Disasters, climate change and development: Reducing risk by tackling the drivers of vulnerability

Introduction

Efforts to reduce disaster risks and climate change risks have co-existed for a long time, and in recent years, there has been growing attention to the relationship between climate change adaptation and disaster risk reduction. Not only are there considerable similarities in the types of actions needed to reduce both kinds of risks, but there is great scope for mutual learning.

Climate-related disasters have also become a rallying point in the international climate negotiations – a tangible, immediate reason to push for more ambitious climate action. The relationship between climate change and disaster risk – and between strategies to address them – is thus a very timely and policy-relevant issue.

The year 2015 also offers a unique opportunity to address it: a successor to the Hyogo Framework for Action (HFA), a 10-year global plan to address disaster risk, is being drafted at the same time as the new Sustainable Development Goals (SDGs) are being formulated, and a comprehensive new agreement is being negotiated under the United Nations Framework Convention on Climate Change (UNFCCC). This is a chance to integrate three key international frameworks to guide policy and action on disasters, climate change and development more effectively and coherently.

This discussion brief examines the relationship between climate and disaster risk reduction, aiming to identify ways for them to work better together. Insights from our analysis may be useful to policy-makers from the international to the local level, as well as to interested members of civil society.

Disasters, climate change and development

Despite many overlaps, disaster risk reduction (DRR) and adaptation have evolved separately, with distinct differences. For example, DRR focuses on current and near-term risks (as well as remediation after disasters), while adaptation typically takes a longer view.

The HFA, which laid out an agenda for 2005–2015 to increase the resilience of nations and communities to disasters (UNISDR 2005), recognizes climate change and variability as drivers of disaster risk. It aims to support research on climate-related hazards, climate modelling and weather forecasting as part of its efforts to identify, assess and monitor disaster risks and enhance early warning. It also aims to reduce underlying risk factors relating to climate change and variability and to promote the integration of adaptation and DRR (Priority for Action 4).

The role of climate change itself in shaping future disaster risk – how greenhouse gas concentrations might affect the frequency and severity of storms, floods, droughts, etc. – is a less-explored area. Yet this dimension is critical for understanding how climate-related disaster risks may evolve and how DRR (and adaptation) will have to evolve to address them. Our analysis thus takes a risk-based approach to the management of climate variability and change, which can help to bridge the divide between adaptation and DRR. Risk analysis is increasingly seen as crucial for the assessment and management of climate impacts at the global scale (IPCC 2012; PROVIA 2013).

Recent research has estimated the average annual damages from disasters triggered by climatological, hydrological and meteorological hazards in 2002-2011 at US$103 billion, US$24 billion and US$52 billion, respectively (Guha-Sapir et al. 2013). This research has also shown that 47.9% of damages occurred in Asia, 38.6% in the Americas, 9% in Europe, 3.7% in Oceania and less than 0.8% in Africa. While total economic losses are highest in developed countries, fatality rates and economic losses in terms of GDP are higher in developing countries.

In its Special Report *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX – IPCC 2012), the Intergovernmental Panel on Climate Change (IPCC) notes that disaster risk is driven not only by the impacts of extreme events, but also by exposure and vulnerability to those impacts. A hurricane, for example, will usually pose a greater threat in the storm-surge zone than inland (exposure), and to poor and marginalized populations than to wealthier people who can easily get out of harm's way and have good property insurance (vulnerability).

Indeed, the IPCC finds, although economic losses from climate- and weather-related extreme events have clearly increased since the second half of the 20th century (though with large variations by region and by year), those increases are due to a great extent to increased exposure of people and economic assets (IPCC 2012). There is also a high confidence

Workers on a disaster risk reduction project in Bhutan, which is increasingly exposed to glacial floods due to climate change.

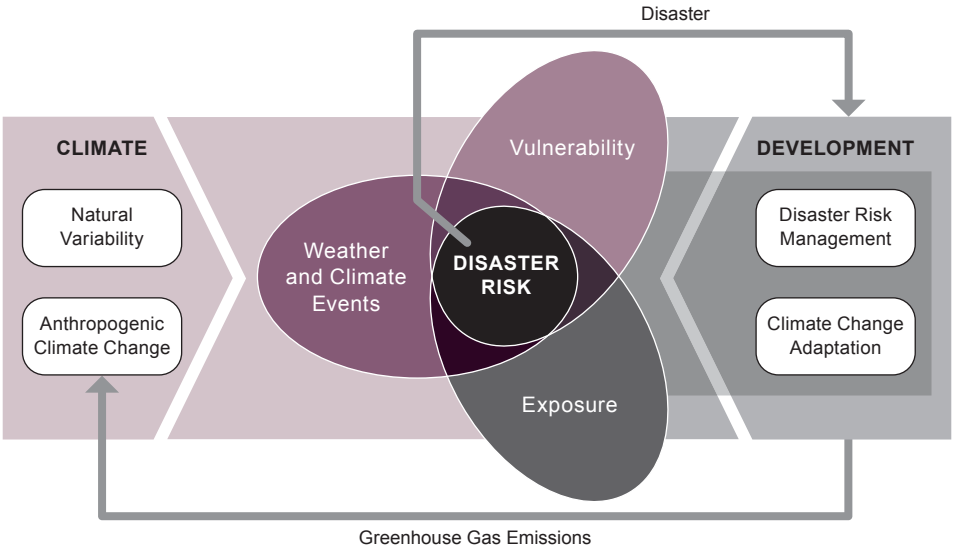

Figure 1: A framework for understanding disaster risk, adaptation and development. Source: Adapted from IPCC (2012, p.4).

that settlement patterns, urbanization, and change in socio-economic conditions have played a role.

In its *Fifth Assessment Report,* the IPCC expresses high confidence that the overall risk of climate change can be reduced by limiting the rate and magnitude of GHG emissions (IPCC 2014b). Yet, because disaster risk is so closely tied to exposure and vulnerability, the IPCC stresses that both adaptation and DRR have to be understood in the context of wider social and economic development. Figure 1 illustrates interactions between climate, disaster risk and development.

Rethinking approaches to climate and disaster risk

There is a growing recognition of the need to make stronger connections with climate change mitigation, adaptation, and sustainable development. Within the DRR field, this is part of a broader effort to address several concerns about the effectiveness of current approaches:

1. Disaster risk continues to increase dramatically in many parts of the world, arising from a combination of natural hazards, climate change, environmental degradation, rapid and poorly planned urban development, and insecure livelihoods.

2. New risks are arising from existing and emerging economic and social processes, and growing faster than existing risks are being reduced.

3. Climate change is expected to continue to drive disaster risk, with significant increases in the frequency, intensity, spatial extent and duration of extreme events.

4. Despite a growing recognition among scientists of the importance of social, cultural, economic and political factors in driving vulnerability to disasters, the underlying causes of social vulnerability are still not well understood or addressed in policy or practice. Assessments of the HFA, for example, have found the least amount of progress was made in addressing the underlying risk factors and causes of risk creation (UNISDR 2011; UNISDR 2013). The HFA has had limited impact on improving governance at the national and sub-national levels to reduce social vulnerability and empower vulnerable groups.

5. Important linkages between natural resource management, development, DRR, and climate change mitigation and adaptation exist but are frequently not understood or considered.

6. The DRR paradigm itself has been questioned, because efforts continue to focus primarily on emergency management and preparedness, and corrective or compensatory risk management, not on the underlying drivers of risk.

7. A new emphasis on disaster resilience offers some new ways of thinking, but interpretations of the concept vary, and it is poorly understood by many policy-makers and practitioners.

At the same time, much work remains to be done to ensure that development helps to reduce, not exacerbate, vulnerability to environmental hazards, including climate change. When dams are built, for example, the change in water volume and flow can affect floods and drought risks downstream. Such problems are not inherent to development, but result from a failure to consider the range of current and possible future disaster risks in the planning process.

A rethink is thus urgently needed to better integrate disasters, climate change and development issues in theory and practice and enable transformational change in how we do "development". Current discussions on the post-2015 agenda for DRR (HFA+) have identified the need for a new framework to prevent the creation of new risks (including those arising from climate change), reduce existing risks, and strengthen resilience (United Nations General Assembly 2014).

Climate change as a driver of disaster risk

The IPCC's *Fifth Assessment Report,* particularly the contributions of Working Groups I and II (IPCC 2013a; 2014a) and the Synthesis Report (IPCC 2014b), provides the most comprehensive analysis available of the extent to which climate change drives disaster risk. It finds that warming of the climate system is "unequivocal", and many changes observed since the 1950s "are unprecedented over decades to millennia" (IPCC 2014b).

The IPCC also warns that continued GHG emissions "will cause further warming and long-lasting changes in all

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Flooding in the Escuintla region of Guatemala, where precarious living conditions heighten risk.

components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" (IPCC 2014b). The risks associated with future climate change are expected to increase with rising temperatures, as shown in Figure 2.

The IPCC expresses less confidence, however, about some of the evidence on links between climate change and extreme events in the recent past. It finds it is likely heat waves have become more frequent in large parts of Europe, Asia and Australia (IPCC 2014b), but expresses only low confidence in observed global trends in droughts. It finds strong evidence that both the frequency and intensity of heavy precipitation events have increased in North America and Europe, but expresses "at most medium" confidence in heavy precipitation trends elsewhere.

Similarly, the IPCC expresses only low confidence that climate change has to date changed the magnitude or frequency of floods globally (IPCC 2014b), in part because human activities, such as land use change and infrastructure, also affect flood risks, and these two influences are difficult to separate. The costs of floods have been rising since the 1970s, but this is partly due to increased exposure of people and assets, the IPCC notes.

With regard to coastal storms, the IPCC finds it likely that extreme sea levels (such as during storm surges) have increased since 1970, mostly due to a rise in global mean sea level (0.19 metres in 1901–2010). However, it expresses low confidence that long-term changes in tropical cyclone activity are robust, though it does find it "virtually certain" that intense tropical cyclone activity has increased in the North Atlantic since 1970.

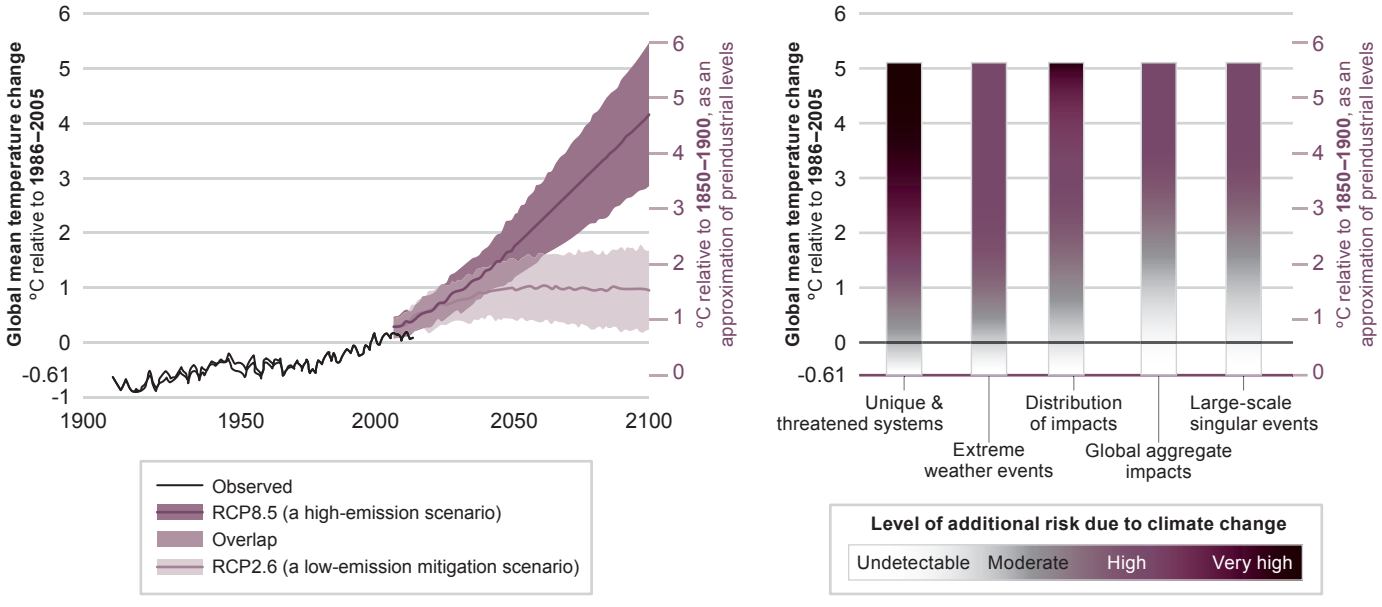

Figure 2: Emission scenarios, projected changes in global mean temperatures and associated risks.

Source: Adapted from IPCC (2013b, p.21).

Figure 2 shows projected changes in global mean temperature relative to the period 1850–1900 for two emission pathways and the level of additional risk due to climate change. For example, the risks from extreme weather events such as heat waves, extreme precipitation and coastal flooding are expected to be high with even 1°C of additional warming, and they become higher as temperatures rise.

For the future, the IPCC finds that extreme precipitation events are very likely to become more intense and more frequent over most mid-latitude land masses and tropical regions by the end of the century (IPCC 2013b). The IPCC also expresses medium confidence that the intensity and/or duration of droughts is likely to increase on a regional to global scale in the second half of the century.

It is considered very likely that coastal system and low-lying areas will increasingly experience adverse impacts such as submergence, coastal flooding, and coastal erosion as a result of sea-level rise in the coming century (IPCC 2014b). The IPCC also finds it very likely that precipitation extremes related to monsoons will increase in South America, Africa, Asia and Australia (IPCC 2013b).

In this context, the IPCC highlights that many risks of climate change are concentrated in urban areas, which are threatened by coastal surges, flooding, and heavy precipitation, and may also suffer from water scarcity and heat stress (IPCC 2014b).

Understanding the relationship between DRR and adaptation

Disaster risk reduction and adaptation are two ways of reducing the risk posed by natural hazards. Both are concerned with reducing vulnerability, monitoring hazards, and raising societal capacities to reduce and manage risks. DRR considers a broader range of potential hazards, however (including geophysical, biological, and chemical hazards), as well as their interactions and cumulative effects (ADPC 2013). The overlap between DRR and adaptation is in managing disaster risk related to climate variability and climate extremes, and preparing for risks related to climate change.

Yet scholars conceive DRR and adaptation in fundamentally different ways: while DRR is a set of practices that can be put into action, adaptation is seen as more of an overarching notion – a change in perspective that guides actions. Thus, in practice, DRR can be a component of adaptation, to the extent that adaptation requires addressing climate-related disaster risks.

Both DRR and adaptation have an "**ideal**" way of operating, and less-ideal realities:

- For **disaster risk reduction**, the ideal way is to systematically prepare people for extreme events – whether the result of extreme vulnerability or extreme natural hazards – so that impacts are minimal. Actual DRR, however, tends to focused on addressing the impacts of individual events, which can be substantial.

- For **adaptation**, the ideal way involves a long-term process of adjusting to changes (including more severe natural hazards), and iterative learning. Actual adaptation efforts to date, however, have tended to involve individual and relatively short-term projects that mostly look at expected or experienced impacts and for which we don't have much evidence of outcomes (because it is relatively new).

It is important to note key differences in DRR and adaptation practice as well. DRR focuses on reducing near-term risks (through preparedness and prevention), and on managing the consequences (response, relief, recovery). Adaptation aims to help people live with changes, including extreme events. Thus, though they involve similar activities, the priorities are different. Below we highlight key distinctions that can create challenges in linking adaptation and DRR.

Different purposes and perspectives

DRR and adaptation operate on different spatial and temporal scales, work from different knowledge bases, and follow different norm systems (O'Brien et al. 2008; Birkmann and Teichman 2010). As noted above, DRR also focuses on a much broader range of disaster risks, including non-climate hazards such as earthquakes. There are some practical constraints too, such as the fact that DRR is about addressing the potential that a disaster will take place, whereas adaptation is about adjusting to new changes, such as increased risk.

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A refugee camp in Dadaab, Kenya, during the East Africa food crisis in 2011.

In other words, DRR is the suite of actions, policy, attitudes and understandings necessary to reduce the possibility that a hazard will be translated into a disaster, and the impacts caused by a disaster when it does occur. Adaptation is about making shifts to incorporate changes, including new risks, into life, to avoid or to minimize the damage that slow-onset changes in climate as well as extreme weather events can cause. There is therefore an implicit notion that adaptation is a bigger idea than DRR. We may talk of a risk reduction mind-set that penetrates everything we do, but

adaptation requires that *and* accepting that change is happening, not just "risk".

Fragmented knowledge, institutions and policy

Research on the links between climate change, climate action and DRR is mostly case-based and fragmented, giving little guidance to practitioners and policy-makers. Despite the need to strengthen collaboration and to facilitate learning and information exchange between them, DRR and adaptation have largely remained distinct research and policy communities, with different approaches, institutions, conferences, assessment mechanisms, strategies and funding sources.

Discrepancies in the intellectual development of the two fields and in the channels for implementation of risk reduction measures have resulted in policy inconsistency, redundant investment and competing approaches to addressing the same problems (Schipper 2009; Thomalla et al. 2006). Despite the commonalities between adaptation, mitigation and DRR, practices and policies at all levels are often disconnected.

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The poorest people in developing countries often live in marginal areas such as this slope in Piñas, Ecuador, where a landslide left four families homeless.

There is a huge challenge in reconciling the existing global policy arenas, including not only those that relate to adaptation and DRR, but also to climate change mitigation, development assistance, sustainable development, and economic development. Good governance is essential for this.

Poor stakeholder coordination

A key challenge is the many different types of actors involved, and how they interact. For example, power dynamics may lead one group to deliberately undo what another has done, thereby not only wasting resources but also exposing people to greater vulnerability and more confusion. That was the case in El Salvador during the 1990s and early 2000s, where the institution that housed the risk reduction, seismic monitoring and meteorological institutes was separate from the civil protection authority, and both felt they had the mandate to address disaster risk (Schipper 2006).

Another challenge is getting actors on the same "side" to understand each other. Debates continue on what exactly adaptation means, with particular disagreements between those who focus on the physical impacts and those who focus on the development and vulnerability dimensions. While DRR is more established, many practitioners and governments continue to focus on post-event action only, giving preparedness and disaster prevention little care. In their work in Indonesia, Djalante and Thomalla (2012) describe coordination challenges in terms of defining the responsibilities and institutional arrangements for implementing DRR and adaptation, either individually or together.

Ongoing efforts to integrate DRR and adaptation

Considerable efforts to integrate adaptation and DRR activities have occurred at the international level. While the UNFCCC focuses on longer-term climatic change, later negotiations, namely the Bali Action Plan in 2007, have called for enhanced action on adaptation that considers disaster risk reduction, particularly in vulnerable developing countries (UNFCCC 2007).

In a similar vein, climate change has been mentioned in international DRR agreements, including the HFA. The HFA Priority for Action 4 includes the impacts of hazards related to climate variability and climate change as underlying disaster risks and explicitly calls for the integration of DRR strategies with adaptation to reduce underlying risk factors (UNISDR 2005).

Actions to enhance the relationship between DRR and adaptation have also taken place at the regional level. A number of small island developing states (SIDS) have made significant regional efforts in this area. For example, the Partnership to Develop the Strategy for Climate and Disaster Resilience Development (SRDP) was created when actors from the disaster and climate change communities in the Pacific, along with regional intergovernmental mechanisms, decided to coordinate their activities to develop an integrated Pacific regional strategy for disaster risk management and climate change by 2015 (UNDESA 2014).

Efforts at the national level are perhaps most visibly articulated through national policies and frameworks – many of which have been influenced by international frameworks such as the HFA. The government of Vietnam, for example, has made efforts to increase collaboration between DRR and adaptation agencies by promoting joint initiatives while still maintaining separate ministries for each (MARD 2010; UNISDR 2009). Bangladesh has also made significant strides, integrating adaptation and DRR in over 30 policies and plans (Government of Bangladesh 2013).

Local-level integration efforts can be particularly valuable, and should be encouraged through flexible policies that allow strategies to be tailored to local conditions. For example, the local government in the Indian city of Pune implemented a city-specific climate change plan that also addresses disaster risks to deal with recurrent flooding (UNISDR 2009).

Entry points for linking DRR and adaptation

Despite the challenges of addressing DRR and adaptation simultaneously in policy, projects and planning, there are strong arguments for promoting frequent interaction between

DRR and adaptation experts. Both issues are framed in similar ways, presenting numerous opportunities for a robust relationship. The overlaps range from simple things, such as the fact that both DRR and adaptation planning tend to focus on specific sectors (e.g. water, agriculture, health, transport, energy, urban development, etc.) and/or a specific scale (international, national, local) or geographic area (village, town, city, coastal area, etc.), to more complex issues, such as that both are currently the subject of high-level international political negotiations.

One of the most important reasons for linking DRR and adaptation is that some current DRR practices can undermine opportunities for reducing vulnerability to natural hazards in the longer term. For example, international NGOs and humanitarian agencies frequently provide only "temporary", poor-quality shelter after a disaster, leaving governments or other actors to help build new, more resilient housing, with no guarantee that this will occur.

In El Salvador, for example, Wisner (2001) found that those who lost their homes in Hurricane Mitch in 1998 were still living in temporary huts when two massive earthquakes struck in early 2001, leaving the people even more vulnerable since the huts were not designed to withstand severe earthquakes. With longer-term thinking, such shelter would not be accepted for more than a very short time. Thus, bringing adaptation to the table offers DRR an opportunity to improve.

The DRR community has been dealing with climate-related disaster risks since well before climate change was widely discussed. It has a well-established toolbox for assessing and responding to risks, and hundreds of thousands of trained volunteers and professionals whose only business is to help reduce disaster risk. But the "business as usual" approach to DRR and disaster aid that focuses largely on disaster response and recovery is no longer desirable. DRR practitioners need to pay greater attention and resource to disaster prevention and preparedness. This needs to be couched in thinking about reducing vulnerability and risk in a more holistic way, rather than on an event-by-event basis.

Transformative change

The expected outcome of the HFA is a reduction in disaster losses through better disaster risk reduction. This goal is consistent with the goal of adaptation: to reduce the impact of climatic shifts on people's lives. Yet while all five of the HFA priority action areas could be extended to adaptation, only the fourth ("reduce the underlying risk factors") actually gets at what causes risk. This is also where adaptation is mentioned. Discussions about adaptation, although sometimes overly focused on projects and their outcomes, tend to more explicitly emphasize the importance of reducing vulnerability.

For a truly effective, integrated approach to adaptation and DRR, however, we will need a radical transformation in how we think about these issues. This requires:

1. A change in thinking about how adaptation is done, starting with an acknowledgement that decision-makers and practitioners see adaptation as a set of incremental steps, not as the continuous, long-term process that researchers envision. This incremental understanding of adaptation fits the nature of existing development assistance projects and programmes, but it will not produce the transformational change in attitudes, economies, behaviours and politics needed to reduce vulnerability to hazards.

2. A willingness to actively engage actors whose agendas influence vulnerability: those responsible for shaping priorities for national and international economic development, those bartering for peace in war zones, health organizations, the private sector, etc.

3. Multi-hazard risk reduction units, such as the ones in El Salvador, that house units studying hazard and vulnerability together, so that they can collaborate and better understand each other's perspectives and challenges.

4. Guidance for disaster response and recovery on how to incorporate climate change in planning and programming.

5. A human rights-based approach, since many of the causes of vulnerability to climate change impacts and other hazards are rooted in poverty, inequality and injustice with respect to basic human rights and a lack of access to resources.

Both DRR and adaptation must be closely linked to poverty reduction and sustainable development, because climate change and disaster impacts threaten progress on poverty reduction and the achievement of development goals. A more effective way of bringing adaptation into DRR is to take vulnerability reduction as the starting point, rather than risk reduction. As the IPCC (2012) has stressed, social welfare, quality of life, infrastructure and livelihoods need to be part of disaster risk reduction to facilitate adaptation. Thus, rather than thinking about how to address risk, the focus should be on addressing the greatest drivers of risk.

Learning about disaster risk and climate change

The question is then how the DRR and climate change communities can exchange knowledge and learn from each other in order to inform more effective policies to manage future climate risks. There is ample evidence that suggest that disasters can spur learning among policy-makers and lead to new policies and change in approaches to risk management. However, the extent of that learning and change depends critically

The Red Cross offers training on safe rebuilding of homes after Typhoon Haiyan in the Philippines.

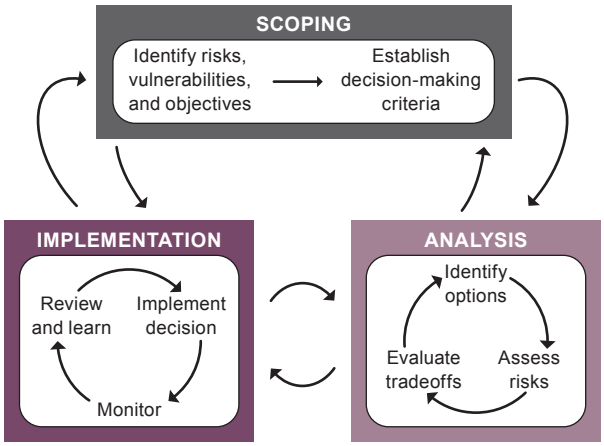

Figure 3: Climate change adaptation as an iterative risk management process.

Source: Adapted from IPCC (2014c, Figure SPM.3).

on the severity of the disaster, beliefs about its causes and consequences, the availability of policy-relevant resources, the openness of decision-making processes, and the social and economic structures and underpin them (Johnson et al. 2005; Brody et al. 2009; Vulturius 2013).

Special attention thus needs to be paid to the ways in which new knowledge about disaster risk and climate change is developed and how it moves into the policy realm. How can new knowledge and experience with disaster risk best be harnessed for policy-making? Given that hazards such as floods occur regularly in many places, and that climate change may alter the frequency and magnitude of some of these hazards, learning and decision-making about suitable risk management options is likely to happen in multiple iterations.

Iterative risk management, illustrated in Figure 3, has been endorsed by the IPCC (2014c) as an effective approach to adaptation decision-making because it is most suitable for dealing with large uncertainties, long time frames, and the influence of both climate and non-climate related changes in disaster risk. It also offers decision-makers formalized methods to analyse vulnerability, risk and uncertainty and to assess possible policy responses (for an in-depth discussion, see PROVIA 2013).

These insights suggest that governance mechanisms involving adaptation and DRR need to become more flexible and conducive to learning in order to be able to adapt to new experiences and knowledge. At the moment, however, risk management is often subsumed in established planning and decision-making structures that are less likely to be conducive to transformative change. Decision-making for DRR and adaptation also often involves competing views about the causes of disaster risks and suitable actions to reduce them (Albright 2011). Stakeholder platforms can offer a forum for joint learning among different policy actors, bridging gaps and potentially leading to collective action.

Conclusions and recommendations

Climate change will cause more hazards, and they will be more severe. Coupled with persistent poverty and governance failures around the world, this means disaster risk is likely to increase. Thus, effective DRR measures will be needed as part of a broader effort to reduce climate risk. Both sides should recognize the different strengths that the other brings to the table, and collaborate to achieve common goals, and both should take a risk-based approach to ensure effective responses. A successor to the HFA should put greater emphasis on Priority Area 4, if there is truly a desire to connect disaster risk reduction efforts with those of adaptation to climate change.

Both DRR and adaptation also need to become better at taking into account the wider development context. Development can play a crucial role in reducing vulnerability, but often it instead compounds and exacerbates it, and it even creates new hazards. It would be useful to more explicitly recognize this problem – that current development pathways, including the associated greenhouse gas emissions, are increasing the risks posed by natural hazards.

Conversely, disaster impacts can interfere with development pathways and make major development investments go to waste. Many of these problems arise from ineffectual policies and governance structures at the national and sub-national levels. There is growing support within both the adaptation and DRR communities for addressing this problem; a successor to the HFA can help by promoting a more integrated approach to development, adaptation and disaster risk. This may require new approaches to governance and to finance.

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References

ADPC (2013). *Integrating Disaster Risk Management into Climate Change Adaptation*. Disaster Risk Management Practitioner's Handbook Series. Asian Disaster Preparedness Centre, Bangkok, Thailand.

Albright, E. A. (2011). Policy Change and Learning in Response to Extreme Flood Events in Hungary: An Advocacy Coalition Approach. *Policy Studies Journal,* 39(3). 485–511. DOI:10.1111/j.1541-0072.2011.00418.x.

Birkmann, J. and Teichman, K. (2010). Integrating disaster risk reduction and climate change adaptation: key challenges—scales, knowledge, and norms. *Sustainability Science*, 5(2). 171–84. DOI:10.1007/s11625-010-0108-y.

Brody, S. D., Zahran, S., Highfield, W. E., Bernhardt, S. P. and Vedlitz, A. (2009). Policy learning for flood mitigation: a longitudinal assessment of the community rating system in Florida. *Risk Analysis: An Official Publication of the Society for Risk Analysis*, 29(6). 912–29. DOI:10.1111/j.1539-6924.2009.01210.x.

Djalante, R. and Thomalla, F. (2012). Disaster risk reduction and climate change adaptation in Indonesia: Institutional challenges and opportunities for integration. *International Journal of Disaster Resilience in the Built Environment*, 3(2). 166–80. DOI:10.1108/17595901211245260.

Government of Bangladesh (2013). *Bangladesh: National Progress Report on the Implementation of the Hyogo Framework for Action (2011-2013)*. http://www.preventionweb.net/files/28810_bgd_NationalHFAprogress_2011-13.pdf.

Guha-Sapir, Hoyois, P. and Below, R. (2013). *Annual Disaster. Statistical Review 2012. The Numbers and Trends*. Centre for Research on the Epidemiology of Disasters. http://reliefweb.int/sites/reliefweb.int/files/resources/ADSR_2012.pdf.

IPCC (2012). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. A Special Report of the Intergovernmental Panel on Climate Change Working Groups I and II (Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley, eds.). Cambridge University Press, Cambridge, UK, and New York. http://ipcc-wg2.gov/SREX/.

IPCC (2013a). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. T. F. Stocker, D. Qin, G.-K. Plattner, M. M. B. Tignor, S. K. Allen, et al. (eds.). Cambridge University Press, Cambridge, UK, and New York. http://www.ipcc.ch/report/ar5/wg1/.

IPCC (2013b). Summary for Policymakers. In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. T. F. Stocker, D. Qin, G.-K. Plattner, M. M. B. Tignor, S. K. Allen, et al. (eds.). Cambridge University Press, Cambridge, UK, and New York. http://www.climate2013.org/spm.

IPCC (2014a). *Climate Change 2014: Impacts, Adaptation, and Vulnerability - Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastandrea, et al. (eds.). Cambridge University Press, Cambridge, UK, and New York. https://www.ipcc.ch/report/ar5/wg2/.

IPCC (2014b). *Climate Change 2014: Synthesis Report*. Intergovernmental Panel on Climate Change, Geneva. http://www.ipcc.ch/report/ar5/syr/.

IPCC (2014c). Technical Summary. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea,T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken,P.R. Mastrandrea, and L.L. White (ed.). Cambridge University Press, Cambridge, UK, and New York. 1–32. https://www.ipcc.ch/report/ar5/wg2/.

Johnson, C. L., Tunstall, S. M. and Penning-Rowsell, E. C. (2005). Floods as Catalysts for Policy Change: Historical Lessons from England and Wales. *International Journal of Water Resources Development*, 21(4). 561–75. DOI:10.1080/07900620500258133.

MARD (2010). *Viet Nam: National Progress Report on the Implementation of the Hyogo Framework for Action (2009-2011)*. Ministry of Agriculture and Rural Development, Disaster Management Center, Hanoi. http://www.preventionweb.net/english/professional/policies/v.php?id=15492.

O'Brien, K., Sygna, L., Leichenko, R., Adger, W. N., Barnett, J., et al. (2008). Disaster risk reduction, climate change adaptation and human security. *Report prepared for the Royal Norwegian Ministry of Foreign Affairs by the Global Environmental Change and Human Security Project, GECHS Report,* 3. http://connectgreen.com.br/site/images/online/arquivo_GECHS_Report_3-08.pdf.

PROVIA (2013). *PROVIA Guidance on Assessing Vulnerability, Impacts and Adaptation to Climate Change*. Consultation document. United Nations Environment Programme, Nairobi, Kenya. http://www.unep.org/provia.

Schipper, E. L. F. (2006). *Climate Risk, Perceptions and Development in El Salvador*. Working Paper 93. Tyndall Centre for Climate Change Research, Norwich, UK. http://www.tyndall.ac.uk/content/climate-risk-perceptions-and-development-el-salvador.

Schipper, E. L. F. (2009). Meeting at the crossroads? Exploring the linkages between climate change adaptation and disaster risk reduction. *Climate and Development*, 1(1). 16–30. DOI:10.3763/cdev.2009.0004.

Thomalla, F., Downing, T., Spanger-Siegfried, E., Han, G. and Rockström, J. (2006). Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation. *Disasters*, 30(1). 39–48. DOI:10.1111/j.1467-9523.2006.00305.x.

UNDESA (2014). *Partnership Briefs for Small Island Developing States: Climate Change & Disaster Risk Management*. UN Conference on Small Island Developing States. United Nations Department of Economic and Social Affairs, Division for Sustainable Development, New York. http://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1344&menu=35.

UNFCCC (2007). *Report of the Conference of the Parties on Its Thirteenth Session, Held in Bali from 3 to 15 December 2007. Addendum. Part Two: Action Taken by the Conference of the Parties at Its Thirteenth Session.* FCCC/CP/2007/6/Add.1. United Nations Framework Convention on Climate Change. http://unfccc.int/documentation/documents/advanced_search/items/6911.php?priref=600004671.

UNISDR (2005). *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters*. Extract from the final report of the World Conference on Disaster Reduction (A/CONF.206/6). United Nations Office for Disaster Reduction, Geneva. http://www.unisdr.org/we/inform/publications/1037.

UNISDR (2009). *Adaptation to Climate Change by Reducing Disaster Risks: Country Practices and Lessons*. Briefing Note 02. United Nations Office for Disaster Reduction, Geneva. http://www.unisdr.org/files/11775_UNISDRBriefingAdaptationtoClimateCh.pdf.

UNISDR (2011). *Global Assessment Report on Disaster Risk Reduction 2011 – Revealing Risk, Redefining Development*. United Nations Office for Disaster Reduction, Geneva. http://www.unisdr.org/we/inform/publications/19846.

UNISDR (2013). *Global Assessment Report on Disaster Risk Reduction 2013 – From Shared Risk to Shared Value: The Business Case for Disaster Risk Reduction*. United Nations Office for Disaster Reduction, Geneva. http://www.unisdr.org/we/inform/publications/33013.

United Nations General Assembly (2014). *Suggested Elements for the Post-2015 Framework for Disaster Risk Reduction*. Geneva, Switzerland.

Vulturius, G. (2013). Policy change and policy learning for enhanced flood policies at local, subnational and EU level. In *Climate Change and Flood Risk Management: Adaptation and Extreme Events at the Local Level*. E. C. H. Keskitalo (ed.). Edward Elgar, Cheltenham, UK; Northampton, MA. pp. 121–49.

Wisner, B. (2001). Risk and the Neoliberal State: Why Post-Mitch Lessons Didn't Reduce El Salvador's Earthquake Losses. *Disasters*, 25(3). 251–68. DOI:10.1111/1467-7717.00176.

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