



## Adaptive governance as a catalyst for transforming the relationship between development and disaster risk through the Sendai Framework?



Martin Brown Munene<sup>a,\*</sup>, Åsa Gerger Swartling<sup>b</sup>, Frank Thomalla<sup>a</sup>

<sup>a</sup> Stockholm Environment Institute, Asia Center, 15th Floor, Witthayakit Building, 254 Chulalongkorn Soi 64, Bangkok 10330, Thailand

<sup>b</sup> Stockholm Environment Institute, Stockholm Centre, Linnégatan 87D, Box 24218, SE-104 51 Stockholm, Sweden

### ARTICLE INFO

#### Keywords:

Adaptive governance  
Disaster risk reduction  
Sendai Framework  
Transformation  
Resilience  
Social-ecological systems

### ABSTRACT

The implementation of the Sendai Framework for Disaster Risk Reduction requires non-traditional management and governance approaches for substantial reduction of disaster losses to occur. Adaptive governance (AG) has been identified as a mechanism through which to fundamentally change the relationship between development and disaster risk, with potentially far-reaching implications for science, policy and practice. At its core are collaboration, multilevel collective action, and continuous learning for building knowledge and effective social-ecological systems (SES) management. This paper presents evidence of AG in the articulation of the Sendai Framework and explores its potential as a ‘non-traditional’ approach to disaster risk reduction (DRR) in tackling the challenges of complex SES and multi-level socioeconomic, cultural and political factors and processes. Taking an AG lens, we analyse the prevalence of AG characteristics and determine which of the Sendai Framework’s components would require an AG approach to facilitate a transformative agenda for DRR. We also identify opportunities for employing an AG approach beyond what is already articulated to further enhance disaster resilience and to foster equitable, resilient and sustainable development. Our findings indicate significant references to AG in the Sendai Framework, and we posit that the Sendai Framework could indeed be an important “window of opportunity” for transforming DRR through AG. We conclude by discussing the challenges that must be overcome for AG to provide practical solutions for the urgent transformations required in DRR, and by calling for further research to identify the spaces and pathways through which deliberate transformations might occur.

### 1. Introduction

2015 was a seminal year for global policy on sustainable development as three critical global agreements were adopted in close succession - the Sendai Framework for Disaster Risk Reduction 2015–2030 [1], the Sustainable Development Goals (SDGs) [2], and the Paris Agreement on Climate Change [3]. The implementation of these agreements will likely be challenging, considering the complex, dynamic nature of the social-ecological systems (SES) in which they must be implemented [4–6]. Thus, their success will be influenced by the interactions between a range of internal and external social, ecological, political and economic factors and circumstances that include, for example, foreign debt and financial crises, persistent poverty, growing inequality, and global environmental change.

The global post-2015 policy agenda envisages a sustainable and prosperous society that is resilient to socio-economic and environmental disasters. This means different things to different people across diverse contexts and scales. In many situations, achieving this vision

will require making trade-offs between ‘development’ and ‘DRR’ outcomes. Conceptually, the goals of DRR and sustainable development are reinforcing – “development that meets the needs of current generations without compromising the ability of future generation to meet their own needs” [7]. But in practice, the relationship between development and disaster risk has not always been so positive. Development has frequently resulted in an increase in disaster-related impacts [8]. In some cases, disasters have provided opportunities and spurred action for ‘development’, thus acting as some type of Schumpeterian creative destructions [9]. If disaster-resilient sustainable development - and prosperity are to be achieved, this relationship needs to be transformed.

While the launch of the Sendai Framework has been hailed by some as a milestone for efforts to build disaster resilience around the world, there is no consensus on how to best implement it. Its success in achieving the intended resilience outcome largely depends on how and to what extent it is implemented to spur DRR action. Thus, a robust implementation approach - capable of anticipating challenges; promoting novel, context-appropriate solutions; exploring opportunities to

\* Corresponding author.

E-mail address: [martin@adreci.org](mailto:martin@adreci.org) (M.B. Munene).

<https://doi.org/10.1016/j.ijdrr.2018.01.021>

Received 7 September 2017; Received in revised form 17 January 2018; Accepted 18 January 2018

Available online 31 January 2018

2212-4209/ © 2018 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

do DRR more effectively; better managing the inherent SES complexity, dynamism, and uncertainty; and securing present and expected future development gains [10–14]- is urgently required. It must be compatible and consistent with the articulation and aspirations of the Sendai Framework to reduce possible operational conflicts and address the inherent gaps and weaknesses in the Sendai Framework, while mediating on the contentious themes and politics within the ‘other’ two realms of climate and development [15].

In this paper, we investigate the importance of AG for DRR through the Sendai Framework, explore the transformations needed in DRR to achieve equitable, resilient, and sustainable development, and identify the challenges that need to be overcome in order to facilitate practical solutions for the successful implementation of AG-informed DRR approaches under the Sendai Framework.

## 2. Theory

### 2.1. Development and disaster risk

In the last decade, there were increased calls for an integrated approach to link action on climate change, DRR and development [16–22]. Growing evidence suggests that progress or regression in any of these areas affects the other areas, sometimes in unexpected ways [21,23–26]. Nonetheless, the post-2015 agendas are organised under separate intergovernmental processes each covering disaster risks (led by UNISDR), climate change (headed by UNFCCC) and sustainable development (spearheaded by UNDP).

Globally, countries pursue development as a desired outcome of their activities and governance processes. This is recognised in the post-2015 agreements, while links between development and disaster risk are well-documented too [20,27–31]. The positive results of development include improved standards of living defined by social and economic progress, improved health and general wellbeing of the people and environmental integrity. Thus, development can help to reduce vulnerability to disaster risks by increasing people's capacity to plan for, cope with, and recover from disasters. Similarly, communities with the lowest level of “development” are usually the most vulnerable and adversely affected by disasters [8], mainly because lack sufficient resources to invest in costly precautionary measures against the hazards they face [30].

On the flipside, development can exacerbate disaster risks – in an apparent paradox. For instance, climate change and related hazards can be attributed to unsustainable development associated with runaway consumerism and compromised ecological ecosystems [32]. Moreover, urbanisation increases the concentration of people and assets in cities, thus increasing their exposure to risks such as flooding, fire, diseases, insecurity and terrorism [33–36], while settlements and infrastructure can be located in hazardous geographical areas [37–39]. Rapid and often unplanned urbanisation creates further risks particularly for the many urban poor in developing countries, especially as local governments are unable to adequately keep up with the ever increasing number of migrants into their cities [40]. Natural storm barriers and coastal defences provided by ecosystems are often exploited for natural resource extraction and other economic development activities thus exposing communities to the associated risks [41–43].

### 2.2. The need for transformative DRR

#### 2.2.1. Evolving intricacies and social-ecological contexts

The relationship between development and disaster risk (see 2.1) needs to be transformed from one that creates risk and inequity to one that leads to sustainable, equitable and resilient outcomes. Like the one before it, the post-2015 agenda for development, climate change and DRR will be implemented in challenging settings to meet equally intricate needs. The evolving intricacies in environmental, political and socioeconomic spheres globally will continue to affect the DRR context

in the coming years. For instance, increasing and rapid urbanisation has increased exposure and vulnerability to disaster risks [44–47] and is exerting more pressure on ecological ecosystems (wetlands, forests, rivers, lakes and oceans), but especially on limited resources like land [48–51]. Asia and Africa, the two continents most vulnerable to disasters [21,52], are also the fastest urbanising in the world [53]. The global human population continues to grow [54], thus increasing the demand for ecosystem goods and services [55,56]. This further plunges the world into an era of unmatched resource consumption [32] and more global warming with adverse effects [57–60]. The prevalent consumerist behaviours together with climate change further threatens the availability of these environmental goods and services [61].

#### 2.2.2. Climate change complexities and impacts

Climate change is a complex, multidimensional phenomenon that poses a risk to many sectors and aspects of the society through intricate interactions and feedback loops. As a minimum, climate change has geographic (spatial), ecological, political, sociocultural, and economic dimensions which can be considered temporally [62]. Agriculture is one of the sectors most adversely affected by climate change. As a key driver of many economies especially in Africa and Asia, agriculture will significantly influence any increases or decreases in poverty and food security under climate change [63–65]. Climate change impacts – e.g. desertification; water shortages, droughts and famines, crop failures, floods, insect infestations, plant and human diseases [64,66–69] and even species extinctions [70,71] – and related disaster losses do not only affect poverty eradication efforts but also pose a substantial risk to sustainable development and economic growth in many countries [8,72,73]. Furthermore, climate change as the “mother of all conflicts” [74] is likely to amplify the risk of violent/armed conflicts and civil wars [75,76] especially in ethnically-fractionalized countries [77]. Evidence of the implications of climate change and disasters for security is growing [78–81] with some analysts considering human and environmental security dimensions [82–84]. Displacements as a result of climate change, related disasters and conflicts threaten to complicate DRR and development efforts as demands for coping with the resultant climate/environmental refugees increase [85–88]. The uncertainties surrounding climate change further obfuscates the already problematic environmental governance landscape [89–92] too.

#### 2.2.3. Governance and inequitable socioeconomic systems

Combating the above complex, multidimensional challenges and needs can be daunting. But increasing social injustices and economic inequalities thwart the efforts especially by augmenting the negative impacts of disasters on the poorest communities, thus making both DRR and sustainable development challenging [8,53,93]. The above (2.2.1-2.2.2) factors cumulatively affect various dimensions of disaster risk, including human vulnerability to disaster risks, the social, political economic and environmental landscape in which disasters occur, and their impacts on communities. How disasters and disaster risks must be addressed need to also evolve as influenced by the complex relationship between coupled SESs [12,17,94]. Pelling et al. [93] argue that “the combination of global environmental change and the global economic downturn provides an opportunity for critical thinking and policy formulation by highlighting the co-dependence of socio-political and ecological processes” (p. 1). This increases the need for better understanding of disasters risks and DRR systems- particularly the critical stakeholders, the disaster resilience coordination and governance processes- in the post-2015 era. Considering the above realities, environmental and disaster governance systems for improving economic development while enhancing resilience and meeting the demands for ecosystem services are required urgently. Such governance systems must be robust enough to anticipate and facilitate effective decision-making, and sufficiently flexible to enable effective adaptation to rapidly changing circumstances while allowing quick systemic modifications based on new information and learning. They must facilitate the

execution of the relevant post-2015 agreements, and accommodate creative action beyond what they articulate. This goes beyond the conventional governance systems.

### 2.3. The Sendai Framework for disaster risk reduction

The UNISDR Sendai Framework was the first of the post-2015 global agreements to be adopted. Thus, it set precedence for the SDGs and the Paris Agreement for Climate Change [15]. This voluntary, non-binding global guideline for DRR resulted from stakeholder consultations initiated in March 2012, and the inter-governmental negotiations held between July 2014 and March 2015, which were supported by the UNISDR upon the request of the UN General Assembly. It builds on its predecessor - the Hyogo Framework for Action 2005–2015, HFA [95]- but was adopted and is being implemented in different socioeconomic, political and ecological milieus (highlighted in 2.1 and 2.2).

The Sendai Framework aspires to achieve “substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries” [1 Art. 16]. Far more than its predecessor, the HFA [95], it underscores the importance of broad-based collaboration to realize this goal: among governments, with the private sector and other stakeholders, reaching well beyond the traditional DRR community. Fig. 1 shows the expected outcome, goal and priorities for action of the Sendai Framework.

Although it encourages contribution from all stakeholders and at all levels for the achievement of the above outcomes, the Sendai Framework places the primary responsibility of reducing disaster risks on the nation states. It is recommended that the States share this responsibility with local governments, the private sector, academia, civil society and other stakeholders.

### 2.4. Adaptive governance in DRR

The concept of AG is an established SES management and governance approach. Conceptualised in the field of environmental governance in the 1990s, it has evolved as an analytical framework for understanding natural resource governance that takes as its foundation the interdependence of social and ecological systems, recognising that the two cannot exist in isolation [12,32,94]. Chaffin et. al. [32] define AG “as a range of interactions between actors, networks, organisations, and institutions emerging in pursuit of a desired state for social-ecological systems”. It has been employed with significant success in the management of SES, especially in natural resource management (NRM) and thus a sizeable literature has developed in this regard [32]. However, there has been little progress in how the concept contributes to resilience especially through the integration of development and DRR [96]. It is only in the last five years that the concept has been significantly reviewed with regards to disaster DRR and resilience to climate change [97–99].

The concept of “disaster governance” has been under discussion

over the last decade in the DRR discourse. It emphasises “the inter-related sets of norms, organisational and institutional actors, and practices (spanning pre-disaster, trans-disaster, and post-disaster periods) that are designed to reduce the impacts and losses associated with disasters” [100]. Both disaster governance and AG transcend formal institutions and processes to include other stakeholders such as business and non-governmental entities at different scales [101].

In resilience research, AG has been used for analysing the social, institutional, economic and ecological foundations of multi-level governance modes that are successful in building resilience to the complex challenges posed by global change, and coupled complex adaptive SES [102]. Djalante et al. (2011) identified four characteristics of AG that are particularly important in building disaster resilience: i) polycentric and multi-layered institutions; ii) participation and collaboration; iii) self-organisation and networks; and iv) learning and innovation. Consistent with the AG literature, they used the concept of *resilience* to explore the interdisciplinary linkages between DRR and AG. Fig. 2 presents a summary of their discussion. The solid-line arrows show the main relationships among the characteristics while the dashed lines represent indirect relationship.

Some of the key challenges to dealing with disaster risk include the uncertainties and complexities of the SES, which form the basis for surprise, especially during rapid-onset disasters [103]. But AG is potentially helpful in dealing with these even in rapid environmental change while taking cognizance of the socioeconomic, cultural and political dynamics contingent at different scales and contexts [104,105]. Through open and cooperative decision-making structures, it provides a framework for integrating science and other forms of knowledge (e.g. traditional ecological knowledge) into policies and practices [106] to advance disaster resilience. AG has become a useful concept in climate change adaptation, and has been suggested as an “alternative approach for governing complex problems such as disasters” [97] and a “leading approach to successfully meet the challenges of changes in social-ecological systems” [107]. It can help advance DRR by facilitating exploration of context-specific characteristics of risk, best associated governance arrangements and risk reduction measures.

Such progress occurs through AG processes, or the systematic approaches for *improving* governance and management policies and practices based on lessons from management strategies that have already been implemented. Adaptive institutions, those “able to adjust to encourage individuals to act in ways that maintain or improve to a desirable state” [107], form the basis of effective AG processes. The establishment of such institutions is, therefore, an important step towards AG and resilience, and augment the prospects for participation and collaboration [107,108]. The nature and characteristics of these institutions are discussed in detail by Koontz et al.’s review which describes adaptive institutions as being “participatory, inclusive, integrative, risk tolerant, flexible, legitimate, accountable, diverse, creative, learning, iterative, autonomous, resourceful, self-assessing, collaborative, transparent, reflexive, and integrated with broader

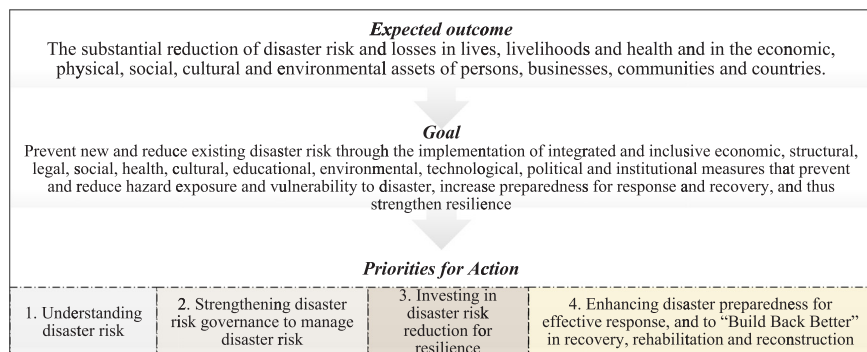


Fig. 1. The Sendai Framework's expected outcome, goal and priorities for action [Adapted from 1].

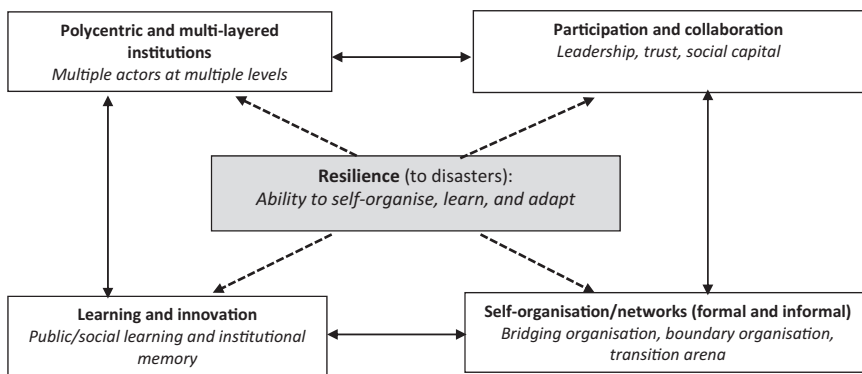


Fig. 2. Components of adaptive governance in building disaster resilience (adapted from Djalante et al., 2011).

processes” [107]. Polycentricism, and multi-layeredness (or federalism) of institutions are other key attributes of adaptive institutions which enable the alignment of activities and processes at various operational scales and environments in which DRR and AG processes happen, and considerations of external processes that affect the institutions’ working environment.

AG approaches offer a mechanism through which to fundamentally change the relationship between development and disaster risk with implications for science, policy and practice. These implications as they relate to the pursuit for sustainability and resilience are synthesised in Table 1. DRR interventions occur in the three realms - science, policy, practice. The influence of AG approach in these realms can have direct and indirect stimulus in DRR.

Since disasters occur within SES, a reasonable approach for addressing them can be found within the SES realm [6]. The aspects considered in Table 1 can be applied in different phases of the disaster management cycle [109] and can also be used to identify avenues for integration of DRR in ‘public project management’ [110] through both formal and informal arrangements. This requires not only strong political support [111] but also research-based evidence for resilience building. In this sense, AG has been termed, as “the most effective approach ... in terms of both management and governance” [112]. The iterative process of policymaking is fed into by research, which provides the “constant monitoring and recalibration of the parameters driving the policy formulation” [112] towards resilience and sustainability.

### 3. Methodology

The overall objective of this article is to examine the potential for implementing the Sendai Framework using an AG approach with the

aim to catalyse transformations in the relationship between DRR and development. We analyse the stated objectives, priorities, language, narrative, as well as the institutional and governance arrangements of the Sendai Framework, to identify the extent to which AG principles are present, the importance of AG for DRR, and the potential of AG in the implementation of the Sendai Framework.

We first determine how the Sendai Framework's ethos aligns – or can be aligned – with AG, and identify the Framework's components that would benefit from adopting an AG approach to enable a transformative agenda for DRR. We then identify opportunities for its application beyond what is articulated to further enhance disaster resilience and to foster practice that places the causes of social vulnerability at its centre and strives to achieve equitable development outcomes.

We combine a content analysis [113,114] and a thematic analysis [115] of the Sendai Framework with the aim to understand the articulation of the Framework and to help in the analysis of the four characteristics of AG identified by Djalante et al. (2011) described in Section 2.4. A systematic review of the literature on AG and DRR is used to identify the keywords and phrases used in the AG literature, to define the research questions, and to determine the analytical categories for coding and the level of analysis. The keywords are then used to examine the presence of AG principles in the text of the Sendai Framework. The frequency of different AG keywords identified in the content analysis of the Sendai Framework document are categorised under the four characteristics of AG.

By analysing the presence of AG in the articulation of the Sendai Framework, we determine the components that would require an AG approach to enable a transformative agenda for DRR. Key transformative aspects of the Framework which make the AG approach tenable and necessary are also identified. Opportunities are identified for employing this approach beyond what is already articulated in the Sendai

Table 1  
Implications of AG in science, policy and practice (adapted from Brunner et al., [106].

|                              | Science  | Policy   | Practice/decision-making   |
|------------------------------|--|--|--|
| Adaptive governance approach | <p>Relations evolve; the behaviours of living forms are contextual.</p> <p>Multiple methods are necessary, including qualitative, interpretive and integrative.</p> <p>Verifiable explanations of behaviours differ from one context to the next. Knowledge of open systems is recognised to be contingent and incomplete; surprises are seen as inevitable.</p> | <p>Multiple goals are to be integrated if possible or traded off if necessary; they depend on judgements in the particular context and are subject to change.</p> <p>Problem definition depends on human interests and other contextual considerations, including law and policy.</p> <p>Local and scientific knowledge are both relevant to solving policy problems</p> <p>Modest incremental steps minimise the unintended consequences of policies</p> <p>Policy process often depends on monitoring and evaluating policies and terminating those that do not work as expected</p> | <p>Policy integration proceeds from the bottom up, under fragmented authority and control.</p> <p>Participation is always open to almost any person or group with a significant interest in the issue.</p> <p>Community-based initiatives can compensate for the limitations of bureaucracies.</p> <p>Local knowledge, mutual respect and trust are considered as key resources for success.</p> <p>Successful policies are diffused and adapted elsewhere, at the same and higher levels.</p> <p>Politics are unavoidable and actually desirable to the extent that they identify and advance common interests.</p> |

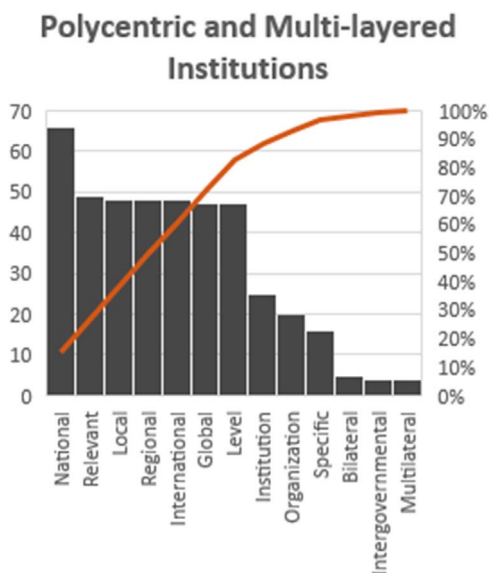


Chart 1. Relative frequency distributions of key AG terms under 'Polycentric and multi-layered institutions'.

Framework with the aim to further enhance disaster resilience and to foster practice that places the causes of social vulnerability and equitable resilience at its centre, and to integrate DRR with the SDGs and the Paris Agreement on Climate Change.

4. Results and discussion

This section presents the results focusing on the language and characterisation of AG in the Sendai Framework. The frequency distribution of individual key AG terms and phrases (expressions) under each characterisation of AG is presented in the thematic Pareto Charts 1 to 4 below.

**Note:** In the Pareto Charts, the left vertical axis shows the frequency of the AG keywords sampled. Each vertical bar shows the contribution of each keyword count to the total. The bars on each chart are ranked in a descending order. The vertical axis on the right shows the percent demarcations. The cumulative line adds the percentages from each bar, from the highest count (left) to show which keywords contribute the highest percentage to each theme. For example, we can see that the top four contribute almost 50% of the total count.

This was followed by a collective analysis of AG characterisations. The relative frequency distributions of the key AG expressions under

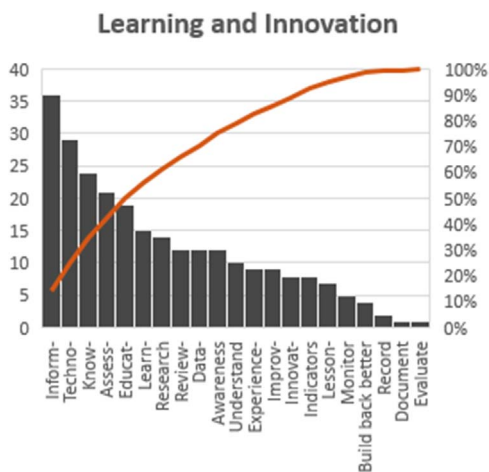


Chart 2. Relative frequency distributions of key AG terms under 'Learning and Innovation'.

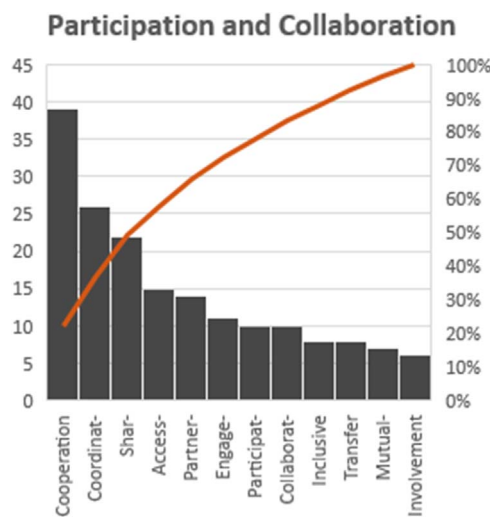


Chart 3. Relative frequency distributions of key AG terms under 'participation and collaboration'. It includes elements of scale, level, and context.

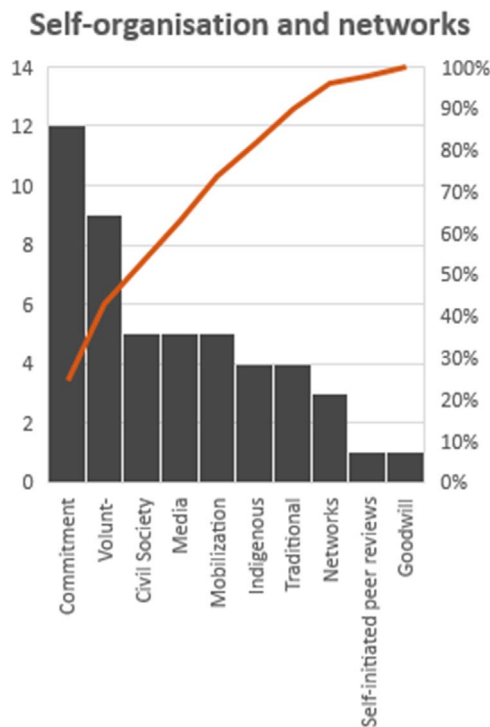


Chart 4. Relative frequency distributions of key AG terms under 'Self-organisation and networks'. This includes both formal and informal networks.

each category are presented in the third Chart 3, which then estimates the cumulative prevalence of each category in relation to the rest.(Chart 5)

The Sendai Framework explicitly acknowledges that effective disaster risk governance requires the involvement of multiple stakeholders operating at different levels, with different centres and extents of jurisdiction. These can be individual or institutional, governmental or non-governmental, formal or informal stakeholders. There are many references to stakeholder participation throughout the Framework, but Sections 5 and 6 specifically focus on the roles and responsibilities of different stakeholders and define their action at global, regional, national and local levels. Also, 64.3% (9 out of 14) of the guiding principles directly refer to institutions, highlighting their centrality in DRR. Key terms alluding to polycentric, multilevel, multi-layered institutions

## AG characterisation frequency distribution

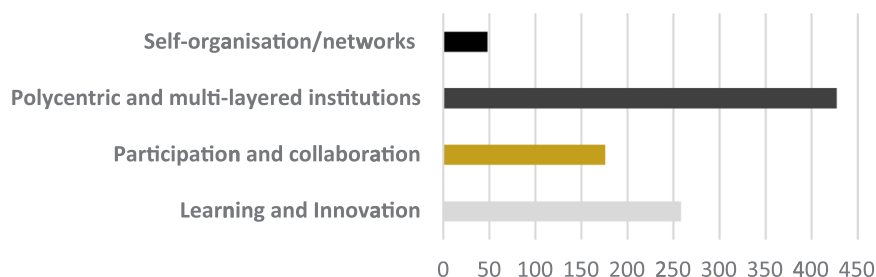


Chart 5. Prevalence of AG in the Sendai Framework.

appear in 427 instances in the Sendai Framework, accounting for 47% of all AG terms, and making it the most prevalent of the four AG characterisations.

Closely related, *participation and collaboration* are stressed in the Framework, especially by emphasising an “all-of-society engagement and partnership” [1 Art. 19(d)] in its implementation. This is encouraged in the development and promotion of DRR products and services, including knowledge and capacity building, early warning systems, DRR plans and strategies, disaster relief and recovery operations, and sharing experiences. Terms like ‘participation’, ‘collaboration’ and their various variants appear in 176 instances, accounting for 19% of the AG keywords and making it the third most prevalent characterisation of AG in the Sendai Framework.

The importance of *learning and innovation* in DRR is strongly emphasised, and the role of science in supporting evidence-based decision-making underscored. Consequently, the Science & Technology Partnership and Roadmap were created at the first UNISDR Science & Technology Conference in Geneva in 2015 [116,117]. “Peer learning” (Art. 24(g)), “mutual learning” (Art. 28(e)) are also encouraged. Although innovation in DRR is recommended in all its relevant forms, technological and/or scientific innovations are distinctly and specifically mentioned. Learning and innovation and their variants (e.g. ‘research’, ‘knowledge’, ‘information’, ‘assessment’, (peer) ‘review’, ‘monitoring’, ‘technology transfer’, ‘science’, and ‘education’) and occur 258 times, thus accounting for 29% of the total AG phrases/words and making it the second most prevalent category of AG elements.

*Networks and self-organised entities* are highlighted in the Sendai Framework as some of the platforms for pursuing its objectives. Academic, scientific and research entities and networks and the private sector are clear examples mentioned in the Framework. *Boundary and bridging organisations* at different levels are recognised as facilitating inter-level operations. Although this is the least prevalent – appearing 49 times and constituting 5% of the AG words in the Sendai Framework- it is not the least important.

It is important to note that there are overlaps between the above characterisations, making it difficult to stringently draw demarcations. For instance, strict definition of the most prevalent AG characterisation (i.e. polycentric and multi-layered institutions) would include this the least prevalent (i.e. networks and self-organised entities). In addition, learning and innovation occur as stakeholders interact in long-term and short-term partnerships and collaborations.

## 5. Discussion

In this section, we discuss the results presented in Section 4.0 above. We briefly comment on the linkages between AG and Sendai Framework in Section 5.1. We then discuss in detail each section of the Framework in Section 5.2 before delving into its transformative aspects in Section 5.3. Additional opportunities, and challenges of implementing the Sendai Framework using an AG approach are discussed in Sections 5.4 and 5.5, respectively.

### 5.1. AG and Sendai Framework linkages

Our review reveals that the underlying principles of disaster risk governance proposed by the Sendai Framework align strongly with the characteristics of AG, suggesting the feasibility of an AG approach to DRR in the implementation of the Framework. The results of our analysis also reveal substantial reference to AG throughout the Framework. Further, the Framework addresses institutional, social, event-based/ecological, scalar (of scales and levels), and technical issues - which are the same issues that underpinned the emergence and development of AG.

### 5.2. Detailed analysis of each section of the Sendai Framework

#### 5.2.1. Preamble, outcome and goal

The preamble lays a strong foundation for AG by highlighting the unique opportunity for hindsight reflection, and learning (from implementation of HFA) and planning for disaster resilience in post-HFA period. Several important aspects of AG including feedback, monitoring, shared learning and experience, cooperation and collaboration, legitimacy (and respect for mandates), self-organisation (coherence across policies, institutions, goals, indicators etc.) are highlighted upfront, suggesting their significance in the subsequent articulation. The concept of “*Build Back Better*” is introduced to signify departure from going back to ‘normal’ by strengthening relevant systems and structures after a disaster. This concept emanates from and is enabled by learning. In fact, the Sendai Framework itself is a product of learning, and ‘an improvement’ of the HFA - which also built on the experiences of past strategies and agreements such as the International Framework of Action for the International Decade for Natural Disaster Reduction (IDNDR) (1989), the Yokohama Strategy and Plan of Action for a Safer World (1994), and the United Nations International Strategy for Disaster Reduction (UNISDR) (1999). Each of these frameworks has been a ‘better version’ of its predecessor by building on ‘lessons learned’ and identified ‘gaps’.

#### 5.2.2. Targets and guiding principles

The Sendai Framework is ambitious, and seeks to achieve more than the HFA did. Its proposed DRR approaches and measures are meant to be *improved, more effective and more robust*. In addition, the targets for 2020–2030 use 2005–2015 as a reference. Sendai Framework's guiding principles compare with Yokohama Strategy's and HFA's, but are said to be more ‘flexible’ and adjustable to domestic circumstances. They also revisit *legitimacy and accountability* questions and acknowledge the importance of shared learning and information-sharing, partnerships, accountability, coordination, coherence and risk-informed decision making, the same aspects central to AG of SES. Experiences and lessons from the HFA strengthen Sendai Framework's appreciation that DRR priorities are contextual and scale-specific. That the interactions of different jurisdictions, authorities and centres of power form the basis for DRR is also acknowledged, and the proposed activities take these into consideration.

### 5.2.3. Priorities for action

Firstly, Priority 1 focuses on *data, information, knowledge, evidence, and disaster research*, but emphasises that these are tailored to suit the needs (and understanding levels) of their intended users. Secondly, Priority 2 emphasises scale-appropriate, coherent *institutional arrangements for DRR*, and prioritises mainstreaming DRR into governance systems at *all levels* and establishing support mechanisms for these. Although only Priority 2 pays specific attention to the governance of disaster risks, the other three priorities are inextricably linked to it. Thirdly, Priority 3 focuses on the *resources (structural and non-structural investments)* required to achieve or support the goal of the Sendai Framework, especially through collaborative investments in DRR. Finally, Priority 4 draws from “*lessons learned from past disasters*” to advocate for stronger disaster preparedness for response in anticipation of disasters, recognising that disaster events could provide a ‘window of opportunity’ to “Build Back Better”. Collective social learning is a central idea in AG and forms the basis for *improving* processes. This priority therefore qualifies both retrospection and forward-thinking as important dimensions in building resilience [12,118–120]. Clearly, all the characterisations are considered in the priorities.

### 5.2.4. Role of stakeholders, international cooperation and global partnerships

The “commitment, goodwill, knowledge, experience and resources” of all stakeholders are recognised as necessary for the implementation of the Sendai Framework (UNGA, 2015 Art. 35), but need to be applied in accordance with relevant national policy and regulatory environment. Section 5 emphatically underscores ‘*context specificity*’ and ‘*scale relevance*’ in the ‘participatory’ implementation of the Framework (the terms ‘relevant’ and ‘specific’ appear 49 and 16 instances respectively in the Framework). Section 6 provides ‘general considerations’ for international cooperation and global partnerships required for the implementation of the Sendai Framework, acknowledging the specificity and uniqueness of States in terms of their capacities, characteristics, vulnerabilities and priorities. The State retains the responsibility to prevent and reduce disaster risks. Like in the AG of SES, DRR processes require stakeholders (as individuals, institutions, and networks). In partnerships, these stakeholders enable mobilisation of resources and capacities for DRR, implementation of other targeted actions, and promote social learning especially during stakeholder interactions. The Sendai Framework suggests partnerships and commitments by stakeholders as fundamental to building resilience. It also proposes accountability and commitment audit mechanisms, especially through maintenance a commitment registry by the UNISDR [1 Art. 48(c)].

### 5.3. Transformative aspects of the Sendai Framework

The Sendai Framework contains several progressive aspects that have the potential to transform DRR and to facilitate progress in the climate change and SDG agendas at the same time. These are articulated in its focus, scope, and approach. It is wider in scope, and employs holistic, multi-hazard approach to DRR, which is concomitant to the systems thinking of resilience, and promotes inclusion of all relevant actors.

Unlike the HFA's narrow focus on natural disasters, the Sendai Framework's scope incorporates all types of disasters – caused by natural, environmental, human, social, and technological hazards. This is consistent with AG's recognition that the social and ecological systems cannot exist independently [32] but form a complex relationship which influences the vulnerability and resilience of either of the two [12,94]. It also considers small- and large-scale, cataclysmic and slow-onset, infrequent and frequent disasters.

In addition, the Sendai Framework emphasises the importance of basing DRR efforts on knowledge, learning from previous events and using this knowledge to improve DRR practice. Whereas this is a common aspect of both Sendai and Hyogo frameworks, former further

emphasises the need to rethink DRR, especially under priority 2 which focuses on “understanding disaster risks”. This promotes learning and augmented understanding of disaster risks and calls for a reassessment of how DRR is done, with a focus on understanding the processes of construction of disasters. This facilitates the development of more robust and proactive DRR approaches and strategies. If this is strictly applied, the strategies developed would not shy away from confronting especially the underlying causes of social vulnerability such as bad politics, poor governance and inequitable resource access and allocation.

In terms of the target problem, the HFA mainly focused on disaster losses, thus sought to minimise the impacts of disasters. However, the Sendai Framework focuses on disaster risks, and thus emphasises on reducing the magnitude of disasters themselves too, rather than only focusing on the impacts. Furthermore, this reorientation of focus means that the Sendai Framework goes beyond the humanitarian contexts and is quite applicable in the ‘normal’ development contexts. Thus, it promotes partnerships between actors who may not have traditional working relationships. This is likely to facilitate mainstreaming of DRR practices in all the sectors as more involvement in DRR processes result to learning and new commitments.

Sendai Frameworks ‘build back better’ is arguably a better aspiration than the ‘bouncing back’ idea. It recognises that the pre-disaster normal is not a progressive aspiration, since it was not good enough to stop the disaster. Thus, the Sendai Framework proposes an understanding of the system shortcomings which led to it being compromised, so that the reconstruction ensures a more resilient system.

### 5.4. Additional opportunities for applying AG in implementing the Sendai Framework

Beyond what it expressly articulates, there are opportunities for employing an AG approach in the implementation of the framework for equitable resilience and development. The Sendai Framework is first and foremost a tool for mobilising DRR investments, and stakeholders to rethink their approaches and commitments to DRR. Many stakeholders mobilised around its development and adoption, and several groups have emerged to support and monitor its implementation. This mobilisation is beneficial in sustaining commitments even beyond adoption, and reducing possible resistance to the changes required for improved DRR at different levels. Rethinking governance and management processes for improvement is an important aspect of AG, and building on the HFA, the Sendai Framework is an opportunity for improving DRR approaches and priorities.

The opportunity for concurrent development and adoption of as many different policy streams as afforded in 2015 is a rarity. The domestication and implementation of these post-2015 agreements present unprecedented opportunities for enhancing policy and institutional coherence (in DRR, SDGs, climate change and sustainable urban development). This could potentially lead to transformative DRR especially by improving rule compliance, leadership and deliberation; facilitating effective resource mobilisation and utilisation; reducing multiplication of efforts and unnecessary redundancies; and enabling streamlined monitoring, evaluation, learning and reporting. These would enhance and facilitate DRR planning, investment, learning, research and technology beyond 2030.

In addition, the Sendai Framework emphasises context specificity and flexibility, avoiding rigid prescription of DRR policy and practice. It is adaptable, thus allowing for creativity and novelty in the design of DRR efforts based on contexts. It also allows room for stakeholders to shape these contexts. This could potentially promote the creative development and application of DRR measures that may be considered unorthodox but effective in a changing disaster risk landscape.

‘Understanding disaster risks’ (Priority 1) forms the basis for all other priorities. This is understanding is of disasters risks in all “dimensions of vulnerability, capacity, exposure of persons and assets,

hazard characteristics and the environment” [1 para. 23] ultimately informs the nature of DRR governance (Priority 2) and DRR investments (Priority 3) required, as well as the nature of pre- and post-disaster measures and processes (Priority 4). A deep understanding of disaster risks in their unique contexts catalyses the development of disaster prevention and impact reduction if or when they do occur. Arguably, it is continuous learning that brings about the ‘adaptive’ aspect of AG.

### 5.5. Challenges in implementing the Sendai Framework through AG

Disaster risk governance is predicated on power relations, the capacity and quality of stakeholders (institutions), and the effectiveness of the strategies employed [121,122]. The Sendai Framework recognises this, but it does not adequately assess and anticipate the likely challenges. Its implementation through AG could encounter several important challenges in the realms of policy, practice/decision-making, and science. Of these, the political and institutional challenges are the most critical because they strongly affect the rest and are arguably the most difficult to overcome.

At the global level, power struggles came into play in the creation of the three post-2015 agreements, where respective custodians of each fought to protect their identity, mandate and resources, rather than create one agreement that served the common purposes. These power struggles will continue, and will most likely be devolved to lower levels of governance. At the national and local levels, social networks, organisations and processes involved in implementing the framework are vulnerable to elite capture and limitations of bureaucracies which community-centred initiatives seek to address.

The idea of ‘self-organisation’ is likely to be thwarted as the feeling of ‘oneness’ or ‘togetherness’ is sabotaged by social stratification, inequality and social injustices in different communities [123–125]. Because of this, applying AG approaches at lower scales, especially at the individual, household and community levels will also be challenging. This is likely to be amplified by inadequate information about, and poor understanding of, the Sendai Framework thus hindering informed decision-making aimed at reducing disaster risks especially because the framework is written in a technical language that is not easily understood outside the DRR community of practice; but also, because the document is in (UN) languages that local users may not be fluent in. At certain scales, large disaster risks may overwhelm self-efficacy. Of course, the Sendai Framework attempts to assign roles at appropriate scales, but these are still ambiguous. For instance, the ‘local level’ could mean different things, depending on the governance system in different countries. Some ‘local’ levels may be larger physically and more complex in terms of governance when compared to some ‘national’ levels.

Political economies/ecologies and governance systems that are more autocratic than democratic are likely to feel threatened by an AG approach to DRR since it requires participation and inclusion of all peoples and knowledges in defining resilience goals, priorities and activities. Ordinarily, policymakers are looked upon by their communities to provide solutions to public concerns, including development, climate change, and disaster risk issues. They tend to be more directly confronted with difficult questions when disasters occur and adversely affect large numbers of people. Such events often reveal that policymakers may not have solutions to all problems. By asking policymakers to share this power with other stakeholders (including the people at risk) to jointly identify risks and jointly develop solutions, an AG approach to DRR inevitably challenges their hegemony. This is likely to cause resistance from policymakers and prevent their cooperation with the communities they are supposed to serve. Human interests will continue to influence problem definition and priorities at all levels, sometimes with unintended negative consequences. The implementation of the Sendai Framework will thus require the development of mechanisms that detect and resolve power tensions that come in the way of transformative DRR. This could be done by engaging neutral

partners in development and DRR such as independent research organisations that facilitate multi-stakeholder processes; civil society organisations; and employing rights-based approaches, which are themselves problematic [126–128].

Another critical challenge is the availability of resources. Implementing the Sendai Framework through AG would most likely impose additional transactional costs, e.g. costs related to enhancing the extent and quality of participation; maintaining polycentric and multi-layered institutions and networks across scales; facilitating learning and innovation; supporting scientific research. This will be a challenge for developing and Least Developed Countries that struggle to meet even the immediate development priorities such as education and health services [129]. Coordination within and across different institutions engaged in DRR will require additional effort and resources that may not be readily available, especially in places where human resource capacities are already stretched. The Sendai Framework is not accompanied by a dedicated and predictable funding mechanism that supports its implementation at the national and sub-national level. In the long-term, however, an AG approach could alleviate this challenge by facilitating the mobilisation of resources, enhancing the coordination of funding mechanisms for joint initiatives that simultaneously address development needs and reduce climate and disaster risks, and by targeting these resources at the scale where they would have the highest impact. To achieve this, existing mechanisms would need to be streamlined and common criteria for funding, monitoring and evaluation developed.

AG is predicated on the ability of systems and institutions to manage adaptively. This means that, depending on the type of system disturbance or change (e.g. a disaster), stakeholders need to be able to adjust accordingly so as to anticipate, cope with, and adapt to the disturbance, or transform into a different state [5,12,130]. Achieving such adaptability and transformation within the large size and complexity of governments and within institutions that are governed by stringent mandates, standard operating procedures, and red tape, will be challenging. Electoral cycles, which tend to bring about changes in governments typically every 3–5 years, also make it difficult to sustain new policies over different regimes [128].

Finally, implementing the Sendai Framework through AG would face certain technical challenges. For instance, in order to achieve its goal, methods and tools would be needed to monitor and evaluate progress against this goal and to hold countries accountable. However, measuring resilience remains a challenge, because of the complexity of the concept and difficulties in operationalizing it. Difficulties would also be encountered in developing resilience indicators that are agreeable to all relevant actors across the policy, practice, and research communities. In addition, collecting the required data for measuring resilience would be a laborious and resource-intensive task, which would be a major challenge for cash-strapped developing countries and may thus compromise the validity and reliability of data at the most relevant level.

## 6. Conclusions

Our analysis shows that the articulation of the Sendai Framework has several synergies with the core ideas of AG. We demonstrate the novelty brought to DRR by using an AG approach and identify opportunities for employing AG in the implementation of the Sendai Framework. The Sendai Framework presents an important window of opportunity to enable the transformation of DRR through AG by acting as a vehicle for promoting novel, innovative and contextualised DRR policies and practices that consider pertinent realities, capacities and levels of development, whilst respecting relevant policies, priorities and jurisdictions. This has the potential to overcome the existing barriers between communities of practice in development, DRR and humanitarian work as it promotes collaborative, participatory, informed, and inclusive governance across all scales. This is an essential catalytic



value of AG, without which the Sendai Framework would likely be less potent.

However, despite the potential of an AG approach to enable the transformation of DRR in the implementation of the Sendai Framework, it would likely face challenges, which would need to be overcome to provide feasible and appropriate DRR solutions. Most of these challenges relate to the rather broad and ambitious goal of the Sendai Framework, which requires more integrated, interdisciplinary and inclusive approaches by all stakeholders, including those outside the traditional DRR community of practice. The AG approach confronts the fundamental structures and processes, such as institutions, governance, politics, as well as social and organisational culture that drive levels of vulnerability and resilience over time and space. Solutions to these challenges, and the transformations urgently needed in DRR to address the causes of vulnerability and to achieve more equitable, resilient and sustainable development outcomes for all, will require interdisciplinary, multidisciplinary and transdisciplinary approaches in research and practice not seen to-date.

AG itself also has important limitations as its core purpose is not to promote transformation. Rather, it has been developed to promote stability of fundamental functions and goals in dynamic contexts. More theoretical and empirical studies are required to determine how AG, or specific elements of it, can support the kinds of visioning, decision-making and action that can be described as transformative. Future research will need to carefully consider the biases and gaps generated by an AG approach and allow for a systematic production of questions on what can be done beyond or instead of AG. Empirical research is needed to demonstrate how AG could be operationalised in DRR projects, and how it could further improve the relationship between DRR and development.

Further research is also needed to identify the pathways through which transformations in DRR can occur. Two innovative approaches are currently being developed in related work by the Stockholm Environment Institute. One focuses on making visible the trade-offs in development and disaster risk reduction decision-making processes and their potential consequences in creating disaster risks in order to make more informed decisions that support sustainable, equitable and resilient development. The other identifies critical issues that need to be addressed as part of interventions that seek to achieve contextualised, equitable resilience.

## Acknowledgements

We wish to acknowledge the financial support of the Swedish International Development Cooperation Agency (Sida) (SEI Project Number 31314). This work is part of the SEI Initiative on Transforming Development and Disaster Risk (TDDR). Our appreciation goes to Albert Salamanca for his leadership and coordination of TDDR, and Hannah Griffiths whose initial start at literature review helped shape this study. We would also like to thank Mark Pelling (King's College London) and Marion Davis (former colleague at SEI) for their useful comments on earlier drafts of this article. Finally, we wish to thank the TDDR research team for their critical insights in numerous discussions that informed several sections of this paper.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.ijdrr.2018.01.021>.

## References

- [1] UNGA, Sendai Framework for Disaster Risk Reduction 2015–2030, UN, Sendai, Japan, 2015.
- [2] UN, Transforming our World: The 2030 Agenda for Sustainable Development, United Nations, 2015.
- [3] UNFCCC, Paris Agreement, UN, Paris, France, 2015.
- [4] P.M. Allen, L. Varga, M. Strathern, The evolutionary complexity of social and economic systems: the inevitability of uncertainty and surprise, *Risk Manag. - Int. J.* 12 (2010) 9–30, <http://dx.doi.org/10.1057/rm.2009.15>.
- [5] L.H. Gunderson, C.R. Allen, C.S. Holling (Eds.), *Foundations of Ecological Resilience*, Island Press, 2010.
- [6] P. Shi, R. Kasperson, *World Atlas of Natural Disaster Risk*, Springer, 2015.
- [7] World Commission on Environment and Development., *Our common future*, Oxford University Press, Oxford; New York, 1987.
- [8] UNISDR, *Making Development Sustainable: The Future of Disaster Risk Management*, UNISDR, Geneva, Switzerland, 2015.
- [9] J. Crespo Cuarema, J. Hlouskova, M. Obersteiner, Natural disasters as creative destruction? Evidence from developing countries, *Econ. Inq.* 46 (2008) 214–226, <http://dx.doi.org/10.1111/j.1465-7295.2007.00063.x>.
- [10] D.R. Armitage, R. Plummer, F. Berkes, R.I. Arthur, A.T. Charles, L.J. Davidson-Hunt, A.P. Diduck, N.C. Doubleday, D.S. Johnson, M. Marschke, P. McConney, E.W. Pinkerton, E.K. Wollenberg, Adaptive co-management for social–ecological complexity, *Front. Ecol. Environ.* 7 (2009) 95–102, <http://dx.doi.org/10.1890/070089>.
- [11] F. Berkes, *Understanding uncertainty and reducing vulnerability: lessons from resilience thinking*, *Nat. Hazards* 41 (2007) 283–295.
- [12] F. Berkes, J. Colding, C. Folke, *Navigating Social-ecological Systems: Building Resilience for Complexity and Change*, Cambridge University Press, Cambridge; New York, 2002, <http://dx.doi.org/10.1017/CBO9780511541957> (Accessed 15 June 2016).
- [13] M.J. Casimir, *Culture and the Changing Environment: Uncertainty, Cognition and Risk Management in Cross-cultural Perspective*, Berghahn Books, 2008.
- [14] R. Mason, Confronting uncertainty: lessons from rural social work, *Aust. Soc. Work.* 64 (2011) 377–394, <http://dx.doi.org/10.1080/0312407x.2011.574144>.
- [15] J. Mysiak, S. Surminski, A.H. Thieken, R. Mechler, J.C.J.H. Aerts, Sendai Framework for Disaster Risk Reduction – Success or Warning Sign for Paris? FEEM Work. Pap. No 0702015. doi:10.2139/ssrn.2636185.
- [16] I. Kelman, Climate Change and the Sendai Framework for Disaster Risk Reduction, *Int. J. Disaster Risk Sci.* 6 (2015) 117–127, <http://dx.doi.org/10.1007/s13753-015-0046-5>.
- [17] I. Kelman, J.C. Gaillard, J. Mercer, Climate Change's role in disaster risk Reduction's future: beyond vulnerability and resilience, *Int. J. Disaster Risk Sci.* 6 (2015) 21–27, <http://dx.doi.org/10.1007/s13753-015-0038-5>.
- [18] T. Mitchell, M. Van Aalst, P. Silva Villanueva, *Assessing Progress on Integrating Disaster Risk Reduction and Climate Change Adaptation in Development Processes*, 2010.
- [19] C. Rivera, Integrating climate change adaptation into disaster risk reduction in urban contexts: perceptions and practice, *PLoS Curr.* 6 (2014), <http://dx.doi.org/10.1371/currents.dis.7bfa59d37f7f59abc238462d53fbb41f>.
- [20] L. Schipper, M. Pelling, Disaster risk, climate change and international development: scope for, and challenges to, integration: disaster risk, *Clim. Change Int. Dev. Disasters* 30 (2006) 19–38, <http://dx.doi.org/10.1111/j.1467-9523.2006.00304.x>.
- [21] T. Tanner, *Climate Change and Development*, Routledge, Milton Park, Abingdon, Oxon, 2014.
- [22] F. Thomalla, T. Downing, E. Spanger-Siegrfried, G. Han, J. Rockström, Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation, *Disasters* 30 (2006) 39–48, <http://dx.doi.org/10.1111/j.1467-9523.2006.00305.x>.
- [23] J. Mercer, Disaster risk reduction or climate change adaptation: are we reinventing the wheel? *J. Int. Dev.* 22 (2010) 247–264, <http://dx.doi.org/10.1002/jid.1677>.
- [24] E.L.F. Schipper, *Climate Change Adaptation and Development: Exploring the Linkages*, Tyndall Centre for Climate Change Research, UK, Norwich, UK, 2007 (<http://tyndall.uea.ac.uk/content/climate-change-adaptation-and-development-exploring-linkages>).
- [25] T. Tanner, J. Rentschler, *Unlocking the Triple Dividend of Resilience - Why Investing in Disaster Risk Management Pays off*, Overseas Development Institute, London, UK, 2015.
- [26] UNISDR, *At the Crossroads: Climate Change Adaptation and Disaster Risk Reduction in Asia and the Pacific - A Review of the Region's Institutional and Policy Landscape*, United Nations International Strategy for Disaster Reduction, 2011. [http://www.preventionweb.net/files/21414\\_21414aregionalmappingdrcca1.pdf](http://www.preventionweb.net/files/21414_21414aregionalmappingdrcca1.pdf).
- [27] I. Burton, R.W. Kates, G.F. White, *The Environment as Hazard*, 2nd ed, Guilford Press, 1993.
- [28] E. Rodriguez-Oreggia, A. De. La Fuente, R. De. La Torre, H.A. Moreno, Natural disasters, human development and poverty at the municipal level in Mexico, *J. Dev. Stud.* 49 (2013) 442–455, <http://dx.doi.org/10.1080/00220388.2012.700398>.
- [29] I. Schumacher, E. Strobl, Economic development and losses due to natural disasters: the role of hazard exposure, *Ecol. Econ.* 72 (2011) 97–105, <http://dx.doi.org/10.1016/j.ecolecon.2011.09.002>.
- [30] H. Toya, M. Skidmore, Economic development and the impacts of natural disasters, *Econ. Lett.* 94 (2007) 20–25, <http://dx.doi.org/10.1016/j.econlet.2006.06.020>.
- [31] United Nations Development Programme., *Bureau for Crisis Prevention and Recovery., Reducing disaster risk: a challenge for development., United Nations Development Programme, Bureau for Crisis Prevention and Recovery*, New York, 2004.
- [32] B.C. Chaffin, H. Gosnell, B.A. Cosens, A decade of adaptive governance scholarship: synthesis and future directions, *Ecol. Soc.* 19 (2014), <http://dx.doi.org/10.1007/s13753-015-0046-5>.

- 5751/ES-06824-190356.
- [33] S. Bartlett, D. Satterthwaite, *Cities on a Finite Planet: Towards Transformative Responses to Climate Change*, Routledge, 2016.
- [34] K. Chmutina, L. Boshier, Rapid Urbanisation and Security: Holistic Approach to Enhancing Security of Urban Spaces, in: Palgrave Handb. Secur. Risk Intell., Palgrave Macmillan, London, 2017: pp. 27–45. doi:10.1057/978-1-137-53675-4\_2.
- [35] D.R. Godschalk, Urban Hazard mitigation: creating resilient cities, *Nat. Hazards Rev.* 4 (2003) 136–143, [http://dx.doi.org/10.1061/\(ASCE\)1527-6988\(2003\)4:3\(136\)](http://dx.doi.org/10.1061/(ASCE)1527-6988(2003)4:3(136)).
- [36] D. Serre, B. Barroca, R. Laganier, *Resilience and Urban Risk Management*, CRC Press, 2012, <<https://books.google.co.uk/books?hl=en&lr=&id=ikPLBQAQAQBAJ&oi=fnd&pg=PP1&dq=serre+2012+urban&ots=jF4IYYEiym&sig=OyU4gmx-bqDOWhKpMkcLCAQxvKw>> (Accessed 12 July 2016).
- [37] I. Adelekan, C. Johnson, M. Manda, D. Matyas, B. Mberu, S. Parnell, M. Pelling, D. Satterthwaite, J. Vivekananda, Disaster risk and its reduction: an agenda for urban Africa, *Int. Dev. Plan. Rev.* 37 (2015) 33–43, <http://dx.doi.org/10.3828/idpr.2015.4>.
- [38] J.E. Hardoy, D. Mitlin, D. Satterthwaite, *Environmental Problems in an Urbanizing World: Finding Solutions in Cities in Africa, Asia and Latin America*, Routledge, 2013.
- [39] UNISDR, 2009 Global Assessment Report on Disaster Risk Reduction: Risk and poverty in a changing climate Invest today for a safer tomorrow, United Nations, Geneva, 2009.
- [40] M. Pelling, B. Wisner, eds., African cities of hope and risk, in: *Urban Disaster Risk Reduct. Cases Urban Afr.*, 2012: pp. 17–42. [https://books.google.co.uk/books?hl=en&lr=&id=FdvNNIDEKIC&oi=fnd&pg=PA17&dq=African+Cities+of+Hope+and+Risk&ots=9XJTPUOllG&sig=edwHp9y\\_mBlkxDiInOXcVAiIHM](https://books.google.co.uk/books?hl=en&lr=&id=FdvNNIDEKIC&oi=fnd&pg=PA17&dq=African+Cities+of+Hope+and+Risk&ots=9XJTPUOllG&sig=edwHp9y_mBlkxDiInOXcVAiIHM) (Accessed 3 August, 2016).
- [41] W.N. Adger, Social-ecological resilience to coastal disasters, *Science* 309 (2005) 1036–1039, <http://dx.doi.org/10.1126/science.1112122>.
- [42] H.K. Lotze, Depletion, degradation, and recovery potential of estuaries and coastal seas, *Science* 312 (2006) 1806–1809, <http://dx.doi.org/10.1126/science.1128035>.
- [43] S. Temmerman, P. Meire, T.J. Bouma, P.M.J. Herman, T. Ysebaert, H.J. De Vriend, Ecosystem-based coastal defence in the face of global change, *Nature* 504 (2013) 79–83, <http://dx.doi.org/10.1038/nature12859>.
- [44] S. Khan, Disasters: contributions of hazardscape and gaps in response practices, *Nat. Hazards Earth Syst. Sci.* 12 (2012) 3775–3787, <http://dx.doi.org/10.5194/nhess-12-3775-2012>.
- [45] C. Rivera, C. Wamsler, Integrating climate change adaptation, disaster risk reduction and urban planning: a review of Nicaraguan policies and regulations, *Int. J. Disaster Risk Reduct.* 7 (2014) 78–90, <http://dx.doi.org/10.1016/j.ijdrr.2013.12.008>.
- [46] L. Seeliger, I. Turok, Averting a downward spiral: building resilience in informal urban settlements through adaptive governance, *Environ. Urban.* 26 (2014) 184–199, <http://dx.doi.org/10.1177/0956247813516240>.
- [47] C. Wamsler, E. Brink, C. Rivera, Planning for climate change in urban areas: from theory to practice, *J. Clean. Prod.* 50 (2013) 68–81, <http://dx.doi.org/10.1016/j.jclepro.2012.12.008>.
- [48] I. Douglas, K. Alam, M. Maghenda, Y. McDonnell, L. Mclean, J. Campbell, Unjust waters: climate change, flooding and the urban poor in Africa, *Environ. Urban.* 20 (2008) 187–205, <http://dx.doi.org/10.1177/0956247808089156>.
- [49] M. Douglass, *The Urban Transition of Environmental Disaster Governance in Asia*, Asia Research Institute, National University of Singapore Singapore, 2013, <<http://admin.indiaenvironmentportal.org.in/files/file/urban%20transition%20of%20environment%20disaster.pdf>> (Accessed 16 December 2016).
- [50] D. Mitlin, D. Satterthwaite (Eds.), *Empowering Squatter Citizen: Local Government, Civil Society, and Urban Poverty Reduction*, Earthscan, London; Sterling, VA, 2004.
- [51] UNISDR, UNESCAP, *Asia Pacific Disaster Report 2012: Reducing Vulnerability and Exposure to Disasters* | United Nations ESCAP. <<http://www.unescap.org/resources/asia-pacific-disaster-report-2012-reducing-vulnerability-and-exposure-disasters>> (Accessed 16 December 2016).
- [52] S. Kreft, D. Eckstein, L. Dorsch, L. Fischer, Germanwatch, *Global Climate Risk Index 2016 Who Suffers Most From Extreme Weather Events? Weather-related Loss Events in 2014 and 1995 to 2014*, 2015.
- [53] UNDESA, *World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352)*, United Nations, New York, NY, 2014.
- [54] UNDESA, *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables*, United Nations, Department of Economic and Social Affairs, Population Division, 2015. [https://esa.un.org/unpd/wpp/publications/files/key\\_findings\\_wpp\\_2015.pdf](https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf) (Accessed July 4, 2016).
- [55] R. Haines-Young, M. Potschin, The links between biodiversity, ecosystem services and human well-being, in: D. Raffaelli, C. Frid (Eds.), *Ecosyst. Ecol. New Synth.* Cambridge University Press, 2010, pp. 110–139 <[https://www.pik-potsdam.de/news/public-events/archiv/alter-net/former-ss/2009/10.09.2009/10.9-haines-young/literature/haines-young-potschin\\_2009\\_bes\\_2.pdf](https://www.pik-potsdam.de/news/public-events/archiv/alter-net/former-ss/2009/10.09.2009/10.9-haines-young/literature/haines-young-potschin_2009_bes_2.pdf)> (Accessed 16 December 2016).
- [56] J. Tratalos, R.A. Fuller, P.H. Warren, R.G. Davies, K.J. Gaston, Urban form, biodiversity potential and ecosystem services, *Landscape Urban Plan.* 83 (2007) 308–317, <http://dx.doi.org/10.1016/j.landurbplan.2007.05.003>.
- [57] S.J. Davis, K. Caldeira, H.D. Matthews, Future CO<sub>2</sub> emissions and climate change from existing energy infrastructure, *Science* 329 (2010) 1330–1333, <http://dx.doi.org/10.1126/science.1188566>.
- [58] J.A. Puppim de Oliveira, O. Balaban, C.N.H. Doll, R. Moreno-Peñaranda, A. Gasparatos, D. Iossifova, A. Suwa, Cities and biodiversity: perspectives and governance challenges for implementing the convention on biological diversity (CBD) at the city level, *Biol. Conserv.* 144 (2011) 1302–1313, <http://dx.doi.org/10.1016/j.biocon.2010.12.007>.
- [59] D. Satterthwaite, The implications of population growth and urbanization for climate change, *Environ. Urban.* 21 (2009) 545–567, <http://dx.doi.org/10.1177/0956247809344361>.
- [60] J. Webb, Climate change and society: the chimera of behaviour change technologies, *Sociology* (2012), <http://dx.doi.org/10.1177/0038038511419196>.
- [61] S.R. Carpenter, H.A. Mooney, J. Agard, D. Capistrano, R.S. DeFries, S. Díaz, T. Dietz, A.K. Duraiappah, A. Oting-Yesoah, H.M. Pereira, C. Perrings, W.V. Reid, J. Sarukhan, R.J. Scholes, A. Whyte, Science for managing ecosystem services: beyond the Millennium Ecosystem Assessment, *Proc. Natl. Acad. Sci.* 106 (2009) 1305–1312, <http://dx.doi.org/10.1073/pnas.0808772106>.
- [62] S. Sakai, C. Umetsu (Eds.), *Social-Ecological Systems in Transition*, Springer Japan, Tokyo, 2014, <http://dx.doi.org/10.1007/978-4-431-54910-9>.
- [63] S. Hallegatte, Strategies to adapt to an uncertain climate change, *Glob. Environ. Change* 19 (2009) 240–247, <http://dx.doi.org/10.1016/j.gloenvcha.2008.12.003>.
- [64] D.B. Lobell, M.B. Burke, C. Tebaldi, M.D. Mastrandrea, W.P. Falcon, R.L. Naylor, Prioritizing climate change adaptation needs for food security in 2030, *Science* 319 (2008) 607–610, <http://dx.doi.org/10.1126/science.1152339>.
- [65] T. Wheeler, J. Von Braun, Climate change impacts on global food security, *Science* 341 (2013) 508–513.
- [66] C.A. Burge, C. Mark Eakin, C.S. Friedman, B. Froelich, P.K. Hershberger, E.E. Hofmann, L.E. Petes, K.C. Prager, E. Weil, B.L. Willis, others, Climate change influences on marine infectious diseases: implications for management and society, *Annu. Rev. Mar. Sci.* 6 (2014) 249–277.
- [67] C.B. Field, V.R. Barros, M.D. Mastrandrea, K.J. Mach, M.A.-K. Adbrabo, W.N. Adger, Y.A. Anokhin, O.A. Animov, D.J. Arent, J. Barnett, V.R. Burkett, R. Cai, M. Chatterjee, S.J. Cohen, W. Cramer, P. Dasgupta, D.J. Davidson, F. Denton, P. Döll, K. Dow, Y. Hijioka, O. Hoegh-Guldberg, R.G. Jones, R.N. Jones, R.L. Kitching, R.S. Kovats, P.R. Lankao, J.N. Larsen, E. Lin, D.B. Lobell, I.J. Losada, G.O. Magrin, J.A. Marengo, A. Markandya, B.A. McCarl, R.F. McLean, L.O. Mearns, G.F. Midgley, N. Mimura, J.F. Morton, I. Niang, I.R. Noble, L.A. Nurse, K.L. O'Brien, T. Oki, L. Olsson, M. Oppenheimer, J.T. Overpeck, J.J. Pereira, E.S. Poloczanska, J.R. Porter, H.-O. Pörtner, M.J. Prather, R.S. Pulwarty, A.R. Reisinger, A. Revii, O.C. Ruppel, D.E. Satterthwaite, D.N. Schmidt, J. Settele, K.R. Smith, D.A. Stone, A.G. Suarez, P. Tschakert, R. Valentini, A. Villamizar, R. Warren, T.J. Wilbanks, P.P. Wong, A. Woodward, G.W. Yohe, *Climate Change 2014: Impacts, Adaptation, and Vulnerability: Summary for Policy Makers of the Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Intergovernmental Panel on Climate Change (IPCC), Cambridge, UK, 2014.
- [68] K.A. Garrett, S.P. Dendy, E.E. Frank, M.N. Rouse, S.E. Travers, Climate change effects on plant disease: genomes to ecosystems, *Annu. Rev. Phytopathol.* 44 (2006) 489–509.
- [69] A.J. McMichael, R.E. Woodruff, S. Hales, Climate change and human health: present and future risks, *Lancet* 367 (2006) 859–869.
- [70] K.E. Carpenter, M. Abrar, G. Aeby, R.B. Aronson, S. Banks, A. Bruckner, A. Chiriboga, J. Cortes, J.C. Delbeck, L. DeVantier, G.J. Edgar, A.J. Edwards, D. Fenner, H.M. Guzman, B.W. Hoeksema, G. Hodgson, O. Johan, W.Y. Licuanan, S.R. Livingstone, E.R. Lovell, J.A. Moore, D.O. Obura, D. Ochavillo, B.A. Polidoro, W.F. Precht, M.C. Quibilan, C. Reboton, Z.T. Richards, A.D. Rogers, J. Sanciangco, A. Sheppard, C. Sheppard, J. Smith, S. Stuart, E. Turak, J.E.N. Veron, C. Wallace, E. Weil, E. Wood, One-third of reef-building corals face elevated extinction risk from climate change and local impacts, *Science* 321 (2008) 560–563, <http://dx.doi.org/10.1126/science.1159196>.
- [71] M.C. Urban, Accelerating extinction risk from climate change, *Science* 348 (2015) 571–573.
- [72] IFR, *World Disasters Report 2010: Focus on Urban Risk*, International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland, 2010.
- [73] UN, *World Urbanization Prospects: The 2014 Revision*, United Nations Department of Economic and Social Affairs, Population Division, New York, 2014. <http://esa.un.org/unpd/wup/>.
- [74] P. Gilding, The mother of all conflicts, *Brown J. World Aff.* 18 (2011) 167.
- [75] M.B. Burke, E. Miguel, S. Satyanath, J.A. Dykema, D.B. Lobell, Warming increases the risk of civil war in Africa, *Proc. Natl. Acad. Sci.* 106 (2009) 20670–20674.
- [76] C. Devitt, R.S. Tol, Civil war, climate change, and development: a scenario study for sub-Saharan Africa, *J. Peace Res.* 49 (2012) 129–145, <http://dx.doi.org/10.1177/0022343311427417>.
- [77] C.-F. Schleussner, J.F. Donges, R.V. Donner, H.J. Schellnhuber, Armed-conflict risks enhanced by climate-related disasters in ethnically fractionalized countries, *Proc. Natl. Acad. Sci.* (2016), <http://dx.doi.org/10.1073/pnas.1601611113>.
- [78] E.S., 2012. Cameron, Securing indigenous politics: a critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic, *Glob. Environ. Change* 22 (2012).
- [79] G. Colpitts, Peace, war, and climate change on the northern Plains: bison Hunting in the neutral Hills during the mild winters of 1830–34\*, *Can. J. Hist.* 50 (2015) 420–441.
- [80] L.K. Comfort, Risk, security, and disaster management, *Annu. Rev. Polit. Sci.* (2005) 335–356.
- [81] M. Mason, Climate insecurity in (Post) conflict areas: the biopolitics of united nations vulnerability assessments, *Geopolitics* 19 (2014) 806–828, <http://dx.doi.org/10.1080/14650045.2014.903393>.
- [82] D. Alles, Depoliticizing natural disasters to enhance human security in a sovereignty-based context: lessons from Aceh (2004) to Yangon (2008), in: B.T.C. Guan

- (Ed.). Hum. Secur. Springer, Netherlands, 2012, pp. 157–172 <[http://link.springer.com/chapter/10.1007/978-94-007-1799-2\\_8](http://link.springer.com/chapter/10.1007/978-94-007-1799-2_8)> (Accessed 20 November 2014).
- [83] A. Maltais, K. Dow, Å. Persson, Integrating Perspectives on Environmental Security. SEI Poverty and Vulnerability Report, Stockholm Environment Institute, Stockholm, Sweden, 2003.
- [84] K. O'Brien, L. Sygna, R. Leichenko, W.N. Adger, J. Barnett, T. Mitchell, E.L.F. Schipper, T. Tanner, C. Vogel, C. Mortreux, Disaster Risk Reduction, Climate Change Adaptation and Human Security, University of Oslo, 2008.
- [85] F. Biermann, I. Boas, Protecting climate refugees: the case for a global protocol, *Environ. Sci. Policy Sustain. Dev.* 50 (2008) 8–17.
- [86] M. Foster, International Refugee Law and Socio-economic Rights: Refuge from Deprivation, Cambridge University Press, Cambridge, U.K.; New York, 2007.
- [87] C. Methmann, A. Oels, From “fearing” to “empowering” climate refugees: governing climate-induced migration in the name of resilience, *Secur. Dialog.* 46 (2015) 51–68, <http://dx.doi.org/10.1177/0967010614552548>.
- [88] N. Myers, Environmental refugees: a growing phenomenon of the 21st century, *Philos. Trans. R. Soc. B Biol. Sci.* 357 (2002) 609–613.
- [89] C.I. Millar, N.L. Stephenson, S.L. Stephens, Climate change and forests of the future: managing in the face of uncertainty, *Ecol. Appl.* 17 (2007) 2145–2151.
- [90] S. Shackley, B. Wynne, Representing uncertainty in global climate change science and policy: boundary-ordering devices and authority, *Sci. Technol. Hum. Values* 21 (1996) 275–302.
- [91] M. Webster, Communicating climate change uncertainty to policy-makers and the public, *Clim. Change* 61 (2003) 1–8.
- [92] S. Weintrobe, Engaging with Climate Change: Psychoanalytic and Interdisciplinary Perspectives, Routledge, 2012.
- [93] M. Pelling, D. Manuel-Navarrete, M. Redclift, Climate Change and the Crisis of Capitalism: A Chance to Reclaim, Self, Society and Nature, Routledge, 2012.
- [94] F. Berkes, C. Folke, Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience, Cambridge University Press, Cambridge, 1998.
- [95] UNISDR, Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, United Nations International Strategy for Disaster Reduction (UNISDR), Geneva, Switzerland, 2005.
- [96] E. Boyd, C. Folke (Eds.), Adapting Institutions: Governance, Complexity, and Social-ecological Resilience, Cambridge University Press, Cambridge; New York, 2012.
- [97] R. Djalante, Review Article: “adaptive governance and resilience: the role of multi-stakeholder platforms in disaster risk reduction, *Nat. Hazards Earth Syst. Sci.* 12 (2012) 2923–2942, <http://dx.doi.org/10.5194/nhess-12-2923-2012>.
- [98] R. Djalante, C. Holley, F. Thomalla, Adaptive governance and managing resilience to natural hazards, *Int. J. Disaster Risk Sci.* 2 (2011) 1–14, <http://dx.doi.org/10.1007/s13753-011-0015-6>.
- [99] M.A. Hurlbert, Adaptive Governance of Disaster, Springer International Publishing, Cham, 2018, <http://dx.doi.org/10.1007/978-3-319-57801-9>.
- [100] K. Tierney, Disaster governance: social, political, and economic dimensions, *Annu. Rev. Environ. Resour.* 37 (2012) 341–363, <http://dx.doi.org/10.1146/annurev-environ-020911-095618>.
- [101] M. Gall, S.L. Cutter, K. Nguyen, Governance in Disaster Risk Management (IRDR AIRDR Publication No. 3), Integrated Research on Disaster Risk., Beijing, 2014 (<http://www.irdrinternational.org/wp-content/uploads/2015/01/AIRDR-Project-Report-No.-3-WEB-6MB.pdf>) (Accessed 27 September 2016).
- [102] C. Folke, T. Hahn, P. Olsson, J. Norberg, Adaptive governance of social-ecological systems, *Annu. Rev. Environ. Resour.* 30 (2005) 441–473, <http://dx.doi.org/10.1146/annurev.energy.30.050504.144511>.
- [103] M. Brugnach, A. Dewulf, C. Pahl-Wostl, T. Taillieu, Toward a relational concept of uncertainty: about knowing too little, knowing too differently, and accepting not to know, *Ecol. Soc.* 13 (2008), <http://dx.doi.org/10.5751/ES-02616-130230>.
- [104] B.C. Chaffin, L.H. Gunderson, Emergence, institutionalization and renewal: rhythms of adaptive governance in complex social-ecological systems, *J. Environ. Manag.* 165 (2016) 81–87, <http://dx.doi.org/10.1016/j.jenvman.2015.09.003>.
- [105] T. Karpouzoglou, A. Dewulf, J. Clark, Advancing adaptive governance of social-ecological systems through theoretical multiplicity, *Environ. Sci. Policy* 57 (2016) 1–9, <http://dx.doi.org/10.1016/j.envsci.2015.11.011>.
- [106] R.D. Brunner, T.A. Steelman, L. Coe-Juell, C.M. Cromley, C.M. Edwards, D.W. Tucker, Adaptive Governance: Integrating Science, Policy, and Decision Making, Columbia University Press, 2005.
- [107] T.M. Koontz, D. Gupta, P. Mudliar, P. Ranjan, Adaptive institutions in social-ecological systems governance: a synthesis framework, *Environ. Sci. Policy* 53 (2015) 139–151, <http://dx.doi.org/10.1016/j.envsci.2015.01.003>.
- [108] A. Foerster, Developing purposeful and adaptive institutions for effective environmental water governance, *Water Resour. Manag.* 25 (2011) 4005–4018, <http://dx.doi.org/10.1007/s11269-011-9879-x>.
- [109] H. Khan, L.G. Vasilescu, A. Khan, et al., Disaster management cycle—a theoretical approach, *J. Manag. Mark.* 6 (2008) 43–50.
- [110] T. Lin Moe, P. Pathranarakul, An integrated approach to natural disaster management: public project management and its critical success factors, *Disaster Prev. Manag. Int. J.* 15 (2006) 396–413, <http://dx.doi.org/10.1108/09653560610669882>.
- [111] J. Dernbach, Toward a National Sustainable Development Strategy, Social Science Research Network, Rochester, NY, 2002 (<https://papers.ssrn.com/abstract=2192117>) (Accessed 23 December 2017).
- [112] A.S. Garmestani, C.R. Allen, H. Cabezas, Panarchy, adaptive management and governance: policy options for building resilience, *Neb. Rev.* 87 (2008) 1036.
- [113] B. Carol, S.D.M. Paul, F. Teresa, K. Rachel, L. Sheri, M. Brad, W. Robert, P. Mike, Content Analysis. Writing@CSU, Colorado State University, 2012, (<https://writing.colostate.edu/guides/pdfs/guide61.pdf>) (Accessed 8 February 2017).
- [114] H.-F. Hsieh, S.E. Shannon, Three approaches to qualitative content analysis, *Qual. Health Res.* 15 (2005) 1277–1288, <http://dx.doi.org/10.1177/1049732305276687>.
- [115] G.A. Bowen, Document analysis as a qualitative research method, *Qual. Res. J.* 9 (2009) 27–40, <http://dx.doi.org/10.3316/QRJ0902027>.
- [116] A. Aitsi-Selmi, V. Murray, C. Wannous, C. Dickinson, D. Johnston, A. Kawasaki, A.-S. Stevance, T. Yeung, Reflections on a science and technology agenda for proceedings of the 21st century disaster risk reduction: based on the scientific content of the 2016 UNISDR science and technology conference on the implementation of the sendai framework for disaster risk reduction, *Int. J. Disaster Risk Sci.* 7 (2016) 1–29, <http://dx.doi.org/10.1007/s13753-016-0081-x>.
- [117] C. Dickinson, A. Aitsi-Selmi, P. Basabe, C. Wannous, V. Murray, Global community of disaster risk reduction scientists and decision makers endorse a science and technology partnership to support the implementation of the sendai framework for disaster risk reduction 2015–2030, *Int. J. Disaster Risk Sci.* 7 (2016) 108–109, <http://dx.doi.org/10.1007/s13753-016-0080-y>.
- [118] E. Boyd, B. Nykvist, S. Borgstrom, I.A. Stacewicz, Anticipatory governance for social-ecological resilience, *Ambio* 44 (2015) S149–S161, <http://dx.doi.org/10.1007/s13280-014-0604-x>.
- [119] G. Conway, The Science of Climate Change in Africa: Impacts and Adaptation, Grantham Institute for Climate Change, Imperial College London, London, 2009 ([https://workspace.imperial.ac.uk/climatechange/public/pdfs/discussion\\_papers/Grantham\\_Institute\\_The\\_science\\_of\\_climate\\_change\\_in\\_Africa.pdf](https://workspace.imperial.ac.uk/climatechange/public/pdfs/discussion_papers/Grantham_Institute_The_science_of_climate_change_in_Africa.pdf)) (Accessed 14 October 2016).
- [120] IFRC, Resilience: Saving Lives Today, Investing for Tomorrow, International Federation of Red Cross and Red Crescent Societies, 2016. [http://www.ifrc.org/Global/Documents/Secretariat/201610/WDR%202016-FINAL\\_web.pdf](http://www.ifrc.org/Global/Documents/Secretariat/201610/WDR%202016-FINAL_web.pdf) (Accessed October 19, 2016).
- [121] J. Ahrens, P.M. Rudolph, The importance of governance in risk reduction and disaster management, *J. Contingencies Crisis Manag.* 14 (2006) 207–220, <http://dx.doi.org/10.1111/j.1468-5973.2006.00497.x>.
- [122] D. Alexander, Chapter 13 - Political responses to emergencies, in: J.F.S.E.C.J.M. Jayawickrama (Ed.), Hazards Risks Disasters Soc. Academic Press, Boston, 2015, pp. 217–231 (<http://www.sciencedirect.com/science/article/pii/B9780123964519000135>) (Accessed 1 December 2014).
- [123] C. Béné, A. Neiland, From Participation to Governance: A Critical Review of the Concepts of Governance, Co-management and Participation, and their Implementation in Small-scale Inland Fisheries in Developing Countries: a review prepared for the Challenge Program on Water and Food, World Fish Center, CGIAR Challenge Program on Water and Food, Penang, Malaysia; Colombo, Sri Lanka, 2006.
- [124] B. Cooke, U. Kothari, Participation: The New Tyranny? Zed Books, 2001.
- [125] IFRC, World Disasters Report 2014: Focus on culture and risk, International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland, 2014.
- [126] J.K. Boyce, Let them eat risk? Wealth, rights and disaster vulnerability, *Disasters* 24 (2000) 254–261.
- [127] B. Concannon Jr, B. Lindstrom, A worldwide response: an examination of International law frameworks in the aftermath of natural disasters: cheaper, better, longer-lasting: a Rights-based approach to disaster response in Haiti, *Emory Int. Rev.* 25 (2011) 1145–1561.
- [128] M.B. Munene, Urban Resilience in Nairobi: Civil Society's Role and Interaction with Climate and Risk Science under Devolution, King's College London, London, 2016 ([http://www.urbanark.org/sites/default/files/resources/Martin-Urban%20ARK%20Working%20Paper%202\\_0.pdf](http://www.urbanark.org/sites/default/files/resources/Martin-Urban%20ARK%20Working%20Paper%202_0.pdf)) (Accessed 17 October 2016).
- [129] M.B. Munene, Å.G. Swartling, F. Thomalla, The Sendai Framework: A catalyst for the transformation of disaster risk reduction through adaptive governance?, 2016. <https://www.sei-international.org/mediamanager/documents/Publications/SEI-DB-2016-Sendai-Framework-adaptive-governance.pdf> (Accessed 17 November 2016).
- [130] C. Folke, Resilience: the emergence of a perspective for social-ecological systems analyses, *Glob. Environ. Change* 16 (2006) 253–267, <http://dx.doi.org/10.1016/j.gloenvcha.2006.04.002>.