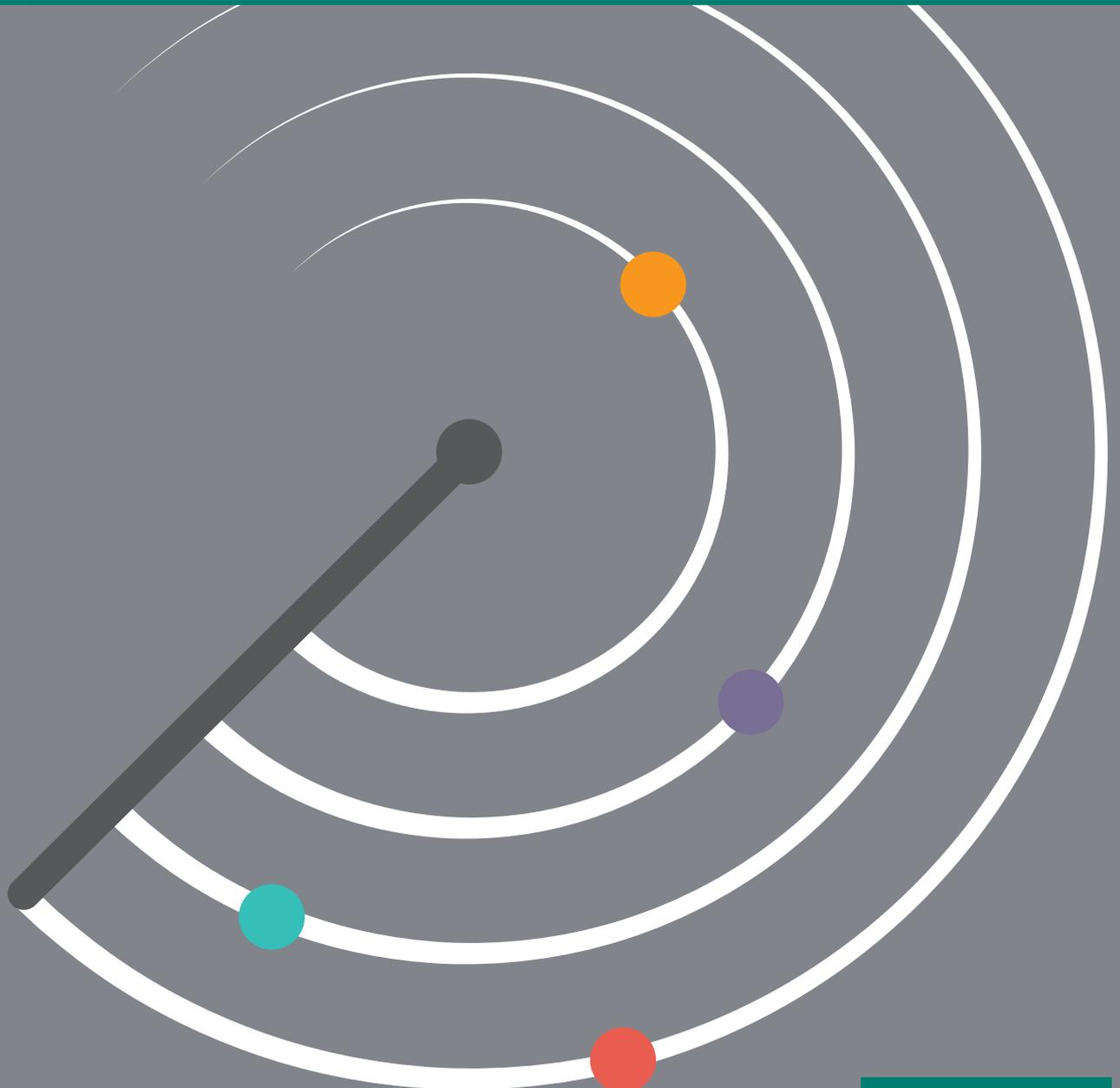




Resilience Scan | April-June 2017

A review of literature, debates and blogs on resilience

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REPORT

As the 'resilience revolution' in international development continues, researchers at ODI are capturing the new directions and reviewing the latest thinking in this field through The Rockefeller Foundation-supported Resilience Scan initiative. With a focus on developing countries, we present quarterly analytical reviews of resilience literature, social media activity and key resilience-related events, as well as collating the views of diverse resilience experts. Complementing these wide-ranging quarterly reviews are a number of 'deep-dive' analytical papers on key emerging resilience-related topics.

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Contents

Acknowledgements	3
List of figures and tables	6
Acronyms	7
Executive summary	8
1. Moving towards a growing global discourse on transboundary adaptation	11
1.1. Summary	11
1.2. Introduction	12
1.3. What is transboundary adaptation?	13
1.4. Building on existing knowledge	13
1.5. Moving up the agenda: opportunities for transboundary adaptation within the UNFCCC	16
1.6. Challenges, opportunities and the way to action	18
2. Resilience in the blogosphere	20
2.1. Methods	20
2.2. Making the case for resilience	20
2.3. Urban resilience	23
2.4. Agriculture and food	25
2.5. Humanitarian crisis and response	26
2.6. Miscellaneous	26
3. Resilience in the grey literature	27
3.1. Insurance and risk financing	27
3.2. Resilience in humanitarian contexts	28
3.3. Urban resilience	29
3.4. Agriculture, pastoralism and food security	31
3.5. Climate and disaster resilience policy	33

4. Review of resilience in the academic literature	34
4.1. Community resilience	34
4.2. Conceptual approaches, indicators and measurements	35
4.3. Policy, planning and governance for building resilience	37
4.4. Urban resilience and infrastructure	39
4.5. Livelihoods and food security	40

5. Understanding the characteristics of resilience in 2017 Q2 literature	42
5.1. Awareness	42
5.2. Diversity	43
5.3. Self-regulation	43
5.4. Integration	44
5.5. Adaptiveness	45

6. References	46
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List of figures and tables

Figures

Figure 1: Google Portfolio Vulnerability	21
Figure 2: Suggested structure for the Climate Resilience Screening Index	36
Figure 3: Innovation, diversity and disturbance	38
Figure 4: Framework for disaster-resilient and low-carbon housing	39

Tables

Table 1: Blog rankings – top ten (full list p. 22)	9
Table 2: Top ranking resilience blog posts in the first half of 2017	22
Table 3: Features of outcome vulnerability, contextual vulnerability and resilience	37

Acronyms

AAI	Africa Adaptation Initiative	ISSD	Integrated Seed Sector Development in Africa
ACCCRN	Asian Cities Climate Change Resilience Network	LDC	Least developed countries
ACI	Adaptive Capacity Index	LDN	Land degradation neutrality
AoA	Agreement on Agriculture	MRC	Mekong River Commission
APA	Ad hoc Working Group on the Paris Agreement	NAP	National adaptation plan
ARC	African Risk Capacity	NAPA	National Adaptation Programmes of Action
BRACED	Building Resilience and Adaptation to Climate Extremes and Disasters	NDC	Nationally determined contribution
CAF	Cancun Adaptation Framework	NGO	Non-governmental organisations
CARIAA	Collaborative Adaptation Research Initiative in Africa and Asia	NWP	Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change
CBD	Convention on Biological Diversity	PCCB	Paris Committee on Capacity-Building
CCAFS	Climate Change, Agriculture and Food Security	PRACAS	Accelerated Programme for Agriculture in Senegal
CCAI	Climate Change and Adaptation Initiative	RS	Resilience Scan
CCCO	Climate change coordination offices	SEI	Stockholm Environment Institute
CDKN	Climate and Development Knowledge Network	SFDRR	Sendai Framework for Disaster Risk Reduction
CGIAR	Consultative Group on International Agricultural Research	SHG	Self-help groups
CRSI	Climate resilience screening index	SNA	Social Network Analysis
CSA	Climate-smart agriculture	TCFD	Task Force on Climate-Related Financial Disclosures
DRR	Disaster risk reduction	TEM	Technical expert meetings
FMIST	Farmer Managed Irrigation System Promotion Trust	TEP-A	Technical examination process on adaptation
GEF	Global Environment Facility	UFCOP	Urban Floods Community of Practice
GGA	Global Goal on Adaptation	UN	United Nations
HEA	Household Economy Approach	UNCCD	United Nations Convention to Combat Desertification
HFA	Hyogo Framework for Action	UNDP	United Nations Development Programme
ICIMOD	International Centre for Integrated Mountain Development	UNECE	United Nations Economic Commission for Europe
IIED	International Institute for Environment and Development	UNEP	United Nations Environment Programme
INBO	International Network of Basin Organizations	UNFCCC	United Nations Framework Convention on Climate Change
INDC	Intended nationally determined contribution	VSLA	Village savings and loan associations
IPCC	Intergovernmental Panel on Climate Change	WASH	Water, sanitation and hygiene
		WTO	World Trade Organization

Executive summary

A growing global discourse on transboundary adaptation

Countries have joint reliance on key natural resources. As climate change puts additional pressure on these already stressed resources, countries must increasingly manage the interacting drivers of vulnerability and risk that are too large for any one country to address alone.

This quarter's expert view provides an overview of some of the emerging issues for transboundary adaptation. It aims to encourage a global discourse on how the Rio Conventions, such as the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD), can serve as a platform for enhancing work on transboundary adaptation.

- The need for transboundary adaptation and global cooperation on adaptation will be increasingly important, despite the political and implementation challenges, as the impacts of climate change span national borders. National adaptation actions can present transboundary risks.
- Challenges exist, including political ones, but there are opportunities to enhance work on transboundary adaptation through existing mechanisms under the Rio Conventions. These include UNCCD (the promotion of landscape approaches to sustainable land management), and UNFCCC (enhancing capacity on transboundary adaptation) through the Paris Committee for Capacity-Building and associated funds (the Global Environment Facility (GEF), the land degradation neutrality (LDN) Fund, the Adaptation Fund, among others). Developing more synergy and coherence between UNCCD, UNFCCC and the Convention on Biological Diversity (CBD) would provide a strong basis for action.
- Transboundary resource management is not a new concept. It presents an opportunity to develop transboundary adaptation frameworks and response measures that build upon existing regulatory approaches in international environmental law, and to develop the work of intergovernmental organisations and regional advocacy organisations.
- The 2015 Paris Agreement has recognised that adaptation is a global challenge and has accepted the

local, national, subnational, national and regional dimensions of climate change.

- The Global Goal on Adaptation (GGA) has a significant role to play in providing a framework for enhancing transboundary and global cooperation on adaptation, especially given the increasingly important role of transboundary adaptation in enhancing adaptation capacity, increasing resilience and reducing vulnerability.
- It is important to undertake transboundary adaptation through national adaptation plans (NAPs) and the intended nationally determined contributions (INDCs). Some countries are already doing this. This work could be enhanced through guidance from the UNFCCC Adaptation Committee, for example.
- Support (including regulatory frameworks, political will and finance) remains a critical element to ensure that transboundary adaptation is implementable.

Resilience in the blogosphere

This Resilience Scan provides an analysis of the 25 most shared blogs on resilience during the half year January to June 2017. A common theme in this period was how to strengthen the incentives and business case for investing in resilience, particularly in the private sector. City contexts also continue to dominate the subject matter, with eight of the top 25 resilience blogs focusing on urban issues. Within the other dominant theme of agriculture and food, seven of the blogs touch on the importance of diversity in agriculture for enhancing resilience, especially in the face of a changing climate. Other topics include resilience in the context of humanitarian crises, the role of social networks and social capital, and global resilience in terms of planetary boundaries.

Resilience in the grey literature

Our review of the grey literature on resilience published between January and June 2017 includes 31 articles, embracing independent research, the private sector, non-governmental organisations (NGOs) and UN agencies. These span five broad themes.

Grey literature on *risk financing* suggests:

Table 1: Blog rankings – top ten (full list p. 22)

Rank	Blog post title	URL	Publisher
1	Building climate resilience, from day one	https://goo.gl/r2n2oo	Rainforest Alliance
2	Modern agriculture cultivates climate change – we must nurture biodiversity	https://goo.gl/v2CRLb	The Guardian
3	Resilient Jakarta: Keeping above water	https://goo.gl/zsxKL6	100 Resilient Cities
4	Communicating the value of urban biodiversity to foster city resilience	https://goo.gl/CnjkbW	100 Resilient Cities
5	Arctic indigenous peoples leading the way in ecological restoration and climate resilience	https://goo.gl/JCexgF	Intercontinental Cry
6	As climate change threatens food supplies, seed saving is an ancient act of resilience	https://goo.gl/V01Z2u	Yes Magazine
7	Crop scientists race to create a climate-change-resilient agriculture	https://goo.gl/PtxGA7	Sierra Magazine
8	How cities can stand up to climate change	https://goo.gl/zx8EhZ	Curbed
9	A threat by any other name	https://goo.gl/rISzV3	Slate
10	Connecting climate resilience to the bottom line	https://goo.gl/zCvKxU	Stanford Social Innovation Review

- Insurance industry expertise can play an important role in supporting risk-informed decision-making.
- Overreliance upon insurance can be detrimental, and may exacerbate inequality.
- At a household level, there may be more demand for flexible savings accounts than for commitment savings and insurance products for risk reduction.

Grey literature on *resilience in humanitarian contexts* suggests:

- There is a need to better integrate longer-term goals for resilience building within disaster response and humanitarian interventions, including longer intervention timeframes and enabling the community to co-run the response alongside humanitarian agencies.
- Humanitarian agencies and municipal authorities must work more closely together to better support people displaced to cities.
- Livelihood support and protection for long-term displaced people should be incorporated into urban humanitarian response.

Grey literature on *urban resilience* suggests:

- Mass migration is an urban phenomenon with long-term opportunities for growing cities.
- To catalyse city climate action on climate resilience, actors should prioritise ‘no regrets’ strategies that help

to alleviate current problems regardless of climate futures.

- There is a need to step up risk-based land use planning to reduce the underlying causes of flooding across all stages of the flood risk management cycle.

Grey literature on *agriculture, pastoralism and food security* suggests that:

- There are equity and gender concerns with climate-smart agriculture (CSA) that should be confronted and addressed.
- Women-led income generating activities, such as market gardening, have the potential to transform gender relations.
- In Nepal, there is a need to focus on enhancing resilience of small and medium-sized irrigation systems, upon which many Nepalese people rely.

Grey literature on *climate and disaster resilience policy* suggests:

- Regional partnerships offer a promising strategy for strengthening infrastructure.
- There is a critical need for national disaster risk reduction (DRR) strategies to be in place before 2020 to deliver on the targets of the Sendai Framework for DRR.
- Flood risk management at river basin scale should be promoted more widely.

Resilience in the academic literature

The academic literature on resilience from the second quarter of 2017 covers a total of 32 publications across five thematic areas.

Academic literature on *community resilience* suggests:

- Community-led activities to strengthen resilience are often a better fit than programmes led by external organisations.
- With insufficient recognition of local views, contexts and cultures, Western approaches to technical interventions following disasters can reproduce or undermine pre-existing local power relations and power structures.
- Social networks are dynamic and evolve throughout a disaster event, during immediate response, relief and rehabilitation. Search and rescue is mostly provided from within the community in the early phases after a disaster event, while key actors can change in later stages towards external facilitation of information and support.
- Dynamic local institutions and technologies to support resilience can emerge through new forms of conflict and cooperation related to water insecurity.

Academic literature on *conceptual approaches, indicators and measurements* suggests:

- A holistic approach – that integrates components of risk, governance, society, the built environment and the natural environment – is needed to better understand and support community resilience.
- The lack of conceptual awareness around resilience and vulnerability in existing water, sanitation and hygiene (WASH) literature requires more stakeholder engagement and a greater combination of the different approaches to support WASH services in the context of climate change.
- Resilience may not always be desirable for a system, because it can present a barrier to innovation.

Academic literature on *policy, planning and governance* for building resilience suggests:

- Web-based technology and open data can support post-disaster recovery, reconstruction and longer-term planning decisions.
- Transparency and inclusion in decision-making across different stages of a dam construction process are crucial to the achievement of better social and environmental resilience outcomes.
- Microfinance and increased financial inclusion can result in greater mobilisation of resources for the support of climate change programmes.

Academic literature on *urban resilience and infrastructure* suggests:

- Knowledge co-production can support sustainability and resilience in cities, but requires a transformation towards more inclusive, critical and reflexive governance and knowledge practices.
- Natural resources on which cities' economies depend influence their levels of economic resilience: to strengthen resilience, economic transformation and diversification may be required.
- Most studies of infrastructure resilience focus on economics, governance and the infrastructure itself. Most are quantitative studies, using community and infrastructure as units of analysis.

Academic literature on *livelihoods and food security* suggests:

- When confronted with a series of cumulative weather shocks, households tend to resort to increasingly unsustainable coping practices in subsequent events.
- Established tools for assessing vulnerability to food shocks can help inform resilience assessments in urban areas, but require expansion beyond their focus on wealth and food security to relate to urban contexts.
- Adaptive capacities and resilience overall may constitute an important contributor to well-being, presenting for instance options for diversification and confidence to adapt to unexpected changes.
- One study finds that access to basic services such as health, water, education, markets and mobility is a more important contributor to resilience than household assets or age and gender of the household head.

1. Moving towards a growing global discourse on transboundary adaptation

1.1. Summary

The scientific consensus is clear. Climate change will alter the frequency, intensity, duration, timing and location of extreme weather and slow-onset events. It will also lead to creeping environmental changes, such as shifts in seasons or sea-level rise (IPCC, 2014; 2012). Changes such as these serve as additional stress factors on ecosystems and on the support they provide for livelihoods, well-being and economies (The Desakota Study Team, 2008). Understandably, in response, adaptation measures have generally been focused on developing national, subnational and sector plans, with actions often taking place at community or local levels. Yet, it has long been understood that the effects of climate change are transboundary, crossing political borders and impacting shared resources.

Countries are geographically linked and have joint reliance on key natural resources. Climate change is putting additional pressure on already stressed resources. Countries must increasingly manage many interacting drivers of vulnerability and risk that are too large for any one country to address alone. For example, food security and water resources are often transboundary in nature and can lead to resource conflict if not adequately addressed at an early stage. With globalisation, national economies are increasingly interconnected and interdependent through trade, supply and value chains.

The development of transboundary adaptation approaches could provide an opportunity to manage these risks more effectively. In addition, there is growing awareness that adaptation efforts in one country can significantly impact the natural resources and adaptive capacity of another country. These include damming of shared water sources for domestic irrigation needs without consideration for downstream countries, changes

in agricultural priorities and policies that affect regional or global food security. Therefore, regional cooperation is needed to manage shared ecosystems and consider the transboundary risk implications of National Adaptation Plans (NAPs).

The aim here is to provide an overview some of the emerging issues for transboundary adaptation and to encourage a global discourse on how the Rio Conventions, such as the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD), can serve as a platform for enhancing work on transboundary adaptation. The key messages include:

- The need for transboundary adaptation and global cooperation on adaptation will be increasingly important, despite the political and implementation challenges, as the impacts of climate change span national borders. National adaptation actions can present transboundary risks.
- Challenges exist, including political ones, but there are opportunities to enhance work on transboundary adaptation through existing mechanisms under the Rio Conventions. These include UNCCD (the promotion of landscape approaches to sustainable land management), and UNFCCC (enhancing capacity on transboundary adaptation) through the Paris Committee for Capacity-Building and associated funds (the Global Environment Facility (GEF), the land degradation neutrality (LDN) Fund, the Adaptation Fund, among others). Developing more synergy and coherence between UNCCD, UNFCCC and the Convention on Biological Diversity (CBD) would provide a strong basis for action.

- Transboundary resource management is not a new concept. It presents an opportunity to develop transboundary adaptation frameworks and response measures that build upon existing regulatory approaches in international environmental law, and to develop the work of intergovernmental organisations and regional advocacy organisations.
- The 2015 Paris Agreement has recognised that adaptation is a global challenge and has accepted the local, subnational, national and regional dimensions of climate change.¹
- The Global Goal on Adaptation (GGA) has a significant role to play in providing a framework for enhancing transboundary and global cooperation on adaptation, especially given the increasingly important role of transboundary adaptation in enhancing adaptation capacity, increasing resilience and reducing vulnerability.²
- It is important to undertake transboundary adaptation through the NAPs and the intended nationally determined contributions (INDCs). Some countries are already doing this. This work could be enhanced through guidance from the UNFCCC Adaptation Committee, for example.
- Support (including regulatory frameworks, political will and finance) remains a critical element to ensure that transboundary adaptation is implementable.

1.2. Introduction

The scientific consensus is clear: climate change will alter the frequency, intensity, duration, timing and location of extreme weather and slow-onset events, and contribute to creeping environmental changes, such as shifts in seasons or sea-level rise (IPCC, 2014; 2012). Where particular ecosystems are degraded, or natural resources overexploited (for example, by economic marginalisation, insecurity or political mismanagement), shifting climate regimes and extreme events may challenge the ability of ecosystems to continue to provide the services upon which some populations and economies have come to depend. Climate change will ultimately affect all countries, and its effects – from droughts to floods – do not respect political borders.

The 2015 Paris Agreement saw the international community agree that adaptation to climate change is a

global challenge (UNFCCC, 2016a). Addressing climate change requires technical transfer of adaptation response measures and financial input across borders. Moreover, the climate change strategies of one country can affect the resilience of another country, and where certain nations are unable to adapt, there will be repercussions at all levels (Magnan et al., 2015). Countries may be geographically linked and rely on shared natural resources, such as water, the flows of which often span national and international borders and represent interacting risks and drivers of vulnerability. And, in our increasingly globalised world, countries must also account for the interdependency of global supply and value chains. If, for example, as part of a suite of adaptation response measures to a drought, a country stops or restricts agricultural exports to ensure food security, it can export its volatility to the rest of the world through price shocks. The volatility of the global commodity markets is therefore recognised as an issue for international coordination (Magnan et al., 2015: 10-11). The UK Met Office states that governments are ‘seriously underestimating’ the risks of crop disasters occurring simultaneously in major farming regions around the world (Kent et al., 2017). This research posits a 6% chance that a concurrent failure in maize production could occur every decade in China and the US – the world’s main growers – resulting in potentially catastrophic food shortages and price hikes in Africa and South Asia.

Adaptation measures can be local in application, but regional and global in implication

One such scenario happened during the global food crisis of 2007 and 2008. The price of wheat, maize and rice doubled, hitting many developing countries hard. In Senegal, for example, while rice makes up 30% of the nation’s diet, just 15% of supply is produced domestically (SEI, 2016). The other 85% is imported, primarily from Thailand and Vietnam, whose rice-producing regions are exposed to sea-level rise and threatened by a growing risk of drought and soil salinisation (SEI, 2016). Recognising its vulnerability to increasing rice prices, the Senegalese government has developed the Accelerated Programme for Agriculture in Senegal (PRACAS), aiming to be self-sufficient in rice production by 2017. But this strategy has

1 The Paris Agreement of 2015 requests that countries strengthen regional cooperation on adaptation, including the use of regional centres and networks.

2 The GGA was established in the Paris Agreement with the aim of ‘enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2’ (UNFCCC, 2016a: 25-26). The GGA is not defined further in the Agreement but it was agreed that the Global Stocktake, the process to establish progress on achieving the global goals that will take place every five years, will review the progress towards achieving the GGA.

wider implications. It will reduce agricultural diversity, making producers more vulnerable to exogenous shocks (either affecting the global price of rice or decreasing yield, and will also displace other crops), which can be a source of food and income for food-insecure households (SEI, 2016).

Adaptation measures can be local in application, but regional and global in implication. That is, action at the local level may be insufficient to deliver the adaptation required, or might increase vulnerabilities across shared ecosystems that support agricultural production. For example, if China's adaptation planning moves agricultural production from the traditional breadbasket provinces of Jiangxi and Jilin to the Tibetan Plateau due to the expected impacts of climate change, this could have significant implications for transboundary water resources and the 18 countries with which China shares rivers and lakes.

As such, there is increasing recognition that adaptation measures that cross regional boundaries will be necessary. Transboundary adaptation approaches are becoming more prominent in discussions at a number of the Rio Conventions, including the UNCCD,³ and in the imminent future will require the UNFCCC to address the issue more formally, developing approaches and facilitating support to meet some of the inherent challenges of building transboundary resilience.

1.3. What is transboundary adaptation?

Traditionally adaptation has been implemented at national and subnational levels, often driven by frameworks developed under the UNFCCC, such as the National Adaptation Programmes of Action (NAPAs) for least developed countries (LDCs) and NAPs for developing countries. However, the importance of transboundary adaptation is increasingly recognised. Though not yet defined under the UNFCCC nor by the Intergovernmental Panel on Climate Change (IPCC), transboundary adaptation can be understood as adaptation planning that addresses the dependencies and interdependencies from a systems perspective when assessing risk and when developing options to manage both the rapid and slow-onset impacts of climate change. Within UNCCD, it is recognised that the cross-sectoral nature of climate change, land degradation and desertification 'demands systems and integrated landscape approaches to assess vulnerability and adaptation capacities' (UNCCD, 2015).

1.4. Building on existing knowledge

Transboundary resource management is not a new concept. There is, though, a renewed opportunity to develop frameworks and response measures that build upon and learn from existing regulatory approaches in international environmental law, as well as the work of intergovernmental organisations, regional advocacy organisations and research programmes already dealing with transboundary resource management.

Regulatory approaches

Existing regulatory approaches to managing global and transboundary environmental problems include multilateral, regional and bilateral treaties, international customary law and soft law instruments, such as memoranda of understanding.

In international law, environmental issues are generally framed either as 'common concerns of mankind' or 'transboundary' e.g. waterways (Birnie et al., 2009: 128). The 1992 Rio Conference on Environment and Development provided a framework for defining global responsibility for the environment, which it distinguished from regional or transboundary environmental responsibilities (Birnie et al., 2009). A particular feature of the Rio frameworks is the use of the phrase 'common concern' to designate those issues which involve global responsibilities (Birnie et al., 2009: 128). Several multilateral agreements include reference to 'common concerns'. For example, the preamble of the Rio Declaration urges 'new levels of cooperation' and a 'global partnership' to respond to global climate change (UN, 1992a). Other examples are the CBD, the Convention on the Law of Non-Navigational Uses of International Watercourses (commonly referred to as the UN Watercourses Convention), the Convention on the Law of the Sea, as well as Chapter 17 of Agenda 21 (UN, 1992b), which refers to the oceans, seas and coastal areas as 'an integrated whole that is an essential component of a global life-support system'. As such the designation 'common concern' points to a 'legal status both for climate change and biological resources which is distinct from the concepts of permanent sovereignty, common property, shared resources, or common heritage, which generally determine the international legal status of natural resources' (Birnie et al., 2009: 130). As noted, climate mitigation responses have thus been advocated for and advanced on the basis of 'common concerns'. In contrast, adaptation has been seen as a national concern and responsibility. However, developing response measures to manage issues with regional and global impact, such as land degradation, climate change and food security nexuses, requires a

3 UNCCD refers to 'landscape approaches' for land management/management of land degradation.

collective and systematic adaptation response if contagion of impacts due to maladaptation at the national level is to be avoided. Consequently, questions remain as to whether the increasing need for adaptation across borders will also become an issue of ‘common concern’.

Another core element of international customary law that relates to transboundary impacts is the ‘precautionary principle’. According to the Charter of the United Nations (UN), States have the right to exploit their own resources, but also the responsibility to ensure that activities within their jurisdiction or control do not result in environmental damage in other States or beyond the limits of their borders (UN, 1945: 6–8). The precautionary principle also enshrines the concept that States have a duty to ‘cooperate in mitigating transboundary environmental risks and emergencies, through notification, consultation, negotiation’ (Birnie et al., 2009: 137). This principle has been reaffirmed in subsequent international legal agreements, including the Rio Declaration on Environment and Development (Bankobeza, n.d.). Principle 15 of the Rio Declaration states that:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation (UN, 1992a).

In relation to transboundary risk, Rio Principle 19 stipulates:

States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith (UN, 1992a).

Certainly, the UNFCCC recalled principles inscribed in international law which endow States with the ‘responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment or other States or of areas beyond the limits of national jurisdiction’ (UN, 1992a).

An additional challenge to the applicability of international environmental agreements to transboundary adaptation is that adaptation is not only concerned with natural resources, but also involves human systems (Tompkins et al., 2010). It is unclear how legal principles apply to national adaptation measures that States might implement domestically,⁴ yet that unwittingly have the potential transboundary impact. In our increasingly globalised world, what are the global and transboundary implications of the adaptation choices of countries, particularly large producers and consumers? Countries must account for the interdependency of global supply and value chains, but where does responsibility for undertaking transboundary adaptation lie? These considerations are of increasing concern, as articulated by many countries in their INDCs, the documents which outline the actions that countries will take in order to achieve the global goals inscribed in the Paris Agreement.⁵ A report synthesising the INDCs found that:

Transboundary issues with a global scope were reported. For instance, a few Parties highlighted that sectors of their economies, for example food production, contribute to ensuring global security, and one Party is studying the impacts of climate change on major food exporters in order to understand the risks to food imports (UNFCCC, 2016d: 71).

Angola, for example, outlines regional adaptation as a priority, and one of its unconditional adaptation strategies (which is already funded) is enhancing resilience in the Benguela fisheries system, a project shared with Namibia and South Africa (UNFCCC, 2015). Such statements demonstrate the increasing identification of transboundary risks, and of approaches to managing and adapting them, as areas of ‘common concern’ that require cooperative adaptation actions. Post-2015, the issue of transboundary risk management and transboundary adaptive responses in the context of climate change seem to be gaining some traction.

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) and the CBD and the UNCCD are examples of global legal frameworks – as well as bilateral and multilateral shared resource agreements (Bankobeza, n.d.). There are 145 agreements on transboundary water

4 Adaptation has been traditionally considered a national and subnational issue guided by national strategies, including NAPs and National Determined Contributions (NDCs).

5 Article 2 of the Paris Agreement outlines three primary ways in which the objective of strengthening the global response on climate change in the context of sustainable development will be achieved: (1) limiting global average temperature rise to well below 2°C and making a concerted effort to keep the global average temperature below 1.5°C, (2) increasing the ability to adapt and fostering resilience to climate change and low-carbon development in a way that does not negatively impact food production, and (3) ensuring that finance flows support pathways towards low-carbon and climate-resilient development.

resources alone, including the Mekong, Jordan, Indus, Nile and Niger river basins.⁶

While regulatory approaches to transboundary resource management are well established for transboundary adaptation, key questions remain. Is ‘adaptation across borders’ also an issue of ‘common concern’ or transboundary in character? How does the precautionary principle – which does not ‘prohibit’ transboundary harm, but rather stresses ‘prevention’ of activities involving the risk of causing significant transboundary harm – apply to the development of a regulatory framework for formulating transboundary adaptation plans? Is current environmental law sufficient to address the character and needs of transboundary adaptation? Can existing transboundary agreements be revised to ensure climate change is addressed? These questions are beyond the scope of this Resilience Scan, but provide food for further thought.

Institutional arrangements

There is also a range of institutions and commissions undertaking work on, or relevant to, transboundary adaptation. At the global level, there is the International Network of Basin Organizations (INBO), established in 2013. Among its objectives is promoting principles of good water management in the context of sustainable development (INBO, n.d.). Transboundary adaptation is a significant part of INBO’s work. In the lead-up to the establishment of the Paris Agreement, it was a driving force behind the Paris Pact on Water and Adaptation to Climate Change (INBO, 2015). The UN Economic Commission for Europe (UNECE) has facilitated work on transboundary adaptation on water resources within its jurisdiction. In 2009 the UNECE prepared the ECE Guidance on Water and Adaptation to Climate Change (UNECE, 2009) and in 2015 a study of adaptation in transboundary basins was published (UNECE and INBO, 2015).

Given their vulnerability to climate change, among other drivers, transboundary water resources, particularly river basins, offer opportunities to learn about approaches. Water resources, such as rivers and lakes, have typically been managed via bilateral and regional treaties, of which there have been more than 2,000 since 1616 (O’Neil, 2009). Intergovernmental organisations, such as river basin commissions, can play an important role in the development of transboundary adaptation by sharing information and knowledge, identifying appropriate

strategies and providing some of the critical resources needed (Heikkila et al., 2013).

The Mekong River Commission (MRC) is perhaps the best known example of a river basin organisation. The Mekong River flows from the Tibetan Plateau through the Yunnan province of China, then forms the boundary between and Myanmar, and between Lao and Thailand. It then continues through Cambodia and the Mekong Basin (Nguyen, 2007). During the rainy season, a sea-level rise of one metre in the East China Sea can lead to flood levels of nearly two metres above current levels on the Mekong Delta (World Bank, 2011).

In Africa, some river basins are shared by as many as 10 countries, with several countries almost entirely dependent on water supplies that originate beyond their own borders

The Mekong Delta region is considered to be extremely vulnerable to climate change and its associated impacts.⁷ Its transboundary nature means that climate change in the basin is both a national and a regional issue, and should be an integral part of the broader development agenda (Keskinen et al. 2010). Forming partnerships among countries of the region to develop common goals and commitments and share resources and knowledge to plan climate response strategies is essential. The Climate Change and Adaptation Initiative (CCAI) was created by the MRC in 2009 to increase understanding of current and future climate change impacts and to facilitate adaptation planning in the Lower Mekong Basin (MRC, 2011). Currently the MRC is developing the Mekong Strategy and Action Plan for the Lower Mekong Basin, which includes a strategic vision to identify priorities and strategies to support adaptation and build resilience (MRC, n.d.).

In Africa, some river basins are shared by as many as 10 countries, with several countries almost entirely dependent on water supplies that originate beyond their own borders (Chikozho, 2014). Mozambique shares nine river basins with other countries, most of which are upstream (Bankobeza, n.d.). The Africa Adaptation Initiative (AAI) is a continental initiative that addresses transboundary and regional adaptation. The AAI plans

6 See http://www.un.org/waterforlifedecade/transboundary_waters.shtml.

7 Apart from floods, climate change impact may also lead to a decrease in annual rainfall and average humidity. An increase in temperature can lead to reduced amounts of snow accumulation in the upstream reaches of the Mekong River in the Tibetan Plateau. This, together with human impacts such as deforestation, agriculture, and hydropower projects on the upper reaches of the Mekong River, will have further impact on the hydrological regime of the Tien and Hau Rivers, and consequently on the livelihoods of millions of people (Chivanno et al., 2008; Eastham et al., 2008).

to develop regional projects on agriculture, water, oceans, ecosystems and infrastructure, with the aim of engaging all affected countries in projects with transboundary implications (AAI, 2016). The AAI already has political buy-in at the highest level from 54 African countries, having been mandated at a meeting of African heads of state in June 2015 (AU, 2015). As such, the AAI could be well placed to create opportunities for synergies between the UNFCCC and the transboundary conventions at policy and practice levels, and to provide guidance as to how to integrate adaptation into transboundary resource management. The AAI aims to help these countries to maintain coherence and synergies between national and transboundary adaptation and to enhance understanding of transboundary risk. This is important, as national plans will be impacted by regional-level adaptation, particularly in the case of shared water resources and movement of livestock.

Another example is The Great Green Wall for the Sahara and Sahel Initiative which was launched in 2007, with the aim of tackling land degradation in Africa (AU, 2016). This transboundary project, led by the African Union Commission, is being implemented in more than 20 countries across Africa's Sahel region. In cooperation with international partners including UNCCD, GEF, World Bank among others. Approximately US\$8 billion have been mobilised and/or promised for this initiative.

In the Himalayas, the International Centre for Integrated Mountain Development (ICIMOD) aims to help advance climate change adaptation efforts across borders in areas with similar climate impacts.⁸ This includes facilitating access to data and information to support decision-making on adaptation. There are also examples of cross-border cooperation in conservation planning and management. Climate change is impacting the migratory patterns of wildlife all over the world (Trouwborst, 2012). In the Serengeti National Park-Maasai Mara National Reserve, transboundary conservation migration areas have been created for wildlife habitats of migratory species that occupy two or more countries.

Research and academic institutions are also endeavouring to better understand transboundary adaptation. The Stockholm Environment Institute (SEI) has undertaken a project – Adaptation Without Borders – to better understand the indirect impacts of climate change

and how they can be addressed (WeADAPT, n.d.). The premise behind Adaptation Without Borders is that, given transboundary risks, no adaptation strategies are purely local. The aim of the project, which began in 2015 and will conclude in 2017 is to increase awareness of the transboundary aspects of climate risks and to develop tools that will support decision-makers in addressing these risks (Davis, 2015). Research within the project suggests that there are four main pathways of indirect climate risks and has produced proposals as to how some of these risks could be addressed through NAPs. The Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) is a seven-year research project which focuses on regional climate hotspots and shares lessons learned from regional research, with the goal of informing adaptation planning in regions that are most vulnerable to climate change (Cochrane et al., 2016). One of the early findings of CARIAA is the need to find innovative ways to ensure that research is strong and that it also supports decision-making (Cochrane et al., 2016).

1.5. Moving up the agenda: opportunities for transboundary adaptation within the UNFCCC

As we have seen, the UNFCCC is by no means the only convention relevant for transboundary adaptation, and is in fact one of the weakest in this regard. However, the UNFCCC will be central to furthering the dialogue, policy processes and resourcing required for transboundary adaptation measures to be effectively implemented where they are most urgently needed. While the UNFCCC does not define transboundary adaptation (nor indeed adaptation), it has acknowledged the importance of transboundary adaptation as a possible response measure. The Cancun Agreements, which established the Cancun Adaptation Framework,⁹ make several references to the importance of enhancing adaptation at the regional level, including the importance of ensuring that developing countries have support to implement adaptation actions at all levels (UNFCCC, 2011).

In recent years, discussions under the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change (NWP) have highlighted the importance of transboundary adaptation – most prominently in water

⁸ See <http://www.icimod.org/?q=16901>.

⁹ The Cancun Adaptation Framework (CAF) was established at the 16th Conference of the Parties in Cancun, Mexico, in 2010. The objective of the CAF is to enhance action on adaptation, including through global cooperation and enhanced coherence on adaptation under the Convention. The CAF invited all countries to enhance action on adaptation in the light of common but differentiated responsibilities and differing capabilities and national and regional priorities. The Adaptation Committee, the oversight body for adaptation under the UNFCCC, and the process for developing and implementing NAPs were established as part of the CAF (UNFCCC, 2011).

resources.¹⁰ While it does not appear that these have been taken any further, there is significant scope for enhancing work on transboundary adaptation under the UNFCCC, and particularly the guidance of the Adaptation Committee and through the development and formulation of NAPs.

The current three-year workplan of the Adaptation Committee will be implemented from early 2016 through to the end of 2018 (UNFCCC, 2016e). The Committee agreed to maintain flexibility to allow for the inclusion of relevant aspects of the Paris Agreement, including the GGA. Given this, there are several areas where a focus on transboundary adaptation could be added or enhanced, including strengthening engagement with institutions working on transboundary adaptation; providing technical support to countries undertaking transboundary adaptation; providing guidance on accessing technical support for the development of strategies and raising awareness; and facilitating the exchange of information on transboundary adaptation. The Adaptation Committee could also provide guidance for the assessment of indirect impacts of climate change and how these can be addressed (SEI, 2014).

While NAPs are national plans, the prevalence of transboundary or shared resources makes transboundary adaptation planning critical. The guidance on NAPs prepared by the UNFCCC encourages countries to establish links between the national, regional and international levels (SEI, 2014). The guidance includes assessing vulnerability and identifying adaptation options, noting that this should be done at all appropriate levels (SEI, 2014). The NAPs could be a platform for enhancing transboundary cooperation on adaptation with guidance from the UNFCCC, in particular the Adaptation Committee. The NAP Task Force under the Adaptation Committee could also provide targeted support to countries on the integration of transboundary adaptation into their NAPs. Specific support to LDCs could be provided through the NAP Global Support Programme, a joint initiative between the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) to provide assistance to LDCs for developing NAPs with funding from the Least Developed Country Fund. The regional training workshops on the NAPs could include an increased focus on transboundary adaptation and facilitate discussions on how to enhance transboundary cooperation within each region.

Some countries have already recognised the importance of addressing the indirect impacts of climate change within their national policies. In its national adaptation framework, Nauru recognises high economic dependency

on a few sectors as key drivers of vulnerability (SEI, 2014). SEI's Adaptation Without Borders proposes four pathways of indirect climate risk: people (migration and health impacts); biophysical impacts on the flow of ecosystem services or resources; trade (altered price, availability or quality of goods and services); and finance (changes in the flow of capital from outside a country). The project suggests that all countries should include both global and transboundary dimensions of vulnerability and adaptation options in their NAPs, with the aim of identifying indirect impacts that are of specific concern, and articulating how climate change impacts within its borders could create indirect impacts for other countries. NAPs could identify the opportunities and potential vehicles for enhancing global and regional cooperation to address indirect impacts of climate change, including through transboundary adaptation (SEI, 2014). Sharing drafts of NAPs with neighbouring countries could provide opportunities for shared learning and the co-development of solutions (SEI, 2014).

Though the term 'transboundary adaptation' has yet to be acknowledged in a UNFCCC decision, there are provisions relevant to it throughout the Paris Agreement. The Paris Committee on Capacity-Building (PCCB) was established to address capacity-building gaps and needs and enhance capacity-building efforts under the Convention (UNFCCC, 2016a; 2016b). One of the activities in the 2016–2020 PCCB workplan is to foster global, regional, national and subnational cooperation (UNFCCC, 2016a; 2016b). Building capacity to support transboundary adaptation should therefore be a key component of these discussions.

The Paris Agreement also established a technical examination process on adaptation (TEP-A), which aimed to identify opportunities for strengthening resilience, reducing vulnerabilities and enhancing both the understanding of and the implementation of adaptation action (UNFCCC, 2016c). The first of the TEP-A's annual technical expert meetings (TEMs), held in 2016, included a session dedicated to enhancing understanding of the challenges and opportunities associated with transboundary adaptation. The technical report from the TEMs included several relevant conclusions, for example the importance of coordinated action to reducing vulnerability (UNFCCC, 2016c). While it is important that transboundary adaptation is being recognised, these conclusions could be actioned through further work under the aegis of the UNFCCC. There is a process underway to profile the key messages from the TEMs at an annual high-level event to be held in conjunction with each Conference

¹⁰ The NWP is a work programme under the UNFCCC which aims to help countries, particularly developing countries, enhance both the understanding of and the assessment of climate change impacts, vulnerability and adaptation strategies to support decision-making on practical adaptation actions and measures to address climate change.

of the Parties. This event engages with high-level policy and decision-makers and could become a platform to catalyse transboundary action on adaptation.

Certainly, the Paris Agreement has the potential to further enhance the narrative on transboundary adaptation, especially in relation to the GGA. Established to enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change, the GGA strengthens the ability of the parties to adapt and facilitate resilience to climate change impacts, which is now one of the overarching goals of the Agreement, alongside efforts to keep the global average temperature increase to well below 2°C and warming below 1.5°C (UNFCCC, 2016c).

While the Paris Agreement does not refer specifically to transboundary adaptation, it recognises that adaptation is a global challenge with local, subnational, national, regional and international dimensions (UNFCCC, 2016a). Decision 1/CP.21, which accompanies the Agreement, asks Parties to strengthen regional cooperation on adaptation, including where appropriate, to establish regional centres and networks, particularly in developing countries (UNFCCC, 2016a).

Parties to the Paris Agreement will need to report on their progress towards achieving the GGA in the Global Stocktake, the process for assessing the progress towards achieving the global goals. Given that some countries have already highlighted transboundary adaptation in their INDCs, there is significant scope to include such efforts in country reports. With its recognition in the Agreement, discussions on the operationalisation of the GGA must also focus on increasing transboundary adaptation.

1.6. Challenges, opportunities and the way to action

It would be naive to suggest that developing transboundary adaptation is not without significant legal, political and practical challenges. Adaptation policy and planning at national, local and sector levels is already challenging. Undertaking transboundary vulnerability and risk assessments is complex, resource-intensive and difficult to integrate, and developing transboundary adaptation strategies poses an even greater challenge.

At a 2012 NWP in Mexico City, workshop discussions highlighted some of these challenges, many of which are already inherent in national adaptation planning processes (Elrawady and Koepfel, 2012). The workshop identified lack of data-sharing and availability, weak joint data-management, inadequate observational networks, lack of consensus on adaptation priorities and an absence of coordination mechanisms finance for transboundary adaptation. The continued focus on national-level adaptation was also mentioned as a challenge, as were the lack of flexibility in existing transboundary risk

management agreements and, perhaps most obviously, fundamental political barriers, such as questions of sovereignty, jurisdiction and responsibility, as well as lack of political will. The 2016 TEMs on adaptation under the UNFCCC highlighted the importance of ensuring that risk and vulnerability assessments incorporate relevant transboundary aspects, such as shared river basins and the repercussions of global food security, on the vulnerability of national agricultural and livestock production (UNFCCC, 2016c). Certainly, there is a disconnection between policy and practice.

But, as well as challenges, there are also several opportunities to better support transboundary adaptation efforts. For example, transboundary cooperation could also support adaptation efforts at the national level by strengthening the capacity to develop and implement adaptation plans; enhancing knowledge on adaptation by pooling regional expertise; sharing costs for activities like developing climate change scenarios and avoiding negative transboundary impacts, particularly in shared river basins and other ecosystems (UNFCCC, 2016c). Moreover, the knowledge being generated by the NWP and the TEP-A, among others, should be incorporated into the official fora, and particularly into the work on adaptation under the UNFCCC. There is also a need for economic incentives to enable joint adaptation planning and engagement of the private sector to finance transboundary adaptation. If countries could be confident that transboundary risk was being addressed through a suite of regionally agreed adaptation measures, this could provide confidence in terms of de-risking investments involving shared resources. Indeed, finance is a significant issue. One way of addressing the challenges could be to establish a formal working and technical advisory group under the UNFCCC. This could then explore mechanisms for facilitating cooperation and coordination between transboundary initiatives and NAPs. This group could also work more formally with existing intergovernmental institutions, such as river commissions, to ensure climate change is addressed in existing transboundary agreements, as well as with regional centres, such as ICIMOD and AAI, to build capacity and knowledge exchange in specific areas of concern, as highlighted by Parties to the Paris Agreement.

There is a lot of ongoing work on transboundary adaptation, particularly though not limited water resources. The INBO incorporates a plethora of basin organisations throughout the world. As discussed, there are many other institutions facilitating cooperation on the management of transboundary resources. This work will become increasingly important as the impact of climate change increases.

The impacts of climate change will cross boundaries, necessitating both bilateral and, in some cases, multilateral cooperation (Magnan et al., 2015). The Paris Agreement

has recognised that adaptation is a global challenge faced by all, and with local, subnational, national, regional and international dimensions (UNFCCC, 2016a). It is now time to move beyond recognition and towards action to support transboundary adaptation. The GGA is one way of ensuring that the many aspects of adaptation – including the geographic and thematic dimensions – are addressed. But while many Parties and groups have indicated that operationalising the GGA should be one of the purposes of the adaptation communications, this has yet to be discussed. It is important that a shared understanding of the GGA be developed to track progress on adaptation (Magnan et al., 2015). The UNFCCC could play a critical role in supporting transboundary adaptation by encouraging countries to provide information and preparing an annual report on transboundary risks and adaptation (Magnan et al., 2015). More specifically, the Adaptation Committee could include transboundary adaptation in its current workplan, and its NAPs Task Force could provide support to countries wishing to integrate transboundary adaptation in their NAPs. The regional training workshops on the NAPs could include sessions dedicated to the transboundary issues in each region.

If Parties include transboundary adaptation in their adaptation communications, then these elements would need to be included in the Global Stocktake. Current discussions under the Ad hoc Working Group on the Paris Agreement (APA), the body under which the implementation of the Paris Agreement is being negotiated, are focused on the details of what will be included in these

documents, but not necessarily on the practical elements of how to ensure that an overarching vision on adaptation is achieved. However, there is a clear and increasing need for transboundary adaptation planning, particularly as climate change impacts water resources and other transboundary ecosystems.

More discussions are needed to bring the adaptation-relevant elements of the Paris Agreement together, and particularly on how to support countries in their transboundary and regional adaptation efforts. Moreover, developing synergies and coherence between other conventions, such as the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention), the CBD and the UNCCD, will be essential to build on lessons learned and to develop comprehensive policy, legislative and needs-based approaches.

Developing robust climate adaptation measures is complex. Devising policies and identifying options must take place in the context of changing physical, socioeconomic and political conditions in which uncertainties are inherent and systemic adjustments required (Moss and Martin, 2012). Ecosystems, and therefore the climate change impacts that affect them, do not stop at state borders. To respond to these impacts as they traverse political and geographical boundaries, and to meet the demands of our increasingly globalised and interdependent world, necessitates new approaches that address the concerns of countries grappling with understanding transboundary risk and risk management.



Mazenod reservoir under construction, Lesotho. Photo credit: John Hogg/World Bank, 2009. CC BY-ND 2.0.

2. Resilience in the blogosphere

2.1. Methods

This section offers insights into how the concept of resilience is written about and discussed in the blogosphere by identifying and analysing the top 25 blog posts on resilience published in the first half of 2017 (see Table 2). This illustrates the popular contexts in which resilience is blogged about, and key themes that dominate blog discourses of resilience. Here, blogs are defined as weblogs or blogsites (websites that publish blog entries), whereas blog posts are discrete, published (with date) blog entries or articles.

The basic approach here is based on the metrics of visibility and (online) impact and engagement, and comprises three phases:

- Using blog search engines, Boolean search queries were performed to identify blog posts that publish about resilience in the context of key sectors/keywords (Resilience and also: Climate, Agriculture, Urban, Water, Disasters, Food Security and Conflict). This initial exploratory search identified the top 50 resilience blog posts.
- To narrow the list down, it was reviewed manually to exclude blogs that have low keyword/subject matter relevance, are unoriginal cross-linked 'farms' and blog aggregators, or have no measurable social sharing features.
- The top 25 blog posts were ranked by social visibility, created by aggregating key social media metrics from Facebook shares, LinkedIn shares, Twitter tweets, miscellaneous social media shares (if found) and backlinks (external hyperlinks from one web page/site to another, often used in measuring blog post impact and readership).

2.2. Making the case for resilience

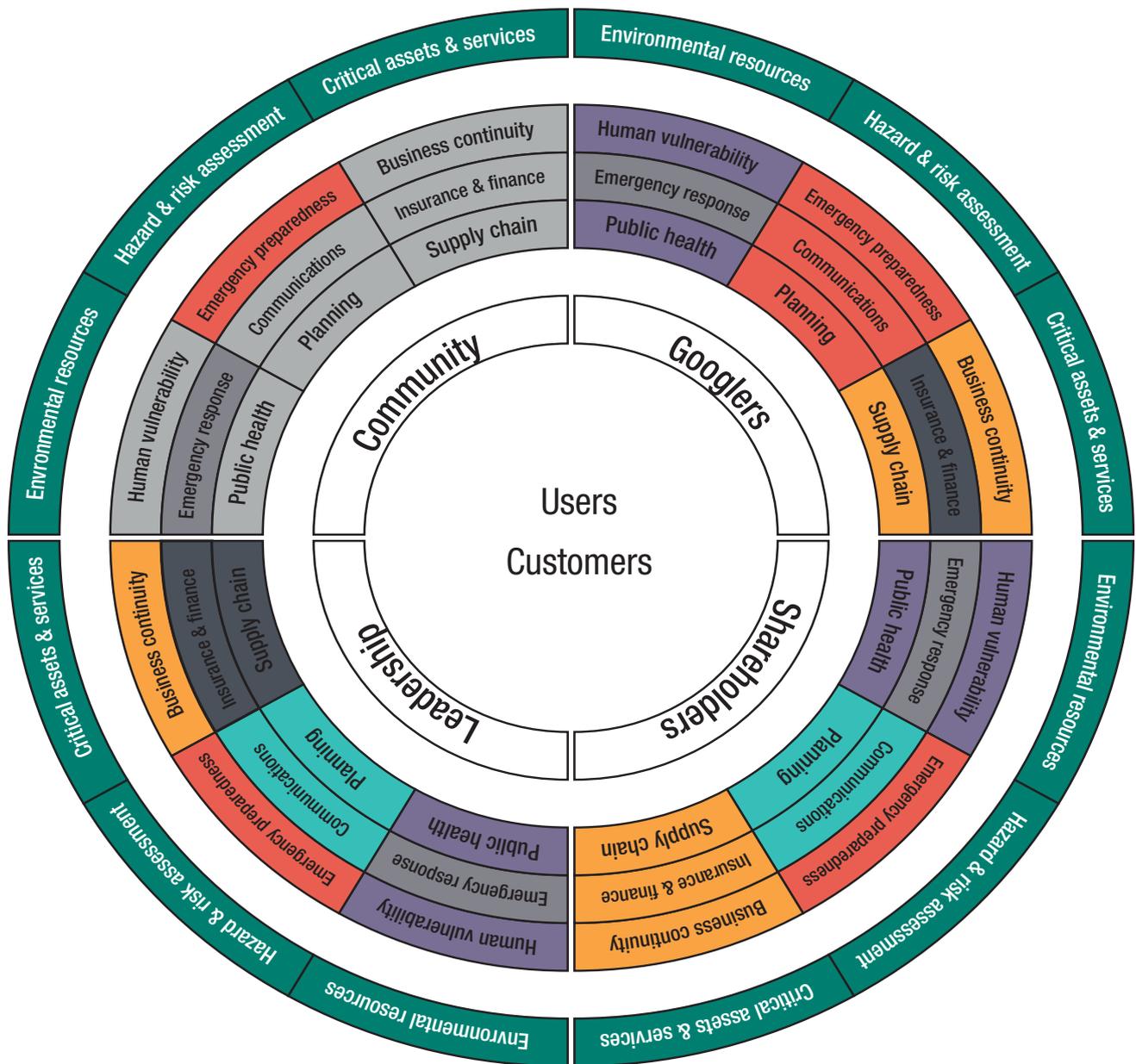
Three blogs (Blog 4, Blog 9 and Blog 10) deal with how to strengthen the incentives and business case for investing in resilience, particularly in the private sector. In Blog 4, Rowan Schmidt and colleagues focus on how to communicate the value of natural assets and biodiversity in fostering city resilience. As cities invest in their future, it is critical to recast the concept of development to include both grey and green infrastructure and ensure that these investments are made to achieve overall resilience and a sustainable future. The blog provides examples to highlight three ways that city leaders can communicate the value and urgency of cultivating our natural environment, including:

- Raising awareness of the value of natural assets and making the business case for their importance in urban resilience.
- Communicating the facts and figures that determine project selection and design, including the use of ecosystem service metrics to demonstrate the value of local green infrastructure projects and their connections to the neighbouring community, the economy and built infrastructure.
- Encouraging systemic policy change, using local projects to inform broader policy, strengthen governance, and establish funding mechanisms to support an integrated approach to build resilience and maximise the resilience dividend.

Blog 10 reflects on the need to make building resilience appealing to policy-makers and businesses. It highlights the growth of business activity around managing climate risk, including the 2016 recommendations of the G20 Task Force on Climate-Related Financial Disclosures (TCFD), which distinguishes transition risks resulting from the evolution towards a lower-carbon future from physical risks resulting from severe weather events and longer-term shifts in climate patterns that cause direct damage to assets and can significantly disrupt supply chains.

The blog uses the example of Google's climate resilience strategy and framework that prioritises impacts on people

Figure 1: Google Portfolio Vulnerability



Notes: Google’s people-centered framework represents aspects of climate resilience within Google, and actors who either influence or are influenced by Google’s climate resilience decisions. Source: adapted from Google.

(including communities, users and Googlers) so that it represents the different aspects of climate resilience within and beyond Google (see Figure 1). Equipped with these frameworks, Google is turning its attention to the question of how to connect climate resilience to the bottom line, and is developing new tools to weigh the cost of inaction against the cost of investing in resilience.

The inherently political nature of climate change is picked up by Henry Grabar in Blog 9, asking ‘Should planners talk about something else?’ He highlights how discussions of future climate change in North Carolina have become part of the public and political discourse since they started focusing less on climate change and more

on something more meaningful to residents: flooding. In this context, Grabar discusses how the word resilience has become the touchstone of climate planning. Planners can use it as a non-partisan substitute for tackling climate change, but also other threats, enabling communities with sceptical constituents to start raising roads and houses without addressing the ‘elephant in the room’. The blog highlights the different ways that the term resilience is interpreted, but ends with a note of caution: ‘We can see what we gain from not talking about climate change. What do we lose?’

Table 2: Top ranking resilience blog posts in the first half of 2017

Rank	Blog post title	URL	Publisher	Social visibility score
1	Building climate resilience, from day one	https://www.rainforest-alliance.org/articles/building-climate-resilience	Rainforest Alliance	32.2k
2	Modern agriculture cultivates climate change – we must nurture biodiversity	https://www.theguardian.com/global-development/2017/jan/09/modern-agriculture-cultivates-climate-change-nurture-biodiversity-olivier-de-schutter-emile-frison	The Guardian	6.9k
3	Resilient Jakarta: Keeping above water	http://www.100resilientcities.org/resilient-jakarta-keeping-above-water/#/-/_/	100 Resilient Cities	5k
4	Communicating the value of urban biodiversity to foster city resilience	http://www.100resilientcities.org/communicating-the-value-of-urban-biodiversity-to-foster-city-resilience/#/-/_/	100 Resilient Cities	4.6k
5	Arctic indigenous peoples leading the way in ecological restoration and climate resilience	https://intercontinentalcry.org/arctic-indigenous-peoples-leading-way-ecological-restoration-climate-resilience-says-major-new-study/	Intercontinental Cry	3.2k
6	As climate change threatens food supplies, seed saving is an ancient act of resilience	http://www.yesmagazine.org/planet/as-climate-change-threatens-food-supplies-seed-saving-is-an-ancient-act-of-resilience-20170607	Yes Magazine	2.1k
7	Crop scientists race to create a climate-change-resilient agriculture	http://www.sierraclub.org/sierra/2017-2-march-april/feature/crop-scientists-race-create-climate-change-resilient-agriculture	Sierra Magazine	1.7k
8	How cities can stand up to climate change	https://www.curbed.com/2017/2/15/14616928/trump-nasa-climate-change-california	Curbed	1.5k
9	A threat by any other name	http://www.slate.com/articles/business/metropolis/2017/03/cities_are_throwing_out_climate_change_in_favor_of_resilience.html	Slate	1.4k
10	Connecting climate resilience to the bottom line	https://ssir.org/articles/entry/connecting_climate_resilience_to_the_bottom_line	Stanford Social Innovation Review	1.3k
11	Climate change, resilience, and the future of food	http://blog.ucsusa.org/science-blogger/climate-change-resilience-and-the-future-of-food	Union of Concerned Scientists	1.1k
12	What drives urban resilience? Two cities that bounced back	https://blueprint.cbre.com/what-drives-urban-resilience-two-cities-that-bounced-back/	Blueprint	825
13	Government action needed on climate resiliency and food security in West Africa	https://news.mongabay.com/2017/05/government-action-needed-on-climate-resiliency-and-food-security-in-west-africa/	Mongabay	757
14	In disaster recovery, social networks matter more than bottled water and batteries	https://www.citylab.com/solutions/2017/02/recovering-from-disasters-social-networks-matter-more-than-bottled-water-and-batteries/516726/	Citylab	673
15	Building more affordable and disaster-resilient housing in Latin America and the Caribbean: a few policy ideas	https://blogs.worldbank.org/sustainablecities/building-more-affordable-and-disaster-resilient-housing-latin-america-and-caribbean-few-policy-ideas	World Bank	485
16	How do we meet the urgent needs of 11 million Syrians fleeing conflict?	https://www.theguardian.com/global-development/2017/jan/21/how-meet-urgent-needs-11-million-syrians-fleeing-conflict	The Guardian	455
17	Toronto the resilient: how the city plans to adapt to climate change in 2050	http://www.cbc.ca/news/canada/toronto/transformto-plan-climate-change-1.4091425	CBC News	398

18	A humanitarian crossroads: Why climate resilience is key to avoiding future food crises	http://www.undp.org/content/undp/en/home/blog/2017/5/3/A-humanitarian-crossroads-Why-climate-resilience-is-key-to-avoid-future-food-crises.html	UNDP	383
19	Resilient cities require resilient food systems	https://www.rockefellerfoundation.org/blog/resilient-cities-require-resilient-food-systems/	Rockefeller Foundation	267
20	Why understanding resilience is key to water management	https://www.thesourcemagazine.org/understanding-resilience-key-water-management/	IWA Source	257
21	Building strong: How resilient design can be used to creatively combat disaster	http://www.constructiondive.com/news/building-strong-how-resilient-design-can-be-used-to-creatively-combat-disa/437486/	Construction Dive	219
22	Are 'open source' seeds necessary for a resilient food system?	https://www.greenbiz.com/article/are-open-source-seeds-necessary-resilient-food-system	Green Biz	198
23	Beyond organic: Carbon farming is a pathway to climate stabilization and resilient soils	https://www.treehugger.com/sustainable-agriculture/beyond-organic-carbon-farming-pathway-climate-stabilization-and-resilient-soils.html	Treehugger	153
24	Climate change and conflict: how Mali can grow more resilient	https://issafrica.org/iss-today/climate-change-and-conflict-how-mali-can-grow-more-resilient	Institute for Security Studies	107
25	Kenyan slum activists build climate change resilience from the bottom up	www.irinnews.org/feature/2017/01/12/kenyan-slum-activists-build-climate-change-resilience-bottom	IRIN	95

2.3. Urban resilience

Eight of the top 25 resilience blogs (Blog 2, Blog 8, Blog 12, Blog 15, Blog 17, Blog 21, Blog 19 and Blog 25), from January to June 2017 focus on urban themes. These include three broader articles on cities as important focal points for tackling climate change and for understanding resilience, and two that examine some incentives and designs of resilient urban infrastructure.

In Blog 8 Alissa Walker contributes to the theme of making the case for resilience. She sees cities as axes of action despite national policy changes under President Trump. The blog describes the emergence of urban resilience planning as a way of preparing for the impacts of climate change and the 'new normal' of hazards and disasters that it is creating. Groups like the Compact of Mayors, C40 and Ready for 100% formed alliances to reduce emissions, while 100 Resilient Cities (100 RC) creates a dialogue among affiliate cities about the best practices for identifying and addressing various risks to their residents. 'So, New Orleans can get guidance from, say, Amsterdam on how to prepare for sea-level rise and coastal flooding.'

Will Symons' commentary on the Indonesian capital Jakarta (Blog 3) highlights key challenges, particularly around traffic congestion (some of the worst in the world) and flooding (exacerbated by subsidence, clogged drainage canals and ageing infrastructure). Over the years, multiple technical reports have been written on the city's resilience challenges. He argues that the broad-based, independent

and practical, though aspirational, nature of the 100 RC programme provides a unique opportunity to help bring together people from across the private and public sectors, civil society and academia. This is helping to develop a common language around resilience and a shared understanding of Jakarta's resilience challenges.

Blog 12 provides a historic account of two cities, Liverpool in the UK and New Orleans in the US, that have experienced adversity and managed to bounce back, to a large extent through their own efforts. These cities provide insights into the nature of good public policy, but they also point to the key ingredients of community, local leadership and a strong sense of place. These examples suggest that:

- State assistance is necessary; although, it requires a massive coordination effort from the national to the local level, and local politicians need to rise to the challenge of navigating through 'crisis mode'.
- Civic engagement is critical to rebuilding community confidence and generating stronger social bonds, resulting in a sense of pride and appreciation for the city despite the challenges.
- There needs to be an adaptation to market forces for the local economy to rebound. Liverpool has become a retail hub, and both cities have embraced tourism as growth drivers.

A strong sense of place and belonging among the citizens helps people get behind the process of bouncing back

and adapting. Some of this is organic, but it can also be deliberately supported by institutional forces.

In Blog 15, Julian Palma and Marisa Garcia Lozano highlight policy prescriptions for affordable and disaster-resilient housing in Latin America and the Caribbean. Summarising discussions at a meeting of housing authorities across the region, they highlight the need for:

- Tying structural retrofitting with better incentives for homeowners, such as granting higher levels of legal security or allowing homeowners to make better economic use of their assets, provided that a combination of government subsidies and affordable loans is available for these purposes.
- Proactively engaging microfinance institutions to increase affordability and advance home resilience, encouraging microfinance markets to expand services to low-income families.
- Linking housing policies to both affordability and energy efficiency, helping to lower energy costs and tackle pollution and climate change.

A bottom-up perspective on resilience in urban informal settlements is provided by Blog 25. Reporting from Mukuru, one of the largest slums in Nairobi, Lou del Bello describes how flooding damages property, endangers health and constrains access to services, such as schools. More broadly, the slum suffers from a lack of access to piped water and inadequate sanitation and garbage handling. A major constraint is that Mukuru residents do not have security over the land. They could be evicted at any time and this discourages them from planning for the long term. A local coalition of activists is working to improve land tenure and property rights – including the conversion of private holdings into community land and then establishing a Community Land Trust. The Trust will help defend constitutional rights to housing, water, health and sanitation.

Blog 21 examines the rise of resilience within construction. It notes the need to manage multiple threats, including acute shocks and more gradual chronic stressors. For example, protection against potential gang violence in hospitals might require the design of separate waiting room and patient treatment areas. Similarly, a treatment space and anteroom can be designed to convert to a freestanding pod upon discovery of a contagion. Not all solutions have to be expensive. For example, simply moving the mechanical systems to a higher floor in buildings vulnerable to coastal flooding, or putting those same systems in the basement in a tornado-prone city, is effective.

Buildings can also be designed to be adaptable, such as the elevated loading docks in San Francisco's Mission Rock development, which can serve as pedestrian walkways in future, as water levels rise. The blog notes that insurance companies have been slow to introduce premium breaks for buildings that have been designed for resilience, but when they do, insurance will become a huge driver of resilience.

Blog 17 reports on the proposed resilience plans of Toronto, which aims to achieve an 80% reduction in greenhouse gas emissions by 2050. The blog notes that this will require lifestyle changes, including greener transport, smaller, low-energy dwellings and compact neighbourhoods where more of the services and jobs and recreational activities will be local. The plan also describes the people of 2050 using fewer 'disposable products' thanks to the sharing economy and local hubs that lend, take back and reuse daily items.

Blog 19 provides an overlap to the next theme, linking urban and food issues. The blog makes the case that city leaders should include food systems and food waste reduction as part of their resilience planning. Highlighting findings of a recent report on The Resilience of America's Urban Food Systems, the blog summarises five recommendations for cities:

- Conduct a food system resilience assessment to identify appropriate short- and long-term solutions.
- Incorporate food systems into resilience planning initiatives and prioritise resilience on urban food agendas. Most cities overlook food systems in their resilience plans.
- Develop neighbourhood food resilience plans, giving priority to neighbourhoods where food access would be disproportionately impacted by a natural disaster.
- Strengthen food business resilience. Cities should work with the food industry to ensure all food businesses, especially smaller ones, have adequate insurance cover and business continuity plans in place.
- Develop government policies and practices that help food businesses quickly return to normal operations, such as expedited food safety inspections, the construction permit process and transportation restrictions.

2.4. Agriculture and food

A common theme across the most shared blog posts in this period is the importance of diversity in agriculture for enhancing resilience, especially in the face of a changing climate. While Blog 2 and Blog 11 examine agricultural systems, three blogs (blogs 7, 6 and 22) describe efforts to protect seed genetic diversity, while two blogs discuss soil carbon and agro-forestry practices.

Blog 11 looks to the future of food systems, arguing that the obsession with technological innovation hides the central importance of public investment of public resources to develop, support, promote and enable the industrial food system. Author Laura Lengnick argues that the new push on 'sustainable intensification' is just 'business as usual' for many actors in the global industrial food system. In contrast, the author offers six levers of change to enhance sustainable agriculture and food systems, offering successful models of locally adapted, climate-resilient alternatives that can be built upon to put humanity on a path to a sustainable and resilient food future.

Similarly, Olivier De Schutter and Emile Frison argue in Blog 2 that recent technological innovations provide only short-term solutions to falling agricultural yields, highlighting instead the need for agricultural diversity to ensure food security and resilience. The risk is that new technologies may simply give industrial agriculture a new lease of life and delay the inevitable shift to a fundamentally different model of agriculture. A viable alternative exists in the shape of diversified agro-ecological systems. In other words, diversifying farms and farming landscapes – replacing synthetic chemical inputs, optimising biodiversity and stimulating interactions between different species – as part of holistic and regenerative strategies to build long-term soil fertility, healthy agro-ecosystems and secure livelihoods. This applies as much for industrial agriculture as for subsistence-style farming.

In Blog 7 Jason Mark describes how the US Department of Agriculture's national and regional seed banks store hundreds of thousands of plant varieties, such as domesticated sorghum, cultivated wild rice and wild sorghum. Across the globe, botanists are working to identify what scientists call 'crop wild relatives' – the weedy cousins of our staple foods. The threat from climate change to food production is at the centre of this new urgency. As droughts, extreme rainstorms and other erratic weather patterns intensify, farmers will need crops that can cope with such stresses. And plants that are wild or weedy – proven survivors – have the necessary traits to meet those challenges.

Sarah van Gelder starts Blog 6 noting the dangers of relying only on these centralised seed banks, citing the recent floods in the huge Global Seed Vault on the Norwegian island of Svalbard. Instead, she highlights the

emergence of local seed libraries and exchanges as a way of enhancing resilience and food security. She describes the over 500 local seed libraries/exchanges around the world, in which many people contribute to a common pool of knowledge and genetic diversity, sharing the benefits in doing so. Van Gelder argues that we need such genetic diversity to ensure food security and resilience in a time of climate change. The blog notes that this model runs counter to that of modern agribusiness, which reduces genetic diversity of food stocks and consolidates control over the world's seeds (six seed companies now control three quarters of the seed market). 'Making big profits requires scarcity, exclusive knowledge, and the power to deny others the benefits.'

Blog 22 also picks up the seed diversity theme, describing the growth of 'open source' seed initiatives around the world, created to ensure that some plant varieties and genes will remain free from intellectual property rights and available for plant breeders in perpetuity. This is in response to the growing consolidation of seed suppliers and patenting of particular plant traits. This is shrinking the catalogue of plant material available to breeders at a time when the need for genetic diversity is greater than ever. As planting material becomes more restricted through intellectual property rights, the future of the food supply is compromised because the gene pool is continually shrinking.

Blog 13 reports on research at the International Institute for Applied Systems Analysis modelling future climate change and food security in West Africa, with Burkina Faso and Ghana already employing the study's findings in their policies. The future climate scenarios were modelled with socioeconomic factors, including whether long-term or short-term goals were prioritised for policy-making and whether state or non-state actors were more prevalent in the process of development. The results of the study show that taking measures to adapt to climate change and to invest in agriculture now will lessen the impacts of climate change in the future. When state actors dominated and focused on long-term goals, food security improved the most and food prices fell. The opposite scenario, which is categorised by non-state actors and short-term needs, had the highest potential for increased food insecurity. Under this scenario, scientists also expect food prices to rise.

Blog 23 provides an introduction to the growth of smart carbon-farming practices. It notes that organic food is not necessarily grown with carbon emissions, but that demand could drive farming towards lower emissions and more resilient agriculture practice if marketed in a similar way to organic produce.

Blog 1, the most shared article in the scanned period, summarises the contribution to resilience of the Rainforest Alliance over the last 30 years. While the Alliance describes its work as forest conservation, 'what we've been doing all

along is mitigating climate change and building resilience to its impacts'. Farmers in training programmes learned how to increase their resilience and adapt to climate change through methods such as the protection of native ecosystems and biodiversity, avoidance of deforestation, maintenance of healthy soils, protection and conservation of water resources, and guidance for farmers in selecting climate-smart planting materials.

2.5. Humanitarian crisis and response

Blog 16 examines resilience in the context of a humanitarian response to the war in Syria and its impact on neighbouring countries. Much has already been done by host governments, local communities and aid organisations to help refugees obtain shelter, food and access to healthcare and education. But most adult refugees are unable to work legally, and just under half of the 1.6 million school-age children refugees are without a place in school.

The blog highlights the risk that the pressures on displaced Syrians and refugees, and in the communities and countries hosting them, will continue to grow. It notes a joint report from the International Labour Organization, the UNDP and the World Food Programme that brings together examples of the many ways that jobs and economic opportunity can be created, to the benefit of displaced people, refugees, host communities and host countries.

Framed by the mounting burden of humanitarian crises around the world, Blog 18 argues that strengthening resilience to climate shocks, stresses and change is vital to reducing the future crisis burden. The blog highlights new project proposals for the GEF to enhance resilience, support climate-smart economies, protect vulnerable Small Island Developing States, scale up successes and create opportunities for vulnerable communities. These include initiatives in Bangladesh, Burkina Faso, Chad, Ethiopia, Guinea, Kiribati, Liberia, Niger and Pacific LDCs.

2.6. Miscellaneous

Three blogs fall outside the classifications above. Daniel Aldrich, in Blog 14, reflects on his work on resilience to shocks such as natural disasters, highlighting the importance of connections to others rather than physical infrastructure or disaster preparedness kits. Research after the Japanese earthquake and tsunami of 2011 found that municipalities which had higher levels of trust and

'horizontal' interaction between town residents had lower mortality levels. It was a surprising finding given that Japan has spent enormous sums on physical infrastructure, such as seawalls, but invested very little in building social ties and cohesion. In high-trust neighbourhoods, people knocked on the doors of those who needed help and escorted them out of harm's way.

Similarly, Aldrich identifies the importance of vertical ties as the best predictor of where a community is likely to be able to recover well and quickly. Communities that had sent more powerful senior representatives to Tokyo in the years before the disaster did best. These politicians and local ambassadors helped to push the bureaucracy to send aid, reach out to foreign governments for assistance and smooth the complex zoning and bureaucratic impediments to recovery.

Blog 20 reports on SEI Director Johan Rockström's address to the Davos meeting in 2017. It argues that water is a key element of global resilience, noting that water brings together the four major global risks – biodiversity loss, nitrogen/phosphorus runoff, land conversions and carbon emissions. For all the looming risks, he remains upbeat about water's future, including by means of investments in innovation, such as water harvesting, drip irrigation, zero tillage. In Africa most agriculture is rainfed, so just as cell phones have helped leapfrog transmission lines, and solar panels have shown an alternative to dirty power plants, Africans may gain more resilience through systemic investments in decentralised water harvesting and small-scale local drip systems, rather than big centralised monopolistic irrigation schemes.

In Blog 5, Hannibal Rhoades and Tero Mustonen outline the findings of a study that recognises the crucial role that Arctic Indigenous Peoples have to play in ecological restoration efforts that help build resilience to major climate change driven shifts in the distribution of land, marine and freshwater species. The blog highlights two case studies where species migration and change threatens the long established physical, cultural and spiritual well-being of Indigenous Peoples, including the Chukchi People's relationship with reindeer in Russian Siberia and the enduring relationship between the Skolt Sami People and Atlantic salmon in Näätamö in Finland. In the latter, a co-management structure is being pioneered that gives the Skolt Sami a louder voice in matters concerning the Näätamö River, opening spaces for them to share observations and recommendations based on traditional knowledge. 'Co-managers' in the process include scientists and local authorities.

3. Resilience in the grey literature

Our review of the grey literature on resilience published between January and June 2017 includes 31 articles, embracing independent research, the private sector, NGOs and UN agencies. These span five broad themes:

- Insurance and risk financing
- Resilience in humanitarian contexts
- Urban resilience
- Agriculture, pastoralism and food security
- Climate and disaster resilience policy.

3.1. Insurance and risk financing

The grey literature on *insurance and risk financing* suggests:

- Insurance industry expertise can play an important role in supporting risk-informed decision-making.
- Overreliance upon risk insurance can be detrimental, and may exacerbate inequality.
- At a household level, there may be more demand for flexible savings accounts than for commitment savings and insurance products for risk reduction.

Seven reports on insurance and risk financing were published in the last quarter. They address national-level agricultural or drought insurance, leveraging private sector expertise and investment, and the role of insurance in building community level resilience.

A guide from the University of Cambridge Institute for Sustainability Leadership (CISL, 2017) suggests that harnessing the expertise and data held by the insurance industry could yield important benefits for risk management, but investors and insurers are often only included in infrastructure development once most of the major decisions have been made. Developing economies often struggle to make full use of the insurance industry's risk transfer and risk management capacities due to low levels of insurance penetration and limited understanding of insurance, as well as weak formal institutions, among other factors. This guide provides the methodology and report from the City Innovation Platform pilot project,

a two-day workshop in Dar es Salaam in 2016, which explored how insurance industry risk management and risk transfer expertise could support city authorities to make more informed decisions in public infrastructure.

A brief from the Asian Development Bank by Chatterjee and Orz (2017) deals with agriculture insurance for climate hazards. National contingency funds, financed by the state budget, have traditionally played a significant role in offering financial compensation to affected populations. This study describes how agriculture insurance mechanisms can better ease recovery processes by removing uncertainty in payment and eligibility requirements (relative to compensation through contingency funds), by relieving pressure on the public budget and – where based on risk-based pricing – by incentivising risk-mitigating behaviour. The effectiveness of insurance frameworks is determined by the policy framework, regulatory environment, risk management system in use, budgetary constraints, exposure, vulnerability and creditability of the institutional arrangements.

An ActionAid report (Reeves, 2017) warns that a G7-backed African Risk Capacity (ARC) drought insurance policy failed Malawi, and particularly Malawian women, in the face of drought in 2016. The report claims that the insurance failed to deliver on its promise of timely assistance to 6.7 million food-insecure Malawians due to problems with the model, data and process used to determine a pay-out. The eventual settlement was made in January 2017, though the declaration of a national emergency occurred in April 2016, and was said to be too little, too late, leaving the government to pursue conventional funding for drought response. The report indicates that Malawian policy-makers involved in climate risk management would now instead prioritise 'no regrets' adaptation and resilience building options that have been proved to be effective, such as improved social protection, more climate-resilient agriculture and irrigation systems, and enhancing the network of weather stations. The study recommends that the G7 and others promoting climate risk insurance consider its equity, effectiveness and indications that it may be exacerbating inequality. It also calls on governments and development partners to place greater emphasis on development of cooperatives, backed by

adaptive, scalable social protection systems and a global mechanism for early crisis response, as an alternative model.

A brief from the New Climate Economy's Climate Policy Initiative compiles lessons from public finance interventions that aim to boost low-carbon, climate-resilient investment, especially in developing countries (NCE, 2017). It outlines key gaps that public policies and resources can address to help scale up private sector investment. These include risk gaps, such as retroactive regulatory change, viability gaps such as inadequate access to finance, and knowledge and awareness gaps. It shares insights about public approaches to leveraging private investment, and effective policy design and tools. It also identifies opportunities for governments to take effective action to improve regulation, enabling environments, and incentives for subnational governments and private investors. For example, the report recommends taxing production areas rather than production volumes or profits to encourage the adoption of new methods and more sustainable and efficient agriculture. Finally, it looks at the next phase of green financing, including new public-private partnerships through initiatives such as the Global Innovation Lab for Climate Finance and the India Innovation Lab for Green Finance.

Two publications discuss the role of financial services and products in resilience building in rural areas. Firstly, an issue of Resilience Intel from the Building Resilience and Adaptation to Climate Extremes and Disasters project (BRACED) reports how in Niger support mechanisms, such as access to adequate financial services, are important for communities to better prepare for and cope with climate extremes, and how village savings and loan associations (VSLAs) support rural communities to address livelihood shocks and strengthen social capital (Diallo et al., 2017). Two innovative research methods – financial diaries and serious games – have revealed VSLA's contribution to climate resilience. These methods show that VSLAs produce behavioural changes that can contribute to resilience building, particularly relating to gender empowerment, social trust and natural resource management.

Secondly, the Asian Development Bank (2017) study examines risk financing for rural communities to support climate resilience in the Greater Mekong Subregion. The analysis concludes that effective climate risk financing, through a combination of risk retention, risk sharing and risk transfer mechanisms, could significantly improve climate resilience among rural communities in the region. It promotes, for example, the establishment of community disaster funds to pool resources to serve as a communal reserve fund, matching grants to incentivise household saving and community disaster funds. It also proposes support to rural financing literacy programmes and

the facilitation of institutional arrangements for cross-community risk sharing.

Mercy Corps (Toth and Hoy, 2017) presents key findings and recommendations on the use of financial products in mitigating disaster risk, based on a survey of 600 households in Indonesia. The study found that financial services are readily used by households to support recovery; that existing access to financial services may not translate to use of savings and financial services for disaster risk mitigation; that expected losses from disasters are more pronounced for business income than wages, and for households with lower job and asset security; that there is little demand for commitment savings and insurance products for risk reduction, in contrast to high demand for flexible savings accounts; and access to disaster-related financial services can have net psychological and behavioural benefits for investment.

3.2. Resilience in humanitarian contexts

The grey literature on *resilience in humanitarian contexts* suggests:

- There is a need to better integrate longer-term goals for resilience building within disaster response and humanitarian interventions, including longer intervention timeframes and enabling the community to co-run the response alongside humanitarian agencies.
- Humanitarian agencies and municipal authorities must work more closely together to better support people displaced to cities.
- Livelihood support and protection for long-term displaced people should be incorporated into urban humanitarian response.

Four publications address the need for better integration of longer-term resilience building within disaster response and humanitarian contexts. Two of these, published by the International Institute for Environment and Development (IIED), focus on urban areas, and therefore there is overlap with the theme below on urban resilience. The fourth, from the World Bank, examines its own response and resilience building efforts, with some consideration of the overlap.

Christian Aid (Murphy et al., 2017) presents research on perceptions of first responders and crises survivors on how to strengthen humanitarian response for long-term community resilience building. There are six core recommended principles to achieve this aim:

- Allow and enable the community to co-run the response
- Where feasible, coordinate interventions and work with the government

- Support community cohesion and establish effective two-way communication between crises survivors and implementing organisations
- Address underlying causes of vulnerability
- Recognise psychosocial support
- Livelihoods and savings.

In addition, the research highlighted the need for longer intervention timeframes for resilience building following humanitarian response, and for government and development programmes to work together to improve infrastructure (particularly roads) to access vulnerable and exposed communities and enable communities to be able to evacuate quickly and safely when risk exceeds capacity to adapt.

Two IIED publications recognise the importance of collaboration between humanitarian agencies and municipal authorities. Urban areas are now home to two thirds of the world's refugees and internally displaced people, and cities (rather than rural camps) are now at the forefront of humanitarian response. Based on a global review and experience of serving Syrian refugees in Lebanon and Jordan, a guidance note (Bermudez, 2017) provides 10 core principles to integrate livelihood support and protection for long-term displaced people in urban humanitarian response. The principles include mainstreaming protection concepts within livelihoods interventions, developing a complaints and feedback mechanism, promoting social cohesion through inclusive livelihoods development and transitioning from acute humanitarian crisis to long-term resilience.

An IIED working paper (Parker, 2017) documents learning from UN-Habitat's experience of providing urban planning support to three local government units after super Typhoon Haiyan/Yolanda in the Philippines. Organisations providing such support should have prior experience working with, and contacts within, local and national government agencies, and hire national staff with urban planning experience to lead work at city level (ideally placing them in the planning department). Lessons for organisations working with local governments include defining the intended outcomes and impact, and degree of participation of stakeholders, from the outset, informed by assessment of their capacity to participate; and avoiding a default to resettlement. Humanitarian donors should provide longer-term (three years or more) funding to support urban planning processes to build resilience after humanitarian crises.

While not limited to humanitarian response, a study by the Independent Evaluation Group of the World Bank (Independent Evaluation Group, 2017) examines evaluations of its own response to shocks and efforts to build resilience. It considers a broad range of shocks, including food crises, the global financial crisis, natural

disasters, climate change and pandemics. The World Bank Group has built resilience into its analytic work and lending operations in most sectors, and has been most effective when it has had steady engagement through lending, analytic and advisory work for a sustained period. It has also had an important role in developing innovative insurance instruments for disasters and climate shocks. However, countries' monitoring mechanisms, and capacity to prepare for and respond to shocks, need strengthening; disbursement of loans and implementation of instruments developed by the International Finance Corporation have been slow; and internal coordination needs to be stronger to promote better knowledge sharing.

3.3. Urban resilience

Grey literature on *urban resilience* suggests:

- Mass migration is an urban phenomenon with long-term opportunities for growing cities.
- To catalyse city climate action on climate resilience, actors should prioritise 'no regrets' strategies that help to alleviate current problems regardless of climate futures.
- There is a need to step up risk-based land use planning to reduce the underlying causes of flooding across all stages of the flood risk management cycle.

Urban resilience was a major theme in this quarter, with seven publications. These deal with migration to cities, lessons from the Asian Climate Change Resilience Network and urban flood management. There is considerable overlap here with the previous section on resilience in humanitarian contexts.

A study from UN-Habitat (2017) explores trends in urban resilience, particularly charting those that have driven resilience theory, how resilience has been incorporated into development agendas, mapping the actors involved, and how this can be translated into forward-looking urban policies and practices. Cities and their partners need to adopt a forward-looking, positive vision that fosters resilience in a comprehensive manner, integrating investments across interconnecting sectors and with the inclusion and effective coordination of multiple stakeholders. The uptake of urban resilience in the overarching UN 2030 Agenda for Sustainable Development consolidates the shared understanding that resilient cities must move beyond disaster risk reduction (DRR), emergency planning or climate change adaptation to encompass sustainable patterns of urban development.

Acknowledging the vast scale of migration to cities – whether driven by displacement or opportunity – a 100 Resilient Cities report presents migration as an urban phenomenon with long-term opportunities for growing

cities (100 RC, 2017). Most migrants now move to and remain in cities. While acknowledging that mass migration poses risks to fragile urban systems – to health, security, social cohesion and other aspects – the report views mass migration as a new reality to be embraced rather than resisted. The report presents aspirations for municipal governments and resilience officers on urban migration, each accompanied by strategic approaches that include: establishing a city-level office dedicated to integrating newcomers; improving access to financial services and supporting income generating opportunities for migrants and other vulnerable groups; strengthening bonds between new and existing populations; and active campaigning to receive policy and funding support for managing migrant integration.

Three reports published in this quarter explore lessons from the Asian Cities Climate Change Resilience Network (ACCCRN). An ISET-International working paper (Nguyen et al., 2017) highlights gaps, challenges and recommendations for better urban DRR and climate change adaptation planning in Vietnam. ACCCRN has aimed to balance the former rural bias of DRR and to catalyse city-level actors to assess climate stresses and vulnerabilities themselves, rather than commissioning external experts or national agencies to prepare such plans. Experience suggests the need to focus on existing challenges and vulnerabilities that could be exacerbated by climate change. This means prioritising ‘no regrets’ strategies that yield benefits for current problems and regardless of climate futures, such as improved drainage or service delivery. At the same time, ‘business as usual’

activities can be redirected away from sensitive areas or sectors and awareness-raising actions can generate broad support for resilience actions.

A second ISET-International publication (Tyler, 2017) explores the role of climate change coordination offices (CCCOs) in Vietnam, which were set up with ACCCRN funding and technical support to build resilience. The collaborative and interactive approach of CCCOs has successfully contributed to awareness-raising, capacity-building, mobilising and managing data, planning and project development. However, there have been challenges for sustaining and replicating this kind of structure, including integration within the Vietnamese government system, difficulty in gaining legitimacy without official recognition by the Ministry of Home Affairs, perceptions that they were only ‘projects’ rather than opportunities for learning and integration into the existing system, and participants’ unfamiliarity with the approach.

Another IIED working paper (Archer et al., 2017) presents lessons on the future of city climate resilience strategies based on experiences in 15 cities associated with the ACCCRN programme across India, Bangladesh, Indonesia and the Philippines. The report highlights three priority areas: ‘engagement and inclusion’, ‘achieving scale’ and ‘embeddedness and transformation’. For scaling up action, a clustering approach fostering collaboration between local governments with shared cross-border issues (such as watershed management) has been shown to be effective, particularly where a large city is surrounded by smaller municipalities, and cities can act as role models for nearby cities. Bringing in regional or state actors, and



Pedestrian waits to cross. Photo credit: Simone D. McCourtie/World Bank, 2009. CC BY-ND 2.0.

networks such as the Compact of Mayors, the Municipal Association of Bangladesh or the (Indonesian) Association of City Governments, can help to facilitate experience sharing. Incentives to act on resilience can be created by integrating climate change into national awards, such as Indonesia's Clean City Award. There is also considerable demand from cities and subnational governments to access climate finance to scale up action.

Mass migration is an urban phenomenon with long-term opportunities for growing cities

A report from the World Bank's Urban Floods Community of Practice (UFCOP) focuses on urban flood management (World Bank, 2017a). It calls for risk-based land use planning to reduce the underlying causes of flooding across all stages of the flood risk management cycle, including reducing water runoff, designating routes and open spaces for response efforts, accommodating urban expansion in flood-safe areas and minimising development in flood-prone zones. This must balance competing needs, maximising net benefits from waterfront activities and ecosystem services while ensuring minimum loss of life and property, including the integration of 'grey' hard-engineered infrastructure with 'green' infrastructure to create a balanced urban water ecosystem. While traditional regulatory instruments for land use planning (such as zoning and building codes) have struggled with compliance, recent city experiments with economic instruments (such as land-based financing and performance incentives) have shown some success, and a combination of tools should be used for effective implementation.

After deadly floods in Accra in 2015 highlighted the threat to the economy, key sectors and lives, a study from the World Bank Group's Global Practice on Social, Urban, Rural and Resilience (World Bank, 2017c) provided a detailed, forward-looking strategy to inform policy and budget decisions to foster a thriving, inclusive and more resilient Greater Accra Metropolitan Area. It highlights challenges such as implementation bottlenecks, the planning lag compared to the rate of urbanisation and the lack of long-term, proactive planning, and recommends improved metropolitan planning and coordination, integrated urban flood and coastal zone management, and a focus on vulnerable communities and settlements, among other measures to enhance resilience.

3.4. Agriculture, pastoralism and food security

Grey literature on *agriculture, pastoralism and food security* suggests that:

- There are equity and gender concerns with climate-smart agriculture (CSA) that should be confronted and addressed.
- Women-led income generating activities, such as market gardening, have the potential to transform gender relations.
- In Nepal, there is a need to focus on enhancing resilience of small and medium-sized irrigation systems, upon which many Nepalese people rely.

Another major theme was agriculture, pastoralism and food security, with eight publications. The issues addressed include climate-resilient seed varieties, farmers' use of climate information, gender concerns in pastoral communities and national-level agriculture and irrigation policy in Nepal.

Integrated Seed Sector Development in Africa (ISSD Africa) presents findings from research in Rwanda, Uganda, Zimbabwe and Zambia on climate change impacts on local food crops and potential climate-resilient seed varieties (Halewood et al., 2017). While the suitability of materials in national genebank collections is expected to decline due to climate change, material in foreign genebanks may be adapted to future climatic conditions of the four countries. Farmers have identified some better adapted varieties being grown locally, though they are not available for wider use due to poor seed quality, seed laws that criminalise their sale or exchange, and subsidies for alternative materials promoted by companies and national programmes. Efforts are needed to connect private companies and farmers to increase their participation in systems for providing and receiving seed and genetic resources, and to integrate formal and informal genetic resource management systems. Implementation of relevant international treaties and national/regional seed laws should be mutually supportive and subregional, given that agro-ecosystems span international borders.

Two briefs from the BRACED project discuss the use of climate information in resilience building. In the Sahel, farmers have innovated for centuries, as part of dynamic, informal processes of learning and responding to change (Grist and Harvey, 2017). This June 2017 issue of BRACED's Resilience Intel papers examines innovative approaches that have been adopted in the region to build resilience to current and future climate risks. It documents, for example, approaches such as integrating climate information into local language radio, training leaders to spread local savings groups and community

networks privately, and through interactive and more fully participatory processes.

Recognising the importance of pastoralists' access to user-tailored climate information services in making informed decisions regarding their livelihoods, a Mercy Corps research brief (Mercy Corps, 2017) summarises existing research regarding climate information and pastoral communities, assesses the scope of users' information needs and usage, and determines the effectiveness of information dissemination services. Most smallholder farmers rarely receive and use climate information, in part due to a lack of finance, human resources and infrastructure to facilitate timely delivery of information, while factors such as political influences, unequal power distribution and ethnicity plays a role in determining access to climate information. Women's lower literacy levels have also restricted access to this technology.

Two papers address equity and gender concerns in agricultural and pastoral communities. A Climate Change, Agriculture and Food Security (CCAFS) working paper from the Consultative Group on International Agricultural Research (CGIAR) Research Program on Climate Change, Agriculture and Food Security (Karlsson et al., 2017) focuses on the poorly addressed issue of the equity implications of CSA. It identifies three principle issues: CSA can transfer the burden of responsibility for climate change mitigation to marginalised producers and resource managers; the CSA discourse generally fails to confront entrenched power relations that can constrain the emergence of more pro-poor forms of agricultural development, adaptation to climate change or carbon sequestration, or the political nature of transformations needed to address climate change challenges; and there is a need for more attention to the institutions that underpin the bargaining power of the poorest and most vulnerable groups.

In a synthesis of the approaches of local NGOs, Zaman Lebidi and CGIAR to addressing gender issues and related social norms as a resilience building strategy, a BRACED learning paper (Crowley et al., 2017) draws on community resilience plans in rural Burkina Faso and Ethiopia. The authors found that age, education and status play a crucial role alongside gender in power dynamics; there is an uneven distribution of tasks, with women's share of labour being significantly greater; women have less access to income generating and social activities, such as selling goods in the marketplace; and women have less decision-making power within the household, among other findings. The resulting Action Plan outlines entry points for a more 'gender transformative' approach in project activities, such as promoting women-led income generating activities, like market gardening, and outlines recommendations for strengthening the gender component within the BRACED programme.

Weingärtner et al. (2017) explore how self-help groups (SHGs) can contribute to building resilience and enhancing food security in protracted crises such as the 2015–2017 drought event in Ethiopia. The research finds that SHGs:

- Can act as grassroots social protection: as members receive assistance from people with the same socioeconomic background and shared livelihood risks in a way that formal microfinance institutions do not, though they cannot provide comprehensive social protection
- Can empower female members financially, socially and politically, but do not completely restructure gender-based power relationships within households or the wider community
- Have supported livelihood diversification and preparedness for shocks
- Had little impact on people's exposure to climate risks
- Have promoted sustainable agricultural practices, among other findings.

Two related reports address aspects of climate-resilient agriculture in Nepal. Most Nepalese people remain dependent upon climate-sensitive agriculture and are under increasing pressures due to extended periods of drought, elevated temperatures and unseasonably heavy rain during winter. A Climate and Development Knowledge Network (CDKN) policy brief (Pradhan et al., 2017) is based on research by Mott MacDonald, the Farmer Managed Irrigation System Promotion Trust (FMIST) and other partners with the Nepal Department of Irrigation produces recommendations to improve the effectiveness and resilience of Nepal's small and medium-scale irrigation systems (MacDonald, 2017). Land use change, upstream water consumption, resource mining and climatic changes are highlighted as key factors contributing to increased flooding and changes in seasonal water variability. Smaller basins, upon which most irrigation in Nepal is dependent, are more sensitive to change. Options for strengthening climate resilience in the irrigation sector include monitoring of river flow, more reliable forecasting for floods and low-flow, and the promotion of a value chain approach to agricultural development, linking producers to markets and addressing constraints at all levels.

A CCAFS policy brief from the CGIAR Research Program on Climate Change, Agriculture and Food Security describes some findings of action research for the Ministry of Agriculture in Nepal to scale up CSA in the country (Poudel et al., 2017). The project identified a 'pool' of CSA technologies, practices and services for effective scale-up of CSA, prioritised with a range of stakeholder groups and evaluated in practice. These technologies range from simple adjustments in crop management practices (such as changes in sowing time) to

transformations of agricultural production systems (such as changing cropping systems and land use). The ‘pool’ includes water, weather, nutrient, carbon and energy, and knowledge-smart activities. The brief looks at options for scaling up and recommends that CSA be systematically integrated into local development plans, the NAP, the Nationally Determined Contribution (NDC) and five-year development plan.

3.5. Climate and disaster resilience policy

Grey literature on *climate and disaster resilience policy* suggests:

- Regional partnerships offer a promising strategy for strengthening infrastructure.
- There is a critical need for national DRR strategies to be in place before 2020 to deliver on the targets of the Sendai Framework for Disaster Risk Reduction (SFDRR).
- Flood risk management at river basin scale should be promoted more widely.

Finally, four reports deal with aspects of climate and DRR policy and decision-making. These diverse publications address national disaster strategies based on experience from the Hyogo Framework for Action (HFA), trade-offs in DRR decision-making, and basin scale flood risk management policy.

A briefing note from the UN Anticipate, Absorb, Reshape (A2R) Climate Resilience Initiative (Väänänen et al., 2017) outlines the current state of play for three capacities for climate resilience based on baseline analysis of data from 114 countries. Specifically, it looks at capacities to anticipate and act on climate hazards and stresses through early warning and early action; to absorb shocks by increasing access to climate risk insurance and social protection systems; and to reshape development pathways by transforming economies to reduce risks and root causes of vulnerabilities and support the sound management of physical infrastructure and ecosystems. Despite data gaps, preliminary findings indicate that social protection programmes are starting to consider climate risks, that climate-resilient development pathways are increasingly being integrated into national budgets and planning documents (though implementation is inconsistent), and that regional partnerships offer a promising strategy for strengthening infrastructure.

An Overseas Development Institute report (Wilkinson et al., 2017) aims to help national and subnational governments, and donors, better understand the pace of change required to deliver on the seven global targets of the SFDRR by 2030. It identifies the critical need for a national DRR strategy to be in place well before 2020.

It presents analysis of HFA reports for nine case study countries and showcases developments in disaster-related losses made in different groups of countries. It sets out recommendations to make significant progress towards SFDRR targets. These include prioritising initiatives that are catalytic and accelerate change, the clear benefits presented by sustained civil society engagement in DRR, and harnessing specialist skills from regional bodies and line ministries as a means of overcoming some of the constraints of small budgets and geography.

A brief from SEI (Tuhkanen et al., 2017) recognises and addresses five key trade-off areas in decision-making with regard to development and DRR: power, equity, temporal, risk and aggregation trade-offs. It highlights opportunities to transform the relationship between development and DRR to build resilience. These trade-offs intersect. For example, the power trade-off arises in decisions about who is involved in planning the rebuilding process: is the process top-down or bottom-up? How much of a say do stakeholders have, and who is included? The temporal trade-off is particularly prominent in post-disaster response and recovery situations. People often want quick solutions, but it can take time to plan and implement a strategy to ensure long-term resilience, and while participatory processes have proven benefits they take longer than top-down decisions.

Finally, a further publication from the World Bank's UFCOP (World Bank, 2017b) promotes adoption of a proactive approach to flood risk management at river basin scale. Recognising increasing interest in integrated flood risk management at river basin level in developing countries, following in the footsteps of developed countries, this knowledge note offers guidance to decision-makers tasked with considering flood management options. Large infrastructure investments are being built to mitigate flood disaster risk, but ongoing changes in land use and land management continue to drive up exposure and vulnerability. For example, these include replacement of forests with agricultural fields, conversion of natural land cover to impervious surfaces in urban areas, and construction of urban drainage systems which can increase flood risk downstream. It describes the role of flood risk mapping in decision-making, provides guidance on flood risk assessment methodologies, and explores the comparative advantages of structural and non-structural measures in managing flood risk. The key messages are that absolute flood protection in flood-prone areas is not possible or desirable, and some calculated acceptance of ‘living with floods’ is necessary; flood risk management investments, particularly non-structural measures, provide an attractive economic rate of return; and flood risk management interventions may have a significant impact on flood risk outside the areas in which they are implemented.

4. Review of resilience in the academic literature

This section summarises academic literature on resilience from the second quarter of 2017. It covers a total of 32 publications across five thematic areas: community resilience; concepts, indicators and measurements; policy, planning and governance for building resilience; urban resilience and infrastructure; and livelihoods and food security.

4.1. Community resilience

Academic literature on *community resilience* suggests:

- Community-led activities to strengthen resilience are often a better fit than programmes led by external organisations.
- With insufficient recognition of local views, contexts and cultures, Western approaches to technical interventions following disasters can reproduce or undermine pre-existing local power relations and power structures.
- Social networks are dynamic and evolve throughout a disaster event, during immediate response, relief and rehabilitation. Search and rescue is mostly provided from within the community in the early phases after a disaster event, while key actors can change in later stages towards external facilitation of information and support.
- Dynamic local institutions and technologies to support resilience can emerge through new forms of conflict and cooperation related to water insecurity.

The way in which communities respond to weather-related shocks and stresses represented a key concern in the academic literature this quarter. Drawing on existing studies, Alam (2017) reviews climate change impacts and adaptation strategies of coastal communities in Bangladesh. The author finds a range of detrimental effects on livelihoods, migration and health. These effects include death or malnutrition, forced migration and a decrease in crop variety and production. Communities have responded and adapted in a range of different ways, including diversification of agriculture and off-farm activities, modifications to housing, and household strategies to

prevent weather-related diseases. Local strategies or community-led activities to strengthen resilience are often a better fit than external programmes, Alam concludes. However, they also face significant limitations; migration away from coastal areas, for instance, can expose people to new risks.

This conclusion also resonates in other contexts. After super Typhoon Haiyan/Yolanda struck the Philippines in 2013, the international humanitarian system responded promptly, providing fast and expansive support to affected populations. However, Field (2017) finds a disconnection in the understanding of what constitutes an ‘effective’ intervention between local communities and the international humanitarian system. Some of the key challenges, the author points out, are related to Western approaches to technical interventions that often disregard the pre-existing local relations and power structures that they themselves may then reproduce or undermine. In addition, social cohesion and community-based activities or local mechanisms for coping, prosperity and survival can potentially be overlooked. Based on this analysis, Field challenges established understandings of relevance and appropriateness in post-disaster response and calls for greater recognition of local views, contexts and cultures to better understand vulnerabilities and needs.

Sea-level rise represents a major challenge to coastal communities around the world. Ali and Syfullah (2017) study the perceived severity and impact of sea-level rise on beel (lake/marsh) communities that are enclosed by ‘polders’ in south-west Bangladesh. They consider two scenarios: one of 30.5 cm permanent inundation and one of 61 cm permanent inundation. For the 30.5 cm scenario, local populations expect a decrease in their livelihood resilience, but also express confidence in their ability to cope with the situation by using local adaptation techniques and enhancing the maintenance of sluice gates. Permanent inundation of 61 cm, however, is perceived as beyond local adaptive capacity, forcing migration to nearby towns in search of new economic activities.

Ciullo et al. (2017) model flood risk dynamics in two different socio-hydrological systems. They consider green systems in Bangladesh, where risk is only addressed through non-structural measures, alongside technological

systems employing structural measures in the city of Rome. The approach assesses dynamics in community resilience and flood risks across the two sites. Results imply that technological systems show significantly lower levels of flood risk, but are also more vulnerable to catastrophic events, resulting in much higher losses. Overall, Ciullo et al. conclude that green systems, while not necessarily efficient in an economic sense, can withstand social and environmental changes to a greater extent, and are therefore more resilient than technological systems.

Similarly, Narain and Singh (2017) combine social and technical lenses in their assessment of water insecurity in Gurgaon in India. The authors explore the mixed impacts of two canals – one for urban water provision and one to transport wastewater out of the city – on the villages through which they pass. They analyse the strategies these peri-urban communities use to grapple with exclusion from the water supply. The authors show that dynamic local institutions and technologies have emerged along the canals through new forms of conflict and cooperation as a response to changes linked with the waterflows in the canals. Water hand-pumps are an example; while not allowed to extract canal water, peri-urban communities have installed pumps along the canals to profit from higher water tables. Such mechanisms, Narain and Singh conclude, support the mediation of water insecurity for enhanced community resilience.

Misra et al. (2017) use Social Network Analysis (SNA) to assess communities' capacity to cope with disasters based on the effectiveness and strength of their social networks in cyclone-affected communities in West Bengal. The authors show how these networks evolve pre-disaster, during disaster events, and during immediate response, relief and rehabilitation. Their research implies that search and rescue were mostly provided from within the community in the early phases after the studied cyclone event, while key actors changed in later stages reflecting external facilitation of information and support. Misra et al. conclude that SNA can support a better understanding of local community networks and culture, which is important for strengthening community resilience.

4.2. Conceptual approaches, indicators and measurements

Academic literature on *conceptual approaches, indicators and measurements* suggests:

- A holistic approach – that integrates components of risk, governance, society, the built environment and the natural environment – is needed to better understand and support community resilience.
- The lack of conceptual awareness around resilience and vulnerability in existing water, sanitation and

hygiene (WASH) literature requires more stakeholder engagement and a greater combination of the different approaches to support WASH services in the context of climate change.

- Resilience may not always be desirable for a system, because it can present a barrier to innovation.

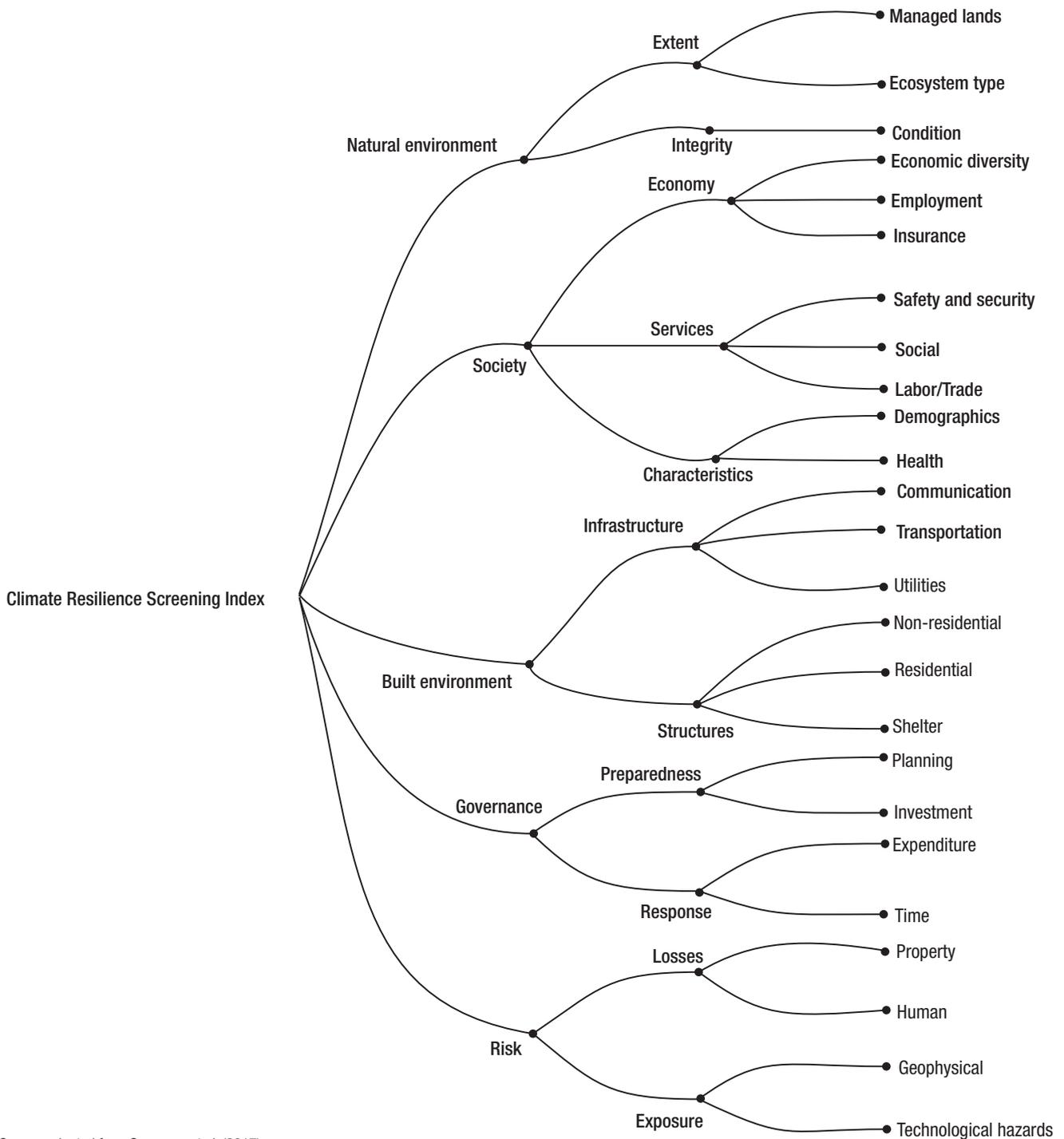
Resilience indices represent an area of focus in the current academic literature. Summers et al. (2017), for instance, suggest a framework for a new index to assess the resilience of communities to extreme weather events and climate change. Their work is based on the premise that a more holistic approach – integrating components of risk, governance, society, the built environment and the natural environment – is needed to better understand and support community resilience (Figure 2). The climate resilience screening index (CRSI) aims to facilitate comparison across different locations and to help identify good practices.

Similarly, Zhang and Huang (2017) present a resilience index that integrates considerations of risk and vulnerability, but places less emphasis on the natural environment as compared to the CRSI. The authors also draw on a narrower understanding of resilience – defined as the degree to which disaster-related economic and human losses can be prevented. Application of the index implies that resilience, on average, is lowest in Asia and highest in South America and Oceania. Overall, resilience is increasing in developing countries, according to the study. Using a sensitivity analysis, the authors conclude that gross domestic product, population density and disaster frequency most strongly determine a country's resilience.

Kohlitz et al. (2017) review 33 published scholarly papers concerning climate change effects on the access to WASH services. The authors find few conceptualisations and definitions, despite the frequent use of resilience and vulnerability language in the literature. While most studies focused, at least implicitly, on outcome vulnerability, scholars have placed considerably less emphasis on contextual vulnerability and resilience (Table 3). Kohlitz et al. regard the lack of conceptual awareness in this literature as a cause for concern, and they advocate more stakeholder engagement and greater consideration of different approaches to support WASH services in the context of climate change.

Mishra et al. (2017) assess factors that may be necessary or sufficient conditions for achieving more resilient outcomes in disaster recovery. Based on a study of 30 Nepalese communities affected in varying degrees of intensity by the 2015 earthquakes, the authors arrive at a typology of resilient recovery outcomes (see Table 4). The authors apply this typology to different recovery dimensions: social, economic, psychological and infrastructure. Results highlight that better or earlier

Figure 2: Suggested structure for the Climate Resilience Screening Index



Source: adapted from Summers et al. (2017).

recovery cannot be traced back to a single factor. Instead, it is their combination and their adjustment to the specific context of a community that support more resilient outcomes.

Building on the relationship between vulnerability and resilience in human and physical geography, Baird et al. (2017) argue that resilience may not always be desirable for a system, because it can present a barrier to innovation. The authors present a disturbance innovation hypothesis,

which suggests that ‘low and high levels of disturbance can yield substantive benefits while moderate levels may only preserve the status quo and undermine innovation’ (Baird et al., 2017; 205). This implies that promoting disturbance, depending on the context, can result in more uncertainty than trying to reduce it – more disruption does not always yield better outcomes (Figure 3).

Finally, Cumming et al. (2017) explore developments in the field of spatial resilience as an entry point to better

Table 3: Features of outcome vulnerability, contextual vulnerability and resilience

Features	Outcome vulnerability	Contextual vulnerability	Resilience
Key concepts	Exposure, sensitivity, hazards	Adaptive capacity, equality	Thresholds, self-organisation, linked domains and scales
Primary systems of interest	Physical	Social	Ecological, social-ecological
Timeframe of focus	Near future (as far as models will allow)	Present	Long-term future
Common analytical objectives	Identify hazards and consider likelihood and severity of their impacts	Understand who is least and most likely to cope with changes in environment and why	Understand interactions within and between systems and what causes systems to shift to a new equilibrium
Commonly recommended adaptation options	Implementing technologies, climate-proofing infrastructure, improving management of technology	Reducing inequalities, empowering people to cope with external stresses in general, poverty alleviation	Optimising or managing resilience properties, developing resilient governance structures and processes

Source: adapted from Kohlitz et al., (2017).

understand social-ecological systems which operate across multiple temporal and spatial scales. They focus on coral reefs and the communities depending on them as an example of such systems, concluding that spatial heterogeneity and connectivity, including interactions and mobility across socioeconomic and ecological networks, are crucial to resilience in social-ecological systems.

4.3. Policy, planning and governance for building resilience

Academic literature on policy, planning and governance for building resilience suggests:

- Web-based technology and open data can support post-disaster recovery, reconstruction and longer-term planning decisions.
- Transparency and inclusion in decision-making across different stages of a dam construction process are crucial to the achievement of better social and environmental resilience outcomes.
- Microfinance and increased financial inclusion can result in greater mobilisation of resources for the support of climate change programmes.

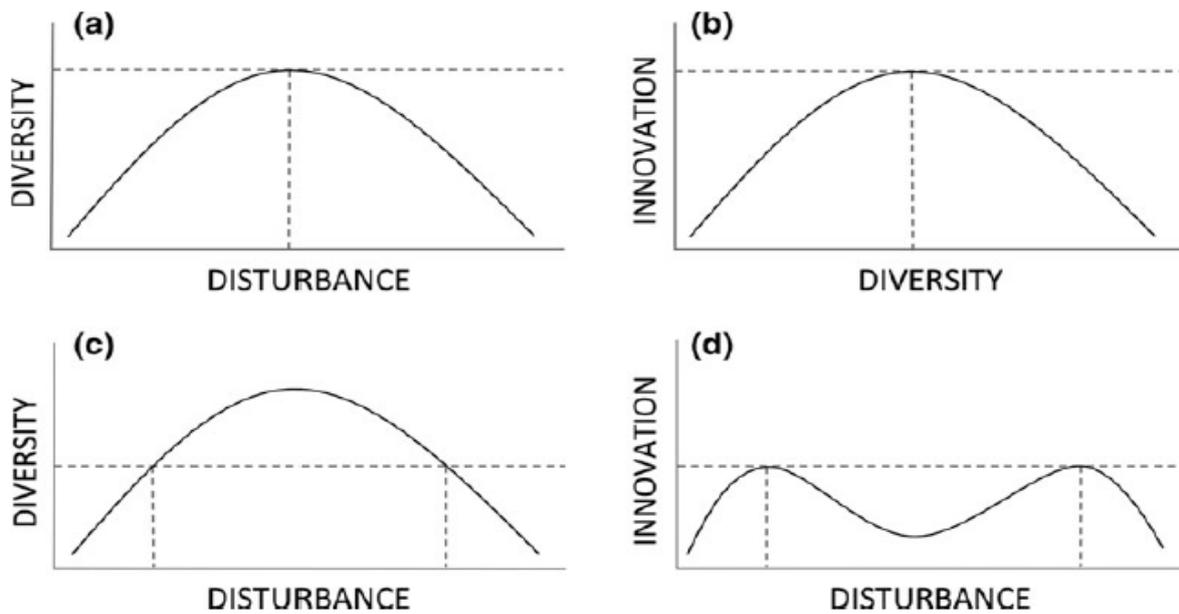
Post-disaster recovery and reconstruction provide a critical opportunity for integrating spatial planning and ‘building back better’, but post-disaster contexts are challenging, so this often fails to occur. Mejri et al. (2017) present an innovative way of using new web-based technology and open data to support this process. The authors apply their approach to the example of Typhoon Haiyan impacts and recovery in the city of Tacloban in the Philippines. Recent disaster events, including Haiyan,

have spurred increased public participation in collecting information and, as a result, greater availability of openly accessible data and maps. Classifying and mining this data can result in a rich supply of information to support reconstruction and planning decisions, for instance around identifying damages and vulnerable areas. Three crucial and challenging steps are part of applying the strategy: understanding recovery and reconstruction activities and identifying critical entry points for strengthening resilience; gathering, sorting and structuring vast and diverse data; and providing sensible maps and information that are useful to spatial planners.

Three of the academic studies in this quarter’s Resilience Scan focus on the contributions of social networks, education and healthcare to resilience. Social networks can play an important role in response and recovery (Misra et al., 2017), but they are not always sufficiently considered in government policies. Islam and Walkerden (2017) argue that this is the case for climate change and disaster management policies in Bangladesh. While policies emphasise larger scale linking networks, for instance between governments or with international donors, local bonding (meaning within households and immediate family), bridging (including relationships with friends and neighbours) and linking relationships (for instance with community organisations, local governments and NGOs) are mostly neglected. Government policy-makers, according to the authors, should give greater consideration to input from local communities in order to better capture and leverage social capital for recovery and resilience.

Education on DRR is another potential contributor to enhanced resilience and reduced disaster losses. Amri et al. (2017) show that the implementation of education programmes on DRR can be challenging and that the

Figure 3: Innovation, diversity and disturbance



Source: adapted from Baird et al. (2017).

sustainability and mechanisms for scaling up these programmes require specific attention. The authors outline the integration of DRR in curricula and teacher training on preparedness and DRR education in Indonesia. As well as school personnel and NGO staff, the authors also capture the views and perceptions of students in a survey. Results suggest that children are generally aware of hazards, want to find out more about DRR and believe they know what to do in case of emergency. However, they still lack important DRR knowledge that would allow them to stay safe when disaster strikes.

The effectiveness of healthcare facilities for disaster response and recovery depends heavily on how prepared they are for natural hazards such as floods. Using a mixed methods approach, Farley et al. (2017) assessed the flood preparedness of healthcare facilities in Sri Lanka’s Eastern Province. Results show a 90% recognition of potential negative climate-related impacts on health among chief medical officers who participated in the study, but more than a third were not aware of climate change. The authors conclude that the disaster preparedness and resilience of the government healthcare system would benefit from increased communication on disaster preparedness, more widespread disaster preparedness plans, continuous training, strengthened human resources, enhanced medical equipment and more supplies.

Building on experiences with the Itezhi-Tezhi dam in Zambia and the Nam Theun 2 dam in Laos, Matthews and McCartney’s (2017) study draws attention to the importance of participatory decision-making processes and comprehensive impact studies and cost-benefit assessments before dam construction. This leads to a better

understanding of complexities, interrelationships and trade-offs related to social-ecological resilience. In both cases, the authors conclude that transparency and inclusion in decision-making across the different stages were lacking and would have been important to the achievement of better social and environmental outcomes.

Chirambo (2017) conducts a literature review and policy analysis to show how microfinance and increased financial inclusion can mobilise greater resources to support climate change programmes. The author suggests that microfinance can support both building climate resilience at community level and strengthening inclusive and sustainable development. It draws on the idea of a revolving credit fund that provides financing opportunities for a variety of non-commercial and commercial funders and channels loans towards inclusive businesses, as well as mitigation and adaptation activities.

Addressing international policy, Daugbjerg et al. (2017) argue that policy regimes are more resilient when they are based on a mixture of different paradigms (varied frameworks of underlying standards and ideas). They support this claim using the example of the World Trade Organization’s (WTO) Agreement on Agriculture (AoA), which granted an exceptional role to agriculture by exempting it from trade disciplines applying to other sectors under the General Agreement on Tariffs and Trade, as well as a later shift towards greater liberalisation. The authors show that the AoA has proved resilient, meaning it has been able to ‘endure, recur or adapt’ (Daugbjerg et al., 2017; 5), in that it managed to accommodate concerns around food security while also increasing food trade liberalisation, despite changes within the WTO’s power

Table 4: Typology of recovery outcomes

	Quality of recovery	
Time taken to recover	Early and better recovery (a resilient recovery outcome)	Early recovery but back to status quo (a partly resilient recovery outcome)
	Late but better recovery (a partly resilient recovery outcome)	Late recovery and back to status quo (a non-resilient recovery outcome)

Source: adapted from Mishra et al. (2017).

balance and other challenges such as the spikes in food prices in 2007/2008 and 2011.

4.4. Urban resilience and infrastructure

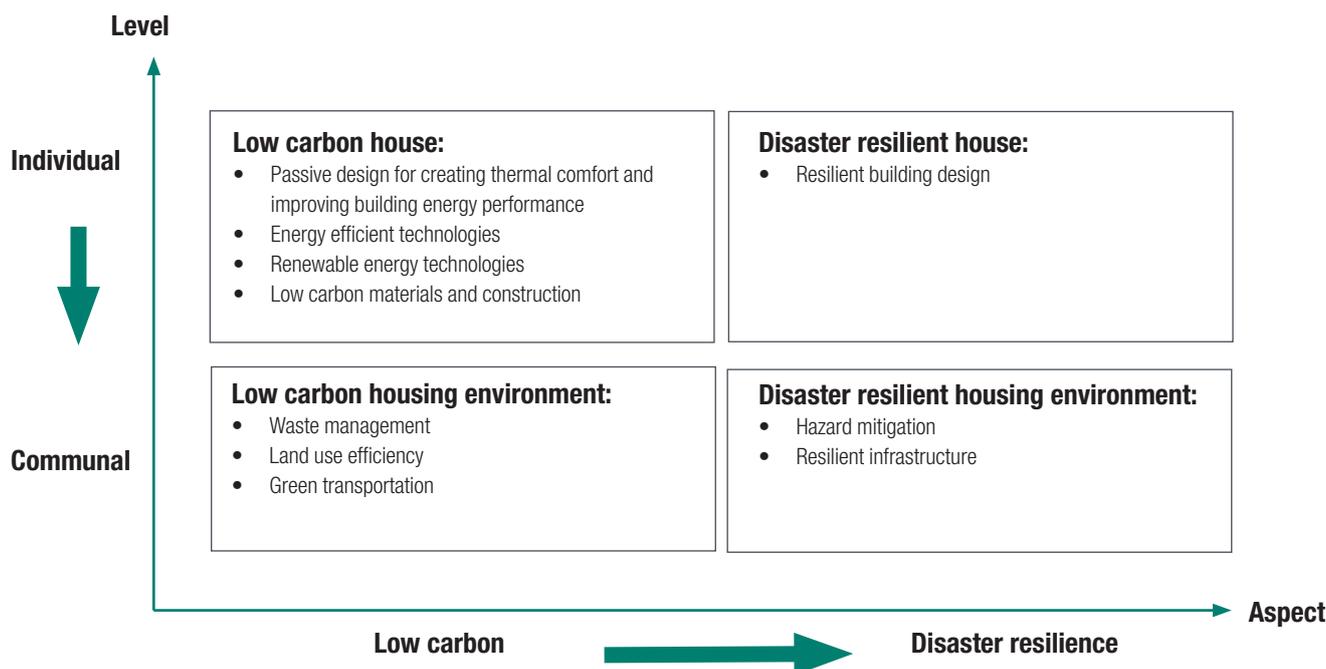
Academic literature on urban resilience and infrastructure suggests:

- Knowledge co-production can support sustainability and resilience in cities, but requires a transformation towards more inclusive, critical and reflexive governance and knowledge practices.
- Natural resources on which cities’ economies depend influence their levels of economic resilience: to strengthen resilience, economic transformation and diversification may be required.
- Most studies of infrastructure resilience focus on economics, governance and the infrastructure itself. Most are quantitative studies, using community and infrastructure as units of analysis.

As housing contributes substantially to CO₂ emissions, and urban areas are often exposed to a range of hazards (including floods), the integration of low-carbon approaches and disaster resilience in housing for the urban poor has presented a global challenge. Charoenkit and Kumar (2017) propose a conceptual framework (Figure 4) and a new tool to support this integration by assisting low-income populations in planning self-help housing. The tool allows residents to ‘assess the performance of their housing design, identify potential measures to create a low-carbon and disaster-resilient housing, and prioritise such actions’ (Charoenkit and Kumar, 2017; 695). In Thailand, the approach demonstrates its potential to support non-expert users being based on applicability, simplicity, soundness and reliability principles.

Echoing the attention paid to knowledge production in previous Resilience Scans, Muñoz-Erickson et al. (2017) use systems analysis to assess knowledge co-production processes for urban resilience and sustainability. Their framework examines the generation, validation,

Figure 4: Framework for disaster-resilient and low-carbon housing



Source: adapted from Charoenkit and Kumar (2017).

communication and application of knowledge. In addition, it helps to consider the implications of social relations, visions, values and power dynamics on these steps in knowledge co-production. The knowledge systems analysis framework therefore presents a way to assess the societal foundations underlying how cities know what they know. Co-production, the authors conclude, 'requires a fundamental transformation of both knowledge and governance towards more critical, inclusive and reflexive practices' (p. 216).

Smaller and medium-size cities are increasingly expected to contribute to building resilience, but they are also challenged by rapid urban growth and limitations in their adaptive capacity. Assessing the influence of different sectors and scales on the adaptive capacity of three smaller urban coastal settlements, Paterson et al. (2017) draw on an Adaptive Capacity Index (ACI) approach. Contrary to the social-ecological systems lens, the authors argue, the ACI pays closer attention to equity than efficiency. It consists of a quantitative index, qualitative policy review and a tool for interactive learning. The authors conclude that 'scale may be a primary factor in the assessment of equity in adaptive capacity' (Paterson et al., 2017; 117); all scales can contribute to reproducing inequalities in adaptive capacity, but non-local actors play a dominant role in this regard. Nevertheless, Paterson et al. also find that local actors have the potential to assert agency, though the effectiveness and extent to which this is done varies strongly between cities.

Tan et al. (2017) look at links between natural resource dependence and urban economic resilience. Focusing on Northeast China, they assess the economic resilience of 19 resource-based cities that are each highly reliant on metals, forests, coal, petroleum or a combination of the above. Their framework links resilience with persistence, adaptation and transformation concepts. In addition to assessing current resilience levels, the authors capture change after the 2003 introduction of the Northeast Revitalisation Strategy. They find that the strategy increased resilience most significantly in forestry-based cities, while petroleum-based cities benefited the least and, indeed, experienced a relative decline in resilience. The authors conclude that economic transformation and diversification are needed to strengthen the resilience of these cities, especially those that are coal- and petroleum-based.

Resilience has played an increasingly prominent role in the academic literature on infrastructure hazards. Opdyke et al. (2017) provide a review of developments and trends in this literature between 1990 and 2015. The authors consider the different dimensions of resilience studied in the literature, as well as the units of analysis, methods and geographic locations of the studies. The results show a concentration of studies of economic, infrastructure and

governance dimensions, considering mainly community and infrastructure as units of analysis. Most studies were based on quantitative methods and conducted in North America.

4.5. Livelihoods and food security

Academic literature on *livelihoods and food security* suggests:

- When confronted with a series of cumulative weather shocks, households tend to resort to increasingly unsustainable coping practices in subsequent events.
- Established tools for assessing vulnerability to food shocks can help to inform resilience assessments in urban areas, but require expansion beyond their focus on wealth and food security to relate to urban contexts.
- Adaptive capacities and resilience overall may constitute an important contributor to well-being, presenting for instance options for diversification and confidence to adapt to unexpected changes.
- One study finds that access to basic services such as health, water, education, markets and mobility is a more important contributor to resilience than household assets or age and gender of the household head.

Three academic studies this quarter focus on farmers' livelihoods and welfare or well-being in relation to resilience. Wineman et al. (2017) consider the impacts of weather extremes on household welfare, drawing on weather data in addition to a panel survey. The authors find that, in rural Kenya, drought periods are the most consistently detrimental shocks. People use a range of different strategies to prepare for and cope with such events. Next to income diversity and asset stocks, financial services, such as savings group membership and access to credit, appear to be important and to have a crucial role to play for strengthening resilience.

Inder et al. (2017) find that increasing the productivity of both land and labour is crucial to supporting child welfare in poor farming households in Kenya, Uganda and Tanzania. In contrast to most other academic studies this quarter, the authors do not conceptualise resilience as a distinct outcome or a means to an end, but rather consider it as one element of child welfare, next to food security and education. The study has a narrow measurement of resilience, focusing only on a household's capacity to provide for clothing, shoes and bed covers. Going forward, a broader range of resilience indicators could help to generate a more comprehensive picture of child welfare based on this approach.

Satumanatpan and Pollnac (2017) build on the premise of a close relationship between resilience and well-being. The authors assess the well-being of small-scale fishers in

Thailand through people's own perceptions across two dimensions – individual and environmental. They find that self-realisation in one's occupation, and the ability to cover basic needs from income, are the strongest determinants for environmental and individual well-being. In addition, having a range of different options – here meaning the capacity to adapt to unexpected changes – is crucial for individual well-being, which highlights the interdependencies between well-being and resilience.

Bacon et al. (2017) assess farmer vulnerability and how seasonal hunger is connected with their socioeconomic characteristics, coping strategies and organisational affiliation. They explore these questions through interdisciplinary research, integrating natural and social sciences, in Nicaragua. Results imply that whether a farming household has links to specific smallholder organisations does not correlate with the number of lean months in the household. Other strategies and characteristics, according to the study, have stronger implications for food security. Households with off-farm employment, larger farms, more fruit trees, higher coffee harvests, and those producing more than half of the food they consume, experience fewer lean months. Coping strategies also appear to be path dependent, meaning that households tend to use ever more severe coping mechanisms for subsequent events when responding to a series of environmental hazards.

Boubacar et al. (2017) propose a new tool to assess household resilience in urban areas. The authors draw on the Household Economy Approach (HEA), commonly

used for monitoring vulnerability in rural sub-Saharan Africa, but make it more suitable to urban contexts, piloting the tool in Niamey in Niger to assess households' absorptive capacity. They find that their adjustments of the HEA helped to expose very different levels of resilience between urban households, even though the population studied was more or less equally poor. This demonstrates an added value to standard wealth class-based approaches for studying resilience, which would not have detected such diversity. For Niamey, results also highlight high exposure to flooding of urban residents, as well as a lack of strategies to cope and adapt, especially among the least resilient households.

Livelihoods of men and women are often affected in different ways by climate change. Omolo et al. (2017) highlight that underlying local power relations and social dynamics can create diverse levels of vulnerability and influence how interventions need to be designed in order to help build resilience to climate variability. While, overall, few households had high levels of climate resilience in Turkana in Kenya, the authors observe that agro-pastoralists generally fared better than primary pastoralists, and male-headed households fared better than female-headed households. Finally, the study finds that access to basic services such as health, water, education, markets and mobility represents a key contributor to resilience, and is even more important in this regard than household assets or the age and gender of the household head.

5. Understanding the characteristics of resilience in 2017 Q2 literature

This section interprets the literature discussed in the grey and academic literature this quarter, based on five broad characteristics of resilient systems identified by The Rockefeller Foundation.

5.1. Awareness

Awareness is 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

- There is a focus on understanding specific drivers of risk, and ensuring better integration between these to build resilience in different contexts.
- Greater awareness of equity and pro-poor considerations in risk assessments and modelling, as well as in policy and programming, is needed to ensure that no one is left behind.
- International humanitarian actors, as well as national and subnational policy-makers, need to pay greater attention to local contexts, including pre-existing systems, norms, cooperation and culture, to increase the adequacy of disaster response and resilience interventions.

Several studies in the grey literature reveal characteristics of awareness of different kinds of risk, which includes forecasting and modelling in order to prepare better for the future. BRACED (Diallo et al., 2017) looks at pastoralists' access to user-tailored climate information services, while the World Bank's UFCOP (World Bank, 2017a) promotes awareness of flood risk and management options. Three publications focus on awareness of urban risk and promoting urban resilience, two from ISET-International

(Nguyen et al., 2017; Tyler, 2017) highlighting the role of DRR and CCCOs in cities across Vietnam and the World Bank (World Bank, 2017c), setting out a strategy for building resilience in Accra.

Three studies emphasise the need for greater awareness of equity considerations. This includes CSA policy and programming (Karlsson et al., 2017), the ARC drought insurance mechanism (Reeves, 2017), and the benefits and opportunities that newcomers can bring, provided they are adequately integrated within a city (100 RC, 2017).

The need for awareness of local contexts and norms in disaster response and resilience building is a common theme in this quarter's academic literature. This includes post-disaster support (Field, 2017), local mechanisms to secure access to water (Narain and Singh, 2017), and bonding, bridging and linking social networks for post-disaster recovery and resilience (Islam and Walkerden, 2017). Meanwhile Ali and Syfullah (2017) assess vulnerability and resilience by focusing on the perceptions of coastal communities in Bangladesh. Greater integration of local community input should therefore be the basis of policies and can help to reconcile top-down and bottom-up approaches to disaster resilience. Finally, Muñoz-Erickson et al. (2017) argue that a greater understanding of existing knowledge systems in cities is needed to better support urban resilience.

Four additional studies focus on resilience conceptualisation and measurements to support an understanding of resilience processes and outcomes. Mishra et al. (2017) stress the importance of comprehensive ex ante preparation for disaster recovery, Zhang and Huang (2017) propose an index to assess resilience and its key determinants across countries. Sadeghi-Pouya et al. (2017) present a methodology for assessing flood vulnerability based on scoring across three indices in Iran. Cumming et al. (2017) emphasise awareness of temporal and spatial dimensions of resilience.

5.2. Diversity

Diversity implies that a person or system has a surplus of capacity to enable a successful operation 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

- Diversification of livelihoods, practices and seed varieties is important in building resilience to climate risk. However, in some circumstances, where weather patterns are changing, wider sectoral diversification may be needed.
- Promoting approaches that maximise benefits and minimise risks during both flood and non-flood conditions, integrating 'grey' hard-engineered infrastructure with 'green' infrastructure, can strengthen urban resilience.
- The diverse and dynamic nature of social relations can present a broad basis of support at different stages of response and recovery after a disaster.
- Diverse livelihoods, along with access to financial services, can help farming households reduce their exposure and shift labour to alternative activities in order to improve response to shocks.
- More diversity is needed in order to expand the scope and value of infrastructure resilience research, including considering social resilience, developing countries and mixed methods.

Diversifying livelihoods, practices and seed variety was highlighted within the grey literature as a means to build resilience to climate risk. This was with regard to seed varieties (Halewood et al., 2017), livelihoods diversification and CSA in Nepal (Poudel et al., 2017). Weingärtner et al. (2017) found that SHGs strengthen livelihood diversification but that new livelihood activities were often exposed to similar (mostly rainfall-related) risks, highlighting the need for wider changes beyond the agriculture sector. Wineman et al. (2017) emphasise access to financial services and a diverse livelihoods portfolio as crucial to reduce exposure and strengthen coping capacity to droughts in rural Kenya. Misra et al. (2017) show the diverse and dynamic nature of social relations within and beyond communities at different stages of response and recovery after a disaster. In an urban context, Tan et al. (2017) highlight the importance of environmentally-sensitive diversification of economic activities for increasing resilience in Northeast China. Meanwhile, the World Bank (2017a; 2017b) highlights diverse benefits during both flooding and non-flooding conditions including by integrating 'grey' hard-engineered infrastructure with 'green' infrastructure.

Two academic papers outline how conceptual and methodological diversity can represent a challenge as well as an opportunity for understanding and building resilience or supporting well-being. Inder et al. (2017) stress the diverse components of child welfare and include resilience as one of its key components next to education and food security. In their review, Opdyke et al. (2017) find that more diversity is needed in order to expand the scope and value of infrastructure resilience research, including considering social resilience, developing country contexts and mixed methods.

5.3. Self-regulation

This implies that 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

- Different scales need to have the capacity to deal with interferences in order to build a resilient system that does not result in extreme malfunction when exposed to shocks and stresses.
- Independence and reducing reliance on external resources in the event of a disaster will help to promote more resilient systems.
- Policy regimes which emerged from a mixture of ideas and standards can be resilient to external change and internal power struggles through flexibility and containment.

Characteristics of self-regulation are evident in the grey literature with regards to climate risk insurance and systems or processes which support interferences without malfunction, despite changing shocks and stresses. This is seen in financial products (Mercy Corps, 2017), flood protection (World Bank, 2017a; 2017b), or small- and medium-scale irrigation systems (Pradhan et al., 2017) that support capacity to deal with disaster shocks through 'safe failure' without extreme malfunction. The need for independence is also highlighted within the grey literature, including urban DRR action without the need for external or national-level support (Nguyen et al., 2017). Meanwhile, the Asian Development Bank (2017) promotes pooled community level climate risk insurance to enhance self-regulation and reduce reliance on external resources in the event of a disaster.

Baird et al. (2017) argue that disruption can either support or undermine innovation, depending on its intensity and context. It can thus be a way to address

‘unwanted’ resilience of systems, which in some cases can stall innovation and present a barrier to change and reform. Daugbjerg et al. (2017) demonstrate how a diversity of paradigms underlying a policy regime can support the resilience of this regime to changes in its internal power structure and context.

5.4. Integration

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

Key messages

- Integration of practices across different agendas is important to help scale up successful approaches.
- Promoting coherent partnerships at different scales will support a more integrated approach to risk management.
- The integration of social and natural science methodologies, along with innovative technologies, can support risk assessment and facilitate more resilient reconstruction and planning.

Enhanced integration, coherence and collaboration are key characteristics across the resilience scan literature, including for practices and approaches, coherence across policy agendas, and in terms of partnerships and stakeholders. The World Bank (2017a; 2017b) promotes

the integration of ‘grey’ and ‘green’ infrastructure to manage flood risk. Both Christian Aid (Murphy et al., 2017) and IIED (Bermudez, 2017) recommend better integration of humanitarian response and resilience building approaches to support long-term community resilience, while Amri et al. (2017) set out key challenges for integrating and scaling DRR education in curricula in Jakarta, Indonesia.

In terms of partnerships, one IIED publication (Bermudez, 2017) highlights the need to integrate displaced and host populations to promote social cohesion, while another (Parker et al., 2017) provides lessons for humanitarian agencies to work together with municipal authorities to deliver urban planning after humanitarian crises, while ISSD (Halewood et al., 2017) call for greater private companies and farmer integration to increase participation in climate-resilient food systems. At the city scale, a City Innovation Platform in Dar es Salaam integrates perspectives from the insurance industry with city authorities for risk management in public infrastructure projects (CISL, 2017). Similarly, Archer et al. (2017) stress the role of city networks and collaborative approaches between local governments and other stakeholders, including the private sector, in urban resilience planning.

A number of studies present integrative frameworks, including integration of inclusive growth and climate change objectives by microfinance programmes and institutions (Chirambo, 2017), and options for strengthening disaster resilience and low-carbon mitigation concepts within housing for the urban poor (Charoenkit



Farmers are trained in the use of raised beds for herb cultivation and other water-efficient irrigation techniques in Nepal. Photo credit: Pankaj Prasad/ICIMOD Kathmandu, 2000. CC BY-ND 2.0.

and Kumar, 2017). Boubacar et al. (2017) integrate resilience dimensions into the HEA for urban contexts. Integrating resilience and vulnerability thinking is also a repeated concern in this quarter's conceptual academic literature (Kohlitz et al., 2017; Summers et al., 2017). Several authors highlight the importance of integrating social science and natural science methodology, including the use of innovative data and technology (Mejri et al., 2017), and explicit human behavioural components into more technical risk assessments (Ciullo et al., 2017).

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 to be better able to withstand it 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 element to take on multiple roles.

Key messages

- Gender, power relations and other context-specific factors must be taken into consideration to promote adaptive planning and implementation.
- Hazard-specific preparedness as well as a broader perspective on system strains and climate change are required to strengthen resilient healthcare provision.
- Cumulative hazards can undermine effective adaptation in agricultural communities.
- Coastal communities pursue a wide variety of locally led adaptation strategies in response to climate change, including changes in livelihoods, health and migration.

Livelihood adaptation to respond to climate change and changing risks are assessed in a BRACED study by Grist and Harvey (2017) for farmers in the Sahel, with another BRACED publication (Crowley et al., 2017) also

considering adaptive programming and gendered access to climate information, decision-making power and other factors relating to resilience. Two publications address adaptation through CSA (Poudel et al., 2017; Karlsson et al., 2017), and a study by 100 Resilient Cities (100 RC, 2017) describes the need for cities to adapt to a new dynamic future as well as the challenges and opportunities of mass migration to cities.

Omolo et al. (2017) underline the crucial role of increasing adaptive capacity, and reducing the underlying vulnerability, to be derived from local social and political structures in any efforts to build climate resilience in pastoralist and semi-pastoralist areas. The differences in resilience between men and women, in this context, require specific recognition. The study by Bacon et al. (2017) of Nicaraguan farmers' coping strategies shows how cumulative hazards over time can strongly undermine effective adaptation.

In the context of coastal settlement, Paterson et al. (2017) argue that scale seems to play a primary role for assessing equity in adaptive capacity, while Alam (2017) finds a large variety of locally led adaptation strategies, including changes in livelihoods, health and human habitation. Sumanatpan and Pollnac (2017) argue that well-being requires a comprehensive approach of capturing satisfaction with one's own life, as well as with the environment. This entails a consideration of a range of resilience components allowing different options to adapt, which the authors found to contribute strongly to the individual well-being of small-scale fishers in Thailand.

Lastly, considering the adaptiveness of public services, Farley et al. (2017) draw attention to the need to improve disaster preparedness and climate resilience in the Sri Lankan government health system. They argue that hazard-specific preparedness, as well as a broader perspective on system strains and climate change, are required to strengthen resilient healthcare provision.

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