reduction. There are works for flooding control, such as planned capacity and the use of alternate flow passages. Reservoir systems are located in the zone that can be used to control the Bogota River floods. Nevertheless, some mitigation works, and urban adoption and construction rules are still pending in the hazard and flood risk zones, especially in the municipalities of the Bogota Savannah.</p> <p>Disaster management. There is a protocol in cases of emergency to manage the rising water of the river. However, experience from the last twelve months indicates that the protocol is not effective in risk mitigation.</p> |

Efforts made by the country to understand the natural reality of the watersheds, through important technical studies, differ from the measures that have been implemented. In all the documents created for La Mojana, they affirm, from different technical perspectives, the importance of conserving and regulating water flows and establishing a comprehensive development and planning of the zone to enhance the economic, social, and cultural development of the region, thus being able to connect with the rest of the country. All of this is aimed at guaranteeing the normal functioning of the water system. However, the present reality reveals the isolation of the buffer system, almost total lack of control of the territory, and its systematic modification. In the case of the Bogota River, it may be asserted that the majority of the required studies are currently available to quantify flood problems and even to make decisions to carry out risk reduction activities. Nevertheless, the weakness of institutional articulation has meant that neither the respective decisions nor the needed works have progressed. As far as the Sinu River basin, it is evident that the quality and quantity of the information does not represent a guarantee for risk management. The information currently available would allow adequate management, even though the lack of interinstitutional articulation makes it difficult to develop investments for risk reduction.

Very few CAR have adequate preparation to respond to disaster. The majority of

the responsibilities of the Corporations, more than just directly intervening in emergencies, should be to participate in the Local and Regional Committees for Disaster Prevention and Response, supporting knowledge actions and risk reduction of the local and regional actors. Due to recent situations of imminent disaster resulting from the La Niña phenomenon that affected the country, the National Government has asked the CAR to develop a more active role in risk management. In November of 2010, the CAR of the Bogota River created a risk management office. This office's first goal, for now, has been monitoring planning programs in all the basins under its jurisdiction, broadening the knowledge of their hydrological and hydraulic conditions, and adequately evaluating the conditions of actual risks in populated areas. In the future, recommendations will be made to the municipalities, since they, in the present system, are responsible for facing risk conditions.

Upon analyzing the available information in the zones of study, it must be pointed out that the problem has not increased due to climate change factors, but because of the lack of implementation of adequate risk management instruments. The information is scattered and in the best of cases, some regional and local POT only have hazard maps, but prepared with different technical criteria, not under a unified and integrated vision. Moreover, none of the territorial entities have studies and vulnerability and risk maps to confront floods.

3.4. RECOMMENDATIONS TO STRENGTHEN TERRITORIAL MANAGEMENT

| RECOMMENDATION | PRIORITY High (H), Medium (M) | RESPONSIBLE |
|---|----------------------------------|--|
| Increase the effectiveness and efficiency of the investments in risk management through strategic planning and coordination, monitoring, and control among territorial levels | | |
| Create a national cofinancing (fund) mechanism to encourage investments in risk management and the creation of capacities for the territorial and sectoral levels. | H | UNGRD, MHCP, DNP |
| Adopt a monitoring strategy of the responsibilities and investments for risk management at different territorial levels. | H | Presidency, UNGRD, DNP, Comptroller, Attorney General |
| Strengthen the local capacity for territorial management in order to reduce disaster risk generation and accumulation | | |
| Adopt a national strategy to strengthen municipal risk management, which responds to the differences that exist in capacities. | H | DNP, Municipalities, Departmental Governments |
| Structurally review the capacity limitations for disaster risk evaluation in order to provide an effective response to the demand of knowledge for the POT and the PD. | H | DNP, UNGRD, MVCT, MADS, Ideam, SGC, IGAC, DANE, CAR, Colciencias, and Departmental Governments |
| Design and implement the PTGR as instruments of strategic and prospective character that orient and give priority of interventions and investments at municipal and departmental level. | H | City Halls and Departmental Governments |
| <ul style="list-style-type: none"> Enhance hazard, vulnerability, and risk knowledge to improve the actions of the territorial entities and society in risk management. | | |
| <ul style="list-style-type: none"> Promote the implementation of early warning systems whose its design, implementation, and operation are shared among different municipalities and departmental governments. | | |
| <ul style="list-style-type: none"> Focus on policies to diminish risk generation and accumulation and to reduce existing risk. | | |
| <ul style="list-style-type: none"> Prepare Local Emergency and Contingency Plans (PLEC) putting emphasis on preparation, provision of equipment, education, and training exercises. | H | DNP, UNGRD, MVCT, MADS |
| Formulate and implement a national policy for intervention of settlements at risk that establishes guidelines for territorial zoning, definition of mitigation criteria, and strategies for action. | | |
| Reduce the number of housing in high-risk zones by the implementation of programs for comprehensive neighborhood improvement and resettlement of families from nonmitigable high-risk zones. | | |
| Promote and continue to make efforts in the cities (case studies) for the inclusion of disaster risk management in planning, municipal actions, and investments as a fundamental strategy for territorial development. | H | DNP, Municipalities, Departmental Governments |
| Reduce flood and landslide risks through planning, investment, monitoring, control, and the articulation of the different agencies responsible for watershed management | | |
| Regulate the inclusion of a Flood and Landslide Master Control Plan as an integrated part of the POMCA. | H | MVCT, MADS, Ideam with the Permanent Committee created for hydraulic management of rivers and water bodies |
| <ul style="list-style-type: none"> Comprehensively analyze the basins to identify existing hazards and flood and landslide risks, and define interventions that should be articulated for risk management. | | |
| <ul style="list-style-type: none"> Define responsible entities and financial mechanisms for program and project implementation as defined in the Master Plan. | | |
| <ul style="list-style-type: none"> Establish channels for coordination, monitoring, and control for the execution of the Master Plan. | H | MADS, CAR |
| Accelerate the formulation and implementation of the POMCA and their incorporation as a relevant instrument of the municipal POT. | | |
| Implement a strategy that strengthens the livelihoods of the population and simultaneously seeks to reduce poverty. | H | DNP, Municipalities, Departmental Governments |

Increase the effectiveness and efficiency of the investments in risk management through strategic planning, coordination between territorial levels, and monitoring and control

Create a national cofinancing (fund) mechanism to encourage investments in risk management and the creation of capacities for territorial and sectoral levels. Creation of a Fund for Disaster Risk Management requires the establishment of strategies and different financing mechanisms, according to the existing risk conditions and the municipalities' capacities. By accomplishing this, it will be possible to guarantee the execution of preventive and corrective actions and risk reduction and control planning, as well as the formation of an effective fund of available resources to moderate the effects of an emergency, without implying the abandonment of competencies and the legal routine obligations of the municipal governments, and especially those competencies defined in land use planning. The promotion of risk management alternatives is fundamental, so that there is a shared responsibility between territorial levels, where municipalities evaluate the effectiveness of including a representative percentage (between 0.1% and 0.5% of current revenue) in their annual budgets, allocating it for risk management through their own resources or money received from the current revenues from the nation, and including fomenting the management of donations and credits with multilateral banking and international organizations to leverage resources that serve as compensation to what is available in the National Risk Management Fund.

Adopt a monitoring strategy of the responsibilities and investments for risk management at different territorial levels. Ensuring the effectiveness in the budgeted destinations and a major social impact requires the articulation of different administrative, judicial, and control agencies. To do so, convening

mechanisms are used with the actors who have responsibilities assigned by law. However, the complexity of the urban problem or nonfulfillment of the functions reduces in large measure the coordination of interventions, making even greater the disarticulation among those entities in charge of control and monitoring. On the one hand, there is a proposal that the city halls create interinstitutional committees and continue in the implementation of agreements to empower the participation of the agents as far as their functions and competencies. On the other hand, as a result of the competencies in each entity and the agreements endorsed, their incorporation in the PD has to progress, including those of the control entities. Their importance lies in the fact that authorities and civil society should perform monitoring and control tasks of the whole process of public management and not only the final result, where the relevance of joint efforts guarantees the articulation and continuity of the actions that are required for territorial planning and risk management.

Strengthen local capacity for territorial management in order to reduce the generation and accumulation of disaster risk

Adopt a strengthening national strategy in municipal risk management, which would respond to the differences that exist in the capacities. Risk management and regulation, and control of land use planning at the local level are closely related to the capacity of the municipal administration. To guarantee sufficient hazard, vulnerability, and risk control conditions, on a medium-term basis, institutional, technical, and municipal financing strengthening are necessary, as is simultaneously adopting a proactive and strategic focus, taking into consideration the principles of complementarity and subsidiarity as

provided for in the Constitution of 1991. These municipal capacities are clearly differentiated according to the categorization made by the DNP and DANE, which propose recommendations to the municipalities with high, medium, or low capacity (capacities defined in Chapter 2 of this document).

Structurally review the capacity limitations for disaster risk evaluation in order to provide an effective response to the POT and the PD demand for knowledge. Implementing a technical support strategy, coordinated by national and departmental entities is essential to update the municipalities' POT, and the formulation of PD in municipalities with less than 50,000 inhabitants. According to Law 507 of 1999, the National Government has implemented local technical assistance, especially through the MVCT, the UNGRD, and some CAR. However, government entities, such as the IGAC, the DANE, and Ideam, the Colombian Geological Survey, and universities or research centers, need to unite efforts in order to optimize acquiring information required by the municipalities for land use planning and management, and by taking into account appropriate coverage and scale. Likewise, it is necessary for the departments to lead and support more vigorously the formulation of the POT, and the incorporation of risk management in the municipal PD.

Design and implement the Risk Management Territorial Plans (PTGR) as instruments of strategic and prospective nature that orient and give priority to interventions and investments at municipal and departmental levels. The PTGR's aim is to contribute knowledge in risk scenarios, in the application of comprehensive interventions for risk reduction and control, and the strengthening of disaster management actions. Taking into account that these instruments make significant contributions, the grouping of institutional

and social agencies that are involved in their design and implementation should be involved in their decision making. In this context, the PTGR is formulated by technical teams from the responsible agencies in each territorial unit and agreed to at the political and institutional level in order to generate a greater appropriation and establish priority criteria according to the needs (project banks). Likewise, agendas or actions plans should be arranged and articulated between the responsible entities to develop internal procedures, define tasks, channel and optimize the use of available resources (municipal entities, public enterprises, private sectors, departmental governments, CAR, etc.), since the PTGR should make it possible to adjust the required budget for risk management in each of the participating entities, pursuant to their functions. It corresponds to the planning and finance agencies to improve resource allocation mechanisms to different objectives, policies, and types of expenditure in order to consent, from their origin, risk reduction at a municipal and district level. Below is a list of some specific recommendations to be considered in the PTGR:

‡ **Deepen hazard, vulnerability, and risk knowledge to improve the actions of the territorial entities and the society in risk management.** Planning should be accompanied with a major investment in knowledge and evaluation of hazards and risks, in which decisions are guided and based on adjusted work scales and a dynamic vision of risk and hazard integration in land use. Planning should also emphasize detailed technical characteristics and classification of the problems, as well as defining the essential causes and effects of the same, and increasing the technical abilities of the professionals in charge so that they may

execute hazard evaluations and update information of populations and infrastructure exposed to risks. These are some of the required elements to guarantee information support for risk management and territorial planning.

- ‡ **Encourage the development of early warning systems, in which the design, implementation, and operation are shared among different municipalities and departmental governments.** Design, implement, strengthen, and operate early monitoring and warning systems, achieving greater understanding of potential natural phenomena behavior. The system should start with prioritizing the phenomenon in each basin and municipality (areas susceptible to floods, mudflows, avalanches, landslides, among other phenomena). It should also include the definition of critical thresholds and topographic, geotechnical, and hydrological monitoring according to the current phenomenon. It requires the expansion or acquisition, installation, and start-up equipment and monitoring stations, data reception and warning emissions stations. In addition to the aforementioned, training is needed on how to manage the equipment and on interpretation of data generated from the early warning systems, at an institutional and community level, as well as establishing protocols in case of having to alert the population. In this sense, early warning systems require a strong investment component, technical training, and population awareness.
- ‡ **Focus on policies to diminish risk generation and accumulation and to reduce existing risks.** In addition to its importance, in terms of policies and standards, it is a priority to carry out comprehensive actions consistent with the territory: planning, adoption of specific and technical regulations, education and citizens' awareness

campaigns, mitigation works, resettlement of families from nonmitigable high-risk zones, and reinforcing vital infrastructure, among other actions.

- ‡ **Local Emergency and Contingency Plans (PLEC), in which emphasis is made on preparation, provision of equipment, instruction, and training exercises.** When a society faces risk conditions, its citizens should be prepared and know in advance what are the tasks to be executed in emergency and disaster situations, be acquainted with those responsible and the coordination mechanisms in these situations, and with what resources they can count on, etc. At the municipal level, the PLEC are important instruments in establishing functions or response and rehabilitation tasks in case of an emergency or disaster, organizational models, administrative and logistic elements, and the systems for control and monitoring, which permit an effective operation in emergency or disaster situations. Since emergency operations management requires coordinated teamwork, appropriate planning equally depends on joint effort. For this reason, plans should be made with the participation of public and private institutions, nongovernmental organizations, and the communities. Furthermore, their formulation, training, and simulation allow faster, more effective, and more coordinated actions when facing emergencies or disasters that result in favor of safeguarding life and reducing negative effects on property, the economy, and the environment.
- ‡ **Formulate and implement the national policy for intervention of settlements at risk, which establishes guidelines for defining territorial zoning, definition of mitigation criteria, and action strategies.** The municipal POT should clearly establish high-risk zone

management according to national policy definitions. Mitigation can be understood as a condition in which there exists the possibility of technical, economic, social, and political intervention in a territory to reduce risk in order that the population, the infrastructure, and the economic activities remain within reasonable and socially accepted safety margins (Ramirez and Rubiano, 2009a). This means there is a need to prepare a comprehensive analysis to define if a high-risk territory can be mitigated or not. Depending on the identified condition, specific intervention actions should be established, in which among others, mitigation works are taken into consideration (when these risks can be mitigated) or the resettlement of families (when they cannot be mitigated). In some cities with greater management capacity, progress has been made in establishing the criteria on this issue, and in intervention policies. However, adopting a national policy will offer municipalities the instruments to appropriately implement actions aimed at managing high-risk zones.

- ‡ **Reduce the number of housing in high-risk zones by implementing comprehensive neighborhood improvement programs and the resettlement of families from nonmitigable high-risk zones.** Focused actions oriented at reducing exposure and vulnerability is an effective option to lessen risk conditions. This means incorporating specific projects and investments in the POT and the PD for the implementation of those programs as a fundamental axis in reducing existing risk. This leads to participation of different municipal entities, so their intervention can be carried out completely and comprehensively, and sectors related to housing, education, health, social welfare, and public services, among others, should work jointly. On the other hand, in order to protect resettled zones, surveillance and con-

trol are required for land use and occupation at the municipal level with the participation not only of the responsible entities, but also of the communities involved.

- ‡ **Promote and continue to make efforts in the cities (case studies) for the inclusion of disaster risk management in planning, municipal activities, and investments as an essential strategy for territorial development.**

The present study reveals that cities like Bogotá and Manizales have been confirming the existing policy and institutional commitment to integral risk management for many years. This cannot be said of cities such as Cali, where precisely due to the lack of political will and adequate strategies, there has been an increase in risk because of the shortcomings in the implementation of policies, programs, and strategies to prevent future and correct the existing risks. Meanwhile, Barranquilla has begun to show responsibility by promoting acquired commitments in the POT and in the PD, even though there is still much to be done. As a consequence of frequent emergencies, Cucuta has implemented procedures and protocols for emergency response, but needs to strengthen its investments in prevention and mitigation. Therefore, this recommendation is made to call the attention to the cities that have been studied to execute more decisively and/or to continue using the strategies that allow incorporation of disaster risk management in their municipal or district planning, actions, and investments. Finally, especially for the city of Cali, the need should be highlighted to create strategies for seismic risk management considering its high risk level, vulnerability, and exposure. Even though Cali's administration has made timely actions, these have neither been constant over time nor comprehensive in their implementation, resulting in generating risk and its grad-


ual increase. The city needs to face its most urgent problems by designing a Risk Management Plan that relies on required financing. This Plan should not include only actions aimed to lessen the problem of seismic risk, but also those of floods caused by the Cauca River and the instability of its slopes.

Reduce flood and landslide risks through planning, investment, monitoring, and control, and the articulation of the different agents responsible for watershed management

- ‡ **Define the people responsible and financial mechanisms for the implementation of programs and projects defined in the Master Plan.** It is necessary that the Plan identify the agencies and territorial entities responsible for executing the agreed actions and among which the following should participate: the departmental governments, the municipalities, the CAR, public and private sectors, etc. This will permit joining of efforts to finance the programs and projects with the assistance of local, regional, and private funds, as well as the identification of additional investments to develop the Plan.
- ‡ **Establish channels for coordination, monitoring, and control of the execution of the Master Plan.** According to Law 99 of 1993, Joint Committees have been formed in cases in which two or more CAR have jurisdiction over a common watershed, and their function is to coordinate, harmonize, and transmit policies to the corresponding environmental management. Equally, Decree 1729 of 2002, in its Article 19 states that “it will be the responsibility of the respective competent environmental authority or the Joint Committee to prepare the watershed management plan. Coordination and preparation of the management plan will be the responsibility of the en-

vironmental authorities who are members of the Joint Committee, and in the other cases, of the respective competent environmental authority.” Therefore, the proposal is to create a Technical Committee to support the respective Joint Committee or the corresponding CAR in the coordination, monitoring, and control of the execution of the Master Plan as an integral part of the POMCA.

- ‡ **Accelerate the formulation and implementation of the POMCA and their incorporation, as a determining instrument of the POT.** Considering that the POMCA are instruments that include comprehensive knowledge of each basin and define actions and interventions for its adequate management, it is urgently required to hasten their formulation, in order to create the required guidelines for updating and implementing the local POT. The aforementioned will allow coherent planning between the regional vision of the basin, the measures to control floods, and the restrictions and constrictions for the use and occupation of land, which are in line with its municipal jurisdiction.
- ‡ **Implement a strategy that allows strengthening the livelihoods of the population and simultaneously reduces poverty.** Changes in the vulnerability of the populations and their possessions are highly dependent on the developmental approach and the population’s socioeconomic characteristics. The link between poverty and disaster vulnerability is increasingly recognized, and thus the country needs to progress in implementing effective strategies to reduce poverty in the following aspects: implementing a rural development strategy, investing in natural resource management, constructing infrastructure, and creating livelihood and social protection mechanisms to reduce vulnerability and maximize the resilience of the livelihood of the population.



Landslide in the Cerro de Oro sector. Municipality of Manizales (Caldas, Colombia), 2011. Photography: Nilson Correa Bedoya.

Disaster Risk Management in *Sectoral Administration*

Carlos R. Costa P., Ana Campos G., Carolina Díaz G.,
Jorge Alberto Serna J., José Edier Ballesteros H.,
Carlos E. Vargas M., Leonardo Morales R.,
Elvira Milén Agámez C., Ana María Torres M.

4



4.1. THE IMPACT AND CAUSES OF RISK IN SECTORS AND ITS SIGNIFICANCE IN THE ECONOMY AND SOCIETY

Sustainability in both productive and service sectors requires responsible risk management. Therefore, it is important that the Ministries, in their role as guides, promoters, and regulators of sectoral development include this issue in all of their management spheres. As can be observed in the whole chapter, sectoral activities are very closely related to risk, either because they directly or indirectly contribute to its generation or accumulation, or due to the fact that the occurrence of dangerous events impacts their performance and infrastructure. The presence or absence of this issue in specific action policies and plans largely determines the degree of responsibility with which public and private actors manage risk, and therefore the vulnerability levels in each sector in events that may cause disasters. Thus, reducing risk conditions should be a fundamental element in sustainability in each sector and in the country as a whole.

In Colombia, some sectors have demonstrated significant progress in including risk management in public policies, while in others, where there has been less progress, the need to face the issue with greater commitment has been identified, partly due to the El Niño and La Niña phenomena in the last decade. The energy environment, for example, after undergoing a crisis in 1998, is outmoded and diversified in power generation resources as a result of long-term policies. Furthermore, it uses economic and regulatory instruments by which risk is controlled in case of a pos-

sible resource shortage, including in the years were there may be severe droughts caused by the El Niño phenomenon. Moreover, sectors like agriculture show hardly any progress in climatic risk management, even though the impacts caused by these types of events are very recurrent. Additionally, inadequate and unsustainable practices such as the draining of swamps and deforestation increase risk not only in agriculture, but in the entire country. Other spheres have also progressed such as housing, which complies with seismic-resistant regulations, and land use planning, which has partially contributed, although not yet to maximum potential, to risk reduction in new buildings. However, it faces a serious situation, since approximately 50% of housing was constructed prior to the existence of the seismic-resistant regulations¹. This was the product of an intense activity in consolidating informal settlements, which produced an increase in risk, since there was no control over construction standards and many buildings are located in zones exposed to some type of hazard.

¹ The Coffee Growing region earthquake destroyed the majority of the houses that were built before the adoption of the first earthquake-resistant construction regulation (1984).

4.1.1. The housing sector: loss of life and family patrimony

The main impact caused by disasters to Colombians' family patrimony is the **destruction or damage to housing**. According to Chapter 1 of this report and to the data established in OSSO Corporation (2011), 190,000 dwellings have been destroyed in the last 40 years and more than 1 million have been affected. In other words, an average of 30,000 families per year have undergone damage or total destruction of their patrimonies caused by dangerous phenomena. Housing stands out among the sectors with the greatest losses due to disasters, since it directly affects the family patrimony, concentrated primarily in the building and the family's household goods. Even though great disasters are the most remembered, minor and intermediate events are responsible for the greater part of the impacts on dwelling units. In fact, between 1970 and 2011, detriment to housing in the country resulting from great events² has been approximately US\$2 billion (US\$51 million per year), whereas intermediate and minor disasters have produced damage of US\$5 billion (US\$126 million annually).

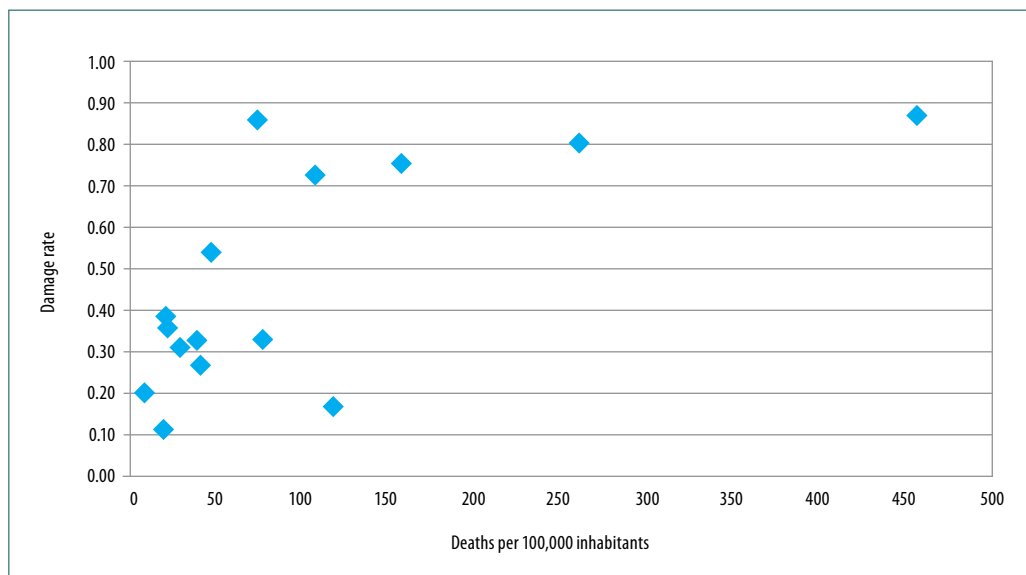
Housing is also principally responsible for loss of life in a disaster, be it caused by its damages (collapse or partial destruction) directly affecting its occupants, or by indirect impacts generated to the population located in its vicinity. Taking into account the historical database (OSSO-EAFIT Corporation, 2011), there is a clear relation between the number of destroyed housing and the loss of life in a disaster (*Graph 4.1*). Moreover, the destruction of structures tends to cause the death of their occupants, whereas their location in risk zones exposes population groups from the surrounding areas (bottom of the slope or basin).

Destruction and damages to housing caused by disasters in Colombia are due principally to the noncompliance of design and construction standards or location in hazard zones. According to OSSO Corporation (2011), of the 190,000 residential units destroyed by disasters in the country between 1970 and 2011, floods caused the greatest losses in more than 79,000 dwellings, whereas seismic activity produced 51,000 losses, landslides almost 18,000, volcanic eruption 5,400 and other events such as windstorms, fires, and 35,000. It may then be concluded that 51% of the housing destroyed in this period (houses affected by floods, landslides, and volcanic eruptions) was the result of location in areas not apt for urbanization, while 26% of destroyed houses (by seismic activity) may be associated with construction deficiencies.

Although the land use planning and construction standards have contributed to reducing some risk factors in new housing, it is estimated that half of the housing in the country would be affected by the seismic hazard. If it is taken into account that in 1985, there were 5.8 million dwellings, and in the 2005 Census, there were 10.3 million dwellings, this indicates that currently, approximately half of the country may be considered vulnerable to seismic activity, since it was constructed prior to the first Seismic-Resistant Regulation in 1984. Good practices in design and construction that provided flexibility and resistance against an earthquake were voluntary and very punctual in the years prior to the regulations (*Graph 4.2*). The Coffee Growing region earthquake (1999) confirmed

2 Housing sector losses for seven disasters: earthquake in Popayan in 1983; eruption of Nevado del Ruiz volcano in 1985; earthquake in the mid Atrato in 1992; Paez earthquake in 1994; El Niño 1997-1998 phenomenon; Coffee Growing region earthquake in 1999; La Niña 2010-2011 phenomenon (Cardona, et. al 2004b; SNPAD and DGR 2011).

GRAPH 4.1. Percentage of destroyed housing vs. loss of life per 100,000 inhabitants



Source: OSSO Corporation, 2011, from OSSO-EAFIT Corporation, 2011

the following: in Pereira, 72% of the units affected corresponded to this older category.³ According to the type of structure, the buildings most affected were built using simple (unreinforced, unconfined) masonry, incurring 35% of the total damages, followed by porch and adobe incurring 25% and 20% of the damages respectively. The same was reflected in 27 other municipalities that underwent damages associated with this seismic activity. It may be that this is representative of the situation that may occur in other major and medium hazard zones in the country.

Vulnerability in housing is growing, principally due to informal settlements, as can be observed by the increase in the rate of residential units annually destroyed per each 100,000 inhabitants. There is a historical quantitative deficit of more than 1 million dwellings compared to the creation of new households in Colombia, which is greater than construction in the formal sector (with license and property title). In the country, more than 250,000

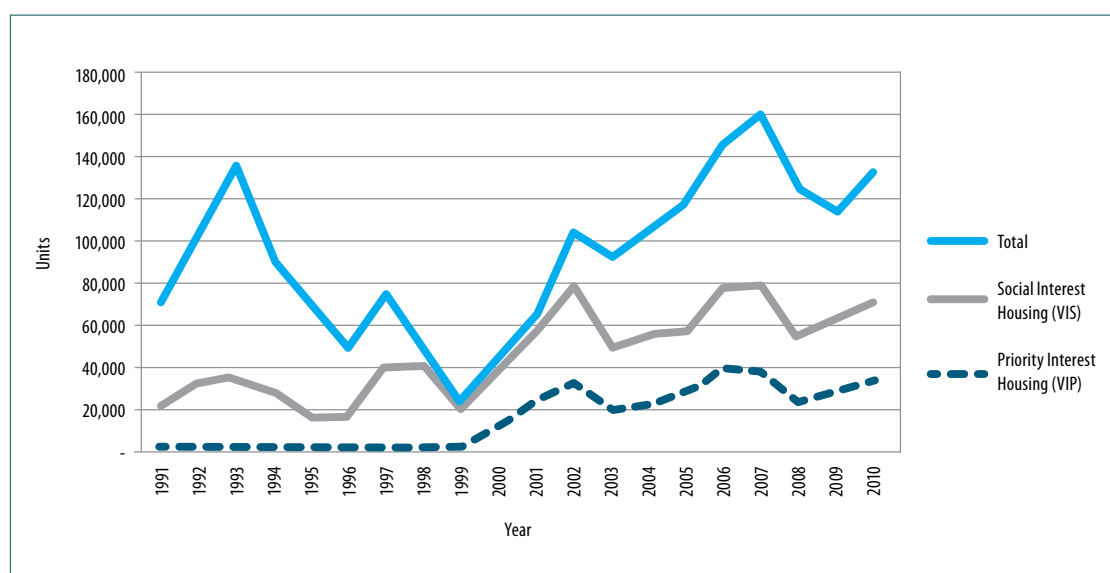
households are established each year, whereas the number of dwellings started per year, for 2007, only reached a maximum of 170,000 (*Graph 4.2*). Rural population migration to urban zones in search of better opportunities, plus forced displacement due to armed conflict, result in having families with few resources settling in precarious and illegal locations and generally outside the perimeter of services, turning these sites into shanty towns that later are legalized by the municipalities, incurring high costs in infrastructure and

³ According to the *Study of Seismic Vulnerability in Pereira*, conducted by the Autonomous Corporation of Risaralda (CARDER) between 1995 and 1999, 40% of existing buildings in this city in the earthquake year were brick buildings without reinforcement or concrete containment. Today this typology is not permitted by the earthquake-resistant construction regulation for a high seismic hazard zone such as Pereira, due to its high fragility. Probably that infrastructure was developed before the first Earthquake-Resistant Building Code of Colombia, issued in 1984. We also identified 4% of building constructed of adobe. Their resilience in earthquakes depends on good maintenance done to the wooden structure to avoid infrastructure deterioration. Maintenance is not done in most cases.

facilities. As a result of this situation, close to 1,370,000 families live in informal conditions on more than 30,000 hectares in precarious settlements (DNP, 2010) (*Table 4.1*), presumably in unsafe infrastructures due to deficient specifications in construction or being located where there is a probability of dangerous

phenomena occurring. Then, the number of residential units at risk continues to increase, a trend that can be confirmed by the amount of housing that is annually destroyed or affected, which is around 15 per each 100,000 inhabitants (See *Graph 1.5* in *Chapter 1*).

GRAPH 4.2. Housing started per year in the country



Source: DNP, 2010a.

TABLE 4.1. Precarious settlement areas

| City | Area of precarious settlements (ha) | % of total residential area |
|--------------------------------------|-------------------------------------|-----------------------------|
| Bogota | 1,875 | 15% |
| Medellin | 1,323 | 21% |
| Cali | 406 | 9% |
| Barranquilla | 715 | 28% |
| Bucaramanga | 124 | 7% |
| Five largest cities | 4,442 | 16% |
| Cities > 300,000 inhabitants | 1,690 | 19% |
| Cities 100,000 - 300,000 inhabitants | 1,031 | 24% |
| Cities < 100,000 inhabitants | 22,982 | 26% |
| Country total | 30,145 | 24% |

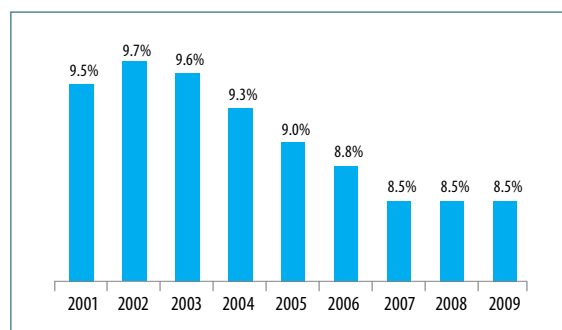
Source: DNP, 2007.

The housing sector is fundamental for the economy of the country, both for its participation in the national GDP and for the employment it creates, but it is equally important for the awareness of safe and responsible construction. Construction of housing in 2010 represented 3.6% of the national GDP (Camacol, 2011), and it is expected that its participation will continue to increase, taking into account the existing deficit and growth of demand associated to population growth and the establishment of new households. That is the reason why the national Government has considered it to be one of the “locomotives” in the National Development Plan. It has the objective of constructing 1 million units for the period from 2010 to 2014, of which 250,000 will be Priority Interest Housing (VIP). The National Government will provide resources directly through family subsidies. Under this context, the investment to be made in the sector, calculated at Col\$95 billion, represents a great effort by public and private entities. Therefore, it is a priority to articulate disaster risk management in the housing sector because of its implications for security, population patrimony, and in terms of the State’s responsibility to protect the life of its citizens.

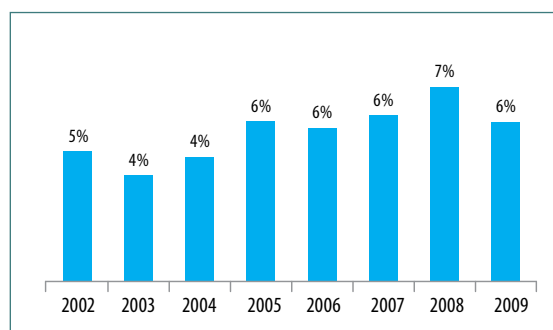
4.1.2. The agriculture sector: great potential in employment, foreign currency, and rural development at risk

The agriculture sector is fundamental for the social and economic development of Colombia. It represents 8.5% of the national GDP (*Graph 4.3*) and though its percentage input has diminished due to large growth in other sectors, such as mining and energy, its production and participation in exports is increasing (*Graph 4.4*). In 2008, the agriculture sector represented 7% of exports and even though it has a tendency to grow, in 2009 it showed a decrease due principally to impacts on production generated by hydroclimatic factors (*Table 4.2*). The intended area for agricultural activities in 2009 reached 5 million hectares, which is a little bit more than 4% of the land surface of the country. In fact, there is a potential for growth, considering that there are 28.2 million hectares apt for agriculture and forest development that today are used for livestock in spite of the fact that this land is not apt for this activity (MADR, 2011b).

GRAPH 4.3. Agriculture sector contribution to the national GDP, 2001-2009



GRAPH 4.4. Agriculture sector participation in exports (tons), 2002-2009



Source: MADR, 2009.

TABLE 4.2. Agriculture sector exports (tons), 2002-2009

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|------------|------------|------------|------------|------------|------------|------------|-------------|
| Total coffee exports | 772,202 | 809,331 | 949,464 | 1,470,660 | 1,461,235 | 1,171,343 | 1,883,221 | 1,542,697 |
| Agriculture sector exports not including coffee | 2,122,818 | 2,191,214 | 2,598,236 | 3,101,779 | 3,423,588 | 4,081,976 | 4,752,473 | 4,400,409 |
| Total agriculture sector exports | 2,895,020 | 3,000,545 | 3,547,700 | 4,572,439 | 4,884,823 | 5,796,319 | 6,635,694 | 5,943,107 |
| Total national exports | 61,714,816 | 78,356,321 | 89,116,306 | 82,311,193 | 88,091,513 | 96,930,302 | 94,750,222 | 103,446,928 |

Source: MADR, 2009

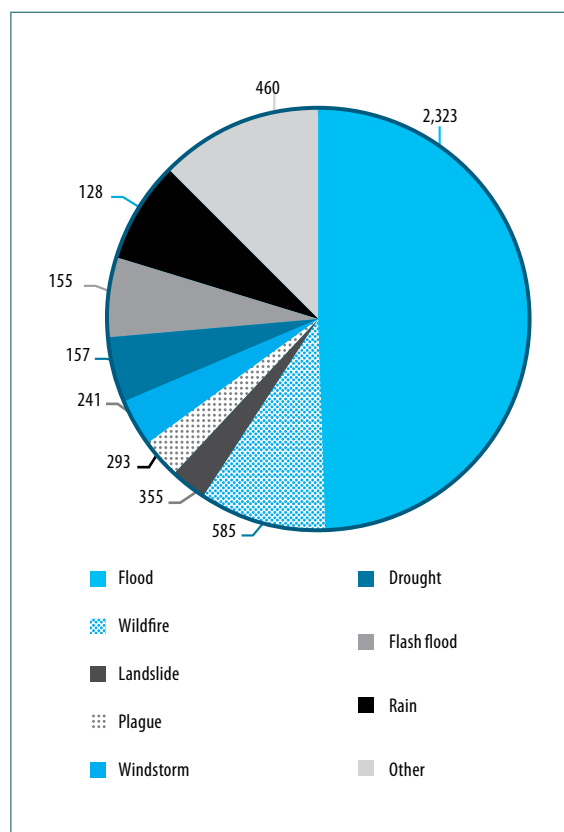
Close to 20% of employment in Colombia is generated by the agriculture sector, making it an important sector in the country's economy and in rural development in general. In 2009, it was the third generator of employment in the national economy (18.6%), followed by commerce (25.9%) and community services (19.6%). The majority of this employment is in the countryside, where 27% of the Colombian population reside, which makes the agriculture sector the main activity and instrument to promote economic and social factors in rural zones, where there are the highest levels of poverty and inequality. Rural poverty, measured in income, went from 69.2% to 64.3% between 2002 and 2009, whereas the urban-rural gap increased from 1.43% to 1.62% in the same period (DNP, 2010a).

Agrarian activity is systematically affected by disasters and during extreme climatic events, it is the one that registers the most economic losses, resulting in a great impact on the economic and social development of the rural areas. According to OSSO Corporation (2011), between 1970 and 2011, 4,898 events were registered in damages and losses in the agriculture sector, of which floods represented 50%, followed by forest fires

and landslides (*Graph 4.5*). The great hydro-meteorological disasters have caused serious damages to the country; for example, El Niño 1997-1998 caused phyto-sanitary (plant protection) problems and a reduction in agricultural and livestock production, resulting in losses estimated at US\$101 million in 2000 (CAF, 2000). La Niña 2007-2008 practically affected all agricultural subsectors, in which coffee underwent a 28% reduction in production, equivalent to US\$340.5 million in exports. Likewise, La Niña 2010-2011 resulted in the most important historic impact in the agriculture sector caused by a hydrometeorological event. It caused damages up to a total of 1,324,000 hectares, losses in coffee production equivalent to US\$285.7 million, and the loss of more than 130,000 cattle, among other negative consequences. Minor and medium disasters are also important; however, their effects are difficult to quantify due to the absence of information.

Damages caused by extreme weather events in the agriculture sector are due to its vulnerability, lack of strategies, and clear responsibilities in risk reduction, as it was addressed by the 2010-2014 National Development Plan. Currently, measures taken by the State in

GRAPH 4.5. Hydrometeorological emergencies in the agriculture sector, 1970-2011



Source: OSSO Corporation, 2011 from information provided by OSSO-EAFIT Corporation, 2011

managing disaster impacts have been more a response to their effects than to risk factor prevention and mitigation. The strategies are principally oriented to grant direct compensation or financial relief to producers after the phenomenon occurrence. The only available measure that may be considered as preventive (since it reduces economic losses, even though it does not intervene or diminish causes) is the subsidy to agrarian insurance. In spite of the efforts made by the Government in this sense, its response has been very minimal, as will be seen further on. Additionally, according to the Agricultural Society of Colombia (SAC),

there are no strategies from the agrarian guild that include in their objectives either risk reduction or disaster responses, and therefore, very few members in the SAC design or execute individual actions. As a response to this circumstance, the NDP 2010-2014 identified the need to adopt an Action Plan in Risk Management and Climate Change intended to define priority and activity strategies in order to provide a response to this issue.

Additionally, some social agents from the agriculture and livestock sector contribute unnecessarily to their own risk in exposing themselves to hazards without taking account the dangers. This is the case in productive activities that are carried out in flood zones. For example, in 2003, La Mojana had 213,000 hectares in livestock and 34,000 hectares in dryland rice, in spite of the fact that it is estimated that the surface without danger of floods is in a zone of only 50,000 hectares (Aguilera, 2004). Furthermore, if El Niño and La Niña phenomenon forecasts are not taken into account, it is not surprising that during the La Niña 2010-2011 episode, 130,000 heads of cattle died in the country (MADR, 2011a). Moreover, risk factors are being created when drought or extreme precipitation forecasts are ignored and when similar decisions are made based on normal weather conditions, subsequently facing disaster situations, in spite of the alert information available several months before the occurrence of the event (Box 4.1).

**Box 4.1. Risk Management Strategies (GRD) and Climate Change Adaptation (CCA)
in the agriculture sector for the Andean subregion**

| Action strategy | Area or sector | Guideline |
|--|--|--|
| Develop governance and political priority in the agriculture sector GRD and ACC. | Legislation and regulations | Adjust policies and regulations to appropriately articulate the GRD and CCA sector. |
| | Institutions and sectors | Strengthen institutions (financial, technical, and human resources). |
| | Intra- and intersectoral coordination | Promote interinstitutional and intersectoral actors from the GRD, the CCA, and the sector. |
| | Strategy monitoring | Generate monitoring and evaluation mechanisms or systems for each one of the country's and subregion's strategies. |
| Strengthen information in risk awareness and climate management. | Observation and monitoring networks | Strengthen and update climate phenomenon observation and monitoring systems. |
| | Investigation | Reinforce risk awareness, climate scenarios, and adaptation measures. |
| | Information systematization | Design and sustain an integrated information system. |
| Improve education and communication to construct a safe and resilient culture in facing climate risks. | Knowledge sharing | Design and implement education and communication strategies in the GRD and CCA sector. |
| Reduce underlying risk factors. | Strengthening of territorial planning processes and rural infrastructure | Articulate GRD and CCA with land use planning and development planning processes. |
| | | Improve rural infrastructure. |
| | Improvement of environmental conditions | Conserve and restore strategic ecosystems. |
| | | Establish compensation programs for environmental services. |
| | | Integrate local communities in planning and decision-making processes. |
| | | Promote the rational use of hydric resources. |
| | Improvement of productive systems. | Give priority to more efficient production systems. |
| | | Stimulate sustainable management in production systems. |
| | | Promote local production systems. |
| | Reduction of financial vulnerability | Increase availability and access to credits in sustainable agriculture. |
| | | Promote agrarian insurance. |
| Strengthen preparation, response, and joint assistance systems and preparedness in case of disasters. | Response to emergencies, assistance, and humanitarian aid | Improve preparation and response mechanisms to climate disasters. |

Source: Campos, et.al, 2009.

Another factor by which the agriculture sector is responsible for creating its own risk is through its inappropriate intervention in the environment. Deforestation produces sediment in the rivers that, when added to draining of wetlands and marshes for agricultural uses, gradually reduces the ability to control natural floods. This historical process, consciously or unconsciously, or inclusively with the support of the State and illegally in many cases, to a large degree increases hydrological risk, affecting not only agrarian activities, but also other social and economic sectors. An example of this may be found in the Sinu River basin, caused by land use conflicts (*Table 4.3*), since

there are more than 50,000 wetland hectares that are used for agriculture or livestock, thus increasing the exposure and the probability of floods, in which only 41% of the area of the basin is not in land use conflict. Unfortunately, the situation is replicated in almost all the wetland zones of the country.

Even though the development in disaster risk management in the agriculture sector has been minor, some examples of flower, cane, and coffee growers indicate that there has been progress and cost-effective measures to reduce risk. According to self-evaluation surveys made by SAC, DNP, and the World Bank⁴, it can be confirmed that these three

TABLE 4.3. Land use conflicts in the Sinu River basin

| Conflict | Potential use | Current use | Area (ha) | Area (%) | Ecosystem |
|--------------------------------------|------------------------------|---------------------------------------|--------------------|-------------|-----------------|
| Very high | Conservation | Miscellaneous | 92,981.9 | 6.7 | Paramillo |
| Very high | Conservation | Selective forest harvesting | 12,320.3 | 0.9 | Paramillo |
| Very high | Conservation | Extensive livestock | 5,163.8 | 0.4 | Paramillo |
| Very high | Conservation | Extensive livestock and agriculture | 225.6 | 0.02 | Mangrove swamps |
| Very high | Forest production protection | Extensive livestock | 205,393.8 | 14.7 | |
| Very high | Protection | Extensive livestock | 10,277.9 | 14.7 | Wetlands |
| Very high | Recuperation | Extensive livestock | 32,365.9 | 2.3 | Wetlands |
| Very high | Recuperation | Industrialized commercial agriculture | 11,288.8 | 0.8 | Wetlands |
| Subtotal | | | 370,018.0 | 26.5 | |
| High | Agriculture | Extensive livestock | 306,831.9 | 22.0 | |
| Subtotal | | | 306,831.9 | 22.0 | |
| Medium | Forest production protection | Traditional commercial agriculture | 134,708.8 | 9.7 | |
| Subtotal | | | 134,708.8 | 9.7 | |
| Low | Conservation | Fishing and subsistence farming | 2,093.8 | 0.2 | |
| Subtotal | | | 2,093.8 | 0.2 | |
| Very low | Agriculture | Selective forest harvesting | 2,755.0 | 0.2 | |
| Subtotal | | | 2,755.0 | 0.2 | |
| No conflict | Current use | Potential use | 578,836.5 | 41.5 | |
| Subtotal | | | 578,836.5 | 41.5 | |
| Total area of the river basin | | | 1,395,244.0 | 100 | |

Source: CVS and Fonade, 2004.

organizations use weather information to make important decisions related to planting crops, harvesting, fumigation, and fertilizing. Forecasts are also used in making decisions about planting or not planting crops in case of extreme events such as El Niño and La Niña phenomena. Flower growers use the Ideam Frost Early Warning System in order to take corrective measures (light torches and air moistening in greenhouses). Moreover, cane growers have relationship with the CLOPAD and the CREPAD in order to face fire hazards. These are some examples of the preventive measure portfolio that is applied to the agriculture sector and that includes the use of weather forecasts to adopt future measures (products to cultivate, planting dates, mobilization, and livestock sales), early warning systems, and irrigation infrastructure in drought risk zones, among others. Government and the guilds can contribute to public awareness campaigns, training, and incentives to encourage adoption.

4.1.3. The transportation sector: the largest direct losses to the State's patrimony

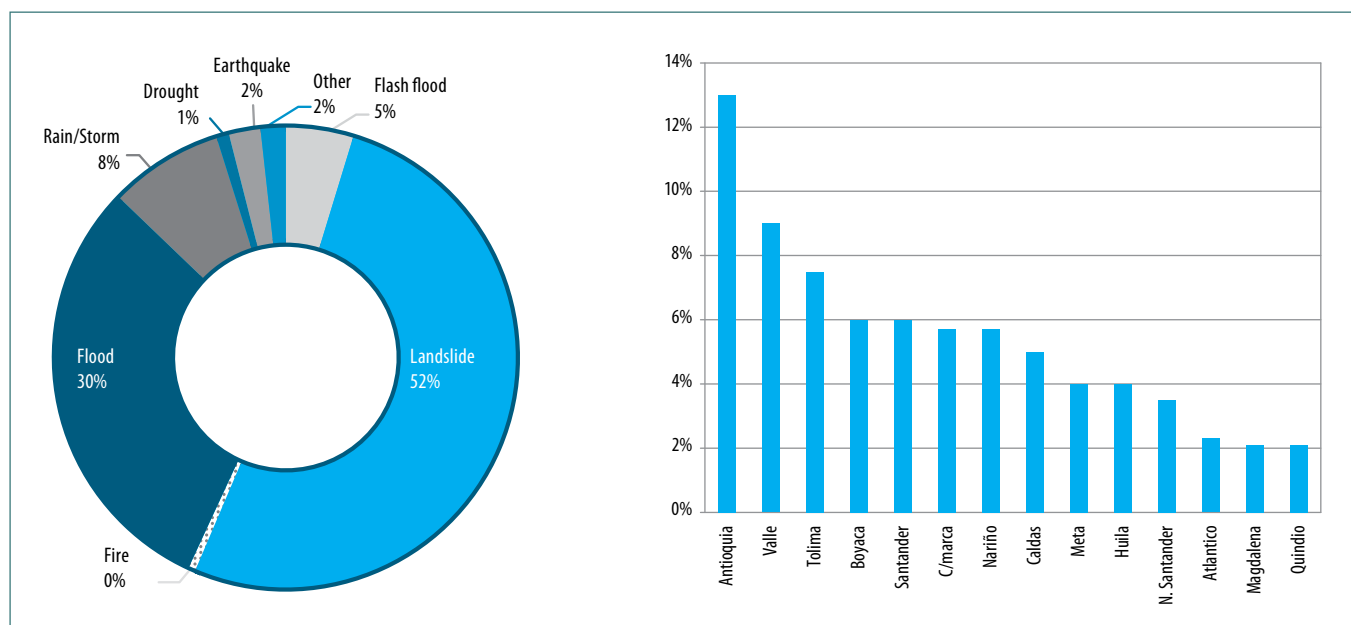
Infrastructure and services megaprojects, such as ports, airports, and dams have been designed applying the strictest risk control standards and count on contingency plans, while the road subsector is frequently affected by damages caused by disaster events. In general, the large port and dam infrastructure in the country has withstood without any problem dangerous physical phenomena in the last decades due to the design quality that in the last few years has been appraised as part of licensing both in construction and environmental processes, including when necessary, design evaluation and

maintenance activities. On the contrary, the national road network, as stated in Chapter 1 of this report, recurrently undergoes the impact of disaster events and does not count on adequate formulation and ex-ante reviewing actions.

According to the DesInventar database (OSSO-EAFIT Corporation, 2011), in the last 40 years, approximately 75,000 road kilometers have been affected. This number is considered conservative, since Local and Regional Committees do not report frequent damages and these are not entered into the system. A quarter part of the registers (7,748) present diverse types of road damages related to landslides (54%), floods (30%), and rain, gale storms, and flash floods (13%), where the majority of emergencies are concentrated in the Andean region (*Graph 4.6*). During the La Niña 2010-2011, 92 bridges and more than 1,690 kilometers of the primary road were impacted, equivalent to 9.7% of this network, 2,453 kilometers of the secondary road network (7%), and 27,492 kilometers of the tertiary road network (20.3%), requiring response to more than 600 road emergencies in more than 290 stretches of the national road system (Ministry of Transportation, 2011). In the fluvial sector, even though there is less systematic information available, the La Niña 2010-2011 rainy season required intervention in works to control floods in La Mojana region, the Canal del Dique, and some other areas along the Magdalena River, where dredging was also required in the areas of access to maritime and river ports.

4 The Colombian government, through the DNP and the DGR, with support from the World Bank and the Agricultural Society of Colombia (SAC), conducted self-assessment surveys between April and June 2001, addressed to the main actors and entities of the agriculture sector in the country.

GRAPH 4.6. Event distribution and departments with affected roads, 1970-2011



Source: OSSO Corporation, 2011 from OSSO-EAFIT Corporation, 2011

Taking into account the magnitude of road damage and the fact that this type of infrastructure is mainly the property of the State, it may be concluded that transportation is the sector that causes the most direct losses to the nation's patrimony as a result of dangerous natural events. The approximate length of the Colombia road network is 166,233 kilometers, of which 74,746 kilometers belong to the tertiary network under the control of the municipalities, Invías, and private sector (World Bank, 2004); 66,082 kilometers of the secondary network are under the control of the departments, and 16,786 kilometers of the primary network are under the responsibility of Invías and the National Infrastructure Agency. Of the primary network, 5,500 kilometers are operated by private agents under the concept of a concession, many of these being constructed by the concessionaire. In this context, it is convenient that both the State and the private concessionaires take into account lessons learned in proj-

ect design, construction, and maintenance, as well as contractual management to reduce risk. Moreover, as noted in Chapter 1, Invías, with resources from the “Emergency construction works for the national road network” account, annually invests an average of Col\$50 billion. Nevertheless, in periods when there is greater intensity in precipitation, investment increases considerably, as for example occurred in 2009 when investment surpassed Col\$120 billion (Ministry of Transportation, 2011). As far as the National Infrastructure Agency, it does not have the budget resources to cover emergencies that take place in road concessions of first and second generation and the railroad network, in which the National Government is liable for the risks.

Apart from the direct impacts to the national patrimony, the effects on the road system produce indirect damages associated with the suspension of service, aggravating the quality limitations of road transportation service,

and thus decelerating the economic and development growth of the country. According to the World Bank (2011b), Colombia occupies, among 139 countries, the 101st place in road quality infrastructure⁵, below countries like Chile, Uruguay, Mexico, and Argentina. In spite of an improvement of 4,700 kilometers in the national road network between 2006 and 2010 and an increase of almost 700 kilometers in two-lane roads (Colombian Chamber of Infrastructure 2009), in 2010, 50% (83,000 kilometers) were in poor conditions and only 5% (25,000 kilometers) of this total were paved (DNP, 2010; Colombian Chamber of Infrastructure, 2009). This already complex situation is constantly aggravated by disaster impacts on these roads. In the case of La Niña 2010-2011, landslides caused the closure of the stretches between Honda-Villeta, Bucaramanga-Barrancabermeja and Manizales-Mariquita, creating inconveniences in freight transport between production centers in the interior of the country and its ports. The vulnerability economic Study of the Bogota-Villavicencio highway (Pontificia Universidad Javeriana, 2004) concluded that during the 2000-2004 period, the highway was interrupted on an average of 7.01 days per year, causing total losses of Col\$16 billion in 2004. In addition, according to the Freight Transportation Association (ATC), blockages caused by landslides in the Cisneros-Buenaventura road in March 2011 produced damages estimated at Col\$16 billion, equivalent to Col\$2 billion daily. The freight transport sector estimates that the economic impact caused by La Niña 2010-2011 ascends to Col\$344 billion, represented in lost profits, benefits, and salaries, as well as in related industries (lodging, vehicle repair and tire repair garages, and gas stations), 30% of which were affected due to these impacts (ATC, 2011).

Other indirect effects include the poor service provided to passengers and the impossibility of placing perishable agrarian products on the market on time, although these effects are neither measured nor quantifiable. Consequently, the current National Development Plan (2010-2014 “Prosperity for All”) defines the program “Routes to Prosperity”, which has as its goal for 2014 to intervene in 50,000 kilometers of tertiary roads in order to improve access conditions to municipalities where the transportation of their agricultural products is the mainstay of its economy. Likewise, it is important to consolidate execution plans in order to foment employment in these regions.

The climatic conditions in the country, its difficult topography, and the young geology of the Andes are very demanding, but the real cause of disaster impacts on the road infrastructure are deficiencies in design, prevention, and maintenance. The climatic, topographic, and geological conditions of the country are known, although the evaluations carried out in the transportation sector conclude that vulnerability in the existing infrastructure can be reduced, mainly by using better layouts, designs, and maintenance measures. Furthermore, it is possible to control future risk by taking into account the lessons learned to date. Figure 4.1 shows the road sections that have the most frequent emergency sites, confirming the susceptibility of the Andean zone, whose deficiencies have to be analyzed in detail in order to take corrective measures and to formulate conclusions that will assist in implementing technical regulations and recommendations in new infrastructure projects.

5 The quality indicators include kilometers of paved network per million inhabitants and kilometers of two-lane roads per million inhabitants (2010-2011).

FIGURE 4.1. Road sections with frequent emergency attention



Source: Ministry of Transportation, 2011

The budget limitations make it challenging to cover 100% maintenance of the national network and to execute preventive works. Environmental degradation and improper practices in land use planning are identified as the main causes of natural phenomenon impacts in the transportation sector. Roads under the responsibility of the State, which are the majority, not only do not rely on a systematic budget for their maintenance, which is reflected in the poor state they are in, but are also affected by their vulnerability in dangerous physical events. According to the Master Transportation Plan 2010-2032, the reconstruction of one kilometer of road may cost in current value more than five times the cost of carrying out proper preventive maintenance. In fact, according to the Ministry of Transportation and the Chamber of Infrastructure, during La Niña 2010-2011, the performance of the roads granted in concessions, compared with those administered by the State, was superior and there were fewer service interruptions thanks to adequate maintenance.

Taking into account the antiquity of the road network and the high recurrence of damages caused by floods and landslides, it can be concluded that damages are caused by deficient standards in design and protection facing risks, and/or deficient control during the construction. The knowledge of geological factors and the development of construction techniques and design have progressed significantly with regard to the period in which the greater part of the country's road network was constructed. Deficiencies in standards, along with maintenance problems, are factors that contribute to the weakness of the oldest infrastructure. It is necessary to carry out studies of the existing vulnerability to undertake interventions that will increase the resistance parameters of the network to different hazards to which it is exposed, as well as to consider strategies in the

outlines that would provide a greater redundancy and flexibility to its performance.

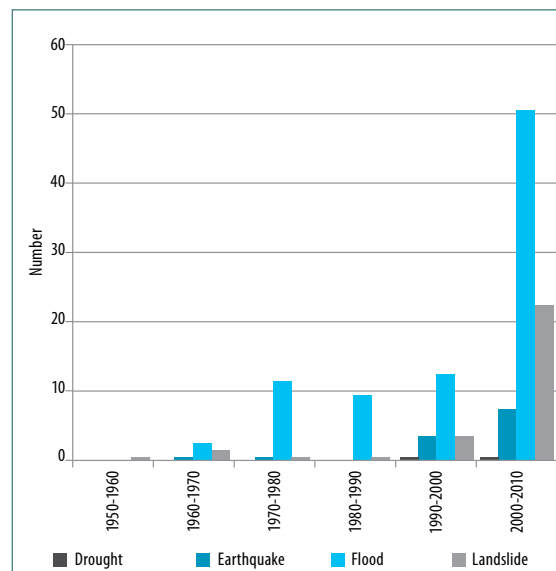
Invias is the only entity in the sector that has an emergency prevention and attention office and a budget to cover its costs. However, only an average of 9% is allocated to prevention, the remainder going to annual disaster management and emergency costs. The budget needed to recuperate roads traditionally does not leave many resources to implement mitigation actions so, the same sections are affected again (See *Graph 1.14* in *Chapter 1*) (Colombian Chamber of Infrastructure, 2008). In many cases, slope stabilization works are required, which should be combined with maintenance, as indispensable and highly cost-effective measures.

4.1.4. Safe drinking water and basic sanitation sector: indirect impacts difficult to calculate

The reports on annual damages caused by natural phenomena in the water and sewage systems indicate a growing tendency. According to DesInventar (OSSO-EAFIT Corporation, 2011) information, since 1950 there has been a permanent increase of disaster impacts on water and sewage services in the country. In the 1980s, an annual average of 20 incidences caused by disasters was reported, a figure that was doubled in the 1990s. In the last ten years, although it may be due to better access to information, there has been an annual average increase of 4.5 incidences, associated with a larger exposed infrastructure, but in particular with the El Niño 2009-2010 and La Niña 2010-2011 phenomena (*Graph 4.7*). Floods and landslides are the events that are the most recurrent in this sector and have the greatest number of registries, followed by seismic activity. Droughts

are becoming more important due to population growth which requires greater demand for water and consequently causing vulnerability in the systems.

GRAPH 4.7. Disaster events impacting water and sewage systems, by decade



Source: OSSO, 2011 Corporation from information provided by OSSO-EAFIT Corporation, 2011

El Niño 2009-2010 initiated the rationing of water or water shortages in at least 130 municipalities in the country. In spite of it being considered a moderate event, 130 Colombian municipalities were affected by the decrease in their water supply sources causing impacts in the water service. Compared to El Niño 1997-1998 (*Table 4.4*), identified as one of the most intense in the history of the country, it is evidenced that the risk conditions due to water shortages caused by drought improved on the Atlantic coast with the exception of the department of Bolívar. On the other hand, 40 municipalities in the department of Boyaca

and 30 in Cundinamarca were affected. Water rationing or suspending of water service had diverse impacts in these departments, such as temporarily closing schools and restricting rendering of services in hospitals. Moreover, the hotel industry was affected and a decline was seen in the number of tourists visiting municipalities such as Barichara in Santander.

In spite of the fact that the exact impact on the water and sanitation systems caused by the 2010-2011 rainy season is not known in detail, it is assumed that like in other sectors, losses could be the largest in history. According to the Vice Minister of Water and Sanitation, pertaining to MVCT, the Water and Sanitation Department Plans had allocated more than Col\$61 billion in rehabilitation expenses to normalize the rendering of services. As far as losses and reconstruction costs, the Vice Minister consolidated a database prepared by the managers of these plans, using 685 reports, which indicates that 371 municipalities in the country were affected in their water and sanitation services. Furthermore, preliminary analyses indicate that resources are needed for reconstruction, clearly associated with the emergency, for close to Col\$500 billion. However, the total of the request made by the municipalities is more than Col\$1.6 billion, but even though these requests are not directly related to the rainy season, they respond to the weaknesses of the infrastructure, which have to be attended to in order to reduce vulnerability in the territorial entities.

There are no estimates of the indirect impacts caused by the suspension of water and sanitation services, but according to international experiences, it may be assured that they far exceed the direct costs in the sector's infrastructure. The suspension of the service has social and economic consequences among the local entities. In the social aspect, the short-

TABLE 4.4. Water rationing and/or water shortages caused by El Niño in 1997-1998 and 2009-2010

| Department | 1997 – 1998 | 2009 - 2010 |
|--------------------|------------------|------------------|
| | # Municipalities | # Municipalities |
| Antioquia | 10 | - |
| Atlántico | 11 | 6 |
| Bolívar | 11 | 21 |
| Boyacá | 39 | 40 |
| Caquetá | - | 3 |
| Cauca | - | 1 |
| Cesar | 24 | - |
| Chocó | - | 2 |
| Cundinamarca | 14 | 30 |
| Huila | 7 | 3 |
| La Guajira | 14 | 3 |
| Magdalena | 13 | - |
| Nariño | - | 1 |
| Norte de Santander | 1 | 8 |
| Quindío | 4 | - |
| Risaralda | - | 2 |
| Santander | 7 | 5 |
| Sucre | 15 | 3 |
| Valle del Cauca | 4 | 2 |
| Total | 190 | 130 |

Source: MVCT – Vice-Ministry of Water and Sanitation, 2011.

age of safe drinking water produced serious effects on the health of the population, mainly gastrointestinal illnesses due to the consumption of unsafe water and difficulties in rendering services in other activities, such as education and the operation of health centers. As far as the economy, the suspension of the system generated impacts not only on the water and sanitation companies, but also on all of the productive and commercial sectors.

One of the principal causes of vulnerability in water shortage in Colombia is that

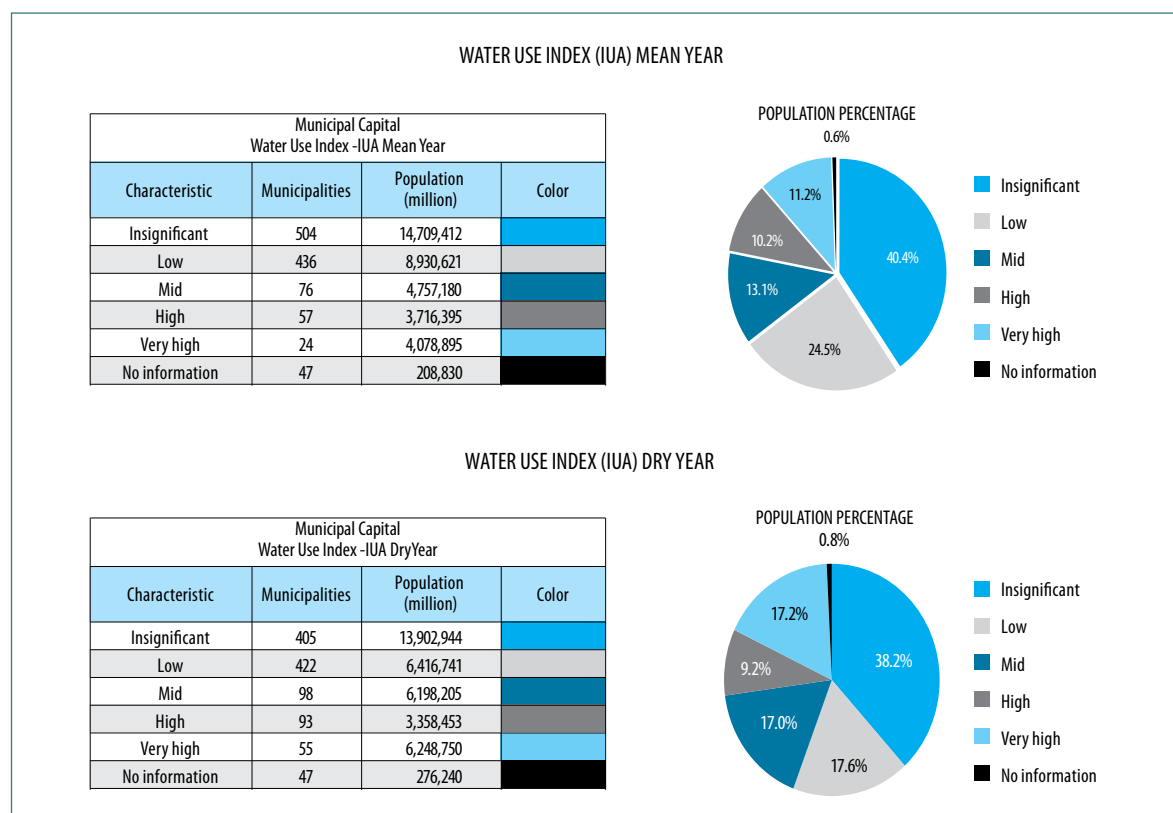
95% of the water supply systems are supplied by superficial currents originating from small watersheds. It may be added that there is a lack of redundancy in the collecting systems and supply sources, thereby exposing the rendering of this service to the fluctuation of hydroclimatic behavior. According to the Ideam (2010), the provision of water for human consumption mainly comes from superficial sources, especially from mountains, with small water flows, which are distributed by the force of gravity. These conditions, added to population growth, water demand, and absence of redundancy systems, expose the rendering of the service to weather fluctuations, creating the possibility of suspending the water supply in drought seasons, damages to the water collecting systems, and adduction during the intense rainy seasons due to crescents in the supply sources.

The Colombian population is concentrated in regions where there is less water. There are more than seven million people located near watersheds with high or very high Water Use Indices, even as demographic pressure and water demand continue to increase. Some 66% of the population in the country lives between 1,000 and 3,000 meters above sea level, where 34% of the water is to be found (Ideam, 2010). Additionally, 708 of the 1,119 municipal centers are located in the Magdalena-Cauca watershed, whose supply of water service does not reach the 15% of the national total. The Water Use

Index (IAU) measures the pressure of demand of superficial water with respect to the supply. In other words, a high index implies strong pressure on the supply available (*Graph 4.8*). According to the IAU, in a year where the average climate behavior is medium, there are 4,078,895 people in 24 regional municipalities with a very high index, whereas in a dry year, a very high IAU has affected 6,248,750 people in 55 centers. Additionally, demographic increase and the pressure on water resources for other uses permanently increase the probability of water shortage in zones that are under low water stress. It is probable that the greatest concentration of risk due to these conditions is in the city of Cucuta, which takes its water mainly from the Pamplonita River, a stream that is now being used to the limit (Costa, 2005).

Seismic activity, volcanic eruptions, landslides, and other hazards, including climate, also generate risks in the water and sanitation infrastructure. The system is exposed to multiple hazards, both natural (seismic activity, volcanic activity, and landslide phenomena), and anthropic activities (altering water quality by dumping toxic and dangerous substances and terrorist attack substances). On the other hand, failure in providing clean drinking water services and basic sanitation services are factors that generate health and other emergencies. Some of the emergencies that occurred between 2006 and 2010 are indicated in Table 4.5.

GRAPH 4.8. Water Use Index (IUA) in Colombia



Source: Ideam, 2010

TABLE 4.5. Events that have produced problems in the rendering of public services

| Municipality | Triggering event | Effect |
|--|---|--|
| Tumaco (Nariño) | Mira river avalanche | Urban and rural water overflow |
| Paez – Belalcazar (Cauca) | Volcanic eruption in the Nevado del Huila | Water shortage and damage to the sewage system infrastructure |
| Manizales (Caldas) | Landslides | Water shortage over 11 days |
| Villavicencio (Meta) | Terrorist attack | Water shortage over 7 days |
| Cali (Valle del Cauca) and Neiva (Huila) | Increase in solids due to torrential rains | Water collection closed |
| Bocas de Satinga (Nariño) | Lateral undermining | Collapse of the water intake |
| Quetame (Cundinamarca) | Seismic activity | Water shortage and damage to the sewage system infrastructure |
| Clemencia (Bolívar) | Floods | Damage to the power system, water shortage for more than a month |
| Suarez (Tolima) | Critical diminishing of watersheds at the supply source | Water shortage in the rural zone |
| Barichara (Santander) | Critical diminishing of storage at the dam | Water shortage |
| Cali (Valle del Cauca) | Critical diminishing of watersheds at the supply source | Rationing |

Source: MVCT - Vice-Ministry of Water and Sanitation, 2011.

Box 4.2. Water supply watersheds affected by the La Niña 2010–2011 phenomenon in the city of Cucuta

The excessive generation of water flows in the two watersheds in the Cucuta water supply system (Norte de Santander), combined with the processes of deforestation, produced such murkiness in the water that it made it impossible to purify the water with any water treatment system. As a result, the water company, Aguas Kpital Cucuta S.A. E.S.P., was compelled to stop production in the Pamplonita River and the Zulia River, a situation that went out of control and overwhelmed the technical and operational capacity of the company. This resulted in water rationing in some zones and in others the rendering of providing water service could not be guaranteed.

The climatic history of Cucuta and the geomorphological characterization of the Zulia and Pamplonita watersheds totally changed from the 2010–2011 rainy season on. The degree of deforestation in these watersheds is evidenced in the increase of the levels of murkiness with values over 26,000 UNT (murkiness nephelometric units) in Pamplonita and 16,000 UNT in Zulia. In April 2011, water treatment plants operated at minimum levels and were suspended over 12 days.

| Hours suspended at the Pórtico plant | | | | |
|--------------------------------------|--------------------------------|------------------------------|------------------|------------------------|
| Day | Start (day/month/year hour) | End (day/month/year hour) | Total (hours) | Murkiness Max (UNT) |
| 16 | 16/04/2011 18:15 | 17/04/2011 00:00 | 05:45 | 22,670 |
| 17 | 17/04/2011 00:00 | 17/04/2011 16:00 | 16:00 | 25,680 |
| 18 | 18/04/2011 00:00 | 19/04/2011 00:00 | 24:00 | 28,750 |
| 19 | 19/04/2011 00:00 | 19/04/2011 11:00 | 11:00 | 13,400 |
| 20 | 20/04/2011 04:30 | 20/04/2011 11:00 | 06:30 | 14,260 |
| 21 | 21/04/2011 18:00 | 22/04/2011 00:00 | 06:00 | 17,400 |
| 22 | 22/04/2011 00:00 | 23/04/2011 00:00 | 24:00 | 27,300 |
| 23 | 23/04/2011 00:00 | 24/04/2011 00:00 | 24:00 | 25,700 |
| 24 | 24/04/2011 00:00 | 24/04/2011 13:30 | 13:30 | 12,000 |
| 25 | 25/04/2011 02:00 | 26/04/2011 00:00 | 22:00 | 22,240 |
| 26 | 26/04/2011 00:00 | 26/04/2011 04:00 | 04:00 | 10,240 |
| Total hours suspended | | | 156:45 | |

Source: Aguas Kpital Cucuta S.A. E.S.P., 2011.

Among the main risk causes in the drinking water and basic sanitation sector is the infrastructure weakness, which conditions the system vulnerability. The linear character of the network, generally several kilometers long, the multiplicity of construction material used, as well as the age of the different elements increases its vulnerability, which can trigger damages that generate water shortages for human consumption or the interruption of sewage services. The components in the water and sanitation systems (water intakes, pipelines and fragile distribution, inferior quality

resistance joints and materials, and poor deformation capacity, high loss indices, etc.) are characterized by their weaknesses, creating extreme structural and functional vulnerability, particularly in mountainous and rural zones. Some examples of this are (i) the sewage system in Bahia Solano (Choco), which has not had maintenance in the last ten years, has 12 obstructed stretches, which cause overflows, and has more than 22 of the 37 inspection wells in very bad conditions that result in leakage; (ii) the raw water pipeline system in the Dosquebradas municipality (Risaralda), which has

permanent failures because it was constructed with asbestos (cement) three decades ago and it crosses through an area of active landslides in a zone called “Boqueron”; and (iii) the raw water pipeline system in the city of Villavicencio (Meta), 16.5 kilometers of which is located in an area of concentrated geological instability that puts the system at permanent risk in the service rendering⁶.

The lack of institutional capacity in rendering services and the insufficient preparation to face emergencies are critical factors in this sector. In Colombia, there are more than 10,000 service providers under different schemes (public sector, private sector, community sector). In 460 municipalities, these services are offered directly by the municipality, through offices assigned to different secretariats. Most of these agents are not specialized and do not have technical, administrative or financial capacity to provide quality services, coverage, and continuity to the population. These deficiencies are most critical during emergency situations (Box 4.2).

4.1.5. The education sector: long-term socioeconomic impacts

The education sector is affected by the occurrence of disaster events causing damage to the infrastructure and incurring reconstruction costs including the use of its installations in providing temporary lodging. During La Niña 2010-2011, 3,083 educational institutions and 13,225 classes in 19 departments in the country were affected, of which the most impacted were Bolívar, Magdalena, Atlántico, and Chocó. Additionally, 14 educational centers and 119 classrooms were used as temporary shelters. Consequently, damages to the infrastructure, if

it can be repaired, result in a serious social consequence of having almost 800,000 students without classes or of difficulties in receiving educational services (*Table 4.6*).

In some cases, the disasters’ indirect impacts may have a greater transcendence than the direct ones, as it is exemplified in the education sector. During the recent 2010-2011 emergency, rehabilitation and reconstruction costs in the sector were estimated to be in the amount of approximately Col\$258 billion, corresponding to 4% of the total resources invested in the integral action plan specifically to manage an emergency. While this process included the need to allocate part of the budget to technical studies, maintenance, mitigation works, and relocation and reconstruction projects that in the future will strengthen the incorporation of prevention in the educational infrastructure, there are other indirect impacts related to the suspension of services: delay in the academic curriculum, interruption of school cafeterias, and activities in precarious locations while the normal infrastructure is used for temporary shelter and thus affecting the rights of the students’ communities.

One of the National Ministry of Education guidelines is to guarantee continuity in the educational service rendering in the communities affected by disaster. In relation to the emergency management in the case of La Niña 2010-2011 disaster, different strategies have been proposed to reestablish educational service operations and school cafeterias as well as developing and implementing pedagogic projects in risk management, education in emergencies, and

⁶ For more information see the Single System for Public Services Information, see at: <http://www.sui.gov.co/SUIWeb/logon.jsp>.

sexual education. Moreover, the regions are allowed to use these establishments as temporary shelters in cases of emergencies, which is contradictory in relation to the right of education continuity. Cities such as Bogota, for example, have as a policy guideline that schools cannot be used as shelters by people affected by disasters. They may use community halls, sporting venues, and other types of installation in case these are required (*Table 4.6*).

4.1.6. Health and social protection sector

The economic and social impacts produced in the health sector due to hazardous natural phenomena are the consequence of not assuming integral strategies in risk management. During La Niña 2010-2011, 441 health facilities were affected, including local hospitals, health centers, and health posts in 199 municipalities and

TABLE 4.6. Damage caused by the rainy season in the education sector, 2010-2011

| Department | Total of sites | Sites affected | Classrooms affected | Students affected |
|--------------------|----------------|----------------|---------------------|-------------------|
| Amazonas | 137 | 3 | 11 | 451 |
| Antioquia | 6,397 | 210 | 679 | 55,353 |
| Atlantico | 1,656 | 86 | 433 | 49,137 |
| Bolivar | 2,131 | 590 | 2,995 | 172,064 |
| Boyaca | 2,647 | 39 | 284 | 13,804 |
| Caldas | 1,581 | 25 | 92 | 1,973 |
| Caqueta | 1,639 | 42 | 81 | 6,090 |
| Cauca | 2,897 | 216 | 700 | 44,815 |
| Cesar | 1,741 | 112 | 403 | 20,689 |
| Choco | 1,296 | 188 | 868 | 23,300 |
| Córdoba | 1,669 | 124 | 656 | 40,199 |
| Cundinamarca | 3,892 | 256 | 1,038 | 45,074 |
| Capital District | 3,292 | 4 | 17 | 4,444 |
| Huila | 2,082 | 111 | 341 | 23,844 |
| La Guajira | 531 | 29 | 77 | 9,454 |
| Magdalena | 2,304 | 124 | 758 | 37,836 |
| Nariño | 3,051 | 78 | 295 | 23,615 |
| Norte de Santander | 2,649 | 368 | 1,662 | 83,017 |
| Quindio | 445 | 16 | 139 | 21,272 |
| Risaralda | 1,090 | 96 | 349 | 21,155 |
| Santander | 3,558 | 110 | 309 | 23,209 |
| Sucre | 1,191 | 94 | 362 | 12,873 |
| Tolima | 2,723 | 37 | 200 | 14,556 |
| Valle del Cauca | 4,665 | 125 | 476 | 29,607 |
| Total | 55,264 | 3,083 | 13,225 | 777,831 |

Source: SNPAD and DGR, 2011.

19 departments in the country, where the most critical damage occurred in Bolivar, Nariño, Magdalena, and Norte de Santander. The estimated rehabilitation and reconstruction costs, according to reports from the Public Health Providing Institutions and Health Territorial Agencies increased to Col\$156 billion. These resources were invested in replenishing 146 health posts, 28 health centers, and 23 hospitals (*Table 4.7*).

Other essential establishments that provide social welfare services have also been seriously affected by dangerous natural phenomena, and for this reason an impact on child and family support is recognized. As a consequence of the emergency caused by the La Niña 2010-2011 phenomenon, a total of 23,343 ICBF facilities (central zones, community gardens, children's homes, community homes, school cafeterias, and dining rooms for elderly people, breakfast for children, foster homes, and welfare institutions, among other centers), were affected by some type of damages. Some 4,858 facilities in 16 departments, or 21% of the ICBF infrastructure, included 3,374 facili-

ties that were partially damaged and 1,484 that were completely destroyed. This caused close to 68,012 girls and boys to be affected by the interruption of social attendance services; the departments that had the greatest problems were Atlantico, Magdalena, and Bolivar (SNPAD and DGR, 2011).

The long-term effects of the social and health infrastructure losses transcend medical attention and become a development problem.

Despite the difficulty of estimating the costs of damages caused to the welfare of the population due to the suspension of these services caused by a disaster, it is acknowledged that there are also multiple indirect impacts related to the increase of illness risks, environmental fragmentation, post-traumatic stress, and suspension of vaccine programs and logistic delivery of supplies and medicine. These problems increase the fragility of the population in shaping and increasing the complexity of the vulnerability and risk factors and their recovery capacity in emergency situations.

TABLE 4.7. Types of interventions by effect on the health sector infrastructure, 2010-2011

| Type of intervention | Health posts | Health centers | Local hospitals | Total | m ² | Cost (Col\$) |
|----------------------|--------------|----------------|-----------------|------------|----------------|------------------------|
| Reposition | 146 | 28 | 23 | 197 | 61,947 | 112,861,343,517 |
| Major adaptability | 57 | 22 | 20 | 99 | 29,354 | 29,446,881,514 |
| Minor adaptability | 52 | 45 | 48 | 145 | 36,735 | 14,172,718,898 |
| Totals | | | | 441 | 128,036 | 156,480,943,929 |

Source: SNPAD and DGR, 2011.

4.2. RISK MANAGEMENT IN SECTORAL PUBLIC ADMINISTRATION

4.2.1. Risk management in regulation and sectoral policies

From the regulation and policy perspective, important progress has been made in incorporating risk management, as it is in the case of safe drinking water and basic sanitation, while in environmental, power, education, and housing sectors only partial developments have been observed. The levels of risk management incorporation in sectoral policies are heterogeneous in the country. In this sense, the proposal set forth in the guideline document for safe drinking water and basic sanitation sector stand out, as established by the Water and Sanitation Vice Ministry, as well as the risk control policy in the power sector. Likewise, there has been progress in regulations in the environment, education, and housing sectors, and an integral risk construction strategy in the agriculture sector has been started. Additionally, the transportation sector has been modifying its traditional focus toward a more integral vision of risk management as evidenced in the current Master Transportation Plan 2010-2032, prepared by the Ministry of Transportation and the DNP.

Since 2007, the drinking water and sanitation sector has had strategic proposal documents called Policy Guidelines, initiated by the Vice Ministry of Water and Sanitation, which incorporate risk management in public services rendering water supply, sewage systems, and sanitation. Even though these have not been officially approved, the documents adopted a conceptual framework to include risk management based on its hazards and vulnerability

and likewise emphasized the aforementioned in three fundamental elements: (i) the risk over the rendering of Residential Public Services (SPD), (ii) the risks caused by rendering SPD services to society, and (iii) risks generated in society due to deficiencies in the rendering of services in case of emergencies and disasters. They also define the strategic lines of action that address incorporation of risk management in planning and investment⁷ instruments and in regulations⁸, strengthening service providers and municipalities in this subject, development in hazard and risk information, and preparedness to guarantee appropriate service in emergency situations.

Risk management is gradually being included in several regulation instruments in the area of drinking water and sanitation. Law 142 of 1994 of Public Utility Services establishes that the service providers should collaborate with the authorities in emergency situations or public calamities in order to avoid serious injury to the users. Subsequently, the Technical Regulation for the Drinking Water and Basic Sanitation Sector (RAS), adopted in 2000, sets the requirements for the designs, works, and procedures in the sector and its complementary activities, including risk management as part of its environmental component. Likewise, Decree 1575 of 2007, on water quality for

7 Sanitation and Dumping Management Plans, Water Supply and Sewerage Master Plans, Solid Waste Management and Work Plans, and Investment Service Providers.

8 Technical Regulation for the Drinking Water and Basic Sanitation Sector (RAS).

human consumption, requires that the service providers formulate a contingency plan in case of emergency and give guidelines for its activation. Currently, the Vice Ministry of Water and Sanitation is preparing a specific risk management document for the next RAS version, in which the previously mentioned policy guidelines will be incorporated.

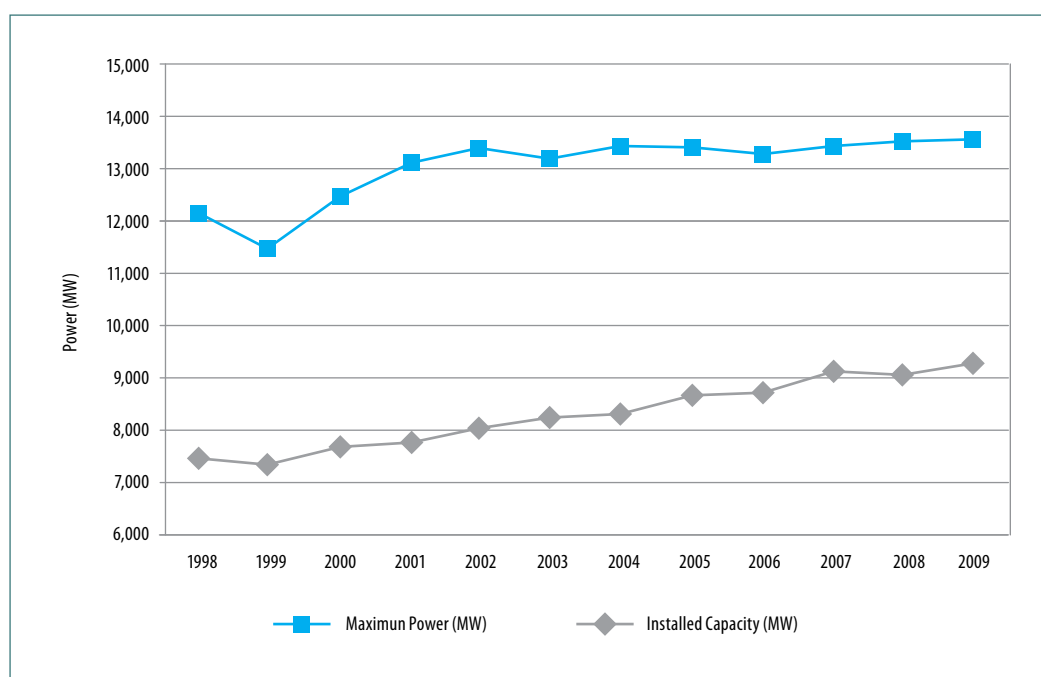
Risk management was also incorporated in the Water and Sanitation Departmental Plans (PDA), subsequently changed to the Water Program for Prosperity, which as an institutional and financial strategy was meant to extend the quality and coverage of public services and advance toward the Millennium Development Goals. The PDA were regulated by Decree 3200 of 2008 with the purpose of allocating investments at the territorial level through a sole regional plan that seeks articulation, economies of scale, cost-effectiveness, and sustainability. In 2009, a specific risk management annex was included in all the PDA in order to evaluate vulnerabilities, give priority to investments in reducing these vulnerabilities, and guide resources to respond to emergency situations. However, presently, the effectiveness of the compliance of this guideline has not been evaluated, and neither has the manner in which it has influenced the allocation of money for this subject, or the development of specific actions. The PDA were modified at the end of 2011 when they became the Water Program for Prosperity, which should include the progress made in risk management by the PDA.

The energy sector has the strengthening policy of “continuity of the service” in facing a water shortage hazard in case of extreme drought. This was achieved by mandate of the Public Utility Services Law (Law 142 of 1994) and the Power Law (Law 143 of 1994), and by the knowledge acquired in the “blackout” caused by El Niño 1991-1992. Law 142 of 1994 estab-

lishes, as one of its purposes, the State’s intervention in “the continuous and uninterrupted rendering” of public utility services, which was ratified by Law 143 of the same year. In compliance with this principle and as a consequence of the subsequent power rationing produced by El Niño 1991-1992 (which was due to the country’s strong dependency in hydroelectric energy), a medium- and long-term strategy has been adopted to reduce vulnerability, improve regulatory and financial instruments that encourage competition, diversify the power sector, and install a greater capacity that will outweigh the demand. Currently, Colombia has an installed capacity of 50% greater than the demand (*Graph 4.9*). It has a diversified power park and regulations, which, by order of the government, protected water reserves during El Niño 2008-2009, hence reducing the production of hydroelectric energy and increasing the production of thermal energy that went from supplying 14% of the demand in the country to 50% (*Graph 4.10*). Due to the redundancy of sources and excess capacity, it has been possible not to ration water in times of water scarcity.

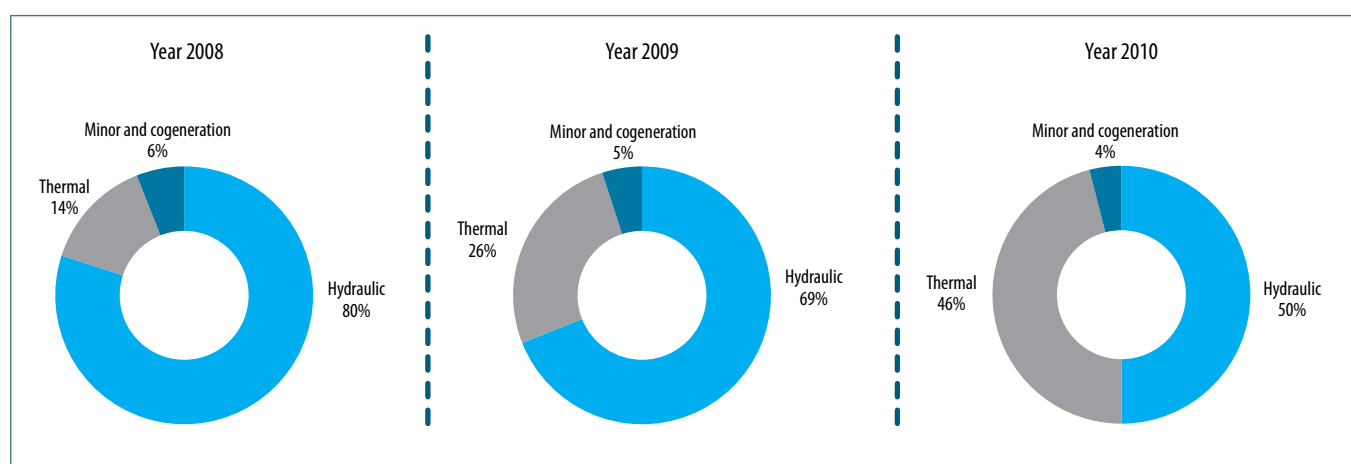
The energy sector has also been successful in guaranteeing the continuity of services in spite of damages to the sector caused by terrorist attacks, making evident its response capacity in anthropic disasters. The redundancy concept of the elements and the system’s flexibility to function in case of a component’s failure are fundamental factors for public service operation and continuity. The Operations Room of the National Dispatch Center, employing highly qualified personnel and having access to the national electrical interconnection network, has been a key element in facing any crisis. Likewise, the country counts on the Support Control Center in case the Operations Room fails to respond. Additionally, their own technological developments

GRAPH 4.9. Evolution of the installed capacity and the maximum demand for power, 1998-2009



Source: UPME, 2010.

GRAPH 4.10. Composition of power generation, 2008-2010



Source: Ministry of Mines and Energy, 2010.

have maximized the use of the systems, although there are failures in some sections. Moreover, the advantages of the regulation framework promote open competition and private investment while concurrently facilitating swift intervention in a crisis situation. For more than two decades and especially in times when armed conflict was more intense, there have been no significant energy service suspensions in the country, a capacity which is also useful in disasters caused by natural phenomena that would affect the power infrastructure.

The agriculture sector, even though it has been affected by recurrent disasters, has had an incipient advance in regulations and policies for risk management. However, the current National Development Plan (NDP) seeks the adoption of a new strategy that includes adaption to climate change and market risks. Agrarian activities are systematically impacted by disasters, which affect economic and social development in the rural areas and register the highest economic losses caused by extreme climatic events (*Graph 4.5*). However, the sector's policy has been focused on granting direct compensation or financial relief to the affected producers, and risk prevention and mitigation interventions have been minor. Acknowledging the need to have a more integral approach, the current NDP adopted a strategic line to "Promote risk management schemes and improve investment conditions in the countryside" as one of the seven priority lines for the agriculture sector and rural development. This strategy is incorporated in strengthening preventive culture, adoption of climate change mechanisms, and promoting safety.

The education sector has important regulations in disaster risk management. Resolution 7550 of 1994 regulates the activities of the National Education System in Emergency and Disaster Prevention and Response. In-

stitutions are required to set up School Disaster Prevention and Response Committees and the Secretariats of Education are to use the counseling provided by the CREPAD, the Departmental Board of Education, and the National Office for Disaster Prevention and Response. Subsequently, Ministerial Directive No. 12 of July 2009 comprehensively addresses the subject of risk management in the sector. Even though its title refers to "Continuity in rendering education services in emergency situations", its content also deals with prevention and mitigation requiring that the Secretariats prepare risk maps, relocate educational installations under risk, and adopt contingency plans. Additionally, it provides instruction on how to coordinate with other State entities during a crisis situation and how to proceed in managing resources in the reconstruction phase. On the other hand, the contents of the curricula are contained in the 2002 National Environmental Education Policy. All of this indicates that the education sector has the availability of policy instruments and important regulations to progress in risk management.

Since 1989, priority has been given to the housing sector to relocate populations in high-risk zones and restrict construction in nonmitigable conditions. However, there has been insignificant progress in this respect. Law 9 of 1989, related to urban reform, for the first time required that the municipalities identify and relocate settlements in high-risk zones. Moreover, Law 3 of 1991, which created the National System of Social Interest Housing, established a family housing subsidy and regulated relocation processes. Subsequently, Law 388 of 1997, related to land use planning, requires local entities to adopt in a peremptory time its POT, and identify, among other elements, nonmitigable areas and areas apt for housing construction. Moreover,

these are fundamental to reduce existing risk, since they require population relocation, define conditions and restrictions in land use in order to control factors that increase hazards and vulnerability, and avoid the generation of risk scenarios. Where the municipalities in the country have adopted their POT, it is evident that the definition of a peremptory deadline, without counting on resources and/or technically defined methodologies, has had negative effects in the quality of administering risk management. Although it is acknowledged that Colombia has progressed in regulations in institutionalizing land use planning, there are great challenges that must be assumed in the process of updating these planning instruments.

The last three PND have given priority to the need to support municipalities in risk reduction in the housing sector by the POT formulation and implementation. The PND 2002-2006 had as a goal to support 100 municipalities in including risk management in the POT, which resulted in the Conpes Document 3305, reiterating the assignment of this responsibility to the Ministry of the Environment, Housing, and Territorial Development. The issue was retaken during the PND 2006-2010, and as a result the Ministry provided aid to more than 600 municipalities in this process (57% of the country's municipalities). However, an evaluation concluded that there are multiple weaknesses in the conceptualization and adaption of risk management in land use planning. Faced with this situation and minimally applying Article 56 of Law 9 of 1989, related to relocation of population at high risk, the PND 2010-2014 orders the current Ministry of Housing to define and assign resources in order to formulate a methodology to prepare inventories of settlements at risk and to provide support to municipalities in implementing and consolidating the information.

The Integral Neighborhood Improvement strategy, adopted in 2004, in addition to providing better quality in housing and its surroundings, aims to reduce risk conditions. However, with the exception of land titling, there have not been any significant advances. In Colombia's housing, there are more than 1.3 million underdeveloped dwellings, which have structural failures due to the fact that they were constructed under poor and informal processes. The *Second Colombian Centennial: 2019* (DNP, 2007) proposes optimizing conditions in more than 800,000 units. The government has allocated Col\$30 billion (adjusted to 2007 Col\$) in order to offer a national guarantee to credits to improve housing. However, this financial method was not well received. Subsequently, through the Conpes Document 3604 of 2009, the Integral Neighborhood Improvement Policy and a proposal to give housing titles to 350,000 dwellings and 11 pilot projects to improve neighborhoods was implemented. To date, more than 240,000 property titles and 25,000 subsidies have been granted. However, those that have been used for reinforcing housing structure have been minor. Pilot projects like those in Barrancabermeja (Santander) have produced excellent results that merit being copied.

Another important measure is the adaption of seismic-resistant construction codes. The first Seismic-Resistant Code was adopted when Law Decree 1400 of 1984 came into force, and it was updated by Law 400 of 1997 and its NSR-98 and NSR-10 regulations. These regulations set design and construction standards in order to minimize damages produced by earthquakes with the purpose of diminishing fatalities and reasonably protecting the owner's patrimony.

The measures adopted in the housing sector have had positive impacts in risk control, but the sector lacks an integral policy that would incorporate the reduction of existing vulnerability in formal and informal settlements. Measures

taken in land use planning and construction regulations are fundamental in minimizing hazards to new and formal housing, although there are challenges in their implementation and their progress is incipient. Furthermore, there is lack of clarity in influencing informal housing, which represents close to 30% of the units annually constructed, this being one of the primary causes for the increase of risk in Colombia. In this sense, it is necessary to implement design measures that strengthen urban control in applying seismic-resistant regulations, land use planning, and overall the application of criteria approved in construction planning permits.

Apart from the responsibility in participating in the National System of Disaster Prevention and Attention, the Ministry of Transportation does not have any clear functions in the area of risk management. However, progress can be seen in entities like the Invias Disaster Prevention and Attention Office and its inclusion of the risk management concept in the concession contracts, even though these have some deficiencies. Decree 087 of 2011 modifies the Ministry of Transportation's structure by redefining its functions and dependencies. It is assigned with the task of participating in a responsible risk management system and even though the Decree does not explicitly mention the subject, there have been advances such as the creation, in 2003, of the Invias Disaster Prevention and Attention Office. Another important contribution is attributed to Conpes 3107 of 2001⁹, regarding the State's Contracting Risk Management Policy in Private Infrastructure Participation Processes, which include Inco and the recently approved Conpes 3714¹⁰. This document establishes the need to give the private investor responsibility over the execution and/or the operation of the project, which should encourage the use of safety standards in infrastructure design given in concession, and free the State of these risks. In spite

of this, instruction has not been fully addressed and contractual gaps have been produced in Inco, which in 2010 paid more than Col\$85 billion in arbitral awards, judgments and settlements (Inco, 2010).

Progress has been made in the health sector in formulating and implementing the Regional Policy on Safe Hospitals, in compliance with a worldwide strategy to reduce vulnerability in hospital facilities. The Ministry of Social Protection has been developing a safe hospital plan within the campaign framework promoted by the United Nations through the International Strategy for Disaster Reduction (UNISDR) and the World Health Organization (WHO), with the purpose of having national policies and regulations to face disasters, protect life, investment, and the function of new establishments and those identified as priorities in the health service network, as well as monitoring those interventions. With this, the country seeks to have health establishments that provide permanent and accessible services in function of their maximum capacity and within their own infrastructure immediately after the disaster occurs. It also contemplates improving emergency training by preparing and updating national, local, and hospital plans, training health personnel and other related sectors, as well as assuring essential resources in case of a disaster event.

9 Conpes Document 3107 of 2001 establishes the guidelines for assigning risk to force majeure as follows: "(i) force majeure risks are defined as events that are beyond the control of the parties, and their occurrence entitles requests the suspension of obligations under the contract; (ii) temporary events of force majeure, causing delays, can often be solved by allocating the costs between the parties. Major events of force majeure may lead to disruption of the project; and (iii) the risk of insurable force majeure refers to the adverse impact on the project implementation and/or operation that natural disasters can cause. These include earthquakes, floods, fires, and droughts, among others. Normally, these type, of force majeure risks are insurable, so this risk will be borne by the private investor."

10 Document 3714 on predicable risk in public contracting.

4.2.2. Sectoral institutions in risk management

Institutionalism and specific sectoral capacity in risk management is very limited. There are not many dependencies whose function is to adopt and implement policies in different Ministries and even though some entities execute tasks in this respect, generally they are carried out by contractors having multiple functions and a high turnover rate, which restricts their performance. As it is indicated in Chapter 2 of this study, and in spite of norms such as Decree 919 of 1989 and Conpes 3146, which requested the creation of dependencies that would have specific functions in risk management in the different Ministries, the only national sectoral entities that have disaster prevention and attention offices are Inviás, the Vice Ministry of Water and Sanitation, and the Ministry of Social Protection. The office created by Inviás may not adopt policies in all areas of transportation and in the absence of a sectoral policy and the needs associated with everyday emergencies and disasters, more priority is given to response than to prevention. Currently, the Ministry of Agriculture and Rural Development is seeking alternatives to create an Agrarian Risk Management Office¹¹, and the recently created Ministry of Environment and Sustainable Development has also considered the possibility of creating an Office in this subject matter. The law project in conciliation process in Congress, which proposes to replace Law 46 of 1998 and Decree 919 of 1989 with the purpose of modernizing the SNPAD, reiterates the commitment of creating dependencies in the Ministries with clear policy, execution, monitoring, and risk management functions, which should be closely linked to adaption to climate change

strategies and more efficient environmental management. However, at the moment there is a large deficit in sectoral institutional capacity and therefore, there are many shortcomings in defining policies, strategies, and instruments for reducing and controlling risk.

The drinking water and basic sanitation sector has a Risk Management Group, which has been fundamental in formulating and implementing policy guidelines on this subject. In 2006, and as part of the credit execution strategy with the World Bank “Program for Reducing the State’s Fiscal Vulnerability in Facing Natural Disasters”, the Risk Management Group was created for the drinking water and basic sanitation sector and is part of the Vice Ministry for Water and Basic Sanitation. Since its creation, the Annual Plans have included objectives in this area, which were originally associated with the development of the operation with the World Bank, and subsequently, included actions such as providing aid and support to service providers and municipalities, developing methodological instruments, and adopting a Risk Management Chapter in the RAS.

In October 2011, the Ministry of Social Protection (MPS) had in the Vice Ministry of Health and Welfare an Emergency and Disaster Attention Office, and within the General Directorate of Quality Services, it also had a Physical and Technology Infrastructure Office. The MPS has among its functions identifying and implementing strategies in reduction, mitigation and overcoming risks that may originate from natural and environmental sources as well as social and economic factors related to the labor

11 The Ministry of Agriculture and Rural Development tried unsuccessfully to create an Agrarian Risk Directorate in January 2011, aided by emergency decrees issued in response to the La Niña phenomenon of that year.

force, vital cycle, and health within the framework of its assigned competencies (Decree 205 of 2003). The existence of a specific work group in risk management in the interior of the MPS makes evident the capacity installed and its interest, thus allowing the adoption of policy and regulation guidelines and their subsequent implementation and monitoring¹².

The role of the municipalities and departments in the implementation of sectoral policies is fundamental, given that the Constitution of 1991 and the legislation make them responsible for the administration of their territories and directly accountable in providing public services and managing risk. However, the majority have restrictions in their resources and institutional capacity to undertake these tasks adequately. The lack of policies and instruments in different sectors, as well as strategies for accompaniment, complementarity, and capacity transfer to territorial entities, may be considered as one of the principal factors in risk generation, as previously stated in Chapter 2. For example, according to Law 136 of 1994, the municipalities are responsible for land regulation, control, and surveillance in construction and the sale of residential property. However, only 35 cities in the country have Urban Curators and close to 90% of the local entities (categories 5 and 6) do not have skilled civil servants or sufficient resources to appropriately comply with their tasks. In transportation, the municipalities are responsible for the tertiary road network, but generally they have very deficient standards and the greatest vulnerabilities. The local governments also have the obligation to provide public services with quality and continuity standards. Moreover, they must carry out censuses and relocation of populations at risk. These activities require capacities and resources that are absent in many municipali-

ties. In addition, the support provided by the National Government has not been sufficient or constant, which only exacerbates the institutional vulnerability that is in itself one of the primary causes for the increase of risk in Colombia.

4.2.3. Sources of risk management financing at the sectoral level

The General Participation System and the Water for Prosperity Program can finance activities related to risk management in the drinking water and basic sanitation sector. Without any exception, the activities to be financed must be adjusted to the provisions of Articles 10 and 11 of Law 1176 of 2007¹³. However, there are some considerations that have to be taken into account in relation to interventions in an emergency situation related to (i) works for collapsed infrastructure recovery or for damages that affect its operation; (ii) works to stabilize slopes that directly impact the water or sewage systems where if the intervention is not done immediately, it may cause interruption in the service¹⁴; and (iii) implementation of temporary alternative measures in collection, transportation, and proper disposal of waste so that the emergency situation is mitigated and sanitation problems are avoided (MAVDT, 2008). As far as an

12 The Ministry of Social Protection was restructured by Decree 4107 dated November 2, 2011.

13 "By which the Articles 356 and 357 of the Political Constitution are implemented and other provisions are issued".

14 The infrastructure to which subparagraphs a) and b) of Act 1176 of 2007 refer include water supply systems (collection, adduction, conduction of raw water, treatment systems, tanks, or major networks) and sewage systems (collectors and interceptors, treatment systems, pumping stations, and sewage network systems).

early recuperation of the affected infrastructure at a municipal level, those projects that do not require design were once considered directly viable by the Directorate Committees of the Departmental Water Plans¹⁵. However, subsequently, it was observed that the works did not logically correspond to the hydrographic watersheds. This aspect should be re-evaluated and taken into account in the new Water for Prosperity Program. On the other hand, the projects that are presented to the Vice Ministry of Drinking Water under the mechanism of Sole Window are evaluated and considered viable to access resources, such as the National Royalties Fund (FNR). Additionally, the Vice Ministry is part of the National Water, Sanitation, and Hygiene Consulting Commission (CASH), which is a member of the Pan-American Health Organization, the International Plan, Unicef, Oxfam, etc. The Commission channels technical assistance through this organization with the purpose of providing solutions to the affected zones.

The transportation sector responds principally to requests from municipalities and departments. However, these requests may also be made to the National Calamity Fund (FNC), Invias, and the National Royalty Fund (FNR) without a formal articulation mechanism among these sources or a priority procedure to optimize the use of resources. There is not a solid planning system that facilitates an adequate structuring and prioritization in investment projects, in some cases leading to the execution of poorly organized contracts that encourage renegotiation processes. This situation is due to the lack of technical personnel or high turnover, inadequate organization, and weak institutional coordination in administering projects. Moreover, it is recommended that apart from traditional financing sources for risk management in the transportation sector,

there should be specific criteria to facilitate the incorporation of other channels of resources, even though these do not have to be directly related to emergency situations, such as financing through public-private or private sources, tariffs and rates, etc.

In order to provide energy service, there are different funds which may be resorted to in case resources are needed for risk management.

Under the outsourcing model, the private sector is in charge of generating, commercializing, and distributing the electricity service. Therefore, it would be the responsibility of the companies to reestablish power in case of a disaster and supply the service in affected zones. These activities are currently under the supervision of the Superintendence of Public Services. However, territorial entities can administer projects with the support of companies that provide these services and operate in the same jurisdiction using the following financial sources: (i) Financial Support Fund to provide Energy for Interconnected Rural Zones (FAER) (Article 105 of Law 788 of 2002 and Regulation Decree 1122 of 2008), for the execution of plans, programs, and expansion projects in the power sector in order to satisfy demand in interconnected rural areas; (ii) Financial Support Fund to provide Energy for unconnected Rural Zones (FAZNI) (Articles 81 to 83 of Law 633 of 2000 and Regulation Decree 1124 of 2008), which provides support in power infrastructure to extend its coverage in zones that are not connected, as well as investing in construction and installation of new elements and replacement or rehabilitation of existing ones; (iii) Social Power Fund

¹⁵ This prioritization is carried out taking into account information that includes the municipality affected, through the CLOPAD, at the request of an emergency declaration in the department, and the latter in the DGR.

(FOES) (Laws 812 of 2003 and 1151 of 2007, and Decree 4978 of 2007), to cover a percentage of the value of electrical energy intended for the consumption of users located in difficult administration zones¹⁶, less developed rural zones¹⁷ and subnormal urban sectors¹⁸, as defined by the national government (unregulated users will not benefit from this Fund); and (iv) Solidarity Fund for Subsidies and Income Redistribution (FSSRI) (Laws 142 of 1994 and 286 of 1996), by which resources are administered and allocated by the National Budget and/or the same Fund in order to cover subsidies in electrical energy and combustible gas distributed by the physical network to minor income users. FSSRI may be focused on subsidies for families affected by disasters that are not able to pay for the service. Another possible source is the National Royalty Fund (FNR), even if it does not mention states of emergency in rehabilitation projects or recovery of impacted infrastructure caused by disasters; several of its funding lines may nevertheless be applied to urban or rural centers whose service has been interrupted due to these conditions.

The health sector relies on multiple financial resources for infrastructure and rendering services within the framework of risk management through funds including the General Participation System. The Ministry of Social Protection (currently the Ministry of Health and Social Protection) relies on the Solidarity and Guarantee Fund (Fosyga) (Articles 167 and 218 of Law 100 of 1993 and Decree 1283 of 1993), using a subaccount to respond to Catastrophic Events and Traffic Accidents (ECAT). The Fund is managed from the MPS as a trust, without having legal autonomy or its own offices, and its resources are allocated to attending to persons injured in traffic accidents, terrorist activities caused by bombs or other explosive

devices, natural catastrophes, or other events expressly approved by the National Social Security Health Council¹⁹. Additionally to the money provided by the SGP and the timely support of the MPS, both municipalities and departments may have access to royalties (direct and indirect) through the presentation of Regional Investment Projects under the terms outlined by the FNR. In this case, the viability is the direct responsibility of the Ministry. The MPS also supports the functioning of the hospital network in the country, the updating and implementation of Hospital Plans in Disasters, and the revision and adjustment of the Emergency Medical Attention Guides. Likewise, with the purpose of contributing to vulnerability reduction in institutional hospitals at the national level, the MPS has a program to reinforce structures, unfortunately limited in budget in relation to the existing demand, which has not adequately complied with the established deadlines in the Law in order to minimize the vulnerability in essential buildings.

16 Decree 4978 of 2007: "A group of users located in the same area connected to the INS, which has in the past year on an ongoing basis the following characteristics: (i) overdue loans over 90 days by 50% or more of users belonging to that community, or (ii) level of power losses exceeding 40% over the input power to the system that serves only this community".

17 Rural sector areas of interconnected zones with the following characteristics: (i) average index of lower quality of life up to 46.6%, according to the Socio-demographic Indicators System of DNP, and (ii) connected to the SIN.

18 Settlements located in regional municipality connected to the SIN, which meet the following characteristics: (i) they do not have energy service or they get it through networks not approved by the Network Operator, and (ii) are not areas where the service is prohibited as provided in Article 99 of Law 812 of 2003. It is up to the mayor or the competent authority to issue the certification.

19 For this purpose, the Law specifies: *Natural disasters* are those changes in the physical environment, identifiable in time and space, producing massive and indiscriminate damage on people and collectively affecting a community, such as earthquakes, tsunamis, volcanic eruptions, landslides, floods, and avalanches. *Other events* are those expressly approved by CNSSS or other authorities substituting it from a natural origin, or those that are accidental or voluntarily man-made, whose magnitude exceeds the adaptive capacity of the community in which they occur and affecting them massively and indiscriminately, creating the need for outside help.

4.2.4. Information and knowledge of risk at the sectoral level

Significant progress has been made regarding availability of information in the areas of energy and education. However, in other areas, there is limited knowledge of risk as a key component in the creation of sectoral strategies. In the energy sector, real-time information is available about hydroelectric reservoir levels and weather forecasts, which has allowed timely decision making in order to avoid power shortages. In the education sector, an inventory of education infrastructure is being prepared, which includes mechanisms for evaluating post-emergency damages. These mechanisms were implemented when the census of damages caused by La Niña 2010-2011 was conducted and proved to be very valuable tools for timely management of education infrastructure needs during this event. In other sectors, the availability of automated historical information with the level of detail required for decision making is still limited.

Few cities have prepared an at-risk housing census, even though the law holds territorial entities responsible for doing so. Identifying and evaluating at-risk settlements provides information essential for understanding the magnitude of the problem, estimating the costs, and preparing a strategic plan for reducing hazard and vulnerability factors in the sector. To that end, it is convenient to use standards and have the support of the Ministry of Housing, which has increasingly taken on more importance in the current PND.

The livestock and agriculture sector has requested that a registry of producers be drawn up in the current National Development Plan. This information is essential for identifying exposure

and crafting strategies for risk reduction. It can also be useful for developing models for estimating potential future impact, implementing rapid damage evaluations immediately after a disaster occurs, and preparing a government response in a more timely fashion.

With respect to actions in the transport sector, there are various information sources that could be linked together in order to consolidate a risk management information system. Detailed inventories of the main road infrastructure were recently performed and are available. The Invias and the ANI also have disaster impact databases, but the information is still not standardized or automated; therefore, it is not possible to carry out a historical analysis. There are also some studies carried out by the University of Los Andes on the vulnerability of the road network, which are well worth considering and updating for different modes of transport. In contrast, information about the weakness of the main infrastructure elements (such as bridges), risk analysis of critical locations, or data on indirect impact due to damages to roads has serious limitations. The aforementioned information is essential for advancing cost-benefit calculations for risk reduction.

Regarding drinking water and basic sanitation, numerous information sources were identified which, if linked together, could contribute to improving decision making for risk management and identifying existing gaps. The Public Utility Sole Information System, from the Superintendence of Public Utilities, contains data on service providers and their infrastructure, including vulnerability studies of aqueduct and sewer systems. However, data is still being fed into the System, its procedures are very complex for municipalities with less than 10,000 inhabitants, data queries are not very user-friendly, and the consistency and structure of the information needs improvement. The Vice Ministry of

Water and Basic Sanitation has a Sole Window information system for all sector projects, which includes their characteristics and status. It is an essential tool for monitoring risk reduction. The Hydrological and Meteorological Information System from the Ideam is also available for monitoring and forecasting the weather and the water supply, facilitating the issuance of early alerts, and analyzing hazards and vulnerabilities related to hydrometeorological phenomena. On the other hand, no progress has been made in the detailed evaluation of the indirect impact of the suspension of public utilities, whose assessment is assumed to be greater than that of direct damages to infrastructure.

There is an awareness of the need to generate knowledge about seismic hazards for the health services infrastructure, even though there is a requirement to evaluate information gaps in other types of phenomena. In compliance with seismic resistance regulations and in order to deal with the vulnerability of hospitals in catastrophic events such as earthquakes, the Ministry of Social Protection has been developing planning and coordination activities that protect the lives and property of the people and the assets of the government and ensure the permanent provision of health services, through the implementation of the Program for Reducing Structural Seismic Vulnerability. From 2003 to 2005, this program invested resources amounting to Col\$2.95 billion²⁰ to support the preparation of 171 seismic vulnerability studies.

Sectoral knowledge and information systems containing historical records of the losses and damages caused by disasters, inventories/registries of infrastructure and its vulnerability, and risk analysis are essential for determining the real magnitude of the problem, identifying needs, and developing specific risk management plans based on cost-benefit studies. Some areas show progress in the matter but, in general, there are

deficiencies in understanding and sizing risk at the sectoral level. The 2010-2014 PND emphasizes the importance of building information systems covering the population, exposed assets, and their vulnerability, as well as the urgent need to promote a culture of, and adequate access to, knowledge for making decisions that minimize risk and strengthen the effectiveness of early alerts. In accordance with Decree 919 of 1989, the UNGRD is responsible for promoting a system that coordinates data from sectors and from the actors of the SNPAD. Therefore, it is essential that this initiative be a part of the ICDE (Colombian Spatial Data Infrastructure), ensuring greater interoperability by implementing international standards, and strengthening disaster risk estimation and management.

4.2.5. Risk reduction in sectors

The energy sector is the best example of how a combination of regulatory, economic, and planning instruments can be effective mechanisms for reducing risk. After the rationing caused by the El Niño 1991-1992 phenomenon, a strategy for reducing vulnerability, which included restructuring the sector and fostering a culture of mid-term and long-term planning, was implemented. Based on the experience of the deficient operation of the system and the shortage of water caused by El Niño (reservoirs with levels 40% below their capacity), financial, commercial, and administrative modernization and reform processes were conducted in order to make companies viable, improve control procedures and, above all, open up to competition

20 Ministry of Social Protection, Office of Physical Infrastructure and Technology, October 2011.

and contributions by new operators. The electric expansion plan sought to overcome the high dependency on hydrological resources by building and commissioning thermal energy plants, which led to an increase in installed generation capacity from 8,356 MW to 11,587 MW. Currently, the aforementioned 2010-2024 expansion, generation, and transmission plan is the instrument par excellence for ensuring the continuity and stability of service.

The “reliability surcharge” is an instrument that allows provision of energy in times of drought. In a predominantly hydroelectric system such as the one in Colombia, the challenge of ensuring service continuity in the face of weather phenomena can produce significant disruptions that hinder reaching real equilibrium between demand and supply (Villareal and Cordoba, 2007). The reliability surcharge, which has been in operation since December 2006, has proven benefits such as encouraging the private sector to invest in backup technology (mainly thermal) and, simultaneously, allowing free market competition to ensure the lowest cost for users. This is possible through OEF (Firm Energy Obligations) that reflect commitments by generators, which are backed by an infrastructure capable of producing energy, mainly thermal, in critical supply conditions. The OEF required to cover the demand of the system are auctioned. The winner receives a known and stable remuneration during a specific period and has the obligation to deliver a certain amount of energy when the market price, the so-called scarcity price, exceeds a threshold previously established by the CREG (Energy and Gas Regulatory Commission). The aforementioned is calculated and collected by the ASIC (Administrator of the Commercial Exchange System)²¹ and is paid by the users of the SIN (National Interconnected System) through the fees charged by the retailers.

The risk reduction strategy of the Ministry of Education is focused on an inventory of its entities, so that the magnitude of the problem may be quantified and the use of the resources of the Ministry and of each Secretariat may be prioritized. The SICIED (Education Infrastructure Interactive Consulting System), which began operating at the end of 2008, seeks to consolidate the National Inventory of the Educational Institution Infrastructure by including the characteristics of buildings and the hazard levels they are exposed to. As of 2011, the System contained data from 55 Certified Territorial Entities and the analysis is expected to be complete by the first quarter of 2012²². The partial information covers 13,482 lots (*Table 4.8*). The program shows the current state of facilities: the department, municipality, age, materials, risk type and level (high, medium, low), number of students, and other variables; it will be the basis for the development of risk reduction plans by every Education Secretariat and the prioritization of investments by the Ministry.

TABLE 4.8. SICIED exposure of the education infrastructure by type of risk*

| Risk type | Lots | % |
|---------------------|---------------|----------------|
| Flood | 1,314 | 9.75% |
| Landslide | 1,205 | 8.94% |
| Landslide receptors | 415 | 3.08% |
| Marshy area | 725 | 5.38% |
| Sanitary landfill | 132 | 0.98% |
| None | 10,133 | 75.16% |
| Total | 13,924 | 103.28% |

* The report covers the 55 Certified Territorial Entities that are registered in the SICIED.

Source: MEN, 2011.

21 ASIC is responsible for contract registration settlement and invoicing of all transactions carried out on the market.

22 SICIED, Ministry of Education, June 2011

Some cities, especially Bogota, have advanced considerably in the reduction of risk in the education sector through measures such as structural reinforcement of schools and financial insurance.

In 2000, Bogota performed a qualitative analysis of the seismic vulnerability of 100% of its infrastructure, in compliance with the 1998 National Seismic Resistance Regulation. Of the 2,507 schools that were evaluated, 430 required a detailed study for their subsequent reinforcement. The Education Secretariat of the District took actions for improving its facilities through structural reinforcement, expansion, and replacement. Toward the beginning of 2003, financial support was offered by the IDB and the World Bank through “The Project for Reducing the Physical and Fiscal Vulnerability of the District on Confronting Disasters”, as an endorsement of the aforementioned initiative on vital buildings, including private schools. During the period of 2004 - 2010, 185 schools were reinforced, 69 were expanded, and 40 new schools were renovated (Office of the Mayor of Bogota - FOPAE, 2010). The process that was carried out allowed not only the improvement of education facilities, but also the legalization of informality, an increase in class sizes and coverage, adequate schools for boys, girls, and teenagers, and appropriate spaces for their education (Ramirez and Rubiano, 2009a).

Reduction of risk in housing shows scant progress because investments are focused on new construction, and even though pertinent regulations exist, issues such as resettlement and reinforcement of high-risk housing are relegated. Although the MVCT cofinances vulnerability reduction projects through of housing subsidies, responsibility is assigned by law to the municipalities. However, previously existing risk, fiscal limitations of territorial entities, and the focus of central government subsidies contribute to minimum progress in this field. This is a critical issue, considering that 50% of the homes that exist in Colombia were built before the Seismic Resistance Regulation or are located in

high-risk zones. From 2003 to 2011, the Fonvivienda (National Housing Fund) has allocated only 6.1% of its subsidy budget to disaster prevention (Table 4.9). Other programs such as the pilot program for Integral Improvement of Neighborhoods have offered interesting lessons, which need to be duplicated in order to generate relevant risk reduction results in the sector.

Although measures such as incentives for irrigation and agriculture in general may contribute to reducing disaster risk, the main measure that has been adopted is the subsidy for livestock and agricultural insurance (recently declared mandatory for future borrowers of Finagro), though it only covers 1% of the productive areas in the country. Law 69 of 1993 created the National Livestock and Agricultural Risk Fund and established insurance as well as the possibility of subsidizing up to 60% of the value of the premium paid by producers; however, less than 1% of the cultivated area in the country is currently protected under that scheme. In 2011, the National Livestock and Agricultural Credit Commission ruled that, starting in January 2013, loans or subsidies provided by Finagro must be accompanied by risk insurance against natural or biological phenomena. For some loans, this has been mandatory since January 1, 2012. Up to 60% of the value of the insurance is subsidized by the current administration (30% of the individual policy and 60% of the group policy) and covers excess or shortage of rainfall, floods, hailstorms, strong winds, frost, landslides, avalanches, and biological and phytosanitary risks. This measure is expected to encourage massive adoption of insurance, promote competition among insurance companies, and reduce costs considering that, currently, only one entity provides the service in the country. Other instruments, such as incentives for irrigation and rural capitalization systems, have had a positive effect on risk reduction, but they are not considered in the project evaluation process. Doing so would increase the impact and use of such instruments.

TABLE 4.9. Allocation of subsidies by Fonvivienda. 2003-2011

| Type of action | Fund | Subsidies | Subsidies (%) | Current allotments (Col\$) | Constant allotments (Col\$) | Constant (%) |
|---------------------------|----------------------------------|----------------|---------------|----------------------------|-----------------------------|--------------|
| Rents | Terrorist attacks fund | 3 | 0.0 | \$14,371,250 | \$18,299,779 | 0.0 |
| | Displaced population fund | 20,650 | 6.6 | \$106,253'017.543 | \$127,598'190.310 | 4.7 |
| | Total Rent | 20,653 | 6.6 | \$106,267,388,793 | \$127,616,490,090 | 4.7 |
| Disaster response | Reconstruction | 71 | 0.0 | \$618,903,600 | \$712,494,144 | 0.0 |
| | Repairs | 1,402 | 0.4 | \$6,955,515,700 | \$7,802,410,312 | 0.3 |
| | Resettlement | 24,510 | 7.8 | \$193,129,258,541 | \$232,657,917,257 | 8.6 |
| | Total Disaster response | 25,983 | 8.3 | \$200,703,677,841 | \$241,172,821,713 | 8.9 |
| Terrorist attacks | Terrorist attacks fund | 7,332 | 2.3 | \$63,176,395,904 | \$74,281,220,683 | 2.8 |
| Legalization | Enabling titles | 44,739 | 14.3 | \$7,486,230,637 | \$9,205,094,834 | 0.3 |
| Nonpreventive improvement | Health fund | 19,090 | 6.1 | \$70,032,229,925 | \$73,784,000,821 | 2.7 |
| Disaster prevention | Construction at own site | 13,280 | 4.3 | \$111,637,880,412 | \$134,623,766,213 | 5.0 |
| | Improvement | 5,026 | 1.6 | \$25,369,793,570 | \$28,590,266,708 | 1.1 |
| | Total Disaster prevention | 18,306 | 5.9 | \$137,007,673,981 | \$163,214,032,921 | 6.1 |
| New housing | Total New housing | 176,283 | 56.4 | \$1,748,469,560,287 | \$2,007,309,486,903 | 74.4 |
| TOTAL | | 312,386 | 100.0 | \$2,333,143,157,368 | \$2,696,583,147,965 | 100.0 |

Source: MVCT and Fonvivienda. 2011.

There is a consensus that livestock and agricultural insurance is not the only measure for reducing risk; therefore, some associations have implemented other preventive measures. Furthermore, the Ideam provides an early warning system that is being used by producers. Various sectors use forecast and weather information in making important decisions to reduce the risk of being affected by extreme weather events. Nevertheless, the MADR needs to design strategies and reduction measures that are much more comprehensive and consider rural land use planning, improvement of the production infrastructure, and strengthening of plant species.

Regarding the road sector, the main action for reducing vulnerability is maintenance; however, there is great limitation of resources for this area. Main roads that are operated under concession

are subject to maintenance programs by the operators. The Invias is responsible for maintenance of main roads not under concession and has technical manuals which include risk management. In the case of the secondary road network, for which departments are responsible, and the tertiary road network, for which municipalities are responsible, the situation is difficult because, with few exceptions, technical capabilities as well as resources are limited.

According to the Vice Ministry of Water and Sanitation, more than US\$110 million were invested from 2006 to 2011 in sectoral risk reduction projects. The central government, with funds from the National Royalties Fund, its own resources, public hearings, and cofinancing from the royalties of local entities and from the General Participation System, has enabled the execution of risk reduction projects such as

dredging clogged gutters and basins, infrastructure for capture and storage of raw water as a backup element, systems for improving drinking water, structural reinforcement, slope stabilization works, flash flood control works, and works to recover degraded protective zones in supply basins. These projects are evaluated and made viable in the Sole Window of the Vice Ministry of Water and Sanitation and the information is stored in the databases²³.

Public utility companies in urban areas of capital cities have made great progress in including risk management in their mission-related tasks. Aqueduct and sewer companies in Colombia have made important developments in risk knowledge and reduction by assigning professional personnel to specific duties, formulating and permanently updating their sectoral Emergency and Contingency Plan, and transferring risk through different kinds of insurance policies. Some noteworthy examples follow (i) The Aqueduct and Sewerage Company of Bogota is conducting a seismic risk reduction campaign, which includes the structural reinforcement of its facilities; (ii) the Public Service Company of Medellin articulated risk analysis and reduction as one of the main axes of its quality assurance system; (iii) Aguas de Manizales increased redundancy in its supply sources in order to mitigate the probability of damages to water collection due to flash floods; and (iv) Cucuta, which is the capital city with the highest risk of water supply shortages, is currently undertaking the replacement of its networks, which will reduce water losses. The city is also conducting campaigns for using water efficiently and is carrying out studies and seeking funds for finding an alternate source of water. However, the strategies must be continuous and integral in terms of vulnerability reduction and rapid response because any change or failure to react in a timely fashion may have significant consequences. An

example is the water shortage in the municipality of Manizales due to a lack of redundancy in the system, because a needed repair was not performed swiftly on the Niza Plant, which was inoperative since October 2010²⁴, and the subsequent collapse of the 28- and 30-inch water conduction pipeline and the distribution tank of the Luis Prieto Gomez Plant in October 2011. These events paralyzed the system completely and had multiple economic, social, and environmental effects on the 370,000 inhabitants who for more than 10 days had no water.

The Water for Prosperity Program may become the main instrument for reducing sectoral risk in Colombia. However, priority should be given to its support in the 550 municipalities that have less than 10,000 inhabitants, because that is where there are the most deficiencies. Once the transition from the PDA to the Water for Prosperity Program is complete, it is expected that most of the investment in this sector will originate in the Program, thus enabling the coordination of municipal, regional, and national resources. In other words, the funds provided by local entities will always receive significant matching contributions in return for adhering to the rules of the program. The program also includes strengthening domiciliary water and sanitation service providers in order to achieve greater efficiency, concerted planning and execution of sectoral investments, the expansion and replacement of all infrastructure, based

23 C3 Database of projects considered viable in Sole Window and C2 Database of projects considered viable. Every sector project is in these instruments (all projects of municipalities and departments that claim to receive national cofinancing from any source should be studied by the Single Window of the Vice Ministry of Water and Sanitation).

24 The Niza Plant is one of the two drinking water supply sources Manizales has. Its operation was shut down on October 28, 2010, due to landslides that occurred in the Cerro de Oro area of Manizales, whose slope was destabilized and affected 80 meters of raw water piping intake from the Olivares Ravine (General Comptroller of Manizales, 2011).

on technical criteria supported by detailed designs in compliance with the sectoral Technical Standard (RAS) and the Colombian Seismic Resistance Regulation. All of them are essential actions for sectoral risk reduction in the country.

Although the Vice Ministry of Water and Sanitation prepared a set of risk management methodology tools for municipalities and service providers and provided technical support for more than 350 local-level entities, progress is still limited. The guidelines that were prepared facilitate compliance with regulatory standards when formulating an Emergency and Contingency Plan and sectoral infrastructure vulnerability analysis²⁵. From 2006 to 2010, support in the form of workshops was given to municipalities and service providers, in coordination with the DGR, the Ideam, Ingeominas, and some CAR, for the formulation of action plans for water shortages and interruptions to sewer and garbage removal services. However, most of the plans have not been fully implemented, which may be due to institutional weakness, budget limitations of service providers, permanent changes to their staff, and what seems to be an opportunity to request resources from the central government when a national disaster is declared.

In order to contribute to reducing the vulnerability of hospital institutions across the country, the MSPS has a structural reinforcement program. In compliance with the provisions of the National Seismic Resistance Regulation and Law 715 of 2001, the MSPS implemented a nationwide technical assistance and cofinancing strategy for evaluating the seismic vulnerability of the health service infrastructure. As a result, after performing 161 studies, investments amounting to Col\$3.986 billion (in 2010 Colombian pesos) were made from 2003 to 2005 for structural reinforcement of Level 1, Level 2, and Level 3 hospitals. From 2006 to 2009, structural reinforcement works amount-

ing to Col\$44.114 billion were cofinanced for 14 Level 2 and Level 3 hospitals (MSPS, 2011). Subsequently, the government of Colombia has been monitoring the resources amounting to Col\$24.6 billion that were assigned in 2008 and 2009 to structural reinforcement works in hospitals (MSPS, 2011). Furthermore, the MSPS issued Resolution 976 of 2009 in order to respond to the “Disaster-Safe Hospital” global initiative, a nationwide program for risk reduction in the health sector. However, there has been limited progress due to existing budgetary constraints.

Ecopetrol is another entity that stands out for reducing seismic risk to its infrastructure. Just like the MSPS, it has conducted vulnerability studies of its vital and community service buildings since 2009. The blueprints of 94% of its facilities, or 251 buildings, were reviewed. Ecopetrol executed reinforcement works on 55.8% of them because, according to the results of the studies, 66 buildings did not require any kind of intervention.

4.2.6. The role of sectors in creating a culture of responsibility in facing risk

Although the strategy of building a culture of responsibility in the face of risk is limited, it has been relatively successful in some sectors. Risk management has been included as an essential component of the Environmental Education Policy (2002), which has the joint participation of the Education and Environmental Ministries, even though the policy focuses mainly on formal

25 Guide to Emergency and Contingency Plans for companies (Law 142 of 1994 and Resolution 1096 of 2000), Guide for risks associated with flooding phenomena, Guide for landslide phenomena, Guide for drought, Guide for water quality risks (for companies, health, and environmental authorities, Decree 1575 of 2007), and Guide for risks associated with human activity.

school education and not on private sector actors. Administrations in main cities have conducted mass campaigns to promote awareness about the hazards they are exposed to. According to a survey by the World Bank for this report (2011a), 46% of the population in large cities is familiar with this type of campaigns and 34% indicated that they have taken measures to reduce risk in their homes. On the other hand, during the El Niño 2009-2010 episode, the drinking water and energy sectors conducted saving exercises and the former MAVDT declared it had achieved a 13% reduction in water consumption. Finally, in response to El Niño 1997-1998, booklets were produced and distributed in the livestock sector. However, the various efforts to generate awareness have not been part of integral and continuous communication strategy and there are very few evaluations of their effectiveness.

4.2.7. Sectoral administration in disaster response

Sectoral emergency response and management in terms of programs and resources vary according to disaster type and usually lack planning. As discussed in Chapter 1, diverse and dangerous natural events can occur in Colombia and can trigger disasters. According to the type and severity of phenomena, the magnitude of damages also varies depending on the physical, social, economic, and cultural vulnerability of the affected actors and regions. Furthermore, government response is subject to the fiscal context that exists when the events occur. This conditions the response to different types of events, which depends on the phenomenon that triggers the events and the severity of the phenomenon, as well as the unique and specific characteristics of the events. This leads to a requirement for management and reconstruction strategies that include specific programs and

resources. However, a lack of clear policies regarding the responsibility of the government and each agent, a lack of progress in identifying possible loss scenarios, establishing tasks to undertake when managing emergencies and/or disasters, and coordination mechanisms and resources of a National Emergency Plan lead to the adoption of different actions for each event, ignoring lessons learned and successful experiences, and even generating delays in identifying, designing, and implementing recovery tasks.

In the livestock and agriculture sector, the response to major events has usually been focused on implementing financial relief programs. This includes debt write-offs for small producers, refinancing and amnesty on interest for medium and large producers, and soft credits and guarantees for restoring production capacities. In most cases, the programs and their funding are established by Conpes Documents, but there are also measures like the Livestock and Agricultural Solidarity Fund (1996) for purchasing debt portfolios in disaster situations. Although the instruments are similar, the magnitude of the benefits and the procedures for accessing them vary by event according to the availability of funds and the type of damages. Although these measures provide relief to the victims, in general they do not have an effect on reducing sectoral vulnerability; on the contrary, they generate increasing financial pressure.

The transport sector has different entities responsible for disaster management according to the category and level of the road network that is affected. For roads that are operated under concession, the responsibility for emergency management falls on the operator, in accordance with the Road Operating Manual²⁶. The operator must also submit a report to

26 This manual is a document annexed to the State Concession.

Invias on the emergencies that occur, in order for Invias to record the events and the care that was provided. Regarding infrastructure not under concession, the functions of Invias include designing, updating, and executing preventive and corrective Contingency Plans. Invias has 26 territorial branch offices that report damages to the central office after an adverse event occurs, so that the central office may authorize intervening and clearing the road as soon as possible. These interventions are financed by an exhaustible amount of resources allocated to each territorial branch office. If dealing with a large-scale emergency, an interdisciplinary group travels to the affected area and establishes a procedure for handling the event under a declaration of Manifest Urgency, in compliance with the provisions of Law 80 of 1993. Departments and municipalities are responsible for secondary and tertiary road networks, respectively, and are expected to respond with preventive, corrective, and recovery actions for the infrastructure.

The education sector has preestablished procedures for accessing resources, which increase their effectiveness regardless of the amount available and its sources. Education Secretariats, on behalf of territorial entities, participate in the identification of damages to education facilities. The information that is collected is included in the census of damages that the municipality submits to the department and the UNGRD (formerly, the DGR), when requesting a declaration of emergency or public calamity. Recovery and rehabilitation projects should be appraised, formulated, and submitted by the Secretariats to the Vice Ministry of Education in order to ensure their feasibility and have access to the support resources that are available from the central government²⁷. The Ministry supports the recovery and post-disaster reconstruction of affected municipal and/or departmental facilities²⁸. To that end, it has funds available in its budget. Accord-

ing to MEN Directive No. 12 of 2009, the funds for rehabilitation and reconstruction of buildings in the sector must be requested exclusively by Education Secretariats in certified territorial entities. There are preestablished procedures for accessing these funds, which are handled by the Ministry regardless of their source budget (Ministry, Royalties Fund, or Calamity Fund). The MEN verifies the requests and streamlines the identification of needs with the support of the National Education Infrastructure Inventory of the SICIED Program. During La Niña 2010-2011, this allowed an efficient response in terms of a well-organized recovery, with minimal interruption to education services, as well as a quantification of priorities and the management of resources.

In the housing sector, preestablished procedures are available, which make resource allocation transparent. As a result, reconstruction problems are usually of a budgetary or technical nature. Resources for resettlement, repair, or reconstruction of housing are requested from the subsidy pools of the Ministry of Housing. This is done exclusively by municipal administrations that are required to submit structured projects, which are evaluated with standard procedures. The departmental governments and the CAR contribute by formulating projects and providing vital matching resources, in accordance with the regulations for granting subsidies. The biggest problems during reconstruction are the identification of affected buildings and assessing damages, availability of lots with public utilities, and areas of mitigable risk for resettling the victims. In cases of large-scale events, such as the Coffee Growing region earthquake, special institutional arrangements have been made in

27 Investment projects with resources of MEN or others such as DGR, for disaster prevention and response (FNC or FNR).

the form of specific policies and intervention mechanisms. In the case of the Coffee Growing region, the FOREC was directly responsible for housing projects. In general, the subsidy amount and the type of support provided by the government, as well as the beneficiaries, the methodology for assessing damages, the parties responsible, and the control and monitoring mechanisms, are not clearly established. Proof is offered by the fact that, six months after the end of La Niña 2010-2011, there was still no estimate of the damages to homes, the funds allocated by the government, and the mechanisms to be used (see *Table 2.5 of Chapter 2*).

Regarding the drinking water and sanitation sector, service providers do not participate in the CLOPAD, with the exception of those who work in capital cities. This complicates the actions of operational entities in cases of emergency, not only in terms of water and sanitation needs of the affected communities, but also in terms of identifying the distribution of damages, estimating the impact on drinking water, sewer, and garbage removal infrastructure, and establishing the measures authorities need to take in order to reestablish services. Humanitarian aid and immediate care include temporary solutions for resource distribution, which may be taken on by the entities in charge of aqueduct and sewer networks or by humanitarian assistance organizations, according to what is decided, because currently there is no National Emergency Plan with established protocols and roles. For example, during La Niña 2010-2011, the Ministry of the Interior and Justice coordinated the temporary provision of drinking water with the respective CREPAD and CLOPAD, using resources from the National Calamity Fund.

More than Col\$61 billion were assigned by the PDA for the rehabilitation of aqueduct and sewer infrastructure. Rehabilitation seeks

to activate the rendering of services and reestablish the operation of networks by means of repairs, quick works, and tasks such as cleaning pipelines. For the 2010-2011 rainy season, most PDA allocated resources for more than Col\$61 billion to deal with the emergency, which were provided both by the PDA and the Humanitarian Colombia Calamity Fund. The PDA were in charge of screening the requests from municipalities, determining their relevance, and distributing available funds. Furthermore, the Vice Ministry of Water and Sanitation built a consolidated database of reconstruction needs based on periodic reports submitted by PDA administrators in order to design a plan for full reconstruction.

When an emergency arises in the health sector, local entities are responsible for caring for the affected population because the system is decentralized. The actions of the MPS are intended to strengthen territorial networks that provide services, by cofinancing the purchase of communications equipment²⁹, improving the national reserve center³⁰ and evacuating in case of emergency³¹. The MPS also supports health development programs for persons in high-risk zones who live in cities with a population of more than 50,000, and vulnerable persons in towns with a population of less than 50,000. The MPS has a National Rural Health Plan and also contributes to the operation of the hospital network, the update and implementation of Hospital Disaster Plans, and the review and adjustments to the Emergency Medical Care Guides.

28 For this within the MEN, there is the Coverage and Decentralization area attached to the Vice Ministry of Education.

29 Crisis response room and emergency plan of the MPS.

30 Supply of medications, medical-surgery supplies, antidotes, basic sanitation items, etc.

31 Mobilization of personnel, elements, emergency medicines and supplies, among others.

The National Contingency Plan for Hydrocarbon Spills is a successful case of organizing for emergency situations. Although it was established by decree, it could be duplicated voluntarily by other sectors. The “National contingency plan for spills of hydrocarbons, byproducts, and harmful substances in marine, fluvial, and lacustrine waters” was established by Decree 321 of 1995 as a instrument for cross-institutional coordination between the disaster management and prevention entities of the Colombian government and environmental and industrial sector authorities, with the purpose of managing this kind of emergencies under common criteria. The goal is to combine government and private efforts for having equipment, knowledge, and expertise available to face emergencies across the country, rather than having each company facing the situation separately, even though the responsibility for coordinating the control of the spill and its consequences is still in the hands of the facility, operation, or owner of the substance

or activity that caused it. Although the Plan was structured to deal with the risk of operating accidents or terrorism, it can be very useful in cases of disasters associated with natural phenomena and it should be adopted either voluntarily or mandatorily by other sectors, such as in mining and hazardous materials industries.

In general, financing sources for emergency response operate on demand. They do not have standard procedures for evaluating damages and they are not articulated. In consequence, there are resource allocation imbalances due to the administrative deficiencies of the territorial entities. The diverse institutional capacities of the municipalities lead to variations in the quality and timeliness of resource requests for response and reconstruction after a catastrophic event, and they often do not coincide with the real damages observed in the field. As a result, local entities with less capacity tend to receive fewer funds due to their administrative deficiencies.

4.3. FINANCIAL PROTECTION: THE RESPONSIBILITY OF THE GOVERNMENT FINANCE SECTOR

There is a high probability that Colombia may face a major disaster, which would place government finance in jeopardy. In spite of having suffered significant disasters such as the Coffee Growing region earthquake and the La Niña 2010-2011 phenomenon, there is a high probability that Colombia may face a major event for which it needs to be prepared (see *Chapter 1*). Financing the reconstruction of the Coffee Growing region required significant borrowing by the government and measures such as the financial transaction tax, which started at 0.2% (“2 per thousand”), was later increased to 0.4% (“4 per thousand”), and is still in force. In order to respond to the 2010-2011 rainy season, the government has resorted to various measures such as selling some of the nation’s assets. The occurrence of a major disaster could cause serious problems for the country, especially if the nation’s economic situation is critical, as was the case in 1999 when the Coffee Growing region earthquake struck.

Even though it is certain that disasters that impact the local economy, the population, and the government occur every year, government provisions for financing the response have always been insufficient. There is no question that the government needs to have a financial protection strategy that will allow it to pay for losses effectively. As will be explained later, the budget that is assigned to the FNC at the start of every year needs to be increased as the year progresses. This situation is clearly observed in the housing, livestock, and agriculture sectors, which must periodically seek resources for relocating settlements or compensating farmers who have been affected. A protection strategy should ensure the

capability of the government to respond to recurring disasters and important events because both types of occurrences imply structural response measures.

The responsibility for disaster response is shared between the central government and the territorial entities. However, the rules for co-responsibility are not clearly established, which leads the central government to assume most of the fiscal burden. Only some large capitals have risk management funds for financial response to disasters. Since a significant number of the municipalities in the country are category 5 or category 6 and do not have flexible budgets, the central government has had to assume most of the public burden of disasters.

A financial protection strategy implies adopting an optimal combination of instruments for retaining and transferring risk, which ensures the lowest opportunity cost and allows a comprehensive reply in terms of emergency response, rehabilitation, and post-disaster reconstruction. The Colombian government currently sustains virtually all the risk because, when a disaster occurs, it has to respond with its own resources, even for repairing buildings and public infrastructure, that have insurance, as required by law, but lack adequate coverage. If there was a will to increase the transfer of risk, the coverage and quality of infrastructure insurance could be increased, ensuring that it is equivalent to the replacement value of the infrastructure, and generating coverage, that would give the central government access to funds for protecting the private assets of the strata 1 and 2 (for which the government is sometimes responsible) and

have reinsurance, catastrophe bonds, and other measures. The FNC is the instrument par excellence, which should be activated for handling retained risk, especially in the face of the most recurrent events. When its capacity is exceeded, due to damages caused by major phenomena, it may resort to budget reallocations, loans, and other fiscal sources such as taxes or the sale of assets. In essence, the purpose of a financial protection strategy is to combine various existing instruments and mechanisms in order to ensure that resources are available so that the government can respond adequately by adopting a balanced portfolio of measures for retaining and transferring risk, which also ensures its macroeconomic stability.

The aforementioned strategy may include mandatory or voluntary instruments so that private actors can transfer their risk and the government does not have to support them in case of a disaster. Although there are no clear regulations or policies in this regard, the government is required to respond for part of the damages caused by a disaster event to private assets, especially those of the poorest population groups, for humanitarian reasons (see *Chapter 5*). On several occasions, the government has also supported the productive sector in order to reactivate the economy. Thus, in case of a disaster, the fiscal responsibility is not limited to public infrastructure, and mandatory measures or instruments for promoting insurance among private actors would effectively reduce the fiscal risk to the country.

The financial protection strategy must be designed as a complementarity element, not an alternative to the reduction of physical risk. The ultimate goal of risk management by the government is to reduce the probability of loss of lives and property, both public and private, to acceptable levels. Therefore, it is essential to reduce existing risk and control the creation of

new risk scenarios. However, considering that it is impossible to eliminate risk entirely and that it takes time to reduce risk to an acceptable level, it is critical to be prepared to face a disaster. To that end, there is a requirement for a strategy to reduce the loss of lives in parallel with a financial protection strategy, because if actions for reducing physical risk are not implemented appropriately, the design and application of financial instruments available on the market could be unsustainable. A clear example of how financial protection cannot be independent of other risk reduction instruments is the case of hospitals, because it would be useless to ensure the availability of resources to replace a hospital after an earthquake if the hospital is not providing services when they are most needed.

4.3.1. Advances and limitations in financial protection in Colombia

Depending on the magnitude and the type of disaster, the Colombian government has different instruments and sources for financing its response

- Insuring government property, which has been mandatory since 1993, allows part of the risk to be transferred to insurance companies which, in case of a disaster, will provide the government with the resources for paying for repair and reconstruction costs.
- Budgetary reallocations.
- The FNC is the main source of funds for responding to the multiple low-intensity disasters that occur every year.
- The FNR has been used since 2007 to provide additional resources for disaster response and reconstruction in regions and municipalities, where it is permitted by the law.

- Some ministries have subsidy accounts or pools, which may be employed as additional sources of funds in case of a disaster although, as discussed previously, their financing is scarce.
- Contingent loans (such as the Development Policy Loan with a Catastrophe Deferred Drawdown Option, CAT DDO, from the World Bank), give the government immediate and timely access to liquidity in case of a national disaster.
- Some big cities have their own disaster prevention and management funds.
- Fiscal sources such as international loans, creation of new taxes, and sale of government assets, are to be used in case of extreme events.

Insurance, a tool par excellence for transferring disaster risk

If all properties, both public and private, that are exposed to the occurrence of disasters were insured, the fiscal vulnerability of the government would be minimal. However, in Colombia, insured losses have never exceeded 10% of the damages. According to Fasecolda (2011), 10% of the direct losses caused by the Coffee Growing region earthquake had some type of insurance, and only 4.5% of the total losses caused by the 2010-2011 La Niña phenomenon were insured. Insuring public and private assets reduces the government's fiscal risk by reducing the losses to its own equity and minimizing the impact on the private sector, considering that when the private sector suffers serious damages, the government is also responsible for it. This chapter describes the advances in insuring government assets and Chapter 5 discusses the same topic for private assets.

By law, all government assets should have financial protection, even though their quality and characteristics are unknown. Likewise, individually insuring properties does not allow taking advan-

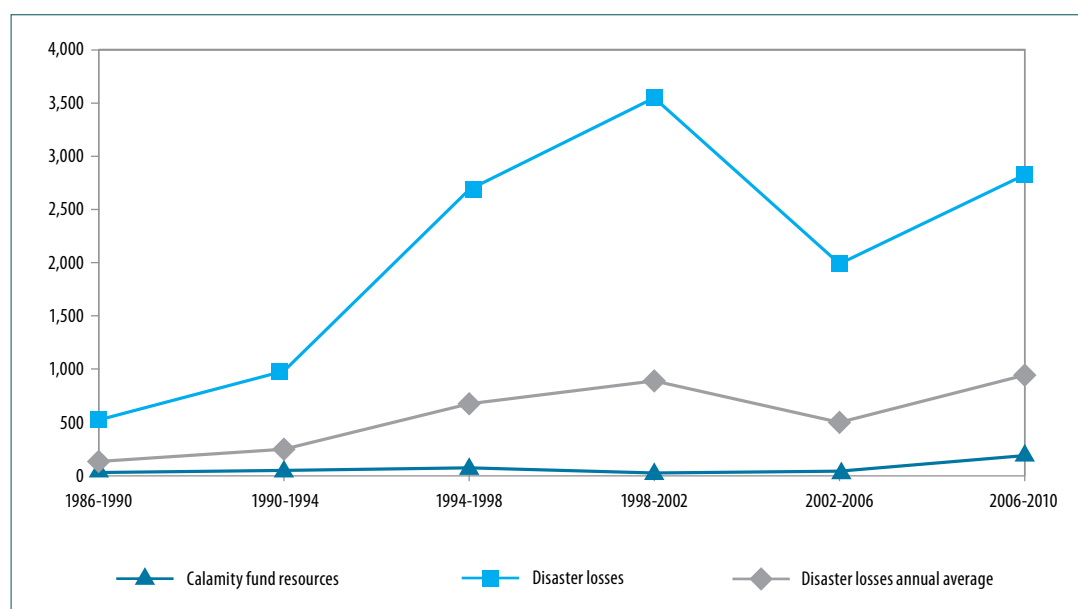
tage of risk diversification and economies of scale associated with the number of government assets.

Law 42 of 1993 stipulates that financial protection of government assets is mandatory. However, only recently have studies been made to determine compliance with this law and whether the insured amount corresponds to the book, assessed, or commercial value. It is highly probable that in all cases, the insured value is not equivalent to the replacement value, which is usually higher than the commercial value, due to demolition costs, new construction regulations, and the standards of services provided by the building that will be rebuilt. Furthermore, each infrastructure element has individual insurance, which is inefficient because it does not allow the government to take advantage of the benefits of diversification related to grouping the risks of all buildings in a single portfolio, thus reducing the cost of coverage.

The FNC, which is the financial instrument for recurring disasters, has major resource limitations and requires matching contributions from territorial entities

The FNC, which was created in 1984, is the instrument with the longest tradition of providing government response to disasters. It is in charge of responding to highly recurrent small-scale events in the country, but it lacks sufficient resources. The Fund was created by Decree 1547 of 1984 and modified by Law Decree 919 of 1989. Initially, it had its own equity, administration, and accounting, but it later became an account attached to the Ministry of the Interior and Justice. For this reason its budget is assigned annually and cannot be accumulated for use in years of hardship, as initially planned. The FNC is administered by the Fiduciaria La Previsora, controlled by the Consulting Board (Law Decree 919 of 1989), and financed with annual allocations from the PGN, which are usually augmented during the

GRAPH 4.11. Cumulative losses, natural disaster annual average, and FNC resources (US\$ million)³²



Source: Ingeniar Ltd., 2011.

year as resource requirements exceed the initial allocation. Graph 4.11 shows how the allocation of resources to the FNC has always been significantly less than the losses caused by disasters. Thus, the FNC is only able to provide a limited initial response to an emergency and it does have enough funds to support public and private recovery and reconstruction processes. Furthermore, it makes practically no investment in risk reduction measures. Although the gross contribution of the nation to the FNC has an upward trend, the amounts as a percentage of government revenue are decreasing. According to the IDB and ECLAC (2005), the highest participation was in 1995, when the nation contributed 0.11% of its revenue; during the period 2000-2009, participation never exceeded 0.5%, according to a report by Ingeniar Ltda. (2011).

In contrast to similar funds in other countries, the FNC contributes all the funding for its investments without requesting matching funds from territorial entities. As will be discussed below, only large capital cities in the country

have a fund equivalent to the FNC. On the other hand, in Mexico, for example, the *Fonden* (Natural Disaster Fund) requires matching funds from territorial entities to support investments in disaster response and prevention. Local and regional administrations in Colombia currently have no incentives to assign internal resources for emergency situations and, since they are not required to match funds to the FNC, there is a perception that the central government is fully responsible for response and reconstruction. Therefore, it is practically impossible for category 5 and category 6 municipalities which have strong budget limitations, to invest in risk management. However, municipalities with high per capita income can partially assume their obligations. A differential cofinancing strategy, in accordance

³² This Graph shows the impact of damage caused by the earthquake in the Coffee Growing region, but fails to register the impact of La Niña 2010-2011 which will make greater the difference between damages and resources assigned to the FNC.

with territorial capabilities, would increase investments in risk management in general and disaster response in particular. On the other hand, incentives for strengthening capacities, central government financing for risk reduction actions, and access to low-interest loans, would promote more responsibility for the aforementioned processes at the local level.

Budget reallocations and the FNR are the resources that are available, but limited, for rehabilitation and reconstruction

Budget reallocations, which were initially conceived for financing government investment programs, are one of the sources of immediate liquidity that allow the government to respond to disasters. The availability of resources for emergency response depends on the performance of entities and is usually not very flexible due to constitutional and legal regulations, which allocate expenses beforehand and establish specific destinations for funds. According to the Technical Interinstitutional Committee (Banco de la República, MHCP, and DNP, 2010), 86% of the items in the 2010 PGN could not be reallocated when facing the impact of La Niña 2010-2011. The items with the highest inflexibility in the national budget that year were servicing the debt (27%), transfers to territories through the SGP (16%), and pension payments (15%).

The FNR (National Royalties Fund), which is currently the National Compensation Fund, has gradually increased its contributions for prevention and reconstruction, but it is incapable of making equitable contributions due to the restrictions on the destination of its resources. Graphs A.5 and A.6 (in the appendixes) show how the participation of the FNR in risk management increased significantly during 2009 and 2010, even in terms of resources for recon-

struction. However, this source of financing is unreliable because allocations depend on the type of projects submitted by the territorial entities who will be the beneficiaries. The growth over those two years was a result of a political decision by the central government. Nevertheless, since the regulations for the new National Compensation Fund are currently being established, risk management priorities may change. Furthermore, this source of financing cannot handle all the requirements of the country because it has thematic and geographical restrictions for the destination of resources, which depend on their origin.

Sectors also have some mechanisms for supporting rehabilitation and reconstruction, but they usually need to be refinanced by the central government when a disaster occurs. Instruments such as the housing subsidy window for disasters, the Invias emergency account, and other sources mentioned in Section 4.2.3 are available for financing rehabilitation and reconstruction, but resources are limited and every year they are subject to budget increases provided by the FNC or the PGN.

Contingent credit is an instrument for timely injection of liquidity when responding to major national disasters

The use of the CAT DDO³³ from the World Bank during the 2010-2011 La Niña phenomenon showed the advantages of contingent credits as sources of immediate liquidity when other sources were restricted. In anticipation of the need to have access to immediate liquidity, the government of Colombia in 2008 subscribed to a DPL with a CAT DDO with the World Bank,

33 Development Policy Loan with a Catastrophe Deferred Drawdown Option (DPL with a CAT DDO).

TABLE 4.10. Coffee Growing region's reconstruction financing, by source (Col\$ million)

| Source | 1999 | 2000 | 2001 | Total | Part. % |
|----------------------------------|----------------|----------------|----------------|------------------|---------------|
| National Budget | 199,997 | 619,583 | 150,497 | 970,076 | 60.71 |
| Functioning | 997 | 1,117 | 977 | 3,091 | 0.19 |
| Investment | 199,000 | 616,690 | 128,269 | 943,959 | 59.08 |
| Audit fee | | 1,775 | 1,251 | 3,026 | 0.19 |
| Debt ⁽¹⁾ | | | 20,000 | 20,000 | 1.25 |
| External Loans | 596,966 | | 14,431 | 611,397 | 38.27 |
| IDB | 155,268 | | 13,300 | 168,568 | 10.55 |
| IBRD | 441,698 | | | 441,698 | 27.64 |
| KFW | | | 1,131 | 1,131 | 0.07 |
| International Cooperation | 16,318 | | | 16,318 | 1.02 |
| Donations | 15,184 | | | 15,184 | 0.95 |
| Donation interests | 1,134 | | | 1,134 | 0.07 |
| Total per year* | 813,280 | 619,538 | 164,928 | 1,597,791 | 100.00 |

(1) Ministry of Finance and Public Credit.

* In constant currency of 2001, the budget is Col\$1.7 trillion.

Source: Cardona, et. al., 2004a.

in the amount of US\$150 million³⁴. This instrument is a prenegotiated credit line, which may be activated immediately in case a national disaster occurs, and at the exact moment that the President declares a National Disaster. The Government used this instrument and requested its full disbursement by the Bank in December 2010 due to the effects of the La Niña 2010-2011 phenomenon³⁵.

Extraordinary fiscal sources used in case of large-scale disasters

The FOREC, which was created for rehabilitation and reconstruction purposes after the Coffee Growing region earthquake, executed from 1999 to 2001 more than Col\$1.7 trillion, which originated mainly from budget reallocations, international loans, and a new tax (Table 4.10). The impact of the Coffee Growing region earthquake rapidly exceeded the resources of the government at a

time when the country was in recession. Therefore, the central government resorted to securing international loans and creating the financial transaction tax of 0.2% ("2 per thousand"), which was maintained and later increased to 0.4% ("4 per thousand").

In the case of La Niña 2010-2011, the DNP estimated that the total cost of response, rehabilitation, and reconstruction was nearly Col\$30 billion, and to finance this amount the national government is resorting to budget reallocations, new taxes, the sale of the State's assets. By June 2011, the Government had allocated Col\$6.87 billion to address the emergency response and rehabilitation, Col\$4.75 billion executed through FNC, mainly from the Humanitarian Colombia subaccount, and another Col\$2.12 billion from

34 CAT DDO has a maximum limit per country of 0.25% of GDP or the equivalent of US\$500 million, whichever is lower.

35 DPLs with a CAT DDO are assigned by the MHCP; they should not necessarily be granted to the FNC.

TABLE 4.11. Financing sources facing the 2010–2014 La Niña phenomenon

| Winter emergency 2010–2014 | | | |
|--|-------------------------------------|---|---|
| Calamity Fund (Col\$6.3 billion) | | | Adaptation Fund (Col\$10 billion–Col\$16 billion) |
| National Budget 2010 (Col\$1 billion) | Patrimony tax (Col\$3.3 billion) | Financial Transaction Tax (GMF) (Col\$2 billion) | Sales of Ecopetrol assets (Col\$10 billion–Col\$16 billion) |

Source: Confis, 2011a.

different national entities³⁶. Recovery, construction, and reconstruction activities were estimated by the DNP at Col\$22 billion, an amount that exceeds the cost of damages (Col\$8.6 billion), since in most cases infrastructure replacement should have higher standards than those previously existing (such as water and sewage systems, schools, and health posts). It is also common that after a disaster the investment in preexisting public facilities becomes more necessary and evident, so that reconstruction necessarily will exceed the simple replacement of the budget incurred in the damages budget. However, considering that FOREC took three years to spend Col\$1.7 billion in 2001, the country will require a long period to run the currently available budget, if it is fully executed. This will be conducted by the Adaptation Fund (created by Decree 5819 of 2010), whose funding sources are described in Table 4.11. The first Col\$5.7 billion for reconstruction have already been allocated through an addendum to the 2011 budget, approved by Congress (*Table 4.12*).

In the future, the Government may use resources from the Stabilization Fund, created in 2011, for disasters. This Fund aims in the long term to generate savings in PGN to be used in case of a deficit that exceeds the provisions of the Fiscal Rule. However, in a disaster or economic crisis, the government may temporarily divert Fiscal Rule limit and use the Stabilization Fund or borrowed resources to finance a higher deficit.

TABLE 4.12. Additional sources and uses of the 2011 budget (Col\$ billion)

| Sources | | Uses | |
|------------------------------|-------|---|-------------|
| Patrimony tax | 830 | National Calamity Fund | 3,500 |
| FOREC | 944 | | |
| Credit operations | 1,726 | | |
| Sale of assets | 1,500 | Adaptation Fund | 1,500 |
| National Royalties Fund- FNR | 434 | Regions - FNR | 434 |
| Others | 260 | Ministry of National Education – Law 20 | 88 |
| | | Subsidies for housing and others | 152 and 108 |

Source: MHCP, 2011a; Confis, 2011a.

In absence of a funding strategy, fiscal sources have faced recent major disasters. However, fiscal demands grow exponentially, hence it is more convenient to have a predefined financial strategy. According to the Superior Council for Fiscal Policy (Confis) (2011b, 2010), the country's economic situation insecurely faced the La Niña 2010–2011 phenomenon, without evidencing any important³⁷ fiscal deterioration.

36 Figures taken from the daily report of June 29, 2010, from the La Niña Phenomenon, www.dgr.com.

37 The total projected effect on the winter emergency in 2011 is an additional deficit that corresponds to 0.4% of GDP over 2009, although it should be noted that in estimating this figure, the surcharge of the patrimony tax was included reducing the overall effect.

Nevertheless, it is important to highlight that in the last decade there have occurred two major national disasters: the Coffee Growing region's earthquake and the La Niña 2010-2011 phenomenon, where losses of the latter were three times higher and the reconstruction costs were ten times higher than in the 1999 earthquake. This is an example of the multiplicity of phenomena and the possible impacts to which Colombia is exposed, and confirms the need for policies to reduce fiscal vulnerability in facing events of great magnitude.

Municipal funds for disaster prevention and response

Bogota and Medellin have risk management funds, but departments and most municipalities, despite law requirements, have very limited resources to address the problem. Chapter 3 shows the differences in municipal risk management investment in the cities analyzed as case studies for this publication. Only a few of them invested significant resources in risk reduction and have financial provisions to deal with disasters, even though municipalities are primarily responsible and are required by Decree 919 of 1989 to establish risk management funds.

4.3.2. Examples of instruments used by the Colombian government to increase risk transfer to private sector

To the extent that private property has been insured, there is a decrease in the State's fiscal risk. Promoting or making compulsory that private property be insured reduces the likelihood that the State has to act as a guarantor of last resource, that is, to respond partially or fully to losses of private actors, either because they are in "evident vulnerability" after a disaster, or because they are

considered essential for economic recovery. The Colombian government has taken some steps in this regard, both at a national level, making insurance mandatory for some private property, and at municipal level, adopting schemes to insure lower strata housing and promote other financial strategies in general.

To protect savers, Colombian law requires financial institutions to insure their own property against fire and earthquake, and it requires mortgaged real state property that guarantees the current or future credits (Organic Statute of the Financial System Decree Law 663 of 1993), which reduces the State's fiscal risk. To protect citizens in case of disaster damages caused to the financial institutions' property or mortgaged property as collateral of loans, the State intends for the savers' patrimony not to be affected. This measure will reduce the State's fiscal risk, since financial institutions are protected against disaster damages. The regulation states that the real estate property must be insured "at its destructible part" and for "its market value". Unfortunately, today there is not yet a definition of the "destructible part" concept, and there is no unified procedure on how to update property market value when it comes to renewing insurance policies.

Under the Horizontal Real Estate Property Regime in Colombia, it is compulsory to insure private property that also covers the common areas of buildings, condominiums, residential, and other forms of horizontal property³⁸. In theory, this regulation protects against fire and earthquake Colombians who own property in joint ownership; however, according to Fasecolda, the level of this insurance coverage is very low, and it is necessary to improve awareness and verification strategies to compel compliance with the law as well as extending insurance to other risk coverage.

38 Article 15 of Law 675 of 2001, by means of which the Horizontal Property Regime was issued.

Currently in Colombia, the insurance market penetration is very low and it is relatively limited to the mandatory insurance of property, as in the case of dwellings, so it is necessary to generate awareness among the population to voluntarily increase insurance, and thus reduce the State's fiscal risk. According to Fasecolda (*see Chapter 5*), in Colombia, only 13% of houses are insured, of which 8% correspond to mandatory insurance for mortgaged property and only 5% of the total correspond to voluntary insurance. In addition, many of them are insured for less than the market value, since not all financial institutions update the price of the property, preserving the original value when establishing the mortgage. The high vulnerability of the buildings has caused the State, after disasters like the Coffee Growing region earthquake, to assume responsibility for granting subsidies to repair and replace all affected units, resulting in greater fiscal spending. The government needs to create, in collaboration with the insurance sector expertise, an innovative strategy for financial protection that encourages participation of local entities and promotes an insurance culture, so that it not only covers losses that arise, but also stimulates citizens' responsibility.

As a strategy to reduce the State risk, the insurance models adopted by Manizales (Caldas) and Sabaneta (Antioquia) include collective housing insurance to enhance the private protection and in some cases to provide a cross-subsidy that covers the lower strata population. Manizales has a voluntary housing insurance scheme against earthquakes that was implemented through a collective policy which automatically and additionally protects strata 1 and 2. The higher strata have the option of voluntarily joining the collective policy by paying the insurance premium through the property tax bill payment. The degree of protection for strata 1 and 2 depends on the level of voluntary insurance adopted by the

other strata. The investment of the municipality is purely administrative, since the policies are paid entirely by the middle- and upper-class homeowners, thereby reducing the State's risk to a minimal investment, as the policy functions as a cross-subsidy. In the case of Sabaneta, the collective housing insurance program emerged as a tax incentive to encourage payment of property tax as well as updating the assessed valuation of each property. Since 1999, the municipal administration of Sabaneta contracted insurance on the assessed appraisal of residential properties, which covers all real estate in good standing for this property tax.

4.3.3. Funding needs for the State's response to disasters

Estimation of the State's funding needs for future disaster responses is complex due to lack of appropriate information and clarity about what is its true responsibility. The three phases of the State's response to disaster (response, rehabilitation, and reconstruction) have different costs per hectare, per person, or per square meter, depending on the type of disaster. The flood unitary value in a rural area is very different from an earthquake unitary value in an urban area, and there is no systematic and reliable historical information on these amounts, among other things, because the State's response is not always the same and it varies according to availability of resources. The State's response facing small events, for example, has been very different from facing national disasters, like the Coffee Growing region earthquake in 1999. At that time, the FOREC granted housing subsidies to all affected families from strata 1 to 6, including those that were renting, while there is no record of how many units impacted by minor events have been repaid. There is no regulation or policy that clearly defines

the State's responsibility with respect to the victims. Response should be given immediately to all people affected, without distinction, and priority should be given to restore public utilities service and all damaged public infrastructure as soon as possible. Regarding the affected population, there is a perception that the State should be responsible for the most vulnerable parts of the population, such as strata 1 and 2, but that level of responsibility is not yet defined. To the extent the Government's commitment is stated, the estimation of its disaster contingent liability can be accurately established (*see Chapter 5*).

For purposes of financial strategy design, it is necessary to differentiate the resources needed to address high-frequency/low-cost and low-frequency/high-cost events (World Bank 2008). In the case of disasters of high-frequency/low-cost, e.g., small disasters that occur every year, it makes sense to have an immediate liquidity strategy, such as the FNC, to timely respond to events that are likely to take place. For a low-frequency/high-cost disaster, it is not convenient to have a permanent liquidity strategy, but reliable funding sources coming from an optimal instrument combination for risk retention and transfer would prove very useful, especially those that provide equanimity that the event will be handled properly without impacting the fiscal stability of the nation.

Average losses caused by events of high frequency/low cost in Colombia are about US\$450 million annually and show a significant increasing trend. Only the average annual losses in the housing sector for small and intermediate disasters for the period 2000-2009 amounted to US\$350 million. Meanwhile, Invias investment, during the period 1999-2008, in which there were no major disasters affecting the transportation sector³⁹, was about an annual average of US\$30 million, while damage in the agricultural field for minor events during the period 1991-2000 (the most recently published information available) was about US\$58

million annually. Although they are not exactly the same indicator, the sum of these three values is a good estimation of average annual losses in the sectors, US\$438 million, a figure that also has been significantly increasing (*see Chapter 1*).

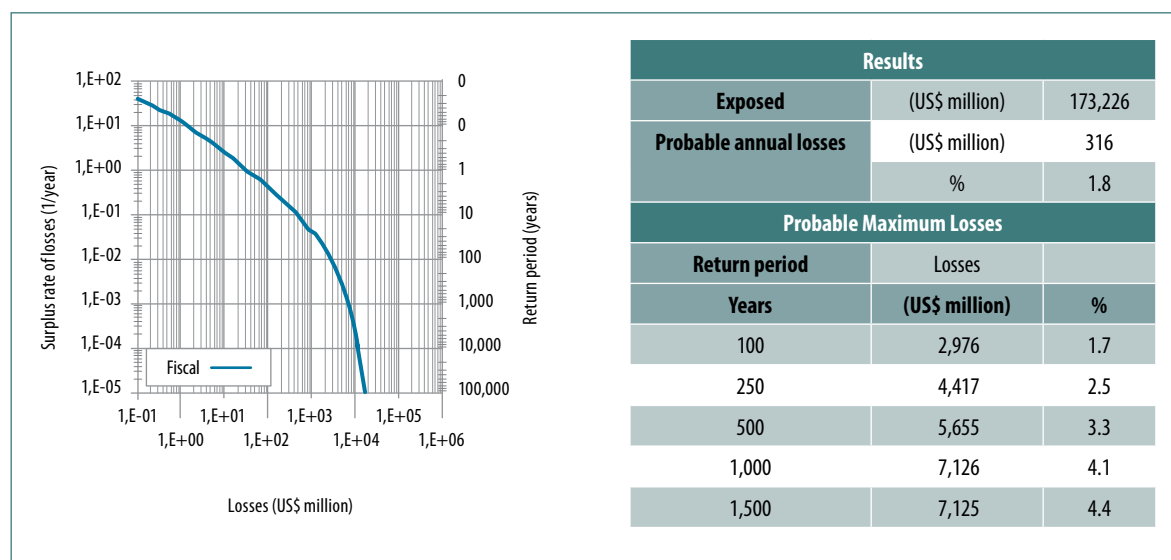
The losses of low-frequency/high-cost events also show a high upward trend, and the models indicate that Colombia should be prepared for an event of greater impact than those that have occurred to date, probably incurring losses of around US\$45 billion, seven times more than the losses caused by La Niña 2010-2011. Ten years after the earthquake in the Coffee Growing region, which left losses of US\$1.5 billion, the country experienced La Niña 2010-2011 with losses of US\$4.7 billion. Estimates from IDB and ECLAC (2005), and Ingeniar Ltd. (2011) warn that these losses can be expected from an event with a return period of 500 years. In other words, in the next 50 years, it has a 10% possibility of occurring again and it could be seven times greater than La Niña 2010-2011 (*see Chapter 1*).

Assuming that the State is primarily responsible for damages caused by high-frequency/low-cost events in the strata 1 and 2 population⁴⁰, it can be that most of the losses would be the State's responsibility, as these events usually affect the physical infrastructure and the poorest people. Ingeniar Ltda. (2011) prepared a review of the asset portfolio that is the responsibility of the State (public assets, fiscal property, national infrastructure, and buildings for low-income population in the private sector) and estimated its vulnerability to calculate its approximation of the exceedance loss curve exclusively for the assets that are the responsibility of the State (*Figure 4.12* shows the case of a seismic event). When comparing total losses (*see Chapter 1*) with only fiscal losses, the ratio is approximately 8:1.

39 The year 2009 is not included because it was a year in which the La Niña phenomenon made a hard impact precisely in the transport sector.

40 As it was in the Coffee Growing region earthquake and other large events.

GRAPH 4.12. Estimation of the probable maximum losses due to earthquakes across the country for different return periods



Source: Ingeniar Ltd., 2011

The hybrid curve is an approximation to the loss exceedance curve of the State's responsibility (*Graph 4.13*). In this curve, the fiscal losses caused by high-frequency/low-cost events are estimated from historical losses, assuming that total losses are public. Losses caused by low-frequency/high-cost events are estimated through modeling these disaster impacts in the asset portfolio that is the State's responsibility, as was done for the seismic case in *Graph 4.12*. In fact, comparing the two graphs shows that seismic risk largely controls the behavior of the hybrid curve on the right side. Fiscal losses caused by events of high recurrence periods estimated in the hybrid curve are very similar to the losses generated exclusively by the seismic risk, according to *Graph 4.13*. Therefore, it can be assumed that the ratio between total and fiscal losses in low-frequency/high-cost events is then maintained in the order of 8:1.

The hybrid curve is the best approach to estimate fiscal losses caused by disasters; how-

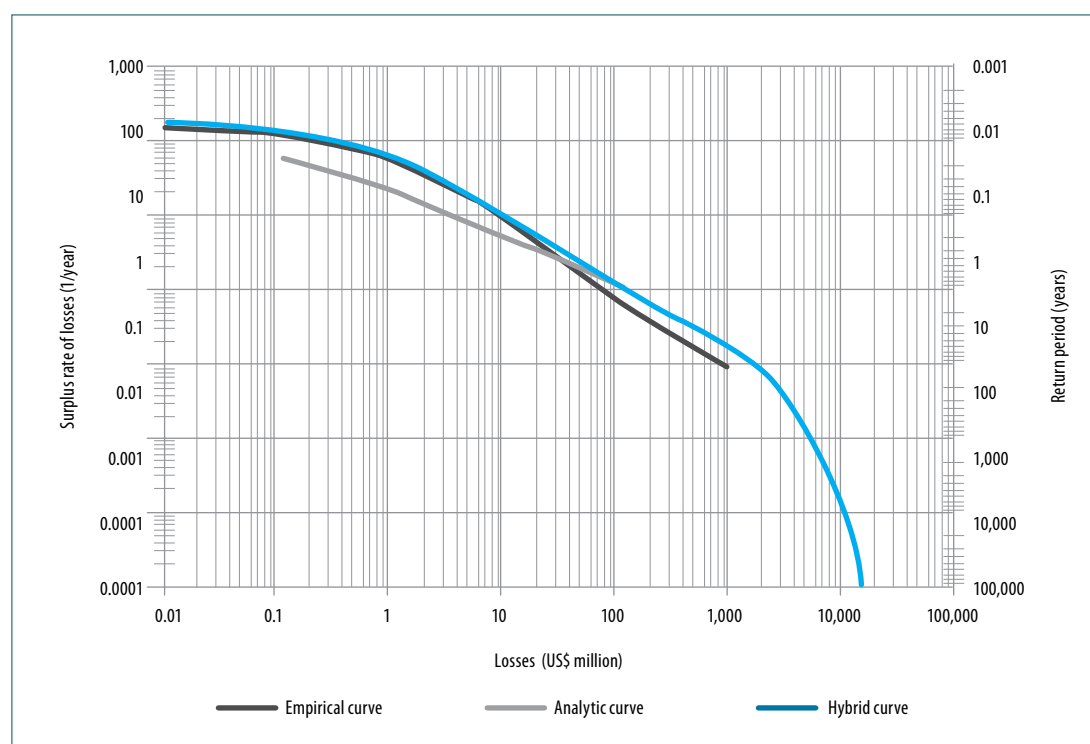
ever, it is not enough to estimate the financial needs for the State's response, since response, rehabilitation, and reconstruction costs need to be added, and these can be several times higher. As mentioned in this chapter, in the case of La Niña 2010-2011, estimated losses totaled Col\$8.6 billion (IDB, ECLAC, and DNP, 2011), and only response and rehabilitation as of July 2011 required an investment of Col\$6.87 billion (SNPAD and DGR, 2011). In addition, DNP estimated reconstruction costs at approximately Col\$22 billion (this budget aims to leverage the infrastructure of public utilities and flood control with much higher technical specifications than the old destroyed infrastructure, which was in poor condition). In other words, responding to a flood with that figure of losses, the Colombian government considers that close to US\$29 billion is necessary, which is 3.4 times of the loss amount, although the budget included investment needs identified prior to disaster but, as often happens after a disaster, investment

becomes a matter of urgency. The care and rehabilitation costs vary depending on the type of event. In the case of the rainy season, care and rehabilitation of public services for a highly dispersed population in many towns and infrastructure services in poor condition, are quite demanding in terms of resources, as shown in the numbers. Regarding the Coffee Growing region earthquake, the high costs of response and rehabilitation were due to cleaning and handling a high volume of debris, and especially due to the temporary lodging and meals for homeless families. Moreover, the reconstruction is usually more expensive than the value of the losses (not only in terms of structural strength, but service standards to be rendered). This is the case of the physical infrastructure needs of hospitals that evolves in medical technology development, not to mention the additional cost of replacing equipment.

In order to respond to La Niña 2010-2011, the State requires 3.4 times the value of the losses caused by this emergency to respond to minor disasters every year. It only allocates between 1% and 7% of the lost values. Figure 4.11 shows how the resources allocated to FNC between 1986 and 2010 on average have not exceeded more than 7% of disaster losses, indicating that the responsibility level assumed by the State varies depending on the event scale. To determine the funding needs of the State's response to disasters, it is necessary to first define which are the levels of their responsibilities in damages resulting in lower-strata populations.

The resources required by the State to address disasters depend on the event magnitude and frequency. If the State decides to take responsibility for damage caused to strata 1 and 2 populations, there is not enough information to determine the financing needs of low-frequency/

GRAPH 4.13. Loss exceedance hybrid curve exclusively for Colombia's fiscal portfolio



Source: Ingeniar Ltd., 2011.

high-cost events. In the case of La Niña 2010-2011, the investment budgeted was US\$16 billion, ten times more than in the case of the Coffee Growing region earthquake.

More refined and accurate risk assessment models are essential to optimize the public and private asset insurance in facing disasters. At present, the Government (through the Financial Institutions Superintendence in coordination with Fasecolda) seeks to promote the use of advanced techniques for risk assessment to establish the probable maximum losses and premiums, in order to promote a partnership between the public and private sectors to improve the financial component of risk management in the country.

4.3.4. Progress and considerations in the creation of a fiscal management strategy for the State's response to disasters

In addition to the instruments presented above in sections 4.3.1 and 4.3.2, the Colombian State has identified the need to adopt a comprehensive fiscal management strategy for its disaster response, knowing that both instruments and sources are disarticulated and do not have enough resources. The resources allocated annually to the FNC have been insufficient to address the minor disasters that have occurred annually, its budget has had to be aggregated, and despite that it has never exceeded 10% of the estimated losses. In addition, when disasters are of national magnitude, the FNC capacity is overwhelmed and the State must seek and achieve funding sources that were not foreseen. For these reasons, in the last National Development Plans (2002-2006, 2006-2010, and 2010-2014), the State has included the need to formulate a financial disaster risk management strategy and define the State's responsibility in the reconstruction processes.

The delay in the adoption of this strategy is due in part because there is no entity or agency clearly responsible for disaster fiscal management, and although there is a legal framework for contingent liability management, it does not consider disasters as one of the State's fiscal risk sources. Law 819 of 2003 established the requirement to include in the State medium-term fiscal framework an annual statement of contingent liabilities arising from public credit transactions, administrative contracts, rulings, and settlements. This requirement was in response to budgetary imbalances that arose during the 1990s due to private concession contracts that generated high unforeseen public expenditures. Taking into account this law's origin, it should consider disasters as fiscal risk sources, although it does not currently do this. Moreover, the Risk Division of the General Directorate of Public Credit and National Treasury of the Ministry of Finance, which has led to contingent liability management since 2003, has not included disaster risk within its functions, though it has been interested in giving comprehensive managing to the subject; this discourages a continuation of this process.

Physical disaster risk reduction to supplement the fiscal management strategy of the State's response to disasters

The State is aware that the best strategy to reduce fiscal disaster risk is to mitigate physical risk, and thus the disaster impact. Although the risk in Colombia continues to grow, this analysis shows that institutional, sectoral, and local entities' efforts to control the physical risk are still insufficient. The government, aware of the limitations of those efforts, is reconciling a Law Project to increase the effectiveness of SNPAD, and has given specific instructions in the current PND, among others, in terms of inventory and control

of high-risk settlements. Moreover, the State can reduce its contingent liability by reducing the risk of its exposed assets and avoiding the generation of new scenarios through inclusion of disaster risk control criteria in the instruments governing the approval of public investment.

It is essential, however, that the State is prepared institutionally, technically, and financially to respond to disasters, since it is impossible to eliminate risk entirely, and the process of reducing it to acceptable standards is costly and time-consuming. According to Chapter 1, Colombia has made progress in terms of reducing loss of life and the number of people affected by disasters, although in economic losses there is a significant increase, and there are still major challenges. It is essential to reduce risk growth rate and it is possible to do it by working in two fields; reducing physical risk and improving the institutional, technical, and financial management to disaster response.

Articulation of existing instruments and supplementing them with other additional instruments is a fiscal management strategy of disaster response by the State

A differentiated structure is proposed that addresses the needs of high-frequency/low-cost and low-frequency/high-cost events in order to achieve transferring risk to where it is economically reasonable and to constitute reliable resources to respond adequately to the retained risk. Table 4.13 shows a scheme where existing instruments are articulated with others that are supplementary, so as to ensure in advance a timely and optimal funding, and also to protect the State's fiscal balance. Adopting such strategy requires detailed identification of the amounts needed, choosing the most appropriate instruments, and application of those that are financially more economical for each risk layer.

TABLE 4.13. Scheme of fiscal management strategy for the State's response to disasters

| Risk layers | Instruments | |
|---|--|---|
| | Retention | Transfer |
| High-risk layer (low frequency/high cost) Amount to be defined (US\$16 billion was the response cost to the rainy season 2010-2011) | <ul style="list-style-type: none"> Loans within the borrowing capacity of the nation Sale of public assets previously identified as candidates to finance a possible disaster Contingency fund with regional resources New taxes | <ul style="list-style-type: none"> Traditional insurance (may include public infrastructure and lower-strata housing) Municipal collective housing insurance Parametric insurance Vehicle reinsurance Catastrophe insurance pool Disaster bonds |
| Medium-risk layer | <ul style="list-style-type: none"> Contingency credits Flexibility to reallocate resources from PGN | |
| Low-risk layer (high frequency/low cost) At least US\$450 million (If the State is responsible for the effects on the strata 1 and 2 population) | <ul style="list-style-type: none"> Relies on enough annual resources in FNC and the exception to the principle of the budgetary annuity, so savings can be made in relatively calm years Sectoral funds Territorial funds | |

Source: Adopted from World Bank, 2008.

Determining risk and funding needs of the State

From the advances in modeling disaster risk losses, a study must be carried out to identify the resources the State needs to address the stages of disaster response, rehabilitation, and reconstruction. There is a great methodology development in estimating the disaster damages and losses; however, it must be supplemented with additional information, such as the State's asset value and vulnerability under its responsibility (not just buildings, but also other types of infrastructure). It is also necessary to calculate the costs of response, rehabilitation, and reconstruction. While advancing on this path, the historical cost information can be used as a starting point, along with the available studies of probabilistic risk assessment.

Risk retention

The FNC, in conjunction with other liquidity sources for financing disaster response, should be able to meet the low-risk layer in any year. If the decision is clear that the State is responsible for all of the effects caused by disasters to citizens in strata 1 and 2, between the FNC, sectoral sources, and regional funds, it should have the capacity to provide sufficient resources per year, and as far as possible to allow the FNC to become a true multiannual reserve instrument, exempt from the principle of budgetary annuity, so savings can be made in years of relative calm.

Encouraging greater risk transfer by the private sector

Strengthening the measures identified in section 4.3.2 of this chapter and developing awareness campaigns, new incentives, and mandatory standards will greatly contribute to risk reduction and provide the resources required by the State to respond to disaster. Although Chapter 5 reviews

in detail various measures to enhance risk management by private actors, it is worth reviewing compliance with current regulations, including the amounts by which the property is insured, as well as considering new rules on issues, such as coverage of publicly traded companies, in order to reduce the risk impact on financial markets and to protect the patrimony of the shareholders, who may be ordinary citizens.

Monitor the adopted measures to expand agrarian insurance so as to increase the area insured. Section 4.2.5 presents the historical and recent measures taken to promote agrarian sector insurance in the country, which up to date represents less than 1% of the cultivated area, in spite of the sector being a recurrent victim of floods, droughts, or frosts. It is convenient to monitor the responsiveness of recent measures to force the insurance of Finagro credits and extend awareness campaigns.

Transfer of public risk

There are several ways to extend insurance coverage of public assets and to reduce the cost of the policy, exploiting economies of scale from a large number of properties. Presently, the compliance with Law 42 of 1993 with regard to State's property insurance is done property by property, since the law assigns responsibility to the entity's representative owner of the property. This mechanism is inefficient because it does not allow the benefits of diversification, which would be generated by the risk pooling of all buildings in a single portfolio, resulting in lower cost of coverage. Therefore, the assurance of public goods could be strengthened by (i) designing a collective policy for public building insurance, (ii) requesting from the insurance market a particular product for the infrastructure sector, and (iii) evaluating the establishment of a National Reinsurance System to reduce insurance costs.

An interesting alternative might be to regulate a subaccount within the State Entities' Contingency Fund, operating as a "captive" insurer of State agencies, combining risk retention and transfer for more efficient use of available resources. The various government agencies would contribute to the Fund in proportion to their individual risk calculated on actuarial basis. To improve the financial viability of the Fund, the State may retain some of the risks, either through a simple guarantee or through a credit line. This would enable it to increase its reserves rapidly.

The promotion by the National Government of the adoption of collective municipal housing insurance schemes would contribute to transferring part of the risk to local entities that are currently the State's responsibility. As an incentive for the adoption of these schemes, the MHCP could encourage the creation of a catastrophe insurance pool for the largest municipalities in the country, offering a line of credit to back it up (which would help increase the retention capacity, thus lowering

the transfer cost). According to Ghesquiere and Mahul (2010), the mechanism would reduce insurance costs significantly: (i) reduction of 7% to 10% of administrative costs due to the premium collected through property taxes, (ii) reduction between 15% and 25% of the premium cost for the collective risk (for the five largest cities in Colombia), and (iii) decrease of 25% to 35% of the premium cost for risk retention guaranteed by the State.

Finally, although it is not a highly developed market and it is costly, it is worth taking into account alternatives for risk transfer, such as parametric insurance and catastrophe bonds. These options are useful because the payments are triggered by the occurrence of an event that exceeds certain parameters. Some products may be triggered by parameters, such as the Richter scale earthquake intensity or maximum wind speed, allowing a property not to be insured or the damage assessment to receive resources. This makes them complementary instruments to traditional insurance.



Reinforcement of the Caldas Hospital. Municipality of Manizales (Caldas, Colombia). 2011. Photography: Dora Catalina Suarez.

4.4. RECOMMENDATIONS FOR STRENGTHENING PUBLIC SECTORAL MANAGEMENT

| RECOMMENDATION | PRIORITY High (H) Medium (M) | RESPONSIBLE |
|--|---------------------------------|--|
| Reduce risk generation and disaster impact through specific policies and action plans | | |
| Designate an office responsible for risk management in each sector. | H | Ministries |
| Adopt sectoral policies for risk management in each Ministry. | H | Ministries |
| • Intervention policy for settlements at risk. | H | MVCT |
| • Financial protection policy. | H | MHCP |
| • Comprehensive risk policy for natural hazard phenomena, market risks, and other risks associated with climate change. | H | MADR |
| • Minor and medium-intensity disaster management policy. | H | UNGRD |
| • Policy mechanisms to orient reconstruction processes in a declared situation of national disaster. | M | UNGRD |
| • Policy to incorporate risk management in public utilities in the supply of water, sewerage, and sanitation services. | H | MVCT |
| • Risk criterion inclusion in policies and planning “locomotives for growth and employment generation”. | M | MT, MVCT, MME, and MADR |
| Adopt and implement Sectoral Action Plans and interministerial risk management. | | |
| • Strategy to generate information, and knowledge on hazards, infrastructure vulnerability and exposed property, early warning and climate change. | H | Ministries |
| • Road Vulnerability Reduction Program. | H | MT |
| • Program to Reduce Settlements at Risk. | H | MVCT |
| • Adopt the risk management chapter in the RAS. | H | MVCT |
| • Cofinancing program for the implementation of Ministerial Directive No. 12 of 2009 on the continued provision of educational services in emergency situations. | H | MEN |
| • Strengthening Safe Hospitals Program. | H | MSPS |
| • Regulating flood risk management criteria in the operating protocols of dams. | M | MME and MADS |
| • Program to support local entities in risk management inclusion in land use planning. | H | MVCT, MADS, and MADR |
| • Strengthening the inclusion of risk management in the Land Use Planning and Watershed Management (POMCA). | M | MADS |
| • Program to encourage risk reduction measures and adaptation to climate change in medium and small agrarian producers. | H | MADR |
| • Adopting a strategy for disaster management in each sector. | H | Ministries |
| Delineate public and private responsibilities in risk management and extend the reduction of the State's fiscal vulnerability to disasters | | |
| Adopt clear political guidelines on the level of protection that the Colombian State and local entities must offer to those affected by hazardous events. | H | Central Government DNP, MHCP, UNGRD |
| Adjust regulations to clarify the private sector responsibility in risk management, and strengthen the defense of public entities to reduce the State's fiscal contingencies for claims on this matter. | H | Ministries |
| Design and implement a comprehensive strategy for financial protection of the State at the different sectoral and territorial levels, in order to ensure an adequate disaster response and protect the long-term fiscal balance. | H | MHCP |

Reduce risk generation and disaster impact through specific policies and action plans

Assign an office responsible for the risk management in each sector. Most ministries and entities have no direct functions or units responsible for risk management, which has been noted repeatedly in documents such as the Conpes 3146, mentioned as one of the causes of poor management in this area. The answer to this is the definition of dependencies or officials with clear responsibilities and hierarchy, to coordinate the creation of sectoral risk management policies and lead their implementation, as is provided by the Decree 919 of 1989. These dependencies could also coordinate issues such as climate change and environmental sustainability in each area, simplifying their coordination within the sector and with other sectors. It would also facilitate the adoption of policy instruments, including environmental and climate change risks, and it would strengthen the performance of the sectors and the local capacity to implement instruments such as POMCA, the POT, and the PD.

Adopt sectoral risk management policies in each Ministry. The approach to sectoral risk management has been largely reactive and protective, resulting in a steady increase in vulnerability and disaster impacts. This can be managed with a comprehensive policy, which also ensures risk assessment and awareness and the reduction of existing risk. It also eliminates the generation of new risks in projects and investments, and the effective and timely disaster response, promoting joint and shared responsibility with local authorities and the private sector. This strengthens risk awareness, especially in vulnerability studies in each sector, and better strategies can be designed for reducing physical, operational, and financial risk, and properly planning disaster management. It is

essential to generate local capacity for specific sectoral risk management actions and mechanisms for articulating with local authorities. It should also include institutional strengthening and risk reduction cofinancing, so as to meet their needs while promoting responsibility and in this manner achieving a synergy among the different levels of government. Guild organizations are able and willing to play a deciding role in this field. The PND 2010-2014 aims to build the National Policy and also some Sectoral Policies on Disaster Risk Management that would become constituent elements of the National Policy and Planning Sectors with special emphasis on “Locomotives for growth and employment generation”: transportation, housing, mining and energy, and agriculture. Among the prioritized sectoral policies currently in the PND are:

- **Housing.** Intervention policies for settlements at risk, aimed at controlling and managing these settlements and reducing the construction of informal housing. The overall improvement of neighborhoods, through risk analysis and the introduction of restrictions and constraints in land use planning (POT), development of projects to mitigate risk, family relocation in high-risk non-mitigable areas, and additional urban land availability increase VIS construction and strengthen urban control.
- **Finance.** Financial protection policies to reduce the State's fiscal vulnerability resulting from disasters. The policy defines a differential strategy to address the needs of high-frequency/low-cost events, as well as low-frequency/high-cost events, transferring the risk as far as is economically possible, constituting a reliable source of funds to address the retained risk and encourage participation of local governments and private entities.

- **Agriculture.** Comprehensive risk policy to face natural phenomena, market risks, and risks associated with climate change that includes an integral knowledge strengthening, risk reduction, and disaster risk management.
- **Interior and Justice.** Low- and medium-intensity disaster management policy as well as policy mechanisms to guide the reconstruction process in a declared national disaster situation.
- **Drinking water and sanitation.** Policy to incorporate risk management in the provision of water supply, sewerage, and cleaning public services for which there is a document proposing these guidelines, though they have not been formally adopted.
- **Transportation.** Contracting concession management policies incorporating risk reduction criteria.

Adopt and implement Sectoral and Interministry Action Plans on risk management.

Once Sectoral Policies are implemented, the Sectoral and Interministry Action Plans would become their application instruments. These plans could define short- and long-term strategic priorities, and identify funding and development mechanisms. The objectives of risk knowledge and reduction, and disaster management mentioned in the policies should be reflected in the strategies, programs, and projects' action plans. Moreover, they must also include assigning those responsible and the coordination, financing, monitoring, and control mechanisms, addressing the needs and promoting the responsibility of territorial authorities and private sector agents. Some specific actions recommended for inclusion in these plans are as follows:

- **Agriculture, housing, and environment.** Promote a partnership to support territorial entities in incorporating risk manage-

ment in land use planning, granting equal priority to rural and urban space. This will help to confront municipalities' technical and financial capacity limitations and bring sectoral policies to the territory.

- **Transportation.** Vulnerability Reduction Program in the different modes of transport, prioritizing the roads, establishing a solid program to invest in reducing existing vulnerability, focusing on the critical sections, either with stabilization work and/or improving standards of alternate routes. This reduction program should also involve updating technical specifications and procurement systems, incorporating the definition of acceptable risk levels, assessment of projects from feasibility stage, design methods, and construction systems, operation, monitoring and control, and establish the risk profile and strengthen road maintenance.
- **Housing.** Promote the Settlement Risk Reduction Program, which includes the definition of inventory methodologies, capacity strengthening, cofinancing, and technical assistance to the municipalities' census of an endangered population. Implement the Comprehensive Neighborhood Improvement Policy. Adopt a strategy to control risk resulting from informal urbanization, which may include affordable housing alternatives such as leasing for lower strata and training in construction. Formalize self-construction of one- and two-floor houses to intercede in the process of building informal housing. Adopt acceptable risk levels for residential buildings facing floods and landslides, much in the way they are implemented in seismic risks.
- **Drinking water and sanitation.** Implement the RAS risk management chapter, including approval of acceptable ¹⁶ maximum risk levels, infrastructure risk assessment,

reducing existing risk, and the design and construction of parameters in accordance with the standards set for new infrastructure. With regard to the fee structure, incorporate crossed feasibility for financing risk management activities, vulnerability studies, risk reduction criteria maintenance, and the ability to secure the infrastructure.

- **Education.** Establish a capacity strengthening program and cofinancing to support territorial entities in compliance with Ministerial Directive No. 12 dated July 2009, both to reduce educational infrastructure risk and to improve preparedness to face emergencies.
- **Health.** Strengthen and expand hospital insurance program coverage.
- **Energy.** With the environmental sector, articulate the inclusion of flood risk management criteria in dam operation protocols, starting from adopting maximum acceptable risk levels.
- **Environment.** Strengthen the inclusion of risk management in the POMCA, adopting maximum acceptable risk levels for all hazards and the definition of restrictions and constraints that must be reviewed and detailed in the planning processes such as land use planning (POT). Include in the POMCA a Master Plan for Flood Risk Reduction, ensuring articulation between different actors in watersheds and verifying that the risk reduction investments are consistent and positive for the entire area, not just a part of it.
- **Agriculture.** Organize with the agrarian guilds the implementation of a program to encourage small and medium farmers to use risk reduction measures and to adapt to climate change. This includes a collective and aligned effort with the Ministry of Environment and Sustainable Development to promote sustainable land management through planning and applying environmentally

adequate production technologies, erosion prevention, and flood control. Risk reduction strategies are also recommended. Using drought- or flood-resistant varieties, weather forecasts to make decisions during the production cycle, and early warnings about El Niño and La Niña phenomena are recommended strategies when deciding on product types, sowing seasons, and planning any livestock relocation. Along with the environmental sector, implement a joint strategy for recovering marsh areas where flooding occurs as areas to mitigate floods.

- **All sectors**

- a. Implement a decision-making strategy in each sector through strategies aimed at providing information and knowledge on hazards, infrastructure vulnerabilities, property exposure, early warnings, and climate change. Vulnerability assessment and the risks to each one allow each person to formulate their own risk reduction plan. Actions and investments based on where hazards are concentrated and a cost-benefit analysis should be a priority. Hazard exposure, susceptibility, and damage assessment methodologies, as well as assigning responsibilities and deadlines have to be adopted. It is important to consider not only present scenarios, but also future ones, which take into consideration aspects such as growth in demand and aging of the infrastructure. It is also convenient to encourage sectoral information and knowledge needs by strengthening the financial and technical coordination among SGC, IGAC, Ideam, DANE, and academia in general to sup-

41 Service suspension risk for natural disaster events.

port the sectoral needs of information and knowledge.

- b. Implement sectoral strategies to build a culture of accountability and risk management among private actors. This strategy may include awareness campaigns and training on the risks to which they are exposed, the responsibility of private actors, and alternatives to reduce risk, improve risk management, and prepare for action in case of an emergency. The drills are used to evaluate and improve the proposed actions and to increase awareness. The guild organizations can be a key partner in this endeavor.
- c. Adopt a strategy for disaster management in each sector, articulated and supported by the UNGRD and the FNC. The current PND assigns to the UNGRD, with the support of the DNP, the formulation of a public policy of “Minor and medium-intensity disaster management” and “Mechanisms for guiding reconstruction processes in a situation declared a national disaster”. Experiences like the one in Mexico show the advantages of ministries of each sector controlling the rehabilitation and reconstruction processes of their own infrastructure: opportunity, autonomy, technical suitability, monitoring, and control. Transparency and efficiency are guaranteed by using standardized and established procedures to assess damage, access to resources by Government agencies and the private sector, and mechanisms for monitoring and control. However, the Oil Spill Contingency National Plan experience and its replication to other sectors should be assessed, and it should probably be extended to contingency plans for each of the hazards.

Delineate public and private responsibilities in risk management and extend the State’s fiscal vulnerability reduction in confronting disasters

Adopt clear policy guidelines on the level of protection that the Colombian State and territorial entities should offer to those affected by hazardous events. One of the requirements of appropriate preparedness and response to a disaster situation is to have a financial protection strategy. For this, it is essential to clearly define the State responsibilities with respect to those affected, specify the scenarios in which the nation will participate, as well as the actions of the State’s different levels under the principles of correspondence, complementarity, and subsidiarity with the territorial entities, and the role of the private sector (more details on this aspect are presented in the recommendations in Chapter 5).

Adjust the regulations to clarify the responsibility of the private sector in risk management, and strengthen the defense of public entities to reduce State fiscal contingencies for claims on this issue. A clear definition of responsibility of the private sector will strengthen the defense of public entities in the courts. Additionally, specific guidelines to facilitate the proper integration of risk management in governance will reduce vulnerability and losses caused by Government actions. In addition to the priorities in this area, identified in Recommendations in Chapter 5, other priorities related to sectoral public management are:

- Analyze the risks and alternatives from prefeasibility of projects. Incorporate this in the rules of the Public Investment Projects’ Banks (BPIN).
- Regulate concession contracts, in compliance with the Conpes 3107 of 2001, assigning risk management responsibility for natural events to private investors as a transferable

risk through insurance policies and other financial mechanisms.

- Implement technical regulations for each sector, such as bridge code update. Complete the adoption process of the risk management chapter in the Technical Regulations of Drinking Water and Sanitation Sector (RAS), among others.
- Articulate between the agriculture, mining, and environmental sector strategies for implementation of the recent Environmental Sanctioning System, in terms of illegal deforestation, drought, wetland invasion, alteration of watercourses, etc.

Design and implement a comprehensive State financial protection strategy at different territorial and sectoral levels, in order to ensure an adequate response to disaster occurrence and to protect the long-term fiscal balance. There is not enough information to determine financing needs with regard to low-frequency/high-cost events, but in the case of La Niña 2010-2011, the budgeted investments amounted US\$16 billion, ten times more than in the Coffee Growing region earthquake. However, the calculation of these amounts depends on the definition of the State responsibilities and the efficiency in the implementation of resources. In addition to the Government's strategy, it would be convenient to establish risk management funds and financial protection strategies at the sectoral and territorial level (municipalities and departments)

to encourage responsibility based on the principles of complementarity and subsidiarity:

- National financial protection strategy (See *section 4.3.4 and Table 4.13*).
- Financial protection for each sector to complement the national strategy, coordinated by the Ministry of Finance with the following elements: (i) identification of funding needs, (ii) definition of retention strategies and risk transfer, (iii) national and sectoral funding sources with complementarity rules defined to account for the retained risk (sectoral funds, the National Calamity Fund, Risk Management Fund, currently included in the law project to reform SNPAD, royalties resources) (see *section 4.3.2*), and (iv) promoting responsible risk management among private agents.
- Incentives to promote the establishment of funds and territorial strategies to protect the State from disasters. This may include (i) the adoption of clear rules of territorial cofinancing to access national and sectoral sources of funds for risk management, (ii) national cofinancing incentives for territorial strategies, and (iii) incentives for municipal adoption of collective housing insurance schemes, such as the creation of a catastrophe insurance pool for the largest municipalities in the country, and a credit line to support this pool (which would help to increase the retention capacity, and thus reduce transfer).



Municipality of Gramalote (Norte de Santander – Colombia), 2011. Photography: Gabriel Jaime Arango Zapata.

Public and Private Responsibility in Disaster Risk Management

Carlos R. Costa, Ana Campos García,
Víctor Manuel Moncayo, Alejandro Vega

5



5.1. THE NEED TO ESTABLISH LIMITS BETWEEN PUBLIC AND PRIVATE RESPONSIBILITY

When discussing responsibilities in disaster risk, it is necessary to understand the social construction of risk. Risk refers to the potential damages or losses that may occur due to the effects of dangerous physical events during a specific time period, which later become real damages, depending on the vulnerability of the exposed elements (*Ingeniar Ltda., 2011*). Therefore, disaster risk derives from the combination of hazards and vulnerabilities. The latter refer to factors built by man as a result of various decision-making processes regarding the occupation of territories, design, and technical characteristics of the construction that make up the physical component of the aforementioned occupation. These decisions are influenced by economic, social, political, cultural, and other factors. On the other hand, a hazard refers to the probable occurrence of a dangerous phenomenon, which is usually classified as a natural phenomenon in events such as earthquakes and volcanic eruptions, where there is no direct or significant human intervention. Other phenomena, such as floods, landslides, etc., are classified as socio-natural phenomena, because in most cases they are exacerbated by anthropic activities such as deforestation and inadequate handling and use of land and runoff waters, as mentioned in the previous chapters.

When making decisions about risk reduction and management, it is essential to understand that the concept of acceptable risk is always implicit. Acceptable risk is defined as the risk that is reasonably assumed or tolerated due to the probability of occurrence of the risk, the limited nature of the damages that may be caused, or the feasibility of prevention,

mitigation, financial protection, response, and recovery measures. According to this concept, decisions are made regarding seismic resistance standards that set design parameters for a 500-year return period. These standards contemplate a 10% probability of an event being exceeded during the 50-year useful life of a building, so that the building does not collapse and protection of life is assured, and certain levels of acceptable damage. However, in terms of perception, it is important to point out that seismic resistance does not imply that a building is “anti-seismic”, because anti-seismic structures do not exist. The real goal of seismic resistance is a significant reduction in the effects of the phenomenon.

In spite of the high frequency with which Colombia faces disasters caused by dangerous physical events, the limits of public responsibility and private responsibility are not clear yet.

After a disaster occurs, most victims, ranging from low-income families who have lost their homes to productive sectors, that have suffered damages to their infrastructure or production facilities, expect replacement of their assets and government subsidies or tax incentives, without being aware, in most cases, of the responsibilities of self-construction and the prevention and reduction strategies they might have adopted before the disaster. The most recent Colombian administration has responded in different ways to expectations and demands after serious disasters, which proves that there is no applicable policy in place.

The absence of a clear policy and a record of past cases, in which the government has usually

taken responsibility, discourages citizens and the private sector from assuming their role in risk reduction and management. Ideally, both citizens and the private sector should be aware of their own risks and should manage them consciously, i.e., reduce the physical and economic aspects of risk as much as is feasible, in order to protect their life and assets as much as possible. Residual risk, or risk which cannot be reduced, may be managed with preparation and assurance strategies for knowing how to act in the event of a disaster. In this regard, the government should do its part by following constitutional precepts and policy guidelines, in order to enable and encourage citizens and the private sector to take on the reduction of risk, which ultimately would reduce the fiscal vulnerability of the country. To that end, it is necessary to first clearly establish the limits between public and private responsibility so that all parties can take measures and act effectively. Second, it is essential to encourage social agents to recognize and accept their responsibility so that they may implement preventive strategies in a timely fashion.

5.1.1. The current gray area between public and private responsibility

5.1.1.1. Responsibility of the government

From a legal standpoint, it cannot be argued that the government is not liable for the damages caused to a private agent by disasters. In both private and public tort responsibility, the parties are exempt of all responsibility due to force majeure events. Since disasters are a typical example of force majeure events, it could be said that the government should not be under any obligation whatsoever as a result of the occurrence of a dangerous physical phenomenon.

On the other hand, the government is responsible for protecting the victims, especially when they are in a condition of “evident weakness”. However, the goal is not to compensate for damages and losses, but to provide special protection to the population as far as it is possible. Article 13 of the Constitution of 1991 orders the government to protect “those persons who due to their economic, physical, or mental condition are in a state of evident weakness”, which applies to many of the victims of a disaster. However, in rulings SU-111/97, SU-225/98, and C-251/92, the Constitutional Court established that this obligation is not applicable immediately and its performance depends on the capacity of the government.

Regarding losses or damages suffered, although the Constitution assigns the Government the duty to protect the “life, honor, and property” of citizens, the Council of the State has ruled that, in cases of natural or socio-natural disasters, the government is liable only for damages caused by an action or omission (failure) of public entities. According to the Constitution, authorities are established to “protect the life, dignity, beliefs, and other rights and liberties of all persons residing in Colombia, and to enforce the social duties of the government and of citizens” (Article 2 of the Constitution), which is a very broad statement that is subject to interpretation. However, in a ruling dated June 24, 1994, regarding the Armero disaster, the Council of the State ruled that there were grounds for responsibility of the government only if the judge who was hearing the case found evidence of the following: (i) failure, (ii) unlawful damages to individuals, (iii) a causal link between the failure and the damages, and (iv) the absence of grounds for exemption such as force majeure.

When damages are proven, even if they are caused by a dangerous physical event but are attributable to failure of public entities, the gov-

ernment is required to pay indemnification. Article 90 of the Constitution mandates that “the government is financially liable for the unlawful damages for which it is accountable, whether they are caused by the action or omission of authorities.” In other words, it is required, on the one hand, to provide solidarity protection, sometimes called humanitarian protection, based on Article 13 of the Constitution, and on the other hand, to respond financially to the harmful consequences of disasters caused by dangerous physical phenomena, when it can be proven that all or part of the damages have been caused, either exclusively or concurrently, by the action or omission of the government.

Once government responsibility is established in this matter, there are several instruments available to private actors for its enforcement. These instruments include Protection action [writ for the protection of constitutional rights] (Article 86 of the Constitution), popular actions and group actions (Article 88 of the Constitution), compliance actions (Article 87 of the Constitution), and legal actions for nullity and reestablishment of the right to direct and contractual compensation (Articles 84 and 85 of the Constitution).

There are still many loopholes in the definition of responsibilities, as mentioned in previous chapters, but the process of regulating and defining obligations should be comprehensive and should consider both public and private agents, because the risk of lawsuits against the government due to action or omission is proportional to the amount of existing legislation, unless responsibility of both parties is clearly established. Article 121 of the Constitution indicates that “no government authority may perform any functions that are different from those assigned by the Constitution and the law”; therefore, the way to determine failure by action or omission on the part of government

authorities is only in light of the functions they have been assigned. There are numerous legal proposals that have defined the authority of the government regarding risk management at different levels of its hierarchy, but loopholes remain in the private sector, which gives rise to situations of unlawful damages that may be problematic for the government. For example, the adoption of regulations that require risk control (such as mitigation works or zoning of hazards) reduces the occurrence of disasters, but a failure that is not detected or controlled by the corresponding authorities (such as a failure in design of mitigation works or risk estimation) could result in financial responsibility to the government. In the absence of regulations, the risk for the population would be greater, but when regulations are present and their limits or the jurisdiction of the private sector are not taken into account, the financial risk to the government usually increases, unless the regulation makes it clear from the start that complying with public requirements does not transfer responsibility to the government. In this context, the requirements of the government shall be construed as minimum requirements, not a guarantee for eliminating risk completely, which would be technically impossible or economically unfeasible.

The government is responsible for protecting, as far as it is capable, victims in a state of “evident weakness,” and for responding financially to the damages that are attributable to actions or omissions (failure) of public entities, which clearly does not mean the government is required to pay full indemnification for the losses of those affected by a disaster. Although it seems contradictory, this does not allow for a clear definition of the responsibility of the government. However, it is legitimate to respond to the victims in different manners in each disaster situation; the financial risk for the government, and therefore,

for the population, may be greater depending on how regulations for reducing risk are adopted. It is necessary, therefore, to delimit the scope and extent of public and private responsibility with a clear understanding of the regulations and the policy definitions.

One way to delimit the obligations and responsibilities of all agents could be the adoption of risk awareness and reduction and disaster management policies (handling, rehabilitation, and reconstruction), in which criteria for different types of events are established. Regulations already exist in the field of seismic resistance, which includes parameters for microzoning studies, building design and construction, and vulnerability assessments. These regulations also define who is in charge of executing, reviewing, and approving blueprints, works, and other elements. Therefore, it is necessary to create policies and regulations that establish security or acceptable risk parameters for floods, landslides, and other phenomena, as well as the roles and responsibilities of different public and private agents in planning, design, construction, operation, maintenance, follow-up, and control processes. In this manner, the government and the citizens would know the guidelines, procedures, and responsibilities from the start, and would undertake the implementation of ex ante actions and prepare for ex post actions related to disaster risk.

5.1.1.2. Responsibility of private agents as generators of public risk

The actions of the private sector may create risk for society, but only the failure to comply with an explicit regulation generates legal responsibility for the private agent. Construction of infrastructure or housing that is vulnerable to hazards, handling of dangerous materials or production processes, alteration of the en-

vironment, and many other activities, clearly increases vulnerability to dangerous natural phenomena and gives rise to risk situations that later become disasters. However, according to Article 6 of the Constitution, citizens are liable to authorities only for infringing the Constitution and the laws; therefore, it is necessary to develop adequate regulations so that the consequences of generating risk scenarios are assumed by those who cause them and not by the victims or the government.

Due to the deficiencies of public entities and the weaknesses of regulations, in many cases the government ends up assuming the costs of regulatory noncompliance by private agents. The regulations for controlling public risk generation by private actors are focused on establishing restrictions and standards for private actors, such as risk zoning in the Land Use Planning (POT) or the regulation for seismic-resistant constructions. However, failure to comply with these restrictions or standards on the part of a private actor does not necessarily mean that the private actor bears full responsibility. The government may be partially responsible, due to either failure to enforce compliance with a regulation or a poor legal defense when faced with a lawsuit. As a result, there are many rulings in which 50% of the costs are borne by the government and the remaining 50%, by the private actor. The Colombian government has created an agency for its legal defense due to the high number of negative rulings on account of deficiencies and inadequate processes.

When adopting levels of acceptable risk, such as those established in seismic resistance standards or in risk zoning in the POT, such levels should be explicit and should be known to all agents so that private and public responsibilities are clear. For example, Article 1 of Law 400 of 1997 regarding seismic-resistant constructions establishes that “a building designed in accor-

dance with the standards for seismic-resistant constructions should be able to withstand, in addition to the forces imposed by use, low-intensity earthquakes without suffering damage, moderate-intensity earthquakes without suffering structural damage, but possibly sustaining some damage to nonstructural elements, and high-intensity earthquakes with damage to nonstructural and structural elements, but without collapsing.” Therefore, anyone who builds, approves the construction of, or buys a house under these criteria, should know that it is feasible (10% probability according to the provisions of the standard) that a seismic event of a magnitude greater than considered may occur and may cause structural failure of the buildings designed in accordance with the construction code. Complying with the standard does not make constructions seismic-resistant. The lack of awareness of this situation by society in general may result in lawsuits against the government.

The regulations regarding the responsibility of private agents in risk management are inadequate, which forces the government and the victims to assume responsibility for the damages caused by a disaster. Article 95 of the Constitution expressly indicates the duties and responsibilities of every person, which include the following duties and responsibilities related to risk management: “to respect the rights of others and not abuse their own rights (...), to act in accordance with the solidarity principle (...), to protect the cultural and natural resources of the country and watch over the preservation of a healthy environment (...), to contribute to the financing of the expenses and investments of the government under the concepts of fairness and equality.” However, regarding explicit obligations in matters of risk management, progress is insufficient or the obligations have not been duly implemented.

Low levels of implementation of currently available instruments have been identified. These instruments set forth some of the specific duties of private actors with regard to risk management. No use has been made of instruments such as the Statutory Law on the duties of private actors, which is mentioned in Article 152 of the Constitution; Section 10 of Article 2 of Decree 919 of 1989, which registers in the National System for Disaster Prevention and Response (SNPAD) all private agents who on account of their purpose and functions have a connection with disaster prevention and management; or Article 4 of the same Decree, which allows the government to ask for cooperation of private agents in the preparation and execution of the National Plan for Disaster Prevention and Response (PNPAD). Participation of private actors in the SNPAD has been very limited, few specific implementations are known, and the mechanisms have not been regulated.

The rules established in Articles 8 and 9 of Decree 919 of 1989 have only been implemented partially in the city of Bogota. According to these standards, and as a preventive measure, “private agents in charge of providing services, who perform large-scale civil works or carry out industrial activities or any other type of activity that poses danger or high risk, as well those activities specifically determined by competent public authorities, are required to carry out a vulnerability analysis and take appropriate protective measures.” This responsibility has been implemented only partially in Bogota, as part of the city’s disaster prevention and management system, but it has not been implemented nationwide or by other territorial entities. It is set forth that, for the handling and management phases of a disaster, specific action plans are mandatory for the private sector (Article 20 of Decree 919 of 1989). Furthermore, participating in opera-

tions in disaster situations is also mandatory, in accordance with specific action plans and the nature of the purpose, functions, and jurisdiction or sphere of influence of the private actors (Articles 11 and 22 of Decree 919 of 1989). Nevertheless, it is not known if these provisions have been implemented.

Clarifying regulatory frameworks, requiring the private sector to meet its responsibilities, and ensuring the disclosure of this information are key elements toward a sustained reduction of risk conditions. It is essential that more regulations, diffusion, and enforcement be developed related to the responsibilities of private agents as generators of risk and to their duties in supporting the government in risk management issues, with the purpose of reaching the stated goals of significantly reducing risk in the country and having all agents assume their respective obligations.

5.1.1.3. Responsibility of citizens in managing their own risk

Private agents do not assume the responsibility of knowing and managing their own risk. The obligation of the government to protect the “life, honor, and property” of citizens, which is set forth in Article 2 of the Constitution, could be supplemented with the responsibility of citizens for knowing and managing their own risk, so that when making decisions in a risk situation, they would at least have a concurrent duty with the government. However, there are currently no regulatory developments in this regard.

The only provision concerning the responsibility of citizens in risk management is the requirement to insure common areas in horizontal property buildings as well as property that is financed with some kind of credit. There are no requirements for other forms of risk transfer by

insuring private property assets, except in the case of horizontal property and real property that is financed with credit.

In the absence of the above developments, the obligations of the government and the private agent who is affected by a disaster are subject to interpretation by the judicial branch of the government. Courts have ruled against the government in numerous cases even when the decisions that placed lives or assets at risk were made solely by private agents. Insurance plans, even if they are voluntary, as in the cases of Manizales (Caldas) and Sabaneta (Antioquia), which are discussed in Chapter 4, would reduce the risk of the individual and the government by having a system that responds to damages to homes affected by a disaster, and would provide clarity to courts when assigning responsibilities, because the courts would have to take into account that the victims had been informed of the risk they were exposed to and of the possibility or obligation of purchasing insurance.

5.1.2. Government fiscal contingencies related to lack of clarity in policy frameworks

5.1.2.1. Contingencies in post-disaster assistance and recovery programs due to lack of clarity in policies

After a disaster, the government should perform several tasks. One of these tasks is assisting the affected population, and estimating its costs is of the utmost difficulty. In a disaster, the government is required to rescue and protect the people who are endangered, and it should also reestablish the services under its charge. The government has information about these services, which allow it to formulate

the case strategy. During reconstruction, the government should take charge of its own infrastructure, but it should also ensure the well-being of the population groups that are in a state of “evident weakness” and the reconstruction of the social fabric and, if deemed necessary, it should also contribute to the replacement of physical losses and repair the damages caused to the aforementioned population groups, so that they may bring their lives back to normal. Not knowing who belongs to the population groups in a state of “evident weakness” and how much support they need, makes the costs of this government task most uncertain.

The Constitution and the laws are flexible with regard to the responsibility of the government for the victim, since they allow responsibility to be defined according to the capabilities of the government. As mentioned in the previous paragraph, the responsibility of the government to those affected by disasters is limited to persons who are in a state of “evident weakness”, and the interpretation of the Court in this respect has been that the government should respond as far as it is capable. This grants the government flexibility in scope and form of action but, at the same time, it generates uncertainty both for the government and for the potential victims. Legislators could reduce the uncertainty by assigning specific responsibilities through new laws. On the other hand, it is possible for the government itself to define its obligations by means of policy instruments, which would simultaneously maximize flexibility and reduce uncertainty.

Due to the absence of preexisting policies or more regulatory development regarding the assistance to victims, the government is forced to make decisions during a crisis, which ends up generating differential treatments, whose fiscal consequences are difficult to quantify. Below are some examples of recent decisions based on circumstances and their consequences:

- During the reconstruction following the disaster in the Coffee Growing region, the FOREC (the Coffee Growing Region Reconstruction Fund), provided subsidies for repairing all affected homes, regardless of their owners’ socioeconomic status, but during the La Niña 2010-2011 episode, government resolutions for assistance were directed mainly at the poorest classes (strata 1 and 2).
- The decision by the FOREC to grant a repair subsidy for all affected homes was modified by a court order, based on the right-to-life argument. The FOREC was required to direct the subsidy not only to repair the affected homes, but also to reinforce their structures. The absence of clear policies in this matter resulted in unforeseen costs for the government.
- The decision to provide temporary lodging to the persons affected in the Coffee Growing region case led the FOREC to assign subsidies for new homes to all affected families who were in the shelters, even to those who were living in rented accommodation before the occurrence of the earthquake. This decision, which was the only measure that could be used to end the temporary situation, generated additional costs that had not been initially foreseen by the government.
- The assistance to victims of the La Niña phenomenon 2010-2011, as a result of the declaration of National Disaster, is different from that given to victims of previous rainy season emergencies, in which this declaration was not made and no programs were adopted, like the one currently developed by the Humanitarian Colombia or the Adaptation Fund.
- Bogota has a relocation policy for at-risk population groups that grants housing subsidies only to families in the poorest classes (strata 1 and 2). However, pending a court decision, the city has been granting rent subsidies for more than five years to lower-middle-class

families (stratum 3) who were in risk zones, while the courts decide whether those families are also entitled to subsidies for housing relocation. As a result of the lack of clarity, the costs of rent that have been assumed by the city are in some cases almost equivalent to the costs of a new home.

5.1.2.2. Fiscal contingencies in lawsuits against the government due to lack of clarity in regulations concerning public and private responsibility in risk management

It is clear that the government should respond financially to private agents who have suffered damages due to failures of service by public entities. The current constitutional precept (Article 90) is not only mandatory for requiring the government to respond, but it also establishes distinctions depending on the area of activity of public authorities. This precept actually establishes two conditions under which the government can be found liable: when there exist unlawful damages and when the unlawful damages are attributable to action or omission by a public authority (Constitutional Court ruling C-333-96).

In spite of the obligatory nature of this precept for the government, factors such as the lack of clarity in some regulations, the interpretation of these regulations by the courts, and the weak legal defenses of the government have given rise to controversial rulings. Below are two recent examples:

- **The city of Cali was found to be fully liable for the failure of a retaining wall in an upper-class building (stratum 6).** In 2009, a 5,000 m³ avalanche of mud and rocks blocked the recreational area (pool and arcade) of the Monterrosa Building in Cali, which had been built by private developers from 1993 to 1995 in an upper-class sector (stratum 6) of the city.

After a Protection Action based on the right to life and adequate housing was filed by one of the co-owners of the building, a ruling by a court of appeals ordered the municipality, among other things, to clear the rubble and to design and execute the works for stabilizing the slope. The costs so far have surpassed 10 billion Colombian pesos. The ruling found the city fully liable, based on the argument that in 1992 the Administrative Agency for Municipal Physical Control granted the construction permit without placing any responsibility on the project promoters, designers, and constructors, even though the terrain was classified as high-risk in the Cali POT, and previous studies by the project developers showed that they were aware of an existing hazard.

- **A judge ordered the municipality of Bogota to carry out mitigation works in an area that was undergoing resettlement after it had been declared a nonmitigable high-risk area.** In 2006, a significant portion of the San Rafael, Rincón del Porvenir, and Porvenir de la Estancia neighborhoods in the Ciudad Bolívar locality were undergoing a resettlement process financed and executed by the city after it had declared itself as a “nonmitigable high-risk area.” However, the community action committees filed a *Protection Action* invoking the rights to physical integrity, health, adequate housing, and a healthy environment. Eventually, the city agencies were ordered, among other things, to “immediately begin working to stabilize the terrain (...) without the excuse that the initiation or duration of the works depends on, or is subject to, financial resource availability.” Currently, in addition to complying with the ruling, at a cost surpassing Col\$30 billion, the city is carrying out the resettlement process of more than 3,000 families because the area is still declared a high-risk area.

5.2. COLOMBIAN CITIZENS AND RISK MANAGEMENT

The configuration of risk conditions in a country is largely the result of decisions made by its citizens.

The disaster risk of a territory is made up mainly of the probability of losses to government assets, damages to private production infrastructure, and revenue losses for the private sector and endangerment of the lives and assets of its citizens. The decisions made by citizens about where they live, the type of homes they live in, how they protect their lives and their family circle's lives, how they invest their family patrimony, and even apparently trivial decisions such as where they take vacations determine either directly or indirectly the risk configuration of a country.

The decisions of citizens to occupy and use territories do not necessarily make them responsible for risks because the lack of options and information makes it impossible to avoid them.

Critical factors related to the lack of safe housing at affordable prices, or the lack of basic income to afford such housing, encourage the occupation of risk zones and the informal construction and use of homes. Furthermore, there are deficiencies in access to information about the hazards to which people are exposed, and as a result people cannot make objective decisions. On the other hand, elevated indices such as the Unsatisfied Basic Needs (UBN) Index and conditions of poverty make risk management a low priority for a family. Therefore, the government should guide citizens in making the best decisions in a complex socioeconomic environment and assist them in case they are affected by a disaster.

Greater levels of awareness of risk and of the responsibility for managing risk should contribute to reducing risk, or at least to con-

trolling its causes, on the part of citizens. In order to assess the levels of awareness of Colombian citizens about their own risk and their responsibility in reducing and managing risk, and in order to make recommendations for improving decision making by Colombian citizens, the World Bank conducted a nationwide evaluation. Approximately 1,150 persons of all socioeconomic levels were surveyed in eight Colombian capital cities with different risk levels. As many as 90% of interviewees have been living for more than 4 years at their current location. Box 5.1 shows the methodology and technical details of the survey. The results are analyzed in the sections below.

Box 5.1. Data sheet. Risk perception survey of Colombian citizens

Sample: 1,148 respondents

Cities: Bogota, Cali, Medellin, Barranquilla, Cartagena, Manizales, Villavicencio, and Pasto

Data collection dates: May 30 to June 15, 2011

Strata: 1 to 6 – urban population

Collection technique: home personal interviews

Respondents' profile: male and female heads of households

Age: 20 to 65 years old

Distribution of the sample:

- Bogota: 405 surveys
- Cali: 122 surveys
- Medellin: 120 surveys
- Barranquilla: 100 surveys
- Cartagena: 102 surveys
- Manizales: 100 surveys
- Pasto: 100 surveys
- Villavicencio: 100 surveys

Sampling error for the country: 2.7%

Confidence level: 95%

(Error is greater when analyzing results by city and stratum).

Source: World Bank, 2011a.

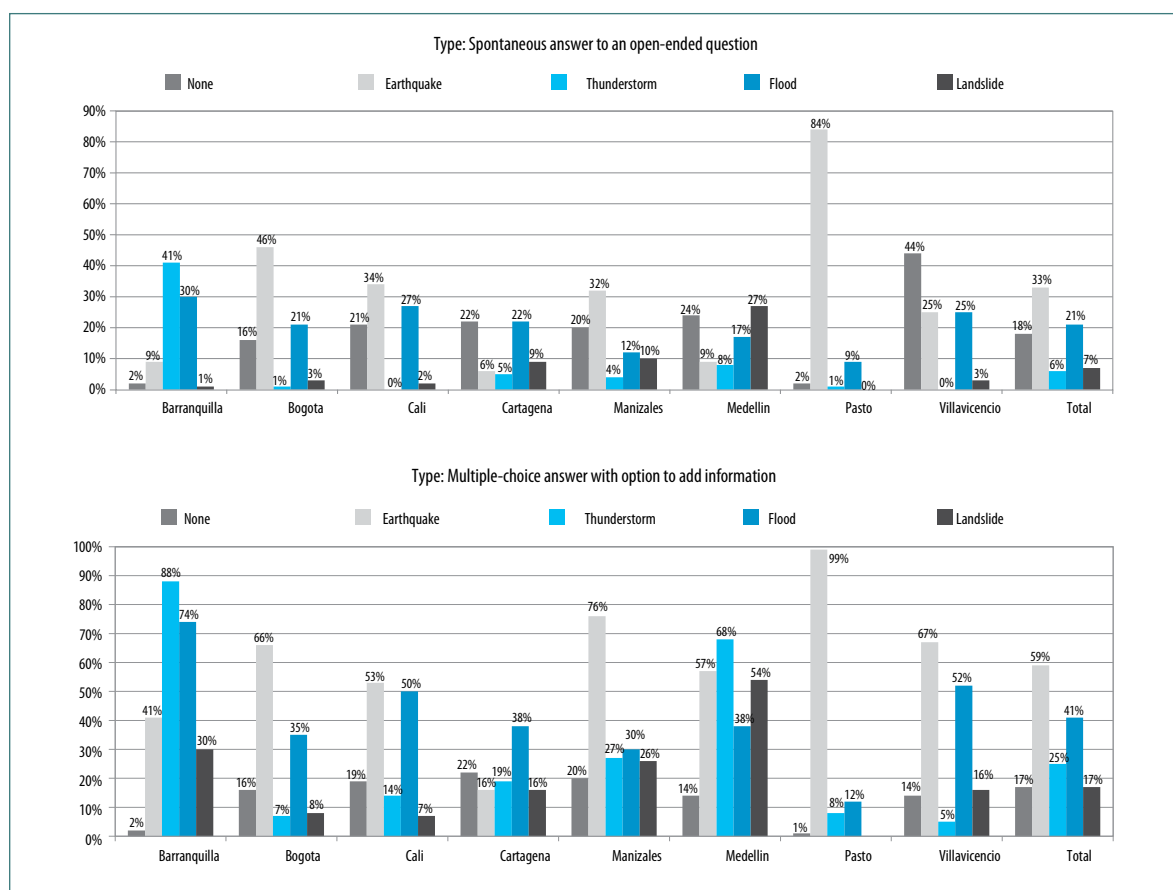
5.2.1. Citizens' perception of risk

According to the survey, 18% of Colombians do not feel exposed to any risk from natural phenomena that may endanger their lives, while 82% felt themselves threatened by a risk. Graph 5.1 shows how a high percentage of the population surveyed is aware of their risk conditions, although, according to Chapter 1 of this document, all Colombians are exposed to some type

of dangerous phenomenon. Although the Andean region population lives in a high or intermediate earthquake hazard and is also exposed to a great possibility of landslide occurrences, almost half of the people surveyed in the Andean cities do not feel threatened by seismic events. The exception is Pasto, where people have a high degree of awareness of this scenario, probably due to the frequent occurrence of the Galeras volcanic activity.

GRAPH 5.1. Perception of major hazards to which households are exposed

Question: What natural events do you feel exposed to that threaten your life in your home?



Source: World Bank, 2011a.

Sample base: 1,148 respondents.

Among the cities studied, Cali reported the lowest perceived risk to seismic events, despite being in a high-hazard area. Only 53% of respondents in Cali consider earthquakes as a hazard, compared with 67% in Villavicencio, 76% in Manizales, and 99% in Pasto, taking into account that these four cities have the same level of seismic hazard. The risk perception of respondents in Cali is even less than the levels registered in Bogota (66%) and Medellin (57%), areas with an intermediate seismic hazard level.

Awareness of other threats such as floods, storms, and landslides is closer to reality. The survey shows a high perception of flood risk in cities such as Barranquilla, Cartagena, and Villavicencio, and a high recognition of storm and gale risks in Barranquilla and Medellin. As for the landslides, the city reporting the highest risk perception is Medellin, followed by Manizales. Outcomes are consistent with geographical conditions and the number of registered events in these cities.

Only 49% of respondents say that disaster losses are increasing. This view is similar to a worldwide trend, according to the survey reported in “Frontline Vision, 2011,” and although this percentage reflects a certain level of awareness, it is not consistent with the reality of a country where losses are evidently increasing. “Frontline Vision, 2011” concludes that “57% of respondents feel that disaster losses have increased in the last five years, while 21% perceive that these have decreased” (Global Network of Civil Society Organizations for Disaster Reduction, 2011, p. 4). According to the World Bank survey, 8% of the respondents in Colombia think losses have been reduced, 24% think that losses have remained the same, while 49% believe that losses are on the rise, leaving a significant percentage of the population that is not aware of the situation. It disturbingly draws attention that this risk underestimation in Colombia is registered in a survey that was conducted during the flood caused by the La Niña 2010-2011 phenomenon, which af-

ected more than 90% of the municipalities of the country (Figure 5.2).

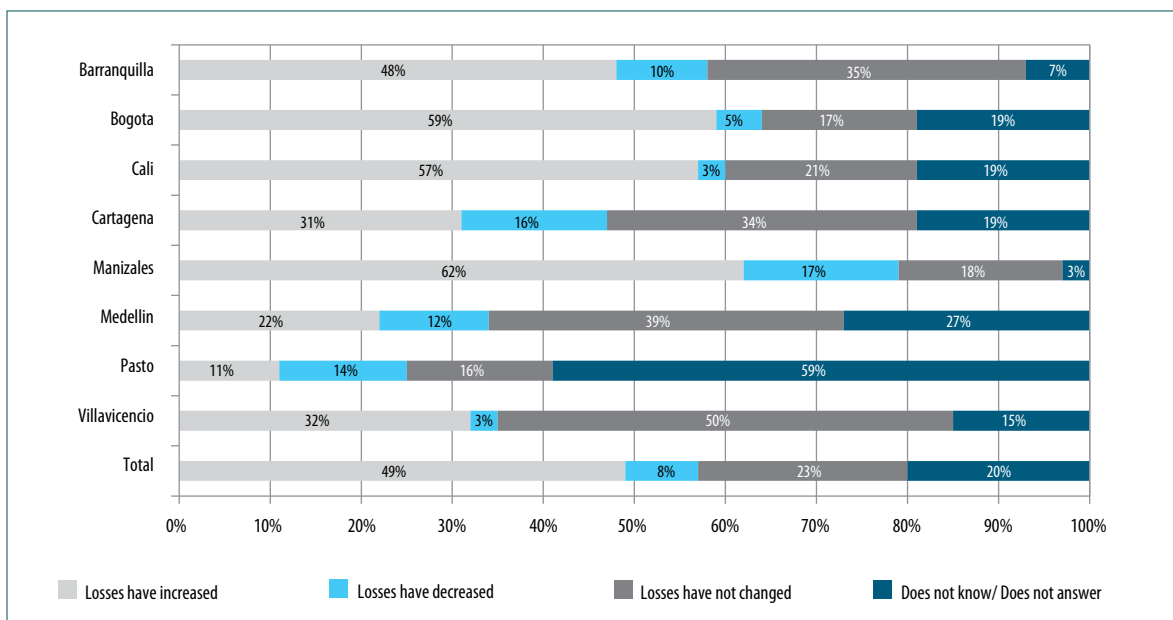
Risk perception is similar in all the socio-economic strata, although it is slightly higher in the lower strata. According to Chapter 1, the levels of risk in strata 1 and 2 are greater, especially due to unsuitable land occupation for urbanization, informal settlements, noncompliance with building standards, and social vulnerability factors in general. Accordingly, disasters in Colombia tend to produce a larger relative impact in these strata. Therefore, it is not surprising to find the highest level of risk perception among this population. On the contrary, lower levels of risk recognition are concentrated in strata 3 and 4, which may be due to the fact that minor disasters do not affect them with the same recurrence as in strata 1 and 2, whose their priorities and concerns are different from those of social groups with higher incomes (*Graph 5.3*).

Frequent exposure to events seems to explain higher levels of risk perception. The survey shows higher risk recognition of frequent hazardous events such as floods and landslides, rather than of earthquakes. The exception is Pasto, which can be explained by the high recurrence of seismic events associated with volcanic activity experienced by the city. In fact, about 40% of citizens surveyed in Bogota and Medellin does not know they are located in areas of intermediate seismic hazard, and 46% of Cali's population do not identify their exposure level to earthquakes. Ignorance of this kind of risk in most of the Andean cities surveyed is worrying, which makes relevant a clear need to promote high levels of awareness, prevention, and preparedness to achieve risk control and mitigation.

1 The “Front Line Vision, 2011” is a research and action project carried out by civil society actors along with government agencies, whose purpose is to measure progress toward implementing the Hyogo Framework for Action (HFA) at the local level in developing regions and countries.

GRAPH 5.2. Perception of losses resulting from disasters (cities)

Question: Going over the past five years, do you consider that losses suffered directly or indirectly by disasters in your area have increased, decreased, or remained the same?

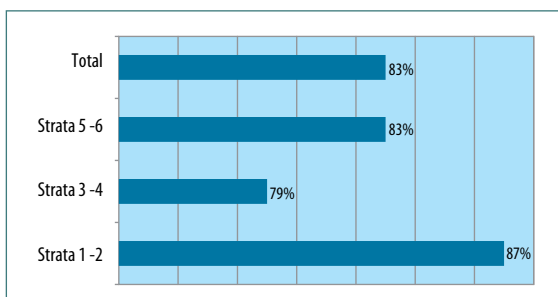


Source: World Bank, 2011a.

Sample base: 1,148 respondents.

GRAPH 5.3. Perception of losses resulting from disasters (strata)

Question: Going over the past five years, do you consider that losses suffered directly or indirectly caused by disasters in your area have increased?



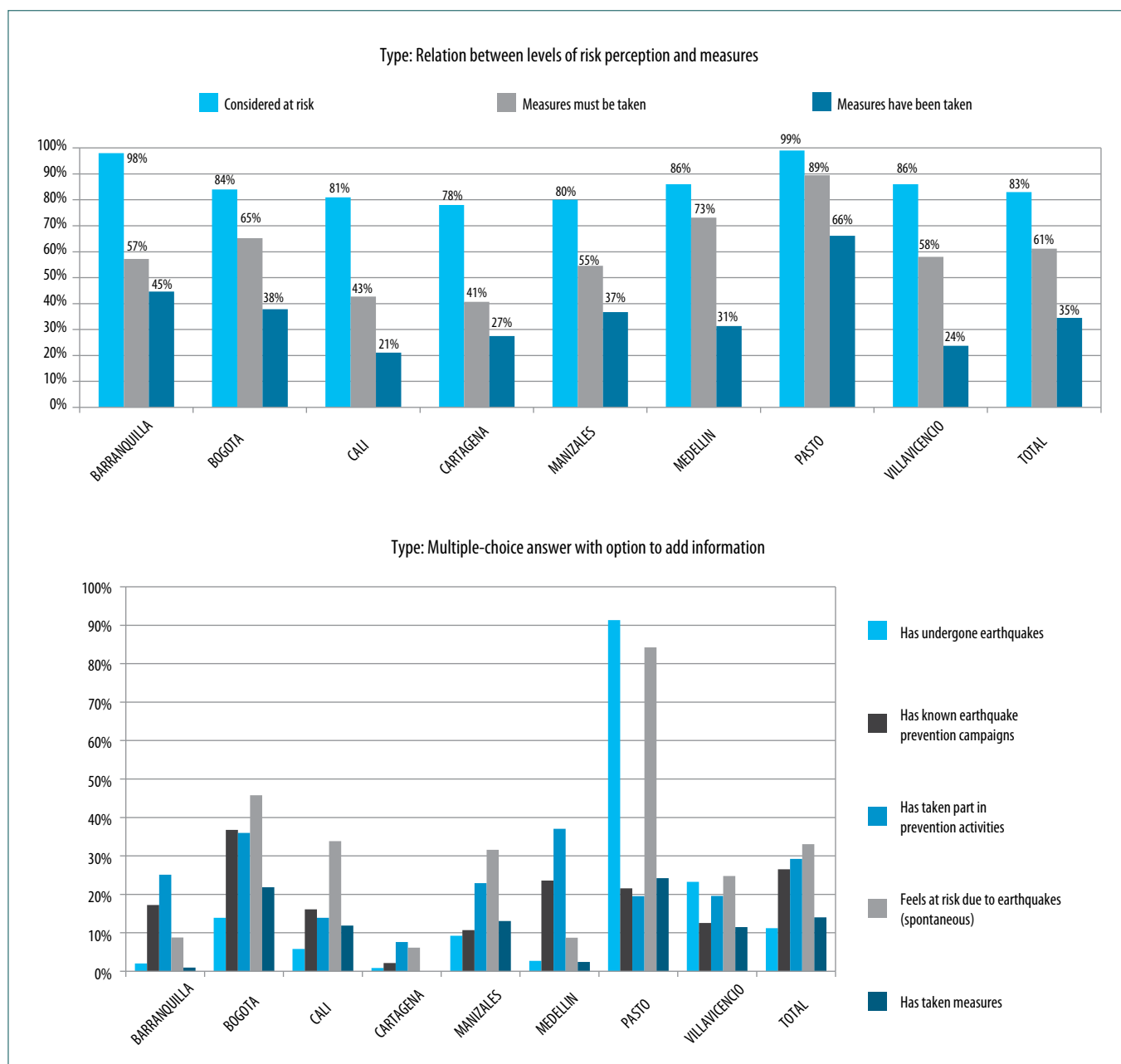
Source: World Bank, 2011a.

Sample base: 1,148 respondents.

5.2.2. The perception of citizens and the Government's responsibility

While 83% of Colombians surveyed feel at risk from natural hazards, only 61% believe they should take steps to reduce it, and only 35% are reported having done so. In every city, there is a significant gap between the percentage of households that are considered at risk and the percentage of people that have taken any step toward risk management. This means that with appropriate awareness campaigns, proper information management, and incentives, there is a great potential for reducing risk in Colombia, since it is expected that if the majority of the population has greater clarity about disaster risk concepts, this population will take actions to mitigate risk (Graph 5.4).

GRAPH 5.4. Relationships among taking measures, risk perception, and other variables



Source: World Bank, 2011a.

Sample base: 1,148 respondents.

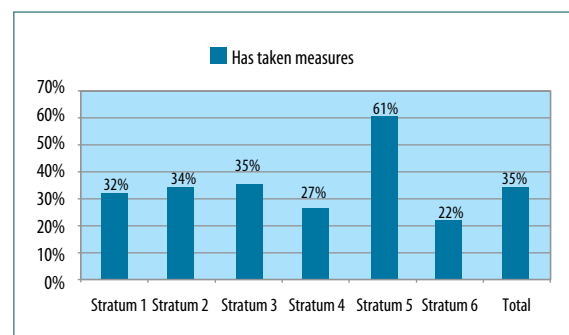
The survey shows that risk perception itself is associated with prior exposure to disaster events, awareness campaigns, and participation in prevention activities. The graph presented below shows that levels of risk perception can be explained by the historical memory and exposure to disaster events. Thus, cities with a high occurrence of earthquakes, such as Pasto, have broader measures of risk perception than cities such as Cali and Bogota, where these events occur less frequently. The graph also shows that cities like Bogota and Manizales, where respondents report higher levels of recall of awareness campaigns and participation in prevention activities (such as drills, brigade organization, etc.), reveal higher values of risk perception. The exception seems to be Medellin, where despite reporting campaigns and prevention activities, the percentage of perceived seismic risk remains low.

There seems to be a direct relationship between the perceived risk and the measures taken for its reduction. In cities where there exist medium or high seismic risk situations, between 30% and 50% of the population who feel exposed to risk say they have taken steps to reduce their risk. The percentage of families reporting the implementation of measures to reduce their risk is more or less the same for every social stratum, where strata 5 and 6 distance themselves from the average with positive trends. Stratum 5 evidently is more active in managing their risk, while stratum 6 reports less activity. Several hypotheses arise in explaining this behavior, which should only be evaluated with a more extensive study (Graph 5.5).

Citizens' decision to implement actions in order to reduce risk is not enough for effective risk management, so there is a need for them to receive advice on how to guide their intervention. Bogota and Pasto indicate a higher percentage of families who took measures to reduce seismic risk. However, the quality of the reaction reported in each city seems to be different, as shown in

Graph 5.6. The level of detail of the knowledge of risk management actions in both cities is different, because 76% of the population in Pasto, who have reported having taken measures, failed to specify what type of measures were taken. In comparison, only 25% of the population in Bogota did not respond to that question. Moreover, the actions implemented in Bogota were more effective than those developed in Pasto. While Pasto reported that 5% have insurance and activities such as "protecting the children" or "listening to the early warning systems", strategies taken in Bogota were more specific and indicate prior planning. Some 13% of the population in Bogota has insurance, is equipped with an "emergency kit," and is aware of "evacuation routes" and "meeting points." This situation implies that citizens in Bogota have greater clarity on how to respond to a seismic event, despite not being exposed to the same frequency as Pasto's population. This graph also indicates that Bogota's citizens have had more contact with awareness campaigns such as "Bogota with its feet on the ground", with its "six masterstrokes" that provided training on preventive measures. These strategies explain the difference between the two cities in knowledge and clarity of the subject.

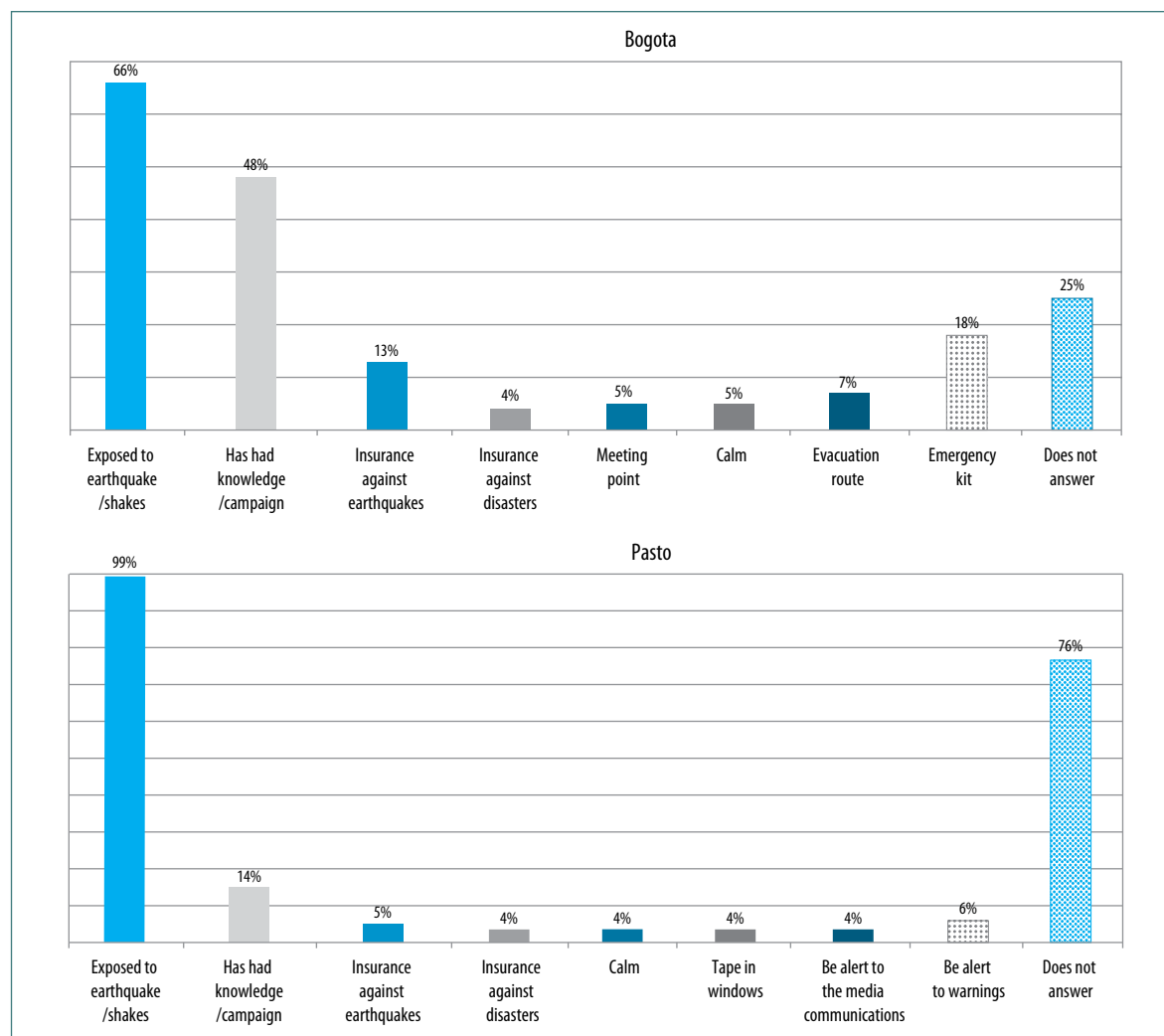
GRAPH 5.5. Taking measures to reduce disaster risk by socioeconomic stratum



Source: World Bank, 2011a.

Sample base: 1,148 respondents.

GRAPH 5.6. Types of measures for earthquake risk reduction as reported by the citizens of Bogota and Pasto

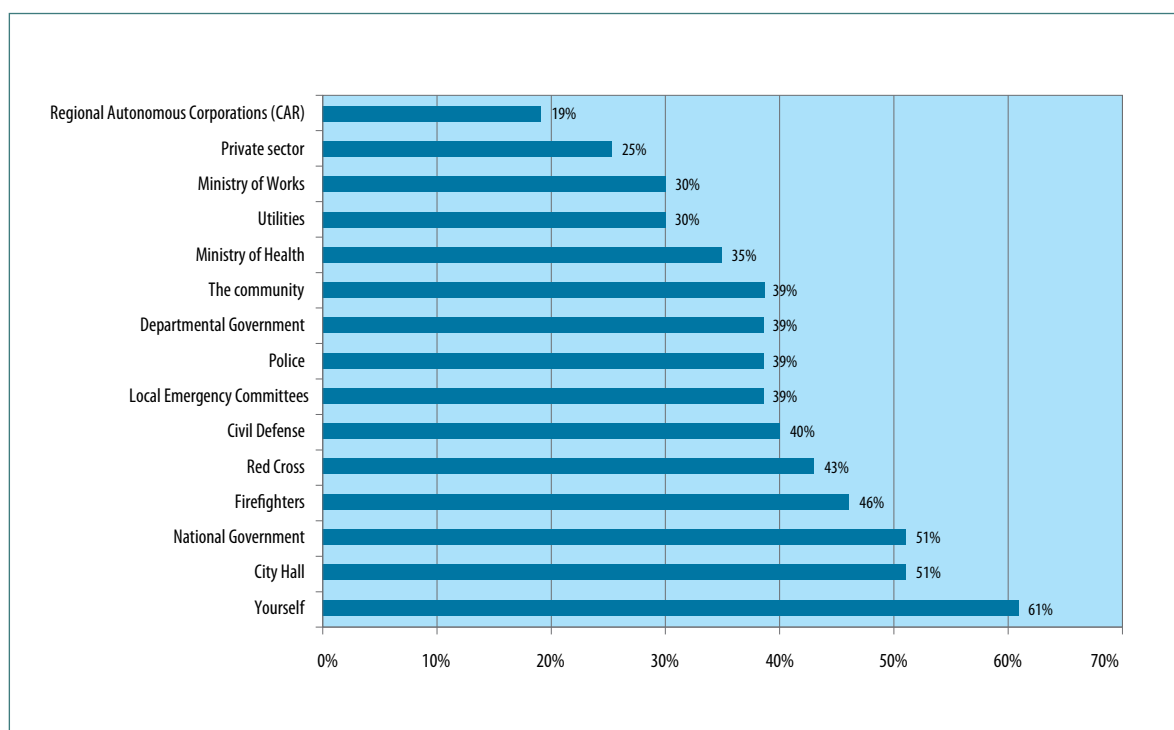


Source: World Bank, 2011a.

The survey indicates that apart from the citizens' lack of clarity on facing their responsibility in risk reduction, about 40% of Colombians believe that other agents should be responsible for implementing intervention measures. Some 61% of the respondents believed that they should take steps to reduce their risk and that this task should be accompanied by the national government and relief agencies. However, the remaining 39% thought that the responsibility falls entirely on the government and relief agencies, and it is not their obligation to intervene. It is particularly interesting that in Cali, located in a high seismic

hazard zone, only 45% of the surveyed population consider themselves responsible for taking measures to reduce risk. Cartagena, which is in a low seismic hazard zone, has a similar percentage. In the case of Cali, where there have not been many prevention campaigns, levels of knowledge and recall of these strategies have been higher than those of Bogota over the past five years. Consequently, variables such as the quality of the campaigns, their duration, and the economic situation of the city, among other factors, should be examined so as to design an effective and sustainable strategy for risk reduction (Graph 5.7).

GRAPH 5.7. Social agents responsible for taking prevention and/or assistance measures



Source: World Bank, 2011a.

Sample base: 1,148 respondents.

The citizens' willingness to participate in disaster management activities is much greater than the opportunities offered to do so, so public entities and civil society organizations have a great mechanism that so far has been underutilized. Although only 26% of the respondents reported having engaged in activities in disaster risk management (drills, brigades, committees, etc.), 72% expressed their willingness to participate. The latter figure is very similar to the percentage of citizens who indicate feeling threatened by some kind of event and it reflects the sense of mutual responsibility and willingness to contribute. The highest participation in such activities appears to occur in cities where historically there have been more programs for the population to participate in. This demon-

strates that there is a far greater capacity to offer citizen participation programs in risk reduction than what is currently presented. The challenge to public and private entities is the design and coordination of such programs.

A significant number of Colombians surveyed consider themselves mutually responsible for their risk to natural disaster events and are willing to take action, but require information to guide their actions and take participation opportunities. Therefore, it is necessary to strengthen the transmission and the quality of awareness campaigns and risk reduction programs, as well as preparation for emergency response involving citizen participation. Drills, brigades, and response plans are a fundamental part of these programs.

Box 5.2. Few Colombians consider insurance as a measure to reduce disaster risk

- Between 50% and 60% of life and property insurance in Colombia is the result of mandatory compliance, life insurance penetration being higher than housing insurance penetration. According to the survey, about 30% of Colombian households have a member with life insurance, and about 20% have two members with this insurance. However, they report that only in half of the cases the life insurance was taken voluntarily, in contrast to the other half, in which the insurance was considered an employer or business requisite. Moreover, as far as housing, the survey coincides with Fasecolda's figures (2011) in that 13% of homes are insured (from the more than 8 million homes that exist in Colombia) and more than half of the insurance policies are mandatory, since these are associated with a mortgage.

| Earthquake insurance figures, 2010 | | | |
|------------------------------------|--|---|---------------------------------|
| Field | Premiums issued (thousand of Col\$) | Average premiums (thousand of Col\$) | Number of insurance policies |
| Earthquake | \$477,086,716 | \$374 | 1,277,283.65 |
| | | Approximate number of risks | 1,277,283.65 |
| | | Number of mortgages (December 2010) | 785,563.00 |
| Percentage of insurance policies | Mortgages | | 61.35% |
| | Voluntary | | 38.65% |

Source: Fasecolda, 2011.

- Overall, Colombians do not consider property insurance as an attractive alternative to protect themselves against disasters. This is evidenced by the low market penetration of housing insurance. In addition, in the World Bank survey, the insurance option was chosen by less than 10% of respondents as an alternative, since they were aware that their house was at risk.
- Accessibility to housing insurance seems to explain part of the greater penetration of this class of insurance in other countries. In Chile and other places with higher market insurance penetration, there are very aggressive strategies, where the policies are offered in banks and supermarkets. Similarly, in Manizales, a voluntary housing insurance offer, through the property tax bill, initially generated an increase of insured homes, although it has recently decreased, probably influenced by the increased value of the property tax bill, which includes the voluntary insurance charge.

5.3. THE COLOMBIAN PRIVATE SECTOR FACING RISK MANAGEMENT

5.3.1. The private sector as risk generator and the responsibility for risk management

Entrepreneurs in the industry, infrastructure, housing, and agriculture guilds as well as public service operators are the private actors with the greatest potential to generate disaster-causing public risk and therefore, they need to take precautionary measures. Industry, transport, and public services in general may produce hazardous conditions as a result of substance use, or operation of substances, or inadequate equipment, and also may have infrastructure failures caused by natural and/or anthropic causes that affect their staff or the public. For these reasons, the different sectors, proactively, should be aware to avoid and keep under control risk resulting from their activities or infrastructure throughout the development process (construction, operation, or maintenance).

The lack of clear rules in industry, infrastructure, and service sectors has produced heterogeneous results

Decree 919 of 1989 specifically requires that industry, utilities, and infrastructure sectors carry out a mandatory analysis of vulnerabilities and the protective measures to be taken. As it has already been mentioned, Articles 8 and 9 of this Decree state that “all public or private entities responsible for public utilities, or executing large-scale civil works, industrial activities, or developing any type of dangerous or high-

risk activity, as well as those specifically set by UNGRD should perform a vulnerability analysis that considers and determines the probability of a disaster in the areas under their jurisdiction or influence, or that may be produced as a result of their activities, the capacities and availability in all aspects to address them (...), and should take applicable protective measures as a result of this vulnerability analysis.”

Although the adoption of this regulation, in most cases, has resulted in risk management measures by public and private agents, its application is not uniform, and thus requires further development. Sectors of industry, infrastructure, and public services in medium-sized and large cities in some cases count on vulnerability studies and Emergency and Contingency Plans. However, their implementation is heterogeneous, since the elements required in Decree 919 such as standards for risk assessment and prevention, minimum standards of protection, and risk monitoring have not been specified and detailed with the thoroughness required. Neither have they appointed those responsible, nor the mechanisms for monitoring and control. The exception is Bogota, which has progressed in this sense. This has been observed in the quality of its action plans, frequent drills, and the “mutual aid committees” implemented in industrial areas such as Puente Aranda, or institutional areas like 72nd Street,, although the latter area was chosen because of the terrorist attack that occurred at the Club El Nogal in February 2003. Other municipalities and the UNGRD would benefit from these relevant regulatory developments.

5.3.2. Private sector and its own risk management

5.3.2.1. Institutional and regulatory development for occupational risks is effective for workers

Life risk management of the private sector's employees, consistent with institutionality and strict regulations in professional risks, has been effective in everyday conditions, although it would be worthwhile to assess their performance in facing major disasters. The governing body of the policy in this area is the Directorate of Risk Management of the Social Protection Ministry, whose strategic instrument is the National Occupational Health Plan 2008-2012. There is also the current Professional Risk Fund to finance research, studies, and campaigns. At company level, Decree 614 of 1984 establishes the obligation of organizations to carry out Occupational Health Programs, which according to Resolution 1016 of 1989 should include, among other subjects, identification of risks in companies' facilities and activities, control and monitoring of the existing risk, and an emergency plan. Additionally, in terms of institutions, there is the Colombian Safety Council as a private trade organization and leader in the field. Thus, the performance of private companies, accompanied by institutional and regulatory developments, finds Colombia being well evaluated by international standards. However, since high-impact events do not occur often, there is no information on the performance of emergency plans, so the evaluations should be made through drills.

5.3.2.2. An important part of the physical infrastructure of the production sector is at risk

There is no data on risk management in the service and productive infrastructure of the private sector. Therefore, infrastructure built

before 1984, the year in which the Seismic Resistance Regulation was issued, is one of the most concerning issues. It is expected that the infrastructure constructed after the Seismic Resistant Building Code of 1984 counts on adequate seismic-resistant standards. However, prior construction should have had very varied specifications. It is highly recommended that the production and services infrastructure built before 1984 be evaluated and strengthened where necessary, taking into account the direct and indirect consequences if these are affected and the potential impact it could have on society and the economy. While some industries have done so in a timely manner, no information exists for the entire country to be able to reach conclusions. There are some advances in the field, according to the provisions of the Seismic Resistance Regulation, mainly for essential buildings and those that provide services to the community, such as schools and emergency, and health facilities.

The insurance market for property and trade in Colombia is below the levels of developed countries and those of Chile and Panama.

Insurance penetration in the nonlife (insurance other than life insurance) segment in 2009 in Colombia, including industry and commerce, housing, vehicles, and others, was 1.11% (expressed as a percentage of GDP). The country is then placed in the lower range of the region, ranging from 0.76% for Bolivia to 2.04% for Panama, which is explained by the very low contracting of home insurance. In relation to the industry and trade insurance segment, Colombia has a high penetration range if expressed as a percentage of GDP, but in terms of per capita value, it is within the region's average, but well below Chile and Panama, countries known for large insurance penetration in the industrial sector (Table 5.1).

TABLE 5.1. Insurance penetration, expressed as total value of insurance premium per capita and as percentage of GDP, by country (nonlife, industrial and commercial, and housing)

| | Nonlife ⁽¹⁾ | | | | | | | |
|----------------|-------------------------|------------|---------|------------|----------------|------------|---------------|------------|
| | Property ⁽²⁾ | | | | | | Total nonlife | |
| | Industry and trade | | Housing | | Total property | | % | Per capita |
| | % | Per capita | % | Per capita | % | Per capita | | |
| United States | 0.24 | 109.44 | 0.44 | 205.00 | 0.95 | 438.30 | 3.26 | 1,511.7 |
| United Kingdom | 0.30 | 130.21 | 0.45 | 199.36 | 0.87 | 381.50 | 2.69 | 1,174.70 |
| France | | | | | | | 2.30 | 1,057.73 |
| Canada | | | | | | | 2.24 | 1,008.81 |
| Panama | | | | | | | 2.04 | 139.35 |
| Venezuela | | | | | | | 1.97 | 224.68 |
| Germany | | | | | | | 1.93 | 856.87 |
| Argentina | 0.10 | 7.94 | 0.09 | 6.89 | 0.27 | 21.14 | 1.86 | 143.73 |
| Japan | | | | | | | 1.44 | 555.81 |
| Ecuador | | | | | | | 1.61 | 61.19 |
| Chile | | | | | 0.47 | 45.74 | 1.19 | 114.84 |
| Colombia | 0.18 | 9.08 | 0.01 | 6.68 | 0.22 | 10.90 | 1.11 | 55.64 |
| Brazil | 0.11 | 8.95 | 0.07 | 5.44 | 0.21 | 16.73 | 1.05 | 85.49 |
| Mexico | | | | | 0.23 | 18.86 | 0.84 | 67.63 |
| Bolivia | | | | | | | 0.76 | 13.44 |
| Peru | | | | | | | 0.71 | 30.64 |

¹ Nonlife segment pools all insurance except life, car, and health insurance.

² Property pools cars, transportation, theft, housing, industry and trade, and other types of insurance.

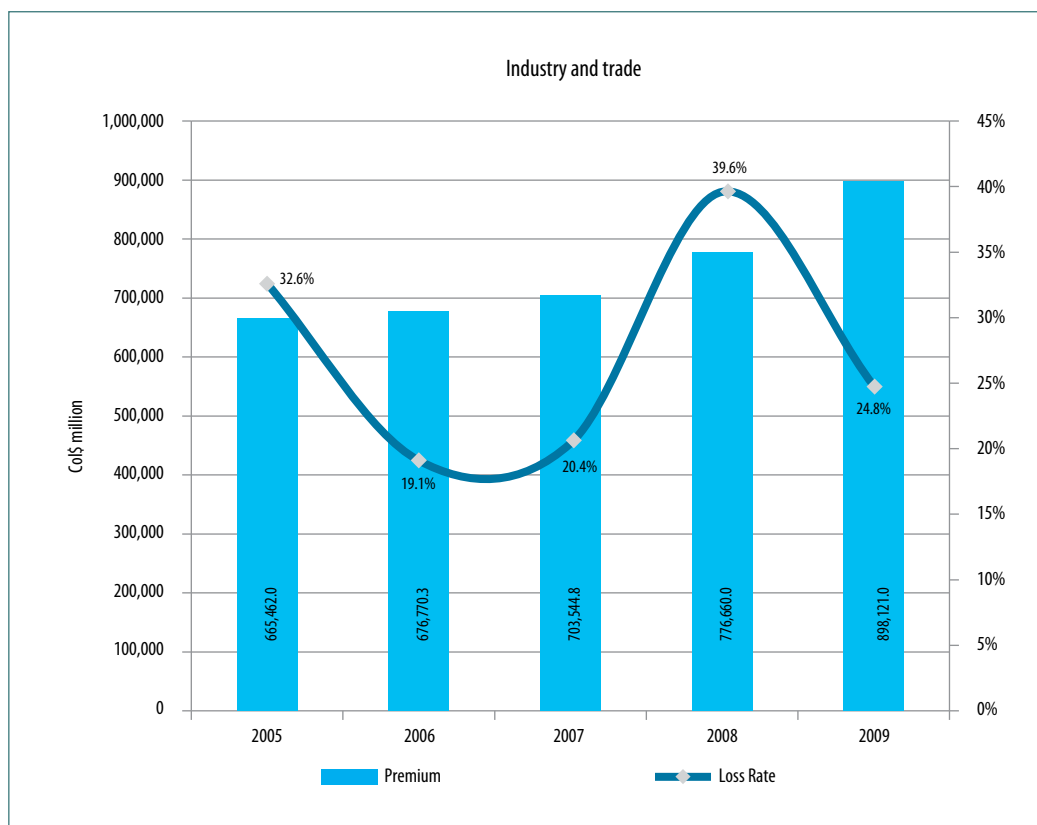
Source: AXCO, 2010.

Although insurance penetration in the industrial and trade sector is increasing, in absolute terms it remains stable when expressed as a percentage of GDP. The level of insurance policies in this sector rose by 35% between 2005 and 2009, virtually the same percentage that Colombia's GDP grew in those years. It would be desirable to identify strategies to increase the use of insurance, particularly among small and mid-size enterprises, which are those with the lowest insurance rates (Graph 5.8).

5.3.2.3. *The agriculture sector has a modest management of its risk, despite being one of the most vulnerable*

The agriculture sector is aware of its hazard levels, mainly caused by extreme weather events. However, although the sector is working on them, it does not have individual, guild, or public strategies to mitigate risk or to deal with disaster events. According to a survey conducted of the guilds affiliated with the Agricultural Society of Colombia

GRAPH 5.8. Performance of insurance penetration for industry and trade from 2005 to 2009, expressed as the total value of insurance premium



Source: AXCO, 2010.

(SAC), the risks to which they are mostly exposed are associated with extreme weather events, drought being the most common phenomenon. For dairy and livestock groups, flooding is the major impact. However, they also reported that guild capacity to address the situation is poor due to the lack of strategies to reduce risk and deal with disasters. In addition, the modest participation of the sector in the Local and Regional Committees of Disaster Prevention and Response is evident, with the exception of Asocaña, which has been particularly concerned about fire issues. Moreover, the low penetration of government programs to encourage or cofinance risk mitigation measures and the lack of public and

guild campaigns to prevent and reduce vulnerability are other critical elements registered. The survey also reports that practically agricultural insurance, despite being heavily subsidized, has very low levels of acceptance. Despite this situation, the sector is aware of the need to develop different strategies, showing interest and giving the topic the required relevance.

The strategy that the agriculture sector is building attempts to comprehensively manage disaster risk and climate change by starting from the current advances. While there is no structured strategy, many members affiliated with the SAC guilds have taken measures to reduce the risk, from which a formal strategy

can be built. The use of climate forecasts to make decisions about products to plant and planting dates is reported. Some guilds, such as coffee and sugar cane growers, show greater knowledge and experience and it is well worth being duplicated in other sectors. Some other measures used are the use of varieties resistant to thermal and water stress and the construction of reservoirs. It is noteworthy that according to the SAC, half of its members that are vulnerable to extreme weather events expect the government to support them to cope with disasters, which is logical given the tendency of the Colombian government and other countries to grant subsidies. It is therefore important to review the current programs of the Ministry of Agriculture and Rural Development, based on a more holistic and proactive approach toward reducing disaster risk. Such programs should include technological development activities, support to irrigation systems, rural land use plans, making the agrarian species more adaptable, awareness and training campaigns, and guild articulation to implement cost-effective strategies, among others. Finally, given that

disasters that affect the agriculture sector are associated with weather, it is essential and strictly necessary to link the issue of climate change and its adaptation measures.

The aim of this strategy is to include market risk, which can be effective, since insurance is part of the solution for all hazards, but progress is needed in its review, extending its coverage, and improving its disclosure. The insurance industry has developed several products to serve the agriculture sector from general crop insurance to other types of disaster events. There is insurance that is activated when there is a loss of crops, and other types of insurance that are only activated by the behavior of climatic variables. These are known as parametric insurance, since it needs no verification or the quantification of individual losses in the field. There are also financial instruments to address price volatility and currency, and many of these products can work in combination. In this context, it makes sense to include price risk management to the management and prevention strategy in the agriculture sector.

5.4. RECOMMENDATIONS TO ACHIEVE A BALANCE BETWEEN PRIVATE AND PUBLIC RESPONSIBILITY FOR RISKS AND DISASTERS

| RECOMMENDATION | PRIORITY High (H), Medium(M) | RESPONSIBLE |
|--|---------------------------------|---|
| Accurately define the public and private responsibilities for risk management and extend fiscal vulnerability reduction policies of the State in facing disasters | | |
| Adopt policy guidelines on the level of protection that the National Government and territorial entities should offer to those affected by hazardous events. | H | Presidency |
| Adjust the regulations to clarify the responsibility of the private sector in risk management and strengthen the defense of public entities to reduce state fiscal contingencies due to claims of this type. | H | All Ministries |
| From the regulations, clarify the participation forms and mechanisms of private agents in the different phases of risk management. | H | Presidency, UNGRD, DNP, Ministries |
| Promote and encourage municipal and sectoral strategies for raising awareness and capacities of the population in risk management. | H | UNGRD, Ministries, territorial entities |

Delimit public and private responsibilities for risk management and extend the Government's fiscal vulnerability reduction policies in facing disasters

Adopt clear policy guidelines on the protection level that the National Government and local authorities should offer to those affected by hazardous events. The Government should assess its ability to support people affected by a disaster, and it should previously define a policy, which should be expected of the government, to respond to the possibility of imminent disasters. It should also establish the scope of responsibility of the central government and territorial entities by promoting joint responsibility based on the subsidiarity and complementarity principles. In this way, the financial provisions required to meet obligations to those affected can be estimated. Additionally, adopting clear policies in this regard and their disclosure will allow citizens to know to what

extent the Government will be responsible in the event of a disaster. In turn, with this knowledge, citizens will be encouraged to assume responsibility for their own risks and take measures in risk prevention, mitigation, or risk transfer, according to their particular situation. Seeking for coherence and integrity, this policy should consider the following elements:

- Characteristics to describe and catalog the affected people's "evident weakness" (e.g., the condition of belonging to the poorest group of people -strata 1 and 2- has been used frequently).
- Protection offered to those affected and catalogued as "evident weakness" and what kind of support will be offered to others affected.
- Tax, financial, and other incentives to mitigate losses in the productive sector.
- Tax, financial, and others incentives to promote economic recovery.

Adjust regulations to clarify the private sector responsibility in disaster risk management, and strengthen the defense of public entities to reduce Government fiscal contingencies produced by the claims of those affected. This will facilitate the adoption of fair rulings and discourage breaching of the law in risk management. The policy adjustments could include the following:

- **Regulation should be issued that would define accurate guidelines on exclusive, solidarity, or complementarity concurrence of public and private responsibility.** Facing risk management, the responsibility normally is shared between (i) public entities, by act or omission, (ii) private actors that as part of their production activities generate risk, consciously or unconsciously, and (iii) victims or people affected, who have, consciously or unconsciously, decided willingly or unwillingly to assume the risks that later are materialized into disasters. However, most judicial complaints for risk management are addressed against public entities, although in many cases, there is third party participation, whether it is private or public, or even if the same plaintiff affected is an excluding or reducing circumstance to the Government's responsibility. Absence of rules generally leads to establishing responsibility almost exclusively on public agencies, affecting their economic or budgetary conditions. Therefore, a careful and thoughtful legal reform is advisable. In judicial proceedings against those instances, started from general, contentious administrative, or protective special actions, the reform will facilitate that both plaintiff as well as judicial courts may call to the proceedings other possible risk event generators, whether they be private or public entities. This possibility shall open the space to define if there are, and under what circumstances exclusive, solidarity, or concurrent conditions of responsibility in favor of the State, and also the possibility of filing judicial actions against public servants accountable for their actions.
- **Regulations stating, as clearly as possible, the functioning fields of competence of public agencies in risk management.** An important aspect, in legal disputes over the State's responsibility, is the definition of the content, scope, and limits of the powers that correspond to each of the public entities involved directly or indirectly in risk management. Thus, it is imperative that the law governing the subject be especially clear when it comes to processes in which sequentially different state agencies participate.
- **Regulations setting out precisely the ways to establish and derive State and private responsibility, and as far as possible, eliminate the uncertainty about the power of judicial interpretation.** There is a need for legal rules that define the ways to establish the State's responsibility with all the requirements and conditions. Jurisprudential and doctrinal interpretations may be used, but considering that in terms of risk management, there are both public and private factors that establish the concurrence of responsibility among multiple entities. This will determine, for example, that in case of gross negligence or willful misconduct by private agents in their risk responsibilities, they shall be the people who should assume the entire cost of damages.
- **A legislation which confirms and clarifies those responsible for the physical protection of constructions.** Advance toward a regulation that will establish the responsibility of the Urban Curators, who prior to issuing the license or authorization acts, will require the compliance with technical construction standards in terms of Decree 564 of 2006, Article 49, and the provisions of Law 400 of 1997, Decree 33 of 1998, and other related norms.

- **Mandatory legal rules regarding financial protection applied to both public and private sectors.** Assess cases in which individuals may be forced to define strategies for insurance or other financial protection mechanisms similar to those existing in regulation of the common areas in condominiums.
- **Modification of the person's rights and obligations in risk reduction and management in the Statutory Law.** Assign citizens the responsibility of knowing and managing the risk they are exposed to, due to the probability of a natural disaster occurrence.

Clarify, as far as regulations, the procedures and mechanisms as to how private agents participate in the different phases of risk management. The current system provides the intervention of private agents in risk management, but with insufficient development and lacking the conditions to apply it. This could include the following elements:

- Obligations of private and public agents in the preventive phase, as referred to in Articles 8 and 9 of Decree 919 of 1989 or in dealing with the results of damages, which with the exception of the partial development of Bogota have not been used.
- Specific modifications in Statutory Law in regards to citizen participation in risk management that take into account that every individual should “act in accordance to the principle of social solidarity and carry out humanitarian deeds where there exist life-threatening situations or those endangering the health of the population” (numeral 2, Article 95 of the Constitution).
- Design and implement a strategy where the State, the insurance sector, and the private sector are included in order to reinforce insurance penetration in Colombia. This should be done in order to increase insurance coverage among individuals as well as coverage in the private sector. The strategy may include State incentives, but the insurance sector should be responsible for increasing and offering the availability of its products.

Promote and incentivize municipal and sectoral strategies to make the population aware and competent in risk management. Section 5.2 of this chapter refers to how the levels of awareness and knowledge about alternatives for risk management are highly related to effective management by the community, while in the sectors, the low values in perception of risk management is associated with lack of alternatives to do so. Take advantage of the citizens' readiness to contribute and advance in awareness and knowledge in risk management using cost-effective measures to reduce risk to the nation, which the State can implement by:

- Developing awareness campaigns, mainly in those cities that have high risk levels, versus those where hazards are scarce; likewise, in cities or towns where these risks are more frequent in order to strengthen the appropriation level of the campaigns. Clarify public and private responsibility, especially evaluating vulnerability in each home and disclosing clear and effective risk reduction recommendations.
- Implementing risk management programs jointly with the community. These should have real and sustainable impacts and have to include risk prevention strategies and disaster preparation (drills and brigades). They have to achieve effective risk reduction, so the participants will have a greater awareness and knowledge of these risks.
- Accompanying the guilds in designing risk management strategies to inform and train their members, promoting measures to mitigate existing risks, and reinforcing coordination in decision making. Thus, the guilds can influence their members on how to reduce risk, so it can consequently be mitigated in the sector as well as in the country in general.



Panorama of the Tumaco (Nariño - Colombia) municipality, 2009. Photography: Colombian Ocean Commission.

Final Conclusions and Recommendations to Strengthen Disaster Risk Management

Ana Campos G., Niels Holm-Nielsen, Carolina Díaz G.,
Diana M. Rubiano V., Carlos R. Costa P.,
Fernando Ramírez C., Eric Dickson

6



Although the scope of this study is fairly broad, the dimensions of the subject have not permitted a more exhaustive and detailed evaluation of the different risk management processes (awareness, risk reduction, and disaster management), diverse phenomena (geological and hydrometeorological), and sectoral and territorial realities (municipalities and departments by categories). In this context, the conclusions and recommendations in the *Analysis of Disaster Risk Management in Colombia* can only be taken as the most exceptional aspects from the point of view of the authors and the persons interviewed and surveyed. From these opinions and relevant information, elements have been extracted that will help strengthen risk management in the country. In the measure that its implementation advances, more specific studies will be required so that these may be adapted to each sector or territory without misplacing a comprehensive and holistic approach and acknowledge explicitly the need to

articulate it in priority spheres such as adaptation to climate change, environmental sustainability, and development.

Achieving improvement and effective consolidation in risk management as a public policy required that the analysis would be critical and at the same time offering proposals. In this regard, commentaries regarding existing gaps and limitations should be understood as they were formulated, taking into account that they are an invitation and a suggestion to improve disaster risk management permanently. Hence, the World Bank is willing to provide any support required by the country and to provide continuity to the efforts that have been jointly developed during the last 12 years.

The report shows four factors that explain the increase in disaster risk and it points out that this increase is more due to inappropriate territorial, sectoral, and private management than to external factors such as climate change.

1 The conceptual advances in the relationship between risk management and development have not been raised to the level of State policy, nor have they been incorporated as an integral part of the public administration, thus contributing to the growth of risk conditions.

Despite Colombia's long history in organizing and designing risk¹ management instruments, the conceptual advances achieved and the efforts carried out to update the System with this information have failed to permeate government practices. The materialization of risk reduction policies, cross-cutting in both sectors and territories, require surmounting the reactive tendency to disasters. There is no national policy on disaster risk management and as a consequence, the Government's actions in

this matter have been addressed by planning instruments such as the National Plan for Disaster Prevention and Response (PNPAD) and some Conpes documents. However, the guidelines and contents of these instruments have been ineffective in their implementation.

¹ National System for Disaster Prevention and Response (1985), National Plan for Disaster Prevention and Response (1999), Conpes Document (2001).

There has been progress in incorporating risk management in the instruments guiding planning and furnishing it with political significance. Despite this, the fulfillment of commitments is deficient and disarticulated. Since the PNPAD formulation, the subject has been incorporated into the Development Plans (PD) of the last four presidential terms, putting emphasis on risk knowledge, strengthening the system, reducing fiscal vulnerability, and risk transfer. However, although the description of the activities and challenges is quite clear and consistent with the needs, the definition of goals and indicators established for each one of these axes do not reflect the scope proposed and only sets aside partial coverage of the proposals outlined.

Observing the resources allocated to comply with the goals set at different government levels, it can be concluded that there are fundamental differences between the allocated amount and the items financed. While the nation has focused its efforts on disaster management and risk knowledge, being the main financial entity of these activities, the municipalities have carried out these activities by risk reduction, particularly in areas such as reforestation and watershed conservation which supply clean drinking water. National investment has had two growth cycles related to major disasters namely the cases of the Coffee Growing region earthquake (1999) and the La Niña phenomenon of 2010-2011. However, municipal investment shows an inverse performance, evidencing the nation's intense intervention in the reconstruction process without requiring any compensation, and thus discouraging the local authorities' responsibilities in the risk area. The departments revealed significantly lower investments from 1998 to 2010.

The existing institutions for risk management at the national level, despite their long history, show a protectionist approach and have negligible articulation with other territorial agencies. In addition, critical factors such as the following are identified: multiple functions and great responsibilities *versus* ineffectual leadership in the former Directorate for Risk Management (now UNGRD), not pertaining to sectoral or territorial levels, irregular and limited operation of advisory Committees, and the possibility of creating parallel structures in the System under a state of emergency in case of a severe public catastrophe. Overall, poor backing in territorial risk management from the majority of governorships and the CAR is due to the divergence in interpreting current regulations. This conclusion has been reflected in the weak incorporation of the subject in the Regional Land Use Plans (POT) and Land Use Planning and Watershed Management (POMCA).

Seismic hazard management has strengths, since it has stronger legal and institutional instruments that define acceptable risk levels, scope of studies and designs, and the roles and responsibilities of public and private actors. For nearly twenty years, the seismic subject has incorporated seismic resistance standards set by established criteria in carrying out microzoning studies, and setting minimum requirements and those responsible for the design, construction, and technical supervision of new buildings and reinforcing the existing ones. This situation does not occur at the same level of detail in the cases of floods and landslides in view of the growing number of impacts caused by these phenomena.

2 Risk is accumulating permanently in cities and in rural areas due to the lack of implementation, monitoring of municipal land use planning policies and instruments, and inadequate watershed management.

Planning in Colombia faces the challenge of articulating various existing instruments, especially those related to environmental and territorial management, such as the POMCA, the POT, and the PD, at municipal and departmental levels.

Having a consistent and updated diagnosis (including the institutional, organizational, regulation, and financial framework for risk management and information on specific risk conditions) is the starting point for the planning process. Subsequently, there should be an integration of risk management with other dimensions of development. Policies, strategies, and especially priority programs should be defined within the annual investment plan, ensuring that goals and indicators are set in order to facilitate monitoring and control activities. These elements should be incorporated into the POMCA as instruments with greater hierarchy and scale in watersheds, and more specifically addressed to the POT and incorporated into the PD to assure investment. Therefore, overcoming the current disarticulation of planning instruments is a critical step in disaster risk management. This would allow the integration of policies, prioritization of investments, and the strengthening of mechanisms for monitoring and control.

The ambiguity in regional competencies in planning and land use planning increases risk.

Whereas there is no single authority in regional planning or a balanced system that integrates the instruments of different character and level, municipal risk growth in both urban and rural areas is the result of decisions and actions related to disarticulated territorial use and occupation by different actors. Regional planning competency is shared among the departments and the

CAR. The departments have the responsibility to guide local planning in a supramunicipal context and coordinate the formulation and implementation of the PD and the Departmental Water Plans (PDA). In turn, the CAR have the authority to (i) formulate planning and watershed management instruments, which may not always coincide with departmental boundaries; (ii) regulate the use of rural land by means of issuing licenses for the right to use water, which interferes with the constitutional duty assigned to the municipalities to regulate land use; and (iii) approve the environmental proposals of the municipalities' POT that the CAR rarely review when granting licenses. In so far as planning, land use planning, and rural land use, these are loosely referred to in the POT, so the decisions are left to the CAR, or they are made at a national sectoral level. The regional territorial management responsibility is diluted among the various actors, not only nationally and regionally, but also among private entities involved in the geographic area.

There are factors associated with policies, territorial planning, and control mechanisms that are affecting the way in which risks have been shaped and emergencies and disasters have taken place in the history of the country's cities.

Some of the factors contributing to the above are weak planning, lack of control policies, land speculation, monopolization of construction materials and supplies, and the particularities in the administration of local territories, which only had competence over land use until the 1991 Constitution. On the one hand, the needs of land occupation, under an unplanned city model, necessitate overcoming the natural

limits of habitability, demanding greater interaction to achieve stability. On the other hand, the absence of an urban-regional land policy and the belated interventions regulation and control influence a disarticulated expansion process that affects territorial reality in biophysical, social, and economic terms. This is evidenced through spontaneous participation, plot by plot, and making clear the difficulty of responding with effective housing solutions and in providing more and better public facilities. In addition, activities related to the exploitation of building materials without planning, control, and proper recovery have greatly contributed to instability in hillside areas and to environmental degradation, especially in the outskirts of the cities.

A high exposure to diverse and potentially dangerous phenomena has been identified in Colombian cities. There has been a gradual increase in the occupation of areas that are unsuitable for ensuring sustainable development. As a result, the population is under elevated hazard levels. However, in addition to spatial exclusion factors, economic and social exclusion factors are also observed, which are found to correlate to an accumulation of risk conditions. Municipal government agencies are expected to respond to variations in the quality of life, both in urban and in rural areas. However, many of these agencies are not prepared to meet the basic needs of their inhabitants with regard to housing, employment, availability of utilities, education, health services, and transportation (*Díaz, 2007*). Indicators such as the Unsatisfied Basic Needs (UBN) Index and the Poverty Line Index, or overcrowding levels, support the aforementioned statements. Furthermore, the quantitative and qualitative housing deficit is concentrated on the poorest classes, which gives rise to a vicious cycle regarding access to adequate and safe housing for the most vulnerable population groups.

In some cities in the country, accumulation of risk has been observed in formal construction areas as well as in upper-class areas. Environmental problems generated by land speculation and conflicting uses within suburbanization processes have been revealed.² In Medellín, Cali, and the Bogota Savannah, there have been emergencies in formal construction areas, which implies that risk is created not only in illegal settlements built without appropriate construction techniques, but also in developments that have not undergone any type of local or regional planning. Additionally, the desire for economic gain by landowners has taken precedence over the planning and investment required for preparing and installing the service infrastructure and equipment needed for construction in suburban areas.

Colombian municipalities show a growing trend in disaster occurrence, although in some cases, progress has been made in significantly reducing their impact and frequency. Biophysical and geographical factors in municipalities that determine vulnerability to certain types of hazards, along with inadequate procedures for territorial intervention, marginal human settlements, and social and economic segregation, generate numerous vulnerabilities, which have had disastrous consequences throughout the history of Colombian cities. Cases such as Cali, Medellín, Cucuta, or Barranquilla show that the risk factors in the cities are cumulating and taking shape in a greater number of events and damage concentration. In other cases, such as Manizales and Bogota, due to the risk management actions, the impacts associated with disasters have diminished, but there are still critical conditions that demand the

2 Known as the growth processes of cities, through which suburban areas are created. From the spatial point of view, these areas are adjacent to spaces where urban building is continuous, and they are used as transitional areas between cities and rural areas, where these functions compete with each other.

sustainability of such policies. In general, special category municipalities have an immense capacity in incorporating risk management in planning, finance, and execution, while those that are in category 1 show medium competence, although in most cases they have the resources to carry out adequate territorial administrative organization. As for the municipal categories 2 to 6, these have a more critical situation due to technical, human, and financial limitations.

Land use planning is not a recent process in the country. However, its progress has not been uniform among municipalities. A negligible level of acknowledgement of hazard scenarios and their management needs, gaps in hazards and vulnerability identification, lack of articulation in investment instruments, and weaknesses in monitoring and control mechanisms confronting the POT implementation are some of the obstacles that reduce the effective incorporation of risk management in land use planning. Specifically, the situation is more critical in municipalities in categories 2 to 6, given their low technical competence, thus requiring backup of appropriate incorporation of risk management in the POT³).

Municipal Development Plans are instruments that allow moving from policy to risk management practice, guiding the territorial planning and, in turn, executing the necessary actions. The PD have a political makeup, so that the incorporation of risk management requires a consensus process with different social agents. Starting from a technical assessment prepared and properly updated, the preventive, corrective, and reactive actions for risks are defined and should be integrated into the annual investment plans through policies, strategies, and programs, using their corresponding monitoring and control system. In turn, municipalities in categories 2 to 6 state the need to strengthen the use and effectiveness of this planning instrument, by

targeting technical criteria, having the awareness that will allow continuity at the political level, and the budgetary provision to ensure comprehensive disaster risk management.

Financing and investment instruments in risk management are rarely used and the resources basically correspond to the current revenues of the municipalities (37%), followed by transfers from the General Participation System (SGP) (21.1%). The cities that invested in risk management between 2002 and 2008 were Bogota, Medellin, and Manizales, amounting approximately to 43% of the total investment at the municipal level⁴. The per capita investment in risk management in Bogota averaged Col\$21,238, and in Manizales it was Col\$16,981. Likewise, Medellin invested during that period Col\$14,712 per capita, and Cali Col\$10,713, in contrast with cities like Barranquilla, where the per capita investment amounted to only Col\$5,278. Specifically, the amounts for the last two cities in risk management did not have significant impacts; in addition to being minor in comparison to other urban centers in the same category, the investment was disarticulated and scattered.

Apart from the weakness in incorporating risk management into territorial planning, there is the absence of real articulation with environmental instruments, where the POMCA should provide guidelines for the preparation of municipal POT and comprehensive watershed analysis. The 83 POMCA adopted at the time of the PND 2010-2014 formulation are long-term plans, have their own watershed analysis, use scenarios and

3 Therefore, efforts have been made through the Fiscal Vulnerability Reduction Program to Natural Disasters, where the national government between 2006 and 2011 provided technical assistance to 792 municipalities (equivalent to 72% of municipalities) for the inclusion of risk analysis in the municipal land use planning (POT) and municipal PD, of which 379 municipalities already have an action plan. In addition, 36 municipalities have hazard and/or risk zoning studies.

guidelines for their management and administration, but have not yet adequately incorporated the risk management component. Most of the POMCA only describe the types of phenomena currently existing in watersheds without exposing a special analysis of hazards and much less of risks, so the

contribution offered to land use is very limited. It is therefore a priority to promote a comprehensive perspective between risk management and environmental management to complement the efforts and initiatives associated with natural phenomenon risk control and management.

3 The gaps in the field of disaster risk management policies and sectoral plans threaten the sustainability of investments, both in productive and in service sectors, thus contributing to increased exposure and vulnerability.

Institutional and sector-specific capacity in risk management is heterogeneous and quite limited. Although regulations such as Decree 919 of 1989 and the Conpes Document 3146 request the creation of agencies with specific functions for risk management in several Ministries, the only national sectoral entities that have disaster prevention and response offices are Invias, the Department of Water and Sanitation, and the Ministry of Health and Social Protection. Currently, the Ministry of Agriculture and Rural Development is seeking alternatives to create an Agrarian Risk Management Department and the Ministry of Environment and Sustainable Development has also considered the possibility of establishing a department for disaster prevention and response.

The role of municipalities and departments in the implementation of sectoral policies is essential, since they are administrators of their territory, responsible for providing public services and risk management. The lack of policies and instruments for risk management in the different sectors as well as support, complementarity, and competency transfer strategies to local authorities may be considered as some of the main factors in producing risks. For example, according to Law 136 of 1994, regarding hous-

ing, municipalities are required to regulate land use, and control and inspect construction and the sale of residential properties. However, only 35 cities have Urban Curators and about 90% of Colombian municipalities (categories 5 and 6) do not have trained personnel or resources to perform these tasks properly. As for the transportation sector, municipalities are responsible for the tertiary network, which generally has the greatest vulnerabilities.

There have been major developments in the availability of information in the fields of energy and education, while other areas show limited risk knowledge, which is a key element in designing sectoral policies. The energy sector offers real-time information on hydroelectric reservoir levels and weather forecasts, resulting in making timely decisions to avoid service shortages. In relation to the education sphere, an infrastructure inventory is being processed. It has defined mechanisms for post-emergency damage assessment, which were implemented

4 The information for the investment analysis in disaster risk management for this publication is supported by the databases provided by the DNP with the Sustainable Territorial Development Directorate (DDTS), which include the data investment made.

in the census of the damages caused by the La Niña 2010-2011 phenomenon and have shown to be valuable instruments that provide a timely response to this sector's needs during the last emergency. In other areas, the availability of systematic and prior information at a detailed level required to make decisions is limited.

Unfortunately, in other sectors the lack of application of technical and design standards to ensure proper location and quality of infrastructure is influencing the systems' vulnerability. Weak technical regulation and mechanisms that allow incorporating security criteria from the projects' prefeasibility as well as the infrastructure design, construction, and operation of different services and production systems generate risk conditions. This is especially critical in road systems, safe drinking water, and sanitation. The weather conditions of the country, its difficult topography, and the young geology of the Andes are very demanding, but the real causes of the disaster impacts in the road infrastructure are its design, and prevention and maintenance deficiencies.

The increase and accumulation of vulnerability of the residential buildings facing hazardous phenomena in Colombia is mainly due to the growth of informal housing, the breach of standards in design and construction, their location in hazardous areas, the possible presence of natural phenomena, and the lack of strategies to intervene in constructions prior to the first seismic resistance standard (1984). According to DesInventar information (OSSO-EAFIT Corporation, 2011), out of the 190,000 houses destroyed by disasters in the country during the period 1970-2011, the greatest losses were caused by floods (more than 79,000 units), while the earthquakes affected a total of 51,000 houses, landslides al-

most 18,000, volcanic eruptions 5,400, and other events such as gales and fires, 35,000. It can be concluded that 51% of residential buildings destroyed during that period (those affected by floods, landslides, and volcanic eruptions) were the result of their location in areas unsuitable for housing developments, while 26% of households destroyed (by two earthquakes) can be associated to construction deficiencies.

On the other hand, the damage caused by extreme weather conditions in the agriculture sector is due to the vulnerability of this sector when facing these conditions. This vulnerability resulted from the lack of clear responsibilities and strategies for risk reduction, as addressed in the PND 2010-2014. Thus far, the measures taken by the government to manage the impact of disasters in the agriculture sector have been more of providing a response to the effects than of work on prevention and mitigation of risk factors. The strategies implemented are supported primarily by providing direct compensation or financial relief to the affected farmers after the occurrence of the phenomena. The only measure available that could be considered as preventive is the agrarian insurance subsidy. Despite the efforts made by the government, its popularity has been very low due to insufficient disclosure of information and little awareness of the benefits of this insurance. The analysis considers that the Ministry of Agriculture and Rural Development requires the design of much more comprehensive risk reduction strategies and measures that take into account rural land use planning, the improvement of productive infrastructure, and the adaptation of agricultural species.

4 The absence of a clear policy and the background in which the State generally assumes the responsibility discourage citizens and the private sector from undertaking their role in risk reduction and management, thus incurring greater fiscal costs.

In relation to losses or damages suffered by disasters and although the Constitution assigns the State the duty to protect people “in life, honor, and property”, in case of natural or socio-natural events the Council of the State has ruled that the government can only be responsible when damage is caused by an act or omission (failure) of public entities. Under the Constitution, the authorities are set up “to protect all persons residing in Colombia, in life, honor, property, beliefs, and other rights and freedoms, and to ensure the fulfillment of the State’s and individuals’ social duties” (Article 2), which is a very broad statement and subject to interpretation. However, the Council of the State, in pronouncing judgment dated June 24, 1994, on the tragedy of the avalanche that destroyed Armero, concluded that the State may possibly have had responsibility only if the trial judge proved (i) a service failure, (ii) unlawful damages to individuals, (iii) a causal link between the failure and the damages, and (iv) the absence of grounds for exoneration such as force majeure.

Once the damages are evidenced, although triggered by a physical event of a dangerous nature, which are attributable to a failure of public entities, the State is obligated to pay compensation. Article 90 of the Constitution imperatively expresses that “the State shall be financially liable for unlawful damages attributable to it, caused by acts or omissions of public authorities.” Based on Article 13 of the Constitution, the State has on the one hand the obligation to provide solidarity protection, sometimes called humanitarian, and on the other hand it may be required to provide materially for harmful disaster consequences caused by dangerous physical phenomena, provided that the damages in full or in part,

exclusively or concurrently, have been caused by the action or omission of the State.

Despite of this State obligation, the lack of clarity in some standards, their interpretation by the courts, and weaknesses in the defense of the State, have led to controversial decisions, generating contingent liabilities and escalating the nation’s fiscal vulnerability. There are many examples where the ruling by the judges has obligated municipalities to take actions that may be considered controversial. For example, the city of Cali was condemned to bear full responsibility for the failure of a retaining wall in a stratum 6 building whose costs have exceeded Col\$10 billion. Moreover, a judge ordered the municipality of Bogota to carry out mitigation works in an area that was in the process of resettlement after it was declared as a nonmitigable high-risk zone. The compliance with this latest ruling has cost over Col\$30 billion and in addition, the resettlement of more than 3,000 families has had to continue because the area remains under risk.

In the absence of a prior policy or more important regulatory developments in assisting the affected population, the State has been forced to make decisions during various crises, which has led to differential treatment and fiscal consequences. During the rebuilding process, after the disaster in the Coffee Growing region, the fund for its reconstruction (FOREC) offered repair subsidies to all affected homes regardless of social status. This decision was later amended by a court order based on the right to life, forcing the FOREC to structurally strengthen the houses that were being repaired. Additionally, the decision to bring the affected people to temporary shelters obligated FOREC to allo-

cate subsidies for new housing to all affected families, including those that previously to the earthquake had paid rent. Government decisions regarding the response to the La Niña 2010-2011 episode are aimed primarily at the population in strata 1 and 2, and restoring services rendered by the State. Currently, these processes are being carried out by Humanitarian Colombia and the Adaptation Fund.

The private sector and civil society are not aware of their responsibility toward risk knowledge, occurrence, education, and control, forcing the Government to assume responsibilities and costs that are beyond its competence. The configuration of risk conditions of a country is largely the result of decisions made by its citizens. People choose where and what type of dwelling they inhabit, how to protect their lives and their families, and how to invest their family's patrimony; even seemingly trivial decisions, like where to take vacations, determine directly or indirectly the country's risk conditions. To evaluate Colombians' risk level awareness and their responsibility in risk reduction and management, and to make recommendations for improving their decision making, the World Bank conducted a national awareness survey within the framework of this study.

According to the survey, 18% of Colombians do not feel exposed to any risk derived from natural risk phenomena that endanger their lives, while 82% perceived themselves as threatened by some risk. Out of the Colombians who feel at risk from natural hazards, only 61% believe they should take steps to reduce it, and only 35% reported having done so. There is a tendency for greater identification and recognition of risks associated with more frequent events such as floods and landslides, in contrast to the perception people

have of seismic hazards, although their impacts have been severe for the country.

In addition to the citizens' lack of clear responsibility in risk reduction, the survey indicates that about 40% of Colombians consider that implementing intervention measures is the duty of other agents. Some 61% of respondents believe they should take steps themselves to reduce their risk and this task should be complemented by the national government's and relief agencies' actions. However, the remaining 39% considered that it is entirely the responsibility of the government and relief agencies and that it is not their obligation to intervene.

As a result of insufficient knowledge related to risk and the need to take measures, in general protection and insurance mechanisms in buildings and individual patrimony are not used, which increases pressure and public risk (fiscal vulnerability). According to Fasecolda's data (2011), only 7% of those affected by La Niña 2010-2011 had insurance. In Bogotá, only 4.5% of the condominiums are insured and in the other cities studied, this figure may be lower. In the earthquake that occurred in the Coffee Growing region (1999), only 10% of direct losses were covered by insurance.

As a result of the work carried out, six strategies and thirty activities are established to enhance governance in disaster risk management. Such strategies are aimed at consolidating government policy in disaster risk management that comprises strengthening local capacity for land management, articulating the different agents involved in watershed management, defining development sectors' responsibilities, and promoting the participation of all public and private actors, thereby contributing to reducing the State's fiscal vulnerability to disasters (*Table 6.1*).

TABLE 6.1. Recommendations to strengthen public administration in disaster risk management in Colombia

| RECOMMENDATION | RESPONSIBLE ENTITY | RELATION TO GOALS OF THE NATIONAL DEVELOPMENT PLAN 2010-2014 | CHAPS. |
|--|--|--|--------|
| <i>1. Incorporate risk management as a State policy and overcome existing imbalances in the System through the adjustment and harmonization of a regulatory and institutional framework</i> | | | |
| Adopt a national policy in disaster risk management that is integrally articulated with public administration, provides support to the territorial entities, and promotes the creation of specific policies and sectoral action plans. | Presidency, DNP, UNGRD, with the support of the National Committee for Disaster Prevention and Response /GRD | Guideline: <i>Governance best practices</i> Goal of the process: Formulate and adopt a National Policy in Disaster Risk Management and update the regulation framework and management instruments of SNPAD. | 2 |
| Create a risk management statute to harmonize the current legislation addressing the gaps identified in defining public and private responsibilities. | UNGRD with the support of National Committee for Disaster Prevention and Assistance /GRD | Goal of the process: Design second phase for the State's Fiscal Vulnerability Reduction Program Facing Disasters. | 2 |
| Reorganize the System by strengthening technical and financial management capacity at the different territorial levels and the participation of the private sector. | Presidency, DNP, UNGRD, with the support of the National Committee - PAD/GRD | Goal of the process: Formulate a policy for the reconstruction process of a declared national disaster. | 2 |
| Give priority to strategic orientation, technical direction, authority, and control of the functions performed by the National Unit for Disaster Risk Management (UNGRD) as head of the System. | Presidency | | 2 |
| <i>2. Increase the effectiveness and efficiency of risk management investments through strategic planning, coordination among territorial levels and monitoring, and control</i> | | | |
| Promote the adoption of the Territorial Risk Management Plans (PTGR) as long-term instruments to guide the POMCA, POT and PD, and articulate public, and private investments. | DNP, UNGRD, MADS, MVCT | | 2, 3 |
| Establish a national cofinancing (fund) mechanism to encourage investments in disaster risk management and generate capacities at territorial and sectoral levels. | UNGRD, MHCP, DNP | Guideline: <i>Governance best practices</i> Goal of the outcome: Improve technical capacity of the territorial entities and the CAR in disaster risk management. | 2, 3 |
| Adopt risk reduction goals in policies and plans, and ensure compliance through progressive implementation of results-based strategic planning. | UNGRD, DNP | Guideline: <i>Risk control and reduction</i> | 2 |
| Strengthen the mandatory incorporation of criteria in disaster risk management when formulating public investment projects (BPIN). | DNP | Goal of the process: Define and incorporate risk management criteria in the formulation of national public investment projects. | 2 |
| Adopt a monitoring strategy for following up on responsibilities and investments in risk management at different territorial levels. | Presidency, UNGRD, DNP | | 2, 3 |

TABLE 6.1. Recommendations to strengthen public administration in disaster risk management in Colombia (continued)

| RECOMMENDATION | RESPONSIBLE ENTITY | RELATION TO GOALS OF THE NATIONAL DEVELOPMENT PLAN 2010-2014 | CHAPS. |
|--|--|---|---------|
| <i>3. Strengthen local capacity in territorial management so as to reduce the causes and accumulation of disaster risks</i> | | | |
| Adopt a national strategy to strengthen municipal risk management that takes into account the differences in capacities. | Presidency, DNP, UNGRD, with the support of the National Committee - PAD/GRD, departmental governments | Guideline: <i>Governance best practices</i> Goal of the outcome: Improve technical capacity of the territorial entities and the CAR in disaster risk management. | 1, 2, 3 |
| Structurally review deficiencies in the capacities to assess disaster risk in order to provide an effective response to the knowledge demand for the POT and the PD. | DNP, UNGRD, MVCT, MADS Ideam, SGC, IGAC, DANE, the CAR, Colciencias, departmental governments | Guideline: <i>Improve risk awareness</i> Goal of the process: Design and implement methodological instruments for hazards, vulnerability, and risk zoning in the municipal sphere. Goal of the process: Modernization of the Integrated Information System for Disaster Prevention and Response to Disasters. Goal of the outcome: Expand monitoring networks and early warning systems, and update hazard maps. | 1, 3 |
| Strengthen departmental governments' capacities in coordinating the municipalities, defining their competencies in disaster risk management according to the principles of concurrence, and subsidiary capacities as established in the Constitution and the possibilities offered by the Organic Land Use Planning Law. | Presidency, DNP, UNGRD, with the support of the National Committee PAD/GRD, departmental governments | Guideline: <i>Governance best practices</i> Goal of the outcome: Improve technical capacity of the territorial entities and the CAR in disaster risk management. | 2 |
| Design and implement the PTGR as instruments which orient and give priority to interventions and investments in municipalities and departments. | City halls and departmental governments | Guideline: <i>Governance best practices</i> Goal of the outcome: Strengthen technical capacity of the territorial entities and the CAR in disaster risk management. | 3 |
| Formulate and implement the national policy in the intervention of settlements at risk that set the guidelines for land zoning, and define mitigation criteria and action strategies. | DNP, UNGRD, MVCT, MADS | Guidelines: <i>Governance best practices</i> Goal of the process: Formulate a policy for risk settlement intervention. Guideline: <i>Improvement of disaster risk knowledge</i> Goal of the process: Design and implement methodological instruments for hazards, vulnerability, and risk zoning in the municipal sphere. | 3 |
| Reduce the number of homes in high-risk areas by implementing integral neighborhood improvement and family resettlement programs from nonmitigable high-risk areas. | DNP, UNGRD, MVCT, MADS | Guideline: <i>Governance best practices</i> Goal of the process: Formulate a policy for risk settlement intervention. | 3 |
| Promote and continue with the efforts carried out in the cities (case studies) for cross-cutting inclusion of disaster risk management in planning and municipal investments as a fundamental strategy in land development. | DNP, municipalities, departmental governments | Guideline: <i>Risk control and reduction</i> Goal of the process: Define and incorporate risk management criteria in the national public investment project formulation. | 3 |

TABLE 6.1. Recommendations to strengthen public administration in disaster risk management in Colombia (continued)

| RECOMMENDATION | RESPONSIBLE ENTITY | RELATION TO GOALS OF THE NATIONAL DEVELOPMENT PLAN 2010-2014 | CHAPS. |
|--|--|---|--------|
| <i>4. Reduce flood and landslide risk through planning, investment, monitoring and control, and coordination of different agents responsible for watershed management</i> | | | |
| Assign responsibility for hydraulic management of rivers and water bodies to a Government agency, and establish the roles and mechanisms of coordination of the different agents involved. | Presidency, DNP, MADS, MT | Guideline: <i>Governance best practices</i> Goal of the process: Formulate a policy for management of recurrent disasters. | 2 |
| Adopt regulations for flood and landslide control and management including the definition of maximum acceptable risk ² and technical standards for risk assessment and mitigation, and a strategy for its implementation, monitoring and control. | MADS, Permanent Committee created to manage the hydrology of rivers and water bodies | Guideline: <i>Improvement of disaster risk knowledge</i> Goal of the process: Formulate a strategy for strengthening risk management research. | 1, 2 |
| Understand in depth the role of risk management, and its links to environmental management, development management and climate change adaptation to incorporate it in decision making at the sectoral and territorial level. | Presidency, DNP, UNGRD, with the support of the National Committee PAD/GRD | Guideline: <i>Improvement of disaster risk knowledge</i> Goal of the process: Formulate a strategy for strengthening risk management research. | 1, 2 |
| Regulate the inclusion of a Master Plan for Flood and Landslide Control as an integral part of the POMCA. | MVCT, MADS, Ideam, with the Permanent Committee created to manage the hydrology of rivers and water bodies | Guideline: <i>Governance best practices</i> Goal of the outcome: Improve technical capacity of the territorial entities and the CAR in disaster risk management. Guideline: <i>Improvement of disaster risk knowledge</i> Goal of the Outcome: Expand monitoring networks and early warning systems, and update hazard maps. | 2, 3 |
| Accelerate the formulation and implementation of POMCA and their incorporation as a determining instrument in municipal POT. | MADS, the CAR | Guideline: <i>Governance best practices</i> Goal of the outcome: Improve technical capacity of the territorial entities and the CAR in disaster risk management. | 3 |
| Implement a strategy to strengthen the livelihood of the population in pursuit of poverty reduction. | DNP, municipalities, departmental Governments | Guideline: <i>Risk control and reduction</i> Goal of the process: Define and incorporate risk management criteria in the national public investment project formulation. | 3 |

5 Acceptable risk is one that the community is willing to take on to change a certain rate or level of benefits. In the design of engineering works, it has been common to use this concept implicitly in order to achieve a level of protection and security to justify the investment, considering as reference the useful life of the work. For such purpose, safety factors are used that in probabilistic terms, cover “reasonably” the uncertainty of the possible magnitude of external actions, the imprecision of the analytical modeling, and approximation of the simplifying assumptions (Cardona, 1990).

TABLE 6.1. Recommendations to strengthen public administration in disaster risk management in Colombia (continued)

| RECOMMENDATION | RESPONSIBLE ENTITY | RELATION TO GOALS OF THE NATIONAL DEVELOPMENT PLAN 2010-2014 | CHAPS. |
|--|---|---|--------|
| 5. Reduce risk generation and disaster impact through policies and sectoral action plans. | | | |
| Appoint a unit responsible for disaster risk management in each sector | All of the Ministries | Guideline: <i>Governance best practices</i> Goal of the process: Formulate and adopt a National Policy on Disaster Risk Management, plus update the SNPAD regulatory framework and management instruments. Goal of the outcome: Improve technical capacity of the territorial entities and the CAR in disaster risk management. Goal of the process: Formulate a policy for management of recurrent disasters. Guideline: <i>Improvement of disaster risk knowledge</i> Goal of the process: Formulate a strategy for the strengthening of risk management research. | 4 |
| Implement sectoral policies for risk management in each Ministry. | All of the Ministries | | 2, 4 |
| Adopt and implement sectoral and interministerial risk management Action Plans. | All of the Ministries | | 4 |
| 6. Delimit public and private responsibilities for risk management and deepen the State's fiscal vulnerability policies facing disasters | | | |
| Adopt clear policy guidelines on the level of protection that the National Government and local authorities should offer to those affected by hazardous events. | Presidency | Guideline: <i>Governance best practices</i> Goal of the process: Design a second phase of the Government Fiscal Vulnerability Reduction Program facing disasters. Goal of the process: Formulate a financial protection strategy Facing Disasters. Goal of the process: Formulate a policy for management of recurrent disasters. | 4, 5 |
| Adjust regulations to clarify the private sector responsibility in disaster risk management, and strengthen the defense of public entities to reduce the State's fiscal contingencies produced by the demands of those affected. | All of the Ministries | | 4, 5 |
| Design and implement an integral strategy for the financial security of the State at the sectoral and territorial level with the purpose of guaranteeing an adequate response when there is a disaster and to protecting the country's financial balance on a long-term basis. | MHCP | | 4 |
| Clarify, as far as regulations, the procedures and mechanisms as to how private agents participate in the different phases of risk management. | Presidency, UNGRD, DNP, Ministries | Guideline: <i>Improvement of disaster risk knowledge</i> Goal of the process: Implement a National Plan for Training and Education on Risk Management. | 5 |
| Promote and incentivize municipal and sectoral strategies to make the population aware of and competent in risk management. | UNGRD, Ministries, territorial entities | | 5 |

1 Incorporate risk management as a State policy and overcome existing imbalances in the System through the adjustment and harmonization of a regulatory and institutional framework

Adopt a national policy in disaster risk management that is integrally articulated with public management, provides support to the territorial entities, and promotes the creation of specific policies and sectoral action plans. The risk management policy, as an integral part of public administration, should be articulated in planning, execution, monitoring, evaluation, and control of the economic, social, cultural, technological, environmental, and political strategies. It should be more decentralized, participatory, democratic, and results-oriented. This policy should consider risk knowledge and information, risk reduction, and disaster management as well as its contribution to territorial safety, social welfare, quality of life, and sustainable development, starting from creating regional consensus spaces and cooperation mechanisms among municipalities, governments, the CAR, regional entities, if any, sectors, and other National Government actors. Likewise, it should be in charge of promoting the creation of policies and sectoral action plans so that each sphere defines its responsibility in its infrastructure safety, minimizing loss of life and the impacts on production means facing disaster risks, and ensuring the ongoing rendering of services.

The policy requires the formulation and implementation of specific strategies for each of the geological and hydrometeorological phenomena, considering variables related to climate change and prioritizing recurrent phenomena.

Last but perhaps most importantly, this policy should promote capacity strengthening, complementary and subsidiary strategies to provide support to municipalities in territorial risk management, recognizing that local capacities are limited (in availability of economic, technical, and human resources).

Create a risk management statute to harmonize the current legislation addressing the gaps identified in defining public and private responsibilities. Legal reorganization is required for all norms related to disaster risk management, through a specific statute that would also complement aspects that are not yet regulated. Defining the processes in knowledge, risk reduction, and disaster management is recommended for each of the different phenomena. Likewise, the actors who should be involved at the different territorial levels and their specific roles and responsibilities should also be included. The statute should also articulate the different regional levels to work together according to their capabilities and resources, thus ensuring compliance with the principles of competition, subsidiarity, and complementarity as established by the Constitution. With regard to risk materialization situations, it is essential to explicitly regulate the types of different situations (emergency, disaster, calamity), so that the concept of severe public calamity, as provided in the Constitution, Article 215, is consistent with the current disaster declaration (Decree Law 919 of 1989). It is also necessary to regulate the responsibilities and instruments of the recovery processes (rehabilitation and reconstruction). The contact points between sectoral legislation and disaster risk issues should be strengthened and the participation and involvement of persons in this management require specific regulations.

Reorganize the System by strengthening technical and financial management capacity at the different territorial levels and including the participation of the private sector. A normative and structural transformation of the System is needed. It should include its mis-

sion, vision, and the objectives of the State and society actions in facing risks and disasters⁶, as well as being in coherence with the Constitution, through an adequate articulation with the principles and guidelines contemplated therein. It is necessary to change the current notion of disaster, reduce duplication in functions, and establish mechanisms to ensure a coordinated effort so that all actors involved have a clear understanding of the System's orientation and its contributions to achieving the proposed objectives. Local Government Councils should be the basis of the System and substitute the committees' formal structure, whose management and decision-making process should be guided by the planning. Likewise, it is necessary to strengthen the departmental level in its articulating role between the national and the local spheres and among the municipalities within its jurisdiction. This should be done at the same time that the nation in its strategic formulating and implementing policy role based on the territorial entities' needs and capacities shall consequently provide technical assistance, co-financing, and incentives to promote better and more efficient risk management by territorial authorities.

Give priority to the strategic orientation, technical direction, authority, and control to the functions performed by the National Unit for Disaster Risk Management (UNGRD) as head of the System. The UNGRD should assume a clear strategic direction, maintain its main coordinating role of national risk man-

agement policy, and carry out authority and control functions. In addition, it should rely on highly skilled technical human resources and strengthen its internal operating procedures. Leading risk management policy not only involves the coordination of national institutional activities led by the government entities, but UNGRD should also be the interlocutor among all levels of government in the country, in compliance with the principles of coordination, concurrence, and subsidiarity. The complexity of risk management requires an "integrating" policy formulation within sectoral limits. The administration implied in supplies should be replaced by rendering accounts based on products and results. Additionally, the UNGRD and the different national and territorial entities should work on better informing the population about the project, strengthening the information system so that it constitutes a support system for all the processes. Its successful management depends on the skills and the convening and coordination mechanisms produced. Its function and activities should focus on strategic leadership and management and leave operational responsibility and emergency management efforts to other actors. This unit should also create incentive systems in the System's different entities, linked to strategies and priorities identified and agreed to in the National Risk Management Plan. It is essential to focus management strategy, financial resources, and organization on successful critical factors.

6 As the Act Project proposed, filed in the Congress of the Republic in July 2011 (Ingeniar Ltda., 2011).

2 Increase the effectiveness and efficiency of risk management investment through strategic planning, coordination among territorial levels, and monitoring and control

Promote the adoption of the Territorial Risk Management Plans (PTGR) as long-term instruments to guide the POMCA, POT, and PD, and articulate public and private investments.

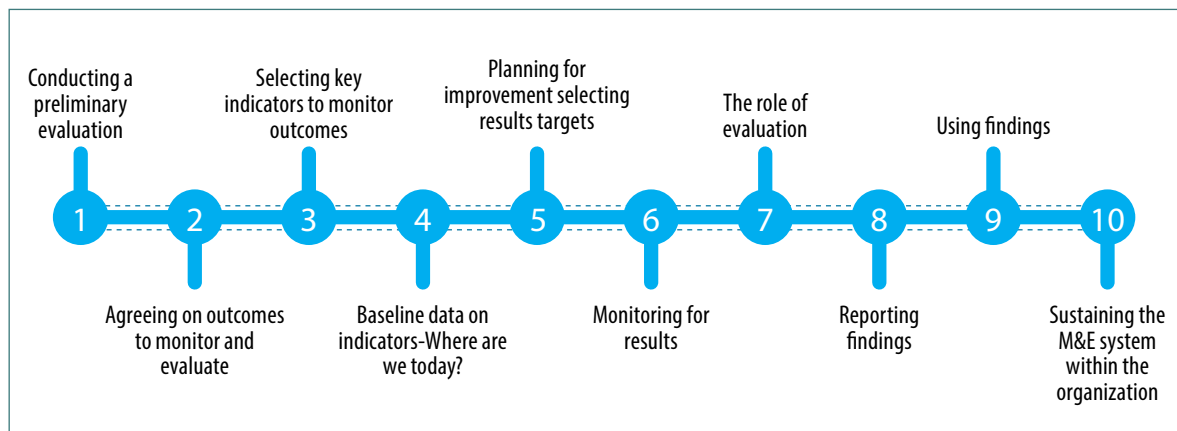
Planning processes are fundamental in a Risk Management System, since it implies formalizing objectives to meet this end in every institution including its formulation in the National, Departmental, and Municipal Risk Management Plans, and its connection and subordination to the national and territorial PD. Thus, the incorporation of programs and projects is assured in the respective institutional investment plans and the complementarity among the different financing sources to provide greater effectiveness. These plans should include dynamic instruments that can be updated and additionally to the activities related to the risk management process mission (awareness, risk reduction, and disaster management), incorporate strengthening capacities, and support instruments and information management relevant to risk management. This should be followed by systematic monitoring, as an execution control element of actions developed by the System. In order to adequately implement it, emphasis should be made on professional training at all levels, focusing on the importance of emergency response and promoting risk reduction.

Establish a national cofinancing (fund) mechanism to encourage investments in disaster risk management and generate capacities at territorial and sectoral levels. Creating a Disaster Risk Management Fund requires establishing different financing strategies and mechanisms under the existing risk conditions and the municipalities' capacities. Focusing mainly on capacity strengthening and cofinancing regional

and sectoral projects contributes strategically to risk reduction. The execution of the preventive and corrective actions, including emergency response, should be covered in order to have a shared responsibility among the territorial levels, where municipalities evaluate the effectiveness of including in their annual budget a representative percentage (between 0.1% and 0.5% of the current revenues) oriented at risk management, to leverage resources that serve as a counterpart to what is available in the Disaster Risk Management Fund. This Fund should coordinate with or be part of a financial strategy that permits risk transfer and retention.

Adopt risk reduction goals in policies and plans, and ensure compliance through progressive implementation of results-based strategic planning. Modern risk management has the challenge to evolve toward strategies that achieve greater investment transparency and effectiveness using a results-based monitoring and evaluation approach applicable to projects, programs, and policies. This type of monitoring and evaluation requires the definition of roles and responsibilities in the generation of products and results by those involved, thus establishing a clear and verifiable relation between the results expected and the allocated resources. It strengthens investment articulation and territorial, sectoral, and institutional coordination. It also requires the definition of baselines and the identification of key performance indicators, and facilitates the implementation of incentives in terms of performance recognition. It is not an easy task; it requires commitment, time, and effort, but national and international experiences in other areas show that the work is justified by its proven successful performance (Graph 6.1).

GRAPH 6.1. Ten steps to design, create, and support a results-based monitoring and evaluation system.



Source: Zall and Rist, 2006.

Strengthen the mandatory incorporation of criteria of disaster risk management when formulating public investment projects. In order to effectively incorporate risk management throughout the planning process and the execution of public investment, it is necessary to explicitly express it in the formulation of projects filed in the Public Investment Project Banks (BPIN). Although there has been some initial progress, to incorporate the subject, it is necessary to review the General Adjusted Methodology proposed by DNP, which determines the minimum content of preinvestment studies and verifies the analysis components, the project evaluation, and the registration cards. This methodology should identify and evaluate the type and level of damages and potential losses that could affect the investment, taking into account the different infrastructure locations and the existing hazards in the territory, both in construction materials and techniques, with the aim of assuring that the ones selected are the safest and most cost-effective. It should evaluate the project's impacts in generating new risks and

articulate these analyses with the preparation of the different modules. This process should be accompanied by training and technical assistance at the sectoral and territorial level in order to reinforce key concepts in risk management, thus assuring its appropriate implementation. This initiative is currently being proposed as an objective in the National Development Plan 2010-2014.

Adopt a monitoring strategy for following up on responsibilities and investments for risk management at different territorial levels. The strengthening of policies and plans, clarification of roles and those responsible, and the definition of baselines and performance indicators should be accompanied by the strengthening of monitoring and control processes. Its importance lies in that authorities and civil society should fulfill the tasks of monitoring and controlling the entire public administration process, not just the end result. Working together is pertinent in ensuring articulation and continuity of the actions required for regional planning and risk management.

Adopt a national strategy to strengthen municipal risk management that takes into account the differences in capacities. Risk management and regulation and land use planning control are closely linked to the municipal administration's operational capacity and action, as well as the restrictions made on their professional personnel, their technical training, and their limits to accessing available technologies. In order to guarantee, on a mid-term basis, an appropriate control of hazard, vulnerability, and risk conditions, it is necessary to strengthen the municipalities at institutional, technical, and financial level by adopting a proactive and strategic approach according to the complementarity and subsidiarity principles set forth in the Constitution of 1991. These municipal capacities are clearly differentiated according to the categories specified by the DNP and the DANE, which then may propose recommendations for municipalities with high, intermediate, and low capacity. Therefore, different options should be analyzed through the following: (i) Redefine the competence distribution in line with the municipalities' potential capacities and their different characteristics and requirements, in a sector (if a cross-cutting subject like risk management can be called that way) that Law 715 of 2001 did not take into account. (ii) Consider the possibility of applying a municipal certification system for risk management processes and establish a priority in subjects such as risk knowledge, investment in risk reduction, and land use planning. (iii) Broaden the Departments' and the CAR's responsibilities and competencies in order to support risk management at a municipal level. (iv) Foster greater cooperation among different govern-

ment entities with the aim of fully developing the aforementioned principles. (v) Identify and analyze successful partnership experiences in providing services in risk management, so that these may be implemented in horizontal cooperation processes among territorial entities. (vi) Study strengthening mechanisms in the fields of risk information and risk knowledge by decentralizing technical-scientific organizations, such as the SGC and the Ideam; coordinating among universities and research centers through the National Science and Technology System; defining clearly the responsibilities undertaken by the CAR, departmental governments, and other national or sectoral agencies; and enriching the municipalities' capacities with the purpose of supplying the information needed for risk management as part of management and territorial planning.

Structurally review deficiencies in the capacities to assess disaster risk in order to provide an effective response to the knowledge demand for the POT and the PD. Although a significant effort has been made in the country in carrying out hazard and risk studies, there have been few results at the different territorial levels, so appropriate decisions cannot be made to reduce them. Their evaluation should follow a prospective approach, taking into consideration the possibility of highly destructive events in the future. Therefore, risk assessment should be oriented at applying models that allow using the scarce information available in order to forecast possible catastrophic scenarios in which great uncertainty is taken into account in the analysis. Likewise, the systematic loss and damage registers have to be more efficient and effective, since these are fundamental in measuring the extent of the disaster's real impacts. The implementation of

a technical support strategy, coordinated among national entities and departments, is indispensable to facilitate future updates of these risk scenarios as well as the formulation of the new municipalities' POT and the PD's jurisdictions with less than 50,000 inhabitants. According to Law 507 of 1999, the National Government has implemented technical assistance in the municipalities particularly through the Ministry of Housing, Cities, and Territories, the previous Risk Management Office, and some CAR. However, other government entities such as IGAC, DANE, Ideam, SGC, and the universities and research centers have to combine their efforts. Similarly, it is essential that the departments take the lead and support with greater vigor the municipalities' formulation of the POT and the incorporation of risk management in the PD.

Strengthen the departmental governments' capacities in coordinating the municipalities, defining their competencies in disaster risk management according to the principles of concurrence and subsidiarity capacities as established in the Constitution and the possibilities offered by the Organic Land Use Planning Law. The recently approved Organic Land Use Planning Law offers alternatives aiming at reinforcing functions among territorial entities in risk management, especially in the departments where the common denominator of almost all the municipalities is disturbing poverty indicators and low-level institutional capacity, as for example in Amazonas, Guaviare, Guainia, Vaupes, and Vichada, the majority of the Pacific coast municipalities (Choco, Cauca, and Nariño), and a great part of Caribbean municipalities (La Guajira, Magdalena, Sucre, and Cordoba, with the exception of their capital cities). This Law also promotes the following: (i) a greater delegation of functions and competencies at the national level over the territorial level; (ii) eliminating duplication between the central and decentralized administration and the territorial entities; (iii) strengthening regional administration and plan-

ning in the departments as an intermediate level of government, and the municipality as a fundamental entity in the State's political-administrative division; (iv) the joint and articulated action of the different levels of government through alliances, associations, and delegation agreements; and (v) the design of regional administration modes for the development of special projects, increased productivity, and modernized municipal administration.

Design and implement the PTGR as strategic and prospective instruments to orient and give priority to interventions and investments in municipalities and departments. The PTGR seek to contribute to the acquisition of knowledge in risk scenarios, the application of integral interventions for reducing and controlling risks, and strengthening actions in disaster management. Articulated agendas and action plans among responsible entities should be established in order to develop internal procedures, define tasks, and guide and optimize the use of the resources available (municipal agencies, public companies, the private sector, departmental governments, CAR, etc.). Planning should be accompanied by greater investment; therefore, the Ministries of Planning and Finance have to reinforce the allocation of resource mechanisms and to verify the safety conditions related to the different policies and types of expenses so as to endorse, from the outset, risk reduction in municipalities and districts.

Formulate and implement the national policy in order to intervene in settlements at risk that set the guidelines for land zoning, and define mitigation criteria and action strategies. The municipalities' POT should clearly establish the management of high-risk areas in accordance with the national policy. Mitigation may be understood as a condition where it is feasible to intervene technically, economically, socially, and politically in a territory, in order to reduce risk for the purpose of producing stability in the population, the infrastructure, and the economic activities within reasonable and

socially accepted safety margins (Ramírez and Rubiano, 2009). This means that a comprehensive analysis has to be prepared that will define if a high-risk territory may or may not be mitigated. Depending on the condition defined, specific intervention actions should be established, in which are considered, among other factors, mitigation works (when risks are mitigable) or the resettlement of families (when they are nonmitigable). In some cities where there is greater management capacity, progress has been made in the establishment of risk reduction criteria and intervention policies. However, implementing a national policy will provide instruments for the municipalities to duly develop actions oriented at appropriately managing high-risk areas.

Reduce the number of homes in high-risk areas by implementing integral neighborhood improvement and family resettlement programs from nonmitigable high-risk areas. The focalization of actions oriented at reducing exposure and vulnerability is an effective option to diminish risk conditions. This means incorporating in the POT and the PD projects and specific investments that are focused on implementing these two programs as basic axes to reduce existing risks. The development of these programs entails the participation of different municipal agencies so that their intervention is carried out completely and integrally. Sectors related to housing, education, social welfare,

and public services, among others, should work jointly. Moreover and with the purpose of protecting areas that have been resettled, surveillance, municipal land use, and occupation control programs are required through the participation and intervention, not only of the responsible entities, but also within the same communities.

Promote and continue with the efforts carried out in the cities (case studies) for cross-cutting inclusion of disaster risk management in planning and municipal investments as a fundamental strategy in land development. The cities studied (Bogota, Cali, Medellin, Barranquilla, Manizales, Cucuta) should promote more decisively and/or continue with strategies that incorporate disaster risk management in planning, actions, and municipal or district investments. It should be pointed out that Cali needs to implement a specific strategy to principally manage seismic risk and floods. And likewise applicable in Barranquilla are landslides and floods (specifically for the well-known streams). A Risk Management Plan that relies on essential financing for its development should be prepared and implemented in all of the cities analyzed. This plan should include actions to carry out effective risk management due to natural and unintentionally human-induced phenomena. The plan has to incorporate activities in risk knowledge and risk reduction as well as in disaster management.

4 Reduce flood and landslide risk through planning, investment, monitoring and control, and articulation of different agents responsible for watershed management

Assign responsibility for hydraulic management of rivers and water bodies to a Government agency, and establish the roles and mechanisms of coordination of the different agents involved. It is necessary to define an authority responsible for the hydraulic management of the rivers, so that the entity can develop policies and standards, define roles and those responsible, and coordinate actions through a Standing National Advisory Committee for Hydraulic River Management.⁷ This Committee shall be responsible for providing technical advice to the competent authority, covering both official and private consultations, performing functions assigned by the research management and monitoring authority, organizing seminars and updating courses, and guiding and advising in flood studies.

Adopt regulations for flood and landslide control and management, including the definition of maximum acceptable risk⁸ and technical standards for risk assessment and mitigation, and a strategy for its implementation, monitoring, and control. It is necessary to overcome existing environmental imbalances that cause increased susceptibility to floods and landslides, which requires adjusting and articulating policy, and regulatory and institutional framework for environment and risk management. This means standardizing acceptable risk parameters in order to establish technical standards for the execution of hazard zoning maps and evaluate the susceptibility or threat by floods and landslides (recurrent periods, safety factors, etc.) for the purpose of land use planning; reviewing the criteria establishing urban and rural protection zones and setting minimum guidelines for the design and

construction of less vulnerable buildings and structural measures for flood control and mitigation, depending on recurrence periods, the estimated height of the water level, its extension, and where appropriate, the speed of the current or water flow, among other factors. It is also important to establish responsible roles and their implementation, monitoring and control of these regulations according to the type of construction or project. The sectoral institutions, policies, and plans should be strengthened so that their infrastructure and production can be more resilient and redundant when confronting risks, and at the same time their development mechanisms contribute to safety and sustainability.

Understand in depth the role of risk management and its links to environmental management, development management, and climate change adaptation to incorporate it in the decision-making process at the sectoral and territorial level. The institutional and programmatic mechanisms between the subjects of risk and climate change should be incorporated in the development planning processes and public investments. This requires the definition of guidelines and spheres

7 The Standing Advisory Committee for Hydraulic River Management, like the Standing Committee on Seismic Resistant Standard, may be composed of one representative each from the Presidency of the Republic, Ministry of Housing, Cities, and Territories, Ministry of Environment and Sustainable Development, Ministry of Transportation, Ideam, IGAC, Colombian Engineer Society, Colombian Association of Hydraulic Engineers, Asocars, plus a representative of the departmental governments, and a representative of the academic circles.

8 Acceptable risk is one that the community is willing to take on to change a certain rate or level of benefits. In the design of engineering works, it has been common to use this concept implicitly in order to achieve a level of protection and security to justify the investment, considering as reference the useful life of the work. For such purpose, safety factors are used, which in probabilistic terms cover "reasonably" the uncertainty of the possible magnitude of external actions, the imprecision of the analytical modeling, and approximation of the simplifying assumptions (Cardona, 1990).

of action to clarify responsibilities and scopes in each subject, thereby avoiding overlapping and superimposition of roles that do not coincide with the ecosystems, watersheds, and government entities. Additionally, efforts to strengthen disaster risk management should go hand in hand in with actions to combat poverty in such a way that there is a real intervention that allows the reduction of vulnerability conditions.

Regulate the inclusion of a Master Plan for Flood and Landslide Control as an integral part of the POMCA. By nature, basins are the regional territorial units, bordered by the dividing lines between them. Comprehensive understanding of the hydrological system that shapes them, planning according to their use and occupation, and the definition of constraints and potentials for their territory, offers valuable input for their adequate protection and utilization. It is then recommended that a Master Plan for Flood and Landslide Control should be included as an integral part of the POMCA, which would make possible establishing the necessary actions and investment requirements to prevent the generation of new risks and reduce those already existing. The development of this Plan provides, as an environmental determinant for the municipal POT (Decree 1729 of 2002, Article 17), the possibility of regulating land use and determining the programs and projects that should be introduced in order to execute appropriate local risk management. The Master Plan should include, among other aspects, the following: (i) reduction and risk management as an integral part of the goals and objectives to ensure watershed safety and sustainability; (ii) definition of the scope and orientation with state-of-the-art zoning methodologies based on hazard assessments, in case of low-, medium-, and high-probability phenomena. Likewise, definition of the risk maps to show the possible effects of floods, determining, the number of people and types of economic activities that could be affected, as part

of this diagnosis⁹; (iii) regulation of restrictions and constraints of land use for each area under hazard/risk; (iv) formulation of penalties for non-compliance; and (v) list of programs and projects for risk reduction and control, protection of human lives, economic activities, ecosystems and cultural heritage, as well as the responsible people and funding mechanisms and the strategies for their implementation and monitoring.

Accelerate the formulation and implementation of POMCA and their incorporation as a determining instrument in municipal POT. Taking into account that POMCA are instruments that incorporate comprehensive knowledge of the basins and define the actions and interventions for their proper management, it is urgent to hasten their formulation in order to generate the required guidelines for updating and implementing the local POT, thus promoting coherent planning between the regional vision of the basins, flood control measures, and the restrictions and constraints in land use and occupation of each municipal jurisdiction.

Implement a strategy to strengthen the livelihood of the population in pursuit of poverty reduction. Changes in population and property vulnerability are highly dependent on the development stage and the socioeconomic characteristics of the population. The link between poverty and susceptibility to natural disasters is increasingly acknowledged, so the country should move forward in developing effective strategies for reducing poverty, including implementing a rural development policy, investing in natural resource management, developing infrastructure, generating livelihoods and social protection mechanisms to reduce vulnerability, and enhancing resilience of rural livelihoods.

9 In this regard, examples of some European countries, USA, and Japan can be found at http://ec.europa.eu/environment/water/flood_risk/flood_atlas/index.htm: Handbook of Good Practices in Flood Mapping.

Appoint a unit responsible for disaster risk management in each sector. It is necessary to define sectoral units or civil servants with clear responsibilities and hierarchy to coordinate the creation of the specific policies of risk management and lead their implementation, as prescribed by Decree 919 of 1989. These units could also coordinate subjects such as climate change and environmental sustainability in each sector, simplifying the articulation of these spheres within each Ministry and among themselves. In addition, it would facilitate the adoption of multipurpose policy instruments, strengthen the sectors' performance, and enhance local capacity to implement instruments such as the POMCA, the POT, and the PD.

Implement sectoral policies for risk management in each Ministry. The sectoral approach to risk management has been largely reactive and protectionist, resulting in a steady increase in the vulnerability and disaster occurrence impacts in all spheres. This can be approached with a comprehensive policy, which also ensures assessment and knowledge about risk and the reduction of existing risk. It also eliminates the generation of new risks in projects and investments, and ensures effective and timely disaster response, promoting joint and shared responsibility with territorial entities and the private sector. This strengthens risk knowledge, especially in vulnerability studies in each sector. Better strategies can be designed for reducing physical, operational, and financial risk, and for planning disaster management in an appropriate manner. It is essential to generate local capacity for specific sectoral risk management actions and mechanisms for coordinating with local authorities. It should also include institutional

strengthening and risk reduction cofinancing, in order to meet their needs while promoting responsibility and in this manner achieving a synergy among the different levels of government. On the other hand, it is also essential to embrace the private sector in these policies with the aim of accompanying and providing its risk management knowledge and responsibility. Guild organizations are able and willing to play a decisive role in this field. The PND 2010-2014 aims to create a National Disaster Risk Management Policy and some of the Sectoral Policies on this subject, which would become elements of sectoral planning with special emphasis on “Locomotives for growth and employment generation” such as transportation, housing, mining and energy, and agriculture. Among the recommended sectoral policies, some priorities in the current PND are as follows:

- **Housing.** Intervention policies for settlements at risk, aimed at controlling and managing these settlements and reducing the construction of informal housing. The policies should cover overall improvement of neighborhoods, through risk analysis and the introduction of restrictions and constraints in the POT, development of projects to mitigate risk, family relocation in nonmitigable high-risk areas, additional urban land availability, increased VIS construction, and strengthening of urban control.
- **Finance.** Financial protection policies to reduce the State's fiscal vulnerability resulting from disasters, which define a differential strategy to address the needs of high-frequency/low-cost events, as well as low-frequency/high-cost events, transferring the risk as far

as it is economically reasonable, constituting a reliable source of funds to address the retained risk and encourage participation of local governments and private actors.

- **Agriculture.** Comprehensive policies to face natural phenomenon risks, market risks, and risks associated with climate change, where strengthening of risk knowledge, risk reduction, and disaster management is comprehensively observed.
- **National Unit for Disaster Risk Management.** Low- and medium-intensity risk management policies and mechanism policies to guide reconstruction processes in a declared national disaster situation.
- **Drinking water and sanitation.** A policy to incorporate risk management in the rendering of public services in water supply, sewerage, and sanitation, for which there is a draft document that has not been formally adopted yet.
- **Transportation.** Contracting policies and concession management that incorporate criteria for disaster risk reduction.

Adopt and implement sectoral and interministerial action plans on risk management. Once sectoral policies are implemented, the sectoral and interministerial action plans would become their application instruments. These plans could define short- and long-term strategic priorities, and identify funding and development mechanisms. The objectives of risk knowledge and risk knowledge, risk reduction, and disaster management mentioned in the policies should be reflected in the strategies, programs, and project action plans, as well as when assigning those responsible and in the coordination, financing, monitoring and control mechanisms, addressing the needs, and promoting the responsibility of territorial authorities and private sector

agents. Some specific actions recommended to be included in these plans are as follows:

- **Land Use Planning.** Promote a partnership to support local entities in incorporating risk management within their territorial planning and providing equal priority to the rural and urban areas. This would help to confront the municipalities' technical and financial capacity limitations and the application of sectoral policies in the territory.
- **Transportation.** Develop the Vulnerability Reduction Program for the different means of transportation.
Roads should be a priority, since these currently have the highest risk levels. Establish a solid program to invest in existing risk reduction, focusing on critical road sections, with stabilization work and/or improving the standards of alternate routes. Also update technical specifications and contracting systems that should include the definition of acceptable risk levels. Evaluate projects from the prefeasibility stage, design methods and construction, operation, monitoring, and control systems, all to establish the risk profile and strengthen road maintenance.
- **Housing.** Promote the Settlement Risk Reduction Program, which includes the definition of inventory methodologies, capacity strengthening, cofinancing, and technical assistance to the municipalities' census of endangered population. Implement the Comprehensive Neighborhood Improvement Policy. Adopt a strategy to control risk resulting from informal urbanization, which may include affordable housing alternatives such as leasing for lower strata and training in construction. Formalize self-construction of one- and two-floor houses to intervene in the process of building informal housing. Adopt acceptable risk levels for residential buildings

facing floods and landslides, much in the way they are implemented in seismic risks.

- **Drinking water and sanitation.** Implement the RAS Risk Management chapter, including approval of maximum acceptable risk levels¹⁰, infrastructure risk assessment, reducing existing risk, and the design and construction parameters in accordance with the standards set for new infrastructure. With regard to the fee structure, incorporate crossed feasibility for financing risk management activities, among which are vulnerability studies, risk reduction criterion maintenance, and the ability to secure the infrastructure.
- **Education.** Establish a capacity strengthening program and cofinancing to support territorial entities in compliance with Ministerial Directive No. 12 dated July 2009, both to reduce educational infrastructure risk and to improve preparedness to face emergencies.
- **Health.** Strengthen and expand hospital insurance program coverage.
- **Energy.** With the environment sector, articulate the inclusion of flood risk management criteria in dam operation protocols, starting with the adoption of maximum acceptable risk levels.
- **Environment.** Strengthen the inclusion of risk management in the POMCA, adopting maximum acceptable risk levels for all hazards and the definition of restrictions and constraints that should be reviewed and detailed in the planning processes such as the POT. Include in the POMCA a Master Plan for Flood Risk Reduction, ensuring articulation between different actors in watersheds and verifying that the risk reduction investments are consistent and positive for the entire area, not just a part of it.
- **Agriculture.** Organize with the agrarian guilds the implementation of a program to encourage small and medium farm-

ers to use risk reduction measures and to adapt to climate change. This includes a collective and aligned effort with the Ministry of Environment and Sustainable Development to promote sustainable land management through planning and applying environmentally adequate production technologies, erosion prevention, and flood control. Risk reduction strategies are also recommended. Using drought- or flood-resistant varieties, weather forecasts to make decisions during the production cycle, and early warnings about El Niño and La Niña phenomena are recommended strategies when deciding on product types, sowing seasons, and planning in advance of any livestock relocation. Along with the environment sector, implement a joint strategy for recovering marsh areas where flooding occurs as areas to buffer floods.

- **All sectors**

- (i) Implement a decision-making strategy in each sector through strategies aimed at providing information and knowledge on hazards, infrastructure vulnerabilities, property exposure, early warnings, and climate change. Vulnerability assessment and the risks to each sector allow each person to formulate their own risk reduction plan. Actions and investments based on where hazards are concentrated and a cost-benefit analysis should be a priority. Hazard exposure, susceptibility, and damage assessment methodologies as well as assigning responsibilities and deadlines have to be adopted. It is important to consider not only present scenarios, but also future ones, so that

10 Risk of service suspension resulting from disasters caused by natural events.

aspects such as demand growth, the infrastructure aging, and climate change are taken into account. It is also convenient to encourage sectoral information and knowledge needs by strengthening the financial and technical articulation among CMS, IGAC, Ideam, DANE, and academic sectors.

- (ii) Develop sectoral strategies in order to create accountability and risk management culture among private actors in each sphere. These strategies may include awareness and training campaigns on the risks that they are exposed to, the responsibility of the private agents in this subject, and alternatives to reduce, manage, and prepare to act in case of an emergency. Drills and simulation exercises are used to evaluate and improve the proposed actions, and contribute to increasing the level of awareness. Guild organizations in each sector can be a key ally in this endeavor.
- (iii) Implement a strategy for disaster management in each sector, articulated and sup-

ported by the UNGRD and the National Calamity Fund (FNC). The formulation of public policies on “Minor and medium-intensity disaster management” and “Mechanisms for guiding reconstruction processes in a declared national disaster situation” have been assigned by the current PND to the UNGRD, with support from the DNP. Experiences such as those in Mexico demonstrate the advantages of each Ministry monitoring its own infrastructure rehabilitation and reconstruction process. This experience offers: opportunity, independence, technical expertise, monitoring, and control. Transparency and efficiency are guaranteed by using standardized and established procedures to assess damage, access to resources by Government agencies and the private sector, and mechanisms for monitoring and control. However, the Oil Spill Contingency National Plan experience and its replication to other sectors should be assessed, and it should probably be extended to contingency plans for each of the hazards.

6 Delineate public and private responsibilities for risk management and deepen the State’s fiscal vulnerability policies in facing disasters

Adopt clear policy guidelines on the protection level that the National Government and territorial entities should offer to those affected by hazardous events. The Government should assess its ability to support people affected by a disaster, and decide in advance of upcoming events a policy defining the government’s expected response. It is also important to establish the levels of responsibility for the Central

Government and territorial entities to promote joint responsibility based on subsidiarity and complementarity principles. Therefore, financial provisions required to meet obligations to those affected can be estimated. Additionally, clear policy implementation in the above matters and its disclosure shall allow citizens to know to what extent the Government will be responsible in the event of a disaster. In turn, with this knowledge,

citizens will be encouraged to take responsibility for their own risks and take measures in risk prevention, mitigation, or risk transfer, according to their particular situation. Searching for coherence and integrity, this policy should consider the following elements: (i) the characteristics to describe and catalog the affected people as “manifesting weakness” (e.g., the condition of belonging to the poorest group of people -strata 1 and 2- has been used frequently); (ii) protection offered to those affected and catalogued as “manifesting weakness” and support of others affected; (iii) tax, financial, and other incentives to mitigate losses in the productive sector; and (iv) tax, financial, and others incentives to promote economic recovery.

Adjust regulations to clarify the private sector responsibility in disaster risk management, and strengthen the defense of public entities to reduce the State’s fiscal contingencies produced by the demands of those affected. A clear definition of responsibility of the private sector will strengthen the defense of public entities in the courts. Additionally, specific guidelines to facilitate the proper integration of risk management in governance will reduce vulnerability and losses caused by State actions. The regulation adjustments could include:

- Regulation containing detailed provisions on exclusive, solidarity, or complementarity concurrence of each of the participants who may be responsible for the disaster impacts: (i) public entities by act or omission; (ii) private actors that as part of their production activities generate risk, consciously or unconsciously; and (iii) victims or people affected, who consciously or unconsciously have decided, willingly or unwillingly, to assume the risks that will later materialize into disasters. This regulation will help to face the fact that most judicial complaints

in risk management are addressed against public entities, although in many cases, there is third-party intervention or participation, whether it is private or public, or even if the same plaintiff affected is an excluding or reducing circumstance of the State’s responsibility. Absence of rules generally leads to establishing responsibility almost exclusively on public entities, affecting their economic or budgetary conditions. Therefore, a careful and meditated legal reform is advisable. In judicial proceedings against the State, whether they be general, contentious administrative, or protective, the reform will make it possible for both plaintiff and judicial courts to call to the proceedings other possible risk event generators, whether they be private or public entities. This possibility shall open the space to define if there are excluding, solidarity, or concurrent conditions of responsibility in favor of the State, and also the possibility of filing judicial actions against public servants accountable for their actions.

- Regulations stating, as clearly as possible, the functioning fields of competence of public entities in risk management. An important aspect, in legal disputes over State’s responsibility, is the definition of the content, scope, and limits of the powers that correspond to each of the public entities involved directly or indirectly in risk management. Thus, it is imperative that the law governing the subject be especially clear when it comes to processes in which sequentially different government agencies participate.
- Regulations setting out precisely the ways to establish and derive State and private responsibility, and as far as possible eliminating the uncertainty of the judicial interpretation. There is a need for legal regulations that define the ways to establish State responsibility with all the requirements and conditions.

Jurisprudential and doctrinal interpretations may be used, but considering that in terms of risk management, there are both public and private factors that establish the concurrence of responsibility among multiple entities. This will determine, for example, that in case of intent or grave fault by a private agent in its responsibilities in facing risk, this agent should assume the entire cost of damages caused.

- Legislation which confirms and clarifies the responsibility for the construction's physical protection. Advance toward a regulation that establishes responsibility for Urban Curators and that upon issuing the license or authorization acts, requires the compliance with construction technical standards as set forth in Decree 564 of 2006, Article 49, the provisions of Act 400 of 1997, Decree 33 of 1998, and other decrees.
- Mandatory legal rules regarding financial protection applied to both public and private sectors. Assess cases in which individuals may be forced to define insurance strategies or other financial protection mechanisms similar to those existing for regulations of common areas in condominiums.
- Modification in the Statutory Law of people's rights and obligations in risk reduction and management. Assign citizens the responsibility of knowing and managing the risk they are exposed to due to the probability of a natural disaster occurrence.
- Other regulations related to the public administration sector, such as: (i) Analyze the risks and alternatives from the projects' prefeasibility; incorporate the subject in the BPIN norms. (ii) Regulate concession contracts and in particular comply with Conpes 3107 of 2001, assigning responsibility for natural event disaster risk management to the private investor, as a transferable risk through insurance policies or other financial instruments.

(iii) Stipulate technical regulations for each sector; for example, updating bridge codes and tunnel regulation; terminate the implementation process of the Risk Management chapter found in the Technical Regulations for Drinking Water and Sanitation Sector (RAS), among others. (iv) Articulate strategies in the agriculture, mining, and environment sectors to regulate and apply the recent Environmental Sanctioning Regime in the illegal activities of deforestation, desiccation, wetland invasion, alteration of a river's course, etc.

Design and implement an integral strategy for the financial security of the State at the sectoral and territorial level with the purpose of guaranteeing an adequate response when there is a disaster and protecting the country's financial balance on a long-term basis. There is not enough information to determine the financial needs of low-frequency/high-cost events, but in the case of the La Niña 2010-2011 phenomenon, the budgeted investments were approximately US\$16 billion, ten times more than in the case of the Coffee Growing region earthquake. In any case, the calculation of these amounts depends on the definition of the State's responsibilities and the efficiency with which these resources are executed. In addition to the strategy of the Central State, it would be desirable to establish a risk management fund and financial protection strategies at the sectoral and territorial level (municipalities and departments) in order to foster the principles of correspondence, complementarity, and subsidiarity.

Clarify, from the regulations, the procedures and mechanisms as to how private agents participate in the different phases of risk management. The current System anticipates the intervention of private agents in risk management, but with insufficient development and lacking the conditions to apply it. This could include, among others, the following elements:

- Obligations of private and public agents in the preventive phase, as referred to in Articles 8 and 9 in Decree 919 of 1989, or in dealing with the results of damages; although with the exception of the partial development that Bogota has had, these obligation definitions have not yet been used.
- Specific modifications in risk management in the Citizen Participation in Statutory Law, taking into account that every individual should “act in accordance to the principle of social solidarity and respond with humanitarian actions to situations that may endanger life or health of the population” (numeral 2, Article 95 of the Constitution).
- Design and implement a strategy where the State, the insurance sector, and the private sector are included in order to reinforce insurance penetration in Colombia. This should be done in order to increase insurance coverage among individuals as well as in the private sector. The strategy may include State incentives, but the insurance sector should be responsible for increasing and offering the availability of its products.

Promote and incentivize municipal and sectoral strategies to make the population aware of and competent in risk management. Take advantage of the citizens’ readiness to contribute

and increase awareness and knowledge levels in risk management using cost-effective measures to reduce risk to the country, which the State can implement through:

- Develop awareness campaigns, mainly in those cities that have high risk levels versus those where hazards are scarce. Likewise, in cities or towns where these risks are more frequent, strengthen the appropriation level of the campaigns. Clarify public and private responsibility, especially in evaluating vulnerability of each home and disclosing clear and effective risk reduction recommendations.
- Implement risk management programs jointly with the community. These should have real and sustainable impacts and include risk prevention strategies and disaster preparation (drills and brigades). They have to achieve effective risk reduction so that the participants will have a greater awareness and knowledge of these risks.
- Accompany the guilds in designing risk management strategies to inform and train their members, promote measures to mitigate existing risks, and reinforce coordination in decision making. Thus, the guilds can influence their members in how to reduce risk, so it is mitigated in the sector and by and large in the country.



Floods. Route Montería - Arboletes, rural area. Municipality of Montería (Córdoba - Colombia), 2011. Photography: María Isabel Toro Quijano.



From *Planning*
to *Implementing*
Disaster Risk
Management
in Colombia

Carolina Díaz G., Diana M. Rubiano V.,
Carlos E. Vargas M., Ernesto Betancourt M.

A *ppendixes*



A.1. INVESTMENTS IN DISASTER RISK MANAGEMENT

When reviewing planning and implementation actions developed in risk management at different territorial levels, it is evident that there has been significant progress. Nevertheless, there is also a significant disarticulation between public investments and the effectiveness of these actions. Following the priority reference areas described in the Hyogo Framework for Action (HFA), it can be seen that despite the country's achievements there are still gaps and limitations in financial terms, resource allocation, and effectiveness in governance, knowledge and information, education and communication, risk reduction, and disaster management at the national, regional, and municipal level. These analyses were performed based on data provided by DNP-DDTS, information that subsequently was reclassified to obtain a more detailed assessment on progress in risk management (*Box A.1*).

A.1.1. The State's investment in disaster risk management

Most of the allocated resources for risk management financing come from the national level through the General Budget of the State (PGNE). Between 1998 and 2010, the invested resources in absolute terms amounted to Col\$7 billion¹ (about US\$3.5 billion²), equivalent to 2.5% of the total national investment and to 0.15% of the GDP. In per capita terms, the annual risk expenditure was close to Col\$12,726.

Within the framework of priority areas, 81.5% of the investment budget executed by the State during the 1998-2010 period was allocated to disaster management, and 16.3% to existing risk

reduction, while 2.1% of the total was invested in knowledge, information, governance, and education. The national public investment in risk management during the mentioned period showed two major growth cycles directly related to major disaster occurrences. The first was related to emergency management and infrastructure reconstruction after the earthquake in the Coffee Growing region (1999-2001), where the resources assigned amounted to almost Col\$2.4 billion (equivalent to US\$2.1 billion). The second was associated with the management of the La Niña phenomenon experienced by the country in 2010, in which the State assigned Col\$3.1 billion as of December 31, 2010 (approximately US\$679 million), especially in humanitarian aid and early recovery (*Graph A.1*).

The State's investments made in the field of institutional strengthening, policy formulation, and other elements related to risk management governance have been small throughout the entire period under analysis, experiencing a slight increase starting in 2005. The activities aimed at strengthening the mechanisms of organization, coordination, sectoral and territorial participation, planning, management, and monitoring require considerable technical and political management, though they are inexpensive and would produce powerful impacts. Particularly striking is the low priority given to implementation and investment, while policy formulation and planning have been given due relevance since 1989 in the PNPAD, in the Conpes Document 3146, and in the last four National Development Plans. This situation largely explains the weakness of the SNPAD and its low governance capacity.

1 All values are reported in Col\$ of 2010 (US\$1 = Col\$1,913).

2 Representative market rate as of December 31, 2010. US\$ 1 Col\$1.913.

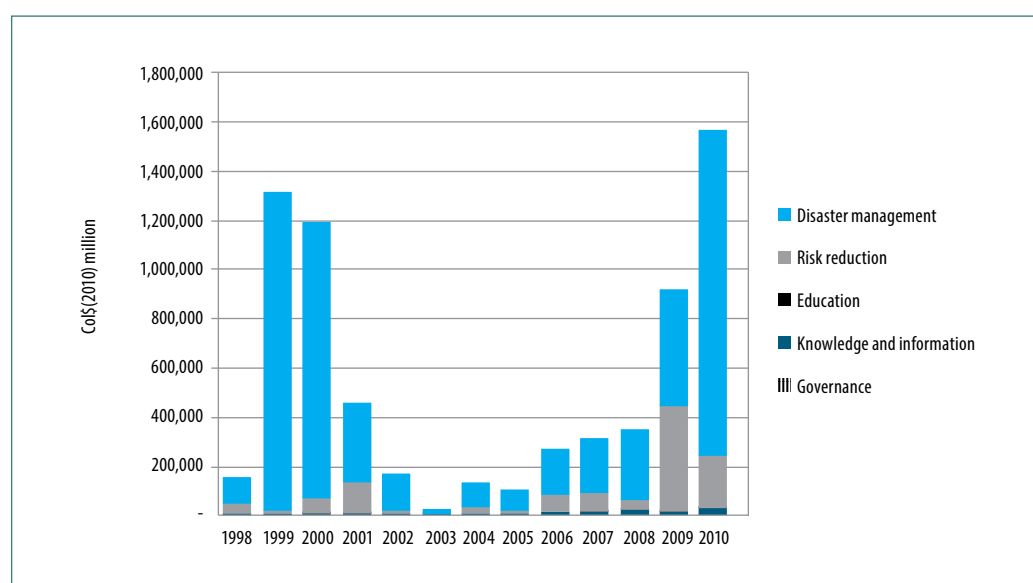
Box A.1. Information for the analysis of risk management investment: Scope and limitations

The main source of information for risk management investment analysis for this publication was the database provided by DNP-DDTS. This information includes investment figures made by national entities under the General Budget of the State (period 1998–2010) and the amounts of investments reported annually, by territorial entities at departmental (period 2004–2008) and municipal (period 2004–2008) levels.

From the data provided a classification of risk management investment accounts was carried out using the HFA priority areas: (i) governance, (ii) knowledge and information, (iii) education, (iv) risk reduction, and (v) disaster management.

- At the national level investment programs and projects were grouped according to their scope, making them coherent with the five HFA areas.
- At the departmental level the risk management investment accounts were classified and grouped as follows:
 - (i) *Governance*: strengthening of the Disaster Prevention and Response Committees.
 - (ii) *Knowledge and information*: risk identification, analysis, and assessment studies related to regulation and land use planning.
 - (iii) *Education*: education in disaster prevention and response.
 - (iv) *Risk reduction*: urban and rural area adequacy in high-risk zones; conservation of microbasins; physical infrastructure investment for prevention, protection, and contingencies in infrastructure works; reforestation and erosion control; resettlement of families from high-risk zones and land adequacy; watershed and microbasin use and management; subsidies to improve social housing; subsidies for housing located in high-risk areas; other risk prevention programs.
 - (v) *Disaster management*: emergency response (disaster response); agreements with fire departments for fire prevention and control; design, development, and updating of Emergency and Contingency Plans; investments in machinery and equipment for disaster prevention.
- At the municipal level, the risk management investment accounts were classified and grouped as follows:
 - (i) *Governance*: preparation, design, and updating of disaster prevention and response plans; strengthening of Disaster Prevention and Response Committees.
 - (ii) *Knowledge and information*: risk monitoring, assessment, and zoning for planning purposes.
 - (iii) *Education*: education for disaster prevention and response.
 - (iv) *Risk reduction*: urban and rural area adequacy in high-risk zones; microbasin conservation; flooding defense; irrigation, drainage, and land recovery; disaster prevention; foresight, protection, and contingency in strategic infrastructure works; housing construction and improvement; reforestation and erosion control; water riverbed and stream regulation; physical infrastructure for structural preparation and reinforcement; high risk-zone resettlement and relocation; subsidies for social housing purchasing; subsidies for social housing improvement; subsidies for high risk-zone housing relocation.
 - (v) *Disaster management*: disaster response; agreements with fire departments for fire prevention and control; machinery and equipment endowment to fire departments; design, development, and updating of Emergency and Contingency Plans.

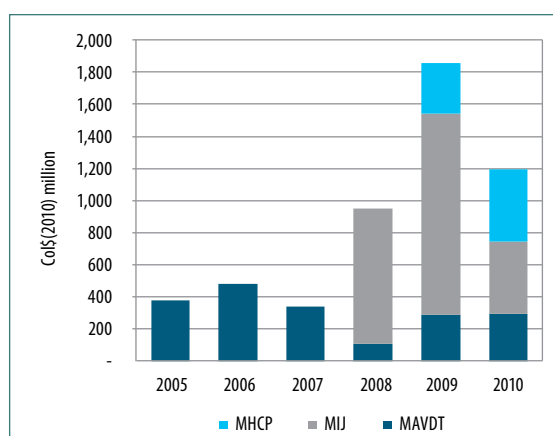
GRAPH A.1. Public investment in risk management at the national level by priority area



Source: Authors' graph from the information provided by PGN, DNP-SDAS, 2010.

Major efforts in institutional strengthening have begun to be observed since 2005 with the State Fiscal Vulnerability Reduction Program in Facing Natural Disasters led by the Ministry of Environment, Housing, and Territorial Development (MAVDT) and the Ministry of Interior and Justice (MIJ) through the Risk Management Division (DRG). Thus, between 2005 and 2010, the MAVDT allocated constant Col\$1.8 billion of 2010 for the coordination of this program and the support to municipalities in their territorial planning processes. This resource allocation represented an average of 39% of the investment in the budget appropriation named “Governance Strengthening” in this analysis. Between 2008 and 2010, the investment made by the MIJ was Col\$2.5 billion, equivalent to 49% of the total resources assigned to the governance area in actions such as support to policies and financial instrument strengthening for the SNPAD, as well as technical assistance to municipalities and departments in the Risk Management Plan formulation. Additionally, the Ministry of Finance and Public Credit (MHCP) made investments in a financial protection strategy formulation in 2007, an activity which was not continued during the 2008-2010 period (*Graph A.2*).

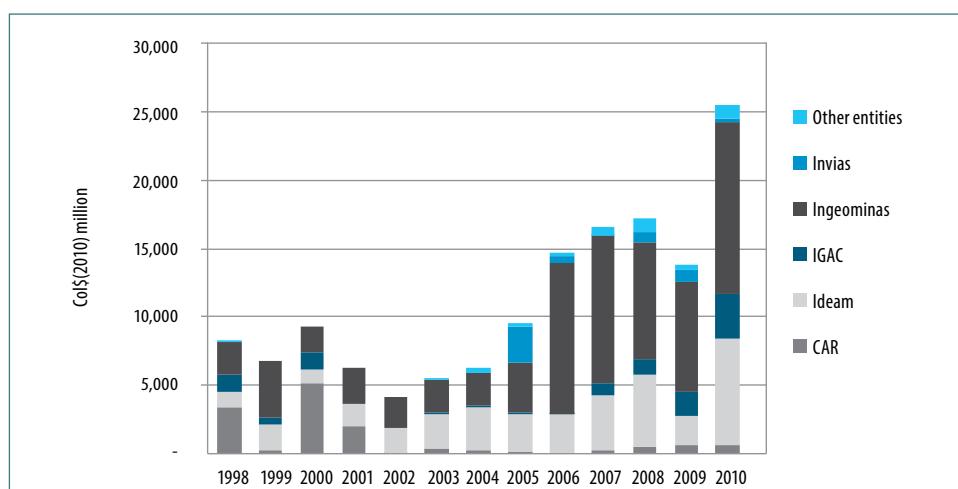
GRAPH A.2. Public investment in governance by national entity



Source: Authors' graph from the information provided by PGN, DNP-SDAS, 2010.

The budget allocation in knowledge and information fields during the late 1990s and 2000 experienced a dynamic and sustained growth, and it represented 2% of the total investment in risk management. Investments made in the areas of knowledge and information at the national level during the period 1998-2010 were valued at Col\$143 billion, in which entities such as SGC (former Ingeominas), Ideam, and IGAC invested 85% of these resources (*Graph A.3*).

GRAPH A.3. Public investment in knowledge and information by national entity



Source: Authors' graph from the information provided by PGN, DNP-SDAS, 2010.

While in 1998, the SGC allocated just over constant Col\$2.5 billion in inventories and geohazard monitoring in 2010, the total investment amounted to Col\$5 billion, accumulating for the period constant Col\$72 billion. An addition to the entity's budget made possible an increase of the geological phenomenon monitoring by updating the National Seismic System, remodeling the Pasto Volcano Observatory and the geodesic station network, and the geodynamic studies.

Ideam reports a similar dynamic in relation to increased investment, considering that in 1998 it had at its disposal approximately Col\$1.2 billion throughout the area of knowledge and information, and by 2010 this figure was a constant of Col\$7.7 billion. The entity has focused the priority of their investments on specific fields in hydrometeorological knowledge management, network maintenance of national environmental stations, and broadcasting environmental information. These are the areas in which the entity has oriented its priorities in terms of investment, registering total resources of constant Col\$38 billion for the period 1998-2010.

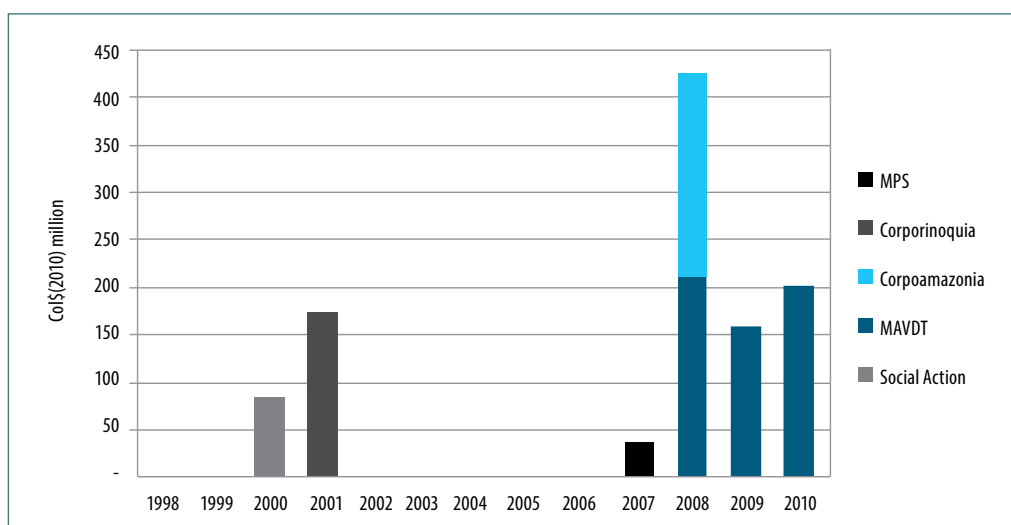
During the same period, the Regional Autonomous Corporations (CAR) have invested in knowledge and information generation close to Col\$13.3 billion, equivalent to 9.3% of total investments that have been made with PGN resources. In 1998, the CAR assigned 40% of the PGN resources for hazard and risk studies to give support to the POT in hydrometeorological instrumentation systems and diagnostics for supply basins. Unfortunately, this participation gradually declined to 2% in 2010. It is remarkable that these data only refer to the resources of the CAR that come from PGN, be-

cause there was no access to their own resource investments or other sources.

Finally, the IGAC accounted for 7.2% of resources allocated for knowledge and information, equivalent to approximately Col\$10.3 billion in the years under analysis. These investments were aimed at gathering information on soils, geographical studies, and monitoring the soil as a resource. It supported the implementation of appraisals for housing relocation and other activities related to damage assessment and post-disaster censuses.

Investments in education and communication are the least favored with lowest rates compared to other risk management actions at the national level, and their dynamic in recent years remains the same. From the total investment budget on risk management at the national level during the period 1998-2010, the education and communication fields received an equivalent of only 0.02%, which corresponds to constant Col\$1.1 billion. Although resources are limited, entities such as the MAVDT as well as some CAR have decided on the 73% of total investments in this area. The MAVDT has focused its activities on environmental management training with emphasis on risk management, particularly during 2007 and 2008, through the State Fiscal Vulnerability Reduction Program. Moreover, Corantioquia and Corpoamazonia also assigned significant resources to instruct social and environmental promoters and to support anthropic risk training programs, but these are specific projects that lack continuity on a long-term basis (*Graph A.4*).

GRAPH A.4. Public investment in education and communication by national entity



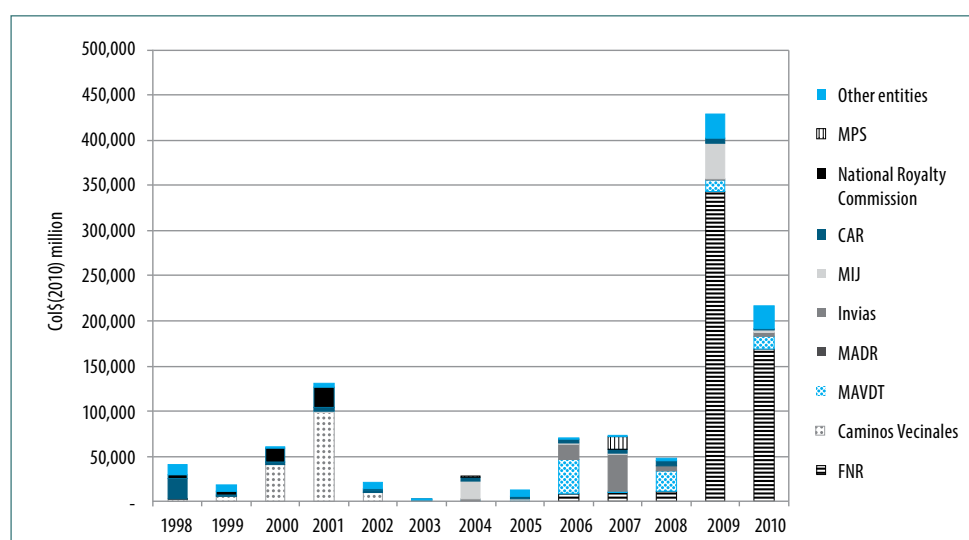
Source: Authors' graph from the information provided by PGN, DNP-SDAS, 2010.

Evolution was unstable in terms of public investment allocated to risk reduction between 1998 and 2010. However, there was a pronounced tendency of growth between 2009 and 2010 due to the participation of the National Royalties Fund (FNR). Risk reduction had within the total investment in disaster risk management for the country 16.3%, equivalent to constant Col\$1.1 billion, and represented the second rank in importance by resources spent at the national level (a big difference with disaster management which ranked first with an investment of 81.4%). Moreover, the increase of the allocation in risk reduction was mainly due to projects funded by the FNR. Between 2009 and 2010, investment spending directed through the Fund totaled Col\$511 billion, of which 60% went to prevention and relief projects and 30% to construction, improvement, and rehabilitation of emergency works in the Magdalena River.

The largest investments for risk reduction were performed in watershed conserva-

tion through the FNR and the CAR, followed by investments in road infrastructure made by Invias. In 1998, the CAR spent on risk reduction Col\$23 billion with funds from the PGN, an amount that represented about 57% of the total investment made by national entities that year. In 2010, this proportion was evidently reduced to a figure of 1% (Col\$2.4 billion) for that component. Also significant were the amounts primarily associated with watershed conservation and recovery financed by the National Royalties Commission, and road infrastructure improvement with investment from the Caminos Vecinales Fund and later from Invias, although a large proportion of these investments have been focused on maintenance and post-emergency road repair and they are not strictly considered to be entirely allocated to risk reduction. The MAVDT has allocated resources since 2007 to several projects especially on technical assistance, watershed protection, and forest fire prevention (Graph A.5).

GRAPH A.5. Public investment in risk reduction by national entity



Source: Authors' graph from the information provided by PGN, DNP-SDAS, 2010.

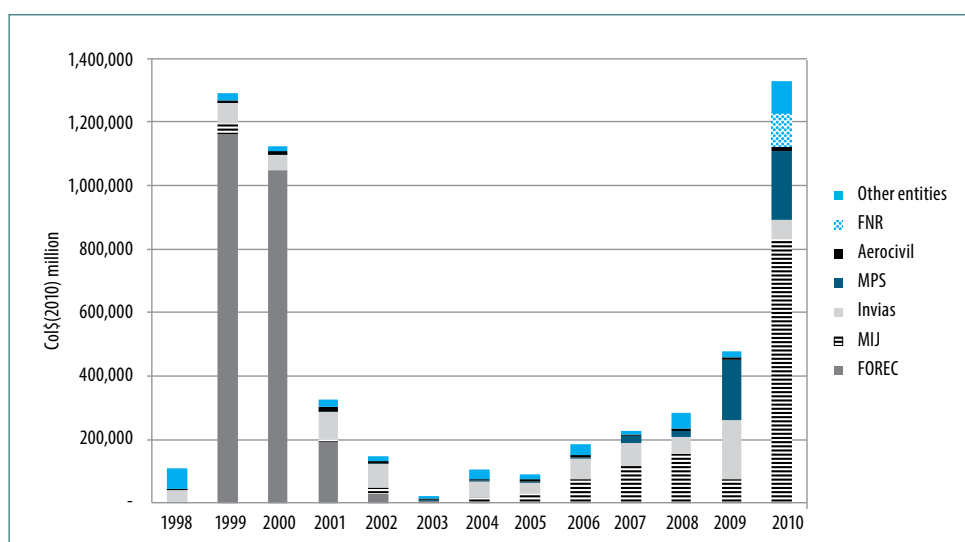
There are several organizations identified that have made investments in areas such as strengthening of health infrastructure and financial protection, with initiatives worth noting. In 1998, the Ministry of Agriculture and Rural Development (MARD), through the implementation of agricultural insurance, allocated resources associated with financial protection. The Ministry of Social Protection (MPS) invested during the period under study more than Col\$16 billion in strengthening hospital infrastructure, standing out as the sector that has made most effort to reduce seismic vulnerability.

Investment in disaster management between 1998 and 2010 was constant Col\$5.7 billion, and in this period most money at the national level (85.1% of total) was channeled to this area. Between 1999 and 2001, through the now liquidated Reconstruction Fund for the Coffee Growing Region (FOREC), a significant amount of resources (Col\$2.4 billion) was executed in disaster management and response caused by the earthquake in

the region. Subsequently, the investment for disaster management declined substantially until mid 2000. Since 2005, the budget appropriation began a new cycle of growth, where the highest level experienced was in 2010, related to the presence of La Niña, which caused heavy rains for several months, causing floods and landslides in almost all the country (as described in Chapter 1).

A large part of the investment in emergency management was performed by the MIJ through the National Calamity Fund (FNC), leaving limited resources for risk reduction. Especially in 2010, the MIJ spent approximately Col\$832 billion for managing the tragedy that was sparked by La Niña in the country. The FNC, which mainly receives its resources from the PGN, according to Ingeniar Ltda. (2011), has had irregular and insufficient flow of resources, giving priority to disaster management and investing very little in activities for risk reduction despite the fact that both areas are part of its objective. Therefore, the above-mentioned

GRAPH A.6. Public investment in risk management by national entity



Source: Authors' graph from the information provided by PGN, DNP-SDAS, 2010.

reveals the existence of a real gap in the main financial mechanism available to the system to encourage and internally cofinance risk management (Graph A.6).

A.1.2. Regional investment in disaster risk management³

Departmental investment in risk management as part of the total investment during the period of 2004-2008 was 0.65%, making it the territorial level with the fewest resources in absolute and relative terms. In the period under analysis, the amounts were constant to Col\$1 billion, showing a minimum percentage of investment in 2006, equivalent to 0.37%, and a maximum investment ratio in 2007 of 1.21%. On per capita terms, it averaged Col\$1.8 billion annually.

Within the priority area framework, 73.7% of the executed budget in departments during the 2004-2008 period focused on risk

reduction, and 18.1% was allocated for disaster management. The areas of education (5%), governance (1.6%), and knowledge and information (1.6%) were placed in marginal positions. Unlike the national level, where investment in governance and education areas is minimal, departments become more important in relative terms, although the total allocation of resources in these areas still continues to be incipient. According to information provided by SDAS in governance, the only registered budgetary appropriations in 2007 and 2008 were of Col\$3.8 billion and Col\$1.3 billion respectively. These resources were aimed at strengthening the Prevention and Response Committees. The area of knowledge and information received about Col\$5 billion concentrated in 2004

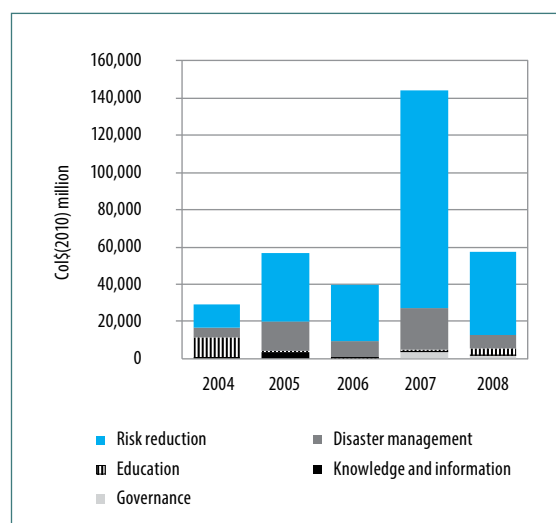
³ For this level of government, information was available only for the period 2004-2008, according to DNP databases. In order to analyze this information, some accounts that the DNP categorized as DRM or DRM-related were rejected, as they do not report investment as such.

(Col\$1.1 billion) and 2005 (Col\$3.3 billion), while in the following years investment decreased to less than Col\$200 million, as happened in 2007 and in 2008. Returning to the education area, it mainly shows an expenditure made in 2004 in the department of Cundinamarca (*Graph A.7*).

A strong increase is evidenced in 2007, the year in which the concept of subsidies for social housing improvement was introduced (Col\$78.6 million) and an unprecedented investment at the territorial level was made. Subsidies for social housing improvement received in only one year 25% of departmental spending in risk management, and 80% of it was allocated to Antioquia. The area of disaster management performed in the same way that disaster response did: it increased from Col\$5.1 billion in 2004 to Col\$15.8 billion in 2005, decreasing in 2006 to Col\$8.5 billion, and then increasing again in 2007 to Col\$22.6 billion, with a further decline in 2008 to Col\$7.2 billion. These values for disaster management were shown throughout the national territory, with emphasis on the departments of Santander, Magdalena, Casanare, and Nariño, which accounted for more than 50% of total resources.

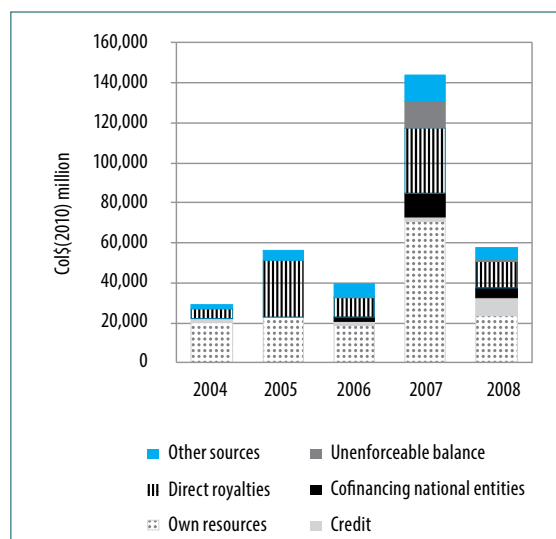
Figures according to the funding sources show that owned resources (current income free of destination and specific destination) are those that have the largest participation in risk management investment at the departmental level, followed by direct royalties. In this way, owned resources (47.6%) and royalties (27.3%) represent approximately 75% of the resources used by departments in risk management and are the primary source of funding for risk reduction (*Graph A.8*).

GRAPH A.7. Public investment in risk management at departmental level by action axes



Source: Authors' graph from the information provided by DNP-DDTS, data processing DNP-SDAS, 2010.

GRAPH A.8. Departmental investment in risk management by funding source*



* Note: For this graph, other sources were used, such as SGP, FNR, FAEP, transferred rents, balances not executed from other years that also include sales of assets, financial returns, and others.

Source: Authors' graph from the information provided by DNP-SDAS, 2010.

Given the low level of departmental fund allocation, this could be reinforced by the widespread use of cofinancing projects (only 5.9% of the investment in departmental DRM is funded through national entities) and economic instruments, following, for example, the model introduced by the CAR in environmental management, which is funded in part with resources from such instruments. As an example, several CAR charge effluent fees for the right to dump waste, a fee for using water, fees for forestry exploitation, eco-labels, the Clean Development Mechanisms, the Forest Incentive Reforestation Certificate (CIF), and municipal compensation for landfill (Ecovera, 2009). All these elements seek to change the agents' behavior against actions that produce high impact on environment and have consequences that negatively affect the population. Additionally, these instruments serve as another way to raise some resources to continue with environmental management and risk management⁴.

In practice, the CAR do not have appropriate mechanisms through which to report their expenses in risk management. Despite the positive meaning of using "alternative" funding instruments for risk management, or their being better for environmental management, which by their close relationship creates a double impact in terms of investments made, these budgets are inconspicuous and do not allow national or territorial control of the same⁵. This also creates disarticulation between risk management carried out by the CAR and the different levels of government.

A comparative analysis of the departments shows that those with increased investment in risk management were Antioquia, Casanare, and Cundinamarca, while per capita investment was headed by Casanare, Arauca, and Meta. Antioquia had the highest allocation of resources in risk management, accounting for 27.5% of the total investment of all the departments, followed by Casanare (18.6%)

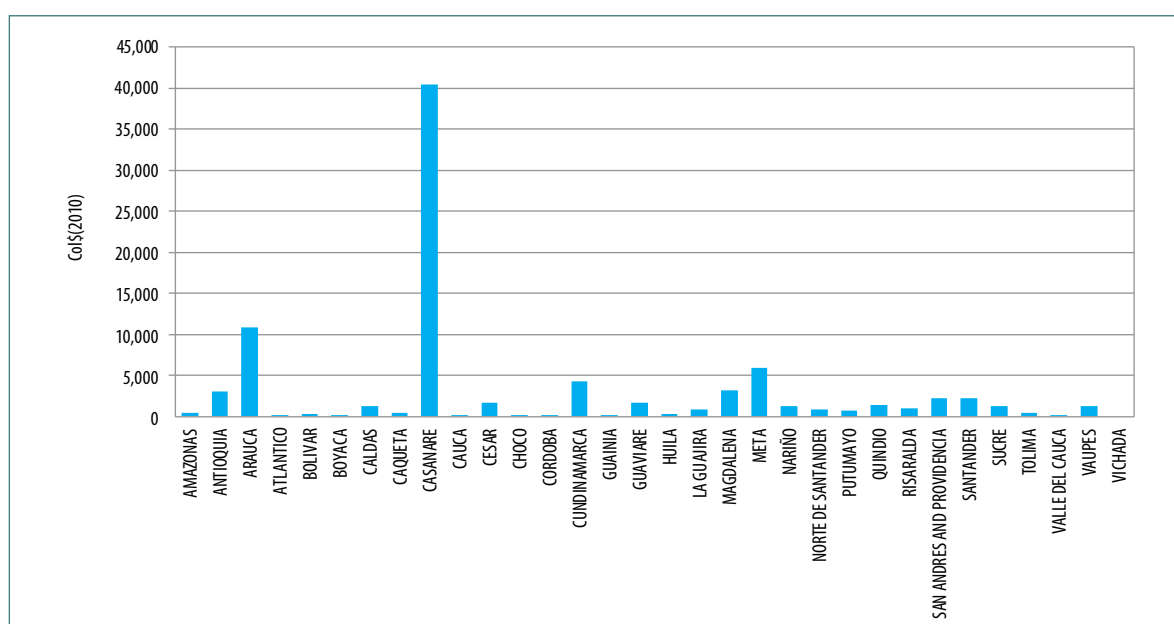
and Cundinamarca (15.2%), but in terms of per capita investment Casanare, with a much smaller population, reached Col\$40,377, which means four times the investment of the second department, Arauca, with an investment of Col\$10,913 per capita. One should highlight the importance that direct royalties have for some departments in the funding of this area, amounting to about 50% for Santander, Meta, and Arauca, and over 80% of funds for risk management activities in Casanare and La Guajira (*Graph A.9*).

In assessing the relationship between disaster occurrence in a department and its response and responsibilities in facing disasters, overall it is not true that territorial entities with greater occurrence of disasters are those that invest more in risk management (whether it be in spending on disaster management or on the four remaining areas) as a proportion to their total investment. Two indicators were defined to explain the above conclusion. The first was the responsibility for risk management, understood to be the ratio between investment in activities different from disaster management (mainly risk reduction, but also governance, knowledge and information, and education) and the total departmental

4 Likewise, the use of tax incentives to change disaster risk reduction performance is another option that should be analyzed. Among these types of instruments used by the CAR are VAT deductions, income tax deductions, and property tax conservation exemption (Ecovera, 2009).

5 With the CAR, there are two tracks: either use the information contained in each of the Action Plans, or use information from the General Comptroller of the Republic (CGR). In both cases, the information obtained is not reliable (it is based on projections, it presents information on resource execution for only some years, and it is dissimilar because data cannot be compared across the different CAR). However, it is noted that the information collected by the CGR presents investments in DRM that cannot be ignored. The result of these data are investments worth Col\$88.91 billion adjusted to 2002 currency for the period 2002–2006, implemented by 24 CAR, with the Autonomous Regional Corporation for the Defense of the Bucaramanga Plateau (CDMB), the Regional Autonomous Corporation of Cundinamarca (CAR), the Regional Autonomous Corporation of Santander (CAS), and the Regional Autonomous Corporation of Risaralda (Carder) contributing approximately 60% of the investment reported (OSSO Corporation, 2009b).

GRAPH A.9. Per capita investment in risk management by department



Source: Authors' graph from the information provided by DNP-SDAS, 2010.

investment. The second indicator was the disaster response, understood to be the ratio between expenditure on disaster management and the total departmental investment. The results are presented in the following charts for all departments, placed according to their position on the scale facing the two indicators (highest to lowest) and their relation to the position occupied by each department in the ranks of disaster occurrence (also from high to low)⁶.

Relating the position of the departmental responsibility indicator and disaster occurrence⁷, it can be concluded that departments with higher disaster occurrence are not those that invest more in risk reduction (e.g., Casanare, Arauca, Meta, Sucre, Vaupes, Quindío, and Putumayo). Certain kinds of proportionality are observed between the two variables in some departments (Caldas, La Guajira, Norte de Santander, Risaralda, and Antio-

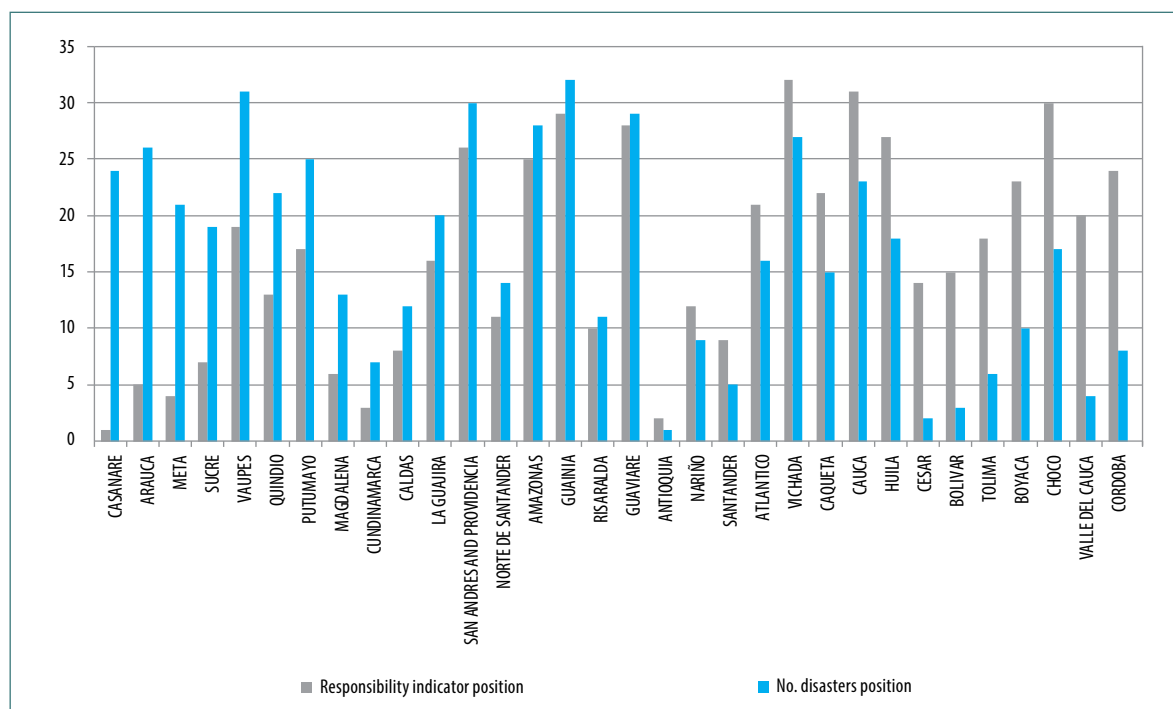
quia), which could be described as positive, but at the same time there are territorial entities such as Córdoba, Valle del Cauca (with the highest total investment), Boyaca, Cesar, and others, which despite having large number of disasters do not invest in disaster risk management⁸ (*Graphs A.10 y A.11*).

6 Information on the number of disasters was obtained from the DesIn-ventar database.

7 Graph A.10 presents favorable positions to the left and unfavorable to the right, with the center as an area that shows proportionality in risk management investment facing occurrence of disasters.

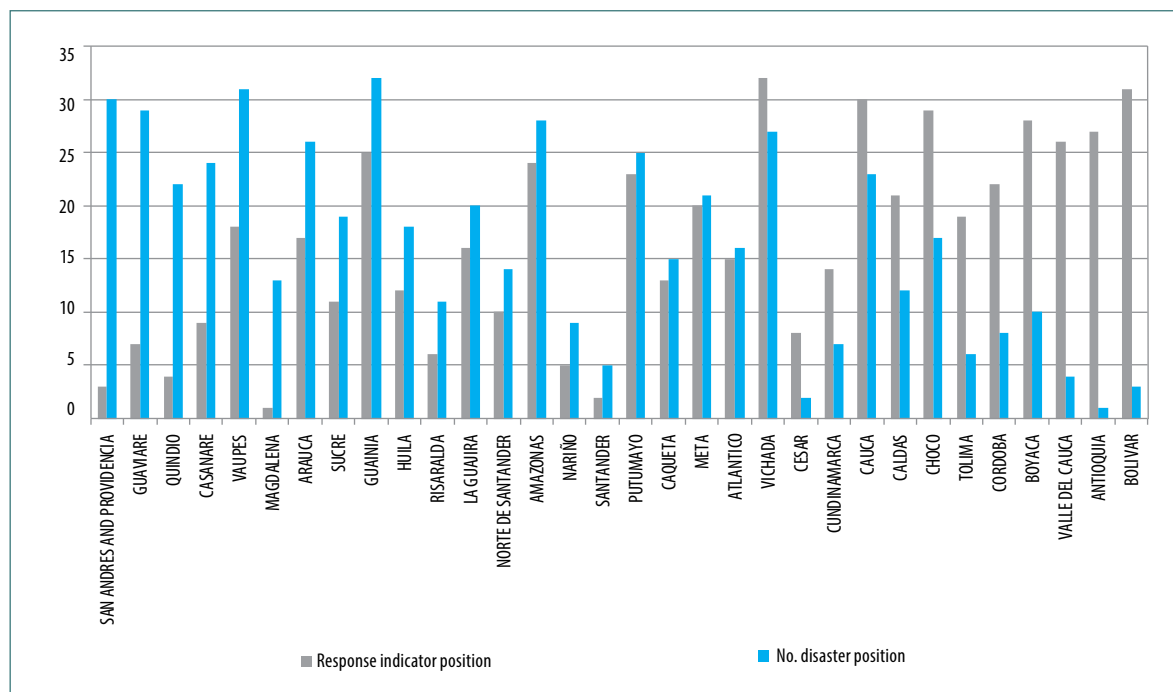
8 The last departments are discarded from the analysis in the responsibility indicator scale (and response as well) because they reported a Col\$0 investment or did not report.

GRAPH A.10. Departmental scale of risk management responsibility indicator and the number of disasters recorded



Source: Authors' graph from the information provided by OSSO-EAFIT Corporation, 2011 and DNP-SDAS, 2010.

GRAPH A.11. Departmental scale of disaster response indicator and disaster occurrence



Source: Authors' graph from the information provided by OSSO-EAFIT Corporation, 2011 and DNP-SDAS, 2010.

The relation between position on the disaster response indicator and position on the disaster occurrence shows that it is not true that those departments that undergo most disasters are those that invest most in disaster management. Departments that have few investment resources, such as San Andres and Guaviare indicate that they are relatively committed to being prepared for an emergency response in spite of not having frequent events. On the other hand, it can be concluded that there are departments that have more resources, such as Valle del Cauca and Antioquia, which have a high incidence of events and still do not take the necessary appropriations for their disaster response. This may be related with the investment made by the nation in Valle, which shows that if there is national money earmarked for disaster management as a result, the department does not make the investments it should in this sense. Similarly, it is observed that there are departments “proportionally” committed to disaster response, such as Santander, Norte de Santander, Nariño, Atlantic, Meta, Caqueta, and Putumayo (*Graph A.10 y A.11*).

A.1.3. Local investment in disaster risk management⁹

Municipal investment in risk management in absolute terms amounted to a total of Col\$3.5 billion in 2010 pesos during the period 2002-2008. In the period under analysis, the invested amounts were the equivalent to 2.30% of total municipal budget, showing a maximum in 2003 with a rate of 3.44%, and a minimum in 2008 with a rate of 1.57%. In per capita terms, the annual average was Col\$12,012.

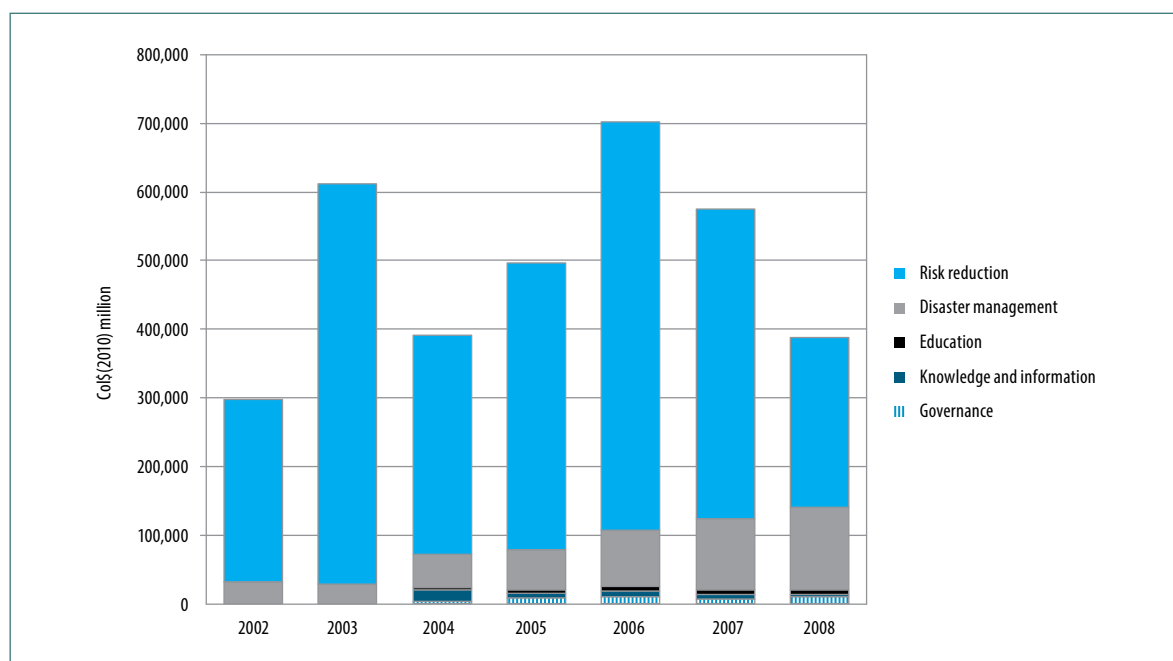
The municipal budget appropriation in this area was focused on risk reduction activities (83.1%) and secondarily on disaster management (13.6%). The areas of knowledge and

information (1.19%), governance (1.16%), and education (0.8%) had marginal investments. As is evident, the money aimed at risk reduction exceeded, as in the departmental level, the money addressed to other areas of action, and thus acquired more importance in relative terms (*Graph A.12*).

In terms of public investment allocated to risk reduction between 2002 and 2008, development was unstable, with a pronounced tendency to grow in 2003 and 2006. From the total funds invested in risk management, the scope of risk reduction corresponds to Col\$2.9 billion. This investment was led by spending on the “watershed conservation” account in the amount of Col\$606 million, which was particularly strong in the 2004-2006 period, principally because of the resources allocated to Bogota. Also, a peak is noted in 2003 due to the “housing construction and improvement” account in the amount of Col\$300.5 million, which only appeared that year. In this case, investments were concentrated in Bogota and Medellin. Regarding the “adequacy of urban areas in risk zones”, the money invested amounted to Col\$165 million on actions that were executed principally in the cities of Bogota and Medellin, followed by Cali and Cartagena. However, it should be noted that actions in watershed management, physical infrastructure tasks in structural reinforcement, and the housing resettlement processes, among others, are still insufficient to sustainably reduce risk conditions, since there is no comprehensive recognition of the problem in the territory, so that interventions are not necessarily planned and there is no national policy to guide such investments (*Graph A.13*).

⁹ For this level, the available information was for the period 2002-2008, according to DNP databases. To analyze this information, some accounts cataloged in principle by DNP as risk management or related to it were rejected, since they did not report investment.

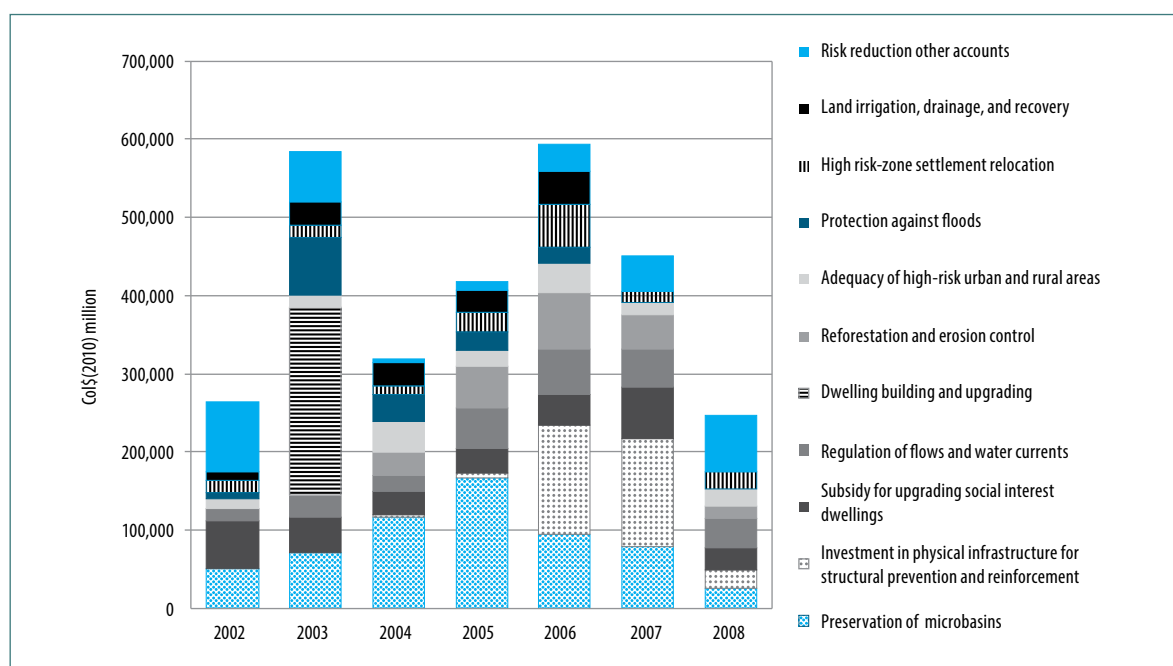
GRAPH A.12. Public investment in risk management at municipal level, by action axes*



*Note: Other sources: Etesa, FAEP, Cordoba and Sucre Department Fund, own capital resources (balances not executed from prior fiscal years, financial returns, asset sales, and endowments), and others.

Source: Authors' graph from the information provided by OSSO-EAFIT Corporation, 2011 and DNP-SDAS, 2010.

GRAPH A.13. Municipal investment in risk reduction



Source: Authors' graph from the information provided by OSSO-EAFIT Corporation, 2011 and DNP-SDAS, 2010.

Municipal investment in risk management versus disaster management has been the second most important area and accounted for 13.6%. Spending on disaster management has been increasing continuously as a result of an increase and provision of equipment for firefighters. The increase of the allocation for disaster response is highlighted in the years 2006 and 2008, where once again it was mainly assigned to Bogota and the municipalities of Antioquia (*Graph A.14*).

Like in the departments, the most important funding source for risk management at the municipal level is the current revenue from the municipalities (37%), followed by transfers from the General Participation System (SGP) (21.1%). The direct royalties (8.3%) at this level are situated in a second position, though they continue being relevant in oil-producing municipalities. Highlighted is the credit-financed spending in 2006, which was almost entirely executed in Bogota and was used for structural reinforcement and preventive measures. It is worth noting the low but ever-present coinvestment (national and departmental) as an instrument to encourage resource channeling in risk management (*Graph A.15*).

It is interesting to note that in local analysis, the performance of investment in risk management by municipal categories indicates that next to Special category municipalities (the largest and with most resources, including Bogota, Medellin, Cali, Barranquilla, Bucaramanga, and Cucuta), those with highest per capita investment in risk management are less populated municipalities with less of their own resources¹⁰. Municipalities that spend the least on risk management (per capita), and by a significant margin, are in category 4. There is also a significant difference in amount spent by Special category municipalities compared to others. In this regard, it may be noted that the scale of economies, which can be used by municipalities with large popula-

tions, reflects part of this same result, since it is less expensive (in per capita terms) to manage large investments in municipalities with large populations, than in municipalities with fewer than 10,000 inhabitants, such as those in category 6. For municipalities with lower incomes, which are approximately 90% of the country, the lack of scale of economies is an aggravating factor, where governance, knowledge and information, and education are those with the fewest resources (Col\$35 per capita in knowledge and information, Col\$79 in education, and Col\$126 in governance). Thus, although compared with other municipal categories, category 6 is not the one that has the lowest per capita investment in such areas, the fact is that it is unlikely that it will have a palpable effect on the local society (*Table A.1*).

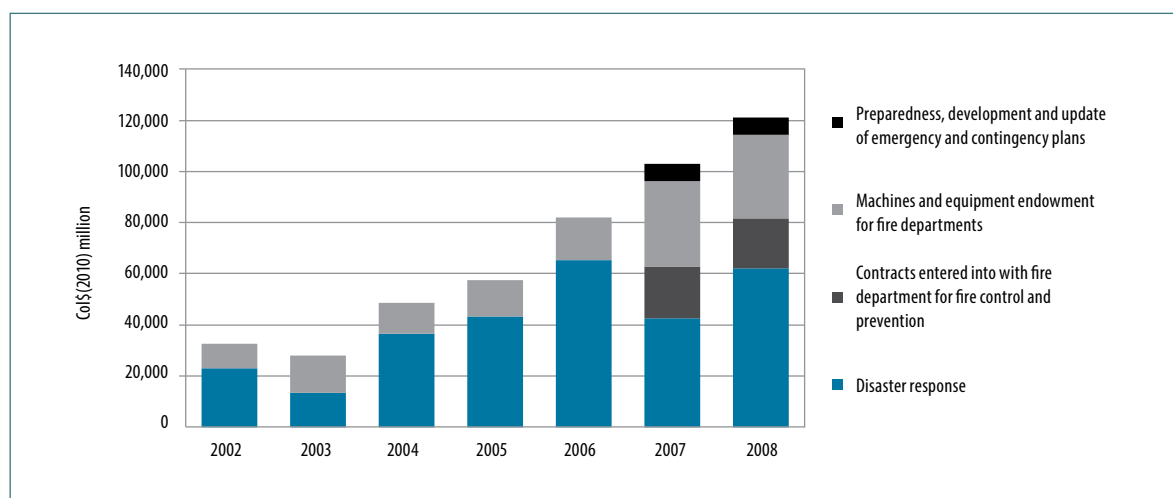
TABLE A.1. Per capita investment in risk management by municipal category in Col\$(2010)

| Municipal category | Per capita investment (Col\$) |
|--------------------|-------------------------------|
| Special | 16,729 |
| 1 | 9,789 |
| 2 | 8,811 |
| 3 | 9,608 |
| 4 | 7,814 |
| 5 | 10,639 |
| 6 | 10,980 |

Source: Authors' table from the information provided by DNP-SDAS, 2010.

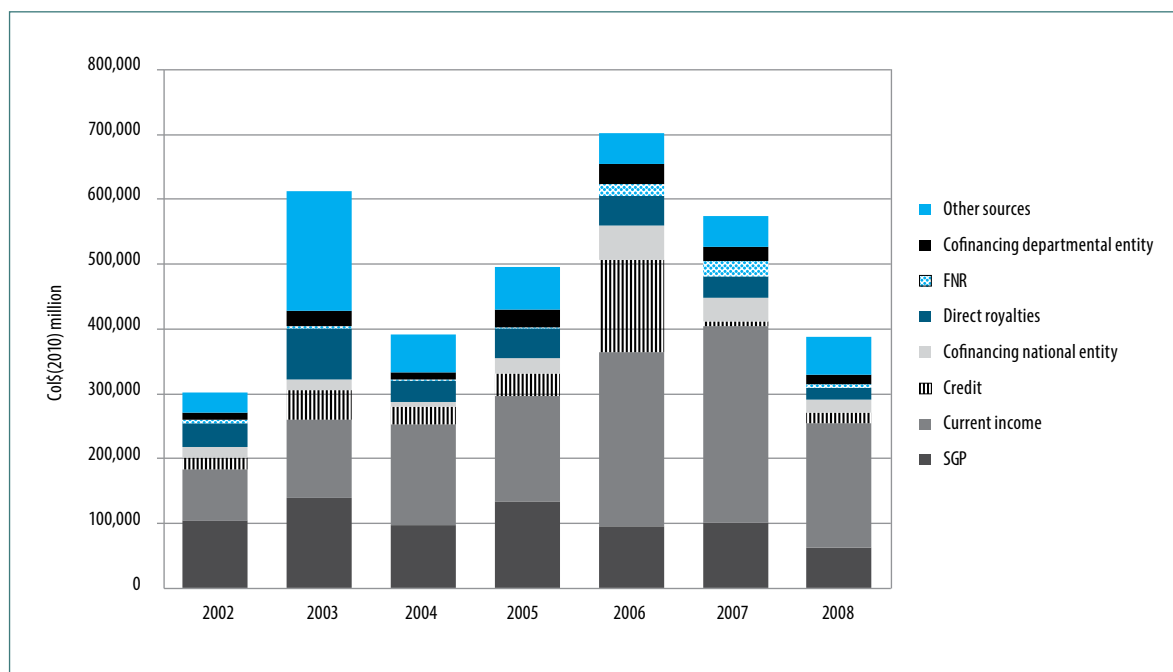
¹⁰ Municipalities in the Special category are Bogota, Medellin, Cali, Barranquilla, Bucaramanga, and Cucuta (for the end of the analyzed period). Among category 1, during the period 2007-2008, the municipalities were Cartagena, Pereira, Manizales, Villavicencio, Ibague, several of the metropolitan areas of Valle de Aburra, Dosquebradas, Yumbo, among others, totaling 14 in 2008. In turn, categories 2, 3, 4, 5, and 6 in 2008 had 14, 19, 22, 25, and 931 municipalities respectively.

GRAPH A.14. Municipal investment in disaster management



Source: Authors' graph from the information provided by DNP-SDAS, 2010.

GRAPH A.15. Municipal investment in risk management by funding source*



* Note: Other sources: Etesa, FAEP, Cordoba and Sucre Department Fund, own capital resources (balances not executed from prior fiscal years, financial returns, asset sale, and endowments) and, others.

Source: Authors' graph from the information provided by DNP-SDAS, 2010.

Municipalities that had the most risk management funding in the period under analysis are Bogota, Medellin, and Cali, with approximately 43% of total investment. Particularly noteworthy is Bogota's investment execution (Col\$1.016 billion), which alone represented a third of what was invested by all municipalities, and was about four times more in absolute terms than the investment made by Medellin (Col\$230 billion) which was second on the list, while Cali ranked third with Col\$159 billion (*Table A.2.*).

Estimates of risk management investment per capita show that the spectrum chang-

es radically, since small municipalities are the major recipients of royalties, putting them on top of the list. These estimates contrast with the municipalities with the highest investment per capita which were Castilla la Nueva (Meta), Col\$542,262, Cantagallo (Bolívar) with Col\$296,588, and Aguazul (Casanare) with Col\$211,207 per person. However, it should be noted that the data and impacts of actions showed a lack of monitoring, and therefore generate some skepticism given the magnitude of the figures.

TABLE A.2. Municipalities with most investment in risk management in Col\$(2010) during the period of 2002-2008

| No. | Municipality | Investment in governance, knowledge, education, and risk reduction | Disaster management investment | Total |
|-----|-----------------|--|--------------------------------|-------------------|
| 1 | Bogota | 896,201,098,021 | 120,527,515,690 | 1,016,728,613,711 |
| 2 | Medellin | 205,070,077,409 | 22,112,954,119 | 227,183,031,528 |
| 3 | Cali | 111,009,847,437 | 47,995,910,592 | 159,005,758,029 |
| 4 | Cartagena | 68,778,857,762 | 5,953,171,403 | 74,732,029,165 |
| 5 | Montería | 48,342,333,530 | 6,349,286,311 | 54,691,619,840 |
| 6 | Villavicencio | 46,180,723,061 | 3,412,549,884 | 49,593,272,945 |
| 7 | Envigado | 38,840,822,987 | 4,482,067,506 | 43,322,890,493 |
| 8 | Barranquilla | 29,590,184,562 | 12,739,266,173 | 42,329,450,735 |
| 9 | Aguazul | 40,141,539,941 | 1,661,161,721 | 41,802,701,662 |
| 10 | Manizales | 26,565,277,060 | 5,563,445,781 | 32,128,722,841 |
| 11 | Girón | 30,937,113,681 | 940,590,536 | 31,877,704,217 |
| 12 | Pereira | 21,811,996,278 | 7,914,098,883 | 29,726,095,162 |
| 13 | Pasto | 25,016,434,836 | 4,539,705,196 | 29,556,140,032 |
| 14 | Barrancabermeja | 25,157,470,718 | 2,309,290,937 | 27,466,761,655 |
| 15 | Neiva | 24,974,555,464 | 2,356,796,408 | 27,331,351,872 |

Source: Authors' table from information provided by DNP-SDAS, 2010.

A.2. PROGRESS IN DISASTER RISK MANAGEMENT

A.2.1. Progress in risk management at the national level

Risk management governance

Risk management policies are not coordinated with public administration in Colombia and their implementation is deficient in terms of efficiency and effectiveness. A preliminary evaluation of Conpes Document 3146 (DNP, 2009) conducted by the DNP concluded that the policies have not been fully implemented and that although implementation effectiveness is 77%, results have been achieved later than was originally set forth. Regarding efficiency, the Conpes Document was rated at only 29%. The strategies for strengthening the SNPAD and disseminating risk and disaster prevention and mitigation had the lowest efficiency ratings (4% and 5%, respectively). In this regard, the policy instrument has been partially implemented and there is evidence of weak coordination both with the corresponding entities and with the rest of the planning instruments related to risk management.

Although the SNPAD was established in 1988 and has a broad legal and regulatory framework, its development is incipient in comparison with more recent systems such as the SINA (National Environmental System). The SINA contains a set of guidelines, rules, activities, resources, programs, and institutions for implementing the general environmental principles set forth in the Constitution and Law 99 of 1993. Its governing body is the Ministry of the Environment, Housing, and Territorial Development (currently the Ministry of the Environment and Sustainable Development). Other entities that make up the

system are the CAR, territorial entities, research institutes attached to and affiliated with the Ministry, and other public, private, and nongovernmental institutions. The SINA has formulated, guided, and promoted environmental policies and regulations at the territorial and sectorial levels in areas such as renewable natural resources, land use, land use planning, business, and institutional management for sustainability, drinking water, basic and environmental sanitation, territorial and urban development, and integral housing. It has also made progress in a process-oriented approach for establishing functions, roles, and responsibilities. In this regard, the SNPAD is lagging in basic elements that ensure risk management governance in the country.

The proposals for strengthening and updating the regulatory framework for disaster risk management in Colombia have not produced concrete results. Conpes Document 3146 stipulates the need to update Decree 919 of 1989 with regard to jurisdiction, coordination mechanisms, and financing for disaster risk management; furthermore, the 2006-2010 National Development Plan established the requirement to revise and update the regulatory framework of the SNPAD and other related regulations, so that territorial entities could develop, within their jurisdiction, technical and financial instruments that are in agreement with an integral approach to risk management and ensure that resources are permanently available. In spite of existing actions and obligations, the update initiative has not yet materialized in the country.

As mentioned in Chapter 2, the strengthening by national-level entities of regional and local committees for disaster prevention

and management is an essential requirement for the sustainability of risk management actions. One of the main organizational gaps is the general weakness of the regional and local committees, which are part of the SNPAD. Although there are exceptions in big cities, these committees are characterized by a deficient ability for action, coordination, and cooperation among territorial entities, a lack of clarity in functions and responsibilities, as well as deficiencies in human, technical, and financial resources, all of which have an obvious impact on effective risk management. These gaps lead to a lack of governance for addressing the issue at various levels. Priority must be given to the creation and implementation of a strategy for strengthening local committees, especially with support from national- and regional-level technical and operating entities for carrying out actions related to knowledge and reduction of risk and disaster management.

The inclusion of risk management in sectoral planning processes (health, drinking water and basic sanitation, the environment, agricultural development, and industrial safety) has not produced compelling results. Above all, there is a lack of coordination and integration among expected goals. The first actions taken should make scaled information available in the form of maps and sectoral studies in order to prioritize and guide decisions, and should have an integral approach to incorporating sectoral risk management into national development plans.

There are no financial protection policies in Colombia. Awareness of this situation has led to the execution of the following projects: the 2004 project titled Support for Strengthening Financial Policies and Instruments of the National Disaster Prevention and Management System (DGR), and the Program for Reducing the Fiscal Vulnerability of the Government to Natural Disasters (APL 1), which began in 2002 (IBRD

7293-CO). During the first phase, the goal was to formulate policy guidelines for risk management in the country based on the preparation of a conceptual framework and a diagnosis of SNPAD regulations, and involving processes with the participation of the different entities of the SNPAD. During the second phase, the goal was to propose regulations for implementing a policy and a National Disaster Risk Management System, in coordination with a strategy for financial sustainability. In order to develop plans for transferring risk, the MHCP, with the support of the DNP, Bank of the Republic, the Bank Superintendence, La Previsora Fiduciary, and the DGR, carried out a risk transfer study that included guidelines for promoting massive disaster insurance for public and private property and so-called catastrophe bonds.

Monitoring and evaluation are essential tools for analyzing compliance with risk management obligations and their effectiveness. Evaluating risk management performance at all levels of the SNPAD requires different tools for monitoring the effectiveness of public administration and compliance with obligations and goals set forth in various plans. On the other hand, although there are control mechanisms and supervising entities – such as the System for Managing and Monitoring Government Goals (SIGOB) – there is a need for monitoring and greater support in order to ensure coordination among the processes performed by the entities in the system, prioritization of programs and projects, and effectiveness of planned and executed investments. Since the PNPAD was created, the subject of risk management has been incorporated into each National Development Plan during the last four presidential periods; however, the goals and indicators that were established do not reflect the scope that was planned and cover what was proposed in the narrative only partially.

Knowledge and information

Significant progress has been made in monitoring seismic and volcanic hazards in the country; however, the early warning systems currently implemented for floods and landslides are inadequate.

Networks for monitoring seismic, volcanic, climatic, meteorological, and hydrological conditions are available across the country and cover 96% of the territory. As a result of the process of updating and expanding seismic and volcanic surveillance networks, 12 active volcanoes are permanently monitored from three volcanological observatories (Manizales, Popayan, and Pasto), in order to provide information and issue early volcanological alerts to the entities of the SNPAD. Furthermore, the SGC (formerly Ingeominas) has expanded and modernized the seismological stations off the Pacific coast of Colombia (stations in Tumaco, Gorgona, Málaga, Malpelo, and Solano), and has installed a Network of GPS Satellite Stations in Malpelo, Tumaco, and Buenaventura, with the purpose of improving the information on tsunami hazards and providing input for constantly updating the National Tsunami Risk Management System (Office of the President of the Republic of Colombia, 2010a). These advances have been made in accordance with the obligations established in development plans and allow for the strengthening of risk management insofar as monitoring is useful for updating and developing hazard maps and, therefore, making decisions. However, very few early warning systems for floods, landslides, avalanches, mudslides, and other events have been implemented at the local level, and it is necessary to work in a coordinated fashion on their design, implementation, and operation.

Various institutions, regional entities, associations, and nongovernmental organizations have generated information about hazards at the

national level, which is used as a strategic input for building risk knowledge. Maps with landslide, flood, and seismic hazards, as well as hazard maps for the most important volcanoes are available in the country. The Ideam, the SGC, the OSSO Corporation, the CAR, seismic and geotechnical engineering associations, universities, and other entities have been essential for advancing the understanding and knowledge of hazards. Furthermore, a geo-referenced inventory of disasters due to historic and ordinary events, with records since 1970, is available through *DesInventar*, a tool for classifying and consulting the database. The tool has various resolution levels (municipal, departmental, and national), which allow the magnitude of the impact of disasters to be estimated. On account of its importance and usefulness, it is desirable to strengthen it by including criteria for assessing the economic impact of disasters.

Seismic hazard is one of the most studied phenomena. A national hazard map, a technical standard for seismic-resistant construction (since 1984), and risk assessments for some cities are available. Nationwide seismic activity is monitored by the SGC and there are regional observatories such as the OSSO (Southwest Seismic Observatory). The cities of Bogota, Manizales, Pereira, Armenia, Medellin, Popayan, and Cali have carried out seismic microzoning studies. Programs for managing the reduction of seismic risk involving projects for reinforcing the structures of health centers, schools, and other buildings have been executed in Bogota.

Although studies of flood hazards have been conducted, it is necessary to advance the knowledge of this type of phenomena. The Ideam generates precipitation maps and intensity, duration, and frequency curves for various areas of the country. It has also prepared nationwide maps of areas vulnerable to flooding that prioritize the information on past events and

the topography of the low-lying areas of valleys and basins. On the other hand, various public and private entities have hazard maps for some basins in Colombia. However, considering the large amount of basins that exist in Colombia, there is a need for greater information coverage on this type of hazards, which can be used as a basic input for risk management and territorial planning processes.

There are different approaches to identifying landslide hazards in the country. However, it is essential to carry out studies with a greater level of detail for supporting decision making in risk reduction and urban and rural land use planning. The Ideam and the SGC have carried out nationwide and local-level studies in order to understand these phenomena. However, the use of the information provided by stability studies requires a spatial understanding of mass removal phenomena and their relation to uses and activities that take place in their sphere of influence. Therefore, it is essential to carry out studies with an appropriate level of detail in order to guide specific risk reduction decisions.

Very little progress has been made regarding knowledge of vulnerability in Colombia. Vulnerability is a function of the exposure to the elements, the resistance to a specific phenomenon, and the degree of resiliency. The evaluation of exposure includes information about the location and conditions of settlements, the characteristics of dwellings and infrastructure, and the economic activities. To that end, information generated by the DANE, IGAC, MAVDT, MADR, the Ministry of Public Works, Camacol, and others, is used. Vulnerability analysis includes technical evaluations that seek to establish the resistance of exposed elements to a specific phenomenon. There are some studies on physical vulnerability, especially to seismic risk. With respect to landslides, floods, avalanches, etc., very few studies have been performed for

evaluating the level of physical vulnerability of specific elements. There have been still fewer studies done in evaluating social, economic, and environmental vulnerability.

Implementing a methodology-based strategy for advancing the knowledge of hazards and risks that takes into account different territorial levels is an essential requirement for decision-making. The strategy must include the preparation of specific terms of reference for detailed hazard and risk studies that allow decision makers to conduct processes for generating knowledge and truly incorporate risk management in regions and municipalities. It is also necessary to specify what type of information maps must contain so that they can not only be read and used appropriately in planning processes, but also used to establish programs and projects for disaster risk reduction.

Risk management requires needs to be coordinated with adaptation to climate change. Although there are initiatives in this matter, deficient knowledge, decoupling of institutions, and a limited vision of the issue reduce the effectiveness of interventions. Multiple technical, regulatory, and environmental initiatives related to climate change and options for adapting to it have been identified. However, they do not necessarily complement disaster risk management initiatives. The main initiatives include the approval by Colombia of the United Nations Framework Convention on Climate Change (UNFCCC); Law 164 of 1994; the approval by Colombia of the Kyoto Protocol (Law 629 of 2000); the First and Second National Communication on Climate Change; the 2002 Guidelines for Climate Change Policy; Conpes Document 3242 of 2003, regarding a national strategy for the sale of environmental services for mitigating climate change; Conpes Document 3700 of 2011, regarding an institutional strategy for coordinating climate change policies and actions

in Colombia; the National Board for Education, Training, and Awareness of the Public; the 2010 National Plan for Climate Change Adaptation (PNACC); the Colombian Strategy for Low-Carbon Development (ECDBC); the National Strategy for Reduction of Emissions Caused by Deforestation and Forest Degradation in Developing Countries and the Role of Preservation, Sustainable Forest Management, and the Increase of Forest Carbon Reserves in Developing Countries (ENREDD+); the Disaster Financial Protection Strategy, and others.

Information must be accessible and relevant for decision making and must use appropriate language to foster capabilities and behaviors through *ex ante* and *ex post* risk management actions. During the last two decades, the subject of information diffusion mechanisms has been a priority for the country, as reflected in the commitments established in various planning instruments (PNPAD, Conpes, and National Development Plans). As a result, the Integrated Information System has hazard maps of seven departments (for floods, mass removal, landslides, and volcanic hazard), which are accompanied by basic cartography (departmental and municipal limits, rivers, and roads) (Office of the President of the Republic of Colombia, 2010a). However, the design and operation of an information system with an accurate integral focus has not materialized yet. The achievements to date are more intrainstitutional than interinstitutional, and no information crucial to disaster management (organizational structures, tasks and functions, inventories, standard damage reports, etc.) has been produced in a coordinated manner. There is even a requirement for establishing processes to guide updates to information according to entities responsible for themes and platforms for its diffusion. Below is a list of the geographical information systems that contain the majority of information on their advances and weaknesses:

- i. **SGC** has a corporate portal for accessing seismic activity reports as well as catalogs, maps, perception surveys for recording seismic intensity, educational materials, etc. The information from seismic and volcanic monitoring networks is coordinated with some of the entities of the SNPAD. However, there are limitations for the analysis of this information by other systems due to the format in which it is published (image format). Information on alerts is not integrated with other institutions like UNGRD and Ideam. Although progress has been made in transmitting the information in a format that is understandable, there are still gaps in guidelines on using cartography, especially regarding land use planning and development planning.
- ii. **Ideam** has a major hydrometeorological monitoring network and offers real-time information products (bulletins, maps, alerts, etc.). The Daily Technical Report on Alerts is published on the website of the Ideam before noon and is sent via e-mail and fax to the UNGRD and various entities throughout the country; special reports are also produced when necessary. However, limitations have been identified when other entities access and use this information. It is feasible to improve the distribution mechanisms and applicability of alerts.
- iii. **UNGRD** has an internal information system and some public applications (documentary information and alerts). Limitations exist due to a lack of coordination with regional and local committees (emergency reports, integrated damage evaluations, coordination of resources), poor diffusion of alerts to other entities using inefficient mechanisms (manual systems), and a lack of systematic updates to disaster inventory databases.

Education and communication

Both the PNPAD and Conpes Document 3146 have established an education and communication strategy for risk management. Furthermore, the subject is included in the risk management strategy of the National Development Plan. However, the importance of education and communication has not been made visible. A preliminary evaluation of the Conpes document (DNP, 2009) concludes that a strategy for disseminating prevention and mitigation of risks and disasters, including training and education of communities, communication and information for decision making, and elevation of public awareness, has an effectiveness rating of only 13%. There is even a disparity in the progress made in the implementation of activities: for example, entities such as the MADR and MPS have made less progress than the DGR and the MAVDT. Regarding efficiency, the Conpes document points out that it is one of the most inefficient strategies (5% efficiency). The rating is a reflection of the gaps in the subject and the partial and uncoordinated application of the strategy, which suggests it is a rhetorical component of planning instruments that lacks any real performance of its obligations. This situation is evident in the goals of the 2006-2010 PND, which are not coherent with the need to strengthen a culture of prevention.

There is a lack of continuity in the efforts to coordinate risk management with science and technology, education, and the environmental system. The National Science and Technology System demonstrated significant progress in 2002 by formulating a Strategy for Strengthening Science, Technology, and Education for Risk Reduction and Disaster Management (Ministry of the Interior et al, 2002), which established that the SNPAD, the SINA, and the Education, Science, and Technology System shall work in coordination

to identify risk reduction strategies. The Strategy had three components: (i) development of research on hazards and risks, (ii) education and the inclusion of the subject of risk reduction in education, and (iii) ownership and dissemination of knowledge on risks from and to the regions. Although the implementation of the Strategy got off to a good start by supporting the strengthening of capabilities in the education sector by promoting the idea of safe education facilities and emergency preparation programs, it has been weakened over the years. Furthermore, no systematic monitoring is being carried out and there are gaps in coordination among national-, regional-, and local-level agents. Additionally, there is the challenge of working in coordination with the National Climate Change System which was recently created.

Risk reduction

Significant progress has been made in government investment processes in Colombia. Nevertheless, the incorporation of disaster risk management is still at an early stage and its inclusion in sectoral planning is incipient. At the national level, there has been a gradual increase in awareness of the importance of introducing risk management in government investment projects and carrying out risk analysis to ensure effective and sustainable territorial interventions. However, the practical implications of this awareness are not as compelling as might be expected. The General Adjusted Methodology (MGA) from the Bank of National Investment Programs and Projects (BPIN) is available to the DNP when preparing investment projects. Although the need for risk analysis at various project stages has been established as a requirement, the corresponding parameters are still basic, with an emphasis on hazard conditions and a lack of coordination with the other project formulation modules.

The availability of measures for anticipating the creation of risk conditions implies working on underlying causal factors in a territory. Reducing existing risk before it materializes in disaster conditions requires the deployment of corrective or compensatory intervention measures.

There is a requirement for actions in environmental management, land use planning, and development planning, as well as interventions for reducing hazard and/or vulnerability levels and their potential effects on population groups, infrastructure, and existing platforms for goods and services. In response, there are efforts by the Program for Reducing Fiscal Vulnerability to Natural Disasters, through which the government of Colombia provided technical assistance from 2006 to 2011 to 792 municipalities (equivalent to 72% of all the municipalities in the country) for including risk analysis in their POT and PD, and 379 of which currently have an action plan. Furthermore, 34 municipalities have zoning studies of hazards and/or risks. Figure A.1 lists these municipalities and their current project status. In this regard, a greater diffusion of guidelines, materials, and instruments developed at the national level is desirable, in order to guide the incorporation of risk management in the POT because, as of today, the visibility and ownership are still not as high as required.

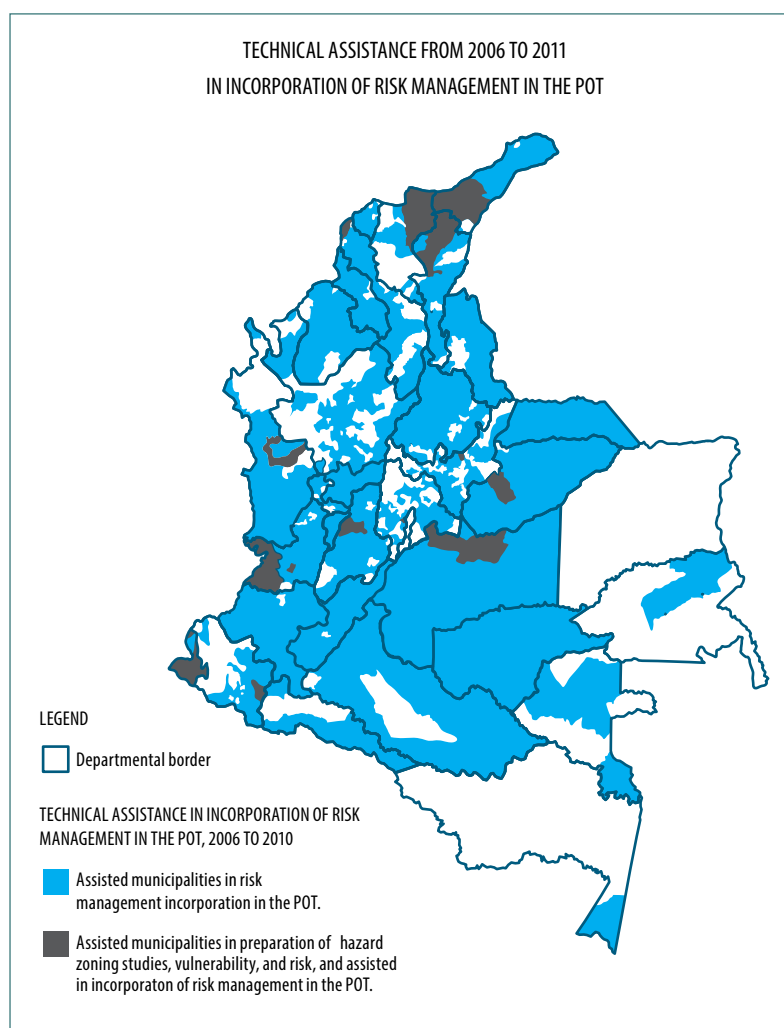
In order to reduce the government's fiscal vulnerability in vital infrastructure, a structural reinforcement of strategy is required. In compliance with the provisions of the National Seismic-Resistant Regulation and Law 715 of 2001, the MPS designed a technical assistance and cofinancing strategy for evaluating the seismic vulnerability of health institutions. In this regard, investments amounting to Col\$3.986 billion (2010 Colombian pesos) were made from 2003 to 2005 in 161 studies for structural reinforcement of Level 1, Level 2, and Level 3 of hospitals, and structural reinforcement works amounting to Col\$44.114 billion that were cofinanced from 2006 to 2009 in 14 Level 2 and Level 3 hospitals (Office of the President of

the Republic of Colombia, 2010a). Subsequently, the government of Colombia has been monitoring resources amounting to Col\$24.6 billion that were assigned for the 2008-2009 fiscal year to structural reinforcement works in hospitals (Office of the President of the Republic of Colombia, 2010b). Furthermore, the MPS issued Resolution 976 of 2009 in order to respond to the "Disaster-Safe Hospitals" Global Initiative, a nationwide program for risk reduction in the health sector. Ecopetrol also completed studies and designs for 94% (251) of its buildings and executed reinforcement works on 55.8% of them, even though, according to the studies, 66 buildings did not require any kind of intervention.

Disaster management

The recent rainy season in Colombia revealed important facts about the country's capacity and regional and local bodies to handle disaster situations. Following the La Niña phenomenon in the country, officially taking place between April 6, 2010, and June 30, 2011, generated a total of 3,379 reported events, which affected 1,052 municipalities in 28 departments plus the Capital District, causing a total of 486 deaths, the destruction of about 16,000 houses, and causing damage to another 550,000 dwellings. In addition to the impacts from the closure and destruction of the country's road system, mobility problems, and economic and social effects on population groups, Bolivar, Cauca, Valle del Cauca, Norte de Santander, Boyaca, Cundinamarca, and the Coffee Growing region emerged as the most affected regions (SNPAD and DGR 2011). Regarding this it can be said that despite the concentration of resources invested in the country, there is no clarity as to disaster management actions or factors relating to the coordination, logistics, communication, and capacities of the entities in the different territorial levels, requiring not only a strengthening but a transformation that goes beyond emergency response actions.

FIGURE A.1. Incorporation of risk management in land use planning



Source: MVCT, 2011.

There are strategies for the formulation of national guidelines and protocols for the preparation of disaster response, but there are gaps in the governing instruments. The experience gained caused by disaster events that have occurred in the country facilitates the preparation and updating of the acting protocols in case of national disaster. However, these protocols do not show great clarity regarding the functions assigned to those responsible (Presidential Directive 005 of November 27,

2001). Based on this, progress has been made in Departmental and Local Emergency and Contingency Plans, as well as Emergency Sectoral and Institutional Plans.

There are Local Emergency and Contingency Plans (PLEC) to confront different types of events, but there is a lack of a leading instrument in terms of a national emergency plan to guide the management of disasters in the country. Colombia has six PLEC available that provide guidance for similar instruments at the region-

al/local levels (forest fires, oil spills, natural gas transportation, tsunamis, massive influx events, confronting events such as El Niño and the case of the Galeras volcano eruption, where the country has an institutional coordination process). However, there is no National Emergency Plan, as a leading instrument to guide disaster management actions (including an interinstitutional structure, assigning functions and responsibilities, coordination mechanisms, communication and implementation, and activation, and control actions). This implies, in particular, a critical factor in relation to the definition of a specific network of actors that allows emergency response coordination and control, enabling those different groups to jointly carry out activities and have available standardized procedures. Also, articulation with other instruments available for risk management is necessary.

The Damage and Needs Assessment is an essential task of the response process and should be coordinated with rehabilitation and reconstruction processes. The SNPAD has designed a unique instrument to collect general information regarding damages and needs, addressed to municipalities and departments as well as some sector spheres, which is useful for carrying out the initial Damage and Needs Assessment (EDAN) once an adverse event occurs. However, these instruments should provide support in targeting rehabilitation and reconstruction activities, that is, they have to perform a key role in evaluating funding mechanisms, identification of future projects, and foreseen interventions. Thus, a gap is displayed in the different territorial levels and with the sectoral disarticulation facing different risk management processes.

A.2.2. Progress in risk management at regional level

Governance in risk management

The SNPAD decentralization process has been internalized inadequately at a departmental level. While departments have created the Regional Committees for Disaster Prevention and Response (CREPAD), most of them meet only in emergencies and do not have specific agendas for issues related to prevention and mitigation. Few departments have Departmental Disaster Prevention and Response Plans. Issues related to disaster prevention and responses are taken into account above all in Cundinamarca, Caldas, and Antioquia.

There are instruments available at the regional level, but there is a real inertia in their accurate implementation, quality, and updating. Although the situation is not widespread, as mentioned before, there are a few Disaster Prevention and Response Departmental Plans, and it is noted that in their implementation and monitoring processes, there are major limitations that reduce the scope and implementation of their objectives. This is due particularly to the lack of coordination between planning instruments and entities within the same territorial sphere, low levels of instrument internalization, and to the limitations of the same Regional Committees and the loss of continuity in the training processes due to high personnel turnover.

Despite the weak integration of the disaster risk management approaches within political processes, organizations, and CAR funding, there is a core capacity in the institutional structure to incorporate this vision. The CAR know in depth the environmental problems facing

the regions, but there is still work to be done in the understanding of the relationship between environmental impacts and risk factors. The CAR, with better institutional capacity, have some knowledge of natural and anthropic hazards that occur in the territory. However, it is important to intensely look into (i) the understanding that environmental management oriented at ecosystem managing, protecting, and recovering is linked to prospective risk management; and (ii) technical strengthening of corporations to incorporate risk management in environmental planning instruments and in programs they are carrying out.

Knowledge and information

There are failures in the production of risk analysis and diagnosis, and difficulties in the information systematization. Diagnoses, regional views, and environmental synthesis of planning instruments count on natural hazard information, especially hydrometeorological. Unfortunately, these diagnoses only have regional problematic issues and they are not used to suggest alternative solutions for risk reduction. In addition, some departments and the CAR have basic information systems and protocols that do not take into account protocols to systematize, save, and protect historical data. The data and statistical series produced by the CAR are often incomplete, lack consistency, and do not have the best quality standards.

Education and communication

Departments and the CAR have not designed training and communication strategies oriented at risk management. Education, communication, and participation have not been oriented at defining actions on disaster risk management. Moreover, while the CAR use

a wide range of communication approaches, they have more capacity committed to communities in tasks such as watersheds, wetlands, wilderness, and other sensitive ecosystem conservation and management. Said channels have been directed almost exclusively toward environmental management and sustainable management of natural resources, but have not been integrated with risk management. However, it is important to mention that the communities in such activities are without a doubt in line with risk reduction.

Risk reduction

The reduction of existing risk and prevention of future risk is an integral objective of plans and environmental policies, but their real impact has not been overwhelming. Governance mechanisms in environmental aspects, in theory, should facilitate and enable a more synergetic articulation with disaster risk management. However, progress in implementing actions is still timid, despite the obvious interest that is generated by climate change adaptation issues in different sectors and institutional agents, integrated management of watersheds, and territorial environmental planning. At departmental level, there are multiple regulations, instruments and methodological guidelines (Regional Environmental Management Plans, Environmental Agendas, Watershed Management Plans, etc.), which have been generated in different temporal contexts and reflect inadequate articulation processes. In addition, they do not show consistency with other planning instruments, such as Risk Management Plans, the POT, and the PD. Moreover, there is a shared concern for the need to expand the climate change adaptation issue at territorial levels, and how knowledge (scales, levels of certainty) would advance decision making.

The CAR have earmarked significant economic, human, and technical resources to minimize environmental impact, and this has had impact on reducing risk factors in the regions. Appropriate interventions in environmental management, although they are not explicitly considered to have the goal of reducing risk factors, have been essential in minimizing potential social and environmental disasters. Actions and investments to protect environmental resources, such as the protection of riverbeds, construction of dams and retaining walls, or measures to prevent erosion, can be capitalized for risk management and considered on their own. However, the absence of a comprehensive analysis to plot potential risk reduction strategies, articulating environmental management with disaster risk management, prevents adding results and can increase flood risk in some areas that have not been previously flooded.

Disaster management

Emergency response actions and plans conducted by the regional governments and the CAR by themselves are not able to reduce the potential factors that trigger disaster risk. Due to the rainy season, the need is made evident for departmental entities and the CAR to play a more active role in response and rehabilitation phases, with the aim of incorporating instruments for disaster planning and preparedness. However, such plans per se are not able to manage and control risk. It is necessary for planning tools to adopt more explicitly and comprehensively a risk management approach by building planning instruments not only with environmental emphasis and criteria, but also by introducing the risk management vision and adaption to climate change.

A.2.3. Progress in risk management at local level

Governance of risk management

A genuine disaster risk management policy has not been able to be consolidated and implemented in a comprehensive and articulated manner in public administration. There have been advances in large cities incorporating risk management in their PD. These are pragmatic and budgetary inclusions, as well as their recognition as the cross-cutting axes in the Municipal Administration Secretariats' functions (environment, health, housing, infrastructure, and planning). The Planning Secretariat is identified as the essential base of the articulation between planning instruments and decision making (hazard and risk maps are essential for land use planning, land use classification, issuance of building permits, etc). Furthermore, although efforts are being made in small municipalities, through the Fiscal Vulnerability Reduction Program to Natural Disasters, the National Government between 2006 and 2010 provided technical assistance to 528 municipalities, and currently only 128 of them have a Local Risk Management Plan (Presidency of the Republic of Colombia, 2010a).

Territorial differences are evident in relation to risk management effectiveness due to limitations in access to economic and financial resources and the availability of technical and human capital. In most of the municipalities, although formally CLOPAD exist, they only act when they have to respond to an emergency or disaster, having few technical, financial, and human resources and no infrastructure to execute actions. In some cases, they can only provide one delegated official as coordinator. Additionally, and to the extent that the role

of the territorial entity is not clear (risk management responsibility is not assigned to the Committee, but to the municipal executive power), there is no clear political commitment to this issue (Presidency of the Republic of Colombia, 2010a).

Knowledge and information

There are important advances in the field of knowledge, although there are thematic and territorial differences and inconsistencies of the responsible people assigned to the activities. The subject of knowledge is conceived heterogeneously. While microzoning studies for floods and landslides and progress in studies of physical vulnerability and damage scenarios in large cities (e.g., Bogota, Cali, Manizales, and Pereira) are highlighted, in small towns there are gaps in information, making it difficult to advance in risk assessments. Among the main demands made by small municipalities are problems related to providing basic information (cartographic and documentary) to cover rural areas, such as the limitations of scales and levels of details in existing hazard maps. These shortcomings necessarily affect their actual implementation in decision making, especially in the PD and territorial planning. On the other hand, limitations in terms of reviewing the technical quality of risk assessments (hardly any sources of information and lack of criteria and methodology standardization) and their monitoring processes are recognized.

Education and communication

Different political and regulatory instruments related to risk management incorporation in formal education have been formulated within the education system. The Institutional Educational Project (PEI) constitutes a stronghold

for educational institutions from the standpoint of its vision and its impact on the organization of the curriculum, enabling its adaptation to a particular context. PEI seeks conceptual and methodological integration of the risk concept with other projects and different subjects in the Study Plans. Moreover, Resolution 7550 of 1994 regulates the development of the School Project for Emergency and Disaster Prevention and Response as an integral part of the PEI and is binding. From this, schools have created PAD School Committees, school brigades, and drill developments. They also have the School Environmental Projects (PRAE), which are part of the PEI, where its design and framework of possibilities have been developed on an ongoing basis through the National Environmental Education Program in the Ministry of Education. Despite the multiplicity of instruments, in small municipalities raise a recurring criticism about the disarticulation between different strategies and instruments developed in the field of education: PEI, PRAE, and School Plans for Risk Management and Emergency Response Plans on school grounds, among others. This disarticulation is due to the fact that in many cases, all these plans are developed just to meet existing policies without having a real vision of prevention and emergency response.

There are recognized experiences in public education and communication in disaster risk management. Although it is not a generalized condition for all territorial areas, there are experiences, particularly in capital cities and in some departments, where there have been interesting public awareness campaigns, among them campaigns such as “Bogota with its feet on the ground” (Bogota, Cundinamarca), “Culture of prevention and early warning” (Bogota, Cundinamarca), “Galeras Professorship” (Nariño), “Toward citizens’ awareness in environmental education” (Quindio), “Living in community:

Everyone's commitment" (Sandona, Nariño), and "Slope Guardians Program" (Manizales, Caldas), among others. This denotes a move toward institutionalization that is acquiring the subject and the feasibility of articulation between different educational, technical, and community entities. Under this framework, it would be desirable to capitalize on these experiences and coordinate with national entities to ensure their reproduction and sustainability.

Risk reduction

Interventions to reduce existing risk conditions require better articulation with other development planning instruments. Municipalities, since the formulation of the POT based on the information and knowledge about the territory, now have criteria for prioritizing interventions (potentialities and limitations of the territory), which should be incorporated into the PD, sectoral plans, and investment projects, which in turn should be aligned with the risk management plans, environmental management plans, and watershed management. However, gaps and discontinuities in the risk management actions and lack of clarity in the prioritization of criteria and verification mechanisms are some of the recurrent items in analyzing different territorial levels.

Investment project quality may be affected by critical factors such as urgency of carrying out projects under emergency situations and deficient project planning. In many cases, project develop-

ers are justified by the lack of financial, technical, and human resources for not carrying out detailed studies, and for this reason they have not progressed in structuring a portfolio or a project bank that ensures quality. This situation has implications in emergency events, when local entities often propose projects that do not necessarily coincide with territorial planning priorities.

Disaster management

There are guidelines for instrument formulation at the local level, but there are also weaknesses in monitoring their real implementation, quality, and updating. Guides are available for the preparation of PLEC, and the national-level efforts in developing skills make possible their development. Nevertheless, it is noted that in their implementation and monitoring process, there are limitations that reduce the scope of and compliance with the instrument objective: (i) small municipalities that do not establish a relationship between the risk scenarios and the likely disaster impact have to face the needs in each of the functions and duties required by emergency and contingency response, as well as the inventory of resources; (ii) weakness or lack of harmonization of PLEC with warning systems and monitoring phenomena; and (iii) low sense of instrument ownership by Disaster Prevention and Response Committees, as well as disarticulation between entities within the same territorial level, plus lack of continuity in training and development of professionals.

A.3. PERCEPTION OF PROGRESS AT EACH OF THE TERRITORIAL LEVELS

There is a certain correspondence between the risk management investment expense undertaken by different levels of government and how they perceive the actions implemented in disaster risk reduction. The overall average results of the self-assessment survey show perception values from emerging up to acceptable in the five thematic areas of the HFA, and important differences are perceived at the territorial level. It can be perceived that the greatest advances are identified in the municipalities from the Special category and category 1, in contrast to the situation occurring in the other municipalities of the country. In the framework of the actions taken by the CAR in risk management, there has been progress in education and governance fronts more than in national and territorial entities, although these levels do not exceed the acceptable range.

Both perceived differences between territorial levels and the thematic area development denote widely different assessments according to respondents. Progress in governance is assessed as emerging (global average 2.5), and gaps and voids (in policies, organization, monitoring, and funding) are perceived as the most critical element for municipalities in category 6, where the issues of autonomy and decentralization are still in process of consolidation and lead to the need to make modifications and adjustments to SNPAD. As for the actions in knowledge and information, these are also assessed as emerging (global average 2.9), with relevant variations between country level and territorial entities, principally the responses obtained by the municipalities of the Special category and category 1 reporting more strengthened effectiveness ranges. The education and communication activities are evaluated as acceptable (overall average 3.0), with similar situations at the national, departmental level, and in large cities, and no marked difference for small municipalities. Moreover, the effectiveness of risk reduction actions is rated as acceptable (overall average 3.1),

TABLE A.3. Data sheet of self-assessment surveys of risk management progress

| | |
|-------------------------------------|--|
| Total surveys | 225 surveys |
| Surveys by population target | National entities: 17 surveys CAR: 23 surveys Departments: 12 surveys Municipalities in Special category and category 1: 14 surveys Municipalities in categories 2 to 6: 159 surveys |
| Instrument design | 5 sections 15 indicators |
| Collection method | Virtual (through Survey Monkey*) |
| Dates | From April 30, 2011, to June 20, 2011 |

*Survey Monkey is an online software tool that allows users to create surveys and questionnaires.

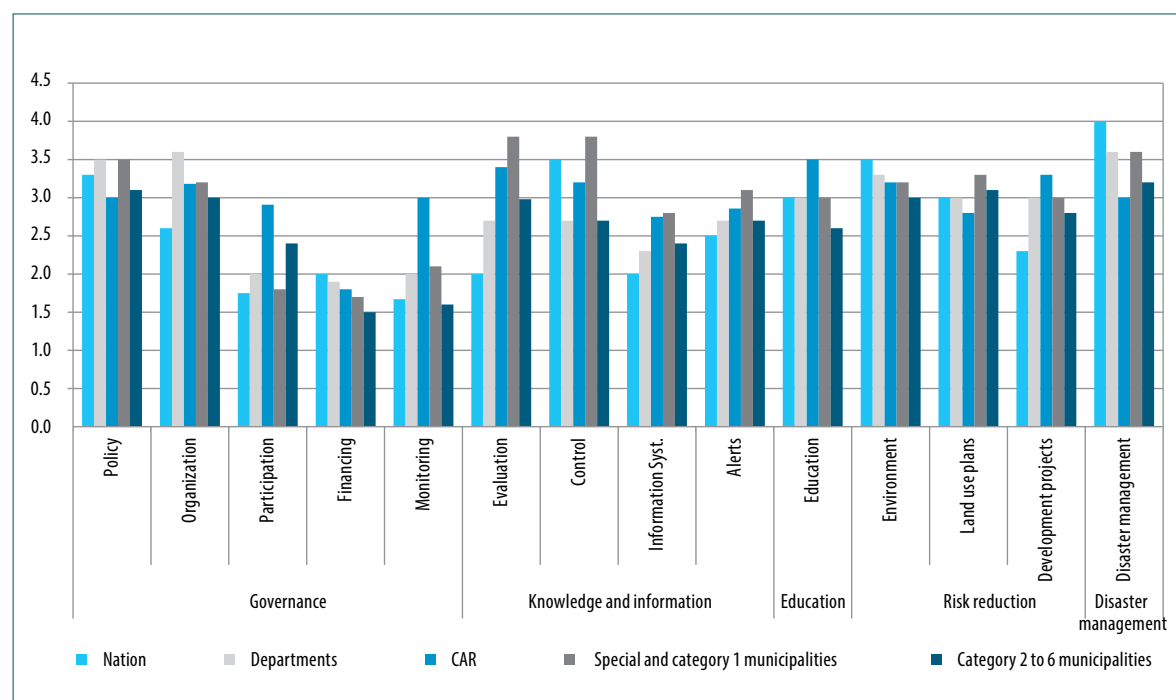
11 The "HFA Monitor" is an online instrument to capture information on the progress made in implementing the HFA, generated through a multisectoral review process. The primary purpose of this instrument is to assist countries in monitoring their progress and reviewing the challenges in the implementation of disaster risk reduction and recovery actions undertaken at the national level, in accordance with the priorities of the HFA. With this national consultation, processes are carried out to collect relevant information pertaining to risk management actions. The official report for Colombia for 2009-2011 is available at http://www.preventionweb.net/english/hyogo/progress/reports/index.php?o=pol_year&o2=DESC&ps=50&hid=2010&cid=37&x=8&y=10.

where the current situation in the country and territorial entities shows no major variations, but the insights obtained for small municipalities show more critical conditions, compared with other territorial levels. Finally, the effectiveness in disaster management is assessed as acceptable (overall average 3.4), being the risk reduction area that has been rated in perception surveys (*Graph A.16*).

The perception from the national level is consistent with the resources invested in this sphere, especially in relation to disaster management. The results showed by the self-assessment surveys

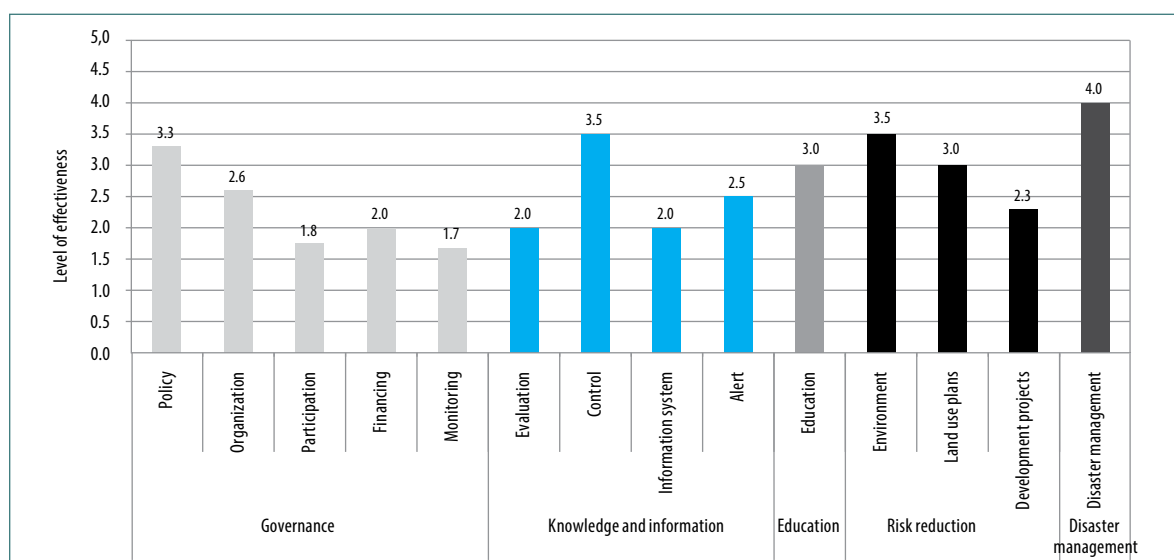
indicate that the vision of the national government entities, within the Hyogo Framework for Action, gives higher grades to disaster management over other priorities, such as governance, knowledge and information, and education. Disaster management is considered of great importance in the context of the actions taken at the national level and their effectiveness is qualified by a notable score (4). The results are consistent with the analysis of public investment assigned to risk management. The second area of importance is risk reduction which, in the country, once more receives more investment resources (*Graph A.17*).

GRAPH A.16. Risk management effectiveness by action axes and indicators for each territorial level



Source: World Bank, 2011c.

GRAPH A.17. Effectiveness of disaster risk management at national level



Source: World Bank, 2011c.

Contrasting self-assessment surveys conducted by the World Bank with the National Progress Report on Implementing the Hyogo Framework for Action in Colombia¹², it appears that in general the report has higher levels of achievement, although the justification and limitations reported are similar to the arguments compiled by the Bank. The progress review made by the Government of the five HFA priority areas notes that disaster management and governance are the areas where the country has been vastly strengthened: response capabilities, disaster management instruments, and financial strategies, as well as organizational frameworks and policies are some of the factors that were improved. While the trend of the ratings (though not the level of achievement assigned) is similar to that obtained in surveys of perception, it is a paradox that national reality denotes its main limitations and gaps in these same factors. These factors became more visible and critical from the last La Niña phenomenon (2010-2011), which was a part of what led

to a major institutional and regulatory reform in the subject for the country (*Graph A.18*).

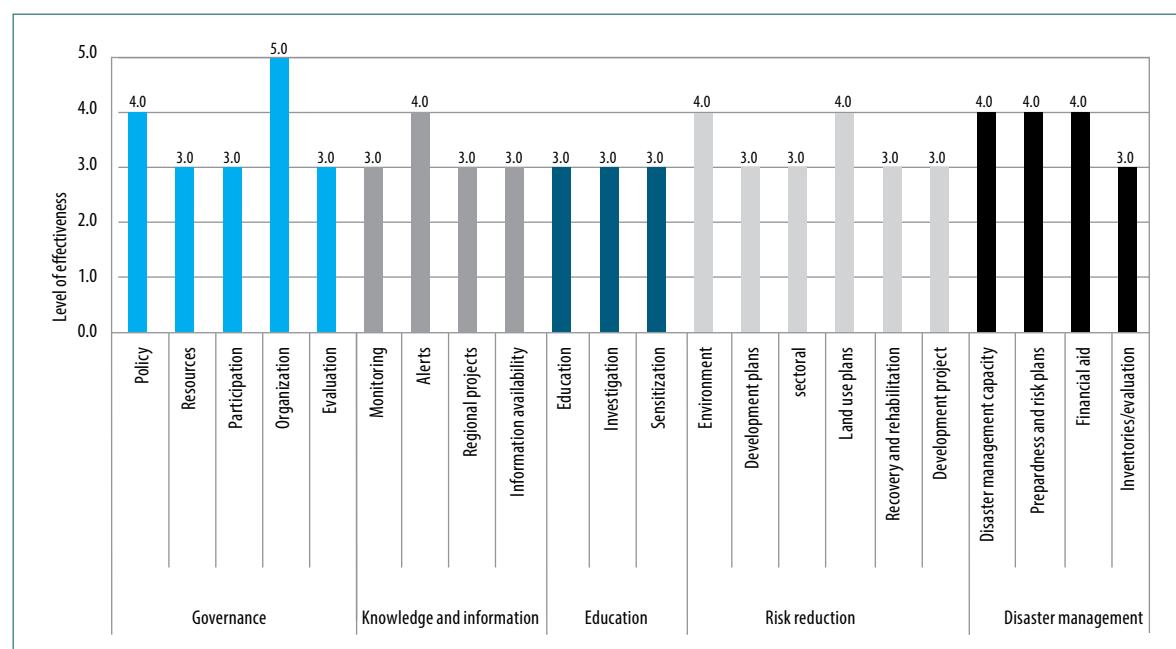
At the departmental level, the effectiveness of action in risk management reports better self-assessments in the spheres of disaster management and risk reduction. The results are consistent with the resources invested by these territorial entities. Surveys show that departmental entities have a better appreciation of their performance in terms of disaster management and risk reduction (both rated at acceptable levels) over other priority areas, such as governance and knowledge and information. Positive assessments of these actions have even been made in education, especially by the CAR, with levels much higher than those obtained for other local areas. However, when the results are put into perspective and com-

12 The "HFA Monitor" for Colombia 2009-2011 is available at http://www.preventionweb.net/english/hyogo/progress/reports/index.php?o=pol_year&o2=DESC&ps=50&hid=2010&cid=37&x=8&y=10.

pared with the resources invested, it is clear that departments are not making a substantial contribution to risk management, reflecting a passive attitude of their territorial reality and thus making evident the existing gaps regard-

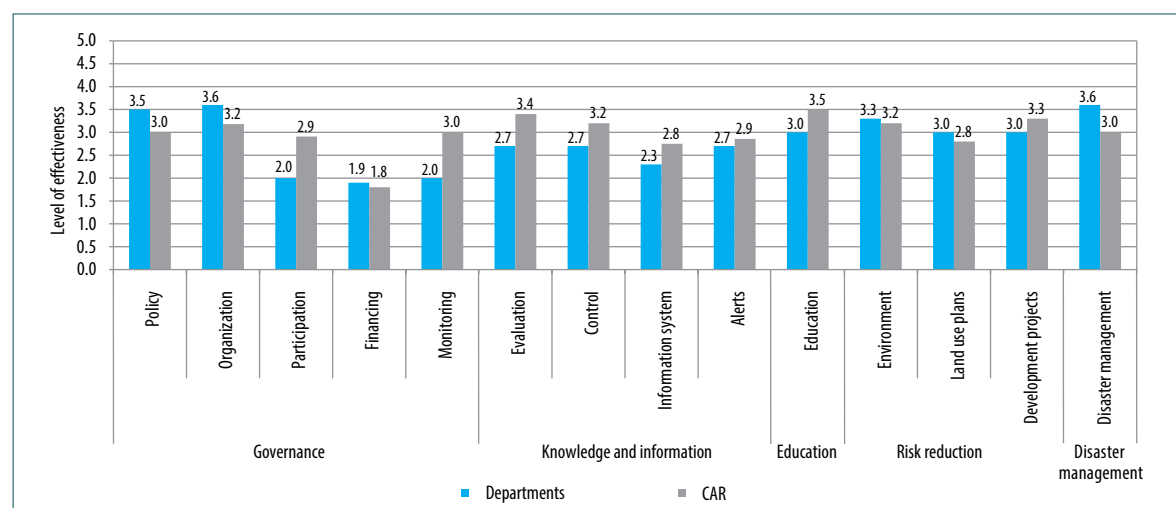
ing the link between local areas, the availability of resources, and a limited scope of action from a regional level. A low score in funding is evident (1.9), and for education the survey reports an acceptable level (3) (*Graph A.19*).

GRAPH A.18. National Progress Report on the Implementation of Hyogo Framework for Action, Colombia



Source: Authors' graph from information provided by MIJ-DGR, 2010.

GRAPH A.19. Effectiveness of disaster risk management at departmental and CAR levels



Source: World Bank, 2011c.

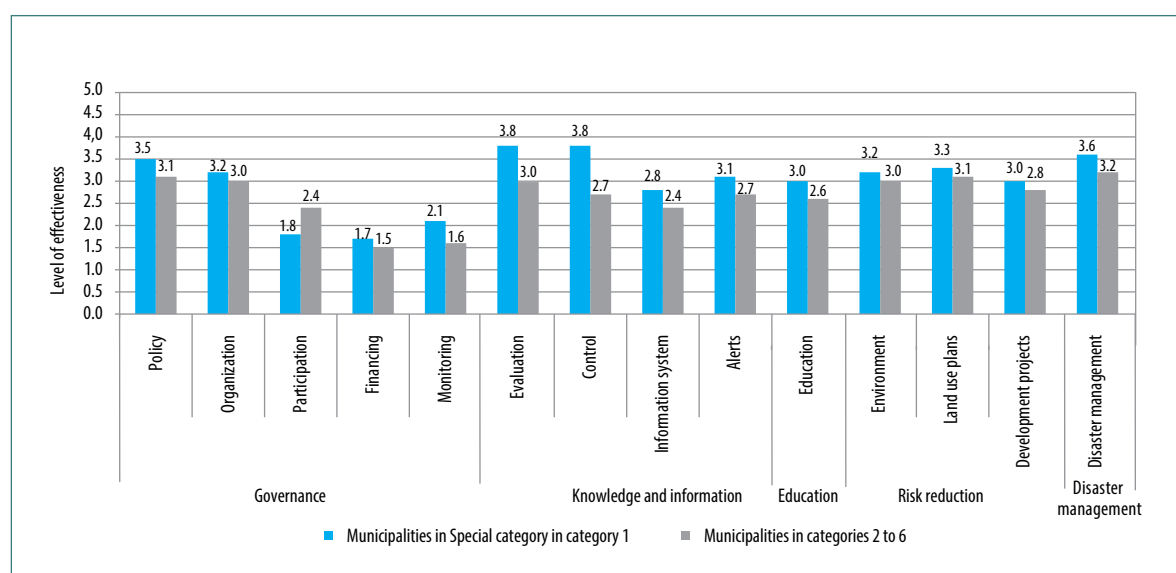
The perception from the municipal level in relation to performance actions in risk management is assessed as acceptable, although significant interterritorial differences are observed for small municipalities that self-assessed as the least effective. While the areas of risk reduction and disaster management are perceived with acceptable values of effectiveness, areas of governance, knowledge and information, and education receive lower ranks, having coincided with the investment structure. However, municipal self-assessment by categories reveals that those in the Special category and category 1 denote greatest strengths in the production of knowledge and information, with levels above those of all other actors (national, departmental, CAR, and municipal categories 2 to 6) (*Graph A.20*).

According to the perception reflected by the self-assessment results through surveys, it can be assumed that at the local level, there is a concentration of operational and protectionist actions with insufficient levels of coordination and articulation among the social inter- and in-

traterritorial entities. Usually, in the municipalities of categories 2 to 6, Disaster Prevention and Response Committees depend on the Government Secretariat, reducing their participation and articulation with other planning processes, which necessarily must be articulated for risk management (POT, PD, Environmental Agendas, etc.). Some experiences with government agencies have been identified as responsible for guiding, regulating, and coordinating actions in risk management in capital cities such as Bogotá, Manizales, and Medellín, and have been achieved with a systemic approach operation.

While risk reduction investments concentrate more resources in relative terms in municipalities, and the same entities surveyed perceive that this is the area in which the biggest progress has been made, in practice, gaps and limitations are evident. Although efforts made by municipal authorities in risk management, technical, financial, and human resources are recognized, weaknesses are some of the items that recurrently appear related to risk reduc-

GRAPH A.20. Effectiveness of risk management at municipal level



Source: World Bank, 2011c.

tion effectiveness. In this context, actions and investments are still insufficient to substantially minimize risk conditions. There is not an integral recognition of the problem in the territory, and there is lack of clarity in defining roles and responsibilities. There are no criteria to assign priority and verification mechanisms,

and in general, there is no coordination among territorial entities. At this stage, interventions developed at the local level are not necessarily planned, due to a lack of a national policy to guide actions and investments, and to support municipalities in capacity strengthening to implement risk management.



Evacuation. Municipality of Gramalote (Norte de Santander - Colombia), 2011. Photography: Colombian Geological Survey.

*B*ibliography



- Abdon C., Lombana. (1982). *Geografía de los suelos de Colombia*. Bogota: Universidad Jorge Tadeo Lozano.
- Aguas Kpital Cucuta S.A. E.S.P. (2011). *Plan de contingencia eventos naturales* - Version VI – 11/ 11 /2011-MPE-06-D-13. Cucuta: Colombia. Available at <http://www.akc.com.co/page/>
- Agudelo, L. (2006). *La ruralidad en el ordenamiento territorial en Colombia*. Paper presented to the Congress of Colombian Association of Urban and Regional Researchers (ACIUR), held in Bogota, Colombia, on November 29, 30, and December 1, 2006.
- Aguilera, M. M. (2004). *La Mojana: riqueza natural y potencial económico*. Working Documents on Regional Economy, No. 48. Cartagena: Centro de Estudios Económicos Regionales (CEER), Banco de la República.
- AIS (2010). *NSR-10. Reglamento Colombiano de Construcción Sismo Resistente*. Bogota, Colombia.
- Alcaldía Mayor de Bogota - Secretaría Distrital de Hacienda – (2011). *Presupuesto General del Distrito Capital (District Budget Address)*. Bogota, Colombia. Available at www.shd.gov.co.
- Alcaldía Mayor de Bogota - FOPAE (2010). *Bogota frente a la gestión integral del riesgo sísmico*. Bogota, Colombia.
- Alcaldía Mayor de Bogota - Secretaría Distrital de Hacienda (2010). *Diseño de la estrategia de aseguramiento para la protección financiera de las edificaciones privadas de Bogota D.C., en el caso de la ocurrencia de un desastre natural*. IBRD Project 7246, Asset and Liability Management: District Fiscal Vulnerability Reduction Component Facing Natural Disasters. Bogota, Colombia. Available at www.shd.gov.co
- Alcaldía Mayor de Bogota - SDHT (2008). *Línea base del Plan de Desarrollo de Bogota Positiva: Para vivir mejor 2008-2012*. Bogota, Colombia.
- _____ (2007). *Encuesta de Calidad de Vida para Bogota (ECVB)*. Bogota, Colombia.
- Alvarado, C. E. (2010). *Estudios de microzonificación sísmica en Colombia*. Summaries on the International Forum of Intense Seismic Activity: A Threat for the Andean Region, held on October 13-15 in Cali, Colombia: World Bank / ACODAL / ACIEM / EMCALI / Gases de Occidente.
- Argüello, R. (2010). *Crisis internacional y pobreza en Colombia: efectos de corto plazo*. In *Perfil de Coyuntura Económica*, No. 15, August. Medellín, Colombia: Universidad de Antioquia.
- ATC (2011). Available at http://blog.atc.com.co/2011_04_01_archive.html
- AXCO (2010). *Insurance Market Report: United States / United Kingdom / Colombia / Chile / Brazil / Mexico / Argentina*. NON-Life (P&C): Washington, DC, United States.
- Banco de la República, MHCP and DNP (2010). *Regla Fiscal para Colombia*. Interinstitutional Technical Committee. Bogota, Colombia.
- Bayarri, S. (2009). *Sistemas de información para la gestión del riesgo de desastres en la Comunidad Andina*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- Benavides, H., Mayorga, R. and Hurtado, G. (2007). *Análisis de índices de extremos climáticos para Colombia usando el Rclimindex*. Technical note of Ideam-Meteo/007-2007. Bogota: Ideam.
- Benson C. and Twigg, J. (2007). *Tools for Mainstreaming Disaster Risk Reduction: Guidance Notes for Development Organizations*. Prevention Consortium. Available at <http://>

- www.preventionweb.net/files/1066_toolsformainstreamingDRRsp2.pdf.
- Blaikie, P., Cannon, T., David, I. and Wisner, B. (1996). *Vulnerabilidad. El entorno social, político y económico de los desastres*. Tercer Mundo Editores. Bogota: La Red/ITDG.
- Bohórquez, L. (2011). *Sistematización de las experiencias, resultados y enfoques del proyecto "Incorporación de la gestión del riesgo en ordenamiento"*. Bogota: Ministerio de Ambiente, Vivienda y Desarrollo Territorial.
- Burbano, W. (2011). *Exposición de vidas y bienes a amenazas naturales en Colombia*. Thesis to obtain the title of Topographic Engineer, Universidad del Valle, Colombia.
- CAF (2000). *Lecciones del Niño en Colombia. Memorias del fenómeno del niño 1997-1998. Retos y propuestas para la región Andina*. Bogota, Colombia.
- CAF and DNP - DDTs (2005). *El Estado y su organización*. Bogota, Colombia.
- Camacol (2011). *Construcción en cifras*. Bogota, Colombia. Available at <http://camacol.co/informacion-economica/cifras-sectoriales/construccion-en-cifras>.
- Cámara Colombiana de la Infraestructura (2009). *Infraestructura y crecimiento económico*. Bogota, Colombia.
- _____. (2008). *Emergencias viales en el país*. Bogota, Colombia.
- Campos, A., et al. (2009). *Articulando la gestión del riesgo y la adaptación al cambio climático en el sector agropecuario*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- Campos, A. (2004). *Salud mental y gestión del riesgo: Nuevas perspectivas para un enfoque psicosocial preventivo de los riesgos de desastres*. Lima, Peru: Intermediate Technology Development Group (ITDG) and National Civil Defense Institute (INDECI).
- Campos, A. and Narváez, L. (2011). *Implementation Strategies for Incorporating Risk Management Criteria in Latin America Public Investment*. Background paper prepared for the 2011 Global Assessment Report on Disaster Risk Reduction. Prepared by Florida International University. Geneva, Switzerland: UNISDR.
- Cardona, A. (2009). *Mapeo institucional, actores relacionados con el abordaje del cambio climático en Colombia*. Project of Risks and Opportunities of Climate Change in National Development Processes and in the Programming for the Countries in the United Nations Integration. Bogota: UNDP.
- Cardona, O. D. (2009). *La gestión financiera del riesgo de desastres. Instrumentos financieros de retención y transferencia para la Comunidad Andina*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- _____. (2007). *Seguro colectivo frente a desastres: Innovador aporte para la gestión de riesgos*. Available at www.manizales.unal.edu.co/gestion_riesgos/descargas/gestion/ArticuloparaJMU.pdf.
- _____. (1990). *El manejo de riesgos y los preparativos para desastres. Compromiso institucional para mejorar la calidad de vida*. Unpublished document for the Office of Foreign Disaster Assistance of the United States Agency for International Development (OFDA/USAID) for the Administration Course for Disasters I.
- Cardona, O. D. and Marulanda, M. C. (2010). *Mecanismos financieros, seguro y reaseguro contra desastres naturales en América Latina y el Caribe: Experiencias recientes*. Regional Seminar on Public Investment and Financial Mechanisms, held in Mexico City, Mexico, on November 22 and 23. Available at www.proteccioncivil.gob.mx.

- Cardona, O. D., Ordaz, M. G., Moreno, A. M., and Yamín, L. E. (2004a). *Análisis de riesgo de desastres extremos en Colombia con fines de valoración de la exposición fiscal*. Study report on the definition of the State's responsibility, its exposure facing natural disasters, and mechanisms designed to cover the State's residual risks. Bogota, Colombia: Consortium ERN - Colombia, ACCI, DNP, and World Bank.
- Cardona, O. D., Ordaz, M. G., Moreno, A. M., Yamín, L. E. and Wilches-Chaux, G. (2004b). *Estudio sobre desastres ocurridos en Colombia. Estimación de pérdidas y cuantificación de costos*. Study report on the definition of the State's responsibility, its exposure facing natural disasters, and mechanisms designed to cover the State's residual risks. Bogota: Consortium ERN - Colombia, ACCI, DNP, and World Bank.
- Cardona, O. D., Ordaz, M. G., Moreno, A. M., and Yamín, L. E. (2005). *Obligaciones contingentes del Estado por desastre, requerimiento de recursos y posibilidades de asignación*. Study report on the definition of the State's responsibility, its exposure facing natural disasters, and mechanisms designed to cover the State's residual risks. Bogota: Consortium ERN - Colombia, ACCI, DNP, and World Bank.
- Cavallo, E., et al. (2011). *Catastrophic Natural Disasters and Economic Growth*. IDB Working Paper Series No. IDB-WP-183. Washington, DC, United States: Inter-American Development Bank.
- _____. (2010). *The Economics of Natural Disasters: A Survey*. IDB Working Paper Series No. IDB-WP-124. Washington, DC, United States: Inter-American Development Bank.
- Cepeda, H., and Murcia, L.A., 1989. *Mapa Preliminar de Amenaza Volcánica Potencial del Nevado del Tolima, Colombia*, S. A. Ingeominas, Bol. Geol., Vol. 29, No. 3, pp. 33 - 75. Bogota, Colombia.
- Central Intelligence Agency (CIA) (1970). *Mapa de usos del suelo en Colombia*. Bogota, Colombia. Available at http://mapas.owje.com/1925_mapa-del-uso-del-suelo-colombia-1970.html
- Clavijo, J. A. (2009). *Incorporación de gestión del riesgo y/o adaptación al cambio climático en el sector agropecuario en Colombia*. In Summaries of subregional workshop "Risk Management Incorporation in Planning, Public Investment, and Assets Financial Protection against Disasters and in the Agrarian Sector," held on May 27-29, 2009. Bogota, Colombia: CAN - PREDECAN.
- Colciencias, et al. (2002). *Estrategia de fortalecimiento de la ciencia la tecnología y la educación para la reducción de riesgos y atención de desastres*. Bogota, Colombia.
- Confis (2011a). *Plan Financiero 2011*. Consultants' Document Confis 03/2011. Available at www.minhacienda.gov.co
- _____. (2011b). *Cierre Fiscal 2010, GNC (Balance preliminar)*. Consultants' Document Confis 004 of 2011.
- _____. (2010). *Cierre Fiscal 2009, GNC*. Consultants' Document CONFIS 004 of 2010. Available at www.minhacienda.gov.co
- Consorcio de Compensación de Seguros, Ministerio de Economía y Hacienda de España (2008). *La cobertura aseguradora de las catástrofes naturales. Diversidad de sistemas*.
- Consorcio ERN - Colombia (2011). *Modelación probabilista de riesgos naturales a nivel global: La curva híbrida de excedencia de pérdidas. Desarrollo metodológico e implementación de casos de estudio. Fase 1: Colombia, México y Nepal*. Study carried out for the ISDR, Global

- Assessment Report on Disaster Risk Reduction. Bogota, Colombia.
- Contraloría General de la República (2010a). *Informe de auditoría gubernamental con enfoque integral modalidad regular para el Incoder*. Bogota, Colombia.
- _____ (2010b). *Informe sobre el Estado actual de los recursos naturales y del ambiente (2006-2010)*. Bogota, Colombia.
- Cormagdalena and Ideam (2001). *Estudio ambiental de la cuenca Cauca-Magdalena y elementos para su ordenamiento territorial*. Bogota, Colombia.
- Corpoboyacá (2007). *Corboyacá evalúa daños ambientales en el páramo de Rabanal*. Available at http://www.asocars.org.co/search_news.asp?idnoticia=224
- Cortés, G. P. and Calvache, M. L., 1997. Informe sobre la Evaluación de la Amenaza Volcánica del Chiles y Cerro Negro (First Version). Ingeominas internal report, p. 43. Pasto, Colombia.
- Cortés, A. (1982). *Geografía de suelos de Colombia*. Bogota, Colombia: Universidad Jorge Tadeo Lozano.
- Costa, C. (2005). *El índice de escasez de agua, ¿un indicador de crisis o una alerta para orientar la gestión del recurso hídrico?* In *Revista de Ingeniería*, v. 22, pp. 102-109. Bogota, Colombia: Universidad de Los Andes –Engineering Faculty.
- Cuatrecasas J. (1989). *Aspectos de la vegetación natural de Colombia*. In *Pérez Arbelaezia Magazine*, vol. 2, No 8. pp. 13-29. Bogota, Colombia.
- Cuervo, J. I. (2002). *El modelo de gestión del FOREC: de la crisis del Estado al Estado franquicia. Balance y perspectivas del Fondo para la Reconstrucción Económica y Social del Eje Cafetero*. In *Revista Opera*, November, Vol. 2, number 002. Bogota, Colombia: Universidad Externado de Colombia.
- CVS and Fonade (2004). *Diagnóstico ambiental de la cuenca hidrográfica del río Sinu*. Monteria, Colombia.
- CVS and Universidad Nacional de Colombia – Medellin Branch (2006). *Plan de Manejo y Ordenamiento Ambiental del Complejo Cenagoso del Bajo Sinu*, Colombia.
- CVS and Universidad Nacional de Colombia - Bogota Branch (2005). *Plan de manejo de la cuenca del río Sinu*. Bogota, Colombia: Natural Sciences Institute. Universidad Nacional de Colombia.
- DANE (2011). Información demográfica y de vivienda en Colombia. Available at http://www.dane.gov.co/censo/files/resultados/NBI_total_30_Jun_2011.pdf.
- _____ (2010). *Gran Encuesta Integrada de Hogares*. Bogota, Colombia.
- _____ (2006). *PIB trimestral sin ilícitos a precios constantes por rama de la actividad económica. Promedio móvil trimestral. Corte III Trimestre de 2006*. Bogota, Colombia.
- _____ (2005a). *Boletín del Censo General. Proyecciones 2010*. Bogota, Colombia. Available at http://www.dane.gov.co/index.php?option=com_content&view=article&id=75&Itemid=72
- _____ (2005b). *Censo General 2005. Muestra Cocensal. Déficit de vivienda. Municipios*. Bogota, Colombia.
- Del Campo, A., et al. (2011). *Incendios de la cobertura vegetal en Colombia*. Volume I. Cali, Colombia. Universidad Autónoma de Occidente, Feriva graphic printing workshops.
- Díaz, C. (2007). *Metodología interdisciplinaria desde el estudio de la problemática ambiental del tramo urbano de la cuenca del río Consota: Hacia el fortalecimiento de la gestión ambiental local*. Graduate Thesis for the title of Master in Environment and Development. Faculty

- of Engineering and Architecture.
Universidad Nacional de Colombia.
- Díaz-Granados, M. (2003). *Hidrología, Plan de Desarrollo Sostenible de la región de La Mojana*. Bogota, Colombia: DNP and FAO.
- DNP (2010a). *Plan Nacional de Desarrollo “Prosperidad para todos” 2010-2014*. Bogota, Colombia. Available at <http://www.dnp.gov.co/PND/PND20102014.aspx>.
- _____(2010b). *Plan Maestro de Transporte 2010-2032*. Bogota, Colombia.
- _____(2009). *Evaluación preliminar del Documento Conpes 3146 de 2001*. Bogota, Colombia: DNP - SDAS.
- _____(2007). *Visión Colombia 2019. II Centenario. Consolidar una gestión ambiental que promueva el desarrollo sostenible*. Bogota, Colombia: DNP – Dirección de Desarrollo Urbano y Política Ambiental.
- DNP - DDTs (2007). *Fortalecer la descentralización y adecuar el ordenamiento territorial*. Bogota, Colombia.
- DNP - SDAS (2010). *Bases de datos de inversiones en gestión del riesgo*. Bogota, Colombia.
- DNP - DPAD and UNDP (2008). *Plan de acciones regionales prioritarias para el desarrollo sustentable de La Mojana*. Bogota, Colombia.
- DNP and Escuela Superior de Administración Pública (ESAP) (2007). *Gestión pública local*. Bogota, Colombia. Available at http://www.dnp.gov.co/Portals/0/archivos/documentos/DDTS/Gestion_Publica_Territorial/CARTILLA%20GESTION.pdf
- ECLAC (2011). *Valoración de daños y pérdidas por los eventos climáticos de la ola invernal 2010-2011 por efecto de “La Niña” en Colombia*. Preliminary report. Bogota, Colombia.
- _____(2009). *La actual crisis financiera internacional y sus efectos en América Latina y el Caribe*. Santiago de Chile, Chile.
- _____(2005). *El sistema municipal y la superación de la pobreza en Colombia*. In *Serie Medio Ambiente y Desarrollo*, No. 110. LC/L.2380-P. Santiago de Chile, Chile.
- ECLAC and GTZ (2008). *Agricultura, desarrollo rural, tierra, sequía y desertificación: resultados, tendencias y desafíos para el desarrollo sostenible de América Latina y el Caribe*. Santiago de Chile, Chile.
- Ecoversa (2009). *Recopilación, evaluación y análisis de los instrumentos económicos y tributarios existentes en materia ambiental*. Final report, Ecoversa Corporation. Bogota, Colombia.
- Eva, H. D., De Miranda, E. E., Di Bella, C. M., Gond, V., Huber, O. and Sgrenzaroli, M. (2003). *The Global Land Cover Map for the Year 2000*. European Commission, Joint Research Centre. <http://www.gofc-gold.uni-jena.de/sites/data/glc2000.htm>
- Fasecolda (2011). *Revista Fasecolda*, No. 140. Bogota, Colombia.
- Fitch Ratings (2010). *Sectoral Report, Insurance Sector in Colombia: 2009 Performance and 2010 Perspectives*. Available at <http://www.fitchratings.com.co/resources/getresource.aspx?ID=748>
- Ghesquiere, F. and Mahul, O. (2010). *Financial Protection of the State Against Natural Disasters: A Primer, The World Bank, Latin American and the Caribbean Region, Finance and Private Sector Development, Sustainable Development Network*. Washington, DC: World Bank.
- Ghul, E., et al. (1998). *Guía para la gestión ambiental regional y local*. Bogota: Fonade, DNP, and Quinaxi.
- Global Environment Facility (GEF), United Nations Environmental Program (UNEP), and Consortium for the Sustainable Development in the Andean Eco-region (CONDESAN) (2010).

- Andean Moor Project*. Available at <http://www.condesan.org/ppa/>
- Gurenko, E. Lester, R., Mahul, O. and Gonulal, S. (2006). *Earthquake Insurance in Turkey. History of the Turkish Catastrophe Insurance Pool*. Washington, DC: World Bank.
- Herzer, H. and Gurevich, R. (1996). Degradación y desastres: parecidos y diferentes. In Fernández, M. A. (ed.). *Ciudades en riesgo: Degradación ambiental, riesgos urbanos y desastres*. Quito, Ecuador: La Red.
- IAvH, CAR, Corpoboyacá, Corpochivor (2008). *Plan de manejo ambiental del macizo del páramo de Rabanal*. Available at <http://www.condesan.org/ppa/documentos/colombia/Plan%20de%20manejo%20participativo%20del%20paramo%20de%20Rabanal.pdf>
- Icontec (2006a). *Norma Técnica Colombiana NTC 4595. Ingeniería Civil y Arquitectura. Planteamiento y diseño de instalaciones y ambientes escolares*. Bogota, Colombia.
- _____. (2006b). *Norma Técnica Colombiana NTC 4596. Señalización para instalaciones y ambientes escolares*. Bogota, Colombia.
- IDB and ECLAC (2005). *Información para la gestión de riesgo de desastres. Caso: Colombia*.
- IDB, ECLAC, and DNP (2011). *Valoración de daños y pérdidas por los eventos climáticos de la ola invernal 2010-2011 por efecto de "La Niña" en Colombia*. Bogota, Colombia.
- Ideam (2010). *Estudio Nacional del Agua 2010*. Bogota, Colombia.
- Ideam (2010b). *Mapa de zonas inundables*. Bogota, Colombia.
- _____. (2009a). *Informe anual sobre el estado del medio ambiente y los recursos naturales renovables en Colombia – Bosques*. Bogota, Colombia.
- _____. (2009b). *Mapa de lluvias en Colombia*. Bogota, Colombia.
- Ideam, IGAC, IAvH, Invemar, Instituto Sinchi, and IIAP (2007). *Ecosistemas continentales costeros y marinos de Colombia*. Bogota, Colombia: Ideam, IGAC.
- Ideam (2003). *Condiciones e Indicadores Ambientales en Colombia*. Report No. 107. Bogota, Colombia: Ideam.
- IGAC- Sistema de información geográfica para la planeación y el ordenamiento territorial (Sigot) (2011). *Cartografía y datos obtenidos del Sistema de Información para el Ordenamiento Territorial en Colombia*. Bogota, Colombia.
- IGAC, Ministry of Agriculture, and Corpoica. (2002). *Cobertura y uso actual del suelo*. Bogota, Colombia.
- Inco (2010). *Comunicado No. 16 Aclaraciones sobre demandas y condenas judiciales*. Bogota, Colombia.
- Incoder (2008). *Plan Estratégico 2008-2010*. Bogota, Colombia.
- Ingeniar Ltda. (2011). *Synthesis Technical Document to Support the Regulation Proposal. Reduction Program of the State Fiscal Vulnerability to Natural Disasters APL1 (IBRD 7293-CO). Support for strengthening policies and financial instruments of the National System for Prevention and Response to Disasters (SNPAD) in Colombia (DGR). Preparation of a draft law that allows the implementation of a policy and a National System for Disaster Risk Management linked to a financial sustainability strategy through participatory processes*. Bogota, Colombia.
- Ingeominas (1997a). *Mapa de Amenaza Volcánica del Galeras (Third Version)*. Special Publication of Ingeominas, p. 46. Bogota, Colombia.
- _____. (1997b). *Evaluación de Amenaza y Vigilancia Volcánica del Complejo*

- Volcánico Nevado Del Huila. Convenio Ingeominas – Nasa Kiwe. Ingeominas, p. 32. Popayan, Colombia.
- _____. (1988). *Mapa preliminar de amenaza volcánica potencial del nevado del Tolima*, Colombia.
- Ingeominas – Carder (1994). Mapa preliminar de amenaza volcánica potencial complejo de domos Santa Isabel – Cordillera Central de Colombia. In Revista Ingeominas No. 3, Santafé de Bogota, pp. 1 – 28.
- Ingeominas – Ideam (2010). Mapa nacional de amenaza relativa por movimientos en masa. Bogota, Colombia.
- International Finance Corporation (IFC) (2011). *Climate Risk and Business Ports: El Bosque* Maritime terminal docks Cartagena, Colombia. Bogota, Colombia.
- Inviás (2009). *Informe presupuestal de la Oficina de Prevención y Atención de Emergencias*. Bogota, Colombia.
- IPCC (2007). *Fourth Assessment Report (AR4)*. Geneva, Switzerland.
- Ipsos Public Affairs (2009). *Encuesta de percepción ciudadana “Medellin cómo vamos”*. Medellin: Proantioquia, Cámara de Comercio, El Colombiano, Universidad EAFIT, El Tiempo, Fundación Corona. Available at <http://www.medellincomovamos.org/bitcache/0014c29ec9d798dc0475b2764358cf2ee77b52eb?vid=375&disposition=inline&op=view>.
- IRG (2007). *Tiempo para entregar el relevo*. San Jose, Costa Rica: USAID.
- Jha, A., Bloch R, and Lamond J. (2012). *Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century*. Washington, DC: World Bank – GFDRR. eISBN: 978-0-8213-9477-9.
- Jha, A, with Barenstein J., Phelps, P., Pittet D., and Sena S. *Safer Homes, Stronger Communities: A Handbook for Reconstructing after Natural Disasters*. Washington, DC: World Bank – GFDRR. eISBN: 978-0-8213-8268-4.
- Lavell, A. (2010). *Gestión ambiental y gestión del riesgo de desastres en el contexto del cambio climático. Una aproximación al desarrollo de un concepto y definición integral*. Consulting Agreement DNP 084 de 2010. Bogota, Colombia: Departamento Nacional de Planeación.
- _____. (2006). *Apuntes para una reflexión institucional en países de la subregión Andina sobre el enfoque de la gestión del riesgo*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- MADR (2011a). *Estadísticas del sector agropecuario 2011*. Bogota, Colombia.
- _____. (2011b). *Coordinación de Sistemas de Información*. Bogota, Colombia.
- _____. (2010). *Anuario de frutas y hortalizas 2005-2009*. Bogota, Colombia.
- _____. (2009). *Anuario estadístico del sector agropecuario 2009*. Bogota, Colombia.
- _____. (2004). *El agro colombiano frente al TLC*. Bogota, Colombia.
- Márquez, G. (2001). De la abundancia a la escasez: la transformación de los ecosistemas en Colombia. In: Palacios, G. (ed). *La naturaleza en disputa*. Bogota, Colombia: Unibiblos, Universidad Nacional de Colombia.
- Martínez, A. (1992). *Geomorfología y dinámica fluvial de la planicie inundable del Caño Viejo - Caño Vidrial, río Sinu, para el manejo del drenaje de la margen izquierda del río Sinu*. Monteria, Colombia: CVS.
- Martínez, C. (2001). *Las migraciones internas en Colombia. Análisis territorial y demográfico según los censos de 1973 y 1993*. Graduate Thesis for the degree of Doctor in Demography. Department of Geography, University of Barcelona, Spain.

- MAVDT (2008). Circular para la presentación de proyectos de reducción de riesgos sobre la prestación de los servicios públicos de acueducto y alcantarillado, afectados con la ola invernal. Bogota, Colombia.
- _____. (2005). *Guía No. 1: Guía metodológica para incorporar la prevención y reducción de riesgos en los procesos de ordenamiento territorial*. From Serie Ambiente y Desarrollo Territorial. Bogota, Colombia.
- MAVDT and Ideam (2005). *Atlas Climatológico de Colombia*. Bogota, Colombia.
- MAVDT, Ideam, UNDP, and GEF (2010). *Segunda Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre Cambio Climático*. Bogota, Colombia: Editorial Scripto Ltda.
- MEN (2011). *Sistema Interactivo de Consulta de Infraestructura Educativa (SICIED)*. Available at <http://www.mineducacion.gov.co/1621/article-156289.html>.
- _____. (2002). *Política Nacional de Educación Ambiental*. Bogota, Colombia.
- _____. (1994a). *Resolución 115 de 1994*. Bogota, Colombia.
- _____. (1994b). *Resolución 7550 de 1994*. Bogota, Colombia.
- Méndez, R. A., Cortés, G. P. and Cepeda, H. (2002). Evaluación de la Amenaza Potencial del Volcán Cerro Machin. Bogota, Colombia: Ingeominas.
- Menoni, S. (2008). Medidas no estructurales de prevención: desde la reducción de la vulnerabilidad física hacia la reducción del ordenamiento urbanístico. In: Andrés, P. and Rodríguez, R. (eds.) *Evaluación y prevención de riesgos ambientales en Centroamérica*. Girona, Spain: Documenta Universitaria.
- MHCP (2011a). *Proyecto de Ley "Por el cual se efectúan unas modificaciones al Presupuesto General de la Nación para la vigencia fiscal de 2011"*. Bogota, Colombia.
- _____. (2011b). *Proyecto de Ley "Por el cual se establece una Regla Fiscal y se dictan otras disposiciones"*. Bogota, Colombia.
- _____. (2011c). Presentación del Ministro de Hacienda a Asobancaria: Avances y desafíos para el desarrollo. Bogota, Colombia. Available at <http://www.asobancaria.com/portal/pls/portal/docs/1/1376050.pdf>.
- _____. (2010a). *Marco Fiscal de Mediano Plazo 2010*. Bogota, Colombia. Available at http://www.minhacienda.gov.co/portal/page/portal/MinHacienda/haciendapublica/politica-fiscal/informacion-fiscal/marco-fiscal-mediano-plazo/MFMP%20PARTE%201_0.pdf.
- _____. (2010b). *Proyecto de Acto Legislativo "Por el cual se establece el derecho a la sostenibilidad fiscal para alcanzar los fines del Estado Social de Derecho"*. Bogota, Colombia.
- Ministerio de Economía y Finanzas del Peru - Dirección Nacional de Presupuesto Público (2008). *Guía para la programación presupuestaria estratégica*. Lima, Peru.
- Ministerio de Minas y Energía (2010). *Informe de gestión 2009-2010*. Bogota, Colombia.
- Ministerio de Transporte (2011). *Programa Infraestructura para la Prosperidad 2010-2014*. Bogota, Colombia.
- _____. (2010). *Inversiones en emergencias. Cifras*. Bogota, Colombia.
- _____. (2008). *Informe de gestión*. Bogota, Colombia.
- Ministerio del Interior y de Justicia - DGR (2011). *Evaluación de daños del fenómeno de La Niña 2010-2011*. Bogota, Colombia.
- _____. (2010). *Informe Nacional del Progreso en la Implementación del Marco de Acción de Hyogo*. Bogota, Colombia.

- _____. (2006). *Guía de actuación y protocolos del alto gobierno en caso de un desastre súbito de cobertura nacional*. Bogota, Colombia.
- Ministerio del Medio Ambiente y MEN (2002). *Política Nacional de Educación Ambiental*. Bogota, Colombia.
- MSPS (2011). Reporte de estudios de vulnerabilidad y reforzamiento de edificaciones hospitalarias. (Documento interno). Bogota, Colombia.
- Monsalve, M. L. (2011). Estudios geovulcanológicos y mapas de amenaza volcánica en Colombia. In: *Revista del Instituto Colombiano de Geología y Minería, Ingeominas*, No. 11, April, pp. 10-19. Bogota, Colombia.
- Monsalve, M. L. and Pulgarín, B. (1993). Mapa Preliminar de Amenaza Volcánica Potencial del Volcán Puracé. *Revista Ingeominas* No. 2, pp. 3 - 27. Bogota, Colombia.
- Monsalve, M.L. and Nuñez, A. (1992). El volcán Cerro Bravo Geología y Amenaza Volcánica. In *Revista Ingeominas* Vol. 1, No. 1 pp. 2-9. Bogota, Colombia.
- Monsalve, M. L. and Méndez, R. A. (1988). Mapa Preliminar de Amenaza Volcánica Potencial del Complejo Volcánico de Cumbal. *Ingeominas. Gobernación de Nariño*, p.18. Popayan, Colombia.
- MVCT - Viceministerio de Agua y Saneamiento (2011). Available at <http://www.minvivienda.gov.co/portal/default.aspx>.
- MVCT and Fonvivienda (2011). *Subsidio Familiar de Vivienda de Interés Social Urbana*. Available at <http://www.minvivienda.gov.co/contenido/contenido.aspx?catID=549&conID=1591>.
- Narváez, L., Lavell, A. and Pérez, G. (2009). *La gestión del riesgo de desastres. Un enfoque basado en procesos*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- NASA, German Aerospace Center, and Italian Space Agency (2003). *The Shuttle Radar Topography Mission (SRTM)*.
- National Oceanic and Atmospheric Administration (NOAA) (2011). *Changes to the Oceanic Niño Index (ONI)*. Available at http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml
- OSSO Corporation (2011). *Comportamiento del riesgo en Colombia*. Analysis of the Disaster Risk Management Project in Colombia. Bogota, Colombia: World Bank.
- _____. (2009a). *Atlas de las dinámicas del territorio andino. Población y bienes expuestos a amenazas naturales*. Cali, Colombia: Secretaría General de la CAN - PREDECAN.
- _____. (2009b). *Diagnóstico del Sistema Nacional de Prevención y Atención de Desastres*. Bogota: Ministry of the Interior and Justice - Risk Management Directorate.
- _____. (2008). *Informe de análisis inventario de pérdidas por desastres*. Lima, Perú: Secretaría General de la CAN - PREDECAN and OSSO Corporation.
- _____. (1998). *Dinámicas ambientales amenazantes en el Atrato Medio*. Bogota: UNDP. Available at <http://www.osso.org.co/docu/proyectos/grupo-osso/1998/atrato/resumen.html>.
- _____. (1994). *Atlas para la planificación con riesgos por fenómenos naturales en la región del Occidente*. Corpes de Occidente.
- OSSO Corporation and EAFIT (2011). *Base de datos de pérdidas históricas en Colombia (período 1970-2011)*. Available at: <http://online.desinventar.org>.
- Parra, E., Cepeda, H. and Thouret, J. C. (1986). Mapa Actualizado de Amenaza Volcánica Potencial del Nevado Del Ruiz. Bogota, Colombia: Ingeominas.

- Ponvert, R. (2007). *La vulnerabilidad del sector agrícola frente a los desastres. Reflexiones generales*. La Habana, Cuba: Universidad Agraria de La Habana.
- Pontificia Universidad Javeriana (2004). *Estudio de vulnerabilidad económica de la carretera Bogota-Villavicencio*. Bogota, Colombia.
- Ramírez, F. and Rubiano, D. (2009a). *Incorporando la gestión del riesgo de desastres en la planificación y gestión territorial. Guía técnica para la interpretación y aplicación del análisis de amenazas y riesgos*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- _____. (2009b). *Incorporando la gestión del riesgo de desastres en la planificación del desarrollo. Lineamientos generales para la formulación de planes a nivel local*. Lima, Perú: Secretaría General de la CAN - PREDECAN.
- _____. Presidencia de la República de Colombia (2010a). *Informe del presidente Álvaro Uribe Vélez ante el Congreso de la República*. Bogota, Colombia.
- Presidencia de la República de Colombia (2010b). *Informe del Ministerio de la Protección Social, Grupo de Infraestructura Física, al Congreso de la República*. Bogota, Colombia.
- Roa (2010). Desastres naturales y vulnerabilidad fiscal, contingentes y riesgos ocultos para Colombia. Graduate thesis to qualify for the Masters degree in Governance and Public Policy. Bogota, Colombia: Universidad Externado de Colombia.
- Rubiano, D. (2009). *Consultoría para la documentación de las experiencias de incorporación de la reducción del riesgo de desastres en el tema escolar de la ciudad de Bogota*. Bogota, Colombia: World Bank.
- Saldías, C. (2007). Structure and Configuration of the City-Region: First Approach from the Case of Bogota. 1991-2003. In *Las regiones de América Latina*. Santiago de Chile: Instituto Fernando Henrique Cardoso (IFHC) and Corporación de Estudios para Latinoamérica (Cieplan).
- Senplandes and CAF (2005). *Plan de Reducción de Riesgos del Sector Vialidad y Transporte*. Quito, Ecuador.
- Servicio Geológico Colombiano (2012). M.M. Arcila Rivera (personal communication, February 2012). Bogota, Colombia.
- Servicio Geológico Colombiano (2011). M.L. Calvache Velasco (personal communication, December 2011). Bogota, Colombia.
- SIGPAD (2000-2010). Available at http://www.sigpad.gov.co/sigpad_app/
- SNPAD (2001). *Guía de actuación en caso de un desastre súbito de cobertura nacional*. Adopted by the Presidential Directive 005 of November 27, 2001. Bogota, Colombia.
- SNPAD and World Bank (2010). *Guía municipal para la gestión del riesgo*. Technical assistance project in local risk management at a municipal and departmental level in Colombia. B.3 Subcomponent of Program APL-1 (Fiscal State Vulnerability Reduction against Natural Disasters, IBRD 7293-CO credit). Bogota, Colombia.
- SNPAD and DGR (2011). *Plan integral de acción específico para el manejo de la emergencia generada por el fenómeno de La Niña 2010-2011*. Bogota, Colombia.
- Soja, E. W. (2008). *Postmetrópolis. Estudios críticos sobre las ciudades y las regiones*. Madrid, Spain: Editorial Traficantes de Sueños.
- Tewfwe, L. (2011). If we do not join hands... In *Global Network of Civil Society Organizations for Disaster Reduction, Summary Report Views from the Frontline Local Reports of Progress are the Implementation the Hyogo Framework for Action*.

- UNDP (2011). *Informe Nacional de Desarrollo Humano Colombia*. Bogota, Colombia.
- UNESCO (2008). *The meteorological phenomenon El Niño 1997-1998, at a regional scale and by countries*. Available at <http://www.unesco.org.uy/phi/biblioteca/bitstream/123456789/468/1/el+niño+1998-2.pdf>.
- UNICEF (2006). *Propuesta para la educación en las emergencias y en las transiciones posteriores a la crisis*. Bogota, Colombia.
- UNISDR (2011). *Global Assessment Report on Disaster 2011: Revealing Risk, Redefining Development*. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/index.html>
- _____. (2009). *Evaluation Report on the Reduction of Disaster Risk (GAR): Risk and Poverty in a Changing Climate*. Geneva, Switzerland: UN.
- _____. (2008). *Disaster Risk Management Today: Global Context, Local Tools*. Panama.
- _____. (2007). *Global Trends Report*. Geneva, Switzerland.
- _____. (2006). *Early warning development*. III International Conference on Early Warning. Panama.
- UNSIDR (2007). *Hyogo Framework for Action 2005-2015: Resilience Increase in Nations and Communities Facing Disasters*. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/index.html>
- Universidad de los Andes (1999). *Estimación Integral del Riesgo de un Sistema Vial Nacional. Aplicación para el caso de la red vial de Colombia*. Bogota, Colombia.
- UPME (2010). *Balance Minero Energético*. Bogota, Colombia.
- _____. (2008). *Cargo por confiabilidad*. Bogota, Colombia.
- USAID and IRG (2007). *Tiempo para entregar el relevo*. San José, Costa Rica.
- Valeriano, Márcio de Morisson. (2008). *Topodata: Guia para utilização de dados geomorfológicos locais*. San José dos Campos, Brazil: Instituto Nacional de Pesquisas Espaciais (INPE).
- Vásquez, H. J. (2006). *Sistematización de la información existente sobre aspectos institucionales, legales y técnicos de la gestión del riesgo en Colombia*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- Vega Mora, L. (2004). *El Estado como sistema. El enfoque sistémico en la formulación, seguimiento y evaluación de las políticas públicas: el caso de la política ambiental*. Bogota, Colombia: Ediciones Systemical.
- Villareal, J. and Córdoba, M. (2007). *Incentivos y estructura del nuevo cargo por confidencialidad en el sector eléctrico en Colombia*. Bogota, Colombia.
- Villota, H. (1991). *Geomorfología aplicada a levantamientos edafológicos y zonificación física de las tierras*. Bogota, Colombia: IGAC.
- Von Hesse, M. and De la Torre, C. (2009). *Incorporando la gestión del riesgo de desastres en la inversión pública. Lineamientos y estrategias para la formulación y evaluación de proyectos*. Lima, Peru: Secretaría General de la CAN - PREDECAN.
- World Bank (2000). *Designing and Building Results-Based Monitoring and Evaluation System: A Tool for Public Sector Management*. Washington, DC: World Bank.
- World Bank (2011a). *Survey on Colombian Citizens' Perception of Risk*: Bogota, Cali, Medellin, Barranquilla, Cartagena, Manizales, Villavicencio, and Pasto. From May 30 to June 15, 2011. Project: Analysis

- of Disaster Risk Management in Colombia. Bogota, Colombia.
- _____ (2011b). *Marco institucional de concesiones en Colombia*. WEF 2010-2011. Bogota, Colombia.
- _____ (2011c). Self-Evaluation on the Advances in Risk Management: National Entities, Departments, CAR, and Municipalities. From April 30, 2011, to June 20, 2011. Analysis of Disaster Risk Management Project in Colombia. Bogota, Colombia.
- _____ (2008). *Financial and Private Sector Development - Global Capital Markets Development - Non-Bank Financial Institutions Unit (FPD-GCMNB)*. Washington, DC, United States.
- _____ (2006a). *Hazards of Nature, Risks to Development. An IEG Evaluation of World Bank Assistance for Natural Disasters*. Washington, DC, United States.
- _____ (2006b). *Prioridades ambientales para la reducción de la pobreza*. Bogota, Colombia.
- _____ (2004). *Prioridades ambientales para la reducción de la pobreza*. Bogota, Colombia.
- Zall, J. and Rist, R. C. (2006). *Ten Steps to a Result Based Monitoring and Evaluation System*. Washington, DC: World Bank.

ABBREVIATIONS AND ACRONYMS

| | |
|-----------------|---|
| ACCI* | Colombian International Cooperation Agency (Agencia Colombiana de Cooperación Internacional) |
| AIS* | Colombian Association of Seismic Engineering (Asociación Colombiana de Ingeniería Sísmica) |
| ANI* | National Infrastructure Agency (before 2011 National Concession Institute) (Agencia Nacional de Infraestructura) |
| ASIC | Trading System Administrator |
| Asocars* | Association of Regional Autonomous Corporations and Sustainable Development (Asociación de Corporaciones Autónomas Regionales y Desarrollo Sostenible) |
| ATC* | Freight Transportation Association (Asociación de Transportadores de Carga) |
| AXCO | Insurance Information Services |
| BPIN* | Bank for National Investment in Programs and Projects (Banco de Programas y Proyectos de Inversión Nacional) |
| CAF* | Andean Development Corporation (Corporación Andina de Fomento) |
| Camacol* | Colombian Chamber of Construction (Cámara Colombiana de la Construcción) |
| CAN | Andean Community (Comunidad Andina) |
| CAR* | Regional Autonomous Corporation (Corporación Autónoma Regional) |
| CAR* | Regional Autonomous Corporation of Cundinamarca (Corporación Autónoma Regional de Cundinamarca) |
| CARDER* | Regional Autonomous Corporation of Risaralda (Corporación Autónoma Regional de Risaralda) |
| CAS | Regional Autonomous Corporation of Santander (Corporación Autónoma Regional de Santander) |
| CASH* | National Advisory Committee on Water, Sanitation, and Hygiene (Comisión Nacional Asesora de Agua, Saneamiento e Higiene) |
| CCA | Climate Change Adaptation |
| CCO* | Colombian Ocean Commission (Comisión Colombiana de Océano) |
| CDMB* | Regional Autonomous Corporation for the Defense of the Bucaramanga Plateau (Corporación Autónoma Regional para la Defensa de la Meseta de Bucaramanga) |
| CGR* | General Comptroller's Office of the Republic (Contraloría General de la República) |
| CIA | Central Intelligence Agency |
| CIF* | Certified Forestry Reforestation Incentive (Certificado de Incentivo Forestal de Reforestación) |
| CLOPAD* | Local Committee for the Disaster Prevention and Response (Comité Local para la Prevención y Atención de Desastres) |

| | |
|---------------------|--|
| CMNUCC | Framework Convention on Climate Change |
| Colciencias* | Administrative Department of Science, Technology, and Innovation (Departamento Administrativo de Ciencia, Tecnología e Innovación) |
| Coldeportes* | Colombian Institute for Sport (Instituto Colombiano para el Deporte) |
| Confis* | Superior Council for Fiscal Policy (Consejo Superior de Política Fiscal) |
| CONPAD* | National Operating Committee for Prevention and Disaster Response (Comité Operativo Nacional para la Prevención y Atención de Desastres) |
| Conpes* | National Council for Economic and Social Policy (Consejo Nacional de Política Económica y Social) |
| CRA* | Atlantic Autonomous Regional Corporation (Corporación Autónoma Regional del Atlántico) |
| CREG* | Energy and Gas Regulatory Commission (Comisión de Regulación de Energía y Gas) |
| CREPAD* | Regional Committee for Prevention and Disaster Response (Comité Regional para la Prevención y Atención de Desastres) |
| CSB* | South Bolivar Corporation (Corporación del Sur de Bolívar) |
| CTN-ERFEN* | National Technical Committee for the Study of the El Niño Phenomenon (Comité Técnico Nacional para el Estudio del Fenómeno El Niño) |
| CTN-PAD* | National Technical Committee for Disaster Prevention and Response (Comité Técnico Nacional para la Prevención y Atención de Desastres) |
| CVS* | Corporation of the Sinu Valley and San Jorge (Corporación de los Valle del Sinu y del San Jorge) |
| DANE* | National Statistics Administration Department (Departamento Administrativo Nacional de Estadística) |
| DCC* | Colombian Civil Defense (Defensa Civil Colombiana) |
| DDTS* | Sustainable Territorial Development Office of the National Planning Department (Dirección de Desarrollo Territorial Sostenible del Departamento Nacional de Planeación) |
| DGR* | Risk Management Directorate - Ministry of Interior and Justice (Dirección de Gestión del Riesgo - Ministerio del Interior y de Justicia) |
| DIMAR* | General Maritime Directorate (Dirección General Marítima) |
| DNP* | National Planning Department (Departamento Nacional de Planeación) |
| DPAD* | Disaster Prevention and Response Directorate (Dirección de Prevención y Atención de Desastres) |
| DPAE* | Bogota Emergency Prevention and Response Directorate (Dirección de Prevención y Atención de Emergencias de Bogota) |
| DRM | Disaster Risk Management (Gestión del Riesgo de Desastres) |
| EAAB* | Bogota Aqueduct and Sewerage Company (Empresa de Acueducto y Alcantarillado de Bogota) |

| | |
|---------------------|--|
| ECDBC* | Colombian Strategy for Low-Carbon Development (Estrategia Colombiana de Desarrollo Bajo en Carbono) |
| ECLAC | Economic Commission for Latin America and the Caribbean (Comisión Económica para América Latina y el Caribe) |
| EDAN* | Damage and Needs Assessment (Evaluación de Daños y Necesidades) |
| EEB* | Bogota Power Company (Empresa de Energía de Bogota) |
| ENREDD+ | National Strategy for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries and the Role of Conservation, Sustainable Management of Forests, and the Increase of Carbon Forest Reserves in Developing Countries (Estrategia Nacional para la Reducción de las Emisiones debidas a la Deforestación y la Degradación Forestal en los Países en Desarrollo, y la Función de la Conservación, la Gestión Sostenible de los Bosques y el Aumento de las Reservas Forestales de Carbono en los Países en Desarrollo) |
| ENSO | El Niño/South Oscillation |
| ERN* | Natural Risk Evaluation (Evaluación de Riesgos Naturales) |
| FAEP* | Savings Fund and Oil Stabilization (Fondo de Ahorro y Estabilización Petrolera) |
| FAO | Food and Agriculture Organization of the United Nations |
| Fasecolda* | Colombian Insurers Federation (Federación de Aseguradores Colombianos) |
| FINDETER* | Finance for Territorial Development (Financiera de Desarrollo Territorial) |
| FNC* | National Calamity Fund (Fondo Nacional de Calamidades) |
| FNCV* | National Rural Roads Fund (Fondo Nacional de Caminos Vecinales) |
| FNR* | National Royalties Fund (Fondo Nacional de Regalías) |
| Fonade* | Financial Fund for Development Projects (Fondo Financiero de Proyectos de Desarrollo) |
| FONAM* | National Environmental Fund (Fondo Nacional Ambiental) |
| Fonvivienda* | National Housing Fund (Fondo Nacional de Vivienda) |
| FOPAE* | Bogota Prevention and Emergency Response Fund (Fondo de Prevención y Atención de Emergencias de Bogota) |
| FOREC* | Coffee Growing Region Reconstruction Fund (Fondo para la Reconstrucción del Eje Cafetero) |
| Fosyga* | Solidarity and Guarantee Fund (Fondo de Solidaridad y Garantía) |
| GDP | Gross Domestic Product |
| GEF | Global Environmental Facility |
| GFDRR | Global Facility for Disaster Reduction and Recovery |
| GMCC | Climate Change Mitigation Group |
| GTZ | German Agency for Technical Cooperation |
| HFA | Hyogo Framework for Action |

| | |
|--------------------------|--|
| IvH* | Alexander von Humboldt Research Institute of Biological Resources (Instituto de Investigaciones de Recursos Biológicos Alexander von Humboldt) |
| IDB | Inter-American Development Bank |
| IBRD | International Bank for Reconstruction and Development |
| ICDE* | Colombian Infrastructure of Spatial Data (Infraestructura Colombiana de Datos Espaciales) |
| ICFES* | Colombian Institute for the Promotion of Higher Education (Instituto Colombiano para El Fomento de la Educación Superior) |
| Icontec* | Colombian Institute of Technical Rules and Certification (Instituto Colombiano de Normas Técnicas y Certificación) |
| Ideam* | Colombia Institute of Hydrology, Meteorology, and Environmental Studies (Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia) |
| IGAC* | Agustín Codazzi Geographic Institute (Instituto Geográfico Agustín Codazzi) |
| IIAP | John von Neuman Pacific Environmental Research Institute |
| Inco* | National Institute of Concessions (Instituto Nacional de Concesiones) |
| Incoder* | Colombian Institute of Rural Development (Instituto Colombiano de Desarrollo Rural) |
| Ingeominas* | Colombian Institute of Geology and Mining (Instituto Colombiano de Geología y Minería) |
| Instituto Sinchi* | Sinchi Amazonian Institute of Scientific Research (Instituto Amazónico de Investigaciones Científicas Sinchi) |
| Invemar* | José Benito Vives de Andreis Institute of Marine and Coastal Research (Instituto de Investigaciones Marinas y Costeras José Benito Vives De Andrés) |
| IGR* | Risk Management Index (Índice de Gestión del Riesgo) |
| Inurbe* | National Institute of Social Housing and Urban Reform (Instituto Nacional de Vivienda de Interés Social y Reforma Urbana) |
| Invías* | National Roads Institute (Instituto Nacional de Vías) |
| IPCC | Intergovernmental Panel on Climate Change |
| IRG* | International Resources Group (Grupo Internacional Recursos del Sur) |
| La Red* | Network for Social Studies on Disaster Prevention in Latin America (Red de Estudios Sociales en Prevención de Desastres en América Latina) |
| MADR* | Ministry of Agriculture and Rural Development (Ministerio de Agricultura y Desarrollo Rural) |
| MADS* | Ministry of Environment and Sustainable Development (prior to 2011 Ministry of Environment, Housing, and Territorial Development) (Ministerio de Ambiente y Desarrollo Sostenible) |
| MAVDT* | Ministry of Environment, Housing, and Territorial Development (Ministerio de Ambiente, Vivienda y Desarrollo Territorial) |

| | |
|-------------------|---|
| MDN – FAC* | Ministry of National Defense - Colombian Air Force (Ministerio de Defensa Nacional - Fuerza Aérea Colombiana) |
| MECI* | Internal Control Standard Model (Modelo Estándar de Control Interno) |
| MEN* | Ministry of National Education (Ministerio de Educación Nacional) |
| MHCP* | Ministry of Finance and Public Credit (Ministerio de Hacienda y Crédito Público) |
| MI* | Ministry of Interior (Ministerio del Interior) |
| MINTIC* | Ministry of Information Technology and Communication (Ministerio de Tecnologías de la Información y las Comunicaciones) |
| MME* | Ministry of Mines and Energy (Ministerio de Minas y Energía) |
| MSPS* | Ministry of Health and Social Protection (before 2011 Ministry of Social Protection) (Ministerio de Salud y Protección Social) |
| MT* | Ministry of Transportation (Ministerio de Transporte) |
| MVCT* | Ministry of Housing, City and Territory (before 2011 Ministry of Environment, Housing, and Territorial Development) (Ministerio de Vivienda, Ciudad y Territorio) |
| NOAA | National Oceanic and Atmospheric Administration |
| OSSO | Southwest Seismological Observatory |
| PD* | Development Plan (Plan de Desarrollo) |
| PDA* | Departmental Water Plan (Plan Departamental de Agua) |
| PEAPAD* | Andean Strategic Plan for Disaster Prevention and Response (Plan Estratégico Andino para la Prevención y Atención de Desastres) |
| PEI* | Institutional Education Projects (Proyectos Educativos Institucionales) |
| PGAR* | Regional Environmental Management Plan (Plan de Gestión Ambiental Regional) |
| PGN* | General Budget of the Nation (Presupuesto General de la Nación) |
| PLEC* | Local Emergency and Contingency Plan (Plan Local de Emergencias y Contingencias) |
| PNACC* | National Climate Change Adaptation Plan (Plan Nacional de Adaptación al Cambio Climático) |
| PND | National Development Plan (Plan Nacional de Desarrollo) |
| PNPAD* | National Plan for Disaster Prevention and Response (Plan Nacional para la Prevención y Atención de Desastres) |
| POMCA* | Watershed Conservation and Management Plan (Plan de Ordenamiento y Manejo de Cuencas) |
| POT* | Land Use Plan (Plan de Ordenamiento Territorial) |
| PRAE* | School Environmental Projects (Proyectos Ambientales Escolares) |
| PREDECAN* | Support Project for Disaster Prevention in the Andean Community (Proyecto Apoyo a la Prevención de Desastres en la Comunidad Andina) |
| PRICC* | Regional Comprehensive Plan on Climate Change (Plan Regional Integral de Cambio Climático) |

| | |
|--------------------|---|
| PTAR* | Wastewater Treatment Plant (Planta de Tratamiento de Agua Residual) |
| PTGR* | Territorial Risk Management Plan (Plan Territorial de Gestión del Riesgo) |
| RAS* | Technical Regulation for Drinking Water and Basic Sanitation (Reglamento Técnico para el Sector de Agua Potable y Saneamiento Básico) |
| REDD* | Reducing Emissions from Deforestation and Degradation (Reducción de Emisiones de Deforestación y Degradación) |
| Ricclisa* | Interinstitutional Network on Climate Change and Food Safety (Red Interinstitucional de Cambio Climático y Seguridad Alimentaria) |
| SAC* | Agricultural Society of Colombia (Sociedad de Agricultores de Colombia) |
| SDAS* | Sustainable Environment Development Subdirectorates of the National Planning Department (Subdirección de Desarrollo Ambiental Sostenible del Departamento Nacional de Planeación) |
| SDHT* | Habitat District Secretariat of the Bogota City Hall (Secretaría Distrital de Hábitat de la Alcaldía Mayor de Bogotá) |
| SDPAE* | District System for Disaster Prevention and Response of Bogota (Sistema Distrital para la Prevención y Atención de Desastres de Bogotá) |
| Sena* | National Apprenticeship Service (Servicio Nacional de Aprendizaje) |
| Senplandes* | National Secretariat for Development Planning (Secretaría Nacional para la Planificación del Desarrollo) |
| SGC* | Colombian Geological Survey (before 2011 Colombian Institute of Geology and Mining) (Servicio Geológico Colombiano) |
| SGP* | General Participation System (Sistema General de Participaciones) |
| SICIED* | Interactive Consulting System of Education Infrastructure (Sistema Interactivo de Consulta de Infraestructura Educativa) |
| Sigob* | Management and Monitoring System of Government Goals (Sistema de Gestión y Seguimiento de Metas del Gobierno) |
| SIGOT* | Geographic Information System for Planning and Land Use Planning (Sistema de información geográfica para la planeación y el ordenamiento territorial) |
| SIGPAD* | Geo-referenced Information System for Disaster Prevention and Response (Sistema de Información Georeferenciado para la Prevención y Atención de Desastre) |
| SIIF* | Comprehensive Financial Information System (Sistema Integrado de Información Financiera) |
| SINA* | National Environmental System (Sistema Nacional Ambiental) |
| SNB* | National Fire Department System (Sistema Nacional de Bomberos) |
| SNC* | National System of Climate Change (Sistema Nacional de Cambio Climático) |
| SNCyT* | National Science and Technology System (Sistema Nacional de Ciencia y Tecnología) |
| SNPAD* | National System for Disaster Prevention and Response (Sistema Nacional para la Prevención y Atención de Desastres) |

| | |
|---------------|--|
| UAEAC* | Special Administrative Unit of Civil Aeronautics (Unidad Administrativa Especial de Aeronáutica Civil) |
| UBN | Unsatisfied Basic Needs |
| UN | United Nations |
| UNDP | United Nations Development Program |
| UNESCO | United Nations Education, Science, and Culture Organization |
| UNGRD* | National Unit for Disaster Risk Management (before 2011 Risk Management Directorate) (Unidad Nacional para la Gestión del Riesgo de Desastres) |
| UNICEF | United Nations Children's Fund |
| UNISDR | United Nations International Strategy for Disaster Reduction (Estrategia Internacional para la Reducción de Desastres) |
| UPME* | Mining and Energy Planning Unit (Unidad de Planeación Minero-Energética) |
| USAID | United States Agency for International Development |
| VIS* | Social Housing (Vivienda de interés social) |

*for its acronym in Spanish



GFDRR

Global Facility for Disaster Reduction and Recovery

Global Facility for Disaster Reduction and Recovery

1818 H Street, NW
Washington, DC 20433, USA

Telephone: 202-458-0268
E-mail: GFDRR@worldbank.org
Facsimile: 202-522-3227



AUSTRALIA



BANGLADESH



BELGIUM



BRAZIL



CANADA



CHINA



COLOMBIA



DENMARK



EGYPT



FINLAND



FRANCE



GERMANY



HAITI



INDIA



INDONESIA



IRELAND



ITALY



JAPAN



LUXEMBOURG



MALAWI



MALAYSIA



MEXICO



THE NETHERLANDS



NEW ZEALAND



NIGERIA



NORWAY



PORTUGAL



SAUDI ARABIA



SENEGAL



SOUTH AFRICA



SOUTH KOREA



SPAIN



SWEDEN



SWITZERLAND



TURKEY



UNITED KINGDOM



UNITED STATES



VIETNAM



YEMEN



THE WORLD BANK

Special thanks and appreciation are extended to the partners who support GFDRR's work to protect livelihood and improve lives: ACP Secretariat, Arab Academy for Science, Technology and Maritime Transport, Australia, Bangladesh, Belgium, Brazil, Canada, China, Colombia, Denmark, Egypt, European Commission, Finland, France, Germany, Haiti, India, Indonesia, International Federation of Red Cross and Red Crescent Societies, Ireland, Islamic Development Bank, Italy, Japan, Luxembourg, Malawi, Malaysia, Mexico, the Netherlands, New Zealand, Nigeria, Norway, Portugal, Saudi Arabia, Senegal, South Africa, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, United Nations Development Programme, United States, UN International Strategy for Disaster Reduction, Vietnam, the World Bank, and Yemen.