

STRENGTHENING LIVELIHOOD CAPACITIES TO DISASTER RISK REDUCTION IN NEPAL



Compilation of Change Studies

PRACTICAL ACTION
Technology challenging poverty



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FOREWORD

Practical Action with its local partners - SAHAMATI and MADE Nepal implemented Livelihood Centred Approaches to Disaster Risk Reduction Project in Chitwan and Nawalparasi Districts of Nepal as a part of Practical Action's international project. The project was funded by UKaid from the Department for International Development.

The project has two main components:-

- Community level activities which reduce the impact of particular hazards by increasing livelihood opportunities, increasing resilience, reducing vulnerability, while fostering preparedness to deal with the hazard and its aftermath.
- Advocacy and capacity building to link community based experiences with district and national level institutions. Community based experiences and best practices are documented and used to demonstrate the validity of the livelihoods approach to disaster management to government institutions.

The project aims to influence development and disaster preparedness and mitigation processes to adopt a livelihood centred approach to disaster management.

This book documents the lessons learned during the project implementation in Nepal. It describes the prevailing physical, institutional and socio economic context, and details the activities and its interventions. This book is a compilation of initiatives and their evaluated outcomes on improved and diversified livelihood strategies,

including the adoption of new income earning opportunities which has increased incomes and food security, and improved health and resilience of targeted communities while reducing their exposure to prevailing and future hazards. The project has changed the concept particularly on community based approaches to disaster risk reduction.

The collaboration and support between the existing community and local government has resulted in the mainstreaming of disaster risk reduction into poverty reduction in Chitwan and Nawalparasi Districts. National level policy makers have been approached to replicate the process in other vulnerable districts of Nepal.

The achievements described in this publication are a tribute to the hard work and dedication of the communities and local government officials supported by Practical Action staff and the members of MADE and SAHAMATI. Hopefully the information and messages included in this publication will inspire readers to adopt a livelihood centred approach to disaster management.

Lastly, I would like to acknowledge the support of our partners Bishnu Silwal, President, MADE Nepal and Karuna Sagar Subedi, Chairperson, SAHAMATI.

Achyut Luitel
Country Director
Practical Action

WHY WORK IN DISASTER REDUCTION?

Nepal faces unprecedented disaster risks. People are being exposed to more frequent and severe hazards. They are becoming more vulnerable to the impact of natural physical phenomena and less able to cope. While hazards may be increasing in frequency and severity, their impacts are exacerbated by a series of dynamic processes including population growth, increasing poverty and marginalisation, environmental degradation, poor planning and preparedness, and the impacts of climate change.

Disasters damage natural and physical resources, on which people's livelihoods depend. While different hazards have specific effects, ultimate impact of each hazard on resource poor people is most frequently to damage, disrupt or destroy their livelihoods. Small farmers, artisans and fishermen are affected both through the loss of assets and the loss of employment opportunities. Prevailing poverty, characterised by low levels of awareness, limited resources, including access to skills and knowledge, limit livelihood options. These constraints limit opportunities to build resilience. Vulnerability of the poor is predicted to increase in future under pressure from increasing human population, environmental degradation, unsustainable socio economic practices and the adverse impacts of climate change. Currently two-thirds of disasters are

estimated to be meteorologically induced. Climate change is likely to increase the frequency and severity of such disasters.

Disaster management has in the past focused on the aftermath of sudden onset large scale events such as earthquakes, volcanic eruptions, floods or tsunamis. Yet more deaths, accumulated losses and greater suffering is caused by slow onset and creeping hazards such as drought, disease, invasive species and the degradation of natural resources. The cumulative effect of a succession of several small adverse events can devastate the lives and livelihoods of poor people; frequently driving them from subsistence to a state of total destitution.

Disasters affect poor countries and the poor most even caused by the small scale hazards. According to UNDP, 24 out of 49 least developed countries face high levels of disaster risks. Nepal is no exception. Not only are the people of poor countries worst affected by disasters, they also lack the capacity to deal with the consequences after a disastrous event. Lack of capacity to deal with the aftermath of a major disaster, developing countries has to await the arrival of external humanitarian aid. This exacerbates the situation

which is often characterised by food shortages, civil unrest and furthermore creates dependency. Despite irrefutable evidence that mitigation activities can reduce the negative impacts of disasters, developing countries are reluctant to spend money to limit the impacts of an event that might only occur at some time in the future, if ever.

Linking disaster risk reduction approaches to development can overcome this dichotomy. Disaster risk reduction and development cannot be separated. Disasters put development at risk and development without considering future disaster risks can aggravate disaster risks. Hazards turn into disasters where there is a low level of physical and social development. For example floods may happen because of the absence of necessary flood management or counter disaster infrastructure such as embankments and drainage channels. In some cases poorly planned development of infrastructure can itself be the cause of disasters - such as outburst of dams and collapse of mines.

Although external efforts are necessarily driven by the disasters they seek to prevent, local communities should be the major drivers of disaster risk reduction strategies. They are at the forefront and the first to suffer and respond.

Each community should be aware of the hazards they are exposed to, should recognize the potential risks and plan interventions to reduce the risk of hazard impacts turning into disasters. Disaster risk reduction should be an integral part of development processes, to reduce potential losses and ensure that development gains are sustainable at all levels - local, national and regional.

This book is based on Practical Action's work on climate change and disaster risk reduction in Nepal. Experiences on community based disaster management have been documented to illustrate how mainstreaming disaster risk reduction into local and national development planning can be achieved. Communities, planners, practitioners and academic institutions are expected to benefit from this publication. Chapters are based on field experiences to provide practical ideas on disaster management. As this work is of particular relevance to Nepal, application of the methodology may require revision for use in other country contexts.

It is anticipated that this publication will prove a useful reference for training, planning and implementation of community based disaster risk reduction initiatives in other vulnerable poor communities.

ACRONYMS

APF	Armed Police Force
CBDM	Community Based Disaster Management
CBO	Community Based Organisation
CBS	Central Bureau of Statistics
CDO	Chief District Officer
cm	Centimetre
CRA	Community Risk Analysis
DADO	District Agriculture Development Office
DCO	Division Cooperative Office
DDC	District Development Committee
DDMC	District Disaster Management Committee
DFID	Department for International Development (of the United Kingdom)
DFO	District Forest Office
DHM	Department of Hydrology and Meteorology
DIO	Division Irrigation Office
DLSO	District Livestock Service Office
DMC	Disaster Management Committee
DRR	Disaster Risk Reduction
DSCO	District Soil Conservation Office
HH	Household
I/NGO	International/Non Government Organisation
IPCC	Intergovernmental Panel on Climate Change
KG or kg	Kilogram
Km or km	Kilometre
LDC	Least Developed Country
LDO	Local Development Officer
LRPs	Local Resource Person(s)
m	metre
MLD	Ministry for Local Development
MoHA	Ministry of Home Affairs
NEA	Nepal Electricity Authority
NPR	Nepali Rupees
NSDRM	National Strategy for Disaster Risk Management
PVA	Participatory Vulnerability Analysis
sq	Square
STW	Shallow Tube Well
UN/ISDR	United Nations/International Strategy for Disaster Reduction
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee



INTRODUCTION

1. Background

Practical Action implemented "Livelihood Centred Approaches to Disaster Risk Reduction" Project in Bangladesh, Nepal, Peru, Sri Lanka and Zimbabwe. In Nepal, the project was implemented in partnership with local non government organisations - SAHAMATI in Nawalparasi and Multidimensional Agriculture and Development Nepal (MADE Nepal) in Chitwan District from January 2007 to December 2010.

The project aimed at building the capacities of communities and political bodies, including Village Development Committees (VDCs) and District Development Committees (DDCs) in particular, to reduce disaster risk while reducing poverty. The resilience of communities have been built through preparedness and prevention; increased coping capacity, effective rescue and relief and appropriate mitigation measures, all of which have contributed to reducing disaster losses and its risks.

Four expected outputs of the project.

1. Testing and establishing successful examples of livelihood centred DRR with communities and stakeholders at local level.
2. Publishing resource materials useful to communities, practitioners and policy makers at local, national, regional and international level, based on the learning from the field.
3. Sharing publications and lessons learned with relevant audiences in order to encourage replication of best practices in other contexts.
4. Influencing policy makers to adopt livelihood centred approaches to DRR which can be mainstreamed into development planning and practice.

2. Communities and Livelihoods

Location

Chitwan and Nawalparasi Districts were selected, based on their extreme vulnerability. In Chitwan, 3 villages in Meghauri VDC and one village in Patihani VDC were selected. Meghauri lies at the confluence of Rapti and Narayani Rivers in the south west of the district. Patihani lies along the bank of Rapti River at almost centre of the district. The communities reside along the river banks, on the flood plains of the inner Tarai.

In Nawalparasi, Baulaha Khola river catchment which covers more than 10 villages in three VDCs - Devchulli, Dibyapuri and Pragatinagar were selected. The watershed includes upper reaches of middle mountains through lower hills to flood plains in the inner Tarai. The communities have varied lifestyles based on the natural resources available to them in their different physiographic zones, but overall their livelihood strategies are similar which is agriculture based.

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Demographics

Livelihood and resilience capacity enhancement activities of the project focused on 536 households (HHs) organised into 23 groups (9 from Chitwan and 14 from Nawalparasi). Activities included the provision of both material and capacity building support.

Many activities such as irrigation schemes, electric fencing, disaster management plans, hazard mitigation activities and skill training, and improved linkages to various service providers, benefited larger populations. The information of the directly benefited communities is presented in Table 1.1 and 1.2.

Table 1.1 Demography of Project beneficiaries in Chitwan

VDC	Village	HH	Population as of 2007			Major castes
			Male	Female	Total	
Meghauri ward 1 and 2	Laukhari	50	154	144	298	Tamang, Kumal and Newar
	Sworgadwari	47	65	62	127	Brahman, Bote, Tharu, Kumal and Dalit
	Kumal Tole	88	248	252	500	Kumal and Tamang
	Meghauri Total	185	467	458	925	
Paithani	Simalgairi	47	118	124	242	Tharu, BK, Tamang, Gurung and Bote
	Chitwan Total	232	585	582	1167	

Migration

Following the eradication of malaria in the 1960s, in response to the government's resettlement programmes, and driven by poverty and disaster losses, people migrated to the Tarai from the middle mountains, settling in Meghauri. Only the Tharus are indigenous in this area. Living on the banks of two big rivers adjacent to the national park, their poverty is exacerbated by their exposure to floods and wildlife intrusion.

Similarly, Simalgairi village in Patihani VDC was occupied by migrants in the 1990s. Their land holdings are extremely small;

before the floods in 2001 and 2003, 87 families shared 26.5 hectares of land. As a result frequent flooding of Rapti River and wild animal intrusion, 43 families were forced to migrate, leaving 47 families behind to occupy the remaining land.

Many of those living in both communities have only de facto rights to the land they occupy. Their livelihoods are built on agriculture and animal husbandry complemented by daily wages, fishing, collection of forest products, all of which are exposed to the prevailing hazards and adversities.

Table 1.2 Demography of Project beneficiaries in Nawalparasi

VDC	Village	HH	Population as of 2007			Major castes
			Male	Female	Total	
Pragatinagar 1 and 7	Bote Tole	45	137	111	248	Bote and Brahman
	Laxmipur	70	166	174	340	Brahmin, Tharu Chhetri and Magar
	Gaidi	175*	538	498	1036	Brahmin, Chhetri and Magar
	Tharu Tole	16	59	57	116	Tharu
	Pragatinagar Total	306	900	840	1740	
Dibyapuri 2, 3 and 9	Keurini	86	261	251	512	Dalit, Brahman, Magar and Bote
	Kadampur	81	218	307	525	Brahman, Chhetri and Magar
	Bandipur	73	224	213	437	Magar
	Mirtung	27	82	81	163	Magar
	Dibyapuri Total	267	785	852	1637	
Devchuli 2	Kirtipur	97	512	461	973	Magar
	Kumsot	33	75	78	153	Magar
	Devchuli Total	130	587	539	1126	
	Nawalparasi Total	703	2272	2231	4503	

Livelihoods

In Nawalparasi, agriculture, which includes a combination of subsistence farming of cereal, oil seeds and livestock rearing, is the main source of living. Members of many HHs engage in agricultural labour to earn daily wages. Some families grow crops on someone else's land sharing the produce with the landowner. Few families rear livestock, particularly goats and buffalos, on a similar shared basis; young stock belonging to wealthier owners are reared by poor families. When sold, the proceeds are shared between the owner and the grower. Some families loan their land as collateral for cash until they pay off their debts. In such cases the money lender cultivates crops in place of interest on his/her loan.

Fishing, collection of thatch and non timber forest products from the forests are other

alternative source of income. Members of alternative source of income. Members of few families have migrated abroad to earn extra money for their families. Magar communities in the upstream of Baulaha Khola brew liquor to sell in the markets downstream as an additional source of income. The downstream Bote communities in Pragatinagar sieve sand and gravel in the Baulaha Khola ford to sell.

Land, forests and water are the natural resources available at different scales of accessibility and quality to communities in these areas. Almost all communities have access to forests nearby for both timber and non timber products. These resources are depleting and no longer sufficient to fulfil the demands of the increasing human population. The availability of resources for particular communities is discussed in subsequent chapters.

* initial plan was to target 13 HH (40+37 population)

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Stakeholders

While the project focuses on communities, interactions with other stakeholders such as local government institutions (VDCs and DDCs), youth clubs, buffer zone user communities and different sector related government agencies such as agriculture, forest, livestock and cooperative offices at VDC and district level were also important. Upcoming chapters will explain the interactions and collaborations between the project and other stakeholders.

3. Hazards and Vulnerabilities

Information on hazards, stresses and factors that affect vulnerability were collated through feasibility studies, Participatory Vulnerability Analyses (PVA) and stakeholder consultations at village, VDC and district level. This information formed the basis for prioritising possible interventions.

Flood, landslide, drought, wildlife intrusion, winter fog, invasive weeds, new pests and diseases in agriculture crops and forests were identified as major hazards affecting livelihood strategies. Many of these hazards may be linked to climate change. Independently their impacts may be slight, but their cumulative effects can negatively impact livelihoods.

Wildlife intrusion is associated with the proximity of the communities to the national park. However, the increase in intrusion despite the decrease in wildlife population is linked to the invasion of

inedible exotic weeds inside the park and community forests. Shortage of edible food, especially during periods of drought, drives wild animals to intrude into community lands, causing casualties to humans, livestock and the intruder itself. Periods of water shortage (droughts) increase the likelihood of fires in both forests and settlements.

Seasonality of stresses

Different hazards impact at different times of the year. Flash floods occur during the monsoon between June and October; dry spells usually occur between November and May. Periods of drought have become more frequent, longer and severe in the past decade.

Rainfall patterns are changing creating water shortages for growing crops even during the monsoon period. Winter fog usually occurs in the mornings during December and January; now it is more frequent, dense and lasts longer (up to a whole day) extending up to the second week of February. New disease and pests attack crops in different seasons; lately winter crops have become prone to virus. Wildlife can intrude at any time of the year, but between November and May, when forage is scarce in the National Park; growing crops in the farmers' fields are more prone to invasion. The proliferation of inedible invasive weeds drives wildlife to alternative sources of food such as the communities' crops.

Sensitivity

Landslides and floods have two effects: eroding or covering agriculture land and damaging crops, most commonly at river banks. In Chitwan whole villages are frequently inundated by flood water. Cutting of land (erosion) is an almost annual event while inundation takes place at 8 to 10 year intervals. Upstream and hill slopes are prone to landslides. Flood and landslides claim physical and natural assets in particular.

Weather patterns are changing, disturbing the usual crop calendar. Winter fog (known as seet lahar) now affects winter crops such as mustard and lentils. Weeds have invaded grasslands in the park and community forests, decreasing the availability of fodder for both wildlife and livestock. Wildlife damages crops, homes and cattle sheds, attacks livestock, sometimes claiming human life. Winter fog, increased wildlife intrusion, obnoxious weeds and shortages of water for irrigation have discouraged farmers in recent years from sowing winter crops. Drought affects agricultural crops and forests in their growth and production. It triggers forest fires particularly between February and April. It is more common for houses and cattle sheds to catch fire during this season.

In the past, people have suffered from significant crop loss up to 75 per cent by a single hazard. Other impacts are loss of land due to cutting and inundation by flood and landslides. More elaborated information on the impacts of these hazards is provided in chapter 2, 3, 6, 7 and 9.

Contributing factors

The geophysical setting, socio economic activities in the catchments, governance and weather patterns all contribute to the vulnerabilities of the communities. Chitwan sites are all downstream at the large water sheds of Narayani and Rapti Rivers where flooding is the result of various factors occurring in upstream of the watershed at remote distances; many of which are unknown to these communities. The causes of flooding are generally similar: improper land use, faulty agricultural practices, deforestation and erratic patterns of rainfall in parts of the watershed. The causes and effects in Baulaha Khola watershed are more visible to the community due its smaller size and the familiarity of both upstream and downstream communities with each others' practices. The following chapters will provide specific information on particular hazards and the sensitivity of communities in different villages.

Impacts

While different hazards have specific effects, the ultimate impacts of each hazard on livelihood outcomes are similar: each reduces livelihood assets, access to the remaining assets, peoples' capacities and their rights by degrading their ability either gradually or abruptly. Indigenous knowledge and coping mechanisms are no longer sufficient for dealing with the cumulative effects of multiple hazards. Prevailing poverty and low level of awareness, limited skills and few alternative livelihood options are major constraints to gaining resilience capacity.

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Vulnerability to these hazards is exacerbated by increased human population, unsustainable agricultural practices in the river catchments, changed vegetation composition (inside the park), limited options for livelihoods, slow development processes and the adverse impacts of climate change. Communities are aware of events that appear suddenly, are physically visible and cause rapid damage. Precautionary actions against slow onset and creeping hazards such as drought, invasive species and the loss of habitat for wildlife are less common, although losses from these hazards are often considerably higher than from sudden onset hazards.

Frequent stresses combined with various aspects of poverty and helplessness has trapped the majority of these communities, particularly those in lower socio economic groups and weaker sects within the society, into a viscous circle of poverty and vulnerability.

All the targeted communities are exposed to a range of hazards. Despite the similarity of their livelihood strategies, the affects of these hazards is context specific, each having impacts specific to the exposure and vulnerability of that locale. It is therefore necessary to adopt a holistic and integrated approach that links different sectors and stakeholders in addressing both development and DRR priorities together.

4. Project Strategies

The project devised and adopted community based strategies to reduce stresses and impacts of different hazards on existing livelihoods. These strategies included structural measures, such as:

- Erecting electric wire fence around villages to prevent wildlife intrusion
- Improving access to existing water resources by:
 - building shallow tube wells (STW) and water collection ponds
 - improving irrigation channels
 - improving spillways
 - strengthening embankments along the river

They also include non structural measures such as:

- Improving knowledge and skills on livestock husbandry
- Improving breeds of livestock
- Improving farming skills in agriculture
- Introducing on and off farm income generating options such as:
 - vegetable growing
 - bee keeping
 - house wiring training
 - candle manufacturing

Both strategies included short and long term activities in conjunction with external bodies such as service providers and government institutions, including DMCs, community groups, and cooperatives. The establishment of inter linkages between communities and external agencies contributes to the sustainability of project interventions. Local skill developments were supported by training, exposure visits and linkages to external supports.

DRR initiatives were introduced through:

- flood warning mechanisms,
- formation of disaster management committees (DMCs)
- encouragement of emergency funds within local governments
- preparedness for seasonal hazards
- promotion of watershed conservation

Implementation modality

Local communities, their organisations and governments have taken a leading role in the identification, prioritisation and implementation of initiatives, with specific expert agencies providing support in their field of expertise. For example:

- community identified STW boring sites and the users to each tube well

- project provided financial support to purchase pipes and pumping machines, and technical support to bore STWs
- benefiting HHs contributed unskilled labour
- VDC recommended to provide access to electricity to the Nepal Electricity Authority (NEA)
- NEA provided tariff subsidised electricity to the communities

Management of STWs is undertaken by the user groups who decide on the levy considering electricity tariff, maintenance and replacement cost of the pumping machines. The multilateral benefits of better access to water resources include timely seeding and transplantation, opportunity for additional crop, reduced cost of irrigation for those who used to rent pump and buy diesel, increased choice of crops and social harmony.

Similarly, the national park provided resources (including funding) and permissions to erect electric fencing around the villages to prevent wildlife intrusion. Forest User Groups provided timber for poles, and the project provided financial support to purchase wire and materials that were not locally available. The community raised funds by collecting levies from each

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benefiting family and contributed labour to supplement the external supports.

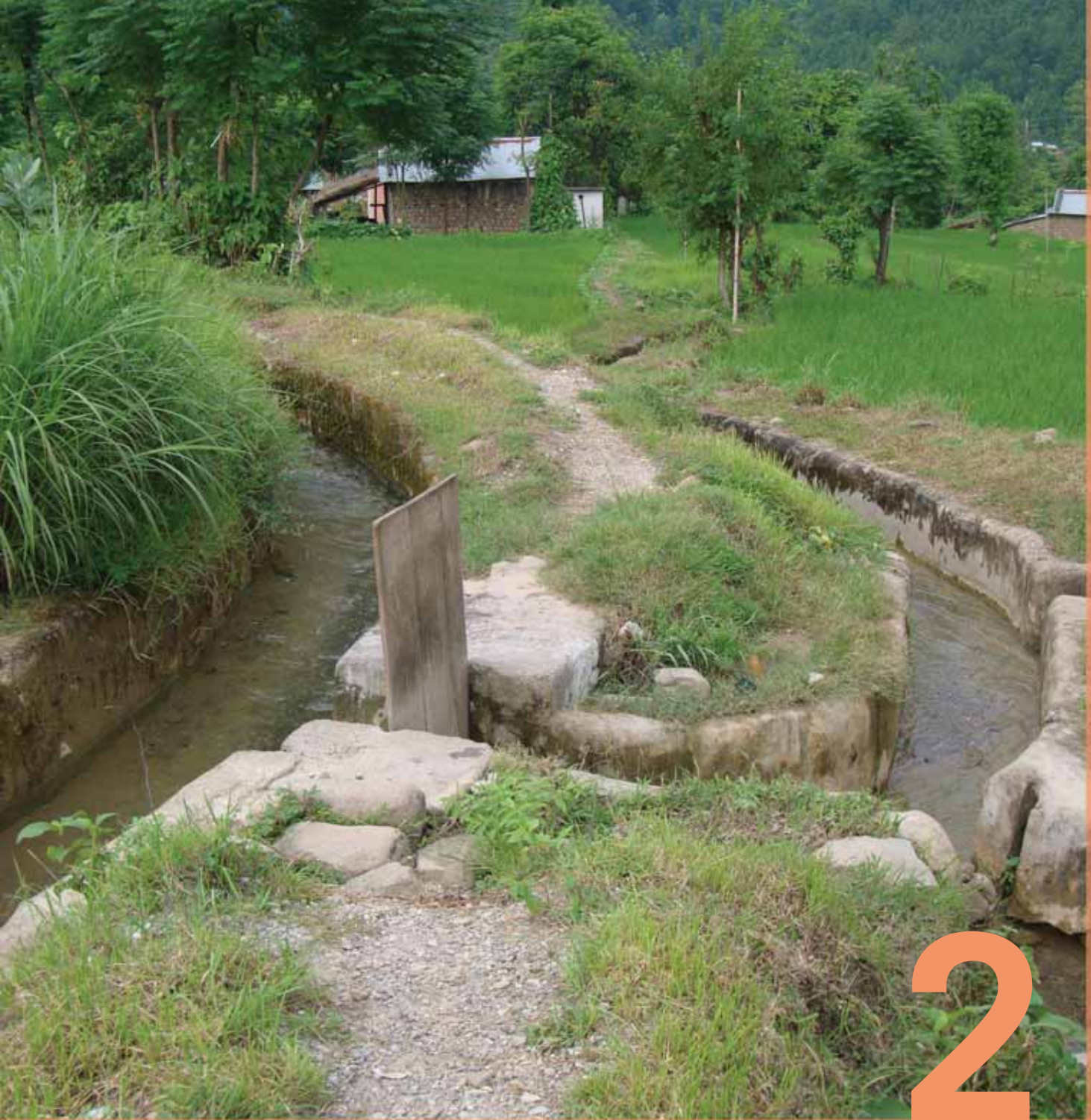
The overall environment was enabled by the respective VDCs and buffer zone council creating the environment of trust amongst stakeholders. As a result, intrusion of wild animals into the community territory was prevented, saving up to 75 per cent of crops that were initially lost. The process also provided an opportunity to raise awareness amongst villagers on DRR and earn their support for biodiversity conservation.

Skill enhancement has been achieved through practical work in the field supplemented with training. Awareness has been raised through training, meetings, and workshops, exposure visits for communities within and outside project areas. Policy makers and practitioners visited project sites and observed good practices. It helped to upscale the activities at district and national level. Project initiatives and outcomes have been shared with national and international audience through different publications, media, meetings and dialogues.

5. Organisation of this Document

This publication brings together different practices of the project. These examples together stand as replicable examples on

DRR and building resilient capacities of communities as well as poverty reduction. Chapter 1 provides a brief overview of the project and targeted communities. Chapter 2 gives an account of water resource management in the context of water scarcity. Chapter 3 discusses how incidents of wildlife intrusion were reduced through multi stakeholder efforts at various locations, often geographically far apart. Similarly, Chapter 4 describes increase in income and livelihood by improving and developing skills on vegetable farming. Chapter 5 is about bee keeping which has a remote objective of reducing environmental degradation. Chapter 6 discusses initiatives that focus on livestock rearing and its contribution to community resilience. Chapter 7 is about improving traditional practices by accessing appropriate technology. Chapter 8 links DRR to development planning at VDC and district level. Chapter 9 introduces off farm income and employment activities that are less sensitive to hazards. Chapter 10 discusses the structural and biological measures on strengthening natural protection system such as conservation of watersheds. Chapter 11 describes institutional development and linkages to wider social and organisational networks contributing to social capital for the communities to continue their initiatives. Finally, Chapter 12 summarises the projects' lessons highlights on the issues and provides conclusions.



2

IRRIGATION FACILITIES REDUCE SENSITIVITY TO DROUGHT

IRRIGATION FACILITIES REDUCE SENSITIVITY TO DROUGHT

Small scale irrigation schemes and the improvement of existing water supply channels improved access to water for marginal farmers, making them less sensitive to droughts. This allowed the timely sowing of seeds and the transplantation of crops that were previously affected by extended dry periods and erratic patterns of rainfall. It further provided opportunities for the cultivation of additional crops such as maize and vegetables, particularly during the winter and spring when rainfall is scarce.

1. Background

The project selected poor HHs living in hazard prone areas, facing multiple stresses highlighted in Chapter 1. Community level assessments identified drought as a common recurring hazard for poor farmers. Marginal farmers, who own less than one third of a hectare of land, are most sensitive as they cannot afford artificial irrigation; it further reduces the productivity of their land and opportunities to earn income through agricultural labour.

Drought is regarded as the period when water is not available for irrigation. This includes protracted periods between rainfalls during the rainy season, since this puts existing crops under stress. The scale of water deficiency stress depends on the sensitivity of the crops and varies for different seasons.

Agricultural practices in Nepal are heavily relied on rain and streams for irrigation. Rainfall patterns have changed, possibly due to climate change. While 80 per cent of precipitation is typically received between June and August; the rainy season now extends to September. Rivers and streams that are relied upon are seasonal: surface

water flow occurs only during the rainy season. This seasonality in water supply forces farmers to grow what they can during the summer, resulting in only one crop a year. Aquifers exist in the Tarai region but obtaining the required machinery to reach this groundwater resource is expensive. This chapter outlines the irrigation activities that have helped farmers in different villages to increase crop production despite increasing frequency of drought and erratic patterns of rainfall.

2. The Problem

Farmers are affected by water deficiency during the dry season between November and May, when surface water sources run low. In the plains, good reserves of water can be found in underground aquifers at different depths fed by perennial rivers and recharged during the rainy season. In order to access this resource tube wells need to be installed, but the extreme poverty of local communities limits their ability to afford the necessary infrastructure.

For people in the foot hills and upper reaches of many rivers, water supply from springs barely meets HH demand. Water in the streams dwindles after November and

IRRIGATION FACILITIES REDUCE SENSITIVITY TO DROUGHT

completely dries up by January. In many cases stream beds fill up with debris brought down by floods and landslides, and the limited water that does flow percolates into the ground becoming unavailable at the irrigation channel intake. In particular the villages of Kadampur, Gaidi, Kirtipur, Kumsot and Bandipur in Nawalparasi District found it difficult to access water for irrigation.

Water shortages cause many land parcels to be left fallow for more than six months each year resulting in loss of production and less food. People were forced to adopt different strategies in order to fulfil food requirements and HH expenses, such as preparing alcohol, sieving sand and gravel, collection of fire wood from the nearby forests, fishing in rivers, daily wage work, and seasonal and longer term migration for work (even abroad). Some of these practices are illegal and many of them have adverse impacts on the environment, effectively increasing the future vulnerability of the communities.

Many poor farmers who cannot afford to install tube wells on their own land have to use well owned by rich neighbours. Farmers in Meghauli VDC were paying NPR 300 - 400 (€ \$3.15 to 4.15) per hour for water used from privately owned wells. Despite paying the fee access to private wells was at the mercy of the well owner. Access to water often did not coincide with the availability of labour and bullocks to work on the land, raising the cost of growing crops. Small farmers were effectively reliant on rainwater for cultivating their lands. Individual investments in STWs were not cost effective for farmers with small parcels of land. These communities lacked the skills and ideas

needed both to organise themselves for group enterprises and to access available appropriate technologies and knowledge.

3. Strategies and initiatives

The strategies for project intervention were to:

- improve access to avail water resources
- improve watershed where feasible
- improve farmers' skills to utilise the available water for best results

Issues of drought and its impacts together with possible solutions based on the availability of resources were discussed with community groups. The communities chose different solutions according to their socio economic and physiographic contexts. Three options emerged: STWs, improvement and management of existing wetlands and the repairing or rehabilitation of existing irrigation channels. As solutions had to be adaptive and appropriate to different contexts, group based small scale irrigation schemes were chosen. The project provided support for materials that were not locally available and technical guidance during construction.

Community participation throughout the project helped to achieve a greater output than expected and some communities led the overall process. Communities organised into groups took the lead with assistance from the project and other stakeholders. In some cases, the VDC and other stakeholders supported the community financially to accomplish the chosen schemes.

IRRIGATION FACILITIES REDUCE SENSITIVITY TO DROUGHT

In the plains, inputs included improvement of natural lakes and dug wells, installation of STWs and the linkage of wells to fields through irrigation channels or delivery pipes. These schemes were implemented in Megghauli, Patihani in Chitwan and, Bote Tol and Keureni downstream of Baulaha Khola in Nawalparasi. In Kirtipur village, a waterfall up in the hill slope has been

connected to the irrigation channel intake through high density polythene (HDP) pipe (see box 2.2 for detail). Villages such as Kumsot and Bandipur did not have any source of water that could be channelled appropriately and rain harvesting ponds were not found feasible considering the geology and steepness of the hill slopes.

Table 2.1 Irrigation schemes supported by the project

SN	Irrigation scheme	Location	Coverage	Beneficiaries HHs
1	12 STWs and water pump	Megghauli - 1 and 2	61.1 ha	163 HHs
2	1 STW	Pragatinagar - 1, Bote tol	2 ha	44 HHs
3	Electric motor to dig well	Divyapuri -1, Keureni	8 ha	33 HHs
4	2 STW	Patihani - 8, Simalgairi	13 ha	47 HHs
5	1 lake and irrigation channel improved			
6	1 irrigation channel	Pragatinagar - 7, Gaidi	113 ha	160 HHs
7	1 irrigation channel	Divyapuri - 7 & 8 Kadampur	178 ha	267 HHs
8	1 irrigation channel	Devchuli - 3, Kirtipur	43.3 ha	78 HHs
	Total		418.4 ha	792 HHs

Note: The cost of one STW ranged between NPR 70,000 to 90,000 (€737 to 948) depending upon the depth to dig and thickness of water table. Community contributed unskilled labour and locally available materials which were around 10 per cent of the total cost.

3.1 Improvement of Shramik Lake, irrigation channel and installation of STWs in Patihani

The community in Patihani had previously tried to channel the water from Shramik Lake to their fields. In the early 1990s they had constructed a mud dam, but it was damaged the following year. They constructed another

dam in the late 1990s which was not durable for the long run. Resources were not available to construct a stronger dam. This meant that only maize was grown during the rainy season, during the winter the land remained fallow. Food production was sustainable only for 2 to 3 months in a year. Almost all HHs adopted share cropping farming in others' land to fulfil their requirements for

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the rest of the year. Other subsidiary strategies included fishing and daily wage labour.

The community insisted the broken dam at Shramik Lake to be reconstructed but its capacity was too small to provide water all year round. In addition to the dam reconstruction, two STWs were installed; each one supplying water to 14 HHs. Both are linked to the irrigation channel that runs from the lake to the farm land. There are two farmers groups in this village which manages the STWs and the lake. The community contributed 10 per cent of the total cost. Other management aspects are presented in section 3.7.

Each STW is capable of pumping sufficient water to irrigate about 1/5th of hectare in an hour. During dry periods, each STW provides sufficient water for member families to grow vegetables and less water demanding crops like wheat, rape mustard and beans. During the rainy season the flagship crop - rice is grown by all the HHs.

3.2 STWs in Meghauli

One hundred and sixty three beneficiary HHs in the Meghauli site required water for irrigation. Families who lived close to private tube wells were paying high fees to use the water and usually had to wait longer to use it. The HHs were organised into 7 different groups. The project provided 13 STWs equipped with electric motor pumps. Group members provided the land to install these tube wells. The community contributed labour and local materials for shading

purpose. Each group was involved in the purchase of machines and pipes for the tube wells to maintain transparency in the investment and to provide exposure to the markets for future management.

3.3 STW for Bote community in Pragatinagar

Forty four HHs comprising of 40 Bote families settled in bank of Baulaha Khola near its confluence to Narayani River in Pragatinagar in 1961. While they are indigenous to this area, they lack legal ownership to the land. Their houses and very small parcels of land (about 1/5th of a hectare for each family) lie in upper terraces while their arable land lies on the lower flood plains. The lower land faces flood damage annually while the upper terraces lack water during the dry winter months. The project supported the provision of one STW for the upper terraces.

3.4 Dug well connected to irrigation in Keurini

A village of 33 HHs in Keruni consists of socially excluded castes. The project improved the hand dug well and provided an electric motor to pump water which is channelled to the farm land. A hut (made of straw and bamboo) was constructed to house the machine and accessories.

3.5 Irrigation channel improvement for Kadampur and Gaidi

Kadampur and Gaidi villages are in the eastern and western flood plains of Baulaha Khola. The population is dominated by mixed sects of migrant people from the

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middle hills in different districts. These two communities have separate irrigation channels with intakes at considerable distance from the fields. During the rainy season the river feeds the channels, although flood damages the intake frequently and often needs repairing. By the end of November, main flow of Baulaha khola dries up. Little water that is left flows underground and very little emerges on the surface. Furthermore, the water that does flow into the canal is soon depleted due to seepage through the unlined floor of the canal. People in Kadampur constructed a pond to

collect water during dry periods but the little water available at the intake of the irrigation channel did not reach the pond.

The project supported both communities to improve their irrigation channels, providing funds to purchase cement and technical advice from civil works technicians. Communities collected locally available sand, gravel, stones and other materials and contributed labour intensively. The expenditure and contributions in the improvement of the irrigation channels is presented in table 2.2 and 2.3.



Communities installing shallow tube well in Bote tol, Pragatinagar, Nawalparasi

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Table 2.2 Irrigation channel improvement in Kadampur (Currency in NPR)

SN	Description of activities	Community (cash and kind)	VDC	Others ²	Project	Total
Kadampur irrigation channel (depth 20 inch, width 20 inch and 730 meter long)						
1	Cement purchase		45,144.50		1,96,583.00	2,41,727.50
2	Local material collection		3,901.00	30,876.50		34,777.50
3	Skilled labour	94,556.00				94,556.00
4	Unskilled labour	1,95,000.00				1,95,000.00
	Total	2,89,556.00	49,045.50	30,876.50	1,96,583.00	5,66,061.00

Table 2.3 Irrigation channel improvement in Gaidi

SN	Description of activities	Community (cash and kind)	VDC	Others ³	Project	Total
Gaidi irrigation channel (depth 15 inch, width 20 inch and 1350 meter long)						
1	Cement purchase	2,63,099.00	30,000.00	1,86,566.00	1,40,000.00	6,19,665.00
2	Local material collection	3,65,491.00				3,65,491.00
3	Skilled labour	77,625.00				77,625.00
4	Unskilled labour	1,02,544.00				1,02,544.00
	Total	8,08,759.00	30,000.00	1,86,566.00	1,40,000.00	11,65,325.00

² & ³ DDC, CFUG and CBOs

3.6 Irrigation channel of Kirtipur

The Magar community has been living for generations in the laps of Devchuli hills. The village consists of three main settlements. They have two types of land - one terraced having a seasonal irrigation facility and the other on the hill slopes, non-terraced where slash and burn agriculture is practiced. The latter cannot be irrigated. The terraced lands also lacked

water for irrigation between November and mid June because the source stream dries at the intake of the irrigation channel. The small flow of water from the hills percolates down into the debris below the level of the intake. In 2008, the project provided partial cost for 730 metres long HDPE pipe to link the irrigation channel with a perennial source of water available higher up the hill. The community provided locally available materials such as sand and gravel, dug the

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channel in which to lay the pipe, built structures to support the pipe where it crossed gullies and streams as well as transported all materials (a 10 km hike uphill from the road). This provided water for domestic use and the timely establishment of a paddy nursery in June.

In 2009, the community improved the 320 metre long irrigation channel, lining it with

cement to prevent leakage. The project provided partial financial support to purchase cement, materials and skilled labour that was not available in the community. The community contributed both cash and labour. Baulaha Khola Samiti, a local NGO provided NPR 20,000 (€211) generated from selling sand and gravel downstream. Total cost of the whole scheme is given in the table below:

Table 2.4 Kirtipur irrigation scheme improvement (currency in NPR)

SN	Description of activities	Community	Project	Others ⁴	Total
A	Pipe linked to irrigation channel (720 meter)				
1	Cement purchase	64,585.00			64,585.00
2	Pipe	94,985.00	3,90,000.00		4,84,985.00
3	Skilled labour	22,320.00	40,000.00		62,320.00
4	Unskilled labour	4,28,301.00			4,28,301.00
5	Local material	69,350.00			69,350.00
6	Cable wire, rod	1,17,521.00			1,17,521.00
	Total	7,97,062.00	4,30,000.00		12,27,062.00
B	Channel improvement (depth 14 inch, width 24 inch and 330 meter long)				
1	Cement purchase	52,925.00	100,000.00	20,000.00	1,72,925.00
2	Local material collection	78,964.00			78,964.00
3	Skilled labour	38,699.00			38,699.00
4	Unskilled labour	444,000.00			4,44,000.00
	Total	614,588.00	100,000.00	20,000.00	7,34,588.00

3.7 Management of irrigation schemes

Each irrigation scheme has a management committee selected from the users. Groups have formulated rules and procedures to use water resources, repair and maintain the scheme with provision of fund.

The project facilitated the registration of Kadampur, Gaidi and Kirtipur irrigation channels with the Division Irrigation Office (DIO) at district headquarters. Creating formal linkages with the government agency ensures future assistance. Other groups who own STWs have been formally linked to the

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District Agriculture Development Office (DADO) which provides opportunities for future support.

4. Outputs and Outcomes

These schemes have improved the access to water resources for several communities in the project sites assisting communities in:

- timely sowing of seeds in nurseries such as rice
- transplantation of seedlings
- vegetables production during winter which was not possible before
- reduced sensitivity to erratic rainfall
- decreased cost of irrigation particularly for farmers in Meghauli

These initiatives have helped communities to cope with often small scale but frequent stresses of drought and erratic patterns of rainfall. The overall impact has been to improve food security, reduce drudgery and increase the income available for HH needs. Many HHs are now food secure, while some are even generating a surplus.

The improved asset base has increased community resilience. Many people have moved from being daily wage labourers to self employed farmers. Some see themselves as entrepreneurs. For example, people in Keureni, Nawalparasi no longer need to sieve sand and gravel and in Meghauli and Patihani the drudgery of share cropping has decreased. There are new opportunities to diversify crops and patterns of production.

Increased income has improved the living standards and well being of the targeted communities. Some families have transferred their children to better schools and are able to afford clothes and learning materials. Farmers have toughened up their houses using durable materials to withstand flood. Increased capacities and the ability to afford further investment have encouraged farmers in Meghauli to install their own small capacity water pumps in order to intensify their cropping. The VDC has developed a community based disaster management plan that includes supporting the installation of STWs in drought prone areas.

Through these irrigation schemes, a total of 792 HHs have benefited from improved access to water and 418.4 ha of land are now being irrigated. Combined with improved cropping pattern the agriculture production has increased drastically (see Chapter 7).

The project has also facilitated the linking of groups to government agencies (Chapter 11). This provides a legal basis for management and has enabled groups to access additional resources from the agriculture and irrigation offices of the government. For example, Gaidi irrigation received NPR 200,000 (€ 2106) from the DDC for further extension (360 m) of the channels and the DDC has committed to provide an additional NPR 500,000 (€ 5264) to further improve the scheme in 2011 (box 11.1). Kadampur group has also received NPR 60,000 (€ 632) from DADO to increase the capacity of their collection pond.



Checking the water flow of shallow tube well after its installation

5. Issues and Lessons

Respective groups are responsible for the operation, maintenance and overall management of each scheme. Operators are employed to run and maintain STW pumps for each functional group. A nominal fee of NPR 20 (€ 0.21) is charged for each unit of electricity consumed. From this, NPR 5 goes to the operator, NPR 3.6 for electricity and the remaining NPR 11.4 goes towards the maintenance fund. This fund can be used as credit and savings among the group members, but is primarily maintained for the repair and replacement of the machine whenever necessary. For irrigation channels, groups collect a charge per annum per hectare of land. The irrigation channels are

registered with the DIO and DDC. Each irrigation channel has its own charter to guide its operation and management. Groups are registered in DADO and have access to support small scale activities such as maintenance.

These provisions are supposed to ensure sustainability after the project. Communities were advised to focus towards their self reliance for managing these schemes. Orientation has been provided to STW operators for simple handling and maintenance of the machines. Similarly, people of Kirtipur have received training to fix the broken pipes. They were also advised on the security of the pipe, prevention of fire damage and conservation of watershed to improve water availability.

6. Potential for Replication

It would be viable to replicate these initiatives elsewhere. Institutional arrangements such as user group, cooperative, agriculture groups and local government bodies depending on the legal provisions and policies would need to be modified depending on the social and legal context. An important issue to consider, especially in the light of possible climate induced changes, is the possible impact of increased uptake of water from a lowering water table. This is currently not an issue as the water table is high, the groundwater being recharged through two major river systems.

7. Conclusion

Better access to resources enhances adaptive capacity to different hazards and stresses and improves resilience. The ability to adapt and reduce exposure to risk depends on the availability of appropriate resources that help to address the adverse situation. Greater efforts are necessary to curb the problem of large scale hazards but small scale hazards can usually be coped with and through community based small scale initiatives. A single solution rarely exists and isolated interventions are not sufficient. Interventions should be integrated with each other to produce synergy for successful outcomes.

Box 2.1: Ram Bahadur escapes drudgery

Ram Bahadur Gorkhali (50) is a resident of Meghauri, Chitwan. He has 0.33 ha of arable land which can support his family of 7 for 6 months only. He works as a labourer for other farmers to supplement his income. He used to produce mustard in winter and maize in summer because he had to wait for the rain before he could plant. Wildlife from the nearby National Park frequently destroyed up to 75 per cent of his crop leaving him destitute.

Things have changed now. Electric fencing has reduced threat from wild animals intrusion and access to irrigation is easier with the installation of STWs.

He joined his neighbours to install a STW with support from the project, learned skills on farming cereals and on growing vegetables. Today, he grows three crops per year rotating paddy-mustard/lentil-maize depending on the season. In addition, his wife manages the kitchen garden to grow vegetables for HH consumption. "We sold surplus vegetables and earned NPR 10,000 (€ 106) last winter (2009)," the wife says. "Production has almost doubled and there is no loss due to wild animals." The Gorkhali family is food secured all year round from their new produce and is supported with the additional income Ram and his son make from working outside. There is less drudgery as they don't need to seek work all year round.

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Box 2.2: Access to resources: gateway to resilience

Kirtipur village lies in the laps of Devchuli hill in Devchuli VDC, Nawalparasi District. Ethnic Magars have lived here for generations. Landslides and flash floods are major hazards during the summer months from June to September. Winter drought is becoming more severe in recent years, extending from November to May sometimes extending to June. Poverty, remoteness and lack of adequate awareness contribute to the community's vulnerability and increasing poverty.

Deusat stream is the main source of water for irrigation, but the accumulation of debris, under which the reduced flow disappears in winter, means that water no longer enters the irrigation channel. Water is, however available all year round further upstream. Lack of resources and technical support limits the community's ability to utilise this resource.

Construction of piped irrigation scheme (Section 3.6 in this chapter) has brought some relief to the community. Tul Bahadur Phweali Magar, one of the treasurers of the irrigation user groups briefly mentioned in the inaugural ceremony that 78 people, 1 from each beneficiary HH, had worked for 70 days to collect and transport necessary materials, dig out trenches and construct anchor blocks, overhead crossings and irrigation channel. These HHs also invested cash though it had taken some time to raise the money. In the second phase, they received some financial support from the downstream community. Naula Singh Gaha (67) is very happy to see water flowing by his house in the month of April. He had

dreamed about as a teenager, every time he looked at the cracked dusty terraces due to lack of irrigation. Naula used to practice shifting cultivation – cutting and burning the hillside slopes to plant his poor yielding crops – in an attempt to fulfil his family's food requirements. Today, Naula's terrace is irrigated, and the training at the farmers' field school (initiated by the project), has helped him grow vegetables.

Villagers have been able to establish paddy seed beds a month earlier compared to the past, as they no longer need to wait for rain. In 2009, farmers were able to plant in time. Maize, a new crop sown in spring on these terraces, resulted in 20 farmers harvesting an additional 96.36 quintal of cereal. In the first winter 35 families earned extra income of about NPR 200,000 (€2106) jointly and consumed fresh vegetables grown in their own land. "The yield of each crop has increased," says Rima Kumari Baral (45) "largely as a result of timely sowing of seeds. Twenty two HHs have initiated vegetable growing on a commercial scale since 2009." In 2010, 32 HHs are growing vegetables to sell.

Chandra Poudel, a local school teacher residing outside the village but has been teaching here for the past 10 years remarked on things look different in this village, "I can see greenery in the winter and people are working in the fields even during the dry spells. This is something I have seen for the first time." The project encouraged the conservation of natural resources. The communities have stopped slash and burn agriculture and grazing practice in the catchments of the stream and are making efforts to control forest fires. Prolonged conservation helps natural systems to cope better with stresses caused by hazards.



ELECTRIC FENCE DECREASES EXPOSURE TO WILD ANIMALS

ELECTRIC FENCE DECREASES EXPOSURE TO WILD ANIMALS

Electric fencing was installed to prevent the intrusion of wild animals from the adjacent National Park into farmland and community territories. This barrier has minimised the risks to life and property from wildlife intrusion and have decreased drudgery of the farmers who earlier had to guard their crops 24 hours throughout crop cycle. This kind of security has encouraged farmers to diversify and cultivate their land to its full potential. The result is increased yields and income. In addition, reduced conflict between humans and wildlife has changed local attitudes; conservation is now viewed positively creating an opportunity for the promotion of nature based tourism (eco-tourism).

Background

Communities living adjacent to the Chitwan National Park were usually disturbed by wildlife intrusion. These include Megghauli and Patihani VDCs in Chitwan and Pragatinagar and Divyapuri VDCs in Nawalparasi. The communities are dependent on the nearby forests for fuel wood, timber, thatch grass for roofing and partition materials, fodder, and to some extent non timber forest products for their livelihoods. This requires people to venture into areas inhabited by wildlife. On the other hand animals intrude into the community habitat to feed on their crops or livestock. Wild animals present a hazard to the community; destroying crops, attacking livestock, causing injury and sometimes even human casualty too. Although rivers act as a natural barrier between the communities and the national park, substantial losses occurred on both sides every year; causing on going conflict between the national park and the people. While locals complained of the damage done by wild animals, the park authorities were of the opinion that the wildlife had also suffered disturbances in their habitats.

The Problem & Traditional Coping Strategies

Prior to the implementation of the project a PVA⁵ was carried out where project staffs found that up to 75 per cent of crops adjacent to the park boundaries were destroyed annually by different wild animal intrusion. Average annual crop losses reported ranged from 40 to 50 per cent for farmers closer to the park border and 25 to 30 per cent for farmers farther from the park border. Tigers and leopards killed livestock. Occasionally, elephants destroyed stored grains, seeds and houses. There have been human injuries in the past although they are not that frequent. As a result, retaliatory actions by the community have harmed wild animals.

Traditionally people scared wild animals by beating drums and lighting torches. They established watch towers known as Machan in the fields and guarded crops 24 hours from the time of sowing till harvest. The threat from wildlife restricted village people from moving around after dark; limiting

⁵ Participatory Vulnerability Analysis

ELECTRIC FENCE DECREASES EXPOSURE TO WILD ANIMALS

working hours. The damage caused by animals had discouraged farmers from intensifying and diversifying crops, livestock breeds and other income generating enterprises such as bee keeping, fishery and vegetables. Many farmers used to left part or all of their land fallow during winter which reduced food security and wellbeing of their families.

Communities who had support from different agencies were able to erect barbed wire fencing and install trenches around the village border. These barriers did not last for long as it was overcome by the animals, leaving the problem unsolved. Consequently, the conflict between national park and people living adjacent to the park

continued as each blamed the other for any loss or disruption.

Inputs and Processes

The national park and other stakeholders, such as the buffer zone committees, have previously explored solutions to reduce this conflict. Experiments introducing low voltage electric fencing in smaller areas had been successful, encouraging both the community and the park to expand this technology throughout the buffer zone. The fence consists of three or four strands of high tensile galvanised aluminium wire connected to an electric fencing unit which delivers a voltage pulse at regular intervals (Box 3.1). These electric shocks do not significantly harm animals, but are sufficient



A traditional machan used for watching wild animals

ELECTRIC FENCE DECREASES EXPOSURE TO WILD ANIMALS

to discourage them from trying to penetrate the barrier. It was decided that this option was viable and would reduce the incidence of intrusion into inhabited areas. The project facilitated the installation of electric fencing to reduce the friction between wildlife and communities.

Financial resources were limited for electric fence installation and if the fencing failed to cover the entire periphery it would have been ineffective. The national park and other conservation agencies partially supported the purchase of transformers that were to be placed at certain distances.

Communities contributed to purchase conductor wire, poles and other materials and provided labour. As the local people were unable to raise the required amount, they requested the project to support 50 per cent. The VDC and other stakeholders supported this request too.

The project provided support for the purchase of electric wire in Megghauli in Chitwan, an electric inverter and battery in Divyapuri and electric wire in Pragatinagar in Nawalparasi. Details of the investments made are shown in table 3.1.

Table 3.1 Total investment for electric fencing in the project VDCs (currency in NPR)

SN	Stakeholders	Support (NPR)	Remarks
Megghauli VDC in Chitwan ⁶			
1	Buffer Zone User Group	3,50,000.00	Cash and kind
2	Megghauli VDC	3,00,000.00	Cash
3	Project	1,30,000.00	Cash for wire
4	Community Forest User Group	30,000.00	Cash and kind
5	Community	1,17,700.00	Cash and labour contribution
Total in Megghauli site		9,27,700.00	10.7 Km distance
Nawalparasi site (Pragatinagar and Divyapuri VDC) ⁷			
1	Chitwan National Park	1,35,000.00	Cash and Kind
2	Project contribution for wire	56,827.00	Cash
3	Community	67,250.00	Labour
4	Project for electricity back up	30,000.00	Cash
5	Community Forest User Groups (CFUG)	1,33,650.00	Timber for poles
Total in Nawalparasi Site		4,22,727.00	4.1 Km distance

⁶ VDC and BZUC jointly took the lead in organising resources and coordinating different stakeholders while the project facilitated the overall process in addition to providing financial support.

⁷ Community forest user group took the lead for implementation while the project facilitated the process, providing financial and technical support.

ELECTRIC FENCE DECREASES EXPOSURE TO WILD ANIMALS

In both project sites, the respective communities took the lead, forming CFUG, organising resources and erecting the fencing. The overall process was time consuming, as it required approaching and coordinating all stakeholders and provided space and opportunity for different stakeholders on both sites to support the initiative.

The communities formed construction committees with representation from different local institutions. Sub committees carried out tasks such as resource collection, layout and labour organisation for construction. The stakeholders involved monitored the work and progress regularly.

The project was responsible for the mobilisation of resources, documentation, maintaining transparency of inputs and outputs and coordination between different stakeholders.

Dibya buffer zone community forest user group initiated the fencing in Dibyapuri VDC territory which was carried forward by Matribhumi, Narayani and Pragati buffer zone forest user groups in the neighbouring Pragatinagar VDC.

Outputs and Outcomes

An immediate outcome is the reduced exposure of wild animals and the

Box 3.1: What is electric fencing?

Also known as game proof fencing, the electric fence is an arrangement of 3 to 4 strands of high tensile galvanised conductor wire running horizontally parallel to each other. In three strand fencing, the lowest strand is designed to deter small animals such as deer and antelopes. It conducts very low voltage alternating current (AC) ranging from 3 to 5 volts. The middle strand is designed to frighten middle size animals such as leopards, cattle, blue bull and conducts 4 to 6 volts. The highest running strand is meant for distracting large animals such as elephants and rhinos and conducts 6

to 8 volts. If there is a 4th strand, the top strand may conduct up to 10 volts. The balance of the current flow is maintained by a converter generally 10 to 12 km away.

The fence works both ways, keeping domestic animals from venturing into the national park, while stopping wild animals entering the community area. The fence frightens animals without harming them. Frequent monitoring and awareness measures are required to avoid unexpected accidents.

Source: Personal communication with Chitwan National Park staff

ELECTRIC FENCE DECREASES EXPOSURE TO WILD ANIMALS

communities to each other. Problems previously associated with the intrusion of rhinos and tigers have been significantly reduced. At least 1235 HHs in Megghauli have directly benefited from the fencing, 519 HHs in Dibyapuri and 1235 HHs in Pragatinagar VDCs. In addition about 450 HHs, residing on the periphery and at some distance from the fence, have benefited from reduced risks of crop damage.

People now feel more at ease on many aspects of their daily life and livelihoods are more secure. They are now able to leave their homes in the evenings and feel encouraged to grow more variety of crops. Farmers in Megghauli have reported a 64 per cent increase in the production of cereal crops. Similarly, a 50 per cent increase has been reported in Nawalparasi. VDC officials and other stakeholders in Megghauli have reported that outward migration from these villages has reduced.

Communities and stakeholders have established a mechanism to look after, maintain and manage the fence. Watchmen are employed for operating, clearing bushes and simple maintenance of different sections of the fence. Local communities are raising NPR 100 per HH per year through the CFUG to pay for these watchmen. These arrangements have been put in place in

each ward in Megghauli and each community forest territory in Nawalparasi.

Issues and Lessons

Exotic alien weeds, particularly climbers, have invaded the national park and the community forests. This has created a favourable habitat for wild boars but an adverse one for deer and rhinos, leading to a population increase of wild boars in the area. Wild boars can dig out trenches and are able to cross the fence under the strands. The intrusion of wild boar has now increased. Wild boars also destroy standing crops although they are not as destructive as rhinos and other bigger animals. Communities are seeking measures to control wild boars.

Potential for Replication

This is a local problem which required special measures to combat the issue. Where similar situation exist, the initiative can be replicated. However as the solution involves huge costs, multiple stakeholder cooperation may be required to secure funding for similar installations. The availability of electricity supply without disruption is essential, while an institutional set up and an effective mechanism for sustainable management is also necessary.

ELECTRIC FENCE DECREASES EXPOSURE TO WILD ANIMALS

Conclusion

Communities and their assets are exposed to a range of hazards and stresses, the sources of which must be identified before specific measures adopted to reduce their impacts on livelihoods can be instigated. Some

measures may require the mobilisation of huge resources, which a single agency may not be able to accomplish. The coordinated efforts of several agencies, while maintaining local communities and stakeholders at the centre of such interventions, can help to complete costly endeavours.

Box 3.2: Pancha Maya is self employed

Pancha Maya Bote (38) of Sukumbasi Tol in Megghauli is a farmer. She occupies about 0.1 ha of land which her previously landless family received on the bank of Rapti River along the border to national park. She is living here for over 10 years with her husband and 5 daughters. Her land was only able to produce maize during the summer and remained fallow for the rest of the year due to the threat from wild animals and lack of irrigation. In order to feed their family, she and her husband worked as labourers in their village. Life was hard and the prospect of a better future seemed dim. Working as day labour she had hardly found time to stay with her children at home.

Following the installation of the fence and a STW in her community, along with training on improved skills in agriculture,

Pancha saw a lot of potential in their tiny patch of land. In 2008 winter, she began to grow vegetables, starting with tomato and radish. She earned NPR 11,000 (€116) by selling her produce. This money helped her to send her daughters to school and helped buy food for two months. The following year she leased 1/6th hectare of land in the vicinity owned by a temple and started growing vegetables and spices. She has also increased the production of cereals during summer as she no longer needs to investment in a Machan or to guard crops. Her time is spent on her land sowing and watering her produce while her husband helps in ploughing, transplanting and harvesting. During the non harvest time her husband does daily wage work. "It is far better to work in my land than work on a daily wage," she says happy with the current situation. "I now have free time to be with my children at home."



VEGETABLES ARE AN ADDITIONAL SOURCE OF INCOME TO IMPROVE RESILIENCE

VEGETABLES ARE AN ADDITIONAL SOURCE OF INCOME TO IMPROVE RESILIENCE

Due to shortages of water for irrigation and lack of agricultural skills, vegetables were seldom grown in the project area. They were considered a luxury only available from outside the village. With improved access to water and advice on how to grow and sell vegetables, home grown vegetables are now both a welcome addition to local diets and an additional source of income. Grown in the season when the land would previously have remained fallow, vegetable growing has generated employment and alleviated hardship.

Background

Drought is the main hazard that forces farmers to leave their land fallow during the dry winter months. Despite owing potentially productive land, the inability to access existing water resources coupled with a lack of agricultural skills has contributed to poverty and marginalisation of targeted communities. Farmers dependent on seasonal rainfall were barely able to harvest two crops a year. Large areas of land remained fallow between November and May leaving some people unemployed. This trend was exacerbated by a lack of confidence in their agricultural ability.

Despite demanding intensive care, vegetable farming is a viable option for smallholder farmers for three reasons:

- (1) Vegetables can be cultivated on a relatively small piece of land accruing greater income per unit area
- (2) Fast growth means several crops can be harvested over a longer time span compared to grains
- (3) Vegetables can be grown in the period between two cereal crops, utilising the land to a maximum

Although growing vegetables was not completely new to the area, many families working with the project had no experience of gardening.

Vegetable production was introduced as a strategy to diversify crops and increase sources of income in order to enhance HH resilience, while at the same time improve the nutritional status and health of the families. As Som Bahadur Kumal of Megghauli recalls, "We had to eat rice with just salt and chilli." Similar sentiments were expressed by many families at the two project sites.

Awareness among the communities was raised through monthly group meetings, home visits, training and exposure visits. Training sessions were of different types (Tables 4.1, 4.2). In Chitwan, farmers were chosen in each village for demonstration. In Nawalparasi, a group of interested farmers from a village formed a contact group who met once a week at a certain location.

VEGETABLES ARE AN ADDITIONAL SOURCE OF INCOME TO IMPROVE RESILIENCE

A demonstration plot was set aside for farmers to take part in theoretical and practical activities. An agriculture expert was chosen as Project Coordinator to facilitate the process and officials from relevant Agriculture Service Centres visited regularly. Continuous support ensured that the knowledge relevant to all stages of the growth cycle was provided at the right time. The participants also practiced in their own kitchen gardens so they could raise questions at the next group meeting. In both districts, community facilitators frequently visited farmers' fields to observe problems which might need an experts' advice.

In Nawalparasi, the project provided seeds for the demonstration plots in the first year. Afterwards, farmers purchased their own. In Chitwan, the project provided 100 per cent support for seeds and other inputs in the first year and a 50 per cent subsidy in the second year. For some farmers, support was given in the third year as well. Material support ceased in the final year of the project. Essential items of equipment such as water cans, sprayers and plastic were provided to all group members.

The project also helped farmers to explore the market and established links with buyers and suppliers. In terms of production the Nawalparasi model worked better. Due to the long distance from market, farmers in Kirtipur had more difficulties selling their produce compared to other villages.

The Process

PVA and need assessments conducted at the beginning of the project provided information on the farmers' current state of knowledge. None of the farmers had ever grown vegetables as a saleable crop. Green vegetables were a rarity in the kitchen, sometimes being bought from the local market.

The project implemented several different strategies to encourage farmers to grow vegetables: (i) improvement in irrigation facilities (see chapter 2), (ii) awareness, training and practical demonstration, (iii) material support for encouragement, (iv) institutionalisation and linkages with service providers, and (v) technical advice for marketing the products. Irrigation improvements were made where ever technically feasible. Different irrigation technologies such as using canes, drips and flooding were introduced.

In most cases the participants returned to attend different training sessions. Exposure visits involved visiting other successful vegetable farming communities in the district.

A total of 140 members participated in 12 week long "farmers' field schools" in 3 locations in Nawalparasi over a two year period. Farmers learned about various aspects of vegetable farming, while practicing in groups and individually on their personal farms. Groups in both districts were linked to agriculture service centres from which some members received additional training.

VEGETABLES ARE AN ADDITIONAL SOURCE OF INCOME TO IMPROVE RESILIENCE

Table 4.1 Vegetable and cash crop training in Chitwan (P = participants)

SN	Training	P	SN	Training	P
1	Basic vegetable farming	178	2	Semi commercial vegetable farming	43
3	Organic farming	13	4	Leader farmer training	19
5	Post harvest training	14	6	Market management	20
7	Exposure visit	24	8	Ground nut cultivation	18
9	Zinger cultivation	8			

Table 4.2 Vegetable and cash crop training in Nawalparasi (P= participants)

SN	Training	P	Material input
1	12 week long vegetable farming - Year 2007 (three locations)	60	Vegetable seeds, water cans and spraying tanks
2	12 week long vegetable farming - Year 2008 (three locations)	80	Seeds of cauliflower (9.5 Pkt), cabbage (9.5 Pkt), tomato (8.5 Pkt), chilly (8 Pkt), Onion (6.5 Pkt) and 13 water cans.
3	Refresher training on vegetable farming - Year 2009 (two locations)	56	No input support
4	Integrated Pest Management orientations	65	No input support
5	Cow pea seed production trial	10	Seed and technical support

Outcomes

Vegetable farming is expanding and farmers are scaling up their farming area as well as their variety of crops. Altogether 68 HHs are selling vegetables while many now consume home grown vegetables. The income from vegetable sales ranges from a few hundreds to NPR 50,000 (€527) per

family per year. The total cash income of 35 families in Nawalparasi was NPR 360,000 (€3790) in the winter and spring of 2009. Similarly, 20 families from Chitwan site earned NPR 264,750 (€2787) in 2009 by selling surplus vegetables.

The income from growing vegetables has helped families to cope with family needs,

VEGETABLES ARE AN ADDITIONAL SOURCE OF INCOME TO IMPROVE RESILIENCE

such as housing, education and medical treatments. In Meghauli, Patihani and Keurini villages, many farmers are now self employed and earning enough to abandon share cropping on other peoples' land. Working on a daily wage is no longer a necessity.

Institutional Setup

Farmers have organised into groups which are linked to relevant service providers such as the DADO. Among the 23 groups in two

districts, 21 groups are registered with the DADO (chapter 11). This kind of linkage is expected to provide sustainable services after the project phase out.

Replication

Vegetable farming is now taken up by other families. The "farmers' field school" provides opportunities for more families to learn and replicate. Some of those who have adopted vegetable farming are more productive than those who have had formal training.



A local farmer using sprinkler

Box 4.1: Vegetables add to resilience

Som Bahadur Kumal (41) lives with his wife and three children at Laukhuri village in Meghauri VDC, Chitwan. He owns 0.25 hectare of land where he grows traditional crops and sells buffalo milk for extra income. Besides poverty, wildlife intrusion and potential flood from nearby Narayani River is some of his biggest problems. Som has lost crop every year sometimes up to 75 per cent due to wildlife intrusion.

"Wild animals destroyed my crops. Rhinos and deer kept entering in my property and leopards snatched our newborn calves," says Som. "My wife and I had to guard our crops day and night and spent many sleepless nights."

In this situation, Som and his wife had to work as daily wages labour to support their family. Today Som's situation has changed for the better. Practical Action's DRR Project helped erect a low voltage three strand electric fence around the village with the community's labour contribution to prevent wildlife intrusion. A STW was also installed to irrigate the smallholder farmer's land during the dry season.

Besides the irrigation infrastructure support, Som received training on seasonal and off seasonal vegetable farming and cereal crops of different varieties. With the new knowledge Som initiated vegetable farming and with surplus water from the STW and no danger of animal intrusion his production has brought him good income. "I sell vegetables in the village market centres. My income has increased three times; my children are well fed and go to school regularly," smiles Som. "It is a nice feeling when people ask me for

advice because they regard me as a model farmer."

Som has also installed his own electric water pump to irrigate vegetables while he uses the community borehole for larger scale irrigation. In 2009, he constructed a two storey house (photo) which cost him NPR 80,000 (€842). The house is constructed to withstand flooding; the ground floor has no walls while the upper storey is for living. His new found income has allowed him to buy two sewing machines so that his wife could start tailoring - a skill that she previously could not afford to practice. He also paid back his loan and returned back his bandhak (lending out of land for loan⁸).

Dependency on chemical fertilisers has declined now that the farmers are managing farmyard manure. Many farmers also practice bio pesticide preparation and use them in vegetable farming. Just like Som, they have also installed their own electric water pumps for irrigation and have reconstructed or improved their homes.

Som sells his produce in the local market and with any surplus he contacts traders from the district headquarters. It is the combination of local and distance marketing that has made him successful. He purchases produce from his neighbours to sell and buys seeds from the market to sell in the village. He now has several sources of income; if one does not do well, the other will maintain his livelihood.

In 2008, Som earned NPR 160,000 (€1685) and in 2009 he was able to increase his income to over NPR 200,000 (€2106). After three years of hard work, the Kumal family is now completely resilient.

⁸ The loan provider cultivates the land as interest for the money until the loan is paid back by the land owner



Beneficiaries with their tomatoes ready to sell

Box 4.2: Vegetables help to give up Khoriya

Shifting cultivation was the primary source of income for many inhabitants of Kirtipur. One hundred and ten HHs belong to Magar ethnicity (a minority caste of Nepal), and many of them practiced Khoriya (slash and burn shifting cultivation). Khoriya is a damaging practice to soil, landscape and biodiversity; accelerating erosion and landslides in hill slopes and flooding downstream. The production from Khoriya was, however, sufficient to provide all year round food for a family. Other locally common survival strategy was youths migrating abroad to support their families. The project organised a 12 week vegetable farming training course for 45 participants (23 in 2007 and 22 in 2008) in this village. All 45 families have started growing vegetables. Out of these 14 commercial growers earned NPR 175,000 (€1842) in 2009.

Awareness and alternative means of income has encouraged these communities to give up Khoriya. Tilak Bahadur Sunari spent much of his time practising Khoriya. He took part in the vegetable farming and forest management training, understood the importance of the forest and chose vegetable farming as an income generating option. He started growing on about 1/30th hac (334 m²) of land and earned NPR 6000 (€64) in one season from growing tomatoes, chillies and cabbages. He found this highly profitable compared to the income from shifting cultivation. This success story has been repeated by many families in the village. The whole village is now running a campaign to give up Khoriya and switch to other income generating activities such as vegetable cultivation, bee keeping and improved livestock rearing.



5

IMPROVED BEE KEEPING AND ITS CONTRIBUTION TO REDUCING LANDSLIDES

IMPROVED BEE KEEPING AND ITS CONTRIBUTION TO REDUCING LANDSLIDES

Traditionally bee keeping was treated as another form of hunting. Colonies of bees that were kept in hollow log hives were severely damaged during the harvesting of honey. Raising awareness about the working ways of bees, coupled with improved bee keeping skills and the introduction of better hives has reduced losses of bee colonies and increased productivity. Bee keeping is now a reliable source of family income. Farmers in Kirtipur and neighbouring villages have linked bee keeping to broader objectives; to conserving plants and forests for foraging, control of landslides and the renovation of degraded hill slopes.

Background

This chapter is based on the experiences of upstream communities in Baulaha khola watershed in Nawalparasi District. Landslides in this area are exacerbated by malpractices on geologically fragile landscapes. Slash and burn⁹ agriculture, excessive grazing and forest fires have destroyed ground cover, making slopes less stable, allowing erratic and intense rainfall to erode land faster and more frequently, increasing the risk of landslides. Few income earning opportunities and low agricultural productivity have led to the adoption of Khoriya Kheti as the traditional way of eking out a living. People are not aware of other less destructive options.

Yet domesticated bees (*Apis cerena*) are available as a potential source of income that is relatively cheap to initiate and requires little maintenance. Bees bring benefits to ecosystems and agriculture. Honey is a healthy foodstuff with medicinal properties as well as a valuable

commodity for sale. Bee keeping in Kirtipur was traditionally carried out using hollow wooden logs as hives. *Apis cerena* dwell in these hives (fixed comb hives) hung on the walls of houses and balconies. These colonies are not very productive. The colonies are small due to lack of space and during harvesting of the honey a large proportion of the colony is destroyed. The quality of honey is low and keeps poorly due to the mixing of larva, wax, honey and other materials.

Project Initiatives

The project initiated the improvement of bee keeping with the long term objective of reducing the degradation of steep forests that contribute to soil erosion and landslides. At first glance, the link between bee keeping and erosion control may appear tenuous. But bees are managed as generators of income, as producers of medicinal honey and as essential pollinators of crops of all descriptions. They

⁹ Locally slash and burn agriculture is known as Khoriya Kheti

IMPROVED BEE KEEPING AND ITS CONTRIBUTION TO REDUCING LANDSLIDES

are dependent on the nectar they harvest from trees, shrubs and flowers that grow in the neighbouring forests. Their well being and productivity is intricately linked with the health and bio diversity of their environment. Their contribution to environmental conservation is answered in the story below.

The project organised group meetings and discussions to explain the benefits of improved bee keeping on income, agriculture and the environment. Seventeen farmers from both up and down stream communities showed an interest in enhancing their bee keeping skills. In 2007 a five day training session was organised. At the end of the training each participant was provided with an improved hive; 8 hives with *Apis mellifera* for the downstream community members and 9 hives for *Apis cerena* for the upstream community members. Despite proving to be lucrative, only 3 downstream participants continued to keep bees. However, it stood as a demonstration tool for replication in the upstream communities (see box 5.1).

In 2008, more farmers from Kirtipur and neighbouring villages demanded bee keeping training. A six day training session, consisting of theoretical and practical exercises for 26 participants, of whom 20 were newcomers, was organised. The training was in partnership with an NGO (NEST) from Pokhara. NEST provided trainers while the project managed logistics. Lessons included were, life cycle of

bees, hive management, honey harvesting and processing, splitting of the colony and foraging. Most of the participants in this training were women. At the end of the training the project supported half of the costs for one hive for each of the new participants. Of the 31 new hives supplied, 11 were purchased with trainees own funds (Table 5.1). The project invested a total of NPR 30,000 (€316) to provide improved hives.

Following the training, experts made home visits from time to time, providing guidance, advice and support. The project also supplied one honey extractor for members of the group to use in turn. As the harvesting and processing of the honey was healthier, cleaner and less damaging to the colonies, income from honey harvesting increased. The community's position in the market improved. As their honey came from natural foraging it fetched a higher price. In 2009 one family earned NPR 30,000 (€316) from the sale of honey and this figure is likely to increase in 2010. This proves that bee keeping is a viable option for generating additional income, without additional drudgery.

Improved bee keeping has the following advantages over traditional log hives:

- It is less damaging to the combs and colony such that more frequent honey collection is possible

IMPROVED BEE KEEPING AND ITS CONTRIBUTION TO REDUCING LANDSLIDES

- The production from a single hive is 4-5 kg of honey per harvest; almost twice as much as log hives
- The quality is improved and healthier as the harvesting process separates the honey from the wax comb and the larvae
- Better care and less disturbance of the colony during harvesting means that the bees do not swarm and leave the hive
- The colony is not restricted but has room to grow and become stronger and more productive
- Each hive provides a net income from NPR 7200 (€76) to 10,800 (€114) per year as compared to NPR 3000 (€31) to 5000 (€52) in log hives

Artificial feeding is not required as the forest conservation and diversified agricultural crops all year round have been nurtured without chemical pesticides in the fields. The collected honey is sold in markets downstream and within the villages. People generally order honey in advance as the demand is higher than supply. In many instances these bee keepers sell the honey locally in the villages. As the honey is consumed locally and within short period, there are fewer problems associated with processing, packaging and storage.

The farmers trained in improved bee keeping have formed a group, "Carena Mauri Palak Samuha" (Carena Bee Keepers' Group) and are registered with the DADO. Registration with DADO provides the group with access to technical advice and support after the phase out.

Table 5.1 Inputs for improved bee keeping

SN	Initiatives	Duration	Participants	Input support
1	Improved bee keeping I: for both upstream and down stream farmers	5 days	Upstream 9 Downstream 8 Total 17	19 improved hives (100% support)
2	Orientation on beehive management in winter	1 event	9	
3	Orientation on beehive management in monsoon	1 event	11	
4	Improved bee keeping II: for upstream communities only	6 days	26	20 modern hives (50% support)
5	Home visits by experts and project staffs (hive inspection and technical orientation)	3 events in a year for 2 years	3 villages	

IMPROVED BEE KEEPING AND ITS CONTRIBUTION TO REDUCING LANDSLIDES



Ek Bahadur Sinjali harvesting honey

Aims to Reduce Landslides

Bee keepers are increasing the number of hives that they manage (Table 5.2). Conversations with the community suggest that this is likely to continue. Simultaneously, since 2009, the practice of Khoriya kheti has ceased. Farmers now understand the multiple benefits bees have in terms of improved diet, increased income, medicinal properties and the pollination of crops. Meetings organised by the project have targeted specific groups of farmers, raising their awareness of the negative impact of Khoriya kheti together with the

positive benefits of the natural forest. These farmers are now committed in stopping the practice of slash and burn. Many of these farmers are themselves acting like extension workers, persuading other villagers to switch to better practices.

Table 5.2 Status of improved bee keeping in upstream villages

Villages	HH with improved bee hives	Total improved bee hives (2010 September)	Initiated year
Kirtipur	15	35	2008
Bandipur	3	5	2009
Kumsot	8	8	2009

Box 5.1: Ek Bahadur Sinjali has more options and opportunities

Ek Bahadur Sinjali is a resident of Kirtipur village. He owns 0.4 hectare of land. Crop production was sufficient to fulfil the needs of his family of 10 for 6 months of the year only. His family had to slash and burn the hill slopes to increase their food production. He worked on a daily wage for the rest of the year. Drudgery was high due to the uncertain income.

In 2007, he took part in five day training on improved bee keeping. He was given an improved hive into which he shifted a local bee colony. He managed the hive as he had been taught how to. In that first year he earned NPR 6000 (€63) by selling honey. In 2008 he purchased another 2 hives for NPR 3000 (€31). He joined the second phase of training in his village and is now confident in his ability to keep bees. His wife has been trained in vegetable cultivation and the family has given up Khoriya to concentrate on agricultural production. Their success has convinced several of their neighbours to also give up Khoriya.

With his new income Ek bought more improved hives and now has a total of 7. He has earned more than NPR 30,000 (€316) in 2010 and he is expecting one more harvest before the year ends. With his savings he is able to support his children's studies by paying for clothes, stationery and school fees. Ek and his family stopped shifting cultivation in the hill slopes in 2009. He is planning to add to his number of improved hives each year.

Not only is the drudgery of Khoriya and wage labour now reduced, but they also have sufficient income to cover other HH expenses. Ek's reputation in the community has also improved as he has something to offer - his skill. "People do not hesitate to lend me money if I need it now," Ek says with exuberance.

He volunteers to provide technical advice and recommends honey harvesting to his neighbours as well. His achievements have helped Ek to convince other people to stop bad agricultural practices and to switch to better and more sustainable methods.



IMPROVEMENT IN LIVESTOCK BREED AND REARING PRACTICES

IMPROVEMENT IN LIVESTOCK BREED AND REARING PRACTICES

The life expectancy and productivity of goats and pigs reared by upstream communities in the Bauhala Khola watershed have increased as a result of several project initiatives. The introduction of improved breeds of pigs and goats to mate with existing livestock and the provision of goat sheds and pig pens have resulted in decreased mortality and better growth rates. Training in livestock management, cultivation of fodder crops and the introduction of stall feeding has improved rearing practices. Together with health checks and treatment camps, these innovations have resulted in increased birth rates with larger numbers of offspring in each litter for both pigs and goats. Growth rates have increased substantially. Health and productivity of other livestock, such as buffalos and cattle, has improved. Confining pigs to pens has reduced open defecation, improving the village environment. Family income from livestock has increased, increasing their ability to cope with existing and future hazards, shocks and stresses.

Background

Livestock rearing is an integral component of Nepalese subsistence agriculture which combines cropping and livestock husbandry. Fodder from field crops is fed to livestock and manure from livestock is applied to crops. While goats are the preferred livestock reared by small holders on the project site, pig keeping is common in the upstream Magar communities. The majority Brahmin and Chhetri castes in downstream parts of Nawalparasi commonly keep buffalos and cows.

Goats and pigs are sold for meat, cattle raised for milk and bulls for ploughing and pulling carts.

Traditional rearing practices in upstream communities in Nawalparasi limited growth and productivity. Small over crowded pens, where animals lived in contact with their own faeces, inbreeding and lack of proper feed

resulted in poor growth rates, small litter sizes and high mortality. Since the sheds were neither appropriately constructed nor cleaned, pigs either lived on slurry of faeces and urine or were more often left to roam freely around the village. People were reluctant to visit these villages due to the dirt and foul smell. These unhygienic conditions meant that goats and pigs were normally infected with several diseases and external parasites.

Goats of different ages and conditions were kept together in crowded narrow sheds. Goats were allowed to graze on the nearby hill slopes, degrading the forests and grazing lands. The Magars kept goats up to 5 years old before they were sold for between NPR 5000 (€53) to 6000 (€63); a price which does not reflect the cost of rearing. (Growth of goats for meat production slows down once the animal passes two years of age). Livestock rearing problems of downstream communities in Baulaha Khola,

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while not as extreme as those experienced upstream, were associated with inbreeding and lack of proper healthcare for goats.

Project Initiatives

Improved breeding bucks and offspring

The project provided groups of farmers with breeding bucks to improve the local breed of goats and improved breeds of pigs to selected families. Training on good rearing practices and support for the development of appropriate

animal sheds was provided. Together with livestock, health camps in different villages and home visits by livestock experts, the profitability of livestock rearing was increased.

Each group selects a family to be responsible for the rearing of the improved breeding buck. The buck is then available to mate with the livestock of other members of the group for a small nominal fee. This encourages the holders of the buck to maintain the animal in good condition. The bucks are exchanged between different

Table 6.1 Training and input support on livestock improvement

SN	Training/input	Beneficiaries
1	Three days goat raising training (2 events)	46 HHs
2	Three days piggery promotion training (2 events)	61 HHs
3	18 improved breeding bucks (8 in Chitwan and 10 in Nawalparasi) (12 bucks - 100 % financed by project and 6 bucks in Nawalparasi - 50% contribution by the project) (Jamunapari cross)	23 groups (718 HHs)
4	34 improved piglet (Dharane black breed)	34 HHs*
5	Cement support for shed improvement 26 goat sheds 58 pig sheds	84 HHs *
6	Livestock health camps (cow, ox, buffalo, goat, pig) at least twice a year in each cluster	23 groups (>718 HHs)
7	35 days veterinary training to 3 persons (Meghauri -1, Patihani -1 and Devchuli -1) - NPR 58500 (€615)	23 groups (3 HHs directly)
8	Castrators and books on livestock husbandry to Local Resource Persons (LRPs)	23 groups (3 HHs directly)
9	Home visit by veterinary doctor at least twice a year particularly in the upstream	Over 100 HH

* In Nawalparasi site only

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communities to minimise the chances of inbreeding.

Female piglets of an improved breed known as 'Dharane black', developed by Pakhribas Research Centre in eastern Nepal, were provided to individual families. The next generation of offspring from these were then passed on to their neighbours.

Shed improvement

The project provided financial support to purchase cement for construction of goat and pig sheds. The total cost of an improved

pig shed was NPR 14000 (€147) and NPR 6050 (€64) for goat shed. The pig sheds are divided into at least two compartments, with a separate compartment for feeding. The cement floor is inclined, allowing dung and urine to drain out to a pit.

Raised slatted wooden platforms have been constructed for goats, ensuring that they are dry and warm, with their faeces and urine dropping through the slats to the cemented floor which is easy to clean. 26 goat sheds and 58 pig sheds have been improved with the partial financial support of the project. Further, 26 pigs sheds and



A model pigsty under construction

IMPROVEMENT IN LIVESTOCK BREED AND REARING PRACTICES

over 50 goat sheds were improved by families using their own resources.

Livestock health camps

During the initial PVA, problems of infertility, kid mortality and general ignorance of good animal husbandry were identified as major constraints to livestock rearing. In order to identify specific animal health problems, provide treatment, raise awareness of hygiene and promote a culture of regular animal health checks, the project initiated livestock health camps. Livestock health camps were organised in

collaboration with the local Community Based Organisations (CBOs) and dairy cooperatives. Experts from the respective District Livestock Service Offices (DLSO) handled the check ups and treatment. This provided an opportunity to establish and strengthen better linkages between farmers, institutions and service providers. Farmers were advised on what to do in specific cases and the kind of expert services available to them. This advice was often beneficial to the wider community. Box 6.1 illustrates the direct benefit of animal health camps. In 2008, 450 animals received check ups

Box 6.1: Balkrishna's milk selling business survives after attending livestock health camp

Balkrishna Acharya is a farmer from Pragatinagar VDC, Nawalparasi, and has lived here since 1973. He owns 2 cows and a buffalo. He sells milk in the nearby dairy cooperative. His buffalo had tumours at her right eye, and this tumour would delay the coming of age for fertilisation. Buyers had offered NPR 15000 (€158), just one third of market the price, whereas Balkrishna had bought the buffalo for NPR 20000 (€211).

Balkrishna brought his buffalo to the livestock health camp in 2009 winter. He received advice on cattle management and the buffalo went through a minor operation.

The tumour was removed successfully. The health of the buffalo improved rapidly as did her milk production. On the advice from the health camp, he fed heat inducing medicine to the buffalo. The buffalo now fetches NPR 40,000 (€421) if Balkrishna intends to sell. In 2010, the buffalo gave birth and is now milking 6 litres a day. He sells 3 litres in the local milk collection centre and earns around NPR 90 every day.

Besides providing check ups and treatment of livestock, health camps have increased the awareness and knowledge of farmers. After participating in the camps farmers were found to be improving the sanitation of sheds, managing manure better and adopting better feeding practices. As a result the growth and productivity of their livestock has improved tremendously.

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(buffalos, cows, goats and pigs). Out of these, 165 received an infertility test, 10 buffalos were cured for infertility and 275 goats were treated with PPR vaccination. Over 350 HHs benefited from these camps.

Similarly in 2009, 676 animals were checked (upstream 342, downstream 112 and 222 in Chitwan). Of these, 222 were vaccinated against black water, PPR and haemorrhagic septicaemia. On both sites over 732 goats were treated for both internal and external parasites (worms, lice, bugs). At least 134 HHs in Nawalparasi and 75 HHs in Chitwan benefited from these services. For example, after the infertility treatment, one farmer in Nawalparasi sold his buffalo for NPR 24000 (€253), for which he had previously been offered only NPR 8000 (€84).

In 2010 farmers reported that they have continued the practices learned in the camps and the orientations. The linkages established in the camps have encouraged farmers to visit livestock service offices for necessary consultations.

Home visits and local resource persons

Livestock specialists have visited farmers' homes, inspected sheds and rearing practices and given specific guidance to the farmers based on their observations. These visits have helped to solve problems on the spot while establishing channels for access to

further advice. The project provided 35 days of veterinary training for 3 people selected by the communities in Nawalparasi and Meghauri. These three now work as LRPs for livestock, providing technical assistance to local communities, helping to solve livestock related problems. At the same time they are able to earn a living too.

Outcomes

Shed improvements have made a marked difference to the health and growth of livestock and the sanitary situation in the village. Farmers have reported that the live weight gains of pigs and goats have increased by as much as 50 per cent. The number of siblings per birth has increased with better vigour and health. The miscarriage and kid mortality rate has decreased in both goats and pigs. This has encouraged other HHs to improve their sheds, with 34 farmers improving goat and pig sheds in Kirtipur on their own. Another Magar community in Bandipur village has initiated similar practices and has been running a campaign to keep pigs from roaming around the village. Anyone who leaves their pigs outside their shed is liable to be punished.

In Kirtipur, the 34 original piglets (Dharane Black) have increased to 315, replacing the older breeds. The breed has also spread to neighbouring villages. Farmers now keep fewer adult pigs due to the higher birth rate,

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better survival and healthier growth of piglets (Box 6.2). With fewer adult pigs to feed and more piglets to sell, income has increased.

In one year the 4 goat bucks provided in Nawalparasi have bred with 180 female goats producing 230 kids. (Some female goats are pregnant and yet to give birth). In Chitwan, 307 goats received mating services from 4 breeding bucks. In 2008 alone, 86 female goats gave birth to 147 kids. The number of offspring per birth has increased significantly (Figure 6.1). Before the introduction of the new bucks, a goat would typically give birth to one kid. Triplets (3 kids per birth) were extremely rare. The cost of the mating service has also decreased from NPR 50 to NPR 10 (€0.5 to 0.10).

In Kirtipur, where farmers used to keep a large number of less productive goats, now keep smaller herds, switching to improved breeds and stall feeding. In the downstream communities of Baulaha Khola stall feeding has become an established practice.

LRPs trained by the project provide basic animal health services, including treatments for internal and external parasites, infertility problems, diarrhoea, flu and the castration of male goats. More complex cases are referred to livestock service centres for further consultation. One of the LRPs in Megghauli has opened a small veterinary

shop. He advises and handles an average of 35 cases a month. Unfortunately, one of the LRPs trained by the project did not provide services to the communities for various reasons.

Significant improvements in the income from livestock rearing are a direct result of the activities described. This increased income has resulted in families accumulating savings while increasing their confidence and ability to deal with day to day stress. The initiatives are replicated in neighbouring villages and the new breeds of pigs and goats have expanded widely. The abandonment of traditional damaging practices of goat rearing in the upstream communities has yet to be achieved, but initiatives to replace them with more cost effective and environmentally friendly methods are in place.



Figure 6.1 Number of live siblings at one birth (225 female goats)

Source: field survey in Megghauli and Patihani, 2009 (168HH)

Box 6.2: Low input but high yield for Balbahadur

Balbahadur Baral and his family live in Kirtipur upstream of Baulaha Khola in Nawalparasi. Like his neighbours, he rears pigs as a source of income. He used traditional methods, local breeds of inbred pigs kept in a pen with a mud floor and without a roof. Due to the unhealthy habitat, piglets had a high mortality rate at birth and a short life expectancy. Infection was common and pigs roamed around his home and village dirtying yards and paths.

After participating in a 3 day piggery training session, Balbahadur realised the failings of his method of rearing pigs. He received one Dharane Black piglet and improved his pig shed with partial financial support from the project. The grown pig has given birth to 13 piglets in its first litter. He sold 10 of them for NPR 3000 (€31) in two months and reared 3 further. Now that his shed is better maintained, his pigs rarely get sick. These new piglets have grown to 120 kg each in a year whereas the old breed only grew to 40 kg in the same time. This has increased

his income from a single pig, three fold, from NPR 4000 to 12000 (€42 to 126) in only one year.

Balbahadur used to rear 5 breeding pigs, each producing 5 piglets in a year earning NPR 22000 to 25000 (€231 to 263). Today he has one female and one male improved pig and earns more than NPR 50,000 (€526) per year by selling meat and piglets. The cost and drudgery of rearing and caring has decreased as there are fewer pigs to feed and his children have time and resources to go to school. His increased income now allows him to pay for medical treatment, stationery, school uniforms and other family expenses for which he previously had to borrow money. He has started saving surplus income in local cooperative; from which he plans to improve his house and send his children for higher studies.

The benefits of improved pig rearing have extended to the environment. His increased income and new awareness of the damage caused has allowed him to stop shifting cultivation in the hill slopes around the village.



7

IMPROVEMENTS IN CROPPING: NEW VARIETIES, TECHNOLOGIES, AND CROPS

IMPROVEMENTS IN CROPPING : NEW VARIETIES, TECHNOLOGIES, AND CROPS

Food insecurity has been aggravated by multiple factors limiting the production of farmers. The project looked to enhance agricultural skills, provide input towards improved crop varieties, improve access to water for irrigation, provide support with markets and services and protect crops against wild animals. Farmers are now less vulnerable to the existing hazards and have increased resilience capacities.

Background

Agriculture in Nepal is dominated by cereal crops and is largely dependent on rain. Rice, maize, wheat and millet are the major crops and sources of food across the project locations. Many families cultivate oil seed (rape mustard) and lentil particularly in winter, either alone or mixed with other crops. Some communities, depending on the local climate, soil and other local factors grow different crops as intercrops.

Available of irrigation facilities, determines the types of crops farmers grow. In the floodplains of Chitwan and downstream of Baulaha Khola in Nawalparasi, when irrigation water is available, farmers sow maize in spring which they harvest in summer, then transplant rice in summer to harvest in October/November and then sow oilseed and lentil to harvest at the onset of spring. However, much of the land in these areas remain fallow in winter and spring due to lack of irrigation water. Access to irrigation in many instances is limited or it is too costly to use. The threat to crops posed by wild animals increases insecurity.

In the highland of hill slopes where the land has lower moisture retention capacity, it is possible to grow two crops only due to the lack of year round irrigation facilities. Communities in the upstream (Kirtipur, Kumsot and Bandipur) grow ginger as major crop in the highland alongside maize and millet, or sometimes as an intercropped with maize.

Sharecropping, growing crops in other people's land and sharing the produce, is popular for those with little or less productive land. Generally farmers lack an understanding of the importance of care in different aspects of crop production and skills required for them. Poor land preparation, seeding, manure application and intercultural operations severely restrict yields.

Assessments of agricultural practices in the project area showed that most of the farmers did not know the importance of seed selection, treatment and its storage. Seed sowing, particularly of rice, was haphazardly done, often interrupted by erratic rainfall.

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Farmers did not know how to apply manure effectively to provide the required nutrients. In many cases, the seeds were selected from the same crop for many generations and the same crop produced repeatedly on the same pieces of land for many years. These reduced the productivity of both the land and the crop.

Lack of technical knowledge and skills, access to improved seeds and irrigation facilities and existing hazards, such as pests and wildlife intrusions, were some of the limiting factors, acting alone or in combination to reduce production and increase food insecurity.

Project initiatives

The project introduced multiple interventions involving improvement of irrigation facilities (see Chapter 2), electric fencing to deter wild animals (see Chapter 3), training and exposure visits to improve skills and knowledge, improved crops and seeds, and new crops to diversify existing cropping patterns. Of the new crops introduced, vegetables are mentioned in Chapter 4. This chapter will describe how improvements in crop varieties and cropping patterns boosted production in the context of identified needs. Combined with the prevailing institutional set up and linkages with service providers and markets for

sustainability of project interventions as mentioned in Chapter 11, these interventions contribute to the resilience of the communities' agricultural livelihoods.

Training and practical orientations

Various training modules on improved seeds, different varieties and cropping patterns (Table 7.1) were delivered to enhance knowledge and practical skills. Training to enhance knowledge and practical skills were field based. The initiatives focused on the individual practices on the farm to let farmers learn by actually farming. Peer-to-peer learning was encouraged. Project staff regularly visited farms throughout the rotation of a particular crop providing necessary technical and material inputs. Farmers benefited from having access to technical expertise. Staff provided orientations in the field on practice to new approaches of farming. Subject based specialists were consulted where and when needed.

All farmers who had received training did not immediately apply the knowledge acquired during the training. Some innovative farmers immediately implemented what they had learned, but others only followed the next year after observing the results on others' land. Modifications to existing rice and oil seed production practices were readily taken up,

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whereas newer interventions required intensive follow up and persuasion. Fifty three participants took part in the compost manure preparation session. Demonstration compost pits were created on farmers' land, but few participants carried out the next steps of the process. Only 25 participants actively practiced composting. However, despite these initial set backs, as their benefits have become obvious, most of these initiatives have gradually been taken up both inside and outside the project area.

Input support

Tested and certified improved varieties of seed were provided to the farmers. Seeds supplied included improved varieties of traditionally grown crops such as rice and rape mustard and new crops of particular interest to some families. Seed support was

provided to farmers in Chitwan, whereas farmers in Nawalparasi District managed to purchase their own seed with technical assistance from the project staff. This clearly illustrates the difference that the facilitation skills of implementing partners makes; where staff mobilised communities skilfully, greater outcomes were achieved with smaller material input but where staffs failed to mobilise communities proficiently, higher material inputs were necessary to implement the initiatives. Table 7.2 shows the seed inputs provided to farmers in Chitwan District.

Besides seed and other input supports, farmers were also supported technically throughout the crop cycle. Training in the selection and storing of seed was provided. Almost all the farmers who received this training stored seeds for next season, while some even sold seed to their neighbours.

Table 7.1 Training on cereal and cash crops

SN	Training and technical inputs	Trainees	Remarks
1	Improved crop production orientation training (cereal) for two days	25	Chitwan
2	Cereal and oil seed production training for 2 days (5 events)	128	Chitwan
	Farm visits and individual orientations throughout crop rotations by project staff and crop specific specialists	>535 HH	Both district sites
3	Compost manure preparation training (1 day orientation and weekly/fortnightly follow up for three months)	53 HH	Two locations in Nawalparasi
4	Soil test for nutrients	80 HH	Chitwan only
	Bio pesticide preparation and application	66	Nawalparasi
5	Organic farming (2 days in Meghauli) – 1 event	19	Chitwan

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Outcomes

Increased production

Increases in production encouraged other farmers to adopt the new practices. For example, Rampur Composite maize produced 817 kg per hectare whereas the traditional variety used to produce only 442 kg per hectare. Rice varieties Hardinath and

Mithila were introduced in Patihani village for planting in March and harvest in June; a time when farmers were not previously able to grow any crop and land remained fallow. Ram variety of rice planted in summer produced 2980 kg per hectare; a 78 percent increase compared to 1675 kg per hectare before the project intervention (Table 7.3). Farmers have reported that production has further increased in the years 2009 and 2010.

Table 7.2 Improved seeds of different crop provided to farmers in Chitwan

SN	Crop/variety seeds	Quantity	Benefiting farmers	Planted in	Production
1	Maize - Rampur composite	500 kg	128 HH	46.5 hac	38,000 kg
2	Rice - Hardinath and Mithila	105 kg	23 HH	2.3 hac	5750 kg
3	Rice - Ram	300 kg	57 HH	20 hac	59,600 kg
4	Ground nut	50 kg	12 HH	0.42 hac	insignificant
5	Ginger	172 kg	11 HH	NA	
6	Potato (TPS)	584 kg	35 HH	1.5 hac	18000 kg
7	Rape mustard	155 kg	127 HH	9.7 hac	2894 kg
8	Wheat	185 kg	61 HH	NA	1200 kg
9	Lentil	168 kg	149 HH	9.3 hac	3002 kg

Note: Farmers were linked to markets to buy improved seeds in Nawalparasi

Table 7.3 Production status of different crops before and after

SN	Village/Community	Crop	Kg/kattha (Before)	Kg/kattha (After)	Increased %
1	Kirtipur	Summer paddy	94	127	35
2	Meghauri	Summer paddy	55.85	100	79
3	Patihani	Spring paddy (new crop)	0	83	
4	Patihani	Summer paddy	39.75	84	52.7
5	Kadampur	Paddy	112	168	50
6	Bote tole	Paddy	140	168	20
7	Gaidi	Paddy	112	154	37.5
	1 kattha=333 m ²				

Source: field survey 2007, 2008 and 2009 (from 535 HH out of 718)

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This increase is the result of several interventions including enhanced skills, improved seeds and varieties, irrigation facilities for timely planting/sowing and the prevention of damage by wild animals. Baseline information is derived from the average production of past five years or longer. The yield data is based on the information provided by the farmers.

Additional batch of crops

In Patihani, it was possible to transplant an additional crop of paddy in the spring to harvest in summer, prior to transplanting another batch of rice. In 2008, 23 families cultivated spring paddy and produced 5750 kg of paddy from 2.3 hectare of land for the first time. Paddy cultivation is now carried out twice a year. In spring there is maize in some piece of land and paddy on the other. In summer all the fields are cultivated with paddy - the favoured crop. Now the fields hardly remain fallow and farmers are growing different crops throughout the year. This has increased the production in their own land and people have reduced practice of sharing cropping in others' land in the neighbouring villages.

In Kirtipur, maize sowing in March and its harvest in June has been made possible by the newly constructed irrigation channel. Earlier the land would have remained fallow during this period. Farmers used to cultivate

maize on slashed and burned hill slopes from which they harvested as little as 62.5 kg per Kattha in late summer. Now cultivating hybrid maize on irrigated land, produces 150 kg per Kattha (333 m²), with an overall 140 per cent increment in production of maize per annum. Between November and March vegetables are grown.

More than 34 families have started commercial farming and almost all HHs have a kitchen garden to support their daily diet. The area of cultivation of wheat and mustard has also increased. As a result, slash and burn agriculture is now decreasing.

In Megghauli the availability of irrigation facilities and protection from wild animals has resulted in an increase in the area under cultivation. Farmers in Bote Tol in Nawalparasi have been able to grow rice in land where previously only maize was possible during summer. In Keurini, farmers are cultivating additional crops particularly vegetables and other cash crops during the winter, increasing their productivity.

Improved crop pattern

Project interventions have resulted in significant changes in cropping patterns. Previously, rice nursery bed preparation depended on rain. Increasingly unpredictable rainfall meant that growing nurseries for transplantation took longer to

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complete (May 15-July15). Some years, sowing would start in early May; in others, it could be as late as the end of June. Delayed rainfall left the seedlings overgrown for timely transplantation. One year in Kirtipur, farmers had to transplant 66 days old seedlings; delayed by 44 days. Such delays disturb the annual crop calendar eliminating the opportunity for some crops to be planted. With available irrigation, farmers can plan and follow a fixed calendar for sowing. Farmers now have more options; if one crop does not do well, another crop can potentially make up for their loss.

Vegetables are now included in the cropping calendar of most of the farmers in the project area. The planting of wheat is diminishing,

particularly in Kirtipur, but in other areas as well, as it intrudes into spring maize that starts being sown between the end of February and the middle of March. Usually, the sowing of wheat seed begins in the middle of November and lasts until early December. Harvesting is between mid March and April. Farmers now prefer growing vegetables instead of wheat as they can be harvested earlier, allowing maize cultivation in March. In Patihani, spring maize, which used to be sown in late April to harvest at the end of June, is now almost replaced by spring paddy that was harvested earlier. This allowed another batch of rice to be planted. In Bote Tole, lentil is replaced by vegetables and mustard in winter.

Changed crop pattern in the downstream (Patihani and Meghauli)

Maize, mustard and lentils are the major traditional crops of Simalgairi in Patihani. Due to very limited access to irrigation paddy was only grown in some low lands otherwise maize was the major crop in summer. Lentils and mustard were cultivated in winter. With improved access to water through the construction

of an irrigation channel and a STW, the cropping pattern has become more intensive and diversified. Figure 7.1 below shows the changed annual cropping pattern in different villages (table 7.4). The inner circle shows the cropping pattern before and the outer circle reveals the current cropping pattern. The figure indicates that options and sources of income have increased.

Changed annual crop cycle in Kirtipur

Paddy, maize, millet, wheat, mustard and ginger are the major traditional crops of Kirtipur community. Paddy, wheat and mustard were cultivated on irrigated land whereas millet, maize and ginger were cultivated on non irrigated highland. With improved access to water following construction of the irrigation scheme

and renovation of the conventional irrigation channel, cropping in the irrigated fields has become more intensive and cultivation of hill slopes by slash and burn has decreased. Table 7.5 below reveals the changed cropping calendar and crops and figure 7.1 (a) at the end of the chapter below shows the changed annual cropping pattern. The figure indicates that the options and sources of income have increased.

Cropping has intensified and lands remain fallow for shorter length of time. The practice of sharecropping and renting in has decreased as the crop cycle has intensified and production has improved. Farmers are better employed on their own land and increased

productivity and more income from the same piece of land contributes to long term food security. On the other hand, time of sowing and transplantation has decreased and access to irrigation freed the farmers from rainfall dependency.

Table 7.4 : Cropping pattern before and after project intervention (also in the figure 7.1)

SN	Community	Crops before the project	Crops after the project
1	Bote tol and Keurini	Paddy, lentil and maize	m+ vegetables
2	Kadampur, Divyapuri	Paddy, wheat and maize	Paddy, vegetable + wheat, maize
3	Kirtipur, Devchuli (irrigated terraces)	Paddy + maize + millet and wheat + mustard+ lentil	Paddy, vegetable + wheat + mustard + lentil, maize
4	Simalgairi, Patihani	Paddy + maize and mustard +lentil	Paddy, mustard + lentil + vegetable and maize +paddy
5	Laukhuri, Meghauli	Paddy + maize, mustard + lentil, maize	Paddy, mustard +lentil +vegetable, maize + paddy

Note: + crops in the same season grown in different part of land

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Table 7.5 Annual crop cycle of Kirtipur, Devchuli and Nawalparasi

Crop	Activities	1	2	3	4	5	6	7	8	9	10	11	12
Paddy	Nursery		After	Before									
	Transplanting			Before	Before								
	Weeding				Before	Before							
	Harvesting							Before	Before				
Maize (new crop)	Sowing										Before	Before	
	Weeding											Before	Before
	Harvesting		After	After									
Vegetable (new crop)	Nursery							Before					
	Transplanting								Before				
	Harvesting									Before	Before		
Wheat	Sowing								Before	Before			
	Harvesting												Before
Mustard	Sowing								Before	Before			
	Harvesting											Before	Before

(Note: months; 1 = Baikaash, 12 = Chaitra; Baishakh ~ April 15 to May 15)

Before ■ After ■



Smallholder farmers planting paddy

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Replication

The replication of these initiatives is very context specific, depending on the available resources, market, climate, topography and soil properties. Limiting factors can be minimised, farmers skills can be enhanced and new technologies can be introduced. Farmers in the neighbouring villages and communities have grown vegetables, new varieties of crops and used improved seeds where the areas are suitable. The introduction of additional crops may require access to knowledge, new technologies and

additional resources. Where farmers have the confidence and ability to access support, particularly technical support; replication is most often successful.

Figure 7.1 Cropping pattern before and after project interventions

The inner circle shows the cropping pattern before and the outer circle reveals the current cropping pattern in each community.

The figure 7.1 (a) indicates additional batch of vegetable from October-November to mid

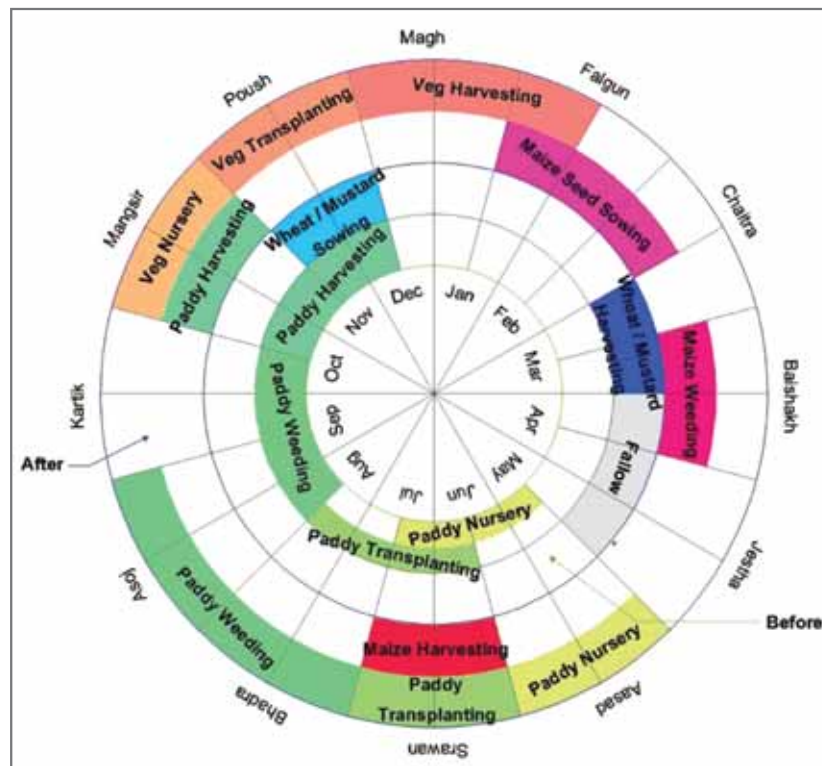


Figure 7.1 (a): Annual Crop Cycle, Kirtipur, Devchuli - 3, Nawalparasi

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of January. Paddy nursery and transplanting duration are reduced from two months to one month. Paddy harvesting, earlier, goes up to December before and now harvesting is done within November end. Spring maize is also additional batch in Kirtipur that starts seed sowing in January to harvesting in July. Most of the land used to be fallow during April to May before and now there is no room for fallow land.

The figure 7.1 (b) indicates intensive two season paddy cultivation in a year.

Sowing of paddy seeds advanced one month from June to May. Paddy transplanting, now, is done within a month and harvesting is completed within mid of November that was last earlier up to mid of December. The major change is two season crops (Paddy-Maize) to three season crops (Paddy-Maize-Paddy). Spring paddy sowing starts from February and harvesting is done till July end giving space for summer paddy transplanting. Maize sowing now is done from October to mid of December and harvests till end of February.

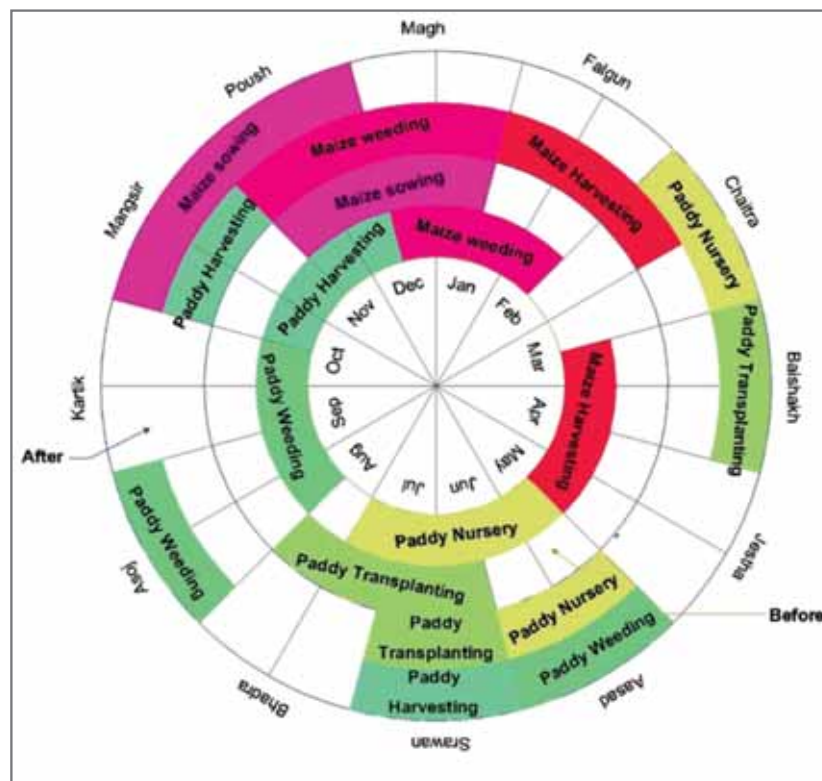


Figure 7.1 (b): Annual Crop Cycle, Patihani - 8, Chitwan



LOCAL GOVERNMENT TAKING THE LEAD IN DRR

The District Development Offices in Chitwan and Nawalparasi Districts have taken the lead in mainstreaming DRR into development planning, leading the process of identifying and prioritising VDCs and municipalities based on their vulnerability to existing hazards. The most vulnerable VDCs and municipalities were prioritised to further assess hazards and vulnerabilities and prepare local disaster management plans. VDC and DDC councils have endorsed the plans for implementation. Although the local governments have very limited resources to effectively implement the plans, VDCs have initiated the formation of DMCs and the provision of emergency funds. Both districts have implemented EWSs covering more than 125,000 people living along the banks of larger rivers.

Background

While national and international policies recognise the need for decentralised measures to prevent, prepare for, respond to and recover from disasters; this is yet to be reflected in practice due to the lack of necessary resources and skills. Many initiatives taken by different agencies are project based, in isolation and do not last beyond the life time of their projects. Practical Action and partners recognised the gap between vulnerable communities and the local authorities responsible for DRR. While the District Disaster Management Committee (DDMC) and the local VDCs and municipalities are mandated to manage local disasters, they lacked in institutional set up and plans that could link vulnerable communities to higher authorities. Plans and institutions at the VDC level were realised in the course of consultative discussions with the district authorities on how the ground level actions on DRR could

be institutionalised into the government's development planning process and linked to the national level policies and plans. A locally owned plan with set priorities of areas and actions could help all the actors to mutually coordinate actions where local bodies can lead the facilitation for implementation, activities carried out by different agencies can be institutionalised for longer impacts and duplications can be minimised.

While stakeholders could identify the areas at risk, based on past events and the presence of hazard sources, they lacked the systematic categorisation of risks. Local bodies, DDCs in particular, were unable to set priorities to take systematic actions to minimise disaster risks. In this context, the project agreed to support both DDCs to prioritise the most vulnerable local bodies and help them to prepare integrated plans that could be mainstreamed into development planning.

LOCAL GOVERNMENT TAKING THE LEAD IN DRR

The Process

The DDMCs in each district classified local vulnerabilities by identifying different elements which could be used to rank them in order of priority. This would allow the planning of specific DRR interventions to reduce these vulnerabilities. Task forces involving agencies working in the field of DRR, were formed in the leadership of district authorities. The task forces examined the situation existing in each local area (VDC) and prepared recommendations which categorised and prioritised the preparation of community based disaster management (CBDM) plans for each VDC/municipality. VDCs are the lowest level government institutions and provide the link between communities and local government decision makers. Strengthening VDCs and their links with vulnerable communities allows communities to truly

be part of the planning and implementation process.

Both districts cover hills, inner valleys and Tarai. Out of 36 VDCs and 2 municipalities in Chitwan, 9 VDCs fall in the hill region, while 2 municipalities and 27 VDCs fall in the inner Tarai. Similarly in Nawalparasi, there are 73 VDCs and one municipality of which 17 VDCs fall in the hill region, 20 VDCs fall in the inner Tarai and 36 VDCs and one municipality fall in the Tarai region. The locations and socio economic conditions have created different multiple hazard environments throughout the district. Different communities from various locations are vulnerable to multiple hazards and stresses. During the monsoon, many streams originating from the Siwalik and Mahabharat ranges which flow down to the Tarai are flooded. Hazards identified in the two districts are listed below.

Table 8.1 Hazards in the districts

Major hazards in Chitwan	Major hazards in Nawalparasi
Flood, landslide, wildlife intrusion, drought, road accident, fire, epidemic, strong wind and environmental pollution	Flood, landslide, fire, fog, wildlife intrusion, drought, wild fire, pest attack, strong wind, snake bite and hail

VDCs and municipalities were categorised into different categories such as most vulnerable, vulnerable, moderately vulnerable and less vulnerable to different

kinds of disasters, based on the frequency and scale of previously experienced losses. In Chitwan, an earlier study had categorised hazards into very high, high, medium, low

and very low. Following an assessment and review of existing documents, the VDCs in two districts were categorized as follows:

In Chitwan 22 VDCs were considered highly vulnerable, 9 VDCs and one municipality vulnerable and 5 VDCs and municipality low vulnerable.

Similarly in Nawalparasi District, 11 VDCs were considered highly vulnerable, 15 VDCs vulnerable, 21 VDCs moderately vulnerable and 27 VDCs and a municipality low vulnerable.

The DDMC in each district decided that DRR plans should be prepared for each VDC and municipality, prioritising those identified as most vulnerable. The project, having been engaged in the process of categorising the vulnerability of the district, was requested to help the DDCs to prepare the plans. Terms of Reference were agreed between the DDCs and the project, wherein the DDCs took the lead with technical and financial support provided by the project. In both districts the project's local partner organisations facilitated the planning process. In Chitwan the Non Government Organisations Coordination Committee (NGOCC) facilitated, while in Nawalparasi, the project partner Sahamati facilitated the planning process. A task group which included project staff and facilitators was formed under the leadership of DDC's

disaster focal person in each district. The overall planning process and the methodology have been documented and shared widely in English and Nepali language and are available at http://www.practicalaction.org/docs/region_nepal/practical-approaches-cbdm.pdf

The project invested NPR 731,890 (€7693) to prepare and publish the plans of 31 VDCs and one municipality in Chitwan and NPR 694,490 (€7310) to prepare the plans of 28 VDCs in Nawalparasi. A further NPR 180,000 (€1894) was contributed by the DDC and concerned VDCs in Nawalparasi to publish the plans. In both districts, the DDCs deployed dedicated disaster focal persons for the overall coordination of the process.

The planning process involved orientation workshops for VDC secretaries and VDC level stakeholders, the assessment of hazards, vulnerabilities and capacities, planning workshops, verification of plans and stakeholder consultations in each district.

Concepts introduced to VDC secretaries included the need for disaster management planning, the planning process and methodologies for planning. The task group and the respective VDCs and municipalities collected relevant information on existing and potential hazards, risks and

LOCAL GOVERNMENT TAKING THE LEAD IN DRR

vulnerabilities. Secondary information from literature, published documents and data available at DDCs were collected and analysed. Planning workshops were organised for each VDC/municipality. Participants included:

- VDC secretary and other staff
- Representatives of political parties in the VDC
- Village level Red Cross representative
- Representatives from forest committees, irrigation associations, buffer zone committees and CBOs in the VDC
- Representatives from women's groups and socially disadvantaged groups
- Representatives from vulnerable or disaster affected communities
- Representatives from relevant government agencies such as the police
- Persons having knowledge of DRR or relevant experience in the area with the potential to provide useful information in the planning process

During individual workshops, various tools were used to identify and prioritise existing and potential hazards. Root causes of the 3 most important hazards were identified and

the natural and socio economic drivers of vulnerability situated both within and outside the VDC were analysed. Draft plans, including both structural and non structural measures for prevention, mitigation, response and restoration were prepared. The draft plans were presented to VDC level stakeholders including the members of VDC council for verification and revision in response to their comments. The revised drafts were then presented at a district level stakeholder meeting prior to finalising the plan. Finally each VDC council endorsed the plans for inclusion in their development planning process. As a final step the DDC councils endorsed the VDC plans as part of the district plans.

The process resulted in the preparation of VDC level CBDM plans for 28 VDCs in Nawalparasi and 31 VDCs and one municipality in Chitwan. These plans can be accessed from the respective DDCs and VDCs. Practical Action has uploaded electronic copies of the plans in its web page based on the requests from the DDCs. They are available at http://practicalaction.org/nepal/region_nepal_disaster_climate.

Outcomes

CBDM plans have been prepared for all vulnerable communities in prioritised VDCs of both districts. This is a completely new

LOCAL GOVERNMENT TAKING THE LEAD IN DRR

initiative for disaster management practice in Nepal, which should serve as a model for nationwide adoption. Chitwan and Nawalparasi District authorities and Practical Action Nepal Office have used the success of this process to advocate this approach at the national level.

The plans include a range of structural and non structural measures, both short and long term with the objective of building the resilience capacities of the communities and stakeholders to multiple hazards. The activities include the improvement of livelihood assets; better and more sustainable natural resource management, structural measures, institutions, human and financial resources and policy improvement. Disaster resilient off farm livelihood options for particularly vulnerable groups, alternative livelihood option to minimise malpractices and building awareness for risk reduction culture are some of the strategies envisaged in the plans.

The plans are as specific as possible to the local environmental and socio economic context. Many activities and projects identified need external support from district and national authorities, such as relief from wildlife damages and international cooperation for problems in border areas. In Nawalparasi District, southern VDCs have identified the need for bi-lateral policy

dialogue between India and Nepal on issues related to inundation caused by the barrage on the border.

Both the VDCs and respective districts have endorsed the plans in their councils; effectively mainstreaming of DRR into development planning in their districts. In Nawalparasi all 28 VDCs have formed DMCs to implement their plans. Similarly, in Chitwan, 20 VDCs have formed DMCs for the same purpose. The formation of these DMCs in the VDCs has made the role of the DDMCs in disaster management easier. While the provision of resources for the implementation of these DRR plans is difficult, small allocations are already being made.

The VDC council discusses these disaster management plans during their annual planning meetings and supports planned activities according to the available budget and existing emergencies. In Chitwan eight VDC level DMCs have an allocated emergency fund. At district level, the plan as a whole is considered as a guide for assessing the district situation. The documented plan plays an important role in describing the district's situation. This is particularly relevant at present, when government officials are frequently transferred to new areas. In Nawalparasi, VDCs have also initiated the establishment of an emergency fund. The

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DMCs meet from time to time to assess the situation and also participate at pre monsoon workshops to prepare for monsoon floods, as per the plan.

The initiatives of DDCs in preparing these plans have influenced approaches to disaster management in the country. Other agencies working in the field of DRR have initiated similar practices in other districts. The Ministry of Local Development (MoLD) is in the process of formulating guidelines for the development of similar plans and the integration of DRR into local development planning.

This project initiative has potentially changed the national approach to DRR; emphasising the importance of DRR as an integral component of development. Credit goes to the officials in the DDCs and other stakeholders at district and VDC level for their commitment to institutionalise the approach.

There are, however, limitations to the implementation of local plans. They require huge resources and cooperation among various stakeholders. VDCs and the districts have limited resources to invest.



Training on community based disaster management for VDC Secretaries



OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

Agricultural livelihoods in the project area are dependent on the weather and climate sensitive to the weather induced hazards. Available options and opportunities were explored as diversifying livelihoods for the community members. Participants were chosen based on their interests and potential. Initiatives and enterprises on off farm have improved employment and income status of the families involved. A few individuals among supported have shown good results as the market factors largely dominated the off farm options.

Background

The livelihoods of most rural communities are based almost exclusively on agriculture, including livestock. Where off farm opportunities exist, they are supplementary. But diversification of income earning opportunities is a proven strategy, reducing exposure to disaster risks while increasing resilience. Off farm skill based enterprises are generally less sensitive to existing hazards, particularly weather related hazards.

Nationwide trend for youths to migrate to India and other countries in search of work in order to send money back home is equally prevalent in the project areas. While remittances provide income for families, the reduced availability of young labour adds to the work load of parents, next of kin and particularly women.

The project explored opportunities and interests of people in the target communities to identify

non agricultural income generating opportunities. While considerable time and effort was expended in identifying such opportunities, comparatively little interest was displayed by the target communities. Some of the interventions eventually chosen are still related to agriculture and animal husbandry. However, a few ideas have been taken up by more entrepreneurial individuals with positive results. This chapter documents these interventions, some of which are still in their infancy and yet to show sustainable positive outcomes.

The process

Off farm activities were explored and selected based on available opportunities and the interests of community members. Efforts were made to create awareness of available opportunities and to persuade people to see their potential. The communities were consulted during the selection of candidates for training in order to ensure that

OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

those selected were confident and sufficiently committed to implementing their newly acquired skills. Although the project hoped to encourage a larger number of people and larger scale enterprises, few people were willing to take up the opportunities offered. Women expressed an interest in using

their daily free time productively for candle making. Some members in Kumsot were interested in generating income using local bamboos to make stools whereas youths were interested in technical skill based training. In most instances, the training were outsourced to different specialised institutions.

Table 9.1 Training on off farm and service income

SN	Trainings	Beneficiaries	Remarks
1	Electrical training (house wiring, rural electrification) - 15 months	3 Male from Bote Tole, Pragatinagar VDC	CTEVT certified
2	Candle making training - 3 days	43 (42 female and 1 male) - 17 Bote tole, Pragatinagar - 14 Mirtung, Divyapuri - 12 Golaghat, Meghauli	
3	Mobile phone repairing training - 3 months	2 Males from Bote community (Pragatinagar)	
4	Electric motor repairing training - 3 months	1 person from Meghauli	
5	Village Animal Health Worker Training - 35 days	3 Male (1 from Chitwan and 2 from Nawalparasi)	CTEVT certified
6	Agriculture technician training- 35 days	3 Male (1 from Chitwan and 2 from Nawalparasi)	CTEVT certified
7	Sitting stool making training - 8 days	10 persons (Kumsot, Devchuli)	

Table 9.2 Input support for off farm income promotion

SN	Input support	Beneficiaries	Remarks
1	9 candle making dyes - set of 3 to each of 3 groups	17 BoteTol, Pragatinagar 14 Mirtung, Divyapuri 12 Golaghat, Meghauli	
2	Machinery and tools for sculpture making	1 Bote Tol, Pragatinagar	
3	Castrator and medicine to each trainee	3 (1 in each Meghauli, Patihani & Devchuli)	
4	Weighing equipment, storage baskets	Communities from Baulaha Khola watershed	

OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

The initiatives

Training

The project provided training and input support to individuals selected by different community groups. Some training were provided provision for community services while some helped create

Input support

Trainees also received sufficient inputs to initiate their trade/skill. Some community members were found to already possess skills which they had been unable to utilise due to inadequate resources. Appropriate support was provided to these members. Table 9.2 describes the material support provided.

Market promotion

Support was provided to individuals and groups to identify and connect with market opportunities. Govinda Bote (box 9.2) has opened a shop at the Daldale market. Trained service providers were introduced to the communities they wish to serve. Some of them sell seeds and agricultural inputs, while animal health workers are engaged in castrating and other primary health care, charging a small sum for their services.

Following a value chain analysis and a fair trade workshop, vegetable producers in the Baulaha Khola watershed organised themselves and opened a vegetable shop at Daldale in 2009. As shown in the table, weighing equipment and storage baskets were provided to the shop. The shop ran well for 5 months, but during the rainy season, when local vegetable production reduced, the shop ran at a loss and was closed. Thereafter, some farmers started collecting vegetables from several villages for sale in the local markets. Over the next year this helped to provide an on going outlet for locally produced vegetables. Now there are new individual shops which buy vegetables from farmers for sale to bigger market centres.

Community groups in Meghauri were supported to set up a stall in a business fair where they sold locally prepared straw and thatch grass mats, pickles made of pulam fruits and processed dried vegetables. The stall also demonstrated early warning and rescue tools and messages were disseminated to raise awareness on DRR. Linkages have been established between these farmers and vegetable whole sellers in the district head quarter markets. Access and linkages to the market has improved following these initiatives.

OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

Box 9.1: Dhan happy with his work

Dhan Bahadur BK (Bishwakarma) is a resident of Bote Tole in Pragatinagar, Nawalparasi. He comes from a marginalised caste. The 22 year old has 9 members in his family and they own a total of 0.26 hectare of land for cultivation. His parents who are old have to do laborious work to accumulate food and income to fulfil their HH needs. Their problems are further aggravated by flood, drought and wildlife intrusion that decreases production in their small piece of land. His father has in the past temporarily migrated to India temporarily in search of work. His mother and other family members work as day labourers, sieving sand and gravel in the river. Dhan left secondary school in order to support his family. He had received basic house

wiring training for 3 months from a NGO, but was unable to get a job.

Dhan received 15 months long electrical training equivalent to national certificate standard. He was supported 75 per cent of the total training cost. He completed the training in February 2009 which is a sub-overseer level. After the completion of his training, he was offered house and small scale industry wiring contracts. He reported that he has completed the wiring of 8 houses during the last 9 months. He also employs 1 to 2 additional people from his own community. He has established links with electricity shops from which he gets work offers and buys supplies. Dhan is now able to support his family as he earns a good income. His source of income is not directly sensitive to existing hazards-flood, drought and wildlife intrusion.



OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

Similarly, candle groups have been linked to local markets both for the purchase of raw materials and for the sale of their products. Candle makers were accompanied to markets, where they were familiarised with the quality and cost of raw materials. At the same time linkages were established with market retailers to sell their candles.

Outcomes

Women in Mirtung, Bote Tole and Megghauli are utilising their leisure time to earn additional income by producing candles for sale. Although it is not financially very lucrative and they face market competition, it has become a useful option as power cuts occur for up to 18 hours a day. This has increased the demand for candles. In Megghauli women have organised themselves as "Sangam Candle Group" and are labelling their products with this trade name.

One of those who trained as an electrical technician is now employed in an industry near to his home while another trainee has been working in house wiring. Since completing his training he has been contracted to wire 8 houses within a span of 9 months, earning NPR 90,000 (€947) in this period (box 9.1). The third electrical trainee, realising the importance of education, has returned to school. He still

does house wiring when school is closed to earn money to pay for his stationery.

Mr. Shree Prasad Dawadi, one of the facilitators in the CBDM planning process, has been employed with different organisations to prepare similar plans in other districts in Nepal.

One outstanding participant from the candle making training has herself become a trainer. She has already independently conducted three training in different locations. This has provided her with additional income in addition to social status and recognition. One of the VAHW has opened a small shop in Megghauli village. He provides dung check ups and treatment for external and internal parasites in livestock (Box 9.3). The other VAHW in Kirtipur, Nawalparasi visits home sheds in neighbouring villages, providing castration and other simple treatment services.

One of the LRPs on agriculture provides free technical advice to farmers while selling seeds, fertilisers, micronutrients and pesticides/insecticides. The other two agriculture resource persons are inactive.

One of the mobile phone repairing trainees is working in an electrical shop, while the other has moved to India to explore further opportunities.

OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

Box 9.2: Govinda now exports his art

Govinda Bote (32) lives in Bote Tole in Pragatinagar on the banks of Baulaha Khola. He has two children and his wife is an agricultural worker. Botes are an ethnic minority in Nepal, whose traditional occupation of ferrying people across the river and fishing has been jeopardised due to the development of infrastructure (bridges and culverts) and decreasing number of fishes in the rivers. Govinda and his family own one third of a hectare of land which can barely provide food for 6 months.

Govinda was interested in preparing idols and sculptures since he was a smallchild and always wanted to join art school. Lack of funds meant he was unable to do so and he dropped out of school without completing grade 10. While working for Lumbini Handicraft Industry as a labourer, he learned how to carve stones and woods earning NPR 4,800 (€50) per month. He left his job to initiate his own business. Unfortunately,

without the correct tools and equipment his business did not flourish; he barely earned NPR 5,000 (€52) per month.

Govinda was supported with tools worth NPR 10,000 (€105) by the project and linkages were formed with local and national buyers. His business has flourished since then. His business now earns him NPR 12,000 (€126) to 25,000 (€263) per month with a total earning of over NPR 120,000 (€1,263) in 6 months. He has been commissioned to carve doors and windows and in November 2010 he received an order for 700 pieces of hand crafted merchandise from a Kathmandu based handicraft exporter who is furthermore interested to buy his artefacts in the future too.

Govinda now employs his relative to assist him to meet the demands of his handicrafts. His home expenses are now affordable and he is sending one of his children to attend an English medium school and has future savings too.



OFF-FARM INCOME OPTIONS LESS SENSITIVE TO HAZARDS

Box 9.3: Anil Kumal has wider recognition

In 2008, Anil Kumal (31) was selected for village animal health worker (VAHW) training at the district headquarters' training centre.

After completing the training, Anil is working as a local resource person providing services to farmers in Megghauli. He has opened a small veterinary medicine shop in the local market. He checks on the condition of 30 - 40 animals each month in and around the project area. He also carries out livestock castrations. Anil has good links with the government's

livestock service centre in the area. He collects dung for testing and refers complex cases to the service centre.

He is now regarded as a 'veterinary doctor'. In addition to being a source of income, Anil's role in the society has increased his social status and recognition compared to the past. This has encouraged him to expand his work to include agricultural seeds as well. The project has provided training and linked him to the agriculture service centre and agro vets. His knowledge on varieties of seeds has allowed him to add cereal and vegetable seeds to his shop.





10

PROMOTING NATURAL AND PHYSICAL PROTECTION

Initiatives to strengthen natural resources for physical protection and buffering against the impact of hazards have had variable results. Physical infrastructures such as spillways and dykes in big rivers where huge investments would be required for long periods were beyond the scope of the project. Many initiatives required community's long term commitment for the maintenance of common property resources. While some visible successes have been achieved, long term objectives are yet to be met and may take several more years to show results.

Background

Project sites include seasonal and perennial rivers and streams, well stocked forests and productive lands, all of which have the potential to provide natural defences against prevailing hazards. The livelihoods of communities are dependent on these resources. Sub-surface springs provide water for drinking and domestic use, while rivers are the major source of water for both drinking and irrigation. In the absence of usable surface water sources, underground aquifers provide a resource that can be pumped to the surface for utilisation. Forests provide a source innumerable products and services and are an indispensable part of the ecosystem.

A healthy ecosystem provides natural defence and acts as a buffer against many hazards, whereas a degraded ecosystem can be a hazard in itself. Forests, particularly on hill slopes are frequently degraded as a result of shifting cultivation, over grazing, exploitive harvesting practices and lack of protection.

Environmental degradation enhances drought, landslides and flash-flooding (See chapter 1). Many hazards are exacerbated by the degradation of the natural environment due to poor resource management, unplanned development activities such as excessive quarrying in the river beds and banks, and unplanned settlements and infrastructures. This chapter describes efforts to reverse some of these trends by strengthening natural resources.

Project activities have attempted to help communities to reduce the impact of hazards while increasing their coping ability. While an integrated watershed management approach has been adopted in Baulaha khola, it has not been possible to embrace the whole watersheds in Chitwan as both Meghauri and Patihani lie along the banks of two major rivers which have huge catchment areas, draining thousands of square kilometres of high mountains. Nonetheless, attempts to adopt similar ecological principles have been followed in Tarai.

Project initiatives

Various structural and non structural measures to control degradation and restore the strength of natural resources were introduced in both the upstream and downstream parts of the Baulaha Khola watershed. These have included the improvement of spillways by establishing and strengthening embankments, construction of check dams and dykes, establishing plantations in degraded hills and flood plains, institutionalising community forestry, and introducing alternative livelihoods options for income generation to reduce pressure on forest resources. A number of training, exposure visits and awareness raising campaigns were conducted with community groups in collaboration with CBOs, government agencies and other stakeholders. Efforts were made to institutionalise these initiatives through local institutions for their sustainable management.

Plantation

In order to reduce damaging practices such as uncontrolled grazing and the lopping of trees for fodder, seedlings of fruit and fodder trees were distributed to individual HHs. Seedlings of different multipurpose forest species were planted on river banks, degraded community lands and land that had been degraded by slash and burn agriculture practice. Pineapples and broom grass, along with different fodder plants, were planted on areas where shifting cultivation had taken place, following the principles of sloping land agricultural techniques (SALT). A total of 9875 seedlings were planted in Nawalparasi and 2000 in Chitwan.

The number of plants of different species is depicted in table 10.1 below.

Table 10.1 Seedlings planted in the project area

SN	Seedlings	Quantity	SN	Seedlings	Quantity
1	Bamboo rhizomes	3289	10	Litchi grafts	360
2	Badahar seedlings	1291	11	Lemon grafts	1230
3	Tanki seedlings	390	12	Jack fruit seedlings	120
4	Siris seedlings	320	13	Amala seedlings	100
5	Beta seedlings	300	14	Nimaro seedlings	100
6	Simal seedlings	200	15	Mendola seedlings	135
7	Jamun seedlings	151	17	Khayar seedlings	1500
8	Bakaino seedlings	1470	18	Barro seedlings	500
9	Mango grafts	419	Total		11875

Plantation activities were carried out in collaboration with different community groups, forest management committees and District Forest Offices (DFOs). In many instances DFOs provided seedlings. Bamboo rhizomes were purchased and local community groups carried out the planting.

These plants were planted in different locations and distributed to different HHs. Pineapples and fruits were introduced in shifting cultivation areas as SALT with the long term objective of restoring degraded hill slopes while increasing the income of families in the upstream communities. In 2008, 6000 pineapple crowns were planted on communal lands; 700 crowns were of improved queen variety and the other 5300 crowns were of local variety. Encouraged by the successful growth of these crowns, farmers planted 19400 (10,000 improved queen variety) crowns. (50 per cent of the cost of these was funded by the project). Unfortunately, the latter pineapple plantation was badly affected by damp weather due to frequent rainfall after planting and only about 50 per cent of the plants survived and is maturing as expected.

More than 700 culms of broom grass were planted on 0.7 hectares of shifting cultivation hill slopes of Kirtipur. Similarly, the Bote communities planted more than 200 broom grass culms along the downstream embankments. Bamboos were planted in 1 meter cube pits filled with "brought-in"

topsoil along the downstream river bank of the Baulaha khola. Unfortunately, intensive drought during the first year after planting led to the destruction of half the newly planted bamboo rhizomes. Similarly, the plantation in Meghauli in Chitwan was not sufficiently well established in its second year to withstand the flooded Narayani River. It was washed away.

Although the establishment of new plantations has not been a total success, for various reasons, these initiatives have contributed to the restoration of degraded lands as the banning of grazing in these sites has allowed substantial natural regeneration which is contributing to the stabilisation of the previously barren lands.

Dam Protection: In early 2008 a 1.5km long banks (both side) of Baulaha Khola were reinforced by a 3m high and 2.5m wide earthen dams. In 2009, a 500m long spillway was excavated further downstream to improve drainage. Gabion boxes were laid at strategic locations and bamboos and broom grass were planted on both sides of the dam to further strengthen it. The dam protects over 100 hectares of agriculture land shared by more than 200 HHs. The total cost of NPR 528,000 (€5557) was shared by the Baulaha Khola Conservation Committee, VDCs and DDC, with the project contributing NPR 220,000 (€2315). In 2009 the river damaged approximately 80 meters of the dam on the Pragatinagar VDC side. The VDC invested NPR 54000

PROMOTING NATURAL AND PHYSICAL PROTECTION

(€568) to rehabilitate the damaged area and have continued to repair and maintain the dam.

Check dams and dykes: The project supported the construction of check dams and dykes which were carried out through multi stakeholder partnerships involving the respective DDCs and VDCs and the community groups. In the foothills, check dams and dykes (made of 1m*1m*3m of gabion boxes) were constructed at 5 locations along the banks of Baulaha Khola. The construction have protected around 20 hectare of irrigated terraces on both banks. While the project supplied the gabion boxes and skilled labour, the community contributed transport and labour for stone collection and construction.

The project also supported the construction of dykes in Megghauli and Patihani in Chitwan. NPR 25,000 (€263) was spent on transporting stones to construct a dyke at the Rapti River. Rest of the cost of this substantial dyke (10 meter long, 4 meter wide at base and 5 meter high) was supported by DDC. These dykes deflect flood waters, protecting the houses and agricultural land of more than 47 families in Simalgairi. Similarly in Megghauli, the project provided NPR 32,000 (€336) to complete the dyke in Rapti River. In both sites community members undertook the physical construction of the dykes.

Training and awareness raising activities: Training and awareness raising activities on forest conservation and management were organised in coordination with existing community forests user groups, VDCs, DFOs, and District Soil Conservation Office (DSCO).

Several training events on watershed management were conducted. In Nawalparasi 25 participants from both upstream and downstream communities participated in 3 days training delivered by resource persons from the DFO and the DSCO. Topics included the effects of upstream activities on downstream communities, structural and non structural techniques of landslide and flood management, and the importance of mutual cooperation between upstream and downstream communities for effective watershed management. The participants acquired knowledge on the selection of species for plantations under different agro-ecological conditions. Twenty three participants were trained over 5 days on nursery management by the DSO and project staff. Two farmers were subsequently supported to establish tree nurseries, one at upstream and the other at downstream.

Training on the adverse impacts of shifting cultivation was conducted over 3 days. Thirty two participants from different upstream villages in Nawalparasi learned about the negative impacts of shifting

cultivation and how it can be reduced by the adoption of SALT. The training was facilitated by the DSO officer. Good practices

for controlling soil erosion in steep slopes and ways for reclaiming degraded land were included in the training

Table 10.2 Forest and watershed management training

SN	Training	Participants	
		Male	Female
1	Watershed management training	16	9
2	Nursery management training	13	10
3	Training on adverse effects of shifting cultivation	21	11

Besides acquiring technical knowledge, these training were instrumental in harmonising upstream and downstream efforts for conservation and DRR.

Institutionalisation of community forest user group: Two community forests totalling 363 hectares were established in the upstream area. The forests were registered with the DFO and their operational plans have been approved. Project and partner staffs were instrumental in raising community awareness on the provisions of

community forestry, supporting the preparation of their constitutions as per the provisions of the Forest Act and surveying and documenting the forests and user HHs. One hundred and nineteen HHs are registered users of these forests. A series of meetings and workshops were organised to discuss and finalise the constitution and operational plans of the community groups, each of which has an elected executive committee. One of the community forests is completely led by women as shown in table 10.3 below.

Table 10.3 Community Forest User Groups (CFUGs)

SN	CFUGs	Executive Members		Area (hectare)	Registered Year
		Male	Female		
1	Srijana CFUGs	7	4	199	2009
2	Tinkanya Mai Women CFUGs	0	9	164	2010



Community members prepare land for planting saplings to prevent landslide

Besides these newly registered community forests, there are already established CFUGs in the downstream areas of the Baulaha Khola in Chitwan. These activities are were supported with training and tree planting.

Biogas installation: In an attempt to reduce demands for fuel wood and the consequent degradation of forest resources, in 2008, 8 demonstration biogas plants for improved cook stoves were supported in different villages in the upstream and foothills. The project supported 20 per cent of the cost of each plant, a government subsidy provided

a further 25 per cent and the rest was born by the owner. These plants have multiple benefits which are - improved human health, forest conservation, increased energy efficiency, reduced fuel costs and less environmental pollution. The bio-digesters also encourage farmers to stall feed their livestock (using the dung to fuel the digester), thereby reducing grazing in the hill slopes. Although uptake of the technology has been slower than anticipated, several families in Kumsot village have initiated the construction of biogas plants in 2010.

Outcomes

These initiatives with the long term objective of strengthening natural protection systems are yet to show their full potential. Some plantations have faced high mortality and damage rates and parts of embankments have been damaged that needs repair. But, communities in Kirtipur have reduced their dependence on shifting cultivation; grazing is controlled in critical micro watersheds and degraded hills are now in the process of restoration. Some families have initiated stall feeding practices and are growing fodder in terraces. Interest in fruits and broom grass plantation has increased. All these initiatives are reducing harmful pressures on forests and natural protection systems.

Reinforcement and improvement of the embankment dam has restored the arable land of 33 indigenous Bote families. The dam requires further strengthening for long term durability. The improvements have

increased the food security of the community - they have been able to harvest 70 quintals of paddy each year from the reclaimed land. While the extraction of sand and gravel from the river bed threatens to weaken the embankments, efforts to minimise the extraction of aggregates (stone, gravel, sand) is a challenging and ongoing task. The industry earns huge incomes for an elite group who have so far defied state legislation.

Many initiatives described above have improved natural defenses and their buffering of hazards. At the same time they have provided new or improved resources and opportunities on which the livelihoods of communities are dependent. In order to achieve maximum and long term goal to reduce exposure to hazards, communities need to continue with these initiatives. The restoration and maturation of natural systems takes time.



INSTITUTIONAL DEVELOPMENT AND LINKAGES: THE SOCIAL CAPITAL FOR SUSTAINABILITY

Institutional development at community and VDC level has enhanced sustainability and resilience capacity of the communities and stakeholders. Linkages with networks and service providers through formal registration and memberships has provided legal strength to the organised institutions and better access to technical advice, funding support and material inputs. Improvement in governance and management capacities of the community level institutions is still necessary as dynamic social processes change with time.

Background

Recognising that institutions and interconnected networks are important social assets in DRR and resilience building, particularly with respect to the initiatives' sustainability, the project has assisted communities and stakeholders in its formation, institutionalisation and strengthening of community groups, interest based groups, organisations and networks in the project areas. Linking community based institutions to respective government agencies provides long term benefits for technical advice and material inputs in addition to social strength and cohesiveness. The role and outcomes of such interventions have been mentioned in earlier chapters. This chapter documents different institutions and networks.

Project intervention

The project supported communities to organise into different groups based on their livelihoods, resources on which their livelihoods are dependent and the social and economic opportunities from which

they derive benefit. Twenty three farmers groups, consisting of 16-35 members have been formed involving more than 535 HHs (table 11.1). Roles, such as Chair, Treasurer, Secretary, and General member are defined and operational rules developed and documented. Twenty one groups are registered with their respective DADO. Each group has an identifiable name and logo. Two groups from Patihani are yet to be registered.

Group management, account and book keeping, and leadership development training have been provided to group members. Training included conflict mitigation and management, meeting conduction, decision documentation and monitoring. Project staff facilitated and observed the dynamics of meetings and the activities of groups for over two years to assess their self reliance and effectiveness. The groups have also begun saving and credit schemes for their members.

Material inputs to the groups have included minute registers, letter heads and other stationeries (staplers, scales, scissors, stamp and stamp pad and a box to store group

INSTITUTIONAL DEVELOPMENT AND LINKAGES : THE SOCIAL CAPITAL FOR SUSTAINABILITY

belongings). Each group meets every month to discuss current issues on crops and other livelihood issues as well as for savings and credit transactions.

In addition to agricultural groups, user groups and groups based on common property resources also exist. Thus CFUG, irrigation groups and enterprise groups (such as cooperative groups) involve a large proportion of the targeted population.

Irrigation groups are registered to the respective Division Irrigation Offices (DIO) and DDC, CFUG are registered to DFO and Cooperatives has been registered to Division Cooperative Office (DCO) in line with the legal provisions of Nepal. All these groups are supported in building their constitutions and organisational capacities. Some of these groups have made provisions for and allocated funds to support people affected by disasters.

Table 11.1 Institutions in the project area

SN	Institutions	No	Membership		Total HH	Status
			Male	Female		
	Nawalparasi					
1	Agriculture groups	14	167	203	370	Registered at DADO
2	CFUGs	2	530	570	119	Registered at DFO
3	Cooperative	1			137	Registered at DCO
4	Irrigation user groups	3	NA	NA	505	Registered at DDC/DIO
5	(channels)					
6	VDC level DMCs	28	Vary	Vary	NA	VDC wings
7	Chitwan					
8	Agriculture groups	9	136	74	210	7 registered and 2 linked to DADO
9	VDC level DMCs	16	Vary	Vary	NA	VDC wings

Note: 13 agriculture groups manage shallow tube wells for irrigation

The project has supported the DDCs and VDCs in two districts in formation of VDC level DMCs. As of November end, 2010 there are DMCs in 28 VDCs in Nawalparasi and 16 VDCs in Chitwan District. These DMCs comprise of following members:

These committees are mandatory under the Disaster Management Act and Local Self Governance Act of Nepal and bring together

a range of stakeholders. Different task groups can be formed under the DMC as needed. The project has supported the formation of these groups in 5 VDCs and has provided intensive CBDM training to the DMC members. In addition, all the VDC secretaries in both districts were provided with CBDM training where they were introduced to concepts and practical approaches to DRR.

District level flood early warning systems have been set up for major rivers in both districts and the relevant DMCs are linked to the system. The DMCs get support from district level agencies, in particular the DDMC and DDC. The VDCs have prepared disaster management plans which will be implemented with DMC facilitation. Some DMCs have established emergency funds for disaster management.

Outcomes

Linking community institutions with their respective government agencies has enhanced their sustainability and increased their resilience. They are able to access

technical advice, training and material support to improve the initiatives supported by the project. Collaboration with other agencies such as the Buffer Zone User Committee has been improved. In Nawalparasi, Kadampur irrigation group received funding support (NPR 60,000 (€631) to upgrade the existing water harvesting pond from the DADO. Similarly Gaidi irrigation group received funds to extend their irrigation channel (Box 11.1).

Groups in the upstream received seedlings of fruit trees and gabion wire boxes to construct check dams from the DSCO. Many groups sent members for training and exposure visits organised by the agencies with which they are registered.

Table 11.2 List of VDC level DMC members

SN			
1	Chair person of the VDC	Chair	1
2	Representative from ward Chairs (or political party rep)	Member	3
3	Representative from women members in the VDC	Member	2
4	Ward Chairs of vulnerable wards(or political party rep)	Member	n
5	Representatives from wardmembers (1 women)	Member	2
6	Representative of Police Office (in the VDC or nearest)	Member	1
7	Representative of Health Office(in the VDC or nearest)	Member	1
8	Representative of other government line offices (--do--)	Member	n
9	Representative of appropriate NGOs/CBO in the VDC	Member	2
10	Appropriate individuals including 1 women	Member	2
11	Representative of Army Barrack (in the VDC or nearest)	Member	1
12	Representative of Nepal Red Cross (--do--)	Member	1
13	Representative of vulnerable communities (1 women)	Member	3
14	Secretary of the VDC	Member Secretary	1

INSTITUTIONAL DEVELOPMENT AND LINKAGES : THE SOCIAL CAPITAL FOR SUSTAINABILITY

Institutionalisation of the DMCs in the VDCs have decentralised DRR efforts to community level and linked communities to district level authorities. Relief and compensations as per legal provisions can now be received in the VDCs. Previously those affected had to go to the District Authorities. District Authorities have also received support for preparedness and response as VDC level institutions are mobilised for preparedness and response during disaster events (box 11.2). The DMCs are at the front to respond to disasters. For example, during flooding Gardi and Baghauda VDCs in Chitwan DDMC mobilised the VDC level DMCs to manage

the situation as it was not possible for outsiders to go to the area due to blockage of access by the flood and bad weather. The DMCs also collected information such as the number of victims, total houses destroyed, and total land area damaged which was sent to the DDMC. The DMCs were also mobilised for relief material distribution. Different sub committees and task groups were formed as per the response plan and necessary actions for proper coordination. The DDMC coordinated external support and handed over the relief materials to the DMCs. Institutionalisation of the DMCs at national level will make a difference to disaster management in practice.

Box 11.1: Additional funding to Gaidi irrigation scheme

More than 160 HHs in Gaidi village of Pragatinagar VDC, Nawalparasi District contributed to the reconstruction of the irrigation channel to improve water availability during the dry season (November to May). The project provided initial financial support and encouraged the group to organise resources from other sources for improvement of the channel. All the users of the scheme organized themselves into a User Group to prepare the constitution and operational plan for the irrigation channel. The group registered themselves and the irrigation channel with the respective DIO in 2009. In 2010, the group received NPR 200,000

(€2,100) from the DIO to extend the channel further by 360 meters. The DIO has also agreed to provide additional NPR 500,000 (€5263) in 2011 to coat the channel with concrete to stop seepage along the channel (about 2 KM).

An executive committee implements the annual plan and enforces the rules such as turn by turn practice of irrigation in the dry season. There is a levy based on the area irrigated that provides an operational and maintenance fund.

Similar institutions have been prepared and implemented in Kirtipur and Kadampur where communities have sustainable practices and better linkages with government agencies and stakeholders.

Box 11.2: DMCs in Action

On the afternoon of August 23, 2010 the flood level of the Narayani River passed the warning level (6.8 meter) at Devghat station of Department of Hydrology and Meteorology (DHM), putting the people of downstream banks at risk. The gauge reader informed the Chief District Officer - Chairperson of DDMC Chitwan District and Information Officer-the disaster focal person at DDC following the established early warning channels.

On receiving the information, the DDMC and early warning sub committee mobilised the identified information channels and passed the warning message to the VDC level DMCs in the vulnerable areas and informed communities through local FM radios. The DMCs actively responded to the warning by informing people in the vulnerable settlements. Local police and DMC members in Megghauli, the most vulnerable along the bank, quickly visited the settlements on the bank of the Narayani River.

The flood level was monitored in Devghat. Selected community members watched the river banks till late night until they got information from the upstream gauge reader on the decreasing flood level. The flood level rose again in the morning of August 24 in the same river.

Even though the flood level was increasing people living at the banks of the river were calm as they knew they would get early

warning and they had enough time to pack and leave. The security and calmness in this community is due to the data available from the DHM. The DHM has a SMS update system which automatically reaches to the Chairperson of DDMC.

The message was delivered to DMCs in 8 vulnerable VDCs along the bank of Rapti and to the communities through FM radios and telephone networks. DMCs and communities in Sauraha (mostly hotel and lodge holders) in Bachauli VDC, moved their movable assets to safety by 8 AM as they received repeated warning. After one hour and-a-half later Bachauli was inundated. The early warnings helped communities and hoteliers in particular to secure their assets. Similar stories were repeated in other VDCs along the downstream banks of both the Narayani and Rapti Rivers.

The local level institutional arrangement such as the VDC level DMCs; have become instrumental in preparedness and responding to the disaster risks; providing vital support to the DDRC in Chitwan. In a different event in Madi, these DMCs mobilised themselves, providing rescue and relief management, making the DDRC's efforts more effective while ensuring that the whole territory was effectively covered.

(Source: Nepal Floods and Landslides Situation Report, Issue No. 02, 06 September 2010. UN OCHA Humanitarian Support Unit, UN RC / HC Office)



12

CONCLUSION

1. Summary of activities and outcomes

Increasing incomes, food security and livelihood options of vulnerable rural communities has significantly improved their ability to cope with the impacts of prevailing future hazards, shocks, and stresses. Access to appropriate knowledge and skills, coupled with the optimal and sustainable use of water, forest and land resources has increased the resilience of targeted communities. Community cohesion and the development of effective local institutions have created strong linkages between the markets and local service providers. The government personnel have contributed considerably to the long term sustainability of new and improved, and diverse livelihood strategies.

The trained village agriculture and animal health workers have continued to retain their skills by providing their services to the community. Innovative livelihood options such as vegetable growing, candle making, and bee keeping have reduced the human led activity pressure on natural resources. New livelihood options provide reliable sources of income too. Alternative off farm enterprises such as electrical wiring, mobile phone repairing and, sculpting have been successfully adopted as income earning opportunities.

The partnership between the communities, local development organisations, and local government bodies has demonstrated that the livelihood centred approach to DRR

increases the beneficiaries' resilience while improving their well being. It also reduces the negative impacts on natural resources on which they depend.

Both structural and institutional capacities have contributed to DRR in various ways;

- by reducing hazard strengths
- by reducing sensitivity to existing hazards and,
- by increasing resilience capacities of the vulnerable communities

Although the project focused on 718 HHs only, adjoining target areas have benefited too. Activities such as CBDM planning, EWS, electric fencing, and watershed conservation have positively impacted the wider geographical area. Lessons learned is shared and disseminated to various stakeholders through publications and exchange visits both within and outside areas of the intervention.

Twenty one farmers' groups are registered to their respective DADO. Three water source user groups (irrigation groups) are registered to their respective DIO and DDC and two CFUG are registered to DFO. A cooperative that provides banking services to over 130 families is registered with the Divisional Cooperative Office. Community members have joined 6 local cooperatives which have been strengthened through training and orientation. Formal linkages with government agencies and institutions provide opportunities for communities to

access resources and technical support for on going improvement of their enterprises. This contributes to the sustainability of community initiatives, while providing legitimate legal authority to manage and use existing natural resources.

People who received skills and knowledge from the project are now serving as LRPs. For example, Sree Prasad Dawadi, who learnt the process of VDC level DRR planning, is now working as a facilitator in two districts of eastern Nepal commissioned by another development organisation. One woman who learnt the skills of candle making is now providing training to other groups within and outside the district.

2. Issues and lessons

The traditional focus of the government and other organisations the past has been on rescue and relief operations in regards to large scale disaster events. While large scale one-off hazards can wreak havoc on the lives and livelihoods of poor people, recurring small scale stresses and shocks are often even more destructive, gradually eroding peoples' ability to cope and recover. A succession of small events can eventually drive a family from a state of precarious poverty to one of destitution. These events are often exacerbated by underlying socio economic factors over which communities have little control. More often, they are the result of exploitive malpractices which undermine natural regulatory systems - such

as the deforestation of hillsides leading to flash flood, erosion, and landslides. As such, disasters must be seen as the result of development failings, frequently fuelled by ignorance. Experience from this project show that when people are aware and have access to appropriate knowledge and skills, they are keen to embrace solutions which have long term positive outcomes. Increased income, improved well being and sustainable food security are long term goals of even the poorest and most disadvantaged. Thus secure and sustainable livelihoods are a key component of DRR.

A challenge and an opportunity for the project were to create a common understanding among different political ideologies with the need to view disasters in a different light. Instead of seeing disasters as "natural "or "acts of god" over which helpless victims had no control, there was a need to convince sceptical stakeholders that the scale of disasters was correlated with the vulnerability of those affected. A range of discussions, training, workshops, and exposure between vulnerable communities, government line agencies, development organisations, and political party representatives helped to establish a common understanding of hazards, vulnerabilities and their consequences. This seismic shift in understanding has helped to create integrated and cooperative actions from different stakeholders in DRR. Although the pace of change has been slow, the new paradigm in DRR is now firmly rooted in local policy and practice.

Emerging issues include the need for communities to take account of the increasing uncertainty brought about by the impacts of climate change. Besides changes in rainfall, temperatures and other meteorological phenomena, previously unknown diseases and pest are likely to be problematic. Well established links with service providers and access to knowledge will be crucial in helping communities adapt to new challenges.

It was clearly demonstrated that on going access to resources is important for the maintenance of new technologies and the implementation of community based plans. Access to knowledge is in many instances the most important and influential asset. While the community planning process has resulted in the formulation of plans that target development initiatives which increase resilience, the planning process has raised the expectations of the community. Failure to implement any part of these plans will lead to disillusionment, cynicism and a relapse into apathy and dependency. It is important that new sources of funding are sought. While local government alone may not be able to allocate sufficient resources, local service providers might be able to link communities with different funding agencies.

While some of the initiatives undertaken have been relatively expensive (notably the provision of STWs and electric pumps), the project has clearly demonstrated that increasing the security, diversity, and sustainability of community livelihood

strategies significantly increases the resilience of communities. It contributes to poverty reduction. DRR cannot be viewed in isolation; it is a component of development.

While these initiatives can be replicated in other hazard prone areas, it is essential for policy makers and other stakeholders to be aware of the constraints and other factors that contribute to the vulnerability of communities. The involvement of local government and service providers from the onset of the project and their involvement in the initial vulnerability and capacity analyses (VCA) ensure that they appreciate their own essential role in the implementation of risk reduction strategies which increase community resilience. Working in a multi stakeholder environment is not always easy, as individual and group interests have to be overcome. An understanding of local power structures and dynamics is necessary for coordination and the establishment of a common purpose. The current political situation and frequent strikes have at times hampered project activities.

Most significantly the project has demonstrated that where local government is sufficiently aware and sensitive, the establishment of common understanding and strong linkages between policy makers and communities can result in the needs of the poor and marginalised being heard and acted upon. The project has demonstrated that policy can be put into practice.



Practical Action is a UK based charity organisation established in 1966 with the objective of reducing poverty through wider use of appropriate technologies in developing countries. With the Head Office in the UK, Practical Action works through its Country and Regional Offices in Bangladesh, Nepal, Sri Lanka, Kenya, Sudan, Zimbabwe and Peru. Practical Action is working in Nepal since 1979. The current Nepal strategy, 2007 - 2012, focuses on six broad programme areas namely 1) securing food for the poor; 2) reducing risks from disaster and adverse impacts of climate change; 3) maximising the benefits of market for small producers; 4) improving the access of rural poor to basic services; 5) improving urban environment; and 6) supporting in healthy homes.

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