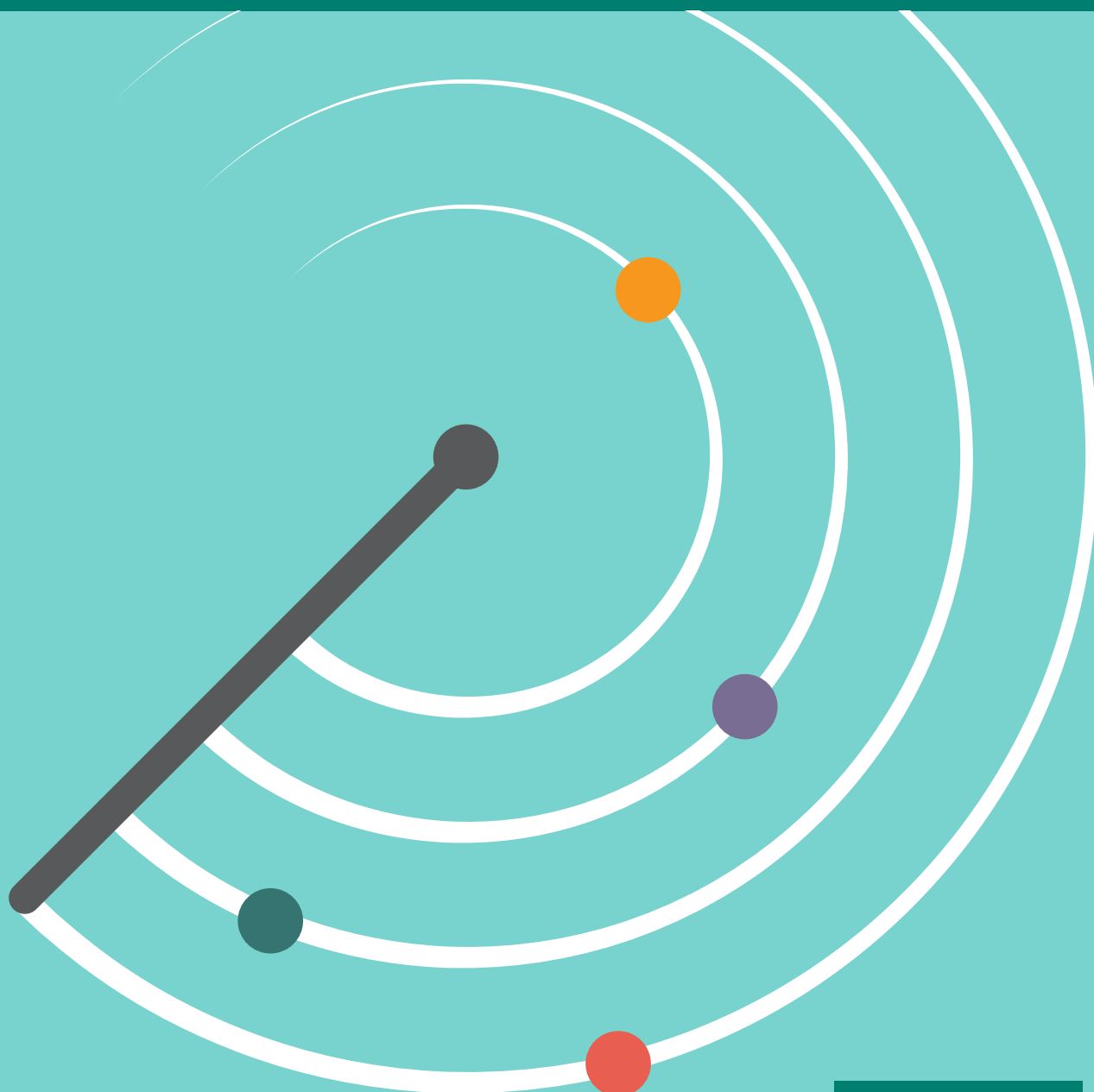




Resilience scan | January-March 2016

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

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REPORT

This report was written by Thomas Tanner, Emma Lovell, Florence Pichon, Aditya Bahadur and Hani Morsi. We are grateful to Olivia Taylor and Stephanie Ong for their assistance with the search. We would also like to thank our reviewers at the Rockefeller Foundation, Chukwudi Onike and Kevin O'Neil.

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

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

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Suggested citation:

Tanner, T., Lovell, E., Pichon, F., Bahadur, A.V. and Morsi, H. (2016) 'Resilience Scan January-March 2016: A review of literature, debates and social media activity on resilience', London: ODI.

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This report received support from
The Rockefeller Foundation.

Abstract

This 'resilience scan' summarises writing and debates in the field of resilience during the first quarter of 2016, focussing primarily on the context of developing countries. The scan will be of particular interest to those implementing resilience projects and policies and those seeking summaries of current debates in resilience thinking. It comprises insights on the key international policy processes in 2016, analysis of Twitter activity on resilience, and summaries of high impact grey literature and academic journal articles. The final chapter synthesises the insights from literature in terms of 5 characteristics of resilience- awareness, diversity, self regulation, integration and adaptiveness.

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Acronyms

APA	Ad Hoc Working Group on the Paris Agreement	M-RED	Managing Risks through Economic Development
BRACED	Building Resilience and Adaptation to Climate Extremes and Disasters	MSD	Market Systems Development
CBA	Community-Based Adaptation	NAP	National Adaptation Plan
CBNRM	Community-Based NRM	NGO	Non-Governmental Organisation
CBO	Community-Based Organisation	NRDC	Natural Resource Defence Council
CCA	Climate Change Adaptation	NRM	Natural Resource Management
CECHR	Centre for Environmental Change & Human Resilience	NUS	Neglected and Underutilised Species
COP	Conference of the Parties	PPP	Public–Private Partnership
CSA	Climate-Smart Agriculture	REDD	Reducing Emissions from Deforestation and Forest Degradation
DFID	Department for International Development	SBI	Subsidiary Body for Implementation
DRM	Disaster Risk Management	SBSTA	Subsidiary Body for Scientific and Technological Advice
DRR	Disaster Risk Reduction	SDG	Sustainable Development Goal
EWS	Early Warning System	UN	United Nations
FAO	Food and Agricultural Organization	UNFCCC	UN Framework Convention on Climate Change
GFDRR	Global Facility for Disaster Reduction and Recovery	VRA	Vulnerability and Risk Assessment
IDEA	Integrated Disaster and Economic Analysis	VSLA	Village Savings and Loans Association
IDP	Internally Displaced Person	WEC	World Energy Council
IK	Indigenous Knowledge	WFP	World Food Programme
INDC	Intended Nationally Determined Contribution	WHS	World Humanitarian Summit

Executive summary

Major events for the 2016 resilience agenda

A number of major intergovernmental agreements in 2015 related directly to resilience issues. These included the Sendai Framework for Disaster Risk Reduction, the 2030 Agenda on Sustainable Development, Financing for Development and the Paris Climate Change Agreement. In 2016, the initial processes for implementing those frameworks will heavily influence the UN and national government resilience landscape, ideally in a way that maximises their linkages and synergies. The year will host some further global meetings of importance, including the World Humanitarian Summit in May, the UN Conference on Sustainable Urban Development (Habitat III) in October and the 22nd Conference of the Parties climate conference in November in Marrakech, which follows up the Paris climate agreement.

Resilience on Twitter

This scan provides an analysis of resilience conversations in a range of different contexts, including climate change, agriculture, food security, conflict, urban development, water and economic resilience. For each of these contexts/sectors we develop:

- a word cloud showing the most frequently used terms in Twitter conversations
- a list of the most prominent discussion themes
- a conversational social network map showing Twitter handles as nodes, and lines connecting the nodes representing relationships and interactions

As in previous Twitter resilience scans, climate resilience claims the largest conversational prominence. Conversely, urban resilience was the least visibly tweeted sector in 2016 Q1. The other five sectors have experienced little fluctuation in terms of conversational visibility since the last scan. Themes of gender, innovation and context-appropriate responses remain to feature as common denominators across the various sectors.

Institutional voices enjoy the widest discursive visibility, largely because of the professional social media management resources most institutions are able to employ. However, more individual experts and academics are joining the conversations and acquiring their share of discursive visibility.

As the dominant mode of tweeting about resilience is expert-driven, formal and more link-broadcasting than interactive, a defining feature of these

conversations remains the expert/institution ‘echo chamber’ effect. With a few exceptions, there is little engagement between top Twitter resilience experts and wider Twitter communities that may be of relevance to resilience themes but that do not focus specifically on resilience. Additionally, a few very central and visible influencers drive most conversational clusters. There is significant overlap between several topic networks, such as the water and agriculture sectors, as well as the conflict and food security sectors.

Resilience in grey literature

Our examination of publications on resilience published between January and March 2016 includes 33 papers from research institutions, donors and multilateral agencies. These span six broad themes.

Grey literature on gender equality and social inclusion suggests:

- the need to include gender-sensitive approaches within the project design stage of resilience-building activities in order to be truly effective and meaningful
- the need to take a context specific, people-centred and participatory approach to gender equality and social inclusion within resilience-building projects
- the need to challenge the root causes of vulnerability, power relations and structural challenges, within different social-economic-political contexts, so as to remove the barriers to gender-sensitive approaches
- the need to reflect on the different needs, skills and capacities of women, in order to consider the role women can play in building resilience to climate change
- gender equality and social inclusion are necessary as cross-cutting themes for organisational approaches to resilience, as well as for food security and resilient livelihood initiatives

Grey literature on urban resilience suggests:

- investing in resilient infrastructure can help mitigate future risk and will result in significantly less financial burden than will repairing infrastructure retrospectively
- cities are systems that need to be managed, integrated and made inclusive in order to build resilience to shocks and stresses

- a need to recognise the interdependencies of physical infrastructure, services and systems, and the cascading impacts disruptions can have at the local, national and global level
- environmental impact and vulnerability assessments are necessary to ensure urban development planning and governance is risk-informed
- forward-looking, strategic, inclusive and sustainable urban planning and governance is needed to manage urban sprawl and ensure citizens have adequate access to critical infrastructure and basic services

Grey literature on *agriculture, livelihoods and food security* suggests:

- it is vital to adopt a systems-based approach to resilient livelihoods/agricultural production
- integrating local knowledge within responses to build resilient food systems will help improve agro-biodiversity
- climate-smart agricultural practices can help build inclusive resilience to climate change, support climate mitigation and increase agricultural production and productivity
- a need for greater data collection, sharing of knowledge and integrated policies and practices for the promotion of resilient livelihoods and food security
- practices that target agriculture, food security and resilience can support peace-building, conflict resolution and post-conflict recovery efforts, all of which are critical to sustainable development

Grey literature on *financial inclusion and markets* suggests:

- financial service inclusion can help build climate resilience, and can support anticipatory, absorptive and adaptive capacities
- building economic security can help ensure long-term and sustainable development outcomes
- resilient financial sector infrastructure can be achieved through removing regulatory and legal barriers, reducing costs, improving access and enhancing competition, protection and flexibility within the system

Grey literature on *organisational approaches* suggests:

- organisational approaches to resilience promote the need for a systems-based approach that takes into account the social, economic, political and environmental context
- numerous frameworks take a people-centred approach, which incorporates aspects of inclusion and participation, in order to build resilience effectively and equitably
- greater collaboration is needed between different partners and agencies working on resilience in terms

of approach, sharing of lessons learnt, funding and implementation

- drawing on existing networks and social protection systems can help build community resilience to disasters, while also being a mechanism to provide support and aid post-disaster recovery
- systems often involve interdependent factors that can lead to cascading failures if they are not managed effectively

Grey literature on *post-2015 processes* suggests:

- while governments may have ratified or supported different agreements, implementation across sectors is still lacking and there are a number of challenges in terms of coordination and alignment
- the goals of the different frameworks cannot be attained in isolation owing to the inter-linkages between them
- synergies on measurement, tracking, reporting and financing need to be agreed and strengthened in order to reduce the burden on countries and support progress against the different frameworks
- while the articles discuss different post-2015 frameworks for addressing climate change, disaster risk and development, the Sendai Framework is mostly excluded from the papers reviewed, perhaps suggesting it does not have the salience it needs
- ex-ante disaster risk financing offers opportunities to support sustainable development objectives while also supporting disaster resilience

Resilience in the academic literature

Thirty-five peer-reviewed papers were included in the analysis, from which five dominant thematic clusters emerged.

Academic literature on *defining resilience* suggests:

- resilience definitions must be explicit about how change and recovery are defined, as societies undergo constant change and returning to a 'normal' state post-disaster can be maladaptive or undesirable
- urban resilience has not been consistently defined; municipalities need to consider and state openly the basic questions: resilience for whom, what, where, when and why?
- there is a danger that resilience language can be used to diffuse responsibility for hazard management

Academic literature on *measuring vulnerability and resilience* suggests:

- vulnerability assessments are important inputs for resilience planning, but must integrate indicators of ecological and social systems
- quantification of vulnerability and resilience often neglects intra-household factors and social structures

- empirical research on social capital has diverse conclusions; some papers highlight the importance of social capital while others demonstrate empirically that it is employed for coping with shocks but has limited impact on resilience outcomes
- research suggests wealthy households are better able to recover from shocks regardless of the coping strategies they adopt
- efforts to measure vulnerability should consider how trade flows pass on and disburse the impacts of shocks, as macro-level disruptions can have serious consequences for household-level food security

Academic literature on *Indigenous knowledge (IK) and participation resilience* suggests:

- IK has no dominant narrative: there are a multitude of approaches towards natural resource management
- successful ecosystem management must be inclusive and participatory
- IK and scientific knowledge are distinct but can be complementary for programming
- IK and resilience approaches can be used to address uncertainty and complexity
- highly centralised or top-down disaster risk reduction legislation neglects opportunities to use communities as a resource for more effective early warning and hazard management

Academic literature on *equity, justice and power* suggests:

- researchers are calling for more emphasis on equity in urban climate change adaptation planning
- entrenched institutional alliances can compromise broader participation in adaptation planning
- private sector initiatives can have negative or perceived positive impacts on the resilience of the poorest, depending on livelihood opportunities and ecological impacts
- technical approaches to tackling climate change foster ‘conceptual blind spots’ about human agency; inciting transformational change requires engaging with directly politics
- strong leadership is not sufficient to prevent ecosystem degradation around city hinterlands; politicians need better knowledge on the interconnections between social and ecological systems

Academic literature on *social capital* suggests:

- empirical research shows social capital is not necessarily linked to adaptation or resilience benefits at the household level
- yet relying on social capital is consistently cited as an important coping strategy in the aftermath of a shock or stress

- displacement can disrupt social capital networks, and can result in lower resilience in the long term
- the least resilient are not always the poorest; a ‘vulnerable middle’ that does not qualify for external assistance can be more dependent on social capital and informal networks to withstand shocks and stresses

Resilience in the academic literature

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

Awareness:

- Measuring social and biophysical vulnerability together is essential to informing CCA planning.
- To understand social vulnerability indices, decision-makers need to be aware of the factors being tracked. The choice of social indicators has a large impact on vulnerability assessment outcomes.
- Across the grey literature, there is a strong focus on gender-sensitive approaches for understanding and building gender equality through resilience projects.
- In relation to food security, nutrition and resilient agricultural systems, we need a more dynamic understanding of resilience, including analysis of the main drivers of change over time.
- Learning and feedback loops are essential to reflect on ways of obtaining knowledge and to ensure flexibility within project planning and implementation.

Diversity:

- The diversity of skills, knowledge and practices people use to respond to climate change and disasters should be built on to strengthen resilience-building initiatives.
- Social protection systems can be used both to build people’s capacity to prepare for a disaster before it strikes and as a means to distribute humanitarian assistance and aid following a shock.
- Financial service inclusion can help people prepare for, cope with and respond to a range of situations by enhancing their capacity to deal with shocks and stresses, thereby promoting resilience.
- Migration is a coping strategy applied by households that lack diversity or alternatives that allow them to continue their livelihoods in the aftermath of a disaster.
- Empirical research found that capacity to recover from shocks was not related to the type of coping strategy employed. Households’ choice of coping strategies was influenced more by nationality and culture than by wealth.

Self-regulation:

- Self-regulation does not feature prominently in the literature, though concepts borrowed from ecology refer to the self-regulating nature of a resilient system.
- Interdependencies within infrastructure, services and systems can lead to cascading disruptions. Lack of self-regulation within these systems can have multi-scalar, long-term implications.
- It is important to support agro-ecosystems to deal with shocks and stresses without resulting in extreme malfunction or cascading impacts, so as to support climate-resilient livelihoods and sustainable agricultural systems.

Integration:

- Integration is a key theme in organisational approaches to resilience. It spans taking partnership and collaborative approaches and sharing lessons across organisations, sectors and scales.
- Collaborative and integrated approaches across countries and regions are highly effective in scaling up best practices and promoting a multi-risk and multi-sectoral approach to resilience.
- There is an urgent need for increased synergies and cohesive solutions to achieve the different post-2015 frameworks, including through joint funding, advocacy efforts, tools and partnerships.
- Integration is about not only working together but also how organisations work together; strategic

positioning is more effective than close clustering in disaster relief.

- Urban planners need to involve stakeholders beyond land use and environmental ministries to tackle the diverse challenges climate change will present.
- The role of social capital in helping people cope after disasters is a recurring theme, though some research questions the link between resilience outcomes and social capital.

Adaptiveness:

- Adaptation can refer to resisting change, accommodating change, and directing change, and adaptation planning strategies need to clarify how change will be treated.
- Resilience-building projects can help improve people's capacity to adjust to shocks and stresses through challenging power relations and social norms, thereby helping strengthen human rights, gender equality and social inclusion.
- Urban adaptation planning must take into consideration justice and equity issues that arise as a result of climate change. It is vital to tackle social and economic issues in addition to technical and infrastructure issues associated with CCA.
- Linking traditional and scientific knowledge can help provide long-term adaptive solutions to building resilience across a range of sectors.

1. Major events for the 2016 resilience agenda

A number of major inter-governmental agreements in 2015 were directly related to resilience issues. These included the Sendai Framework for Disaster Risk Reduction, the 2030 Agenda on Sustainable Development, Financing for Development and the Paris Climate Change Agreement. In 2016, the initial processes for implementing those frameworks will heavily influence the UN and national government resilience landscape, ideally in a way that maximises their linkages and synergies.

The year will also see some further global meetings of importance, including the World Humanitarian Summit (WHS), the UN Conference on Sustainable Urban Development (Habitat III) and follow-ups to the Paris climate summit. This section introduces some of the key events for the resilience calendar, helping make linkages across a range of different sectors.

1.1 Humanitarian sector

The World Humanitarian Summit (WHS) in Istanbul, Turkey 23-24th May hosts the first ever UN conference to bring together the humanitarian community with others working in development, peace-building and peacekeeping to agree a more coherent approach to the way humanitarian aid is delivered. Resilience has provided a framing approach to link humanitarian relief and rehabilitation with ongoing development processes.

One of the action areas structuring the consultations leading up to the WHS focused on 'Resilience: Build hope for new, recurrent and protracted crisis', highlighting the need for cooperation between humanitarian and development actors to tackle protracted, refugee and urban crises. Accordingly, the Synthesis of the

‘One of the action areas structuring the consultations leading up to the WHS focused on ‘Resilience: Build hope for new, recurrent and protracted crisis’

Consultation Process highlights a number of calls for action to enhance resilience, including to:

- Convene an independent advisory group to adapt and get ready for new humanitarian challenges and risks.
- Increase the predictability of response in advance by forging ‘preparedness and response agreements’ for natural hazards between governments and the international community.
- Address the humanitarian dimensions of migrant and refugee movements and ensure respect for the human rights of all people on the move.
- Establish a global urban crisis alliance to tackle escalating risk and generate urban specific response mechanisms.
- Ensure protection and assistance to internally displaced people and find durable solutions.
- Scale-up social protection measures by governments and development partners in crisis-affected areas.
- Improve management of health crisis risks by governments and international actors.

Figure 1: Agenda for Humanity - Five Core Responsibilities

#1	PREVENT AND END CONFLICT	Leaders must assume their responsibility to prevent and end conflict, working to find political solutions to end bloodshed and suffering
#2	RESPECT RULES OF WAR	States need to respect the rules they have endorsed in international humanitarian and human rights law
#3	LEAVE NO ONE BEHIND	Stakeholders must empower and protect the most vulnerable, including women and girls, young people, the displaced and people with disabilities, among others
#4	WORKING DIFFERENTLY TO END NEED	Change people's lives by moving from delivering aid to ending the need for it
#5	INVEST IN HUMANITY	Invest in enhancing local capacities, reducing risk and building effective and inclusive institutions, especially in fragile contexts

Source: www.worldhumanitariansummit.org/learn

- Examine a “refugee hosting deal” for countries and communities hosting refugees.
- Increase government investment in reducing exposure and vulnerability, and disaster preparedness.

The Report of the UN Secretary-General for the WHS ‘One humanity: shared responsibility’ presents the challenge in terms of a call for humanity — people’s safety, dignity and the right to thrive — to be placed at the

heart of global decision-making. To deliver for humanity, stakeholders must act on five core responsibilities. Resilience widely employed in the context of reduced vulnerability and risk, as well as framing the bottom-up, people-centred approach described in responsibility #4.

1.2 Urban development

The other major UN conference of 2016 is the Habitat III, to be held on 17–20 October in Quito. The expected outcome document of this, the New Urban Agenda, will complement the landmark UN agreements of 2015, and particularly contribute to Sustainable Development Goal (SDG) 11 (Make cities and human settlements inclusive, safe, resilient and sustainable).

Resilience features implicitly and explicitly in the 10 Habitat III Policy Units, which focus on the right to the city and cities for all; the socio-cultural urban framework; national urban policies; urban governance, capacity and institutional development; municipal finance and local fiscal systems; urban spatial strategies – land market and segregation; urban economic development

‘Resilience features implicitly and explicitly in the 10 Habitat III Policy Units.’

strategies; urban ecology and resilience; urban services and technology; and housing policies. A formal process of consultations is already underway (see Calendar in figure 2), but a range of other meetings on urban development will help inform and shape proceedings.

The Resilient Cities 2016 Annual Global Forum on Urban Resilience and Adaptation convenes for the seventh time on 6–8 July 2016 in Bonn. Resilient Cities brings together over 400 experts and practitioners from around the world to discuss urban resilience and adaptation. The 2016 programme focuses on inclusive resilience strategies, financing the resilient city, measuring and monitoring progress, resilience and adaptation planning, governance and collaboration, resource management and resilient infrastructure. Regional equivalents, such as the Asia-Pacific Forum on Urban Resilience and Adaptation – Resilient Cities Asia-Pacific 2016 – held in April 2016, has already brought together local governments, institutions and communities to discuss climate resilience in urban areas, including SDG 11.

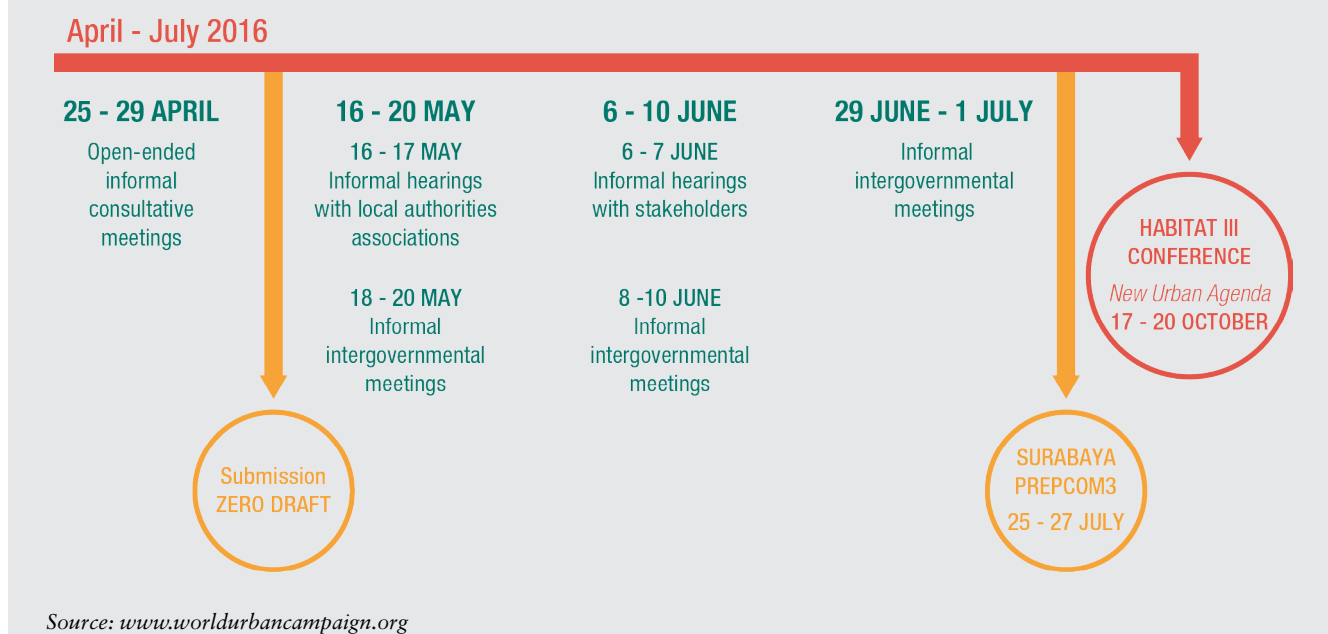
1.3 Climate change

On 22 April 2016, 170 country government representatives met at the UN for a ceremonial signing of the 2015 Paris climate change agreements. Including around 60 heads of state, this was a strong signal of



OccupyTheFarm Re-Occupy the Gill Tract Farm. Photo: Daniel Arauz, 2013.

Figure 2: Calendar of consultative meetings leading up to Habitat III



renewed global commitment to tackling the causes and impacts of climate change. The Climate Action 2016 multi-stakeholder summit took place two weeks later in Washington, DC. This aimed to deepen and expand the action coalitions of government, business, finance, philanthropy, civil society and academic leaders developed in the run-up to Paris.

The intergovernmental process for the Paris agreement under the UN Framework Convention on Climate Change (UNFCCC) meets in various forms during the year. The climate adaptation and resilience agenda will be focused this year on the development of National Adaptation Plans (NAPs), often as part of revised National Climate Change Plans originally submitted as ‘Intended Nationally Determined Contributions’ (INDCs) prior to the Paris summit.

The UNFCCC Subsidiary Body negotiating sessions held in between the annual Conferences of the Parties (COPs) will be held 16–26 May in Bonn. The Subsidiary Body for Implementation (SBI 44), the Subsidiary Body for Scientific and Technological Advice (SBSTA 44) and the first session of the Ad Hoc Working Group on the Paris Agreement (APA 1) will convene. Alongside making progress on adaptation plans and their implementation, there will be a major focus on developing decisions on ‘loss and damage’ at the COP22 meeting in Marrakech in November.

There are significant expectations of the COP22 agreeing concrete outcomes regarding the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts. This mechanism was established to:

‘Alongside making progress on adaptation plans and their implementation, there will be a major focus on developing decisions on ‘loss and damage’ at the COP22 meeting in Marrakech.’

- enhance knowledge of approaches to address loss and damage
- strengthen dialogue, coordination, coherence and synergies among relevant stakeholders
- enhance action and support, including finance, technology and capacity-building

At the COP22, many developing country governments, especially the small island states and the least developed countries, along with climate justice activists, will be lobbying for a shift towards the action and support elements of the Mechanism.

1.4 Disaster risk reduction

In the disaster risk reduction (DRR) community, this year sees the first sets of biennial meetings to define regional priorities and plans for implementation of the Sendai Framework on DRR 2015–2030 resulting

from the Sendai Conference of March 2015. These high-level ministerial meetings are accompanied by side event civil society fora and are explicitly making links to other related multilateral processes such as the SDGs and the Paris climate change agreement. Meetings this year include the regional Ministerials in Central Asia and the South Caucasus, the Americas and Asia.

These regional meetings will also contribute to the build-up to the Fifth Global Platform for DRR, to be held in Cancún on 22–26 May 2017. The Global Platform is the most important international forum dedicated to the DRR agenda, and will enable the

international community to review global progress on the implementation of the Sendai Framework. More than 5,000 participants are expected, including policy-makers and disaster risk managers.

‘This year sees the first sets of biennial meetings to define regional priorities and plans for implementation of the Sendai Framework on DRR.’

Table 1: Key disaster risk reduction events supporting Sendai

Key DRR events supporting Sendai	Location	Dates
Central Asia and South Caucasus Regional Ministerial Meeting on DRR www.unisdr.org/we/inform/events/4142	Bishkek, Kyrgyzstan	29–30 January 2016
High-Level Ministerial Meeting on the Implementation of the Sendai Framework 2015–2030 (Americas) www.unisdr.org/we/inform/events/46626	Asuncion, Paraguay	8–9 June 2016
Asian Ministerial Conference for DRR http://www.unisdr.org/we/inform/events/46721	Delhi, India	3–5 November 2016



Karnataka Urban Development and Coastal Environmental Management Project. Photo: Asian Development Bank, 2012.

2. Resilience on Twitter: insights on influencers, networks and topics

2.1 'Listening in' on Twitter conversations on resilience: methods

Short-form social media platforms like Twitter offer opportunities to tune into conversations around research uptake and policy-influencing processes. The informality and the few participation barriers of the media lend themselves to potentially unlocking insights that would otherwise be unobtainable through traditional means of media monitoring. Social media are rapidly changing how research is communicated and the ways in which audiences engage with the communication process.

This section provides an analytical snapshot of:

1. the key influencers generating and catalysing online conversations on resilience
2. the popular topics in online conversations on resilience and the prominent themes
3. the origins of the social media chatter on resilience, and who is talking to whom

Seven datasets comprising Twitter conversations on or specifically relevant to resilience in the context of eight sectors (climate, disasters, agriculture, food security, conflict, urban, water, economic) were created using the Twitter API¹. The datasets are analysed in two ways: content analysis (to explore thematic structures) and social network analysis (to map conversational and

influence networks). For each of the seven sectors, the analysis is summarised in three sections:

1. a word cloud showing the most frequently used terms on the concept of resilience in the sector; this represents a visual snapshot of the thematic focus of these conversations
2. a list of the most prominent discussion themes
3. a conversational social network map: the network maps comprise nodes (which represent Twitter handles of organisations or individuals) and ties, which are the lines connecting the nodes (representing relationships and interactions)
 - a. The node size (or handle font size) helps the reader determine at a glance the key players in a network. The larger the node, the more its influence in terms of organisational prominence and/or conversational interaction.
 - b. The maps show conversational clusters that represent who is talking to whom on the pertinent topic (e.g. climate and resilience), with the Twitter accounts of prominence often (but not necessarily) driving the conversations, in the centre. The closer a node is to the centre of its conversational cluster, the more vocal or influential in conversations on this topic is the player in question².

The crosscutting insights from this analysis are discussed at the end of the section.

1. Assume one dependant for every worker. Assume rural labour can get work for 250 days a year. \$10 a day in wages then equates to just over US\$3 a day income per person.

2. It is worth noting that some Twitter handles can acquire temporary prominence in terms of perceived influence (during conferences, events or at the time of publishing controversial news or opinion pieces, for instance. This is accounted for in the analysis.

2.2 Climate resilience

Figure 3: Climate resilience word cloud



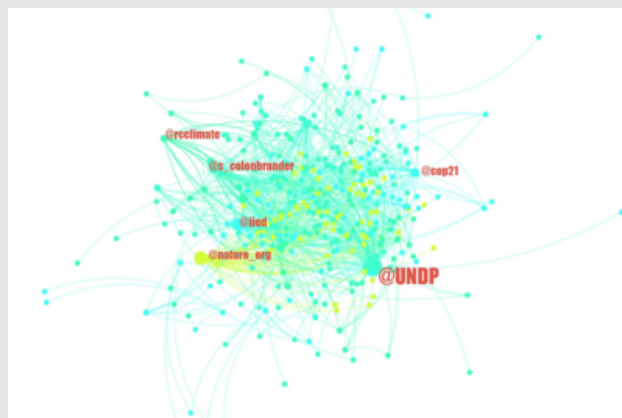
Conversations on climate resilience focus on:

- building climate resilience for rural communities
- nature-based solutions for building climate resilience
- climate adaptation strategies
- the relationship between economic policy and climate resilience
- ways to support various global communities to face climate resilience

What has changed since the last scan?

There are more conversations on nature-based solutions in building climate resilience, and notably less chatter on the theme of financing mechanisms for climate resilience, which featured very visibly in previous scans. The other notable observation is related to the increased density of the conversational network maps compared with in previous scans. There appears to have been a significant increase in Twitter chatter around this theme.

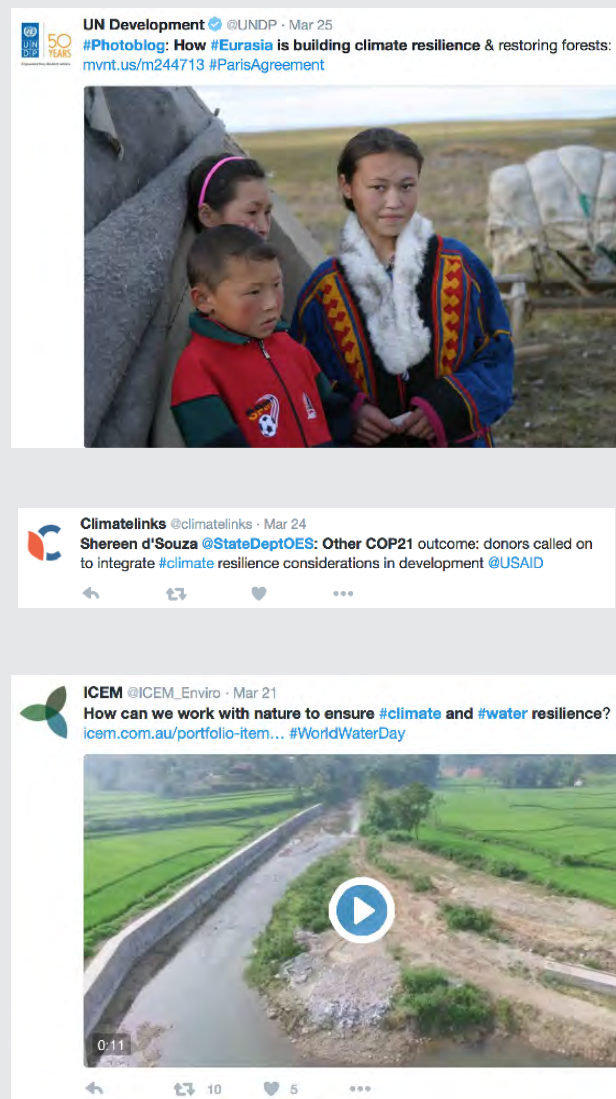
Figure 4: Influence map of conversations on climate resilience



Top influencers on climate resilience:

- @UNDP: The United Nations Development Programme
- @cop21: The UN Climate Change Conference 2015
- @worldbank: The World Bank
- @iied: The International Institute for Environment and Development
- @s_colendrander: Sarah Colendrander, Environmental Economist

Figure 5: Examples of climate resilience tweets



• 2.3 Agriculture resilience

Figure 6: Agriculture resilience word cloud



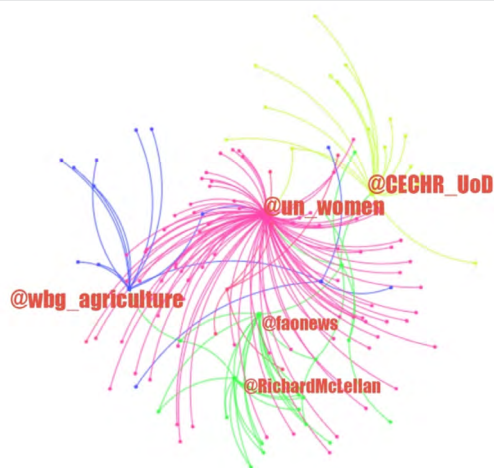
Conversations on agriculture resilience focus on:

- marginalisation, especially of women, in certain agriculture-dependent communities in relation to access to land
- conservation agriculture
- water-efficient agriculture as a way to boost resilience
- the intersection of food, energy and water within the context of agriculture resilience

What has changed since the last scan?

There are more conversations on the theme of gender and marginalisation of women within the context of agriculture resilience. Conversations on climate-smart and water-efficient agriculture continue to feature prominently.

Figure 7: Influence map of conversations on agriculture resilience



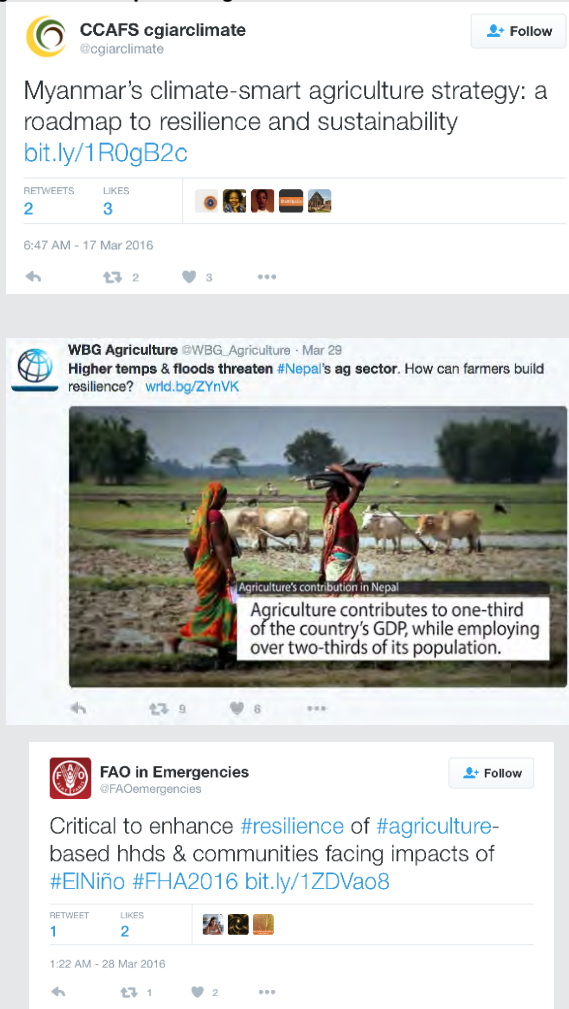
Top influencers on agriculture resilience:

- @UN_women: UN entity for gender equality and women's empowerment
- @CECHR_UoD: Centre for Environmental Change & Human Resilience
- @wbg_agriculture: World Bank agriculture
- @richardmclellan: Richard McLellan, Environmentalist
- @faonews: UN Food and Agricultural Organization news



Bananas transported by truck. Photo: US Army Africa, 2010.

Figure 8: Examples of agriculture resilience tweets

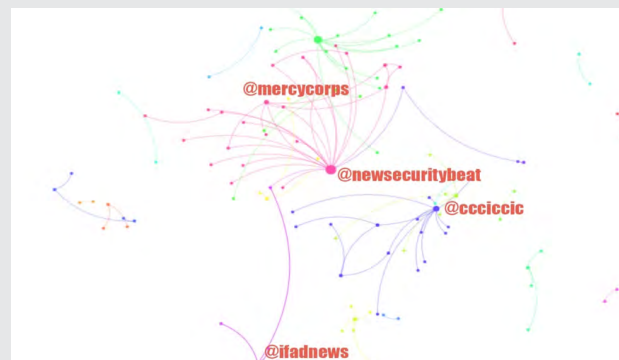


2.4 Food security resilience

Figure 9: Food security resilience word cloud



Figure 10: Influence map of conversations on food security resilience



Conversations on food security resilience focus on:

- The relationship between food security and conflict
- Food security as a concept in nutrition programmes
- Optimising agriculture value chains to improve food security
- •Irrigation, droughts, floods and impact on food security

What has changed since the last scan?

Conversations on the relationship between food security and conflict, as well as the impact of floods and droughts, feature more prominently compared with in previous scans.

Top influencers on food security resilience:

- @newsecuritybeat: Blog of The Wilson Center's Environmental Change & Security Program
- @ifadnews: International Fund for Agricultural Development news
- @cccicic: Canadian Council for International Co-operation
- @mercycorps: Mercy Corps, a global humanitarian organisation

Figure 11: Examples of food security resilience tweets



A rural scene. Photo: US Army Africa, 2010.

2.5 Conflict resilience

Figure 12: Conflict and resilience word cloud



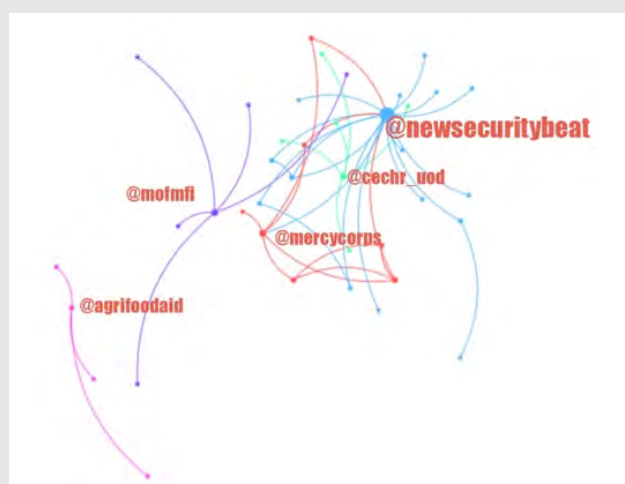
Conversations on conflict resilience focus on:

- the impact of conflict on rural livelihoods
- ways to reduce the impact of conflict on vulnerable populations
- community resilience in post-conflict contexts
- the intersection of conflict, access to resources and food security

What has changed since the last scan?

There is significant ‘mirroring’ across the conflict and food security themes as the network maps and top influencer lists of both contexts show. This evinces dominance in conversations on the relationship between food security and conflict. There are new conversations on the role of microfinance in conflict and post-conflict contexts.

Figure 13: Influence map of conversations on conflict resilience



Top influencers on conflict resilience:

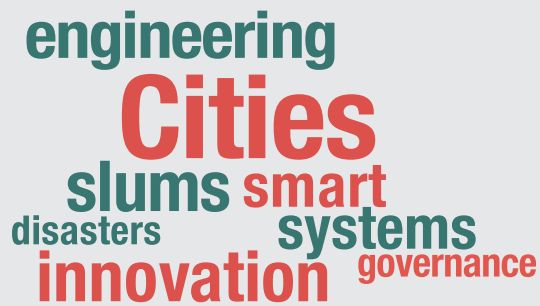
- @newsecuritybeat: Blog of The Wilson Center’s Environmental Change & Security Program
- @mercycorps: Mercy Corps, a global humanitarian organisation
- @agrifoodaid: Cluster consortium providing expert training across the agri-food supply chain in sub-Saharan Africa
- @CECHR_UoD: Centre for Environmental Change & Human Resilience
- @mofmfi: Month of Microfinance

Figure 14: Examples of conflict resilience tweets



2.6 Urban resilience

Figure 15: Urban resilience word cloud



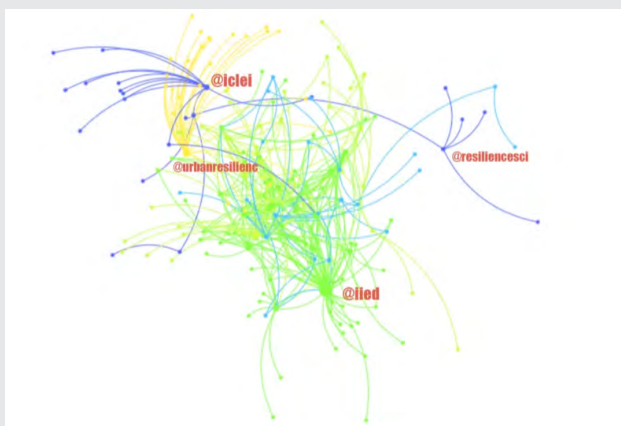
Conversations on urban resilience focus on:

- ways to build smarter cities to improve urban resilience
- resilience-focused engineering
- ways to strengthen the resilience of vulnerable urban communities
- improving the resilience of cities to natural hazards

What has changed since the last scan?

Conversations on the role of innovative engineering and design for urban resilience are still featuring prominently, as well as ways to improve resilience of cities to natural disasters and hazards.

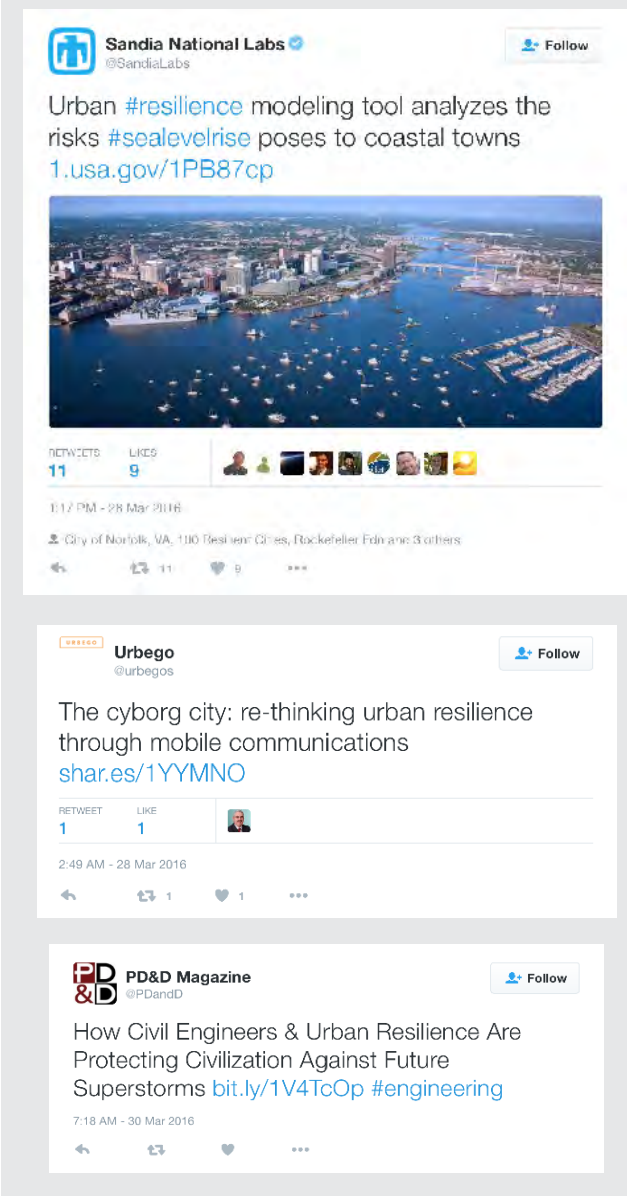
Figure 16: Influence map of conversations on urban resilience



Top influencers on urban resilience:

- @resiliencesci: Garry Peterson, Professor of Environmental Science with a focus on Resilience in Social-Ecological Systems at <http://www.stockholmresilience.org>
- @urbanresilienc: Urban Resilience
- @iied: International Institute for Environment and Development
- @iclei: Local Governments for Sustainability

Figure 17: Examples of urban resilience tweets



2.7 Water resilience

Figure 18: Water resilience word cloud



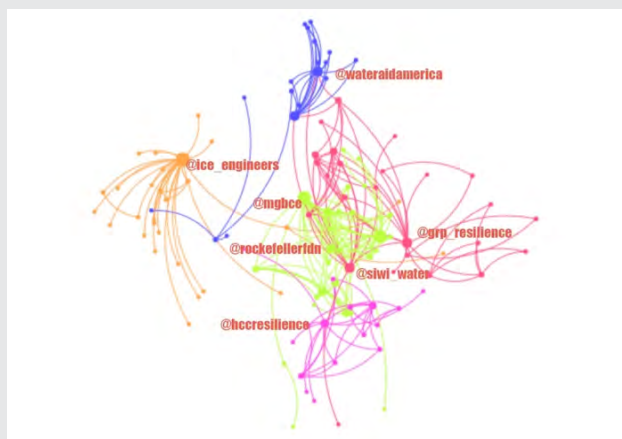
Conversations on water resilience focus on:

- improving the resilience of communities in flood-prone areas
- issues relevant to irrigation, droughts and access to water for agriculture
- water security and ecological resilience
- water management strategies in vulnerable contexts

What has changed since the last scan?

The water resilience conversational network has expanded significantly since the last scan, with more nodes (Twitter accounts) interacting in conversations on this theme. Conversations on droughts, floods and agriculture still feature prominently.

Figure 19: Influence map of conversations on water resilience



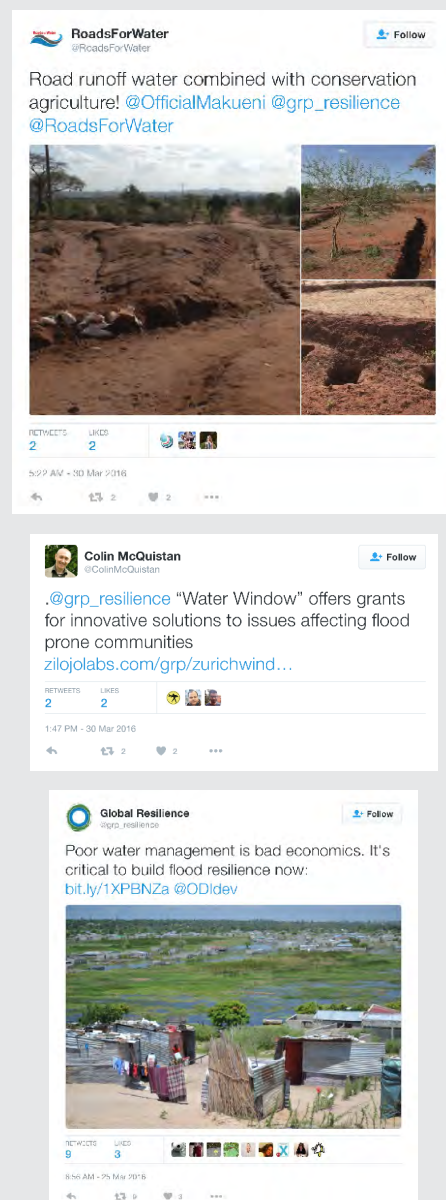
Top influencers on water resilience:

- @wateraidamerica: WaterAid America
- @grp_resilience: The Global Resilience Partnership
- @rockefellerfdn: The Rockefeller Foundation
- @siwi_water: Stockholm International Water Institute
- @ice_engineers: Institute of Civil Engineers



Water treatment plant, Karnataka India. Photo: Asian Development Bank, 2010.

Figure 20: Examples of water resilience tweets



2.8 Economic resilience

Figure 21: Urban resilience word cloud



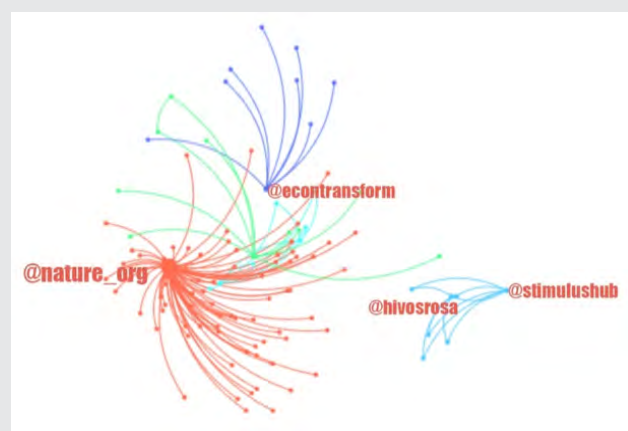
Conversations on economic resilience focus on:

- strategies aimed at bolstering economic resilience
- the relationship between natural disasters and economic crisis
- the intersection of governance, human capacities and economic resilience
- the role of socioeconomic stability in improving resilience

What has changed since the last scan?

Conversations on economic resilience are more thematically diverse. There are fewer conversations on cleantech and the role of business in innovation for resilience compared with the previous scan.

Figure 22: Influence map of conversations on economic resilience



Top influencers on economic resilience:

- @nature_org: Nature Conservancy
- @econtransform: The Supporting Economic Transformation programme
- @hivosrosa: HiVos Southern Africa
- @stimulushub: Stimulus Africa Foundation

Figure 23: Examples of economic resilience tweets

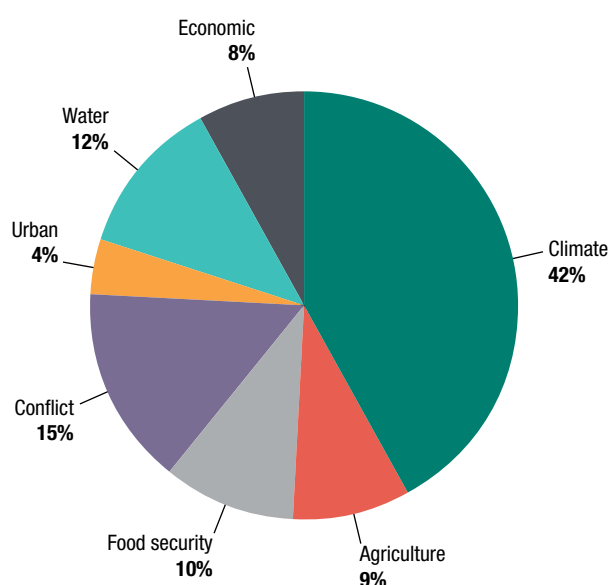


2.9 Reflections on Twitter analysis

What does Twitter discuss when discussing resilience?

As in previous Twitter resilience scans, climate resilience has the largest conversational prominence. Conversely, urban resilience was the least visibly tweeted about sector in 2016 Q1. The other five sectors have experienced little fluctuation. Themes of gender, innovation and context-appropriate responses remain to feature as common denominators across the various sectors.

Figure 24: Thematic distribution of Twitter conversations on resilience



Who tweets about resilience?

Institutional voices still enjoy the widest discursive visibility, largely because of the professional social

‘Themes of gender, innovation and context-appropriate responses remain to feature as common denominators across the various sectors.’

media management resources most institutions are able to employ, but more individual experts and academics are joining conversations and acquiring their share of discursive visibility.

How is resilience tweeted about?

As the dominant mode of tweeting about resilience is expert-driven, formal and more link-broadcasting than discursively interactive, a defining feature of these conversations remains the expert/institution ‘echo chamber’ effect. That is, with a few exceptions, there is little engagement between top Twitter resilience experts and wider Twitter communities that may be of relevance to resilience themes but that do not focus specifically on resilience. Additionally, a few very central and visible influencers drive most conversational clusters. There is significant overlap between topic networks, such as the water and agriculture sectors as well as the conflict and food security sectors.

This study adopts a topic-driven approach. Since the network maps and conversational clusters the datasets generate represent the accounts that are central to how the relevant topics are discussed at a certain point in time, they are in constant flux, and ‘influence’, as a measure of impact on how a topic is communicated and who is driving the conversations, is constantly changing. Another factor is the extent to which momentary spike in the conversational visibility of certain themes happens because of events such as academic and professional conferences with themes of relevance to the sectors under analysis.

3. Resilience in the grey literature

Our examination of papers on resilience published in 2016 Q1 includes 33 from research institutions, donors and multilateral agencies. These span six broad themes: gender equality and social inclusion; urban resilience and cities; agriculture, livelihoods and food security; financial inclusion and markets; approaches to resilience; and engagement with post-2015 processes. The increase in the amount of work on post-2015 processes reflects uptake of the major policy frameworks agreed in 2015, including the SDGs, the Sendai Framework and the Paris climate change agreements.

3.1 Gender equality and social inclusion

Grey literature on gender equality and social inclusion suggests:

- the need to include gender-sensitive approaches within the project design stage of resilience-building activities in order to be truly effective and meaningful
- the need to take a context specific, people-centred and participatory approach to gender equality and social inclusion within resilience-building projects
- the need to challenge the root causes of vulnerability, power relations and structural challenges, within different social-economic-political contexts, so as to remove the barriers to gender-sensitive approaches
- the need to reflect on the different needs, skills and capacities of women, in order to consider the role women can play in building resilience to climate change
- gender equality and social inclusion are necessary as crosscutting themes for organisational approaches to resilience, as well as for food security and resilient livelihood initiatives

Three papers focus primarily on gender-sensitive approaches to building resilience (Bryan et al., 2016; Kawarazuka et al., 2016; Le Masson, 2016). While five articles on organisational approaches to building resilience have gender equality and social inclusion in their frameworks as core crosscutting principles (Christian Aid, 2016; Ensor, 2015; GFDRR, 2016; Mercy Corps, 2016a; Morchain and Kelsey, 2016). Under agriculture, livelihoods and food security (see below), four of the seven articles incorporate the need to promote

‘Recommendations include a need for greater attention to the barriers and opportunities with regard to gender and social inclusion in project design; collection of gender-disaggregated data to inform monitoring, evaluation and evidence-based implementation; and gender-sensitive approaches within project implementation.’

gender equality and gender-sensitive approaches to building resilient livelihoods (Andersen et al., 2016; FAO, 2016a; Jirata et al., 2016; Padulosi et al., 2016).

Le Masson (2016) considers whether selected resilience initiatives address women’s practical or strategic interests, obstacles to changing gender relations in resilience and drivers of transformation in gendered power relations and building resilience. She draws on case studies in Burkina Faso, Myanmar, Sudan/Chad and Uganda as part of the Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) programme. The paper considers the spectrum of gender approaches non-governmental organisation (NGO) projects take, as well as providing different tools and activities for gender mainstreaming in the design of resilience-building initiatives. It concludes by providing recommendations for NGOs, those conducting action research and donors funding projects that aim to incorporate gender mainstreaming within resilience: strengthening people’s capacities to deal with shocks and stresses using a gender-sensitive approach, thereby helping challenge social norms/attitudes and build resilience equitably; promoting gender equality and women’s participation in disaster risk management (DRM) decision-making and implementation; collection of sex- and age-disaggregated



A young girl does her school work in Karachi, Pakistan. Photo: UN, 2011.

data to inform future resilience work; and recognition of the long-term approaches and funding needed to promote transformation of gender relations.

Similarly, Bryan et al. (2016) look at how seven different organisations are incorporating gender-sensitive approaches in their climate change adaptation (CCA) and resilience work. Using surveys and interviews with stakeholders at a range of levels, the authors focus on knowledge, attitudes, practices, policy and advocacy. The paper finds large gaps in integrating gender equality and social inclusion meaningfully within projects, particularly in terms of project design and available funding. The authors highlight that greater collaboration, funding and research are needed to ensure the meaningful incorporation of gender-sensitive approaches. Recommendations include a need for greater attention to the barriers and opportunities with regard to gender and social inclusion in project design; collection of gender-disaggregated data to inform monitoring, evaluation and evidence-based implementation; and gender-sensitive approaches within project implementation. The authors also stress that projects should be context-specific, people-centred and participatory.

Kawarazuka et al. (2016) also consider different challenges and opportunities in bringing together gender analysis to address social-ecological resilience and social-ecological resilience analysis to address gender, looking specifically at small-scale fisheries. They propose a number of principles for an integrated approach, including recognition that gendered power is dynamic and relational, that gendered relationships are interdependent, that different trade-offs and tensions exist and that, to assess power relations, we need to take into account different gender norms so we can identify the root causes of gender inequality. The paper highlights

the need to integrate sex-disaggregated data into social-ecological resilience analysis and provides three practical suggestions (as in Bryan et al., 2016) for better joint analysis of gender and resilience: shifting ‘to question-orientated enquiry and an emphasis on making sense of data’; greater reflexivity; and stronger interdisciplinary research drawing on a range of methodologies to provide an evidence base for decision-makers (pp.33–34).

Gender equality and social inclusion crosscut a number of organisational approaches to, or frameworks for resilience. For instance, two out of four of Christian Aid (2016)’s principles for building resilience support this theme: power, gender and social inclusion; and community-led processes. Also recognised here is the need to assess different contexts in terms of how power is distributed and experienced. Likewise, Mercy Corps (2016a) promotes the need for gender-equitable development that responds to the context and a range of shocks and stresses in their approach to resilience, which focuses on climate-resilient development, natural resource management (NRM) and energy access. Gender and social inclusion are one of the Global Facility for Disaster Reduction and Recovery (GFDRR) (2016)’s crosscutting themes in their work on DRM and resilience, which includes risk identification; risk reduction; preparedness; financial protection; and resilient recovery.

Ensor (2015) on the Vanuatu NGO CCA programme also highlights a strong focus on addressing power relations, gender equality, social inclusion and equitable decision-making through a rights-based approach. Meanwhile, Morchain and Kelsey (2016) focus on the need to conduct a vulnerability and risk assessment (VRA) to promote inclusive resilient development that is gender-sensitive and equitable. The authors discuss lessons from 12 Oxfam country teams and highlight how VRA and community plans can empower and build marginalised groups’ resilience by challenging structural inequalities, governance issues and power relations, all key to promoting gender equality.

A number of the articles on agriculture, livelihoods and food security (discussed later) incorporate the need to promote gender equality and gender-sensitive approaches. For instance, the Food and Agricultural Organization (FAO) (2016a) highlights the need to take a gender-sensitive, multi-scale, sector and stakeholder approach to address the social, economic, political and environmental factors affecting food security, risks, vulnerabilities and capacities. Padulosi et al. (2016) aim to empower women and indigenous people to manage risks by sharing knowledge and including multi-stakeholder approaches to link agro-biodiversity value chains, climate adaptation and nutrition.

Jirata et al. (2016) and Andersen et al. (2016) present conflicting results. Jirata et al. recognise that women’s

livelihoods are often the most vulnerable to climate change. They highlight the positive impact climate-smart agriculture (CSA) practices can have in terms of improved access to natural resources, diversification of livelihood options, reduced work burden and enhanced agricultural productivity, leading to strengthened food security and nutrition for women and their families. Yet Andersen et al. show that, though women are often assumed to be the most vulnerable, given their different roles, responsibilities and access to natural resources, the female-headed households in their study had greater diversification of livelihood options than men, and were thus less vulnerable to the effects of climate change. The authors highlight the need to reflect on the different needs, skills and capacities of women to acknowledge the role they can play in building resilience to climate change.

3.2 Urban resilience

Grey literature on urban resilience suggests:

- investing in resilient infrastructure can help mitigate future risk and will result in significantly less financial burden than will repairing infrastructure retrospectively
- cities are systems that need to be managed, integrated and made inclusive in order to build resilience to shocks and stresses
- the need to recognise the interdependencies of physical infrastructure, services and systems, and the cascading impacts disruptions can have at the local, national and global level
- environmental impact and vulnerability assessments are necessary to ensure urban development planning and governance is risk-informed
- forward-looking, strategic, inclusive and sustainable urban planning and governance is needed to manage urban sprawl and ensure that have adequate access to critical infrastructure and basic services

As per previous scans, a number of papers within the grey literature focus on urban resilience and cities. Of these, three assess different frameworks and partnerships for building urban climate resilience (DFID, 2016a; Friend et al., 2016a; World Bank, 2016). Others focus on case studies in different cities across the world (Friend et al., 2016b; NRDC, 2016; Patino, 2016).

Friend et al. (2016a) reflect on urban transformation within changing contexts and local risk patterns. They analyse trends in urbanisation, drawing on complex Social Ecological-Technological System theory, to move the debate beyond spatial risk, focusing instead on systems- and people-oriented analytical approaches to risk. Using examples from Thailand and Vietnam,

‘The authors call for better urban governance and a multi-scale, systems-oriented approach to urban risk and vulnerability, which considers the access, affordability, delivery and distribution of such services.’

the authors consider the interdependencies of physical infrastructure, services and systems (water, food, energy, transport, communications) on which cities and people rely, while recognising that these are inequitable and unevenly distributed. Moreover, they highlight how disruptions can have cascading systemic impacts, for instance through local/global food production prices. The authors call for better urban governance and a multi-scale, systems-oriented approach to urban risk and vulnerability, which considers the access, affordability, delivery and distribution of such services.

The World Bank (2016) looks at mainstreaming climate resilience in large scale, multi-sector infrastructure public-private partnership (PPP) in 16 countries. It notes a lack of integration of climate risks within infrastructure decision-making and investment, and argues this will increasingly threaten development outcomes and result in economic and infrastructure losses now and in the future. Key actions are suggested for development partners, governments and private sector actors to support adaptation mainstreaming, which include recognising that investing in resilient infrastructure early on in the project cycle can help mitigate future risk and will result in significantly less financial burden than will repairing infrastructure retrospectively.

Meanwhile, the Department for International Development (DFID) (2016a) looks at the establishment of the Urban Climate Change Resilience Trust Fund (2009–2015), which aimed to build urban resilience in 25 medium-sized cities in seven countries across Asia. Key insights are on the challenges and opportunities in building a shared understanding of urban resilience and the need to manage different interests, organisational cultures, trade-offs, knowledge and experiences to build an effective partnership. While cities appear to be of a ‘suitable scale to achieve practical impacts on climate resilience’, context, incentive structures and local government capacity are important (p.7). This is particularly so as cities are systems with their own infrastructural, governance and management challenges, which need to be managed if resilience to climate change is to be built. DFID argues

integrated planning and socioeconomic inclusion are key principles of urban resilience.

Three papers look at urban risk in the context of specific cities. One, the Natural Resource Defence Council (NRDC) (2016) looks at extreme heat health risks in cities and draw on lessons and best practices from the Ahmedabad Heat Action Plan in India. This was launched in 2013, with the aim of reducing heat-related health risks through building awareness, implementing coordinated early warning systems (EWS) and increasing health care workers' capacity to prepare for and respond to heat-related illnesses. The project is now likely to be replicated in three other cities in India. The NRDC provides seven steps for developing an urban heat action plan based on the Ahmedabad experience: city engagement; VRA and the establishment of heat-health threshold temperatures; a heat action plan; team preparation and coordination; implementation and monitoring; evaluating and updating the plan; and strategies for reducing extreme heat and CCA.

Two other papers look at approaches to managing urban sprawl through urban planning and governance. Friend et al. (2016b) focus on challenges of governance, policy and planning in urbanising Thailand. Many cities are attempting to 'catch up with on-the-ground realities', resulting in a path of dependency on investment and structures already in place, as opposed to implementing forward-looking, strategic, inclusive and sustainable urban planning and governance (p.47). The impact urban sprawl has on transport, technology infrastructure, livelihoods, employment, housing, trade and investment is highlighted, as are the interdependencies between some of these systems. The authors also note a lack of environmental impact assessments, with subsequent effects in relation to pollution, congestion, waste management and access to green public spaces, resulting in environmental and health impacts. Five areas to help build inclusive and sustainable urban development in the face of climate change are suggested: building public awareness and participation; addressing land use planning; mobility; housing and shelter; and public space.

Conversely, Patino (2016) analyses an approach to build urban resilience through a resettlement programme called The People's Plan, which aims to support and relocate informal settlers living along waterways in Metro-Manila. As a process, the plan has helped raise awareness of people's rights, improved social mobilisation and access to basic services and provided marginalised groups with the opportunity to engage with and participate in decision-making and planning processes that affect their lives. Challenges include strict rules for communities and groups

to engage in the process and lack of political will, legislation, accountability, collaboration between service providers and budget at the national level. Recommendations include the need for integrated national and local urban planning policies, multi-stakeholder engagement and participation, sufficient funding and regular running of and community participation in local DRR management council meetings.

3.3 Agriculture, livelihoods and food security

Grey literature on agriculture, livelihoods and food security suggests:

- it is vital to adopt a systems-based approach to resilient livelihoods/agricultural production
- integrating local knowledge within responses to build resilient food systems will help improve agro-biodiversity
- CSA practices can help build inclusive resilience to climate change, support climate mitigation and increase agricultural production and productivity
- the need for greater data collection, sharing of knowledge and integrated policies and practices for the promotion of resilient livelihoods and food security
- practices that target agriculture, food security and resilience can also help support peace-building, conflict resolution and post-conflict recovery efforts, all of which are critical to sustainable development

Most of the seven articles under this theme within the grey literature advocate for a systems approach to building resilient livelihoods and agricultural production. Four examine the impact climate change can have on food security, nutrition, livelihoods and agricultural production and suggest different approaches to managing these risks, such as through greater use of local crops, agro-biodiversity and CSA practices (Andersen et al., 2016; FAO, 2016a; Jirata et al., 2016; Padulosi et al., 2016). D'Errico and Di Giuseppe (2016) and the World Food Programme (WFP) (2016) provide a more detailed approach to measuring resilience, livelihood security and food security, including through econometric analysis and needs assessments. FAO (2016b) focuses on the role resilient livelihoods and food security can have in peace-building, conflict resolution and post-conflict recovery efforts.

FAO (2016a) analyses the cascading impacts of climate change on agro-ecosystems, food security, nutrition and vulnerability, and the economic and social effects of these on livelihoods and agricultural production (in terms of markets, income, production prices and trade). Four dimensions of food security are used: 'availability of food,

accessibility (economically and physically), utilization (the way it is used and assimilated by the human body) and stability of these three dimensions' (p.1). Approaches to reduce vulnerability and build resilient livelihoods in the face of climate change are presented through social protection strategies, gender equality and DRR; FAO suggests it is possible to reduce vulnerabilities within the production system through alternative technologies such as crop systems, livestock and pastoral systems and resilient landscape approaches. The report calls for multi-level responses to build resilient food systems, and stress this can be achieved through gender-sensitive, integrated and adaptable policies, strategies and institutions that address different time scales, stakeholders and sectors and incorporate a strong focus on monitoring and evaluation.

Padulosi et al. (2016) present similar recommendations, outlining the proceedings of an international conference during which Bioversity International launched 'Linking Agro-biodiversity Value Chains, Climate Adaptation and Nutrition: Empowering the Poor to Manage Risk', a project in Guatemala, India and Mali. This aims to manage risk, build resilience and nutrition security through the use of local crops, including neglected and underutilised species (NUS). Partners aim to empower farmers and other 'value chain actors' through agricultural biodiversity in relation to 'Production systems (adaptation, seed conservation and availability)'; 'Food systems (quantity and quality, sustainability, buffering shocks)'; 'Market systems (diversity, technology, buffering shocks)'; and 'Other aspects (culture, empowerment of women and indigenous people)' (p.65). The project promotes approaches that are participatory, multi-stakeholder and multi-sector, while focusing on fostering innovation, knowledge-sharing, capacity-building and advocacy. Findings include the need to address uncertain climate patterns, integrate scientific and local knowledge and design adaptable and context-specific solutions to build resilient livelihoods, food security and greater nutrition.

Jirata et al. (2016) examine different CSA practices being undertaken in Ethiopia and the role these can play in building resilience to climate change, strengthening climate mitigation and increasing agricultural production and productivity. The authors consider the impact these practices have on gender equity, the different stakeholders involved, the policies, strategies and institutions that exist and some of the opportunities and challenges in implementing CSA technologies and approaches. Policies and practices are in place, but a number of environmental, political, institutional and social challenges mean the country still faces extreme drought and food insecurity. Recommendations include greater collaboration between stakeholders working on CSA and food security, greater inclusion of CSA within policies and practices, stronger data collection, greater sharing and awareness of scientific

and indigenous knowledge and upscaling traditional and modern initiatives.

Andersen et al. (2016) use four climate models to consider the effects of climate change on global food supplies, food prices and trade patterns, plus local agricultural crop yields and household resilience in Brazil, Mexico and Peru. At the national level, the impacts are found to be minimal, but the economic impact at household and sectoral level varies depending on a number of factors, including crops cultivated, the variety of income sources at household level, the percentage of gross domestic product contributed by agriculture and reliance on imports/exports, which affects supply and demand. The authors suggest all three countries 'try to maximize the benefits that may come with higher agricultural world market prices and to minimize the losses from reductions in agricultural yields' (p.52). To achieve the former, the authors suggest putting in place policies and investments that support export diversification, market penetration and the development of supply chains and infrastructure to support agricultural change. For the latter, they suggest supporting climate-resilient crops and livestock practices, both of which they suggest are 'no-regrets policies' that will support resilient livelihoods regardless of whether the climate changes (p.52).

In terms of measuring resilience, d'Errico and Di Giuseppe (2016) use the Resilience Index Measurement and Analysis model (FAO, 2013) to measure household capacity to respond to shocks in the context of food security. The key pillars used are income and food access; access to basic services; assets; social safety nets; and adaptive capacity. The results demonstrate that female-headed or large households and households involved in crop activities are less likely to be resilient than those that are educated and have participated in own enterprises. Conflict, weather and wage shortages are likely to result in people remaining in the 'lowest resilience capacity class' (p.26).

Similarly, WFP (2016) carries out a cross-sectoral needs assessment and consolidated livelihood exercise in Timor-Leste. The paper looks at the impact of climate change, and in particular El Niño, on food security, livelihoods and resilience in different areas of the country. In addition to analysing current risk profiles, WFP presents a climate analysis for future trends in rainfall, seasons and crop sustainability in these different areas. The aim is to provide a tool to identify adaptation options, contingency planning and response efforts for El Niño. Recommendations include the use of more climate-sensitive crops, diversification of livelihoods, provision of financial capital to support the purchasing of assets and the scaling-up of existing social protection structures. Also suggested are the

implementation of longitudinal multi-sectoral household assessments and stronger collaboration, coordination and knowledge-sharing between agencies.

Another paper looks at the relationship between food insecurity, hunger, malnutrition and conflict. FAO (2016b) highlights the need to invest in resilience, agriculture and food security in order to support resilient livelihoods, while recognising the impact this will have on peace-building, conflict resolution and post-conflict recovery, which are critical to sustainable development. Illustrations of FAO's work include sustainable practices during conflict to improve nutrition and reduce tensions over food supplies and markets; provision of information to support early risk identification; livelihood rehabilitation and reintegration into agricultural production systems; controlling disease and promoting a conflict-sensitive approach to animal health; mitigating and preventing pastoralist and inter-community cattle-raiding and conflict; sustainable land conflict resolution while supporting IDPs to return to their land; and building resilience amid conflict through NRM and local production. These initiatives could also be seen as 'no-regret' policies if implemented in a context-specific way.

3.4 Financial inclusion and markets

Grey literature on financial inclusion and markets suggests:

- financial service inclusion can help build climate resilience, and can support anticipatory, absorptive and adaptive capacities
- building economic security can help ensure long-term and sustainable development outcomes
- resilient financial sector infrastructure can be achieved through removing regulatory and legal barriers, reducing costs, improving access and enhancing competition, protection and flexibility within the system

'The authors recognise the need for a more conducive enabling environment for these services and a significant investment in technology and infrastructure to support the use of financial services in climate resilience.'

Two papers written under BRACED (Haworth et al., 2016a, 2016b) focus on financial service inclusion to promote climate resilience in Ethiopia, Mali and Myanmar. Mercy Corps (2016b) focuses on market systems development (MSD) and DRR approaches to build economic security and resilience.

Haworth et al. (2016a) highlight the role savings and loans, through microfinance institutions, village savings and loans associations (VSLAs), mobile banking and insurance, can have in terms of helping people prepare for, cope with and respond to disasters. Drawing on experiences through the BRACED programme, the authors identify a number of common barriers to the use, accessibility and provision of these non-traditional financial services, including lack of financial literacy and experience, technological and infrastructure-based issues, policy and regulatory environment challenges (including lack of competition within the sector) and lack of capacity among service providers. They also highlight the need to create an enabling environment for financial inclusion that supports demand and supply (see recommendations below).

Haworth et al. (2016b) look at the availability and use of financial services and how policy-makers can support their development to build climate resilience. They draw on the 3As of resilience: anticipatory, absorptive and adaptive (Bahadur et al., 2015a) to consider how the different financial services support building resilience. The authors recognise the need for a more conducive

Figure 22: The ability of microfinance, VSLAs and mobile banking to address the 3As of resilience

	ANTICIPATORY CAPACITY	ABSORPTIVE CAPACITY	ADAPTIVE CAPACITY
Microfinance		✓	✓
Insurance	✓	✓	✓
VSLAs		✓	✓

Source: Haworth et al. (2016b: 88).

enabling environment for these services and a significant investment in technology and infrastructure to support the use of financial services in climate resilience. They stress that strengthening financial sector infrastructure can be achieved by removing regulatory and legal barriers, reducing costs, improving trust in the banking system, improving physical access for the most vulnerable and enhancing competition, protection and flexibility.

Mercy Corps (2016b) takes a market development approach to climate-informed DRR measures, using case studies from its Managing Risks through Economic Development (M-RED) programming in Nepal and Timor-Leste. This integrates DRR and MSD approaches; accordingly, Mercy Corps aims to build economic security and resilience through multi-stakeholder engagement, to help ensure long-term and sustainable development outcomes. M-RED helps form nexus interventions (which take into account energy, climate change, economic and market development) through an Integrated Disaster and Economic Analysis (IDEA), which involves participatory mapping and data collection, community-level assessments, local and subnational market assessments and analysis of climate trends. Through these, Mercy Corps works with different stakeholders to prepare community action plans, which include ‘mitigation and market plans’, funding and implementation interventions (p.2). The authors highlight that the ‘nexus of MSD and resilience is more than just increased incomes’, and that it is important to measure the differing results of DRR impacts as well as economic outcomes, so as to be able to ‘best measure the overall contribution of this nexus intervention’ (p.5).

3.5 Organisational approaches to support resilience-building

Grey literature on organisational approaches suggests:

- organisational approaches to resilience promote the need for a systems-based approach that takes into account the social, economic, political and environmental context within which it is set
- numerous frameworks take a people-centred approach, which incorporates aspects of inclusion and participation, in order to build resilience effectively and equitably
- greater collaboration is needed between different partners and agencies working on resilience in terms of approach, sharing of lessons learnt, funding and implementation
- drawing on existing networks and social protection systems can help build community resilience to disasters, while also being a mechanism to provide support and aid post-disaster recovery
- systems often involve interdependent factors that can lead to cascading failures if they are not managed effectively

This theme’s papers focus on two areas: organisational approaches to the concept of resilience and organisational initiatives to measure or support resilience in specific contexts or sectors. The first group includes Christian Aid (2016), GFDRR (2016), Mercy Corps (2016a) and the World Energy Commission (WEC) (2016); it also includes examples of integrated approaches to resilience across agencies (Ensor, 2015) and regions (DFID, 2016b; Morchain and Kelsey, 2016). The second group includes Gonzalez-Muzzio and Sandoval (2016) and Murphy et al. (2015), who both look at humanitarian response and resilient behaviours to specific disasters. Bastagli et al. (2016) provide an approach for delivering development programmes and supporting response and recovery through shock-responsive social protection systems. While Bahadur and Doczi (2016) advocate for greater consideration of autonomous innovation in operationalising resilience across the developing world.

First, we look at organisational approaches to enhancing/building resilience. GFDRR (2016)’s Annual Report highlights how its country and thematic programmes are supporting the Sendai Framework, through its five pillars of action: risk identification; risk reduction; preparedness; financial protection; and resilient recovery; and crosscutting themes that include building climate change resilience, gender and social inclusion. Christian Aid (2016)’s new Resilience Framework takes a people-centred, integrated and context-specific approach that cuts across multiple sectors, scales and levels. It builds on four principles: community-led process; power, gender and inclusion; accountability; and do no harm; and seven interconnected programmatic areas to build resilience as an outcome across scales: shifting power relations; climate-resilient agriculture and NRM; inclusive market development; community health; DRR; humanitarian response; and tackling violence, building peace (p.2). Mercy Corps (2016a) also outlines its approach to resilience, focusing on CCA for climate-resilient development, NRM and energy access. The paper highlights how ecosystem services, climate services and reliable energy services are inextricably linked and are needed to support economic prosperity and human well-being. It also stresses a need for long-term, gender-equitable development that responds to the local context and a range of shocks and stresses. Like Christian Aid (2016), Mercy Corps has a systems-based approach that builds partnerships at different scales.

WEC (2016) takes a similar approach from a slightly different angle. Instead of being people-centred, WEC looks at the interdependencies and interrelated risks in the energy-water-food nexus and proposes an integrated systems-based approach to building resilience. While

98% of power currently produced requires water, there is increasing uncertainty about water availability and quality, and lack of clarity around energy infrastructure investment decisions and water governance. WEC recognises that disruptions to the water sector can result in cascading impacts on the energy and food sectors in terms of supply and demand for many years. It calls for a more integrated approach to investments and action to promote resilience across these sectors, in a way that helps promote 'energy security, affordability and sustainability' (p.3).

A number of the papers demonstrate a joined-up approach to resilience across agencies and regions. Ensor (2015) discusses the experiences of Yumi stap redi long, a Vanuatu NGO CCA programme that involves a consortium of agencies working on eight islands across four provinces. Ensor summarises the resilience-building work of the programme in the context of climate change, development and community-based adaptation (CBA). The author recognises the multiple interconnected vulnerabilities of different people and considers issues of power (including gender equality and social inclusion), politics, equitable decision-making, adaptive capacity (which includes access to information and knowledge), resilience and transformation. He suggests a need to take a contextual, equitable and rights-based approach to 'address structural constraints on adaptive capacity' through CBA in order to build resilience (p.5). The rights-based approach requires 'transparency, accountability, equality, participation and empowerment in different' social and political contexts (p.26). Similarly, DFID (2016b) demonstrates the achievements of a joint response to climate change in 15 small island states in the Caribbean. Regional cooperation came through the development of a strategic framework and a Caribbean Regional Resilience Development Implementation Plan, endorsed by the Caribbean Community in 2012. All 15 governments have ownership of the plan, which reflects national priorities; this has enabled them to share knowledge, best practice and tools and support a joint strategy to build resilience to climate change in the region. Regional collaboration has also provided governments with greater incentives to secure funding, build partnerships and ensure accountability.

Morchain and Kelsey (2016) provide lessons from 12 Oxfam country teams on principles in conducting a VRA and subsequent implementation of plans. A VRA is a 'participatory, multi-stakeholder and cross-scalar contextual analysis' that takes into account a range of hazards, vulnerabilities, risks, needs and capacities (p.1). The approach aims to be equitable, while empowering and enhancing collaboration between a range of stakeholders, from the local to the national

level. The authors suggest an effective VRA needs to include structural inequalities and governance issues; suggest pathways for transformational change; feed into existing development plans; be owned by community members and decision-makers; plan for the future; remain flexible and dynamic; and involve regular data collection to assess results. Lessons learnt include the need for strong preparation and facilitation and women and men's equal participation. The authors stress the analysis must incorporate social aspects to address the root causes of vulnerability and to ensure findings are contextual and appropriate for locally driven development.

The rest of this section looks at papers that address organisational initiatives to measure or support resilience in specific contexts or sectors. Murphy et al. (2016) demonstrate the approach of the Linking Preparedness Response and Resilience project, being implemented in emergency contexts in Bangladesh, Colombia, Democratic Republic of Congo, Indonesia, Kenya, Pakistan and the Philippines. They draw on experiences from the Philippines, but future work aims to provide a 'multi-risk, multi-context, globally applicable approach for resilient informed humanitarian response [which] will be developed, piloted and rolled out' across the different countries and regions (p.4). The project focuses on three main areas: humanitarian response, resilience-informed conflict prevention and learning and capacity-building. The authors acknowledge the difficult trade-offs and decisions needed to implement a rapid response as opposed to normal development activities. They thus make recommendations for before crises in terms of DRR and development; immediately after crises in terms of the initial emergency response phase; and during recovery and rehabilitation. A number of these involve common themes, such as addressing the root causes of vulnerability and advocating for change at government level; building community capacity to participate in decision-making and implementation; identifying the most vulnerable and ensuring communication with the community in terms of who will be reached, how and when; promoting community and household savings, cash for work and loan schemes at different stages of the emergency cycle; and prioritising psychosocial support immediately after a disaster and during recovery.

Gonzalez-Muzzio and Sandoval (2016) also look at joint responses and approaches to resilience-building post-disaster. They consider the resilient behaviour, responses and strategies taken by individuals, community-based organisations (CBOs) and the private sector in responding to the 2010 Maule earthquake in Chile. The authors draw on Twigg's Characteristics of a

Disaster-Resilient Community framework for analysis, which focuses on four themes: governance; knowledge and education; risk management and vulnerability reduction; and disaster preparedness and response. The analysis recognises the role communities and the private sector played in responding to the earthquake, as well as that of existing networks, for example in providing psychological support after the disaster. While the authors highlight lack of coordination, accountability and trust in local authorities, they do not identify what interventions or response activities were implemented at this level. The authors call for greater identification of hazards, leadership, education, training and improved and inclusive DRR policies and communication to support disaster resilience.

Bastagli et al. (2016) complement this analysis, looking at shock-responsive social protection systems. They consider the overlaps between social protection and humanitarian assistance, which include resource or cash transfers and the provision of material assistance such as food supplies. The authors consider how social protection can be scaled up to help people respond to shocks, while recognising the different timescales, underlying principles, beneficiary selection and value between what are traditionally social protection transfers and humanitarian transfers. Identifying systems that already exist mean the possibility of building on these approaches, particularly in areas that are geographically isolated and where there is a lack of capacity, funding or resource streams to support people in times of crisis, while also providing an opportunity to deliver emergency assistance. The authors also recognise the challenges of such an approach, including managing the different mandates and collaboration between donors and organisations, as well as acknowledging that additional humanitarian aid will likely be needed to support the most vulnerable.

A final paper advocates for greater consideration of autonomous innovation in operationalising resilience across the developing world (Bahadur and Doczi, 2016). The authors argue that bottom-up, frugal and inclusive models of innovation as encapsulated in concepts such as *jugaad* (the Indian approach to improvisation and innovation) can help unlock resilience for vulnerable communities. They argue recognition of this alternative model is vital because great vulnerability exists in resource-scarce settings where structured and scientific innovation is difficult. They also argue that vulnerable communities are the first responders to most shocks and

that uncertainty induced by climate change will make it impossible to fully prepare for all potential disturbances and leave a high degree of ‘residual risk’. This makes it all the more important to ensure the vulnerable are able to innovate autonomously for enhanced resilience.

3.6 Engagement with post-2015 processes

Grey literature on post-2015 processes suggests:

- while governments may have ratified or supported different agreements, implementation across sectors is still lacking and a number of challenges exist in terms of coordination and alignment
- the goals of the different frameworks cannot be attained in isolation owing to the inter-linkages between them
- synergies on measurement, tracking, reporting and financing need to be agreed and strengthened to reduce the burden on countries and support progress against the different frameworks
- while the articles discuss different post-2015 frameworks for addressing climate change, disaster risk and development, the Sendai Framework is mostly excluded from the papers reviewed, perhaps suggesting it does not have the salience it needs
- ex-ante disaster risk financing offers opportunities to support sustainable development objectives while also supporting disaster resilience

Four of the articles reviewed engage directly in the post-2015 processes in terms of climate change, development, DRR and resilience (Benson, 2016; FAO, 2016c; GFDRR, 2016; Horn-Phathanothai, 2016). These identify synergies in terms of funding and implementation to support the integration and alignment of these different frameworks. A number of articles under agriculture, livelihoods and food security also reflect on the post-2015 policy landscape (FAO, 2016a, 2016b; Jirata et al., 2016), thereby providing useful insights into how sectors are approaching these different frameworks.

FAO (2016c) focuses on the Paris outcomes and SDG 15.³ It highlights the outcomes of the Third Land and Water Days meeting held at FAO in November 2015, covering three main themes: land and water governance; integrated land and water management approaches; and climate change, risks and resilience. FAO considers some of the different approaches, tools and frameworks used and challenges for each theme. Priority was given

3. ‘Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss’ (<https://sustainabledevelopment.un.org/?menu=1300>).

to water scarcity, land degradation, agriculture, food security and nutrition in the face of climate change. Recommendations include the need for a people-centred approach to building resilience across scales, drawing on different assessments, mapping and tools. FAO also highlights the need to manage different trade-offs, building on existing synergies across a range of sectors and scales. Interestingly, the Sendai Framework is not mentioned in this document, despite these approaches being useful to support environmental resilience.

GFDRR, however, was set up to support the Hyogo Framework for Action 2005–2015, and this Annual Report (GFDRR, 2016) highlights how it aims to continue to engage and support the Sendai Framework. It points to GFDRR's engagement at the World Conference for Disaster Risk Reduction to support this process, as well as how GFDRR is continuing to support the Sendai Framework: 85 of 91 key activities highlighted in the Priorities for Action of the new framework are incorporated within GFDRR's programme of work (outlined in the approaches to resilience section).

Horn-Phathanothai (2016) and Benson (2016) look at options in aligning the different frameworks. Horn-Phathanothai (2016) looks at how to bridge development goals and climate action. The author highlights some of the challenges and requirements in aligning and implementing the SDGs and the Paris climate change agreements, calling for a 'profound transformation of national economies' and a new mind-set that aligns the two frameworks, rather than implementing them in a fragmented fashion (p.80). The frameworks cannot be achieved in isolation, given the inter-linkages between them, in terms of both the impacts climate change and development have on each other and people's ability to respond to risk. The author suggests measurement, tracking, reporting and financing

'The frameworks cannot be achieved in isolation, given the inter-linkages between them, in terms of both the impacts climate change and development have on each other and people's ability to respond to risk.'

across the two frameworks needs to be integrated and tensions/trade-offs agreed, to minimise the burden on and increase the capacity of those implementing the different goals and targets. Again, the Sendai Framework does not figure in the analysis.

Conversely, Benson (2016) looks at promoting sustainable development through DRM. She notes disasters can reverse years of development gains, while also acknowledging that the post-2015 process for disasters – Sendai and the SDGs – provides an opportunity to build resilience and progress towards sustainable development. The paper focuses on DRM financing, which needs to include financing for DRR, disaster relief, early recovery and reconstruction. Benson acknowledges a lack of data on DRM financing and considers some of the gaps in expenditure. Meanwhile, politicians' short political terms mean they often do not prioritise long-term indirect gains, and there is usually limited funding for post-disaster response. The author argues ex-ante disaster risk financing offers opportunities to support sustainable development and at the same time disaster resilience, and highlights a need to incentivise investment in DRM in order to achieve 'no-regret' interventions.

With regards to agriculture and food security, a number of the articles reflect on the post-2015 policy landscape. FAO (2016a) demonstrates the importance of action now in order to help meet the SDG aim of reducing hunger and helping people achieve food security and good nutrition in the face of climate change by 2030. The paper also highlights the roles that INDCs and the NAPs for COP21 can play in integrating food security as a key objective in different governments' future plans, as well as in terms of supporting regional and international cooperation. Jirata et al. (2016) note there are a number of policies and strategies in place to support agriculture in the face of climate change at the national level, including through ratification of the Paris agreement. Nevertheless, the authors highlight how many of these policies are yet to be implemented or mainstreamed across sectors, and a number of coordination challenges between different stakeholders may 'lead to duplication of efforts and inefficiencies in project implementation' (p.35). Finally, FAO (2016b) refers to the opportunity the SDGs provide in terms of collaborative approaches to eradicate poverty and hunger and support sustainable livelihoods, food security, conflict prevention and peace-building efforts – thereby supporting a number of the different SDGs and their targets.

4. Review of resilience in the academic literature

Thirty-five peer-reviewed papers were retained for full analysis, from which five dominant thematic clusters emerged, centred on defining resilience; measuring vulnerability and resilience; indigenous knowledge (IK) and participation; equity, justice, and power; and social capital.

4.1 Defining resilience

Academic literature on defining resilience suggests:

- resilience definitions must be explicit about how change and recovery are defined, as societies undergo constant change and returning to a 'normal' state post-disaster can be maladaptive or undesirable
- urban resilience has not been consistently defined; tensions between approaches demonstrate that municipalities need to improve policy by considering the basic questions: resilience for whom, what, where, when and why?
- there is a danger that resilience language can be used to diffuse responsibility for hazard management

The debate over definitions of resilience is still evolving. The term's popularity owes partly to its flexibility and interdisciplinary nature, but the divergent ways it is understood can cause challenges. Four papers reveal some tensions in the interchangeable uses between ecology and social science, highlighting how definitions come with disciplinary baggage and conceptual limitations. One paper argues the term 'resilience' can even be used to advance a political agenda, shifting responsibility for hazard management away from governments (Rinne and Nygren, 2016). An accurate lexicon, or at least an explicit one, has implications for the way resilience policies play out on the ground.

Two papers caution against the 'disciplinary blinkers' that unclear definitions of resilience can foster (Kelman et al., 2016). One from a conservation biology perspective (Fisichelli et al., 2016) argues that using the term 'resilience' can impede progress in CCA: a resilience strategy in a national park would aim to preserve and maintain the historic state of the ecosystem in the face of disturbances; for administrative planners, this definition of resilience implies resisting

change, which is in direct contradiction with definitions that promote reorganising and transforming a system in response to climate change. The authors clarify that both outcomes may be positive in different circumstances, but using the same term leaves room for maladaptive practices. Resilience strategies must be clear about how they treat change – whether this means resisting, accommodating or directing it.

Kelman et al. (2016) support Fisichelli et al. while unpicking climate change-centric definitions of vulnerability and resilience. They question the universal application of definitions of resilience anchored in ecology, showcasing the widely used 2013 characterisation of resilience as 'the capacity of a social-ecological system to cope with a hazardous event or disturbance, responding or reorganizing in ways that maintain its essential function, identity, and structure, while also maintaining the capacity for adaptation, learning and transformation' (p.23). The authors ask why a society that is constantly changing should attempt to maintain 'essential function', especially if this includes discrimination and human rights violations. They argue that, more than returning to an arbitrary 'normal state', addressing resilience and vulnerability requires learning from history, past work and wider contexts, so as to consider the broader implications of resilience-building interventions.

Hazy definitions are found across other applications of resilience. Meerow et al. (2016) investigate urban resilience through a bibliometric analysis of academic literature. They argue that it has been inconsistently defined, with six points of tension: 1) the definition of urban; 2) understandings of system equilibrium; 3) positive or neutral conceptualisations of resilience; 4) mechanisms for system change; 5) whether resilience refers to adaptation

'Resilience strategies must be clear about how they treat change – whether this means resisting, accommodating or directing it.'

or general adaptability; and 6) timescales of action. The analysis on Point 2 echoes Kelman et al.'s arguments about a society having no real point of reference for normal; Meerow et al. explain that cities undergo constant change and have no stable state. They reiterate that resilience is an opportunity to bridge disciplines, but its definitions need to address these six tensions and answer: Resilience for whom, what, when, where, and why?

Rinne and Nygren (2016) advance a different take based on empirical analysis of media reporting of flooding in Tabasco, Mexico. The media had framed flood control and resilience conventionally, as a technocentric issue requiring the construction of dams, dykes and canals. By 2003, under a new flood governance programme, the discourse had begun shifting towards cultural adaptation and social resilience, in which citizens had civic responsibility to adapt to floods. The authors argue little attention was paid to why some groups were more vulnerable than others, or whether relocation of the poor away from flood-prone zones had a profit motive (such settlements were located close to renovated city centres). The authors argue resilience concepts that advance 'integrated governance' between civil society, individuals and governments diffuse the responsibility of managing flood risks.

4.2 Measuring vulnerability and resilience

Academic literature on measuring vulnerability and resilience suggests:

- vulnerability assessments are important inputs for resilience planning, but must integrate indicators of ecological and social systems
- quantification of vulnerability and resilience often neglects intra-household factors and social structures
- empirical research on social capital has diverse conclusions; some papers highlight the importance of social capital; others demonstrate empirically that it is employed to cope with shocks but has limited impact on resilience outcomes
- research suggests wealthy households are better able to recover from shocks regardless of the coping strategies they adopt
- efforts to measure vulnerability should consider how trade flows pass on and disburse the impacts of shocks, as macro-level disruptions can have serious consequences for household-level food security

Without better understanding of the contextual factors that impact people's resilience, evidence-based policy remains out of reach. However, building on a trend in all four 2015 resilience scans, nine papers look at resilience measurement. Two use a more critical lens and flag issues related to indices (Nguyen et al. 2016; Turner, 2016). One proposes a comprehensive

framework to test resilience across contexts (Béné et al., 2016), and five test out novel vulnerability indices and measurement tools specific to urban- or country-level assessments (Adelekan and Asiyambi, 2016; Dumenu and Obeng, 2016; Hung et al., 2016; Jarzeski et al., 2016; Kotzee et al., 2016). One broadens measurement approaches by focusing on trade system resilience, developing a predictive model to understand national-level exposure, sensitivity and adaptive capacity to food production shocks (Gephart et al., 2016).

As demand for assessments increases, Nguyen et al. (2016)'s review of approaches to measure coastal vulnerability to climate change concludes they are not always suited to developing policy solutions. Measuring vulnerability is important but few tools have been validated against observed changes, and they produce inconsistent outcomes depending on the indicators. They make a case for integrated approaches that combine social and biophysical factors, to move indices closer to building forward-looking models that can track and predict vulnerability to climate change. Jarzeski et al. (2016) also quantify resilience in ecological and social systems. They use their assessment to evaluate the success of a forest management project rather than diagnosing the resilience of an entire community. The authors unpick the relationship between levels of resilience and acquired levels of economic, sociocultural and natural capital. They find that, for households participating in the project, natural capital was enhanced the most and economic capital remained the least changed. The authors attempt to situate these capitals within a 'basin of attraction' – a concept borrowed from ecological resilience that denotes a favourable and stable condition. When a basin of attraction is destabilised, transformation can occur. The authors do not determine thresholds for these changes, but note that the theory can help in exploring possibilities for transformation.

One paper pilots a sophisticated resilience framework to explore mechanisms that impact resilience across four countries. Béné et al. (2016) test their hypothesis that access to basic services and assets matters in dealing with shocks but subjective perceptions and coping strategies are equally important. Their framework comprises a shock and stressor inventory; a household characteristics and well-being assessment; a household response typology; and an outcome analysis. The latter represents the difference from other vulnerability assessments: the framework tracks the direct impacts of shocks but also combines this with individuals and households' responses. The empirical findings are occasionally surprising. Nationality is more important in how people respond to shocks than wealth: people from the same country adopt similar coping strategies. Wealthy households are also better able to bounce back



regardless of the coping strategy they adopt. The analysis did not yield a positive statistical correlation between key social capital indicators and household resilience, calling into question the theoretical links here. Relying on social networks is a prominent coping mechanism across cultures, but not one that enhances resilience outcomes. Finally, the authors emphasise that cumulative and continuous effects of shocks and stresses make it difficult to disaggregate the impacts of any single shock, and suggest a state of ‘full recovery’ may not exist.

Other vulnerability assessments hone in on specific threats to understand the drivers of community resilience. Kotzee et al. (2016) create a composite index to measure the resilience of a system to a flood. Unlike Béné et al., they find social resilience is the most significant indicator of flood resilience (Béné et al. find intangible factors like social capital relevant but conclude they are not correlated with household resilience outcomes). Hung et al. (2016) put less emphasis on social capital. They develop a tool to measure urban resilience, the Climatic Hazard Resilience Indicators for Localities, overlaying the results with GIS mapping to examine the relationship between local development patterns and resilience factors. The tool includes information on demography, urban development, access to emergency services, land use policies and informal settlements. After applying it in Taichut, Taiwan, the authors conclude

that the least resilient villages are those significantly closer to rivers and with higher population density, more informal settlements and a greater elderly population. In a case study of Lagos, Nigeria, Adelekan and Asiyanbi (2016) also attempt to measure vulnerability to flood risks. Rather than using an index, they use self-reported vulnerability assessments to better understand public perceptions of hazards. The study finds that, after risk of crime and robbery, flood risks are perceived as the foremost urban threat, and a third of respondents are located within 30 m of a source of flood hazard. The authors argue that information on flood risk is inadequate, and decision-makers need to consider public perceptions when formulating DRR policy.

Dumenu and Obeng (2016) design a vulnerability index to identify subnational mitigation and adaptation needs in Ghana. The model combines ‘impacts’, or biophysical factors; ‘adaptation’, or coping strategies; and ‘social vulnerability’, or characteristics of an individual/household that make it more able to deal with shocks. The index is primarily descriptive, though its results show coping and adaptation strategies vary from one ecological zone to the next. The authors argue this shows the importance of local-level vulnerability assessments and the need for highly localised climate policies.

One paper is markedly different in measuring vulnerability and resilience. Rather than tracking how

shocks affect people, Gephart et al. (2016) focus on impacts on trade flows and food security. They develop a forward shock propagation model to quantify how shock scenarios affect global seafood trade flows. Using Allison et al. (2009)'s vulnerability framework, which defines exposure, sensitivity and adaptive capacity as three components of vulnerability, they show that, in region terms, Central and West Africa are the most vulnerable: they are highly exposed, are sensitive to shocks (have high nutritional fish dependency) and have less ability to diversify food sources. The authors highlight the potential of aquaculture development to reduce exposure, and argue for the design of models of economic impacts of disasters to consider how trade flows pass on and distribute shocks.

Turner (2016) focuses on dimensions of climate vulnerability that indices and simple measurement tools do not capture. The study draws on data on wealth trajectories in western Niger in 1984–1994 to understand the role of social relationships in shaping vulnerability. Turner argues wealth has different obligations and entitlements depending on the wealth holder, and questions the notion that an individual's vulnerability tracks the vulnerability of the group it belongs to. He focuses on women's livestock wealth and gains over the time period, arguing that women's holdings are separate to those of their husbands and are also more vulnerable to drought – a fact a household wealth or vulnerability index would obscure. A single wealth number cannot adequately describe the vulnerability and diverse entitlements within a household, and qualitative investigation of social relationships and intra-household dynamics is crucial to understand who is resilient, and why.

4.3 Indigenous knowledge and participation

Academic literature on IK and participation defining resilience suggests:

- IK has no dominant narrative, with a multitude of approaches towards NRM
- successful ecosystem management must be inclusive and participatory
- IK and scientific knowledge are distinct but can be complementary for programming
- IK and resilience approaches can be used to address uncertainty and complexity
- highly centralised or top-down DRR legislation neglects opportunities to use communities as a resource for more effective early warning and hazard management

Most papers examining how IK contributes to understandings of resilience advocate for greater inclusion of marginalised groups in planning. Scientific logic and local observations are not interchangeable, but the two can be complementary in managing resilient

ecosystems. For example, IK can be used to safeguard national protected areas (Lin & Liu, 2016), supplement data collection efforts (Yeh, 2016) and improve land use planning (Hooli, 2016). Importantly, IK is not homogenous, and policy-makers must consider the perspectives of all groups when planning.

Two papers investigate the value of IK for resilience and climate change planning. Yeh (2016) argues for more nuanced understandings of traditional knowledge. In research on local observations of climate change in Tibet, she found inconsistencies in interpretations of climate between different communities, as well as direct contradictions between local knowledge and scientific logic. She urges experts to engage with the perceptions and experiences of local people, keeping in mind that their IK is derived from a process of practical engagement with their surroundings. Hooli (2016), on the coping strategies of the flood-affected poor in Namibia, reiterates this, asserting that IK should be an inherent part of resilience-building. He confirms IK is not monolithic: different people have different ideas, as IK is accumulated through people's observations, behaviours and worldviews. From a resilience perspective, IK can help address uncertainty and complexity. In Namibia, local authorities used IK in land use planning to better understand how to mitigate against local weather extremes.

The importance of broad participation in environmental conservation features in two papers. One argues community-based natural resource management (CBNRM) initiatives are one method of marrying IK with science-based sustainability concepts. The other advocates for greater stakeholder collaboration to apply REDD+ to coastal mangrove forest conservation. Lin and Liu (2016) trace the implementation of a national park in Taiwan. The first phase was successful, primarily because CBNRM planning prioritised local knowledge and tourism was limited. As the park became more popular, however, tensions arose among indigenous groups; local knowledge was presented as homogenous when in fact there existed a plurality of NRM approaches. The Taiwan experience provides a lesson on the importance of inclusive co-management of ecosystems. Similarly, Ahmed and Glaser (2016) investigate the applicability of REDD+ to mangrove conservation and advise that all major stakeholders work together: coastal communities, researchers, government, NGOs and international agencies. Using collective learning platforms, these diverse groups can restore and sustainably manage the 'blue carbon sinks' that mangroves provide and ensure the expansion of aquaculture does not compromise the resilience of coastal communities.

IK can also ensure the sustainability of agricultural endeavours in sensitive ecosystems. Takahashi and Liang (2016) look at the role forests play in supporting

food security and local livelihoods. Terraced rice cultivators have integrated forest management practices directly into their agricultural practices, benefiting from sustainable water supply and protection from landslides. Similarly, tea grown under the forest canopy has been more profitable and sustainable than that from modern tea terraces. With agricultural expansion and forest conservation often seen as binaries, the paper demonstrates that IK can play a role in ensuring the resilience and sustainability of food systems.

Two papers point to the vital importance of broad participation in DRR processes and policy. Cools et al. (2016) highlight the role local knowledge can play in EWS. In Egypt and Mali, local communities provided field observations on historic flooding intensity and duration. In Belgium, local knowledge was used to adjust ‘threat’ thresholds. In turn, the EWS can be used in building hazard management capacities, raising awareness on climate adaptation measures and protecting the environment. Meanwhile, failure to incorporate local knowledge or participatory processes can undermine the long-term success of resilience and DRR policy. Mavhura (2016) reviews disaster legislation in Zimbabwe using the Hyogo Framework, and contends that the law falls short of building national and community resilience. He lists the law’s primary weaknesses: 1) inactive community participation; 2) centralisation of power and resources; and 3) a focus on hazards rather than vulnerability. The legislation is heavily top-down, making it difficult for communities to proactively participate and contribute to DRR knowledge and management. Although the paper focuses on Zimbabwe, the lessons about institutionalising stronger local participation in disaster and resilience planning apply to wider contexts.

4.4 Equity, justice and power

Academic literature on equity, justice, and power suggests:

- researchers call for more emphasis on equity in urban climate change adaptation planning
- entrenched institutional alliances can compromise broader participation in adaptation planning
- private sector initiatives can have negative or perceived positive impacts on the resilience of the poorest, depending on livelihood opportunities and ecological impacts
- technical approaches to tackling climate change foster ‘conceptual blind spots’ about human agency; inciting transformational change requires engaging with directly politics
- strong leadership is not sufficient to prevent ecosystem degradation around city hinterlands; politicians need better knowledge on the interconnections between social and ecological systems

Resilience and adaptation planning needs to ensure the poor are adequately equipped to deal with shocks and stresses. Seven papers explore issues of equity, justice and power in resilience planning, highlighting cases when ignoring political and economic realities has resulted in the poor losing out. The research calls for greater participation in decision-making forums for all groups, though Shi et al. (2016) caution that participation alone without broader reforms is not sufficient to achieve change.

Urban climate adaptation is high on the policy agenda, and two papers attempt to reorient the debate to address issues of power and equity in CCA. Shi et al. (2016) argue that integrating justice into infrastructure and design processes is vital to prevent planners from prioritising technical solutions to climate change challenges over badly needed social, economic and political reforms. Simultaneously, they push for efforts to strengthen the financial and technical capacities of municipal governments to ensure cities can rise to the challenges CCA poses. The authors raise an important point about the need for participatory processes in adaptation planning, cautioning that, without broader reforms, this common policy recommendation is not a panacea.

Research on urban ecosystem-based adaptation focuses primarily on ecological structures and functions that can bring adaptation benefits to a city. In a review of the literature, Brink et al. (2016) shift the narrative to highlight equity and stakeholder participation in ecosystem-based adaptation issues. They define three challenges for research: 1) a large amount of isolated case studies do not place ecosystem-based adaptation in the socioeconomic context; 2) normative aspects, such as who the winners and losers are, are neglected; and 3) there is a need to consider the role of ecosystem-based adaptation in transformative adaptation. The authors advocate for interdisciplinary research that asks who should take action and how society can sustain ecosystems that provide equitable benefits, instead of a continual focus on ecological structures and adaptation benefits.

Chu (2016) considers the power dynamics in municipal adaptation planning for Surat, India. The paper examines the city’s experience of engagement with the Asian Cities Climate Change Resilience Network to understand how adaptation needs were prioritised. In spite of a high-profile international programme that introduced a rigid CCA planning formula, Chu argues that adaptation choices were conceived and institutionalised between the urban political and private capitalist classes, and the city harnessed networks of private actors to devolve responsibilities for creating local adaptation strategies. This allowed for private

‘Integrating justice into infrastructure and design processes is vital to prevent planners from prioritising technical solutions to climate change challenges over badly needed social, economic and political reforms.’

sector innovation but excluded poor and disadvantaged communities from participating in planning. This study speaks to the difficulty of introducing truly participatory adaptation planning in a setting of entrenched institutional alliances.

Two studies examine the equity impacts of large commercial initiatives in areas where communities are highly natural resource-dependent. Orchard et al. (2016) examine the distributional implications of large-scale intensive aquaculture, a major driver of mangrove deforestation, in Vietnam. Wealthy households enjoyed secure mangrove tenure rights and high incomes so the loss of mangroves had little direct impact. For the poorest households, though, mangrove services were the most important safety net in the face of economic shocks. Issues of power mediated access, and respondents claimed local authorities had little concern for them or their environment. The study advocates for more transparent and participatory governance of aquaculture initiatives to take into account impacts on marginalised people. In a similar analysis, Bleyer et al. (2016) explore the impact of commercial forest plantations on traditional rural livelihoods in Mozambique. Unlike Orchard et al, they do not find clear negative livelihood trajectories as a result of the commercial plantations. People feel the plantations have increased alternative livelihood options and improved infrastructure. As a result, most households feel they have had a positive or no net effect on their overall well-being – the exception being households relocated as a result of the establishment of the plantation. The two papers demonstrate the context-specific nature of resilience and contrast the ways in which commercial ventures can support or undermine it. Both studies emphasise the vital nature of local-level consultations to consider impacts on poor people.

Cash (2016) tests the notion that strong political leadership and good governance are key to sustainable urban transitions. Looking at urban South Africa and Canada, Cash reveals that the primary threat to the ecosystems that underpinned the resilience of urban

areas were property development or resource extraction. Governments were swayed by the private sector’s promises of economic development, which continually took precedence over environmental sustainability goals. In this context, ‘strong political leadership’ was not sufficient to protect critical ecosystems. Conditions such as sufficient economic resources, a robust legal structure, adequate knowledge of the interconnections between social-ecological systems and a long time scale (i.e. not in a state of environmental crisis) were all important in preventing ecosystem degradation.

Finally, questions of power and justice in resilience resonate with the concept of transformational change. Gillard et al. (2016) argue that the current focus on sociotechnical transitions and socio-ecological resilience for climate change describes system processes through a technocentric or eco-centric lens, omitting social theory insights on human agency. The authors find this creates ‘conceptual blind spots’ about human agency, and ultimately results in a reformist rather than a radical response to climate change. To move beyond unambitious technical and behavioural solutions, Gillard et al. advocate for directly challenging the institutional and political inertia of societies and bringing a stronger focus on social theory in technical climate change research.

4.5 Social capital

Academic literature on social capital suggests:

- empirical research shows social capital is not necessarily linked to adaptation or resilience benefits at the household level
- yet relying on social capital is consistently cited as an important coping strategy in the aftermath of a shock or stress
- displacement can disrupt social capital networks and result in lower resilience in the long term
- the least resilient are not always the poorest; a ‘vulnerable middle’ that does not qualify for external assistance can be more dependent on social capital and informal networks to withstand shocks and stresses

Social capital is a crosscutting issue in multiple academic literature themes. In the first quarter of 2016, new empirical research shed light on the role of social capital in enhancing resilience, showing the links between social capital and resilience are not as empirically strong as conceptual frameworks often hypothesise. Nevertheless, social capital plays an important part in supporting people to cope with disturbances; in cases of migration and displacement, this is all the more salient.

The role of social capital is most often explored at the community or household level. Andrew et al. (2016) bring a fresh angle, examining how it plays out between organisations and how this affects their resilience. Using interviews with organisations responding to Thailand's floods in 2011, they test two competing theories about how organisational resilience is achieved: the bonding hypothesis posits that organisational resilience is achieved when organisations work closely with others; the bridging hypothesis advocates for an organisation to position itself as a central actor in a network to gain access to novel resources. Andrew et al. find organisational resiliency is associated with the bridging effect. Although bonding structures promote group cohesiveness, they put too much stress on organisations. Bridging allows organisations to collaborate strategically and gain access to a wide range of additional resources.

At the household level, three studies explore the relationship between social capital and resilience. In a study of adaptation behaviours in rural Ethiopia, Paul et al. (2016) challenge the adaptation benefits of social capital. Although resilience frameworks often theorise that the ability of households to adapt is contingent on access to livelihoods capitals, including social capital, Paul et al. found social capital did not encourage households to adopt private household-level behaviours. Social capital was associated with increased cooperative outcomes, but simultaneously with reduced private household-level adaptation. This finding is in line with Béné et al. (2016)'s empirical study, which found social capital was important for coping after a shock or stress but played no role in enhancing resilience outcomes (see measuring vulnerability and resilience).

Another paper contends that social capital is a coping mechanism primarily in the aftermath of a disaster, filling a role that states and markets fail to play. Branching away from research focused on the resilience of the poorest, Engel (2016), on the Chilean earthquake in 2010, found the disaster resulted in what she coins a 'vulnerable middle'. The households that were least resilient and had limited access to assistance were part of an emergent middle. This middle hovered just above the poverty line, not poor enough to qualify for poverty reduction schemes but with insufficient resources to climb the socioeconomic ladder. Without



Children at Jinja station, Uganda. Photo: US Army Africa, 2010.

outside assistance, and with less visible grievances than the poorest, this middle had to rely heavily on informal social networks to cope.

Though social capital may not be key for enabling adaptation, its absence for migrants can have implications for long-term resilience outcomes. Tilt and Gerkey (2016) argue that population displacement along China's Mekong River had adverse effects on social support networks for agricultural households. Up to 20 years after displacement, they experienced lower levels of agriculture labour exchange, a traditional practice of reciprocity among farmers. Resettled households also had reduced landholdings and access to natural capital, and higher economic disparity. The authors argue that resettlement's effect on social capital can be lasting and outpace communities' ability to adapt. Also on migration, Islam and Hasan (2016) found displacement was linked to high levels of vulnerability. Their empirical study of how households fared after being displaced by Cyclone Aila in Bangladesh demonstrated that the poor were more likely to be displaced, as they lacked safety nets and needed to replace income and assets immediately. Migration was an important strategy to try to replace lost livelihoods – but, as Tilt and Gerkey (2016) demonstrate, can have long-term implications for social capital. The authors advocate for better integration of livelihood options, such as food for work programmes or cash transfers, in the aftermath of disaster events.

5. Understanding the characteristics of resilience

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

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:

- Measuring social and biophysical vulnerability together is essential to informing CCA planning.
- To understand social vulnerability indices, decision-makers need to be aware of the factors being tracked. The choice of social indicators has a large impact on vulnerability assessment outcomes.
- Across the grey literature, there is a strong focus on gender-sensitive approaches for understanding and building gender equality through resilience projects.
- In relation to food security, nutrition and resilient agricultural systems, we need a more dynamic understanding of resilience, including analysis of the main drivers of change over time.
- Learning and feedback loops are essential to reflect on ways of obtaining knowledge and to ensure flexibility within project planning and implementation.

Measuring risk, vulnerability and capacity is essential in projects, programmes and approaches to building resilience, as based on the need to assess, learn and ensure feedback loops on the strengths, weakness and progress of any intervention. Awareness is a characteristic demonstrated in eight of the papers in the grey literature. For instance, GFDRR (2016) reflects

on its ways of working and its flexibility in responding to changing circumstances or new objectives, such as support to the Sendai Framework. Morchain and Kelsey (2016) demonstrate methods of information-gathering through VRA, which provides a participatory, inclusive, multi-stakeholder, multi-hazard and cross-scale analysis of vulnerability and risk, drawing on lessons from 12 Oxfam country teams. One paper (Friend et al., 2016a) demonstrates lack of awareness: the authors recognise that urban planning in Thailand depends mostly on past urban planning decisions, investment and infrastructure, as opposed to flexible forward-looking plans that use assessments to consider a multitude of risks.

The academic literature also covers aspects of measuring and assessing risk, vulnerability and capacities. Nine papers develop tools and approaches for measuring vulnerability to increase awareness of factors that undermine resilience, in urban areas, various subnational ecosystems and coastal communities. Nguyen et al. (2016) and Jarzebski et al. (2016) stress that robust assessments must cover biophysical and socioeconomic vulnerability to create a holistic understanding of resilience. Measuring social aspects of vulnerability is challenging, however; Nguyen et al. (2016) argue that choice of social indicators has a huge impact on assessment results and there is little consistency between different approaches. This cast doubts on the role resilience assessments play in increasing awareness; ultimately, decision-makers should also be aware of the indicators and factors being tracked. Turner (2016) argues for taking into account an additional dimension of assessing vulnerability: intra-household dynamics and social relationships. Awareness of the changing nature of these relationships, and the differences in vulnerabilities within households, is key to generating an accurate picture of the drivers of resilience across different contexts.

Three papers in the grey literature assess the extent to which gender-sensitive approaches are incorporated within climate change and resilience work at different levels (Bryan et al., 2016; Kawarazuka et al., 2016; le Masson, 2016). Through analysis of new information, the authors assess gaps and challenges as well as methods and approaches to building gender equality

through resilience projects. For instance, Bryan et al. (2016) use a survey and interviews to assess knowledge, attitudes, practices, policy and advocacy on gender equality. Their best practice recommendations are based on the approaches of seven NGOs and include gender integration in CCA programmes.

Similarly, le Masson (2016) shares best practice and a set of recommendations for NGOs, donors and those carrying out action research related to gender equality and resilience-building. Her analysis reflects on discussions between NGOs, researchers and donors during a Writeshop, during which participants examined different approaches to integrating gender and social equality in resilience-building efforts. This approach further demonstrates characteristics of awareness, learning and feedback loops. Meanwhile, Kawarazuka et al. (2016) bring together analysis of socio-ecological resilience and gender analysis. This approach allows them to assess the strengths and weaknesses of the two approaches, while also reflecting on the trade-offs and tensions in achieving an integrated approach.

All three of these papers highlight the need to collect data disaggregated by sex to feed into the monitoring and evaluation. This demonstrates awareness of the different vulnerability, skills and capacities between different groups, which decision-making and implementation need to consider.

5.2 Diversity

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

Key messages:

- The diversity of skills, knowledge and practices people use to respond to climate change and disasters should be built on to strengthen resilience-building initiatives.
- Social protection systems can be used both to build people's capacity to prepare for a disaster before it strikes and as a means to distribute humanitarian assistance and aid following a shock.
- Financial service inclusion can help people prepare for, cope with and respond to a range of situations by enhancing their capacity to deal with shocks and stresses, thereby promoting resilience.
- Migration is a coping strategy applied by households that lack diversity or alternatives that allow them to continue their livelihoods in the aftermath of a disaster.

‘Within the grey literature, a number of the papers look at the diversity of skills, knowledge and practices people use to respond to climate change and disasters.’

- Empirical research found that capacity to recover from shocks was not related to the type of coping strategy employed. Households' choice of coping strategies was influenced more by nationality and culture than by wealth.

‘Diversity’ is a characteristic that is implicitly addressed in the academic literature through studies of various coping strategies in the face of shocks and stresses. In Béné et al. (2016)'s study of coastal communities in four countries, households adopted a portfolio of coping strategies, rarely relying on a single one. Successful resilience outcomes were not dependent on the type of strategy, disproving the hypothesis that capacity to recover is a result of this. Looking at the aftermath of Cyclone Aila in Bangladesh, Islam and Hasan (2016) find communities employ migration as a coping strategy only when they lack diversity. Poor households migrated after the cyclone but only because they lacked access to safety nets or other strategies that would allow them to continue their livelihoods. Where not many coping strategies are available to households, the authors argue for including livelihood options in post-disaster recovery policies, such as cash transfers, food for work and interest-free loan services. In the event of a disaster, lack of diversity requires targeted responses.

Within the grey literature, a number of the papers look at the diversity of skills, knowledge and practices people use to respond to climate change and disasters. Andersen et al. (2016) reflect on the different needs, skills and capacities of women and the role they can play in building resilience to climate change. Similarly, Gonzalez-Muzzio and Sandoval (2016) look at the diverse coping strategies, resilience response behaviours and DRR strategies taken by individuals, CBOs, local businesses and national companies in responding to the 2010 Maule earthquake. Even without major support from the government, numerous strategies were taken and partnerships were formed to respond to the disaster; initiatives included provision of psychological support after the event, public awareness-raising and use of environmental services for livelihood coping strategies.

Bastagli et al. (2016) consider the diverse responses and capabilities provided through shock-responsive social protection systems, both pre- and post-disaster. They recognise the ability of these systems to provide social protection and humanitarian assistance in a range of circumstances, thereby bridging development and humanitarian work, while supporting people to function even after a disruption. Similarly, Haworth et al. (2016a, 2016b) demonstrate the role financial service inclusion can play in building people's resilience. The authors acknowledge that saving and borrowing can help people prepare for, cope with and respond to a range of situations by enhancing their capacity to deal with shocks and stresses, thereby promoting climate-resilience.

FAO (2016b) takes a different approach, demonstrating diversity through the need to invest in resilience, agriculture and food security in order to support rural livelihoods, peace-building and post-conflict recovery. There is a range of interrelated pathways to support rural livelihoods and conflict resolution along with efforts to ensure sustainable development in the face of shocks.

5.3 Self-regulation

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

Key messages:

- Self-regulation does not feature prominently in the literature, though concepts borrowed from ecology refer to the self-regulating nature of a resilient system.
- Interdependencies within infrastructure, services and systems can lead to cascading disruptions. Lack of self-regulation within these systems can have multi-scalar, long-term implications.
- It is important to support agro-ecosystems to deal with shocks and stresses without resulting in extreme malfunction or cascading impacts, so as to support climate-resilient livelihoods and sustainable agricultural systems.

The grey literature views self-regulation through the interdependencies within systems, demonstrating a dependence and overreliance on parts within these, leading to cascading disruptions. For instance, Friend et al. (2016b) consider the interdependencies of infrastructure, services and systems, such as water,

food, energy, transport and communications, on which both cities and people rely. They claim the 'cascading systemic impacts' of disruptions can be felt locally and globally, such as through changes in global food prices (p.1). They recommend better assessments of these systems, as well as building in mechanisms so they can continue to support people or self-regulate, despite shocks and stresses. Similarly, WEC (2016) considers the need for integrated coordination and governance in the energy-water-food nexus to manage the cascading impacts and overreliance of different systems on each other. WEC provides recommendations, including the promotion of resilient infrastructure to support these different services, particularly in the face of increasing uncertainty about their availability, quality, use and pricing.

FAO (2016a) also considers cascading impacts, first, in terms of those of climate change on agro-ecosystems, food security, nutrition, agricultural production and vulnerability; and second, on the need to understand the 'complex, cascading, multidimensional and multiscale nature of vulnerabilities', which it stresses is key to building resilience (p.27). FAO consequently considers the need to support agro-ecosystems to deal with anomalous situations without extreme malfunction so as to support climate-resilient livelihoods and sustainable agricultural systems.

The academic literature does not reflect the characteristic of self-regulation, though Jarzebski et al. (2016) examine the conceptual overlaps between ecological and community resilience. They borrow the idea of 'basins of attraction' from ecology, using it to describe a point of equilibrium and stability in a socio-ecological system. This basin is a self-regulating one, and moving away from it requires transformation. The paper creates a hybrid approach to understanding resilience that analyses basins of attraction through livelihood capitals – natural, economic, socio-cultural, etc. When testing the theory in the Philippines, the authors found a community-based forest management

'FAO consequently considers the need to support agro-ecosystems to deal with anomalous situations without extreme malfunction so as to support climate-resilient livelihoods and sustainable agricultural systems.'

programme increased natural capital but had barely any impact on economic capital. The implications for the community's basin of attraction are not explained, but the positive impact on natural capital was not enough to transform well-being outcomes or to move the community into a new state or 'basin'.

5.4 Integration

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

Key messages:

- Integration is a key theme in organisational approaches to resilience. It spans taking partnership and collaborative approaches and sharing lessons across organisations, sectors and scales.
- Collaborative and integrated approaches across countries and regions are highly effective in scaling up best practices and promoting a multi-risk and multi-sectoral approach to resilience.
- There is an urgent need for increased synergies and cohesive solutions to achieve the different post-2015 frameworks, including through joint funding, advocacy efforts, tools and partnerships.
- Integration is about not only working together but also how organisations work together; strategic positioning is more effective than close clustering in disaster relief.
- Urban planners need to involve stakeholders beyond land use and environmental ministries to tackle the diverse challenges climate change will present.
- The role of social capital in helping people cope after disasters is a recurring theme, though some research

questions the link between resilience outcomes and social capital.

Integration is a key theme across the grey literature, and is particularly dominant in the literature on organisational approaches to resilience. Christian Aid (2016) highlights how its partnership approach to resilience adds value through joint collaboration, goal-sharing and ability to leverage resources and enhance advocacy. It also highlights seven integrated and connected programmatic areas to build resilience as an outcome across scales, depending on the context and risks. Similarly, GFDRR (2016) highlights its ability to bring together different pillars, crosscutting themes and programmes to achieve an integrated approach to DRM and resilience. Mercy Corps (2016a) also takes an integrated approach to resilience, focusing on CCA for climate-resilient development, NRM and energy access. The paper highlights the need for an integrated approach to ecosystem services, climate services and reliable energy services, showing that these are all inextricably linked and therefore there is the need for cohesive solutions and actions to support economic prosperity and human well-being. Mercy Corps (2016b) shows the organisation's MSD approach to climate-informed DRR measures. M-RED integrates DRR and MSD approaches to help form nexus interventions through an IDEA, which it uses to build economic security and long-term sustainable development.

Many of the papers also look at collaborative and integrated approaches across countries/regions. The Urban Climate Change Resilience Trust Fund (2009–2015) aims to build urban resilience in 25 cities in seven countries across Asia (DFID, 2016b), bringing together a range of donors and demonstrating their ability to collaborate, share information and promote cohesive solutions. DFID highlights some of the trade-offs within a multi-sector partnership, including different incentives



Colours of India - Brightly clad SHG marching despite the rain. Photo: McKay Savage, 2008.

and interests across a range of countries. Similarly, Murphy et al. (2016) explore a multi-risk profile project in seven countries in Asia and Africa that involves the sharing of information, lessons and best practice across agencies and countries. Through feedback loops, the partners aim to provide a 'multi-risk, multi-context, globally applicable approach for resilient informed humanitarian response' (p.4). Murphy et al. recognise the role of different individuals and entities before, during and after a crisis, demonstrating the need for strong coordination, communication and integration of responses across the partnership. DFID (2016a) provides an example of an integrated and joint response to climate change in the Caribbean among 15 small island states. The advantages of regional cooperation here include greater sharing of knowledge, tools and models and a joint strategy and implementation plan for building resilience in the region. Ensor (2015) looks at the integrated approach of a consortium of NGOs working in Vanuatu on CCA and CBA. This partnership and networking approach has been successful in developing a joint resilience framework and strategy, which is being used to support CBA, advocacy and participation in national adaptation planning.

There has also been a focus on integration with regard to the post-2015 policy landscape. A number of papers in the grey literature refer to the different frameworks for DRR, climate and development, either through consideration of the integration of different goals and outcomes (FAO, 2016c) or through the need for increased synergies and cohesive solutions to achieve the different frameworks (Benson, 2016; Horn-Phathanothai, 2016). For instance, following the Paris and SDG agreements in 2015, FAO (2016c) at the Third Land and Water Days meeting took an integrated approach to promoting land and water management for sustainable development in the face of climate change. FAO recognises the interrelated solutions needed to strengthen food and water security, nutrition and land degradation in order to build resilience across scales and highlights the need for greater integration and collaboration between organisations with similar approaches; joining advocacy efforts to raise awareness at the policy level; building partnerships at different scales; and updating tools and mapping to achieve a joint methodology and strategy for the water-energy-food nexus.

Meanwhile, Horn-Phathanothai (2016) calls for cohesive solutions and actions to align and implement the Paris and SDG agreements, demonstrating that these cannot be achieved in isolation, given the inter-linkages between them. As highlighted earlier, the author stresses that departments can no longer work in silos and that, to be truly effective, measurement, tracking, reporting

and financing across the two frameworks need to be integrated and tensions/trade-offs agreed in order to minimise the burden and increase the capacity of those implementing the different goals and targets. Benson (2016) complements this, looking at the need for alignment in terms of activities and investment to achieve the SDGs and the Sendai Framework. Benson argues that, if development policies, plans and actions integrate DRM, there is an opportunity to support sustainable development and disaster resilience in the face of shocks and stresses. She also highlights the need for funding to be integrated for DRR, disaster relief, early recovery and reconstruction in a timely manner in order to support 'no-regret' measures in disaster resilience and sustainable development.

One paper in the grey literature (World Bank, 2016) acknowledges a lack of integration of climate risks within PPP policy frameworks, investment and infrastructure decision-making, arguing this threatens development outcomes, leading to economic and infrastructure losses. The report highlights the need for an approach that integrates climate risk information within adaptation measures and multi-sector policy frameworks, investment and infrastructure decision-making in order to build the resilience of such structures.

The academic literature addresses integration implicitly in a variety of methods – stressing that who works together and how are key for successful resilience outcomes. Andrew et al. (2016)'s study of sources of organisational resiliency during the Thailand floods of 2011 argues that cohesive solutions are created not only through working with diverse stakeholders but also through how those stakeholders work together. The authors found effective results were achieved by working in a networked fashion, where central actors could coordinate strategically. The authors posit that this spreads the risk of organisational failure and mitigates the coordination problems that crop up in a highly clustered network structure of organisations that attempt to work closely together.

The academic literature also highlights that urban adaptation planning requires a broad variety of participants. Shi et al. (2016) claim that adaptation planning is usually relegated to environment and land use planning departments. In municipalities, adaptation has broad implications for public health and the economy, and comprehensive adaptation planning should include health and economic development departments. The authors caution that adaptation planning should be participatory, but participation alone is of limited value without social, economic and political reforms that impede climate change solutions. In a case study that describes

municipal adaptation planning processes in detail, Chu (2016)'s paper in Surat, India, found that adaptation planning processes were conceived of and institutionalised by politicians and private sector actors. This decision-making structure prevented broader participation of poor and disadvantaged communities, which could have implications for the distributional outcomes of adaptation planning.

The academic literature explores the role of social capital and resilience, with social capital used as a proxy for community-wide integration, strong networks and high levels of trust. The empirical links between social capital and resilience outcomes depend on the context. In their study of CCA in rural Ethiopia, Paul et al. (2016) actually found higher levels of social capital were associated with households taking fewer 'private' household-level adaptation measures. Béné et al. (2016) found social capital was important for people's response strategies in the aftermath of a shock. However, the authors did not find a link between social capital and better resilience outcomes.

However, papers exploring migration and resettlement argue that lack of social capital can have implications for long-term resilience outcomes. In cases of population displacement, Tilt and Gerkey (2016) suggest resettlement can have a long-term impact on social capital and communities' ability to adapt. Along the Mekong River in China, resettled households with less social capital have higher economic disparity and reduced landholdings and access to natural resources compared with indigenous households. For migrants and displaced people, social capital is particularly important for improving resilience outcomes, though the literature cautions that the link between social capital and resilience is not ubiquitous across contexts. More research points to the role social capital plays in helping people cope with – not necessarily adapt to – climate change pressures.

5.5 Adaptiveness

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

Key messages:

- Adaptation can refer to resisting change, accommodating change, and directing change, and adaptation planning strategies need to clarify how change will be treated.
- Resilience-building projects can help improve people's capacity to adjust to shocks and stresses through challenging power relations and social norms, thereby helping strengthen human rights, gender equality and social inclusion.
- Urban adaptation planning must take into consideration justice and equity issues that arise as a result of climate change. It is vital to tackle social and economic issues in addition to technical and infrastructure issues associated with CCA.
- Linking traditional and scientific knowledge can help provide long-term adaptive solutions to building resilience across a range of sectors.

A number of the papers in the grey literature focus on the capacity to adjust to shocks and stresses. For instance, FAO (2016a) presents multiple approaches to CCA to build resilient livelihoods, including alternative technologies for crop, livestock and pastoral systems; landscape approaches; supporting adaptive planning and behavioural change through social protection strategies, gender equality and DRR measures; and the implementation of new adaptive policies and frameworks to help build resilient food systems. Meanwhile, Ensor (2015) highlights approaches to support CBA and adaptive capacity in Vanuatu, including through improved access to information; challenging social norms and power dynamics; and gender equality and social inclusion measures. The author uses his own (2011) approach to support adaptive capacity for resilience-building, which can be achieved through power-sharing; experimentation and testing; and knowledge and information. The programme also promotes the use of a rights-based approach to 'address the structural constraints on adaptive capacity' (p.5), as discussed above in more detail.

Meanwhile, NRDC (2016) demonstrates a new approach to addressing extreme heat health risks, through building awareness, changing behaviours and developing policies that aim to support people to better withstand and recover from heat waves and heat-related health risks. Patino (2016) provides another example of learning from previous experiences, with an adaptive planning mind-set. The People's Plan includes a relocation programme to help informal settlers move away from at-risk areas along the waterways

of Metro-Manila. Though it is too soon to see the results of this project, the process has improved social mobilisation, raised awareness on human rights and provided marginalised groups with the opportunity to participate in decision-making, thereby enhancing their adaptive capacity. Moreover, the plan aims to provide these groups with better access to basic services, also helping improve their adaptive capacity and ability to withstand and recover from shocks and stresses.

Two of the articles demonstrate adaptive characteristics with regard to food security and agricultural practices. Padulosi et al. (2016), for instance, present a Bioversity International project that aims to enhance the use and variety of local crops used, including NUS, to promote sustainable livelihoods, income, food and nutrition security. They draw on local knowledge of such species to promote new actions and strategies that incorporate local and scientific knowledge to build resilience. Jirata et al. (2016) look at CSA activities, policies, strategies and institutions for the promotion of sustainable agricultural production and enhanced resilience of the poor in the face of shocks and stresses. They highlight the positive impact CSA practices can have in relation to access to natural resources, livelihood diversification, agricultural productivity, emissions and environmental sustainability.

A number of papers in the academic literature examine adaptation through climate change planning processes, stressing that adaptation policies and projects must take into account issues of power to redress distributional consequences of interventions meant to enhance resilience. Brink et al. (2016) claim for urban areas that normative aspects of adaptation must be considered, including who wins and loses as a result of ecosystem-based adaptation strategies. The authors ask: Who defines the value of ecosystem services? Who participates in management practices and decisions? Who has access to the benefits of ecosystem services? The paper demonstrates that ecosystem-based adaptation is not devoid of political implications. Orchard et al. (2016)'s study of mangrove system dynamics and resilience also

sheds light on issues of power, demonstrating that the most vulnerable households had reduced access to mangroves as private aquaculture initiatives proliferated. Mangroves had been key to their adaptive capacity, providing livelihood services and decreasing their physical exposure to hazards. Excluding the poorest from planning processes concerning NRM, then, compromises their ability to adapt to shocks and stresses. Lastly, Mavhura (2016)'s review of Zimbabwe's disaster legislation argues that ability to deal with disasters is enhanced by devolving disaster management, by decentralising power, competencies and responsibilities locally. Empowering local organisations, governments and people allows for more responsive and flexible disaster management.

One academic paper examines the notion of adaptation critically, arguing that adaptation strategies can have very different objectives. Fisichelli et al. (2016) describe how adaptation to climate change can be accomplished through diverse strategies: withstanding a shock requires different adaptation actions than do adapting to it or accommodating it. The authors explain that adaptation strategies need to be characterised more clearly, to clarify how change is treated. Some strategies are concerned with resisting change, others with accommodating change and still others with directing change. Divergent strategies complicate the use of adaptive management frameworks, and clearer terminology is needed to ensure adaptation strategies can be correctly operationalised by practitioners.

‘Divergent strategies complicate the use of adaptive management frameworks, and clearer terminology is needed to ensure adaptation strategies can be correctly operationalised by practitioners.’

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