Resilience scan | October-December 2015

A review of literature, debates and social media activity on resilience

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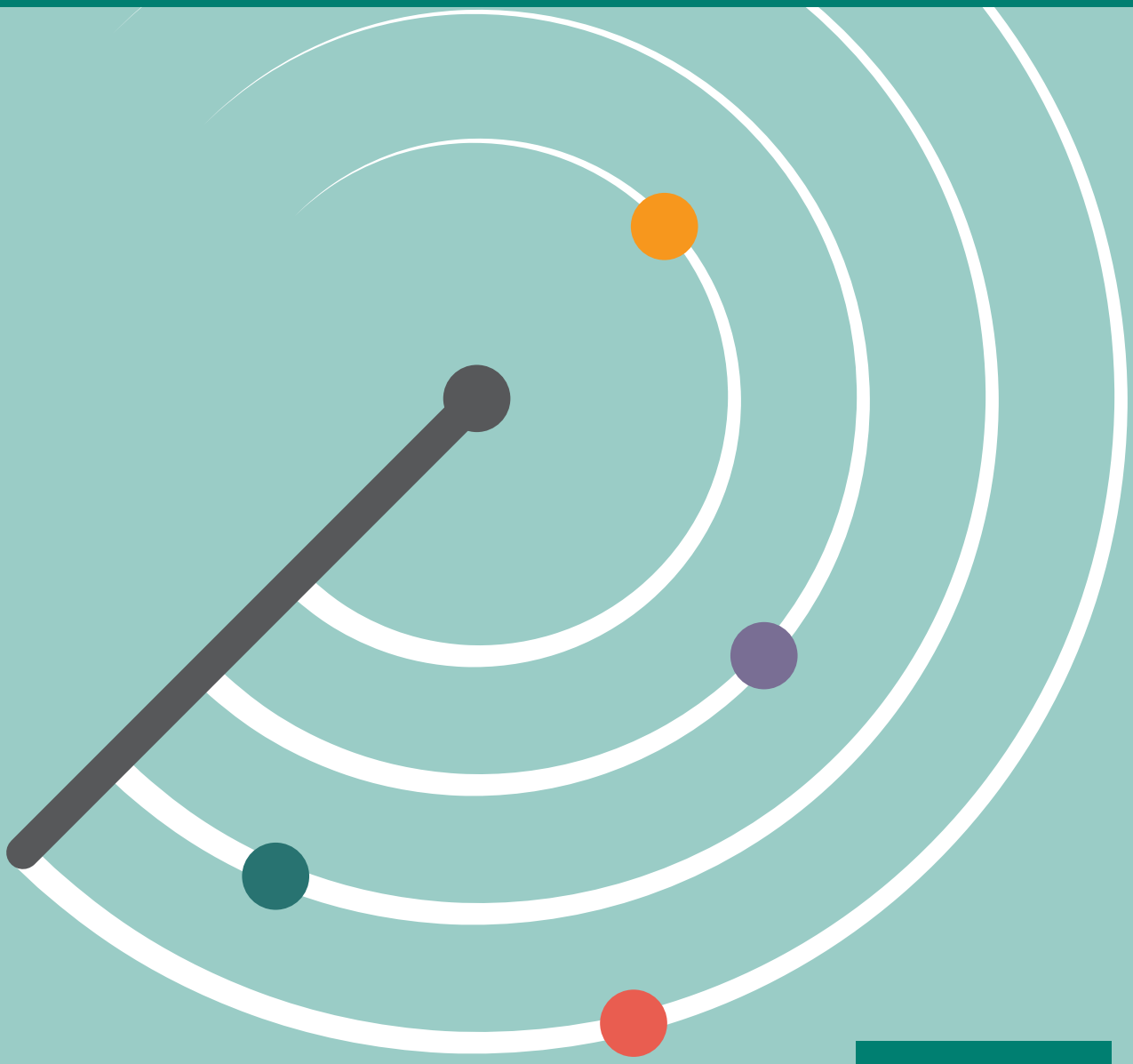

REPORT

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The quarterly resilience scans are complemented by 'deep-dive' analytical papers that focus on emergent aspects of resilience thinking and practice. To date we have published deep-dives that focus on measurement of resilience, assessing perceived of 'subjective' resilience, psychological resilience and autonomous innovation for resilience.

Please see www.odi.org/resilience-scan for details of these papers and previous resilience scans.

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Abstract

This ‘resilience scan’ summarises writing and debates in the field of resilience during the last quarter of 2015, focussing primarily on the context of developing countries. The scan will be of particular interest to those implementing resilience projects and policies and those seeking summaries of current debates in resilience thinking. It comprises insights on the manner in which resilience appeared within key international policy processes in 2015, key blogs on resilience, grey literature and academic journal articles. The final chapter synthesises the insights from literature in terms of Rockefeller Foundation’s 5 characteristics of resilience- awareness, diversity, selfregulation, integration and adaptiveness.

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The expert viewpoint section in this quarter's scan is a reflection on resilience in the context of the international frameworks on disasters, sustainable development and climate change in 2015, culminating in the climate change COP21 Paris Agreement of December 2015

Resilience was a defining feature of multiple frameworks on disasters, sustainable development and climate change in 2015. In Paris, although mitigation of greenhouse gases took top billing, adaptation was defined for the first time as a global goal. Text on adaptation also provided normative guidance for action around the world, including strong participation, transparency of action and the use of local, traditional and indigenous knowledge. A crucial normative signal to governments from the Paris deal was therefore that all states should not only seek to balance their development by limiting or reducing emissions but also adapt and build resilience to the impacts of climate change that mitigation does not prevent. While the legal aspects of international conventions often receive most attention, this norm-setting function is also highly important. The Paris agreement also saw a marked shift towards adaptation as a process of iterative cycles. This reflects the learning and adaptive cycle concepts that underpin much resilience thinking.

Resilience in the blogosphere

Twenty-five of the most influential blog posts on resilience (published between October and December 2015) were identified and reviewed under the following thematic clusters.

Blog posts on *climate resilience* present:

- The UN's new Climate Resilience Initiative, which aim to engage public and private stakeholders to build resilience across developing countries
- Seven new ideas that might solve the world's climate change challenge
- The contribution of water management strategies in achieving adaptation and mitigation goals

Blog posts on *urban resilience* present:

- Solutions for building urban resilience
- The role of 100 Resilient Cities chief resilience officers in creating comprehensive resilience strategies, and urban partnerships to offer new technology to 100 RC member cities
- Ways of empowering communities to create public gathering places to enhance social cohesion and build support networks that can be used during crises
- The importance of inclusive governance for urban resilience
- An overview of how resilience efforts aid cities in mitigating, dealing with or recovering from conflict

Blog posts on *finance for resilience* present:

- The need for innovative financial instruments to scale up finance for climate resilience and adaptation
- A rationale for focusing on ground-up grassroots actions that are currently 'outpacing' top-down funding mechanisms for building resilience

Blog posts on *community resilience* present:

- Studies on the Lord's Resistance Army and the implications for policies that seek to support community resilience against conflict
- Evidence of village committees coordinating disaster risk reduction actions
- 'Four tenets' for designing programmes to address poverty and resilience in remote farmer households in Sub-Saharan Africa
- The role of social entrepreneurship in supporting ecological integrity and increasing climate resilience for the world's poor

Blog posts on *agricultural resilience* present:

- The benefits and drawbacks of climate-smart agriculture
- Strategies to build resilient agricultural systems in the US
- Practices that sustain functional soils to build agricultural resilience and food security
- Research on a rare sunflower species that has high oil content and is able to quickly adapt to environmental changes
- Reports on the use of satellite technology to enhance agricultural resilience in Africa

Blog posts on *forest management and resilience* present:

- The World Bank's work in managing international forest climate funds and creating new markets for forest-based ecosystem services

Resilience in grey literature

Our examination of papers on resilience published between October and December 2015 includes 27 publications from research institutions, donors and multilateral agencies. These span five broad themes.

Grey literature on *policy, planning and resilience* suggests:

- The agreement of the three key international policy frameworks for disaster risk reduction, sustainable development and climate change in 2015 present an unparalleled opportunity for integrated planning for a climate-resilient future.
- In Africa, the emphasis on adaptation and resilience within the World Bank's Africa Climate Business Plan lays an important roadmap for delivering this vision.
- It is vital that climate resilience objectives are built into the substantial infrastructure investments that will be made in the coming decades to achieve global growth expectations, especially in developing countries.
- Multi-stakeholder collaboration in planning and implementation will be central for achieving climate and disaster resilience.

Grey literature on *urban resilience* suggests:

- Globally, city governments are increasingly planning and implementing climate resilience measures at scale.
- Unless cities' economic growth is channelled and translated into pro-poor initiatives, it will not automatically contribute towards increasing resilience for the poor and most vulnerable.
- Achieving urban resilience requires multi-stakeholder collaboration and engagement within urban planning and delivery processes.

Grey literature on *finance and resilience* suggests:

- A range of effective and accessible options are available to cities for creating and sourcing funds to support the delivery of climate resilience measures.
- Private sector investment in climate resilience is on the rise, and a deep shift in private sector climate finance may be on the horizon.

Grey literature on *climate-smart agriculture* suggests:

- In developing countries, the agriculture sector absorbs a quarter of losses and damages from climate-related disasters, rising to over 80% for droughts.
- Enhancing resilience in the agriculture sector must play a central role in delivering the 2015 development agenda.
- In meeting the significant agricultural investment need in Africa, governments, funding bodies and other agencies must ensure these investments are climate-smart.

Grey literature on *monitoring and evaluation* suggests:

- Defining resilience precisely helps in measuring it accurately.
- The measurement of drivers and characteristics allows us to measure resilience without relying on the occurrence of shocks and stresses.

Resilience in the academic literature

Twenty-eight peer-reviewed papers have been reviewed this quarter from which four dominant themes have emerged.

Papers that discuss the interaction between *natural resources and human well-being* suggest:

- There are generic actions that can build resilience in agrarian communities to climatic variability.
- Food security is affected not only by ecological and climatic factors but also by socioeconomic dimensions including gender dynamics, dietary preference and food prices.
- Flexibility in land-use and livelihood strategies allows farmers to benefit from opportunities and protect themselves in times of acute stress.

Papers that engage with the themes of *governments and governance* suggests:

- Local ownership over projects can help ensure robust stakeholder engagement essential for resilience.
- Leadership is frequently overlooked, yet indispensable to effective disaster risk management.

Papers that discuss *marginalisation and inclusion* suggest:

- Adaptation, resilience and vulnerability literature that engages with gender has increased substantially since 2006.
- Gender dynamics have a critical bearing on how people experience natural disasters and periods of food insecurity.
- Different groups must be included in urban planning and policy decisions to effectively enhance urban resilience.

Papers on *resilience in practice* suggest:

- Academics, policy-makers and practitioners often use resilience terminology in a confusing and conflicting manner.
- Although a resilience approach is often comprehensive, it would benefit from an enhanced awareness of issues of power.
- The development of new tools for measuring and assessing resilience is essential in order to better understand the degree to which resilience interventions are effective.

Understanding the characteristics of resilience

The final section analyses the implications that the literature and blogs reviewed in this quarter hold for five key resilience characteristics.

Awareness:

- Improving stakeholder awareness of climate change and disaster risk reduction measures is an important component of resilience building strategies.
- Comprehensive awareness of both physical hazard risks and socioeconomic risks is vital for decision-making to enhance resilience.

Diversity:

- Diversity is the second most frequently discussed resilience characteristic in the blogs.
- Diversification is an effective resilience-building measure against climate risks at all scales, from the farm level (agricultural biodiversity) to the national level (economic diversification to reduce reliance on climate-sensitive agriculture).

Self-regulation

- The concept of 'self-organising' is frequently used to demonstrate how stakeholders can establish new networks or shift existing relationship dynamics to respond to change.
- Regulation and regulatory policies are discussed as mechanisms that can allow various systems (urban, farm, economy) to function and sustain human well-being.

Integration:

- It is vitally important to include insights and involvement from various sectors for building formulating resilience strategies.
- The 2015 agreement of the three key international frameworks presents an unprecedented opportunity for integration in policy, planning and delivery across the disaster risk reduction, climate change adaptation and development agendas, with implications across scales and sectors.
- There is an urgent need and opportunity to lock in a resilient future through integration of climate and disaster resilience concerns within sectoral investments, given the vast investments needed to meet global growth expectations in the coming decades.
- Collaboration and partnerships among multiple agencies will be central to meeting resilience objectives.
- Resilience approaches promote the integration of individuals from disciplines, sectors and levels of society who otherwise often operate in silos.

Adaptiveness:

- There is widespread awareness of the need to building adaptive capacity to achieve resilience. While capacity-building efforts are underway or planned at all scales, the success of these initiatives can be undermined by lack of awareness of risks, among other factors.
- Governance structures should be adaptive, but they should also be underpinned by principles of good governance and social justice if they are to build resilience.

1. Resilience in the post-2015 world

This expert viewpoint section in this quarter's scan is a reflection on resilience in the context of the COP21 Paris Agreement of December 2015 and other related international frameworks set in that year. The section summarises the importance of resilience in the negotiations before setting out forward-looking implications and challenges for finance, policy and practice. The viewpoint draws on perspectives from the authors of this scan as well as a range of blogs on the Paris Agreement (listed at the end of this section).

Resilience was a defining feature of multiple frameworks in 2015, on disasters, sustainable development and climate change. In Paris, although mitigation of greenhouse gases took top billing, adaptation was defined for the first time as a global goal. Text on adaptation also provided normative guidance for action around the world, emphasising strong participation, transparency of action and the use of local, traditional and indigenous knowledge. Paris also saw a marked shift towards adaptation as a process of iterative cycles. This reflects the learning and adaptive cycle concepts that underpin much resilience thinking.

1.1 Was 2015 the year resilience became a truly international agenda?

Every recent article on resilience seems to start with the line, 'The resilience agenda is rapidly gaining prominence around the world', yet we can genuinely look back on 2015 as the year that resilience became a global norm. A combination of international inter-governmental processes have championed the concept, challenging government and non-government actors alike to reduce the impact of shocks and stresses on progress in human development and planetary sustainability. The related reporting processes help embed planning for and building of resilience as a fundamental responsibility of national and subnational governments.

In March 2015, the Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR) agreed a revised strategy to substantially reduce disaster risk and losses in terms of both lives, livelihoods and health and the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. The SFDRR frames resilience in holistic economic, social, health and cultural terms, and refers to resilience of persons, communities, countries and their assets, as well as the environment.

Source: Jerry Velasquez blog.

Priority 1: Understanding disaster risk

Priority 2: Strengthening disaster risk governance to manage disaster risk

Priority 3: Investing in disaster risk reduction (DRR) for resilience

Priority 4: Enhancing disaster preparedness for effective response and to 'build back better' in recovery, rehabilitation and reconstruction

SFDRR targets include reducing the number of people killed or affected by disasters, direct economic losses and damage/disruption to critical infrastructure and basic services. They also aim to enhance national and local DRR strategies, international cooperation and access to information, including multi-hazard early warning systems.

In September 2015, heads of state and government representatives agreed on a set of 17 Sustainable Development Goals (SDGs) and 169 related targets. Resilience is acknowledged both explicitly and implicitly in a range of the proposed SDG targets, and the development of resilience indicators has been cross-referenced to the SFDRR for joint elaboration in the future.

Target 1.5 represents the core resilience target:

'By 2030 build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters'

Resilience is a core feature of **Target 13.1** in its aim to 'strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries'

Resilience underpins the achievement of several other targets, including:

Target 9.1: 'develop quality, reliable, sustainable and resilient infrastructure […]'

Target 2.4: 'ensure sustainable food production systems and implement resilient agricultural practices […]'

Target 11.5: 'significantly reduce the number of deaths and the number of people affected and decrease by [x] per cent the economic losses relative to gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations […]'

Target 11.b: 'substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels'

1.2 How did resilience play out in the Paris Conference and Agreement?

A growing emphasis on adaptation and resilience

The 21st Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC) was held in Paris in December 2015. The outcome was an intergovernmental agreement that provides a framework to guide global action until mid-century on both 'mitigation' of the causes of climate change and 'adaptation' to its impacts. Crucially, this agreement commits all signatories to enhanced action on both fronts.

The establishment of a global goal on adaptation (Article 7.1) is significant in signalling its status in parallel with mitigation and ensuring a level of adaptation response proportionate to the success of mitigation efforts in limiting climate change itself. The goal of 'enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change' is set in the context of adaptation's contribution to sustainable development. A crucial normative signal to governments from the Paris deal was therefore that all states should not only seek to balance their development by limiting or reducing emissions but also adapt and build resilience to the impacts of climate change that mitigation does not prevent. While the legal aspects of international conventions often receive most attention, this norm-setting function is also very important.

Also notable at the Paris meeting was the breadth of different groups, organisations and institutions presenting on adaptation activities and engaging with resilience debates. While indigenous movements and the international NGO sector has long engaged in lobbying for adaptation, there was a significant presence from the scientific community, businesses, investors, and local leaders, including through the *Climate Summit for Local Leaders*. This broad base of support for taking action to minimise harm from, and even take advantage of, climate impacts, signalled that adaptation and resilience is an agenda that goes beyond governments alone.

Resilience and adaptation linkages

In recent years, the term 'resilience' has increasingly appeared in UNFCCC texts alongside 'adaptation', most commonly to describe the outcome of adaptation efforts (e.g. building 'resilient economies'). Although it does not explain the difference, Article 2.1b of the Paris text makes a distinction between 'adaptation' and 'resilience' in framing the aim of the agreement in terms of 'Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production'.

Resilience and adaptation are interrelated terms, although the former generally refers to a state or characteristic while the latter describes a process. 'Adaptation' in the UNFCCC refers strictly to adjustments to tackle the human-caused element of climate change, but in practice most adaptation efforts are based on tackling existing variations in the climate, not just future change, as well as other change beyond the climate. Adaptation does reinforce the need for resilience thinking to give due attention to the dynamics of the hazards burden, often through the lens of the changing frequency, magnitude and location of extreme events.

Equity: Adaptation and resilience of the most vulnerable countries

The Paris Agreement links the level of adaptation required with the level of mitigation achieved, noting that holding the increase in the global average temperature to well below 1.5°C pre-industrial levels would significantly reduce the risks and impacts of climate change. Defining a new level of ambition below 1.5°C was a significant change and potentially crucial for vulnerable countries and people. The agreement also called for a special report by the intergovernmental Panel on Climate Change (IPCC) on the science of mitigation and impacts of a 1.5°C rise.

However, in the absence of a dramatic and unprecedented decline in emissions, short-term emissions trajectories are not consistent with this temperature goal , and vulnerable countries will probably look more to the long-term potential of the agreement (see Amanda Little's blog). As such, climate scientists with an understanding of emissions trajectories, such as Kevin Anderson (see blog), have sounded a note of caution with regard to our ability to stay below even a 2°C rise in the absence of new technology to actually take carbon out of the atmosphere.

'In recent years, the term 'resilience' has increasingly appeared in UNFCCC texts alongside 'adaptation', most commonly to describe the outcome of adaptation efforts.'

1.3 How does the Paris Agreement reflect conceptual approaches to resilience?

Resilience thinking's emergence has entailed a range of conceptual tenets or characteristics that underpin action. For example, the Rockefeller Foundation's resilience approach emphasises awareness, diversity, self-regulation, integration and adaptiveness. Adaptation in general speaks to the dynamic element of resilience thinking, but in the Paris Agreement and at many of the side events around the conference resilience was not viewed as being different from adaptation. As such, these conceptual elements were not visible in most of the debates and presentations. This is an important observation in that it suggests the need for greater linkages between adaptation and resilience practices. At the same time, there were a few interesting exceptions:

1. The Paris Agreement saw a shift towards adaptation as a process of *iterative cycles*. This reflects the learning and adaptive cycle concepts that underpin much resilience thinking. Where adaptation in the world's poorest and most vulnerable countries has been guided by short-term needs in relation to developing and implementing one-off *National Adaptation Programmes of Action*, the Paris agenda creates a cycle and a five-yearly global stocktake on adaptation action. All countries are now invited to communicate adaptation needs and actions, including through *National Adaptation Plans*. The global stocktake can compare practices and needs, share knowledge and assess the sufficiency of financing.
2. The development of a set of normative principles for adaptation in the Paris Agreement has parallels with resilience tenets around diversity and inclusion. Countries agreed adaptation action should follow a 'gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems', and should draw on 'traditional knowledge, knowledge of indigenous peoples and local knowledge systems' (Article 7.5). However, explicit guidance may be needed to ensure these principles permeate adaptation practice (see Harmeling and Kreft blog), including through requirements for accessing international finance.
3. Diversity of actors and sectors was also a striking feature of the Paris meeting. The presence of multiple non-state actors, including a significant presence of business and city representatives, was notable, and this was supported in the run-up to Paris through the Lima–Paris Action Agenda. Their contribution to adaptation/resilience debates and commitments was notable, and high-level champions will maintain the ongoing integration of these actors into the UNFCCC process over the next five years.


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1.4 Key challenges

Despite the optimism, there was widespread acknowledgement, including in the Paris text itself, that the current commitments of the Paris Agreement will not keep climate change to below dangerous levels. This underlines the importance of highlighting (and prioritising) the interests and needs of particularly vulnerable countries, groups, communities and ecosystems. The Paris Agreement signals that adaptation should form a larger share of the $100 billion per year by 2020 target for international climate finance, and that grant-based public finance is important for adaptation as this area can be less attractive to businesses. The agreement also reinforces the need to ensure poor and vulnerable countries are better equipped to access international finance.

Yet one crucial area that is rarely picked up in the intergovernmental negotiations relates to adaptation and resilience in fragile and conflict-affected states, where funding to strengthen resilience is a challenge. Climate change impacts and fragility intersect because the geographies are often more exposed to climate change and because coping capacity is weaker. Katherine Nett's blog highlights the fact that increasing funding will not necessarily increase resilience. This is because these countries experience volatile aid flows, lower government capacity to absorb and effectively administer high flows of international finance and the failure of many adaptation funds to build resilience to the compound risks arising from climate change, conflict and development needs.

Finally, there are significant challenges in linking up the post-2015 frameworks for effective action. The resilience concept itself provides an important way of enabling synergy, with success seen at least in linking the SFDRR and the SDGs. The UN Secretary-General's Office can play a strong role in terms of using resilience as an integrative approach. To make this a reality, international processes need to link and cross-reference frameworks, and different UN departments need to create clear channels of communication to maximise synergies. Targets and reporting frameworks should enable rather than frustrate reporting at national and subnational level. At a minimum, setting out standards for resilience measurement would assist in the development of comparable approaches. National governments also need to create cross-framework platforms for knowledge-sharing and debate. For example, could one country pilot a combined reporting approach on resilience goals and actions under the SDGs, SFDRR and UNFCCC, to be achievable in one document?

'The resilience concept itself provides an important way of enabling synergy, with success seen at least in linking the SFDRR and the SDGs.'

Referenced blogs

What the Paris climate agreement means for vulnerable nations (Amanda Little, 5 January 2016) www.newyorker.com/news/news-desk/what-the-paris-climate-agreement-means-for-vulnerable-nations

Financing for resilience: Three lessons to be learned in climate finance (Katherine Nett, 5 January 2016) www.climate-diplomacy.org/news/financing-resilience-3-lessons-be-learned-climate-finance

A guide to reading the Sendai Framework for Disaster Risk Reduction (Jerry Velasquez, 18 November 2015) www.linkedin.com/pulse/guide-reading-sendai-framework-disaster-risk-jerry-velasquez

Not fully lost and damaged: How loss and damage fared in the Paris Agreement (Saleemul Huq and Roger-Mark De Souza, 22 December 2015) www.wilsoncenter.org/article/not-fully-lost-and-damaged-how-loss-and-damage-fared-the-paris-agreement

Adaptation in the Paris climate agreement: A matter of principle (Sven Harmeling and Soenke Kreft, 4 January 2016) http://www.trust.org/item/20151222142004-zgeou/

2. Resilience in the blogosphere

This section offers insight into how the blogosphere writes about and discusses the concept of resilience by identifying and analysing the blog posts on resilience published in the final quarter of 2015. The methodology, based on a social visibility score, is described in Annex 1. We identify 25 of the most influential blog posts on resilience (published between October and December 2015) and analysed them into thematic clusters. This provides an alternative lens through which to understand the key debates and topics dominating the resilience discourse. Perhaps unsurprisingly, given the importance of these conferences for resilience thought and practice, of the 25 blog four mentioned the UN SDGs (25–27 September 2015) whereas nine posts referred to the climate negotiations in Paris under COP21 (30 November–12 December 2015). Further details about the blog posts are provided under one of six headings: *climate resilience, urban resilience, finance for resilience, community resilience, agricultural resilience and forest management and resilience*.

2.1 Climate resilience

Blog posts on climate resilience present:

- the UN's new Climate Resilience Initiative, which aims to engage public and private stakeholders to build resilience in a developing country context
- seven new ideas or potential trends that might solve the world's climate-related challenges and represent the 'next frontier' of climate resilience
- the contribution of water management strategies in achieving adaptation and mitigation goals

Most of the blog posts reference climate resilience in some capacity, although three blog posts specifically introduce new policies, trends and thoughts in relation to building climate resilience. The first blog post, which is ranked the third most influential blog post in the sample, is titled, 'UN Secretary-General's initiative aims to strengthen climate resilience of the world's most vulnerable countries and people'. Written during COP21 and published by the UN, this blog post outlines the UN's new Climate Resilience Initiative. This initiative seeks to engage various public and private stakeholders to 'focus on early warning-early action systems, insurance, and increasing investment' with the aim of increasing climate resilience action, primarily in a developing country context.

'This initiative seeks to engage various public and private stakeholders to 'focus on early warning-early action systems, insurance, and increasing investment.'

The second blog post, 'The next frontier of climate change resilience' (ranked sixth), was written by Judith Rodin, President of the Rockefeller Foundation, in anticipation of COP21. Rodin notes that 'climate accelerates and complicates almost every other problem' and highlights the importance of a 'systems-deep' approach to identify solutions that satisfy multiple objectives simultaneously. She offers seven possible solutions or 'trends' that will be the 'next frontier of climate change resilience', which we paraphrase here: 1) new financing mechanisms such as 'blended investments' (e.g. catastrophic bonds where investors are paid back with interest if specific social scenarios are achieved); 2) having mayors contribute 10% of the city's annual budget to resilience without increasing taxes; 3) linking together smallholder farmers and new markets; 4) highlighting the importance of natural systems in the global health framework; 5) introducing guidelines to meet increasing global water demands; 6) investment in 'market-driven clean energy plants'; and generating knowledge platforms to enable stakeholders to 'prioritize investments […] that advance climate resilience' (e.g. early warning systems).

Published in the wake of COP21, 'Getting to climate resilience and low carbon urban water' (ranked 13th) draws on European examples to discuss how cities and their utilities can be shifted onto resilient trajectories that achieve adaptation and mitigation goals. The blog post outlines various technologies and their associated benefits at the city or household level, for example diversifying the city's water supply so that 'waters of different qualities may be used for different purposes in our cities' and changing showerheads to increase water efficiency while reducing carbon emission through reduced hot water use. Given their potential to contribute significantly to climate resilience, the blog post calls for more climate funding for water solutions.

2.2 Urban resilience

Blog posts on urban resilience present:

- solutions for building urban resilience, following the flooding in Chennai, India (November), and South Carolina, US (October)
- a partnership between 100 Resilient Cities (100RC) and Resilient Solutions 21 (RS21) that will offer new technology, named the Resilience Spectrum, to 100RC member cities to analyse strategies that build urban resilience
- 100RC's chief resilience officers: 'high-level advisors to the city's chief executive' who work with various stakeholders to create comprehensive resilience strategies, with examples from New Orleans, US
- the enhancement of social cohesion and the building of support networks that can be used in times of shock, achieved by empowering communities to create public gathering places
- inclusive governance as key to increasing urban resilience while minimising increasing inequality; this is a challenge in Asia because of limited public participation
- resilience efforts aiding cities in mitigating, dealing with or recovering from conflict

The most frequently discussed theme was urban resilience, with eight of the 25 blog posts unpicking the determinants of resilient cities under a changing climate. Two of these blog posts were written explicitly in response to a recent weather event. The blog post titled 'A drowning Chennai must force us to build climate resilient cities' (the highest ranking blog post in this sample), describes Chennai, India, after the catastrophic November 2015 floods. Having partially attributed increased flood risk to climate change, the author notes 'urbanisation through bad or no planning or in violation of planning had a big role to play in intensifying the scale of the impact'. Five solutions are presented to build urban resilience to these weather events, including 1) developing accurate land-use plans' 2) creating mixed-use developments with hazard-reducing infrastructure; 3) preserving natural flood defences; 4) penalising those building on ecologically sensitive areas; and 5) engaging multiple stakeholders in 'rethinking' Indian cities. Similar policy solutions for building urban resilience to flooding are presented in 'After South Carolina floods, we must act to prevent similar disaster' (ranked 25th), written in response to the October 2015 flooding in South Carolina, US.

'Innovations in resilience along the water's edge' (ranked 24th) covers a meeting on how waterfront cities (primarily in the US) can 'reinvent themselves to protect land, buildings, infrastructure, and people'. Solutions include building green infrastructure, creating a tidal lagoon and addressing sea level rise in plans for shoreline development. One participant noted the difficultly of spending tax dollars on water infrastructure, as it is often invisible to the public eye, but stated that, if the investment is beautiful, is what the public wants or 'connects to their culture and history', it is easier for investment to go ahead.


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100 Resilient Cities (100RC), pioneered by the Rockefeller Foundation, is an organisation that seeks to build resilience in cities against physical, social and economic challenges. The next blog post, ranked fourth, discusses how '100 Resilient Cities [100RC] & Resilient Solutions 21 [RS21] partner to bring next gen urban analytics to cities'. This partnership of 100RC with RS21, a company that creates solutions in relation to building resilience, will offer 100RC's member cities new analytical technology named the Resilience Spectrum. In compiling various datasets, cities can use this technology to pinpoint resilience strategies that meet multiple objectives, for example 'mitigating the heat island effect in ways that provide underserved children access to new playgrounds'.

The 100RC member cities also receive assistance in creating a 'chief resilience officer' (CRO). Michael Berkowitz, President of 100RC, provides further detail on this in his piece: 'What is a chief resilience officer [CRO] – and what are they doing in Mexico City?' (ranked seventh). He describes a CRO as a 'high-level adviser to the city's chief executive' who works across sectors and scales of government to create resilience strategies against various shocks and stresses, from flooding to housing shortages. CROs from across the world were meeting in Mexico City, Mexico, to engage in 'peer-to-peer learning' and to develop their ability to bridge the silos of government and connect public and private stakeholders together to create comprehensive strategies that build urban resilience.

The first CRO of New Orleans, US, Jeff Hebert, is the focal point of the post named 'Chief resilience officers: The new leaders in cities' fight to bounce back from disasters' (ranked eighth). This piece highlights the strengths of the CRO initiative, and briefly touches on Herbert's resultant strategy of 41 initiatives to 'help New Orleans become "a more equitable, adaptable and prosperous place for all residents"', which include literacy programmes, micro-grid projects and water management strategies.

'From the neighborhood up! Why placemaking is the key to building resilient cities' (ranked 10th) comments on initiatives that have built resilience in Portland, US, such as benches, informal mini-libraries and community-filled tea stations on intersections. The author, who works with an urban resilience organisation, EcoDistricts, argues these types of activities contribute to 'placemaking' through empowering communities to create public gathering places where they can connect. This enables the creation of new networks from which resources can be shared and support given, and the formation of local leadership under which broader decision can be made; this builds urban resilience to 'survive, grow, and adapt to change'.

'The author notes that resilience efforts must explicitly state 'what structures and systems need to improve, who will benefit, and by whose authority it proceeds' in order to minimise increasing urban inequality.'

'Inclusive governance and urban resilience: Challenges at the nexus of urbanization and climate change' (ranked 18th) addresses the links between inequality, vulnerability, natural disasters and urbanisation in Asia. The author notes that resilience efforts must explicitly state 'what structures and systems need to improve, who will benefit, and by whose authority it proceeds' in order to minimise increasing urban inequality. The integration of 'inclusion and social justice' in governance is central to the creation of meaningful urban resilience solutions, although the blog post notes this is a challenge in Asia given government structures that leave little opportunity for public participation.

Finally, resilience efforts are proposed as aiding cities in mitigating, dealing with or recovering from conflict in the blog 'In-conflict/post-conflict: A role for planning in building peaceful, inclusive and resilient cities?' (ranked 22nd). The author notes the lack of a 'single planning approach for cities in or emerging from conflict' and looks at different contexts where different stakeholders (e.g. nations, the UN, the European Union, EU) have engaged in this task (e.g. in Afghanistan, Bosnia, Germany, Somalia), before calling for more research into the interaction between urban planning and resilience against conflict.

2.3 Finance for resilience

Blog posts on finance for resilience present:

- the need for innovative financial instruments to scale up finance for climate resilience and adaptation
- ground-up grassroots actions as currently 'outpacing' top-down funding mechanisms for building adaptive capacity and thus resilience to deal with the impacts of climate change

Lorenzo Bernasconi, Associate Director of the Rockefeller Foundation, writes 'It's time to scale up finance for climate resilience & adaptation' (ranked ninth). Noting the 'fragmented', 'lacking in private-sector' and 'small-scale' investment thus far, Bernasconi argues the 'need to mobilize private sector capital for adaptation at scale, and quickly'. This is why, he states, the Rockefeller Foundation's Zero Gap portfolio is supporting the public–private initiative, the Global Innovation Lab for Climate Finance, to identify new financing solutions for climate resilience and adaptation. The Lab was seeking new proposals (unfortunately due in on 6 November 2015) to add to its 'four innovative financial instruments' that have thus far been successful in scaling up climate finance in developing countries.

'Why climate finance matters to real people' (ranked 11th) states the need for equitable climate finance in the climate negotiations (specifically COP21), with developed countries making pledges that reflect their contribution to climate change. The authors outline the current financing mechanisms, but state that 'ground-up grassroots actions' are currently 'outpacing top-down funding mechanisms'. The blog post calls for increased adaptation finance to build the capacities, and thus resilience, of developing countries to address climate change.

2.4 Community resilience

Blog posts on community resilience present:

- studies on the Lord's Resistance Army and the implications for policies that seek to support community resilience against conflict
- evidence of village committees coordinating DRR actions
- 'four tenets' for designing programmes to address poverty and resilience in remote farmer households in Sub-Saharan Africa
- the role of social entrepreneurship in supporting ecological integrity and increasing climate resilience for the world's poor

Four blog posts focused on building resilience to shock and stress specifically at the community level in a developing country context. 'Supporting community resilience in conflict' (ranked second) is a blog post and podcast by Harvard University's Advanced Training Program on Humanitarian Action. The post links to a study on the Lord's Resistance Army and the implications for policies that seek to support community resilience to conflict. Critical questions are discussed, such as what building community resilience entails and what lessons places that have experienced non-state conflict can provide to strengthen other communities coping with violence.

'Building resilience to climate change in rural Malawi' (ranked 14th) discusses the actions communities are already undertaking to cope with climate impacts, notably flooding. Village Civil Protection Committees (VCPCs) coordinate DRR actions with other community stakeholders (e.g.


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‘Promoting climate resilience by social enterprise blends the sensibilities and goals of social action with the rigor and financing structures of business.’

churches, schools) to reduce negative outcomes on human well-being (e.g. loss of livelihood, housing, food, etc.), such as implementing early warning systems or relocating households from flood-prone areas. The VCPCs, supported by the internationally funded Enhancing Community Resilience Programme, also act as a channel through which climate information can be passed from the government to farmers via text messages. The piece concludes with a call for increased adaptation finance at COP21.

Director of International Operations at Nuru, Aerie Changala, uses his experiences to explain the process of ‘Building resilience in communities on the brink of disaster’ (ranked 16th). He proposes ‘four tenets’ for designing programmes to address poverty in remote farmer households in Sub-Saharan Africa: ‘focus on basic needs’ (e.g. teach healthy behaviours that prevent sickness and thus loss of income for farmers); ‘deliver programs in an intentional sequence’ (e.g. programmes follow a pattern that works to increase impact/remove barriers); work to increase resilience (e.g. include contingency plans); and ‘learn from failure’ (e.g. share insights with organisations).

‘How social entrepreneurs can bolster climate resilience’ (ranked 15th) argues that, ‘Promoting climate resilience by social enterprise blends the sensibilities and goals of social action with the rigor and financing structures of business.’ Social entrepreneurship is suggested as a way to ‘repay our ecological debt’ while ‘generating climate resilience among the world’s poor’. Several companies are highlighted for their efforts, for example Solar Sister, whereby women in Sub-Saharan Africa sell solar lamps, and Komaza, in which families in Africa are remunerated for planting trees.

2.5 Agricultural resilience

Blog post on agricultural resilience present:

- the benefits and drawbacks of climate-smart agriculture (CSA), noting that it must have inclusive and meaningful farmer engagement to be effective (developing context) and increased leadership from governments and businesses (developed context)
- strategies to build resilient agriculture in the US, including increased science communication of climate change and DRR measures to farmers
- practices that sustain functional soils to build agricultural resilience and food security
- research on the rare sunflower species *Helianthus anomalus*, which has high oil content and is able to quickly adapt to environmental changes
- reports on the use of satellite technology to enhance agricultural resilience in Africa

Six blog posts focused on agricultural resilience, two of which discussed climate-smart agriculture (CSA). A blog post on Oxfam’s website questions ‘What’s the danger in climate-smart agriculture [CSA]?’ (ranked 17th). CSA is defined as ‘an approach to sustainably increase agricultural productivity and incomes, adapt and build resilience to climate change, and reduce and/or remove greenhouse gas emissions, where possible’. The post notes the various criticisms of CSA (e.g. lacking safeguards, prioritising mitigation over adaptation efforts, etc.), yet states that Oxfam has joined the African CSA Alliance as a way to coordinate with governments and promote appropriate interventions for farmers. The post ends by stating the importance of inclusive and meaningful farmer engagement for the success of CSA country programmes. The second blog post in this section, ‘Climate change and agriculture: Connecting global warming to business resilience’ (ranked 19th), reports on an event at COP21 that discussed the benefits of CSA for ‘solving climate change’ within the context of North America. However, the blog post notes, ‘Businesses can disrupt systems, but governments can transform them’ through incentives, and calls for further leadership from both businesses and governments in enabling the agricultural industry to transform.

'El Niño highlights need for resilient agriculture' (ranked 23rd) looks at the long-term implications of climatic variability impacting on agricultural resilience in the US, using hypotheses about the 2015 El Niño cycle. The blog post notes the need to understand how crop diversification and diversity of farm sizes contribute to building resilience of the food system at a global and national scale, and of the livelihoods of the individual farmers; however, these resilience outcomes are not always compatible. The post discusses the differentiated ability of farmers to absorb risk, although some US policies favour the already more resilient industrialised producers. Scientific communications about climate change and DRR measures, including data on how crop varieties act under climatic conditions, are proposed as viable ways for farmers to make adaptive decisions.

The final three blog posts provide more technical insights into resilient agriculture. The Food and Agricultural Organization (FAO) discusses how 'Soils store and filter water – improving food security and our resilience to floods and droughts' (ranked 12th). Using info-graphics, this blog post outlines practices that sustain functional soils (e.g. those that trap pollutants and capture water for crop use) to increase agriculture and thus food security. 'Seed searchers seek super sunflowers for key to climate change resilience' (ranked fifth) outlines recent research on sunflowers. The rare species Helianthus anomalus is presented not only as having seeds that contain 'a higher oil content than the wild sunflower' but also as being able to 'quickly adapt to environmental changes' and thus as having great potential to build resilience against climatic variability. The World Bank presents 'Using satellite technologies to protect African farmers from climate shocks' (ranked 21st). Remote sensing – combining satellite and ground-sourced information – is proposed as technology that can quickly identify where risk (e.g. of a drought) occurs so that it is possible to undertake DRR interventions, such as weather-indexed insurance or cash transfers, to mitigate harm. The post recounts stories of success in using this technology across Africa, and states that the technology, and associated interventions, will be the focus of a conference in November 2015, called 'Understanding Risk and Finance'.

2.6 Forest management and resilience

Blog posts on forest management and resilience present:

- the World Bank's work on managing international forest climate funds and creating new markets for forest-based ecosystem services

The World Bank has written a blog post that focuses on 'Growing resilient forest landscapes in the face of climate change' (ranked 20th). The post presents the benefits that can be accrued through 'forest-friendly development'. It refers to the World Bank's recent report *Shock waves*, which highlights the importance of 'climate-sensitive development policies' to reduce poverty, as well as their role in managing international forest climate funds and creating new markets for forest-based ecosystem services. The Bank concludes with reference to an upcoming meeting at COP21 at which various stakeholders would meet to discuss forest management as a pathway to a resilient future.


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3. Resilience in the grey literature

Our examination of articles on resilience published between October and December 2015 includes 27 publications from research institutions, donors and multilateral agencies. These span five broad themes: *policy and planning, climate-smart agriculture, urban resilience, finance and resilience and monitoring and evaluation*. These analytical clusters are similar to the previous scan (July–September 2015), with three of these themes (*monitoring and evaluation, policy and planning and climate-smart agriculture*) also appearing in that scan. *Monitoring and evaluation* is the only cluster to have appeared in all four of the resilience scans for 2015, which is reflective of the substantial amount of effort being put into investigating different approaches to accurately measuring and defining resilience. The *urban resilience and finance clusters* appeared in three of the four 2015 scans.

3.1 Policy, planning and resilience

Grey literature on policy, planning and resilience suggests:

- The agreement of the three key international policy frameworks for disaster risk reduction (DRR), sustainable development and climate change in 2015 present an unparalleled opportunity for integrated planning for a climate-resilient future.
- In Africa, the emphasis on adaptation and resilience within the World Bank's Africa Climate Business Plan lays an important roadmap for delivering this vision.
- Across the world, it is vital to build climate resilience objectives into the substantial infrastructure investments that will be made in the coming decades to achieve global growth expectations, especially in developing countries.
- Multi-stakeholder collaboration in planning and implementation will be central in achieving climate and disaster resilience.

With the adoption of the Sustainable Development Goals (SDGs) in late September 2015, and the Paris Agreement in December 2015, it is no surprise to see papers investigating the implications of these international policy frameworks for climate and disaster resilience emerging in this scan. While only two of these papers reviewed under the *policy, planning and resilience cluster* focus specifically on aspects of the post-2015 international frameworks, many from across this literature review are situated within this new international policy context. Other papers in this cluster relate to regional or national plans for building climate and disaster resilience, the opportunity for good policy and planning in infrastructure to 'lock in' a climate-resilient future and the central role of collaboration and partnerships in planning for resilience.

A UN Office for Disaster Reduction (UNISDR) (2015) 'reflection paper' outlines what disaster risk reduction (DRR) and the Sendai Framework for Disaster Risk Reduction (SFDRR) mean for sustainable development and examines the link with each of the SDGs. It considers opportunities to address disaster risk factors through the SDGs, for shared targets and indicators and for coherence in monitoring and reporting across these complementary international frameworks. The report recommends the High-level Political Forum on Sustainable Development as a platform for member states to achieve coherence in monitoring and reporting across the SDGs and the SFDRR. Shared indicators across the two frameworks could apply to SDG targets on building the resilience of the poor (SDG 1.5), reducing mortality, numbers of people affected and economic losses from disasters (SDG 11.5) and strengthening resilience and adaptive capacity to climate hazards (SDG 13.1), among others.

While not solely about resilience, Dagnet et al. (2015) of the World Resources Institute discuss the measures needed to support capacity-building to deliver on the post-2020 climate regime, which includes building resilience to climate risks. The report focuses on how to improve the institutional architecture under the UN Framework Convention for Climate Change (UNFCCC) for capacity-building

of developing countries to address climate change, including efforts delivered through bilateral and multilateral agencies within and outside the convention. It explores the capacity-building measures currently in place, outlines options to strengthen this existing architecture and recommends two key elements to be included in the new international climate agreement to ensure it can provide the guidance and framework necessary for enhanced delivery. These elements are 1) setting a long-term objective to guide capacity-building, to elevate the importance of effective efforts in this regard to the success of the new agreement, and; 2) the inclusion of a capacity building mechanism.

The adoption of these three major international frameworks in 2015 also presents an opportunity to join up efforts to address climate change and development challenges. Recognising this opportunity, an Overseas Development Institute (ODI) report by Wilkinson and Peters (2015) argues for improved resilience to climate extremes as a requisite for achieving poverty targets. Featuring three detailed case studies – on drought in Mali, heatwaves in India and typhoons in the Philippines – the authors examine the relationships between climate change, climate extremes and poverty, and describe implications and recommendations for policy and planning. To strengthen resilience and safeguard investments in poverty reduction, planners and policy-makers must build adaptive, anticipatory and absorptive capacity; strengthen institutions and support decentralisation to foster more effective local solutions; improve connectivity across scales and sectors; and utilise risk-financing instruments and regional financing mechanisms to catalyse further investment in resilience-building measures.

Translating international targets and ambition into regional strategy, the World Bank's (2015a) Africa Climate Business Plan has an emphasis on adaptation. This focus is in accordance with the priorities expressed within Intended Nationally Determined Contributions (INDCs) that the majority of African countries have submitted to the UNFCCC. It is arranged under three clusters: strengthening resilience, powering resilience and enabling resilience. The plan, which is awaiting approval by the governing bodies of the relevant financiers, provides an organising framework to improve resilience to climate risk and variability in Africa, and proposes internal and external organisational arrangements for its implementation. The first cluster, 'strengthening resilience', includes initiatives aimed at boosting the resilience of natural and physical assets such as forests and infrastructure and measures to increase human and social capital, such as social protection against climate shocks for the most vulnerable. While the cluster on 'powering resilience' is about low-carbon development, this cluster relates to opportunities that deliver resilience co-benefits alongside mitigation gains, such as enhanced capacity to power irrigation systems in times of drought. The third cluster, 'enabling resilience', features initiatives to provide data, information and decision-making tools to strengthen hydro-meteorological systems across Africa and at country level, and to build capacity to plan and design climate-resilient investments.

'The plan, which is awaiting approval by the governing bodies of the relevant financiers, provides an organising framework to improve resilience to climate risk and variability in Africa.'

In view of the 2015 Nepal earthquake, Jackson's (2015) Oxfam Briefing Paper details recommendations to rebuild a more resilient Nepal. Jackson argues that Nepal has made significant achievements in emergency response and early recovery, in challenging conditions, but a lack of national-level plans for recovery and reconstruction have led to confusion, frustration, indecision and delays in implementation. There is a risk of missing the window of opportunity to enhance resilience to climate and disaster risks in Nepal. This paper lays out the issues that urgently need resolution, and provides a set of policy and planning recommendations for parliament, national government, district authorities and implementing partners to help them overcome these challenges. These recommendations address gaps in financial and legal support, provision of temporary shelters, measures to 'build back better' and agricultural recovery, alongside challenges relating to gender equality and inclusion in reconstruction, such as those relating to land ownership and property rights. The most urgent recommendation addresses the reinstatement of the National Reconstruction Authority through passing of the Reconstruction Bill, to build confidence with donors and implementing agencies and to ensure affected communities receive the information and support they are entitled to.

With an eye on the future, Rydge et al. (2015) of the Global Commission on the Economy and Climate (New Climate Economy) highlight the need to build resilience through policy and planning in the infrastructure sector. Approximately $90 trillion in infrastructure investment is needed globally by 2030 to achieve global growth expectations, much of it in developing countries. However, current investments are not aligned with climate goals. For instance, the G20 Global Infrastructure Initiative's mandate to improve infrastructure quality and delivery makes no mention of climate-related risk, and the application of climate policies by development finance institutions is patchy. There is an urgent need and opportunity to systematically integrate climate objectives to ensure new infrastructure investments are climate-resilient and low-carbon. To achieve this, governments and development finance institutions should adopt, and encourage the private sector to adopt, two widely accepted high-level principles for all infrastructure policies, plans and projects: 1) build resilience to the risks of climate changes projected during their lifetimes; and 2) be consistent with countries' adopted climate targets, policies and long-term ambitions. To put this into practice, the authors discuss how these principles can be integrated into infrastructure decision-making in the design of overall strategy and policy, in the composition of infrastructure portfolios and at project level.

A UN Environment Programme (UNEP) (2015) report places collaboration and partnerships at the heart of achieving resilience. More collaboration is needed in policy, planning and delivery between insurers, governments, businesses, non-governmental organisations (NGOs) and communities to build disaster resilience from the local to the regional level. With an emphasis on the role of the insurance industry, this report identifies four partnership models for building resilience – namely, partnerships for resource mobilisation, implementation, innovation and engagement/advocacy. It provides 16 examples of effective multi-stakeholder partnerships for DRR and for disaster risk transfer solutions. These include Bangladesh's Cyclone Preparedness Programme, which has played a key role in building local capacity and resilience to cyclones; the African Union's African Risk Capacity, a ground-breaking risk management and resilience-building platform; and the Caribbean Catastrophe Risk Insurance Facility, the world's first multi-country risk pool and insurance instrument, which demonstrates how regional solutions can limit the financial impact of disasters on national governments. In addition to greater collaboration *within* the DRR and disaster risk transfer sectors, greater linkages between these sectors are also needed to enable integrated disaster risk management.

As discussed further under the *finance and resilience cluster* below, public–private partnerships and private sector investment for resilience are on the rise globally. Governments now have a unique opportunity to create and upgrade policy so as to address gaps and weaknesses in finance provision, increase the demand for climate-resilient investment and enable low-cost and private capital to flow toward these opportunities (UN CCST, 2015). Only with such private investment can international targets and ambition for climate resilience be met.


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3.2 Urban resilience

Grey literature on urban resilience suggests:

- Globally, city governments are increasingly planning and implementing climate resilience measures at scale. However, increased technical and financial support is vital to further enhance urban climate action in developing country cities.
- Unless cities' economic growth is channelled and translated into pro-poor initiatives, it will not automatically contribute towards increasing resilience for the poor and most vulnerable.
- Achieving urban resilience requires multi-stakeholder collaboration and engagement within urban planning and delivery processes.

The majority of the seven papers that engage with the theme of urban resilience discuss challenges particular cities face. The city case studies in this scan focus on Baguio, Cagayan de Oro, Dhaka, Maputo and Mumbai, and urban centres along the coast of Senegal. The only exception is a report by C40 and Arup (2015) on global trends in climate action taken in megacities.

In their detailed exploration of the current status, latest trends and future potential for climate action at city level, the C40 and Arup authors note that climate resilience is an increasingly urgent requirement for urban planning, engineering and design. They present results of research into actions taken at city level to mitigate and adapt to climate change, based on self-reported data from 66 cities. An increasing number of cities are scaling up actions to the 'significant' and city-wide scales, having completed pilot schemes to test the viability and effectiveness of measures to reduce emissions and build resilience to climate risks: 51% of actions reported are now city-wide, up from 15% in 2011. Mayors and city planners are transcending short political cycles to plan according to long (average 15-year) time horizons, demonstrating commitment to long-term planning, including on climate change objectives. Cities have demonstrated impressive resourcefulness in identifying financing mechanisms to support climate actions, and cities' own budgets or savings are funding 64% of investments. The authors argue that, by demonstrating that climate action is possible, scalable and relevant across all regions, cities are leading the way to achieving a low-carbon, climate-resilient future. Collaboration for peer-to-peer sharing of best practices is vital to maintain this momentum and increase the numbers and scale of actions taken. However, 60% of actions currently being taken are in Europe or North America. Enhanced access to technical support and climate finance is necessary to enable cities in developing countries to deliver climate mitigation and adaptation more rapidly and effectively, making Junghans and Dorsch's (2015) paper, discussed in the *finance and resilience cluster* below, especially valuable.

'An increasing number of cities are scaling up actions to the 'significant' and city-wide scales, having completed pilot schemes to test the viability and effectiveness of measures to reduce emissions and build resilience to climate risks.'

Shafiqul Alam et al. (2015), in their discussion of urban climate change resilience in Bangladesh, also highlight the importance of collaboration, in this case focusing on multi-stakeholder collaboration at city level. Informal settlements in Dhaka are becoming home to an increasing number of migrants from rural areas, but they lack basic services and infrastructure. The authors provide an overview of existing initiatives in improving water and sanitation infrastructure and recommend multi-stakeholder collaboration as a means to enhance urban climate resilience in Dhaka. The challenge is to ensure all stakeholders come forward to improve the present situation of service provision and find effective means of collaboration. While a number of NGOs and government agencies are addressing the water and sanitation deficit, climate resilience is not always being considered when implementing these initiatives.

In November 2015, ODI published three case study-based reports on patterns of climate-resilient economic development. Doczi (2015) presents a city case study of Cagayan de Oro, Philippines. The city authorities had a 'wake-up call' in 2011, when they were hit by flash floods, and have since implemented measures to build resilience. Many of those worst affected by the 2011 floods were low-income households. A major driver of the flood's deadly impact was their high exposure caused by lack of awareness of and complacency towards potential flood risk by the city's previous administration, which encouraged the development of informal settlements in flood-prone areas through social housing and support. While the city's overall disaster resilience has increased in the past decade alongside economic growth, and especially since the 2011 floods,

this benefit is not felt evenly across society. In addition, although relocation to remote upland areas has since reduced exposure to floods for many low-income households, they instead face increased risks from landslides, and economic opportunities and access to jobs have declined. Doczi concludes that economic growth is more likely to translate into enhanced climate resilience where stakeholders are explicitly aware of climate risks, where the consequences outweigh the cost of investment and where economic and policy incentives encourage risk-reducing behaviour.

Reaching similar conclusions, Matoso's (2015) case study of Maputo in Mozambique found that high rates of urbanisation and economic growth had improved climate resilience in the central and wealthiest parts of the city while providing little benefit to overcrowded and flood-prone informal areas. Overall, however, the city is more resilient to climate risks and extremes now than it was a decade ago, as governmental initiatives have increased the adaptive capacity of people and assets. Economic growth was not the key factor in this process and in some cases has exacerbated the uneven distribution of adaptive measures, with key infrastructure taking precedence over the poorest who live in the most flood-prone areas. Matoso concludes that, unless sustained economic growth is captured, channelled and translated into suitable pro-poor programmes, it will not automatically contribute towards increasing poor people's disaster resilience.

Simonet and Jobbins' (2015) case study from Senegal found the growth and concentration of activities in urban centres and along the coast had reduced the country's vulnerability to droughts while contributing to increased exposure to new climate risks. Economic diversification in Senegal has enhanced climate resilience by reducing reliance on agriculture, which, as discussed in the policy, planning and resilience cluster, is especially sensitive to drought. However, the growth of tourism and urban centres has also increased exposure to other climate risks, such as storms, coastal flooding and erosion, given the geographical and economic concentration of the sector along the coastline. Again, risks are especially high for the poorest, who often settle in low-lying informal settlements with little social infrastructure, service provision or job security, resulting in low levels of disaster resilience.


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Recognising that meeting water and sanitation needs is a core aspect of urban climate resilience, Ciencia et al. (2015) present a case study of water security, water access, sanitation and urban resilience in the city of Baguio, Philippines. The paper discusses the institutional arrangements, policy recommendations, technology-based interventions and adaptive practices that need to be put in place and adopted in Baguio to ensure water security for its residents. Baguio residents have adopted adaptive behaviours to address the issue of water shortage in the city, such as rainwater harvesting and setting up community water systems. The citywide adoption and implementation of such measures and improved enforcement of environmental regulations, alongside a more integrated and coordinated regulatory framework, is recommended to ensure institutional resilience.

Finally, in a World Bank paper, Patankar (2015) outlines a case study of poor households in the city of Mumbai and their exposure, vulnerability and ability to respond to recurrent floods. A significantly large proportion of poor households and slums are located near areas with chronic and localised flooding. The most significant impacts of recurrent flooding for these households are on health, alongside indirect impacts such as on the non-availability of transport, power, drinking water, food and essential supplies. The study found government compensation represented little correlation between actual losses and assistance provided. In addition, the government offers no financial or technical support to households to undertake risk reduction measures, and there is no early warning system in the city. Despite this, most households prefer to remain rather than relocate to flood-free areas, given the importance of good social networks and because of a lack of financial resources to make such a move. Future climate risks are likely to put greater burden on the poor and push them further into poverty unless well-directed efforts are made to enhance their resilience.


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3.3 Finance and resilience

Grey literature on finance and resilience suggests:

- A range of effective and accessible options are available to cities to create and source funds to support the delivery of climate resilience measures.
- Private sector investment in climate resilience is on the rise, and a deep shift in private sector climate finance may be on the horizon.

Four papers reflect on the urgent need for enhanced subnational access to finance for resilience building and for private sector investment in resilience. As papers under previous clusters highlight, national and local governments across the developing world have a window of opportunity to ensure growing cities and urban areas are climate-resilient and meet low-carbon goals. Adequate and accessible finance for city governments, and the leveraging of private sector investment to support resilience objectives, is a core ingredient in delivering a climate-resilient future.

A Germanwatch report by Junghans and Dorsch (2015) aims to support cities to find the most useful financing schemes available to them to fund climate resilience and low-carbon measures. The authors define internal and external revenue options at the local level, and a range of international climate funds and multilateral development bank and philanthropic sources, and provide insights on their use. Options for raising revenue for climate resilience locally include taxes, user fees and the mainstreaming of climate-compatible development into urban planning. International-level sources of larger funds include the Green Climate Fund, which has declared the design and planning of cities to support mitigation and adaptation as being among its initial results areas, along with climate investment funds, regional development bank financing and others. Despite the growing volume of climate finance, many of these financial instruments are not easily available to cities, given strict requirements for strong fiduciary standards, social and environmental safeguards and creditworthiness. Second-tier cities, which often receive less attention than capitals, can prioritise 'easier access' funds that do not require cooperation with national-level ministries, such as those of the Cities Development Initiative for Asia.

Taking the need for decentralisation of climate financing a step further, Hesse (2015) highlights the potential role of decentralised government structures in allowing communities to participate in decision-making on the use of climate finance through their elected representatives in local government. The author describes pilot initiatives for local adaptation funds in Kenya, Mali, Senegal and Tanzania. These initiatives are designed to establish mechanisms not just to provide local governments with access to climate finance but also to allow poor and vulnerable households to prioritise investments that will provide resilient pathways out of poverty and climate vulnerability.

Securing investment and participation from the private sector is vital to achieve climate resilience goals. Positively, the private sector is increasingly recognising the threat of climate change, and the commercial opportunities it provides, according to the UN Climate Change Support Team (UN CCST, 2015). The authors explain that public–private partnerships are on the rise, following a boost at the 2014 Climate Summit. They identify five early signs of a deep shift in private sector climate finance. While three of these signs are more applicable to low-carbon development, two have significant implications for resilience:

1. Financial institutions from developed and developing countries have recently committed hundreds of billions of dollars in additional finance to support low-carbon and climate-resilient investments across the world.
2. The insurance sector is scaling up its efforts to respond to the climate impacts that are already locked in.

Again, the large majority of these financial commitments relate to low-carbon investments, but some are relevant to climate resilience. The private sector has driven significant growth in catastrophe bonds to preserve the insurability of disasters, with annual issuance having increased from below $2 billion until 2005 to $9.4 billion in 2014. Index-based triggers are increasingly important, especially in developing country schemes. In addition, sovereign disaster risk transfer products have grown significantly in developing countries, as risk is increasingly pooled across countries. As in UNEP (2015), the authors cite African Risk Capacity, which is anchored in the African Union and run by a private company to offer drought protection coverage. This expects to expand from the current five countries to 20-30 countries by 2020, as well as increasing coverage to include tropical cyclones and floods.

Noting the centrality of micro and small enterprises (MSEs) to livelihoods and economies in developing countries, a World Resource Institute and UN Development Programme (UNDP) report by Dougherty-Choux et al. (2015) sets out the drivers and barriers to MSE investment in resilience. This includes investment in their own resilience and their contribution to enhancing resilience locally. The two drivers correspond to those in the findings of the UN CCST report: increasing resilience to climate risks and leveraging commercial opportunities. The six primary barriers include limited financial capacity and challenges in assessing risk and evaluating cost-effective adaptation measures, alongside policies, regulations and social dimensions that hinder adaptation and resilience efforts. The authors describe six types of interventions, and six principles for designing those interventions, which governments, climate funds and multilateral/bilateral partners can employ to incentivise MSE investment in resilience-building. Intervention types include partnerships, technical assistance and financial instruments; principles include the need to prioritise sectors for engagement, given that 'the private sector' is not one entity.

'The private sector has driven significant growth in catastrophe bonds to preserve the insurability of disasters, with annual issuance having increased from below $2 billion until 2005 to $9.4 billion in 2014.'

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3.4 Climate-smart agriculture

Grey literature on climate-smart agriculture (CSA) suggests:

- In developing countries, the agriculture sector absorbs a quarter of losses and damages from climate-related disasters, rising to over 80% for droughts.
- Enhancing resilience in the agriculture sector must play a central role in delivering the 2015 development agenda.
- In meeting the significant agricultural investment need in Africa, governments, funding bodies and other agencies must ensure these investments are climate-smart.

The importance of building resilience to achieve the goals set out in the three key international agendas for 2015 also features in the literature relating to the agriculture sector in this scan.

A World Bank (2015b) report sees the 'triple win' of enhancing resilience and lowering greenhouse gas emissions in the agriculture sector, while boosting agricultural productivity, as a necessary characteristic of the future global food system. Within the SDGs and especially the goals to end global poverty and hunger, there is an opportunity to place the need for CSA at the centre of the development agenda. A more climate-smart food system is sorely needed: nearly two thirds of the world's poor work in agriculture, and improving agricultural performance is central to addressing poverty and food insecurity. Given the impacts of climate shocks and change on agricultural productivity, and the role of greenhouse gas emissions from agriculture in driving climate change, enhancing resilience and lowering emissions in the agriculture sector is vital. Demonstrating the inherent value proposition that lies at the root of the majority of CSA measures can help in achieving transformational scale, but incentives, knowledge, science and finance are also required. Necessary measures include realigning incentive policies currently in place, and developing and utilising innovative risk financing systems in agriculture.

A Food and Agriculture Organization (FAO) (2015) report highlights the centrality of achieving resilience in the agriculture sector to achieving the three key international agendas agreed in 2015. The report offers a substantial contribution to the available evidence on the nature and magnitude of impacts of disasters on in agriculture and its subsectors (crops, livestock, fisheries and forestry). Between 2003 and 2013, disasters cost about $550 billion in estimated damage and affected 2 billion people in developing countries alone. Presenting the results of extensive analysis, the authors show that in developing countries agriculture absorbs 22% of the total losses and damages caused by natural hazards, rising to 25% when considering climate-related disasters alone. Agriculture sector impacts are especially acute for droughts, at 84% of drought losses and damages, felt especially in the livestock and crop subsectors. These impacts have a direct effect on livelihoods and food security, and cascading negative effects across national economies. There is an urgent need for national governments and the international community to embed disaster risk management and resilience-building within agriculture sector development plans and investments.

FAO (2015) provides detailed analysis on the impact of drought in Sub-Saharan Africa, and finds heavy losses, with the greatest impacts in Eastern Africa. In light of this, Carabine et al.'s (2015) policy review on ending drought emergencies in Kenya offers valuable insights into ways to address this risk. Kenya's arid and semi-arid lands are a challenging context within which to achieve resilience. However, the current process of devolution to counties in Kenya is providing a timely window of opportunity to strengthen governance for climate resilience. The authors review the current policy framework supporting resilience in Kenya, the political economy of decision-making for resilience and the enablers and barriers in relation to building resilience, such as access to credit and insurance, an adequate water supply and physical access to markets, among others factors. The report concludes with a series of reflections on the roles of the National Drought Management Authority and county governments, alongside donors and other groups.

In nearby Rwanda, inclusive agricultural development, focused on new crops, new practices and new markets, has reduced poverty and improved the

'the authors show that in developing countries agriculture absorbs 22% of the total losses and damages caused by natural hazards, rising to 25% when considering climate-related disasters alone.'


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resilience of agriculture, according to Parker (2015). In addition, public investment in land management and irrigation has reduced flood and drought risk, while education and higher rural incomes have enhanced adaptive capacity, with short-, medium- and longer-term benefits for resilience. However, sector-led growth has not led to diversification within the wider economy, thus the Rwandan economy remains highly susceptible to climate risks. In the long run, agricultural growth must be part of broader economic transformation to support livelihood diversification, reduced inequality and climate-resilient development.

Looking at Africa, Williams et al. (2015) also recognise the centrality of CSA to climate resilience across the continent, and to achieving the SDG commitment to 'end hunger, achieve food security, improve nutrition and promote sustainable agriculture'. The authors set out challenges, opportunities and broad recommendations for Africa to reap the potential benefits of CSA. Actions recommended again include development of innovative financing schemes to unlock agricultural and climate finance for smallholders, governments and private sector entrepreneurs, and to adapt water management to improve food security. As a proportion of total agriculture investment needs in Africa, the additional cost to make that investment climate smart is small at approximately $3bn per year (of an estimated total of $48.5bn per year). Agricultural development budgets must be the primary public financing source, requiring the screening of agricultural investments with a climate smart lens. However, there is also an essential need for climate finance mechanisms to give more attention to agriculture and to strengthen African countries' capacities to access these funds.

Finally, two short briefings outline the potential benefits of specific measures for building resilience in the agriculture sector. In a two-page info note, Ouédraogo et al. (2015) present initial findings from a project in northern Burkina Faso that suggest the majority of farmers do act on daily and seasonal weather forecast information where it is available and accessible, to the benefit of their crop production. This adds further evidence to existing knowledge on the potential value of large-scale dissemination of climate information as a means of building climate resilience for farmers and rural communities, a service the majority of farmers surveyed are prepared to pay for. The second briefing, by van de Gevel (2015), highlights the benefits of agricultural biodiversity in building resilience to climate variability and change, at the farm and landscape levels. For example, wheat is sensitive to heat during flowering, so planting different varieties with different flowering times can reduce the risk of crop loss in the case of an extreme heat event. Mixed-crop and crop–livestock systems, and diverse food sources, can play an important role in strengthening resilience.

'As a proportion of total agriculture investment needs in Africa, the additional cost to make that investment climate smart is small at approximately $3bn per year (of an estimated total of $48.5bn per year).'

3.5 Monitoring and evaluation

Grey literature on monitoring and evaluation suggests:

- Defining resilience precisely helps in measuring it accurately.
- The measurement of drivers and characteristics allows us to measure resilience without relying on the occurrence of shocks and stresses.

As resilience has risen to prominence in the development sector, defining how best to measure and monitor it is an essential task. Although the cluster of papers looking at the monitoring and evaluation of resilience is much smaller than in the previous scan, two papers published in this period investigate the problems with defining and measuring resilience.

A case study from Ethiopia by Vollenweider (2015) defines and measures resilience as the speed of recovery after a shock – a narrow definition intended to distinguish resilience from related concepts such as vulnerability. According to the author, the added value of the concept of resilience is its focus on dynamics: the poverty pathway over time. The report applies this in a new framework to simultaneously estimate individuals' vulnerability and resilience to climate shocks such as droughts and floods, in the hope that this will allow for rigorous resilience measurement across a wide number of countries for use in policy and programme design, targeting and impact evaluation.

Similarly, Fuller and Lain (2015) note that they have been grappling with the problem of how to measure resilience for several years. In their Oxfam discussion paper, the authors outline lessons learned about measuring resilience from their set of large-N effectiveness reviews. The authors say that focusing on drivers or characteristics makes it possible to measure resilience by means of a snapshot, without having to rely on shocks or stresses actually occurring. Their definition of resilience is 'the ability of women and men to realise their rights and improve their wellbeing despite shocks, stresses and uncertainty'. Based on this definition, the final 'impact' they seek to measure from resilience-building programmes is an improvement in the realisation of rights and well-being. The issue of measuring resilience can therefore be straightforward: they observe the improvement in well-being and/or the realisation of rights. In most cases, however, increased resilience cannot be expected to lead to improvements in well-being over a short timeframe. For short-term measurement, they try to identify drivers of resilience: characteristics that are important for people's ability to thrive despite shocks, stresses and uncertainty. Such characteristics could include, for example, access to a grain bank, improved seeds or early warning information.


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4. Review of resilience in the academic literature

Twenty-eight peer-reviewed papers were retained for full analysis, from which four dominant themes emerged. The first, *natural resources and human well-being*, examines the pathways in building a climate-resilient agricultural society, the determinants of food security and the link between land policy and resilient livelihoods. The second, *governments and governance*, discusses the organisational and institutional considerations involved in guiding society towards a resilient future. The third, *marginalisation and inclusion*, looks at groups – particularly women and migrants –frequently overlooked in project and policy decisions. The last, *resilience in practice*, examines the usefulness of a resilience approach and subsequent tools for measuring and building resilience in the context of project and programme design.

Although these differ slightly from the five analytical clusters in the previous resilience scan, they are consistent with the themes that have emerged throughout the resilience scans as a whole. *Governments and governance* is similar to *politics and governance* in the last resilience scan: they both cover components of good governance. *Natural resources and human well-being* is similar to the *ecosystem-based adaptation and natural resource management* and *agriculture and livelihoods* analytical clusters in the last resilience scan. *Marginalisation and inclusion* mirrors the cluster of the same name in the April–June scan in that they both address voices that are often excluded from resilience planning, even though they cover different marginalised groups. *Resilience in practice* has some overlaps with the *methods and approaches* cluster in the April–June scan, although the focus here is on the value of resilience thinking in development projects and programmes.

4.1 Natural resources and human well-being

Papers that discuss the interaction between natural resources and human well-being suggest:

- There are generic actions that can build resilience in agrarian communities to climatic variability: providing resources to farmers, investing in technological infrastructure and building the regional capacity of institutions to scale up successful agricultural interventions.
- Food security is affected not only by ecological and climatic factors but also by socioeconomic dimensions, including gender dynamics, dietary preference and food prices.
- Flexibility in land-use and livelihood strategies allows farmers to benefit from opportunities and protect themselves in times of acute stress.

Fourteen papers used insights from a range of disciplines to examine the relationship between natural resources and human well-being. Of these, eight presented this relationship as the focus of their paper, with three looking at pathways involved in building a climate-resilient agricultural society, four addressing the determinants of food security and one focusing on land use and livelihoods.

Of the three papers that examined options in building climate-resilient agricultural communities (e.g. farming, fishing), two examined the limited capacity of farmers in Sub-Saharan Africa to adapt to the effects of climate change, particularly droughts. The first paper presents an overview of articles in a special issue on agricultural water management and agrarian resilience (Cofie and Amede, 2015), whereas the paper by Mbakahya and Ndiema (2015) uses a case study to identify factors that might build (currently constrainted) adaptive capacity in farming communities – they note that 82% of households in Nambale sub-county of Kenya are vulnerable to climate change. The papers have similar recommendations, such as developing regional institutional capacity so interventions can be

‘data show that, between 1975 and the late 2000s, the farmers transformed the land type (e.g. forest management, pasture, agroforestry, agriculture) in order to produce and capitalise on global ‘boom’ products (e.g. rubber, brazil nuts, cattle, acai).’

scaled up; providing necessary resources to farmers (e.g. access to credit, climate information); and investing in technological infrastructure (e.g. climate monitoring and rainwater harvesting infrastructure). The final paper in this sub-cluster looked at sustainable intensification and diversification options for agricultural communities in West Bengal, India (Bunting et al., 2015). The authors examine various scenarios that reduce pressure on biodiversity (noted as a key objective), while simultaneously building agro-biodiversity and socioeconomic resilience.

Only four papers focused explicitly on the determinants of food security, despite this topic recurring in many of the studies. Kiewisch (2015) looks at gender as a determinant of food security in cocoa-growing communities in Côte d’Ivoire. A key finding was that the allocation of men’s income for individual spending undermines household resilience and exacerbates food insecurity. Population pressure was expected to be a key variable in a study on the resiliency of food systems in Vanuatu (Lebot and Siméoni, 2015). Having studied six communities with different population pressures across six islands, the authors were surprised to find that highly populated villages had shorter fallow periods and higher yields, but these plots were more demineralised. They also determined that the importation of food was not influenced by land or soil pressures, but rather driven by sociocultural shifts in diets.

The Food Resilience Village Programme (Demapan) was launched in 2006 to address food security in Indonesia and is evaluated in a paper by Dirhamsyah et al. (2015). The authors found that high rice and corn prices and number of household members were most likely to lead households to be food-insecure, whereas greater land area and participation in Demapan training schemes contributed to food security. Finally, Qureshi (2015) takes a broader view to demonstrate that food security in Pakistan, as well as economic development more generally, has rested on the overexploitation of groundwater. Many solutions, such as permit systems, are deemed to be unsuitable to the sociocultural context. Qureshi recommends stabilising the aquifers (e.g. with artificial groundwater recharge), increasing the productivity of groundwater use (e.g. using on-farm water conservation techniques) and revisiting the concept of conjunctive water use. However, he stresses these options would need to be situated within a ‘well thought out, pragmatic, patient and persistent strategy’, which engages both the government and the users whose livelihoods and food security are reliant on this resource (p.708).

A final paper, by Vogt et al. (2015), looks at smallholder land-use and livelihood strategies in the Amazon Estuary since World War II. The authors use census-based and remotely sensed data to examine forest transitions – ‘the reversal between two distinct land-use transitions’ (p.1044). They note that residents have adapted their land-use and livelihood strategies in response to changing shocks or opportunities caused by factors such as climate change, technological advances and shifts in the global economy. For example, data show that, between 1975 and the late 2000s, the farmers transformed the land type (e.g. forest management, pasture, agroforestry, agriculture) in order to produce and capitalise on global ‘boom’ products (e.g. rubber, brazil nuts, cattle, acai). This ability or ‘flexibility’ to employ diverse land-use patterns, in part because of local knowledge of forest and agricultural systems, is noted as having underpinned the socio-ecological resilience in this region over this 25-year period.

4.2 Governments and governance

Papers that engage with the themes of governments and governance suggest:

- Good governance is promoted by means of multi-level stakeholder engagement, accountability, equity and local participation.
- Local ownership over projects can overcome many of the challenges associated with international projects, such as lack of stakeholder engagement.
- Leadership is a frequently overlooked, yet indispensible, characteristic of good governance within a disaster risk reduction (DRR) context.
- Governance structures emerge in relation to governmental structures.

Eight papers explicitly focus on the relationship between governments, governance and resilience. Governance is broadly described as the interaction of both private and public institutions that together address societal problems and opportunities. Perhaps most important are the characteristics that promote 'good governance', such as multi-level stakeholder engagement, accountability, equity and local participation, which are often hard to achieve. McConney et al. (2015) investigate building resilience into fisheries governance in the Eastern Caribbean. They propose using social network analysis to examine the social networks that enable self-organisation among fisherfolk and to integrate them into the broader fisheries governance structure for better multi-level stakeholder representation. In addition, when these networks are being leveraged for detrimental purposes (e.g. used for illegal sea urchin harvest), policies can be designed to reform them.

Doughty (2015) outlines the difficulties facing international projects that aim to create adaptive social-ecological systems, including low stakeholder engagement and limited time. She looks at a case in Peru where a local conservation non-governmental organisation obtains funding from a range of international organisations, such as the International Union for the Conservation of Nature, to conduct projects with local communities. These communities can veto, design and assist in the implementation of these projects, to ensure they enhance resilience to climate change. Key outcomes include the creation of local networks and improved economic activity. Her case study demonstrates the potential for local organizations and people to take charge of their own resiliency efforts where international projects and protocols may otherwise prove ineffective.

A paper by Nolasco et al. (2015) propose further cooperation between local stakeholders as a way to promote disaster risk reduction (DRR) in the Philippines. Using a case study in Naga City, the authors look explicitly at the benefits of linking schools and the community for disseminating important DRR knowledge and for building resilience against natural disasters. Bongo and Manyena (2015) address the characteristics of good governance within a DRR context using two case studies from Zimbabwe. They argue that leadership is a frequently overlooked, yet indispensible, characteristic of good governance – they note its absence in the Sendai Framework for Action for Disaster Risk Reduction (SFDRR).

Two papers looked at the changing interaction between governance and government structures after the conflict in the Solomon Islands (Allen and Dinnen, 2015; McDougall, 2015). McDougall notes that society was labelled 'strong and resilient', and in opposition to the 'weak and failing' state (p.450). She challenges the notion of governments and governance in relation to the concept of 'resilience' within this island context. She argues that, while societal governance structures did help maintain social order, they are not necessarily 'self-contained resilient structures that have retained their shape against external forces', but rather have manifested from within and in opposition to colonial governmental institutions. In contrast with the other papers in this cluster, Hassan and Othman look at the government's role in building economic resilience. Using Malaysia as an example, they discuss how clear signals through strong macroeconomic policies, for example 'diversifying the sectoral structure [and] improving the taxation structure', build economic resilience, which in turn increases private investment (p.379).

4.3 Marginalisation and inclusion

Papers that discuss marginalisation and inclusion suggest:

- Adaptation, resilience and vulnerability literature that is engaging with gender has increased since 2006, yet it is dominated by female experiences.
- Gender dynamics affect how people experience natural disasters and periods of food insecurity; resilience-building projects and programmes must not be gender-blind.
- Different groups must be included in urban planning and policy decisions for them to build urban resilience.

Six papers examined how specific marginalised groups could be better included in policy and planning. Four of these papers focused on the gendered dimensions of resilience in a range of contexts, including DRR (Drolet et al., 2015), food security (Kiewisch, 2015) and climate-resilient agriculture (Chanamuto and Hall, 2015).

Two papers use case studies from Sub-Saharan Africa, where gendered norms undermine household resilience in periods of acute stress (Chanamuto and Hall, 2015; Kiewisch, 2015). For example, Kiewisch finds that separate income allocation (e.g. men use income for individual spending) can cause problems during the 'lean season', when various factors converge to increase food insecurity. Providing women with new livelihood opportunities that increase their decision-making power and encouraging cooperation between men and women to make joint decisions are seen as viable ways of building household resilience.

'The authors state that, by supporting female social capital and women's organisations, and including them in post-disaster reconstruction planning, 'disasters can provide an opportunity to redress gender disparities', build resilience and promote sustainable development.'

Drolet et al. examine gender within a DRR context using case studies from Pakistan and the US, commenting that, 'While the vulnerabilities of women in times of disaster are evident, so too is their resilience' (p.438). They show that women contribute to post-disaster reconstruction and recovery in different ways to men, particularly in relation to emotional support for the family and the provision of food and water. The authors state that, by supporting female social capital and women's organisations, and including them in post-disaster reconstruction planning, 'disasters can provide an opportunity to redress gender disparities', build resilience and promote sustainable development (p.444).

The final paper in this sub-cluster presents a systematic literature review of 123 articles to see how adaptation, resilience and vulnerability (ARV) research is 'engaging' with gender (Bunce and Ford, 2015). The authors design an analytical framework to demonstrate that, although engagement levels have increased since 2006, gender-focused ARV studies are dominated by female experiences, infrequently comment on male experiences and have yet to focus on individuals outside of the gender binary. All articles called for further awareness of gender in resilience thought and practice.

The theme of marginalisation also emerged within an urban setting. Moore (2015) examines a case in Honiara, which is experiencing a significant increase in migrants. The permanence or 'resilience' of village culture, and the relatively small size of the island, hinder the new arrivals' integration into the city, leading to an increase in settlement/squatter areas. The paper concludes that authorities must 'incorporate [the arrivals] into planning or face future urban turmoil' (p.419).

The paper by Friend and Monech (2015) looks at the rapid shift from an agrarian to an urban society that has occurred in Asia, and the resultant increases in poverty and vulnerability to climate change. The authors stress the importance of equitable governance when determining planning and policies to build urban resilience, stating the need the question 'how the urban future is shaped, for whose benefit and by whom' (p.643). They conclude stating, 'the concern here is that the discourse around city systems resilience can easily be framed as involving "tradeoffs" between people and the needs of the system without those people who are likely to be affected having any voice in decisions regarding the trade-offs being made' (p.648).

4.4 Resilience in practice – usefulness and application

Papers on resilience in practice suggest:

- Academics, policy-makers and practitioners often use resilience terminology in confusing and conflicting manners.
- While a resilience approach is often comprehensive in scope, it would benefit from an enhanced awareness of certain disciplines, such as how power relations affect how people benefit (or do not benefit) from resilience-building projects.
- The development of new tools for measuring and assessing resilience is essential so we can better understand effective resilience interventions.

Thirteen papers looked at resilience in practice, five of which focused explicitly on the usefulness of a resilience approach for creating projects and programmes. Four presented new tools and metrics that can be applied to evaluate strategies and projects.

The term 'resilience' has emerged from diverse research disciplines, leading to a multitude of definitions. Many papers cited this as a primary reason for researchers, stakeholders and practitioners using this term in contrasting and conflicting ways. For example, McDougall (2015) argues that, when people use the word 'resilient' to describe the Solomon Islanders post-conflict, they actually mean to call them 'tenacious'. Fisichelli et al. (2015) argue that confusion about the term – in particular whether it refers to a system returning to a previous state following a disturbance or can be transformational – impedes communication between stakeholders working on climate change adaptation and conservation strategies, meaning the word itself is maladaptive. To overcome this, the authors propose new terminology that differentiates between 'strategies that seek to resist change, accommodate change, and direct change (i.e., persistence, autonomous change, and directed change)' (p.1).

Three papers commented that a resilience approach is useful for international development projects, but it would be benefit from incorporating a vulnerability perspective (Hashemi et al., 2015), a gender perspective (Chanamuto and Hall, 2015) and a political economy approach (Friend and Moench, 2015). Hashemi et al. argue that the vulnerability 'approach aims to decrease farmers' vulnerability and [the resilience] approach aims to build resilient agro-ecosystems' (p.20). Using a case study from Iran, they show that combining vulnerability and resilience approaches could reveal situations were farming is found to be tenable, but not desirable or sustainable from a farmers' perspective, thus warranting a systems transformation. They present the value of using an integrated approach for adaptation to climate change in agro-ecological systems.

Chanamuto and Hall show in their case study on resilient livestock projects in Sub-Saharan Africa that a gender perspective is central to designing projects that aim to build household resilience to climatic and economic shock and stress. Finally, Friend and Moench suggest that 'urban resilience' as a policy objective often decreases societal vulnerability through tackling deprivations associated with poverty, without 'necessarily [lending] itself to addressing structural causes of poverty, or toward efforts around enhancing wellbeing' (p.644). They note that a political economy perspective is necessary for building resilient urban centres.

Two papers examined the benefits of using a resilience approach in implementing development projects and programmes. Reed et al. (2015) examined Asian Cities Climate Change Resilience Network projects to question how resilience projects are different from past development projects. They deduce that resilience is about 'doing things differently, not doing different things' (p.473). The way a project is implemented, for example integrating stakeholders and building their capacity to learn and reorganise, contributes as much to building resilience as the project outcomes. They contrast this emphasis on 'building capacity' to concepts of 'implementation' and 'mainstreaming' that frequently dominant climate change adaptation practice. Béné et al. (2015) take a number of case studies from the Horn of Africa and Sahel regions to examine the use of a resilience approach in the context of food security and nutrition programmes. They comment that the main value is the integrative nature of resilience; it is a 'mobilising metaphor', enabling multi-disciplinary collaboration between groups and communities of practice that frequently work in silos (p.4).

Four papers introduced new tools for measuring and building resilience, three of which have insights for projects that aim to build ecological integrity and human well-being. Wang et al. (2015) propose a health evaluation index system and apply it to understand the factors influencing the health status of a semi-arid loess watershed in China. The evaluation is framed on three components: vigour (the functional ability of a watershed), organisation (the stability of each subsystem structure, the mutual connectivity of the components) and resilience (input capacity required for a watershed eco-economy to maintain structure and function during a disturbance).

Maleksaeidi et al. (2015) use insights from a case study in Iran to develop the Farm Households' Resilience Scale (FHRS), which comprises 31 questions. They propose the FHRS be used as a tool to measure the resilience of socio-ecological systems under water scarcity as a way to evaluate and compare the impact of policies and programmes.

Chimonyo et al. (2015) examine crop simulation models (CSMs) and, using examples from Sub-Saharan Africa, demonstrate that these models are currently inadequate for contexts that employ intercropping techniques. They propose new parameters to transform CSMs into more useful decision tools that can be used to reduce food security in these contexts.

Finally, the paper by Quinlan et al. (2015) investigates more broadly the difference between assessing and measuring the complex nature of resilience, noting that assessments aim to understand system dynamics whereas measurements look to quantify resilience in a repeatable manner. They conclude that, just like resilience assessments, the approach for measuring resilience should be iterative and ongoing so as to incorporate and adjust to new information.

'The way a project is implemented, for example integrating stakeholders and building their capacity to learn and reorganise, contributes as much to building resilience as the project outcomes.'


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5. Understanding the characteristics of resilience

As is evident from the preceding sections, multiple disciplines and domains of practice employ resilience thinking. This section therefore draws out connections across the growing field of resilience to understand the directions in which the field is moving. This section interprets the literature discussed in the scans of blogs, academic and grey literature based on five characteristics of resilient systems identified by the Rockefeller Foundation. These characteristics have been distilled through a consideration of a wide body of research on the topic.

5.1 Awareness

The ability to constantly assess, learn and take in new information on strengths, weaknesses and other factors through sensing, information gathering and robust feedback loops.

Key messages:

- Improving stakeholder awareness of climate change and disaster risk reduction (DRR) measures is an important component of resilience building strategies.
- Comprehensive awareness of both physical hazard risks and socioeconomic risks is vital for decision-making to enhance resilience.
- The development of metrics, methods and tools with which to analyse resilience is central to the creation of effective resilience-building interventions.
- Information and knowledge must be disseminated to relevant stakeholders across sectors and scales of society to build resilience to shock and stress – particularly natural disasters and climate variability.

Although the blog posts did not explicitly use the term 'awareness', or being 'aware', various posts describe the need for stakeholders, particularly at the community level, to receive up-to-date information about climate change and disaster risk reduction (DRR) measures. For example, the post, 'El Niño highlights need for resilient agriculture' describes the benefits of disseminating information to farmers about how crops have historically reacted to climatic variability. Blogs also reference new technologies or tools that are being used to identify entry-points for resilience interventions, such as in 'Using satellite technologies to protect African farmers from climate shocks'.

Grey literature explicitly references awareness and awareness-raising as a key factor in building resilience. This relates to awareness of risks, best practices for building resilience or funding opportunities available, among others. A lack of awareness of flood risk by the city government was explicitly cited by Doczi (2015) as a major driver of the high impact of the 2011 floods on low-income households in Cagayan de Oro, Philippines. Similarly, the city government's lack of awareness of landslide risks and the socioeconomic implications of resettlement to areas with fewer job opportunities may have led to a reduction in resilience of low-income, resettled households. C40 and Arup (2015) stress the importance of peer-to-peer sharing of knowledge, learning and best practices – raising awareness that climate action is possible, scalable and relevant across all regions – as a major driver for increased city-level action on climate change and climate risk. Adequate and accessible finance is among the barriers to climate action for cities, and so Junghans and Dorsch (2015) report that aiming to raise awareness of the fundraising options available to city governments is a valuable contribution to building resilience. Ouédraogo et al. (2015) add another perspective to this with their research that shows that farmers surveyed in Burkina Faso are prepared to pay for climate information, and factor this in their decision-making.

Half of the peer-reviewed papers (n=14) explicitly referenced 'awareness' and its link to resilience. Many papers stressed the importance of developing knowledge, suggesting new and improved metrics, methods and tools with which to assess and measure the components of resilience. These include suggestions to enhance crop simulation models (CSMs) to account for intercropped landscapes (Chimonyo et al., 2015), a quantitative index with which to understand the factors influencing the health status of socio-ecological system, defined as an 'eco-economy' (Wang et al., 2015), and a Farm

Households' Resilience Scale comprising 31 questions to measure and compare the impact of policies and programmes (Maleksaeidi et al., 2015). For these resilience measurements to be effective, they must be iterative and able to incorporate and adjust to new information (Quinlan et al., 2015). As part of this adjustment, several papers highlights areas that need to be better incorporated in future resilience assessments, projects and programmes, for example gendered dimensions (Bunce and Ford, 2015; Chanamuto and Hall, 2015; Drolet et al., 2015; Kiewisch, 2015). Finally, several papers discussed the need for more data, proposing, for example, that governments build climate-monitoring infrastructure to meet this need (Cofie and Amede, 2015; Mbakahya and Ndiema, 2015).

Having gathered and measured a system's resilience, many papers stressed the importance of building awareness, or knowledge, in a particular group so they can better manage a situation. For example, a number of papers commented that farmers needed to build awareness of climatic conditions to better manage climatic variability (Mbakahya and Ndiema, 2015), surface water practices to mitigate the development of soil salinity (Qureshi, 2015), the science of intercropping to manipulate crop management factors (Chimonyo et al., 2015) and environmental protection and conservation to improve the ecological health of the region (Wang et al., 2015). Other papers discussed strategies for raising public awareness about natural disasters, for example campaigns and community meetings (Bongo and Manyena, 2015) or partnerships between communities and schools (Nolasco et al., 2015).

5.2 Diversity

Diversity implies that a person or system has a surplus of capacity such that it can operate successfully under a diverse set of circumstances, beyond what is needed for everyday functioning or relying on only one element for a given purpose.

Key messages:

- Diversity is the second most frequently discussed resilience characteristic in the blogs.
- Diversification is an effective resilience-building measure against climate risks at all scales, from the farm level (agricultural biodiversity) to the national level (economic diversification to reduce reliance on climate-sensitive agriculture).
- Diversity was the most frequently cited characteristic of resilience in the peer-reviewed literature.
- The diversification of particular components within a system – including livelihoods, government policies, stakeholders and biodiversity – enable it to adapt to internal and external pressures.

The second most frequently discussed resilience characteristic in the blog posts was diversity, which was present in seven of the 25 blogs and included diversifying income as a DRR measure (in 'Building resilience in communities on the brink of disaster'); crop diversification to prepare farmers and the food system for climatic variability (in 'Climate change and agriculture: Connecting global warming to business resilience'); conserving biodiversity and ecosystems (in 'Growing resilient forest landscapes in the face of climate change'); and diversifying water supply sources in cities in order to allocate water use by water quality (in 'Getting to climate resilient and low carbon urban water').

Two papers refer to national-level economic diversity as a means to enhance resilience using country case studies from Africa. Simonet and Jobbins (2015) give the example of Senegal, where the growth of tourism and urban centres along the coastline has diversified the economy and reduced reliance on the climate-sensitive agriculture sector, which has enhanced climate resilience. However, this has also exposed the economy to new climate threats, such as storms and coastal flooding. Meanwhile, in Rwanda, although investments have led to improved resilience and reduced poverty, a lack of diversification within the wider economy and continued reliance on the agriculture sector leaves the country highly susceptible to climate risks (Parker, 2015). Transformation is needed within the Rwandan economy to support livelihood diversification and enhance climate resilience.

Diversity was the most frequently cited characteristic of resilience, appearing in 24 of the 28 peer-reviewed papers. This covered a range of contexts and subjects, but at least 10 of the papers referred to the diversification of livelihoods, primarily within an agrarian system. This strategy of diversifying the source of income was proposed not only for farming households to exploit untapped opportunities but also to reduce their exposure to external disturbances, such as droughts or water insecurity (Béné et al., 2015; Bongo and Manyena, 2015; Bunting et al., 2015; Hashemi et al., 2015; Mbakahya and Ndiema, 2015; Qureshi, 2015). This diversification might require a change to the system's dynamics: for example Wang et al. look at the factors contributing to a healthy eco-economy in China, and note that a shift in land use (from 'slope cropland to pasture grassland or orchards') would enable farmers to diversify their income by engaging in off-farm employment (e.g. animal breeding) (p.1898). Papers, such as by Kiewisch (2015) on gender, food security and resilience in cocoa-growing communities, also stressed that, 'in addition to [diversifying household livelihoods], households' use of existing resources should be considered' a lucrative intervention for building resilience (p.511). This highlights that, although diversification can be a solution, at times the system would benefit from simply being made more efficient.

A number of papers introduced the concept of biodiversity, for example to discuss the link between climate change, vegetation degradation and biodiversity loss and the possible impact on human well-being (Mbakahya and Ndiema, 2015; Wang et al., 2015). Other examples refer to biodiversity within conservation areas (Fisichelli et al., 2015) and how crop biodiversity positively influences food security and nutrition, particularly in harsh environments (Chimonyo et al., 2015; Doughty, 2015). Related to this, increasing species diversity within a household was also proposed as a means of sustaining the social-ecological system (Lebot and Siméoni, 2015). For example, Chanamuto et al. (2015) argue that increasing household livestock species and breed diversity is an effective resilience intervention.

Diversifying sources of food was proposed as a way to increase food security in a case study in Indonesia (Dirhamsyah et al., 2015). In a similar vein, West African farmers reported reducing the diversity of their food as a strategy to cope during the 'lean season' before the cocoa harvest (Kiewisch, 2015). Vogt et al. (2015) discuss how the diversity in land-use systems in the Amazon enables the farmers to be flexible and adapt to external pressures such as climate change or market forces. Diversity of government policies, such as diversifying the sectoral structure to increase economic resilience, is another example of how this sample of papers discussed the concept of diversity (Hassan and Othman, 2015).

The diversity of stakeholders involved in resilience thought and practice also emerged as a key theme underpinning many of the papers. This was seen as positively influencing resilience through incorporating perspectives from across disciplines, sectors and scales of society (Béné et al., 2015; McConney et al., 2015). However, at least three papers also commented on how diverse stakeholders bring diverse agendas to the process of governance, with implications for differentiated benefits (Friend and Moench, 2015; McDougall, 2015; Reed et al., 2015).

5.3 Self-regulation

This implies a system can deal with anomalous situations and interferences without significant malfunction, collapse or cascading disruption. This is sometimes called 'islanding' or 'de-networking' – a kind of 'safe failure' that ensures any failure is discrete and contained.

Key messages:

- The term 'self-regulating' was not mentioned explicitly in the blog posts or peer-reviewed literature.
- The concept of 'self-organising' was frequently used to demonstrate how stakeholders can establish new networks or shift existing relationship dynamics to respond to change.
- Regulation and regulatory policies were discussed as mechanisms that allowed various systems (urban, farm, economy) to function and sustain human well-being.

Self-regulating was not explicitly addressed in the blog posts. It was only really referred to in passing within the context of regulatory policies and requirements, for example creating 'regulatory requirements for addressing rising sea levels' in 'Innovations in resilience along the water's edge'.

This was the least discussed characteristic in the grey and peer-reviewed literature. When papers discussed this, they tended to use the term 'self-organising', which, as Quinlan et al. (2015) note, is an integral, yet undefined, component of resilient socio-ecological systems. Generally it is understood as allowing complex systems to be adaptive and able to 'regenerate and transform', with a particular emphasis on its value in building agency among local stakeholders (p.2). The self-organising of local stakeholders underpinned a paper by McConney et al. (2015), who stressed that relationships were dynamic and shift in response to feedback loops, internal factors (e.g. trust) and external influences (e.g. climate change). Finally, Maleksaeidi et al. (2015) discuss household resilience under water scarcity, commenting that, 'Management has an important role to destroy or build resilience, depending on how the system organizes itself in response to management actions' (p.1306). This self-organising refers to the system's 'function, structure, identity, and feedbacks' that allow it to absorb and adapt to disturbance (p.1306).

In a different vein, Chimonyo et al. (2015) discuss how effectively constructed farm systems can 'naturally buffer extreme weather events, regulate resource use and competition and reduce risk of pests and diseases through biological or direct control' (p.1512). In doing so, these self-regulating systems promote food security and increase resilience.

A number of papers also discussed regulation within the context of regulatory policies and institutions that enable a system to function. For example, Hassan and Othman (2015) discuss the macroeconomic policies that 'minimiz[e] the impact of shocks and expediting the economy recovery' (p.379). In contrast, Friend and Moench (2015) examine the role of local government in managing, regulating and investing in urbanising land and infrastructure within the context of urban resilience. Finally, Reed et al. (2015) look at how effective regulatory institutions (e.g. building codes, zoning plans) promote disaster resilience. Some papers also talked about the detrimental consequences of unregulated systems, for example how unregulated extraction of groundwater depletes this resource and undermines the resilience of the socio-ecological system (Qureshi, 2015).

5.4 Integration

Being integrated means individuals, groups, organisations and other entities have the ability to bring together disparate thoughts and elements into cohesive solutions and actions. Again, this requires the presence of feedback loops.

Key messages:

- Approaching resilience-building strategies with insights and involvement from various sectors and scales is of great importance.
- The 2015 agreement of the three key international frameworks presents an unprecedented opportunity for integration in policy, planning and delivery across the DRR, climate change adaptation and development agendas, with implications across scales and sectors.
- There is an urgent need and opportunity to lock in a resilient future through integration of climate and disaster resilience concerns within sectoral investments, given the vast investments needed to meet global growth expectations in the coming decades.
- Collaboration and partnerships among multiple agencies will be central to meeting resilience objectives.
- Resilience approaches promote the integration of individuals from disciplines, sectors and levels of society who otherwise often operate in silos.

Four blog posts explicitly referred to integration. This was usually within the context of including various objectives (e.g. DRR, livelihood diversification, etc.) in programme development for more comprehensive and resilient planning. For example Judith Rodin, President of the Rockefeller Foundation, highlights the importance of a 'systems-deep' approach that acknowledges the interconnected nature of the world in order to identify solutions that satisfy multiple objectives simultaneously (in 'The next frontier of climate change resilience'). While not explicitly referring to integration, the climate resilience officer (CRO) position supported by the Rockefeller Foundations' 100 Resilient Cities (100RC) presents new opportunities for peer learning between cities around the world, and for departments within a city to collaborate to create comprehensive resilience strategies, demonstrative of integration.

Within the grey literature, integration is explicitly and frequently discussed with reference to policy, planning and delivery from the international to the local level. With the Sustainable Development Goals (SDGs) and Paris climate change deal freshly agreed, many of these papers emphasise new opportunities for integrated policy and planning to achieve climate resilience, although each approaches this issue from a different perspective. For example, the UN Office for Disaster Reduction (UNISDR) (2015) lays out options for integrating implementation of the Sendai Framework for Disaster Risk Reduction (SFDRR) and the SDGs, with shared targets and indicators across the two frameworks for enhancing resilience; World Bank (2015) and Williams et al. (2015) stress the importance of climate-smart and resilient agriculture in achieving the SDGs, particularly those relating to ending global poverty and hunger; and the Food and Agriculture Organization (FAO) (2015) sees achieving resilience in agriculture as a requisite for achieving all three key 2015 international agendas.

These papers focus mostly on the need to integrate resilience concerns within sectoral planning, particularly in infrastructure and agriculture. World Bank (2015b) elaborates the opportunity to integrate and deliver resilience, lower greenhouse gas emissions and increase agricultural production through climate-smart agriculture (CSA). Similarly, FAO (2015) calls for national governments and the international community to integrate disaster risk management and resilience-building concerns within plans and investments in the agriculture sector. Williams et al. (2015) add that integrating climate resilience within agricultural investments and agricultural development budgets must be the primary public financing source for delivering CSA. Rydge et al. (2015) highlight the urgent need and opportunity to lock climate resilience within the vast infrastructure investment needed to meet global growth expectations in the coming decades, by integrating climate risk considerations within policy, plans and projects.

Several papers commented on the need for collaboration, to engage and integrate a variety of stakeholders in decision-making, so as to achieve resilience. The UN Environment Programme (UNEP)

(2015) stresses the centrality of collaboration and partnerships among government agencies, businesses, non-governmental organisations, communities and other groups in meeting resilience objectives. Most of this literature focuses particularly on integration of stakeholders within policy, planning and delivery of initiatives in the context of specific cities. Both Shafiqul Alam et al. (2015) and Ciencia et al. (2015) recommend greater multi-stakeholder integration and collaboration as a means to enhance water and sanitation service delivery for informal settlements, in Dhaka and Baguio, respectively. Others, such as Dougherty-Choux et al. (2015), emphasise the need to secure private sector engagement and investment to deliver resilience objectives; across the developing world, this especially applies to micro and small enterprises, given their significance to livelihoods and economies in these countries.

Finally, Hesse (2015) highlights the need and opportunity to allow the participation of poor and vulnerable households in decision-making on local use of climate funding, through their elected representatives in local government. Integrating community concerns in this way may help avoid situations such as that seen in Maputo, Mozambique, whereby infrastructure investments have taken precedence over the needs of the poorest living in flood-prone areas, curtailing improvements in poor people's resilience (Matoso, 2015).

At least 17 of the 28 peer-reviewed papers made reference to an integrated system, most frequently to discuss the benefits of cooperation between diverse stakeholders to enhance resilience thought and practice. Within academia, most studies referred to these benefits, and a number of papers requested further integration of disciplines (e.g. of vulnerability approaches, gender) in order to better understand the complexity in these systems (Bunce and Ford, 2015; Hashemi et al., 2015; Lebot and Siméoni, 2015).

In practice, the integration of infrequently partnered groups through collaboration or communication was seen as a way to disseminate disaster knowledge and identify suitable and sustainable DRR strategies (Bongo and Manyena, 2015; Drolet et al., 2015; Nolasco et al., 2015). The benefits of integrating stakeholders from various scales and sectors of society into governance structures were also shown within an urban resilience context (Reed et al., 2015), and in agricultural and resource management papers (Cofie and Amede, 2015; Mbakahya and Ndiema, 2015; McConney et al., 2015; Wang et al., 2015). Papers on the Solomon Islands were conflicted about how integration with larger economies would impact the islands' socioeconomic resilience (Allen and Dinnen, 2015; McDougall, 2015).

5.5 Adaptiveness

Adaptiveness is the capacity to adjust to changing circumstances during a disruption by developing new plans, taking new actions or modifying behaviours so you are better able to withstand and recover from it, particularly when it is not possible or wise to go back to the way things were before. It also suggests flexibility and the ability to apply existing resources to new purposes or for one thing to take on multiple roles.

Key messages:

- None of the blogs used the term 'adaptive capacity' and only one blog used 'adaptive'.
- In the grey literature, there is widespread awareness of the need to build adaptive capacity to achieve resilience. Capacity-building efforts are underway or planned at all scales, but lack of awareness of risks, among other factors, may undermine the success of these initiatives.
- Adaptive capacity is a prominent theme within the peer-reviewed journal literature, which assesses the ability of communities, ecosystems and urban systems to respond to or prepare for shock or stress.
- Governance structures should be adaptive, but they should also be underpinned by principles of good governance and social justice if they are to build resilience.
- Conversely, identifying and modifying maladaptive strategies can be an effective way to build social-ecological resilience.

At least 13 of the blog posts addressed the qualities of being adaptive, making it the most frequently referenced characteristic of resilience within the blogosphere. Within this, nine posts referenced climate adaptation, often in opposition to climate change mitigation. This focus on adaptation varied in quality and quantity, with some posts simply inserting the term as a global policy objective, whereas others delved deeper to look at the determinants of effective adaptation, for example finance, or governance and planning. For example, 'What's the danger in climate-smart agriculture?' looks at the importance of social inclusion when designing and implementing adaptation interventions.

Though not referred to as adaptation, or as being adaptive, social cohesion initiatives were introduced as a viable way to build community resilience to cope with shock or stress. Three blog posts focused on a new government position, a CRO, supported by the Rockefeller Foundation's 100RC initiative. The CRO is connected to other CROs around the world to encourage peer learning. The CRO also works across

the silos apparent in government to connect individuals and initiatives in order to create a comprehensive strategy for building urban resilience. This new position, new plans and new networks all demonstrate a transformation to a society that is working to build capacity to cope with and respond to future shock and stress, demonstrative of 'adaptiveness'.

Interestingly, none of the blog posts used the term 'adaptive capacity', and only one used 'adaptive' within the context of farmers needing climate data for adaptive decision-making (in 'Climate change and agriculture: Connecting global warming to business resilience').

Adaptive capacity is, however, addressed explicitly within the grey literature, particularly within three city-level case studies. Matoso (2015) shows that government initiatives have increased people's and assets' adaptive capacity over the past decade in Maputo, Mozambique. Ciencia et al. (2015) outline adaptive practices that need to be put in place to enhance water security and sanitation in Baguio, Philippines, to enhance urban resilience. This includes the city-wide adoption of adaptive practices that some residents have developed of their own accord. Meanwhile in Cagayan do Oro, Philippines, the city authorities' efforts to build resilience and adaptive capacity have been undermined by lack of awareness of hazard risks and socioeconomic risks across the city (Doczi, 2015).

Building adaptive capacity is also a focus of plans and recommendations to enhance resilience at regional and national levels reviewed within this scan. The World Bank's Africa Climate Business Plan (World Bank, 2015a) sets out a continent-wide plan to strengthen, power and enable resilience-building for adaptation to climate change. The plan features initiatives to increase adaptive capacity in policy and planning across Africa through the strengthening of hydro-meteorological systems and the provision of data, information and decision-making tools. Jackson's (2015) recommendations for capitalising on the window of opportunity to build a more resilient Nepal include a series of adaptive measures specific to the context. These include adapting legal and land ownership frameworks, for example, to enhance gender equality to enhance the resilience of women and women-led households.

Sixteen peer-reviewed papers referred to the various dimensions of 'adaptive'. Within this, eight referred to the determinants of adaptive capacity for certain stakeholders to address shock or stress (Béné et al., 2015; Chanamuto and Hall, 2015; Drolet et al., 2015; Hashemi et al., 2015; Mbakahya and Ndiema, 2015; Reed et al., 2015; Vogt et al., 2015), for example the importance of education in enhancing an individual's disaster preparedness (Nolasco et al., 2015).

A number of papers commented on the properties of an adaptive system, primarily within the context of governance structures. These include feedback loops, flexibility, experimentation, innovation, incremental change, transformational change and the capacity to learn and reorganise (McConney et al., 2015; Quinlan et al., 2015; Reed et al., 2015). Various papers discussed the need to involve local communities in resilience strategies, with Doughty (2015) arguing that 'adaptive management ideas are best when coming from the communities' and that expanding structures (conceived as networks) to these groups 'facilitates collective action which reduces risk' (p.2). The paper by Reed et al. (2015) on urban resilience also argues that adaptive governance needs to be linked with the 'principles of good governance, and particularly assuring social justice' (p.471).

Many papers noted the importance of identifying maladaptive strategies, such as gender-blind interventions (Bunce and Ford, 2015) or relying on traditional activities that today might undermine resilience (Béné et al., 2015). Fisichelli et al. (2015) also argue that resilience terminology itself is maladaptive as stakeholders employ the terms while referring to different definitions, which creates unclear and confusing adaptation strategies. Finally, Quinlan et al. (2015) note 'our understanding of complex adaptive systems will always be partial and incomplete because of their dynamic nature as well as imprecise measurement and imperfect system models' (p.7). Thus, it is important to take an iterative approach and continue to examine and challenge which characteristics and components are included in our understanding of an adaptive and resilient system.

References

Grey literature

C40 and Arup (2015) *Climate action in megacities 3.0*. London: C40 Cities and Arup.

Carabine, E., Jouanjean, M. and Tsui, J. (2015) *Kenya ending drought emergencies policy review: Scenarios for building resilience in the ASALs*. Technical Report Series 2: Strengthening the Evidence Base for Resilience in the Horn of Africa. Nairobi: International Livestock Research Institute.

Ciencia, A., Mendoza, L.C., Cruz, G., Calde, N., Cabalfin, M. and Peñalba, M. (2015) *Towards establishing water security and urban resilience in the city of Baguio*. Asian Cities Climate Resilience Working Paper, November. London: International Institute for Environment and Development.

Dagnet, Y., Northrop, E. and Tirpak, D. (2015) *How to strengthen the institutional architecture for capacity building to support the post-2020 climate regime*. Working Paper, December. Washington, DC: World Resources Institute.

Doczi, J. (2015) *Understanding patterns of climate resilient economic development: Cagayan de Oro, Philippines*. Research Report, November. London: Overseas Development Institute.

Dougherty-Choux, L., Terpstra, P., Kammila, S. and Kurukulasuriya, P. (2015) *Adapting from the ground up: Enabling small businesses in developing countries to adapt to climate change*. Washington, DC, and New York: World Resources Institute and UN Development Programme.

FAO (Food and Agriculture Organization) (2015) *The impact of disasters on agriculture and food security*. Rome: FAO.

Fuller, R. and Lain, J. (2015) *Measuring resilience: Lessons learned from measuring resilience in Oxfam's large-N effectiveness reviews*. Discussion Paper, December. Oxford: Oxfam.

Hesse, C. (2015) *Climate adaptation funds: Using decentralised government structures to channel climate finance and support community priorities in achieving resilience*. Backgrounder, November. London: International Institute for Environment and Development (IIED), London.

Jackson R. (2015) *Rebuilding a more resilient Nepal: Key recommendations for reconstruction and recovery*. Briefing Paper. Oxford: Oxfam.

Junghans, L. and Dorsch, L. (2015) *Finding the finance: Financing climate compatible development in cities*. Bonn: Germanwatch.

Matoso, M. (2015) *Understanding patterns of resilient economic development: Maputo, Mozambique*. Research Report, November. London: Overseas Development Institute.

Ouédraogo, M., Zougmore, R., Barry, S., Somé, L. and Grégoire, B. (2015) *The value and benefits of using seasonal climate forecasts in agriculture: Evidence from cowpea and sesame sectors in climate-smart villages of Burkina Faso*. Info Note, September. Frederiksberg: CGIAR Research Program on Climate Change, Agriculture and Food Security.

Parker, H. (2015) *Understanding patterns of climate resilient economic development: Rwanda*. Research Report, November. London: Overseas Development Institute.

Patankar, A. (2015) *The exposure, vulnerability and ability to respond of poor households to recurrent floods in Mumbai*. Policy Research Working Paper 7481, November. Washington, DC: World Bank.

Rydge, J., Jacobs, M. and Granoff, I. (2015) *Ensuring new infrastructure is climate-smart*. Contributing Paper for Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate. London and Washington, DC: New Climate Economy.

Shafiqul Alam, S., Jahangir Alam, A.T.M. and Rahman, S. (2015) *Multistakeholder collaboration for urban climate change resilience in Bangladesh*. Asian Cities Climate Resilience Working Paper, November. London: International Institute for Environment and Development.

Simonet, C. and Jobbins, G. (2015) *Understanding patterns of resilient economic development in Senegal*. Research Report. London: Overseas Development Institute.

UN CCST (Climate Change Support Team of the UN Secretary-General) (2015) *Trends in private sector climate finance*. New York: UN CCST.

UNEP (UN Environment Programme) (2015) *Collaborating for resilience: Partnerships that build disaster-resilient communities and economies*. Finance Initiative Principles for Sustainable Insurance, Global Resilience Project. Geneva: Geneva: UNEP.

UNISDR (UN Office for Disaster Reduction) (2015) *Disaster risk reduction and resilience in the 2030 agenda for sustainable development*. Reflection Paper. New York: UNISDR.

van de Gevel, J. (2015) *What can agricultural biodiversity do in the fight against climate change?* Montpellier: Biodiversity International.

Vollenweider, X. (2015) *Measuring climate resilience and vulnerability: A case study from Ethiopia*. Washington, DC: US Agency for International Development.

Williams, T.O., Mul, M., Cofie, O., Kinyangi, J., Zougmore, R., Wamukoya, G., Nyasimi, M., Mapfumo, P., Speranza, C.I., Amwata, D., Frid-Nielsen, S., Partey, S., Girvetz, E., Rosenstock, T. and Campbell, B.M. (2015) *Climate smart agriculture in the African context*. Background Paper for Feeding Africa Session 1: Unlocking Africa's Agricultural Potentials for Transformation to Scale.

Wilkinson, E. and Peters, K. (eds) (2015) *Climate extremes and resilient poverty reduction: Development designed with uncertainty in mind*. BRACED Report. London: Overseas Development Institute.

World Bank (2015a) *Accelerating climate-resilient and low carbon development: The Africa Climate Business Plan*. Washington, DC: World Bank.

World Bank (2015b) *Future of food: Shaping a climate-smart global food system*. Washington, DC: World Bank.

Peer-reviewed journal literature

Allen, M.G. and Dinnen, S. (2015) Solomon Islands in transition? *The Journal of Pacific History* 50(4): 381–97.

Béné, C., Headey, D., Haddad, L. and Grebmer, K. (2015) 'Is resilience a useful concept in the context of food security and nutrition programmes? Some conceptual and practical considerations', *Food Security* 1–16. doi: 10.1007/s12571-015-0526-x

Bongo, P.P. and Manyena, S.B. (2015) 'From "government" to "governance": Tensions in disaster-resilience leadership in Zimbabwe'. *Jàmbá: Journal of Disaster Risk Studies* 7(1). doi: 10.4102/jamba.v7i1.188

Bunce, A. and Ford, J. (2015) 'How is adaptation, resilience, and vulnerability research engaging with gender?' *Environmental Research Letters* 10(12): 123003.

Bunting, S.W., Mishra, R., Smith, K.G. and Ray, D. (2015) 'Evaluating sustainable intensification and diversification options for agriculture-based livelihoods within an aquatic biodiversity conservation context in Buxa, West Bengal, India'. *International Journal of Agricultural Sustainability* 13(4): 275–93. doi: 10.1080/14735903.2014.966530

Chanamuto, N.J.C. and Hall, S.J.G. (2015) 'Gender equality, resilience to climate change, and the design of livestock projects for rural livelihoods', *Gender & Development* 23(3): 515–30. doi: 10.1080/13552074.2015.1096041

Chimonyo, V.G.P., Modi, A.T. and Mabhaudhi, T. (2015) 'Perspective on crop modelling in the management of intercropping systems', *Archives of Agronomy and Soil Science* 61(11): 1511–29. doi: 10.1080/03650340.2015.1017816

Cofie, O. and Amede, T. (2015) 'Water management for sustainable agricultural intensification and smallholder resilience in sub-Saharan Africa', *Water Resources and Rural Development* 6: 3–11. doi: http://dx.doi.org/10.1016/j.wrr.2015.10.001

Dirhamsyah, T., Mulyo, J.H., Darwanto, D.H. and Hartono, S. (2015) 'The household food security at the Food Resilience Village Programme in Java', *IOSR Journal of Agriculture and Veterinary Science* 8(1): 23–29.

Doughty, C.A. (2015) 'Building climate change resilience through local cooperation: A Peruvian Andes case study', *Regional Environmental Change* 1–11. doi: 10.1007/s10113-015-0882-2

Drolet, J., Dominelli, L., Alston, M., Ersing, R., Mathbor, G. and Wu, H. (2015) 'Women rebuilding lives post-disaster: Innovative community practices for building resilience and promoting sustainable development', *Gender & Development* 23(3): 433–48. doi: 10.1080/13552074.2015.1096040

Fisichelli, N.A., Schuurman, G.W. and Hoffman, C.H. (2015) 'Is "resilience" maladaptive? Towards an accurate lexicon for climate change adaptation', *Environmental Management*. doi: 10.1007/s00267-015-0650-6

Friend, R. and Moench, M. (2015) 'Rights to urban climate resilience: Moving beyond poverty and vulnerability', *Wiley Interdisciplinary Reviews: Climate Change* 6(6): 643–51. doi: 10.1002/wcc.364

Hashemi, S.M., Bagheri, A. and Marshall, N. (2015) 'Toward sustainable adaptation to future climate change: Insights from vulnerability and resilience approaches analyzing agrarian system of Iran', *Environment, Development and Sustainability* 1–25. doi: 10.1007/s10668-015-9721-3

Hassan, S. and Othman, Z. (2015) 'The effect of economic resilience on private investment in selected Malaysian economic sectors'. *Mediterranean Journal of Social Sciences* 6(6): 374–89.

Kiewisch, E. (2015) 'Looking within the household: a study on gender, food security, and resilience in cocoa-growing communities'. *Gender & Development* 23(3): 497–513. doi: 10.1080/13552074.2015.1095550

Lebot, V. and Siméoni, P. (2015) 'Community food security: Resilience and vulnerability in Vanuatu', *Human Ecology* 43(6): 827–42. doi: 10.1007/s10745-015-9796-3

Maleksaeidi, H., Karami, E. and Zamani, G.H. (2015) 'Farm households' resilience scale under water scarcity', *Mitigation and Adaptation Strategies for Global Change* 20(8): 1305–18. doi: 10.1007/s11027-014-9546-7

Mbakahya, G.M. and Ndiema, A.C. (2015) 'Farming households' vulnerability and resilience to climate change in Nambale sub-county of Kenya', *International Journal of Science, Environment and Technology* 4(6): 1608–17.

McConney, P., Cox, S.-A. and Parsram, K. (2015) 'Building food security and resilience into fisheries governance in the Eastern Caribbean', *Regional Environmental Change* 15(7): 1355–65. doi: 10.1007/s10113-014-0703-z

McDougall, D. (2015) 'Customary authority and state withdrawal in Solomon Islands: Resilience or tenacity?' *The Journal of Pacific History* 50(4): 450–72.

Moore, C. (2015) 'Honiara: Arrival city and Pacific hybrid living space', *The Journal of Pacific History* 50(4): 419–36. doi: 10.1080/00223344.2015.1110869

Nolasco, M.A., Beguia, Y.P., Durante, E.E. and Tipones, G.D. (2015) 'Program for enhancing resilience to climate change: A basis for school-community partnership'. *Asia Pacific Journal of Multidisciplinary Research* 3(4): 158–66.

Quinlan, A.E., Berbés-Blázquez, M., Haider, L.J. and Peterson, G.D. (2015) 'Measuring and assessing resilience: Broadening understanding through multiple disciplinary perspectives', *Journal of Applied Ecology.* doi: 10.1111/1365-2664.12550

Qureshi, A.S. (2015) 'Improving food security and livelihood resilience through groundwater management in Pakistan', *Global Advanced Research Journal of Agricultural Science* 4(10): 678–710.

Reed, S.O., Friend, R., Jarvie, J., Henceroth, J., Thinphanga, P., Singh, D. and Sutarto, R. (2015) 'Resilience projects as experiments: implementing climate change resilience in Asian cities', *Climate and Development* 7(5): 469–80. doi: 10.1080/17565529.2014.989190

Vogt, N.D., Pinedo-Vasquez, M., Brondízio, E.S., Almeida, O. and Rivero, S. (2015) 'Forest transitions in mosaic landscapes: Smallholders' flexibility in land-resource use decisions and livelihood strategies from World War II to the present in the Amazon Estuary', *Society & Natural Resources* 28(10): 1043–58. doi: 10.1080/08941920.2015.1014603

Wang, Z.-T., Yang, L., Cai, G.-J., Mo, B.-R., and Chai, C.-S. (2015) 'A quantitative health evaluation of an eco-economy in the semi-arid loess plateau of China', *Human and Ecological Risk Assessment: An International Journal* 21(7): 1884–1902. doi: 10.1080/10807039.2014.995057

Annex 1: Methodology for blog searches

Methodology

Given the long-form nature of blogs, the utility of online media monitoring software to capture and analyse blog data can be limited. In contrast with short-form social media, the discursive characteristics of blogs (comments, response posts, linking, etc.) require a different approach to data gathering and analysis, which involves more manual (vs. software-based) search and analysis of blog posts. The basic approach is based on the metrics of visibility and (online) impact and engagement, and comprises three phases: exploratory blog search and ranking, identification of top blog posts and thematic analysis of blog posts.

1. Who are the top influencers in resilience blogging?

Measuring visibility

The purpose of this initial step is to offer a bird's-eye view of the resilience blogosphere:

1. Using blog search engines, Boolean search queries were performed to identify blogs that publish about resilience in different contexts. This initial exploratory search identified the top 50 resilience blogs, with the criterion being how visible the relevant blog content is on the web. This ranking was derived by a score based on Google PageRank, Page Authority, Domain Authority.
2. The next step involved narrowing down the list to the top 25 resilience blogs. With the initial list ranked by search engine visibility and content relevance, the 50-blog list was manually reviewed to exclude blogs that:
   - have low keyword/subject matter relevance.
   - are link farms and blog aggregators, which do not publish original content or syndicate posts from other blogs.
   - have no active comment sections or measurable social sharing features.
   - posted no relevant updates in 2015.

2. Who published the most popular blog posts on resilience in 2015?

Measuring impact

A complete manual review and analysis of resilience-related blog posts published in 2015 was performed, and the top 25 blog posts published on resilience in 2015 were identified based on metrics of social shares and comments/reader engagement.

A score was derived by aggregating the following metrics:

- Blog comments
- Facebook shares
- Facebook 'likes'
- Facebook comments
- Twitter shares
- LinkedIn shares

The list was then ranked by aggregate impact score to present the top 25 resilience blog posts of Q4 2015.

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