

Disaster risk governance in volcanic areas



A concept note for Work Package 4 of the Strengthening Resilience
in Volcanic Areas (STREVA) programme

Emily Wilkinson

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Overseas Development Institute

203 Blackfriars Road | London SE1 8NJ | UK

Tel: +44 (0)20 7922 0300

Fax: +44 (0)20 7922 0399

www.odi.org

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Key messages

The Strengthening Resilience in Volcanic Areas (STREVA) programme aims to reduce the risks associated with volcanic activity. Work Package 4 contributes to this goal by analysing how collective decisions are taken to manage risk across spatial and temporal scales in volcanic settings.

Volcanic risk is dynamic, with hazards, vulnerability and exposure of populations constantly changing. To manage risk effectively, disaster risk governance systems need to be flexible enough to adapt to these changes. The concept of disaster risk governance provides a useful analytical framework for assessing the capacity of governance regimes to undergo incremental and transformational institutional shifts in response to volcanic risk.

STREVA will engage with stakeholders in a joint assessment of how different dimensions of disaster risk governance have contributed to resilience in places with a recent history of volcanic activity. It will identify opportunities for decision-makers to improve the complementarity of informal and formal institutions, build networks of actors and strengthen vertical coherence in disaster risk management.

The conceptual framework developed here can be used to assess the norms governing risk management for a range of extreme socio-ecological events.

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Abbreviations

CCA	Climate change adaptation
DFID	Department for International Development
DRM	Disaster risk management
HFA	Hyogo Framework for Action
IPCC	Intergovernmental Panel on Climate Change
NGO	Non-governmental organisation
PEA	Political economy analysis
STREVA	Strengthening Resilience in Volcanic Areas
UNDP	United Nations Development Programme
UNISDR	United Nations International Secretariat for Disaster Reduction
WP4	Work Package 4

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Introduction

1. Introduction

A broad range of measures have been undertaken at different scales of governance to manage the risks associated with environmental hazards in an attempt to strengthen the resilience of social, physical and coupled systems. These activities, carried out by diverse sets of actors, are shaped by complex institutional configurations that vary across socio-political contexts. The types of measures adopted to manage risk and the appropriateness of these measures have been the subject of intense debate in disaster and disaster risk studies, as well as in international, intergovernmental and NGO forums, but the institutional arrangements governing these choices have received considerably less scrutiny. This absence is particularly noticeable in the literature on volcanic disasters and disaster risks, where the focus has traditionally been on the individual and collective actions of stakeholders living in close proximity to the hazard and less on the prevailing governance regimes.

This paper develops an approach under Work Package 4 (WP4) of the Strengthening Resilience in Volcanic Areas (STREVA) programme¹ for analysing the institutional factors that shape collective action to reduce disaster risk at different scales. The conceptual framework, developed through research carried out by the author in Mexico and elsewhere, advances the notion that the dominance of different aspects of governance, including scales and actors, and the types of actions produced as a result, vary across socio-political contexts and phases of disaster risk (of which a disaster is only one), as well as for different hazard- event types. One would expect, for example, local governments to play a more substantial role in preparing for highly predictable rapid-onset disasters, such as those prompted by hurricanes, than

reducing vulnerability to low-probability, high-uncertainty events, like volcanic disasters. So, while the focus of this paper is on governance in volcanic areas, the disaster risk governance framework can be used to assess the norms governing disaster risk management (DRM) decisions for a range of extreme socio-ecological events. These events are socio-ecological as well as physical, because human behaviour and geo-physical or hydro-meteorological processes are involved in the creation of disaster risk.

Three characteristics of disaster risk governance regimes are discussed and provide the basis for further analysis of risk management and development processes in volcanic areas: i) formal and informal institutional relationships; ii) actors and networks; and iii) central-local governance arrangements. There are obvious overlaps between these governance categories; for example, networks can be both formal and informal, stretch across governance scales or be localised. However, by analysing decision-making with respect to these analytical categories, one can begin to comprehend the types of influences on collective action decisions to manage risk across socio-political, temporal and hazard contexts.

This paper also outlines a framework for the whole STREVA project that could be used to promote learning and adaptation in volcanic settings, based on the premise that communities are able to adapt and prosper in hazardous environments, and become resilient through processes of social learning about the risks they face. How governance systems promote and inhibit learning to improve the management of risk in volcanic settings is also a disaster risk governance issue and is the policy-oriented focus of WP4 of STREVA.

¹ www.streva.ac.uk

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The STREVA approach

2. The STREVA approach

STREVA is a four-year UK Research Council-funded interdisciplinary project that aims to reduce the risks associated with volcanic activity and hence the impact of volcanic disasters on people and assets in the Caribbean and Latin America. It binds physical and social scientists, local partners and policy-makers in understanding how risks interact and change over time in volcanic areas, shaping disaster resilience. Part of the STREVA project involves a retrospective or ‘forensic analysis’² of four well-studied volcanoes with recent eruptive histories: Soufrière Hills, Montserrat; Tungurahua, Ecuador; Galeras, Colombia and Soufrière St Vincent, St Vincent and the Grenadines.

By reconstructing and evaluating the conditions and causes involved in particular destructive events at these volcanoes, as well as the collective responses, STREVA aims to develop an understanding of the processes contributing to and key components of resilience. It also seeks to produce a theory of change that explains ‘the causal links that tie programme inputs to expected programme outputs, or a plausible and sensible model of how a programme is supposed to work’ (Weiss, 1998: 55). Based on the indicators and theory of change generated during the forensic process, STREVA will then assess resilience and the capacity to manage the risks associated with future eruptions at two volcanoes with no recent eruptive history: Cotacachi, Ecuador; and Cerro Machín, Colombia. Potential volcanic-disaster scenarios will be developed for each of these trial volcanos, in partnership with local authorities, with the intention of promoting learning and risk reduction without the need for a disaster to have occurred to initiate these improvements.

WP4 of STREVA is concerned with the role of governance systems and institutional capacity in disaster resilience. This paper provides a conceptual basis for understanding the links between the resilience of communities

living close to volcanoes and the governance systems that surround them. This disaster risk governance framework will be tested and refined through its application in the analysis of the governance systems contiguous with the four well-studied volcanic systems. If it provides a useful categorisation of these regimes and the kind of policies produced as a result to address disaster risk, it will then be used to guide primary data collection and analysis at the trial volcanoes.

This work package is just one of five that lead on disciplinary and inter-disciplinary elements of STREVA. Other work packages are looking at different dimensions of risk: the hazardous processes, monitoring capacity, social vulnerability, risk analysis, and resilience in the context of volcanic activity and communications systems. These work packages constitute different methodological approaches to understanding risk, but come together through a retrospective analysis of changes in risk components at the forensic volcanoes: each will identify regime shifts and thresholds along a series of timelines, which will then be overlaid to identify lags and leaders to these changes, with the aim of building a hypothesis of how changes in components of risk, including DRM measures, contribute to disaster resilience. The term DRM is used as shorthand here to refer to all strategies, policies and organised collective activities aimed at reducing the impact of disasters and/ or reducing current and the creation of future disaster risk. This

² The Forensic Disaster Investigation approach is being developed by the international programme on Integrated Research on Disaster Risk (IRDR). Forensic investigations are evaluations of disasters using mixed methods to reveal the circumstances, causes and consequences of losses in disasters and to identify conditions that have limited or prevented loss (IRDR, 2011).



Tungurahua volcano, Ecuador, which became active in 1999 with subsequent eruptions in 2006, 2010, 2012 and 2013. ©2013 Emily Wilkinson/ ODI.

includes development planning decisions and investments that are risk-sensitive. The concept of disaster resilience refers to the capacity of socio-ecological systems to anticipate, resist, absorb, withstand, manage or maintain certain basic functions and structures, and recover from different hazards; as well as the ability to transform living standards in the face of

these shocks and stresses (Department for International Development (DFID), 2011; Pelling, 2011; Twigg, 2009). Disaster resilience is therefore an enduring quality of communities, societies and nations; perhaps more so than disaster risk, which is always present but its components are dynamic and constantly evolving and interacting.

3

Governance and volcanoes

3. Governance and volcanoes

Volcanoes pose a specific set of governance challenges because of their idiosyncratic nature. Volcanic eruptions contribute only a small percentage to total disaster impacts in terms of loss of life, the number of people affected and economic damage; nevertheless, they present significant risks to populations, livelihoods and infrastructure located nearby. This level of exposure is increasing, driven by population growth and migration to large urban centres such as Mexico City, Tokyo, Yogyakarta and Manila, located in volcanic areas. Volcanoes also offer a number of benefits to those living on their slopes, such as fertile soils for agriculture and tourism incomes; and some, such as Merapi in Indonesia, are considered sacred by local people (Head, 2006; Donovan, 2009). These factors do in fact explain why people are there and what they are doing. Hence, although resettlement programmes can reduce the level of exposure effectively, they may be ethically and politically undesirable and have negative consequences for livelihoods and the family economy.

High levels of uncertainty surrounding the volcanic hazards themselves also create governance challenges. Eruptions and the associated risks are notoriously hard to predict in terms of timing, duration, type of eruption, geographical or population exposure and vulnerability to different types of hazard. This makes forward planning and risk reduction in volcanic areas particularly problematic. Volcanic disasters can last for months and even years, completely destroying local settlements, leaving them uninhabitable for long periods after the eruption has ended. The 1995-1999 eruption of Soufriere Hills Volcano in Montserrat, for example, involved a slow, incremental escalation of volcanic activity and associated hazards, after several years of precursory seismic activity (Kokelaar, 2002: 5). More than 15 years after the eruption began it is still not considered to

be over, but none of the scientists involved in monitoring the volcano would have assigned a high probability to this outcome at the start of the eruption. In Peru, the 2006–2008 eruption of the Ubinas volcano was the first long-lasting crisis that the Peruvian civil authorities had to cope with, and as such it has provided important lessons for other areas with active volcanoes (Rivera, et al. 2010). In both these examples, critical lessons were learned by policy-makers during the crisis periods with regard to communicating with the public and managing large-scale evacuations.

An additional consideration – and one that is critical to disaster risk governance – is the number of volcanoes globally that have no record of a historical eruption. Exposed populations are likely to discount the risk of a volcanic disaster occurring if they have no experience of eruptions, and without public demand governments are unlikely to prioritise DRM (Maskrey, 1989). Furthermore, secondary volcanic hazards can occur in the absence of an eruption, creating more complex exposure and risk dynamics, challenging existing institutional arrangements. Intense rainfall during Hurricane Mitch in October 1998, for example, produced a lahar flow on the Casita volcano in Nicaragua that destroyed two towns, killing over 2,500 people (Kerle et al., 2003).

Despite presenting very peculiar challenges for collective action, the governance context has received very little attention in studies of volcanic disasters because of the lack of interdisciplinary research in this field. There is however a growing awareness among the natural hazards community that social science and interdisciplinary perspectives are needed in order for hazards research to be relevant and applicable to disaster managers. There are encouraging signs that volcanology

journals are becoming increasingly supportive of articles on decision-making in volcanic emergencies that use social science theories and methodologies.³

Notwithstanding their idiosyncrasies, volcanic disasters share certain characteristics. They are typically considered extreme events and can be characterised in terms of their spatial and temporal dimensions. Eruptions can be events of slow onset and long duration, as described above, allowing for changes in DRM policy and behaviour while the event is still unfolding. Nevertheless, it is usually possible to identify the crisis period(s) for affected populations and decision-makers, and hence volcanic disaster risk can be considered to have three phases with accompanying options for collective action.

1. Pre-crisis period, in which action may be taken to mitigate existing and anticipate future risk, such as land-use planning, retrofitting roofs, the development and enforcement of building codes, education and training programmes. These can be carried out on the basis of risk assessments. Land-use planning is a prospective tool that can be used to prevent or limit construction in unsafe areas, while relocation and re-zoning of space is a corrective tool to reduce existing exposure to hazards. Education on early warning systems is a reactive measure but education related to building practices that reduce ash entry into homes is a risk management activity that anticipates and reduces risk in the future.

2. Crisis period, which we can sub-divide into: a) start of the crisis and potentially long period of unrest (often characterised by seismic activity), which can be treated as a preparedness phase; and b) heightening of the crisis, usually initiated by an eruption, prompting emergency response activities to reduce negative impacts on people, such as food aid and shelter provision. These sub-phases vary widely across settings however and some volcanoes may do (a) and not (b), while some have (b) with no (a).

3. Post-crisis period, characterised by short- and longer-term recovery measures (the first of which may commence during the crisis period) to restore livelihoods and infra-

structure as well as reduce future losses and promote sustainability (Alexander 2002; Tierney 2012). These corrective and prospective risk reduction measures are more likely to occur in the post-crisis period than before an event has occurred, for reasons outlined below and in the next section.

These three temporal phases may overlap and are not necessarily demarcated by the hazard itself; nor do they represent a cyclical shift in the social system (from stability-to crisis-returning to a stable state). Indeed, the concept of a disaster cycle has been heavily criticised by social scientists for representing disasters as temporary interruptions of a linear development process, after which victims' lives return to normal (Christoplos et al. 2001; Hewitt 1983; Twigg 2004). In fact we can often observe hysteresis or irreversibility, rather than cyclicity, in environmental and social systems following perturbations (Whitten et al. 2012). Disasters can act as catalysts promoting policy change by highlighting previous failures. For instance, the 1985 Mexico City earthquake promoted the creation of a coordinated institutional structure for disaster management (Quarantelli 1993). Although the federal government had an emergency plan prior to the earthquake it was simplistic and inadequate, leaving government agencies with no idea how to act.

These disaster risk/ DRM phases may however represent important differences in terms of governance arrangements. Different social norms govern collective action to reduce vulnerability over the longer term (pre-crisis) than those responsible for mobilising emergency response during a crisis (Tierney 2012). The need for collective action to reduce disaster risk and associated problems are discussed in more detail below.

³ See for example a recent paper on a resettlement programme near the Mayon volcano, in the Philippines, which assesses the effectiveness of the programme in reducing exposure without adding vulnerability through loss of livelihoods and exposing community to new risks (Usamah and Haynes 2012). The paper uses a mixed-method approach, including semi-structured interviews, workshops and participant observations.

4

Organised responses to disaster risk

4. Organised responses to disaster risk

Collective action to reduce disaster risk may be different in important ways from interventions in sectoral issues such as health and education. Vulnerability to geo-physical and hydro-meteorological events is multi-dimensional and dynamic, as well as spatially and temporally contingent, and is therefore inadequately addressed through linear policy-making (Rashed and Weeks, 2003). Like sectoral policy issues, however, DRM has some public good characteristics. For example, the market does not provide sufficient construction of robust levees because individuals and communities do not take into account the flood protection benefits that these might offer to others (Keefer, 2009). At the same time, people may construct levees that protect themselves, with a negative external impact on others, such as those who live outside the embankments. Other aspects of DRM like early warning systems, on the other hand, display characteristics of non-rivalry – whereby consumption by one individual does not reduce the availability of the good to others – and non-excludability, so people cannot be excluded from using the good. For all these reasons, and because states have a moral and often legal duty to protect their citizens, DRM is generally considered to be a government responsibility, albeit with private sector and civil society participation in delivery and standard setting, and as such has been influenced by broader thinking on public service delivery (Wilkinson, 2012a).

4.1 Disasters as collective action problems

Disasters present collective action problems because the effective delivery of DRM requires contributions from multiple actors, but the perceived cost to individuals and governments of investing in DRM is often greater than

the perceived benefit. These motivational challenges often prevent action from being taken to reduce risk. Nonetheless, the mix of incentives and disincentives may vary between DRM activities. There are often economic disincentives to prospective risk reduction: for example, governments have incentives to allow property developers to build on the coast in hurricane-prone areas, destroying the mangroves that offer natural protection against storm surge, because of the high value of these properties and the tax revenues. On the other hand, corrective risk management projects, such as relocation of settlements or retrofitting of buildings, are of enormous value to the construction sector and can be lucrative for local politicians, despite the fact that housing solutions and sites offered to low-income families are often inappropriate (Jha, 2010).

In addition to the trade-offs identified above, the International Panel for Climate Change (IPCC) report *Managing the risk of extreme events and disasters to advance climate change adaptation* (Field et al., 2012) identifies a number of other economic, political and psychological constraints on effective DRM provision.

- Underestimation of the risk: even when governments are aware of the risks, they often underestimate the likelihood of the event occurring
- Budget constraints: particularly when the upfront costs are high, governments will often focus on short-run financial goals, rather than on the potential long-term benefits, in the form of reduced risks
- Difficulties in making trade-offs: many governments are not accustomed to using cost-benefit analysis methods that compare

upfront costs with expected discounted benefits in the form of a reduction in future losses

- Procrastination: governments may delay making a decision when faced with ambiguous choices
- Samaritan's dilemma: the expected availability of external post-disaster support can undermine ex-ante DRM measures when there are no incentives
- Politician's dilemma: the benefits of public investment in DRM will not be visible quickly (and maybe not during a politician's term in office), especially when hazards are infrequent, and this reduces political will.

Finally, DRM has the peculiar characteristic, uncommon to most public services, that decision-making is very often driven by crisis, and so 'time to think, consult, and gain acceptance for decisions is highly restricted' (Boin et al., 2005: 11). Under constraints of time and resources, and in situations of high volatility and uncertainty, policies will tend to be reactive, dealing with the symptoms of disaster and leaving the most vulnerable out of decision-making processes (Pelling, 2003; Cutter, 2006). Effective management of disaster risk requires high levels of multi-stakeholder cross-sectoral cooperation and coordination, but this is difficult to achieve under these conditions and given the hierarchical command-and-control paradigm that has traditionally dominated emergency management (Britton, 2001; PAHO, 1994).

4.2 The limits to decentralisation of disaster risk management

The constraints identified above are particularly prevalent at the local level. Municipal governments tend to regulate land use but the perceived cost of preventing construction to control future risk, may outweigh the benefits. Municipalities also face severe resource constraints, lacking the financial capacity to invest in corrective and prospective risk reduction, and they also suffer more than higher levels of government from a Samaritan's dilemma (or moral hazard). Local

governments are expected to pay for pre-crisis risk reduction measures out of their own funds – from central government transfers and locally raised revenues – but the availability of aid from national and/or international sources provides a disincentive to doing so. They also face a politician's dilemma, especially when terms of office are short. In Mexico, municipal presidents govern for three years and cannot be elected for a consecutive term. Hence there are minimal political incentives for developing longer-term DRM strategies (Wilkinson, 2012b).

Decentralisation of DRM and other services has been promoted by the World Bank since the 1980s as a panacea for problems including overloaded public sectors, macroeconomic instability and corruption (World Bank, 2001, 2004). Advocates of local-level DRM draw on many of the assumptions used in support of decentralisation: chiefly, that it generates greater efficiency in public services delivery and deepens democracy. Decentralisation is believed to increase efficiency because local governments are more aware of the service needs of local residents, so decision making can be more responsive to the people for whom the services are intended (Oates, 1977; Shah, 1998; Finot, 2005). It is also expected to improve access to public services (UNDP, 2002) and increase political participation and accountability (Turner and Hulme, 1997; Grindle, 2007).

Despite these lofty claims, recent political economy studies have pointed to the fact that decentralisation has not in fact generated the desired outcomes because of political market imperfections. These include: lack of information among voters about the performance of politicians; social fragmentation amongst voters; and lack of credibility of political promises to citizens (Keefer and Khemani, 2005). Imperfect information makes it hard for citizens to assign blame or credit to local government, so politicians have heightened incentives to seek rents rather than provide public goods. In fact, decentralisation has often strengthened of 'authoritarian enclaves', whereby local elites capture public resources and use them to meet their own narrow interests rather than those of local citizens (Turner and Hulme, 1997: 158).

As Keith Griffin (1981: 225) explains:

It is conceivable, even likely in many countries, that power at the local level is more concentrated, more elitist and applied more ruthlessly against the poor than at the centre [so] greater decentralisation does not necessarily imply greater democracy let alone 'power to the people'.

Keefer and Khemani (2005) argue that political market imperfections may be strongest in the health and education sectors where information asymmetries make it difficult for citizens to evaluate the quality and efficiency of services. DRM could easily be added to this list, as voters find it very difficult to evaluate the quality and efficiency of these services in terms of lives saved or damage avoided.

Policy incoherence has also constrained the performance of decentralised services, defined as contradictions in policy design, structure and roles such that policies become completely or partially un-implementable or unimplemented (Wild et al., 2012)⁴. This often stems from only partial implementation of decentralisation reforms, imposing greater responsibility on local governments for service provision and additional costs that are not paid for by the federal government, a problem referred to as 'unfunded mandates' (Posner, 1998). Central governments are reluctant to let go of power, so the factors influencing redistribution of power from the centre to the periphery are likely to affect the implementation of decentralisation, as well as its impact on local governance. Overall, decentralised governments have not been as efficient or democratic as the theory suggests and local-level DRM provision is likely to suffer from the same limitations.

Based on a growing realisation of the role of users and citizens in holding governments to account for the delivery of services, international and donor frameworks for DRM also endorse community consultation and participation in decision-making (see for example UNISDR, 2005; DFID, 2006). Advocates of participatory approaches anticipate benefits in terms of greater effectiveness, efficiency and sustain-

ability of interventions, as well as more equitable access to the benefits of risk reduction measures (for a more in-depth analysis, see Maskrey, 1989, 1994; Lavell, 1994; Lavell et al., 2003; Heijmans, 2004; Twigg, 2004; Wisner et al., 2004; DFID, 2006). In service delivery more broadly, this recognition has led to a range of initiatives attempting to empower users and provide them with institutionalised spaces for participation, such as health councils in Brazil, through which citizens can be directly involved in policy making and service delivery (Joshi, 2006).

Similarly, for DRM, communities need formal and informal mechanisms through which they are able to put pressure on government to develop more proactive policies to reduce risk (Delica-Willison and Willison, 2004; Heijmans, 2004; Tearfund, 2007). In reality, however, citizen involvement in policy making and service delivery tends to be limited to volunteer group involvement in emergency response activities such as first aid, and the provision of free labour for recovery measures including cleaning up debris and housing reconstruction.

In the developing world, countries as diverse as Colombia, Bangladesh and the Philippines have taken steps to decentralise DRM, with mixed success. Of all the Latin American countries, Colombia has arguably progressed furthest. It is one of the most decentralised countries in the region although small and rural municipalities continue to depend heavily on central government transfers. These differences between municipalities are also reflected in DRM capacity. The overall picture is extremely varied but small municipalities appear to suffer particularly from low levels of capacity to analyse risk and fewer resources, both financial and technical, to manage it. By 2000, 60 per cent of the 1,098 municipalities in the country had employed the concept of 'prevention' in their spatial planning, although deficiencies were observed in the application of these plans, above all in small municipalities and rural areas (Bollin et al., 2003). Similar patterns have been observed in Mexico and elsewhere (Wilkinson, 2012b).

⁴ For a more in-depth analysis of this incoherence see the discussion on central-local governance arrangements in section 5.2.

5

Disaster risk governance

5. Disaster risk governance

5.1 The relevance of governance in the context of risk

Governance has many connotations but in its broadest and most common form it denotes the structures and processes for collective decision-making (Nye and Donahue, 2000). It is also described as a different way of governing in which the state is not the only, or necessarily the most important, actor (Stoker, 1998). Governance can refer to new – and better – forms of regulation that go beyond traditional hierarchical state activity, implying ‘some form of self-regulation by societal actors, private-public cooperation in the solving of societal problems, and new forms of multilevel policy’ (Biermann et al., 2009: 21). This focus is useful for understanding approaches for dealing with disaster, as it emphasises not only the institutions of decision-making but also the decision-makers.

Governance belongs to the realms of politics, polity and policy. Focusing on how interests are transformed into collective action falls within the realm of politics, while the institutions or systems of rules that influence behaviour are a societal or polity concern and the different modes of policy-making are a policy issue. Hence, governance covers a complex range of societal dynamics (Pahl-Wostl, 2009). Political economy analysis (PEA) is often used to analyse how these structural and behavioural factors influence the quality of service delivery, namely:

- the underlying structures affecting collective action including long-term contextual factors such as geography and culture, and institutional structures
- the motivations influencing decision-makers (Harris and Wild, 2013).

PEA therefore focuses explicitly on politics and polity issues. The earth-systems governance literature, on the other hand, is concerned with the adaptiveness of governance mechanisms

and processes, of their accountability and legitimacy, and of modes of allocation and access (Biermann, 2007). Hence it pays more attention to the societal aspects of governance – how institutions shape decision-making – and policy issues around how resources are allocated.

The notion of ‘risk governance’ applies the concept and principles of governance described above to the context of risk and risk-related decision-making (Gunningham et al., 1998), focusing on polity and policy. It is concerned with a range of hazardous agents, not all of which are environmental; and it is based around risk assessments processes and their outcomes – risk management and risk communication – taking into account the legal, institutional, social and economic contexts in which a risk is evaluated, and the involvement of different stakeholders (Renn, 2008). Risk management is therefore seen as only one element or activity of risk governance.

In the same way, disaster risk management applies the concept of risk management to the context of disaster risk and is commonly used to refer to activities aimed at lessening the adverse impacts of hazards and the possibility of disaster, such as risk analysis, monitoring and mitigation measures. The various laws, policies, plans and procedures related to the management of disaster risk have received considerable attention in the disasters literature and have been the subject of many international conferences and prescriptive frameworks including the Hyogo Framework for Action (HFA). The focus tends to be on the formal institutional arrangements shaping decision-making, with government as the key – and sometimes exclusive – actor, and hence fails to consider the broader societal influences and wide array of actors and mechanisms for encouraging collective action to reduce disaster risk (Tierney, 2012). Similarly, the concept of disaster risk governance can be used to refer to the actors and networks involved in formulating and implementing DRM policies and the sets of

norms shaping these actions and actors. Norms include laws and regulations at multi scales, informal institutional arrangements (such as coercion and trust) and other mechanisms that encourage and detain collective action. Disaster risk governance therefore draws on broader conceptualisations of governance used in the public policy literature, as well as notions of environmental and risk governance.

5.2 Disaster risk governance characteristics

Understanding the dynamics of complex governance systems and how these shape DRM policies is a challenge. Relevant conceptual frameworks in the social sciences, such as regime theory, new institutional economics and game theory, fail to capture the complex, context-specific nature of governance regimes (Young, 2007, cited in Pahl-Wostl 2009), while policy-oriented research on DRM and climate change adaptation (CCA) tends to conflate governance with normative concepts of good governance. Governance aspects of resilience are often identified in United Nations (UN) agency and non-governmental (NGO) reports, divided into:

- a) DRM-specific instruments and organisations such as policies, plans, political commitment and mainstreaming, legal and regulatory systems and partnership arrangements
- b) non-DRM-specific norms such as accountability and community participation (UNISDR, 2005; Twigg, 2007).

These instruments, organisational arrangements and components collectively provide a conceptualisation of governance that is useful in the promotion of more effective DRM policies, by describing areas of intervention and standards that need to be reached. However, what this conceptualisation gains in instrumentality it loses in analytical power, as it does not explain how the governance components evolve, how they are connected or their context specificity. In short, lists of governance aspects of DRM are of limited explanatory use as they describe outputs not institutional processes.

The literature on environmental governance and CCA provides more analytical framings of governance at a higher level of abstraction,

taking a step back from the output focus described above. One useful characterisation, provided by Pahl-Wostl (2009: 356-358), identifies four characteristics, also of relevance to disaster risk governance:

1. the relationship and relative importance of formal and informal institutions
2. actor networks, with emphasis on the role and interactions of state and non-state actors
3. multi-level interactions across administrative boundaries and vertical integration
4. governance modes – bureaucratic hierarchies, markets, networks.

This conceptualisation of governance focuses on the realms of polity and policy, highlighting both the institutional arrangements shaping collective action (formal versus informal; state versus non-state; central versus local) and the different modes of policy-making (hierarchies, markets and networks). These four dimensions of environmental governance can also be used to assess and classify types of disaster risk governance regimes and have been adapted and developed for that purpose (see below). Points two and four have been combined to produce one analytical concept related to actors and networks, as it was felt that this would help to highlight the influence of agency in decision-making as well as structure. In fact, each of the three systemic features of disaster risk governance (formal and informal institutions, actors and networks and central-local arrangements) is influenced by both structural and agency factors, and the nature of this interaction will be further explored through this research.

The three dimensions of disaster risk governance are described below, with examples of the different types of characteristics one would expect to find across disaster risk phases and for different types of socio-ecological events. These categories are not mutually exclusive and there may be overlaps, but they provide useful and distinct lenses through which to analyse disaster risk governance regimes.

Formal and informal institutional relationships

This disaster risk governance dimension is concerned with the relationship and relative importance of the formal and informal

institutions shaping DRM activities. The concept of institutions refers to the rules, norms and strategies that shape individual and organisational behaviour (North, 1990; Ostrom, 1999). Institutions are persistent, predictable arrangements, laws, processes or customs serving to structure political, social and economic transactions and relationships in society. They may be formal, including legislation and parliamentary procedures, or informal, such as cultural rules for decision-making (Handmer and Dovers, 2007; Pelling and Holloway, 2006). The goals of formal and informal institutions may be either compatible or conflicting (Pahl-Wostl, 2009), and if the two types of rules systems complement each other then governance processes are likely to be more efficient and effective – measured, for example, by lower rates of corruption.

It is important to take these interactions into account to understand the nature of potential governance failures in DRM, as well as the opportunities for – and barriers to – change. A study of civil protection reform in Mexico, for example, found that informal institutional arrangements for DRM dominate at lower governance scales because municipal DRM practices are more heavily influenced by political and personal relations with state government authorities than by national civil protection legislation and policies. Despite decentralisation reforms, centrist and paternalistic tendencies persist, affecting the civil protection system and Mexican public administration in general (Wilkinson, 2012b). The suggestion is that although formal mechanisms to ensure local government compliance with national strategies may be weak, informal arrangements are often more effective.

On the other hand, informal or customary institutional arrangements can work to subvert formal rules. Even when there are formal institutions like parliaments, elections and decentralised modes of governance, there are also informal networks outside these through which decision-makers work to advance personal or particular interests rather than collective ones, sometimes referred to as neopatrimonialism (Cammack, 2007). Clientelism and patronage arrangements, where public funds are targeted to secure loyalty, are detrimental to service delivery, contributing to poor access to and poor quality of services,

and inequality or marginalisation of some groups (Wild et al., 2012). These patronage logics are prevalent in DRM, where powerful interest groups often resist disaster planning and land use regulations (Drabek et al., 1983; Tierney, 1989). Particularistic interests are often pursued in emergency response as well. The distribution of aid in Mexico after hurricanes Wilma (2005) and Dean (2007) was subject to political manipulation by municipal and state governments in election years, with municipal governments targeting resources to local supporters, and state governments attempting to damage the credibility of municipalities run by opposition parties by delaying the distribution of resources (Wilkinson, 2011).

Actors and networks

This dimension of disaster risk governance emphasises the role and interactions of state and non-state actors involved in DRM. Historically, key DRM functions such as regulation have been carried out by public agencies, based on formal institutions. However, complex social problems, such as disaster risk, cannot be addressed adequately by one organisation and many DRM functions formerly carried out by centralised public agencies are now dispersed amongst a range of actors (Tierney, 2012). For example, to control future levels of risk, local governments can regulate land use and building construction, but private companies and NGOs often deliver key services and are responsible for the larger infrastructure projects that can control risk, such as dykes and sea walls; while households contribute labour and assets to housing and other low-tech construction projects.

The actors in DRM have diverse interests and behave in different ways. There are individuals or organisations that support DRM reform as well as those who oppose it; those who engage with the issues and those who ignore them; and individuals or organisations who benefit from potential reform and those whom it will cost. Actors will vary in their ability to exercise agency and influence decision-making and resource allocation, in large part due to the power (economic, social, and political) they hold. Even among civil society actors, there will be competing incentives and decision logics, and the interests of these actors are not necessarily oriented towards the wider public good. Civil society organisations may reflect particular

social, political and economic interests based on factors such as wealth, geography, religion, and gender. This wide range of interests, combined with the possible existence of market or state links, implies that even within civil society there may be competition and conflict over values and interests (World Health Organization (WHO), 2002).

Actors and groups are brought together through networks, which are largely governed by informal institutions. Networks are decentralised structures and are often considered to be the meso level between market and hierarchy, incorporating different knowledge sources and competencies (Newig et al., 2010). They can involve state and non-state actors in a set of relationships to address collective action problems and are more likely to produce emergent – as opposed to planned – responses to disaster risk, resulting from self-organising processes and interactions within a wide range of actors (Dynes et al., 1994; Quarantelli, 1994). Networked structures are expected to be more effective for managing risk than hierarchical bureaucracies because they are more flexible, adaptable and capable of mobilising diverse resources (Powell, 1999). However, these decentralised network structures may not work in ways that favour the most vulnerable for the reasons outlined in section 4.2.

Network characteristics are particularly important in large-scale disasters, where emergency response functions are often carried out by emergent groups that lack central coordination (Dynes et al., 1990; Quarantelli, 1993). Following the 1985 Mexico City earthquake, although the government had an emergency plan it was simplistic and inadequate, leaving government agencies with little idea how to act (Quarantelli, 1993). This prompted an unprecedented response from civil society that has been well documented (see for example Dynes et al., 1990; Quarantelli, 1993, 1994). Insights from the literature on communities of practice (Wenger 1998) and sociological studies of collective responses to disaster (Dynes et al., 1990; Quarantelli, 1993), however, suggest that well-established networks are more useful than ad-hoc ones for effective mobilisation during extreme events and long-term learning (Moser, 2008). In summary, the notion of networks for DRM carries the implications of:

1. enhancing social relations and enabling collective action
2. flexible organisation and adaptability
3. innovative linkages between entities that have not been understood previously as linked (Schmidt-Thomé and Peltonen, 2006).

Networks can also be promoted by state agencies, particularly when there is a recognised need to improve the effectiveness, appropriateness and sustainability of public service delivery, and DRM is no exception (for a more in-depth analysis, see Maskrey, 1989, 1994; Lavell, 1994; Lavell et al., 2003; Heijmans, 2004; Twigg, 2004; Wisner et al., 2004; DFID, 2006). Civil society is even being brought into the design of formal institutions that govern its behaviour – such as regulations and development planning – in order to improve efficiency. However, this may come at the expense of decreased efficiency as participatory processes can be resource-consuming (Pahl-Wostl, 2009). Private sector actors are also playing an increasingly prominent role in DRM, with insurance companies helping governments and communities to spread risk and construction companies often responsible for producing voluntary building codes and standards.

Central-local governance arrangements

This dimension of disaster risk governance is concerned with the coherence and consistency of governance arrangements for DRM. Vertical coherence is of particular interest and relates to the division of roles and responsibilities for DRM between different levels of government and between local governments and other exogenous actors. DRM is often considered a local government responsibility not just on the basis of subsidiarity in public service provision, but also because the problem in question – disaster risk – is geographically as well as socially defined. No two communities have the same combination of exposure to hazards and vulnerability (Lavell et al., 2003), and these very context-specific risk configurations are better understood by local stakeholders. Conversely, if local stakeholders are not engaged in DRM then the resulting policies, strategies and plans are less likely to respond appropriately to local conditions. For example, ‘cases abound of projects to build hazard resistant but ecologically and culturally

inappropriate housing, which ends up not being accepted by the local population' (UNISDR, 2009: 167). Hence, local autonomy in defining and implementing DRM measures is expected to produce more appropriate and effective collective action to reduce risk.

Despite the broad benefits of decentralising decision-making and resources for DRM, decentralised structures can also undermine local collective action, particularly where regulatory capacity is weak (Wild et al., 2012). In many countries municipal governments are responsible for controlling construction in hazard-prone areas and do so through the development of land-use regulations and building codes, but enforcement is a big problem. In 1999, the Marmara earthquake in Turkey killed 17,000 people despite the existence of adequate design specifications in the Turkish seismic code. It was not lack of regulation but lack of enforcement which led to deaths: an estimated 70 per cent of housing did not conform to the regulations because of long-standing inadequacies in local government and lack of control mechanisms (Ozerdam, 1999).

An additional factor to consider is that local governance regimes are not the only or even the most important unit of analysis, as these are embedded in broader institutional structures operating at other governance scales, which also have critical roles to play (Andersson and Ostrom, 2008). A focus on these relations and in particular the dependence/autonomy in central-local relations is useful because disasters create exceptional circumstances whereby central authorities typically have a legal mandate to interfere in local affairs. In Italy, through each successive eruption of Mount Etna the state has become more involved since 1928. Today, emergencies are closely managed by central government, through civil protection authorities, with supporting departments and scientific institutions. According to Chester et al., (2012) this 'top down' intervention is characterised by the adoption of uniform measures such as engineering approaches to lava diversion and land-use planning based on hazard mapping, rather than interventions tailored to the

particular needs of a given community. Hence, 'on Etna, although intervention by the State has boosted overall resilience, the traditional deep-seated disaster resilience of pre-industrial times has been reduced' (Chester et al., 2012: 77).

In addition to central-government domination, donors, regional organisations, NGOs and other actors can play an influential role in DRM in developing countries. These actors are all exogenous to the locality and so are considered to be 'central' actors in this 'central-local relations' construct. The relationships between these actors, the coherence of their roles and responsibilities for DRM and exogenous intervention in local affairs are key concerns in the analysis of central-local dimensions of disaster risk governance.

The three-dimensional framework of disaster risk governance outlined above can be used to assess, characterise and compare disaster risk governance regimes across a variety of socio-political and hazards settings. It can also be used to explore the dominance of different dimensions of disaster risk governance for different types of DRM decision-making: from reactive risk management decisions typically concerned with emergency response during a crisis; to corrective and prospective risk reduction before a crisis and in post-crisis recovery and reconstruction. A summary of what the results of such an assessment might look like is outlined in Table 1 (below).

It is important to note that the characteristics of disaster risk governance outlined in the table will likely vary according to the context. The extent to which they will be present at all depends on issues such as levels of state capacity and penetration, as well as strength of community ties, all of which are shaped by nature of the broader political economy. Indeed, PEA frameworks can be used to help guide the analysis of these characteristics and their outcomes, in terms of effective DRM. This type of analysis assumes that both structure and agency factors form the basis of a country's political economy and underlie service delivery outcomes (Harris and Wild, 2013).

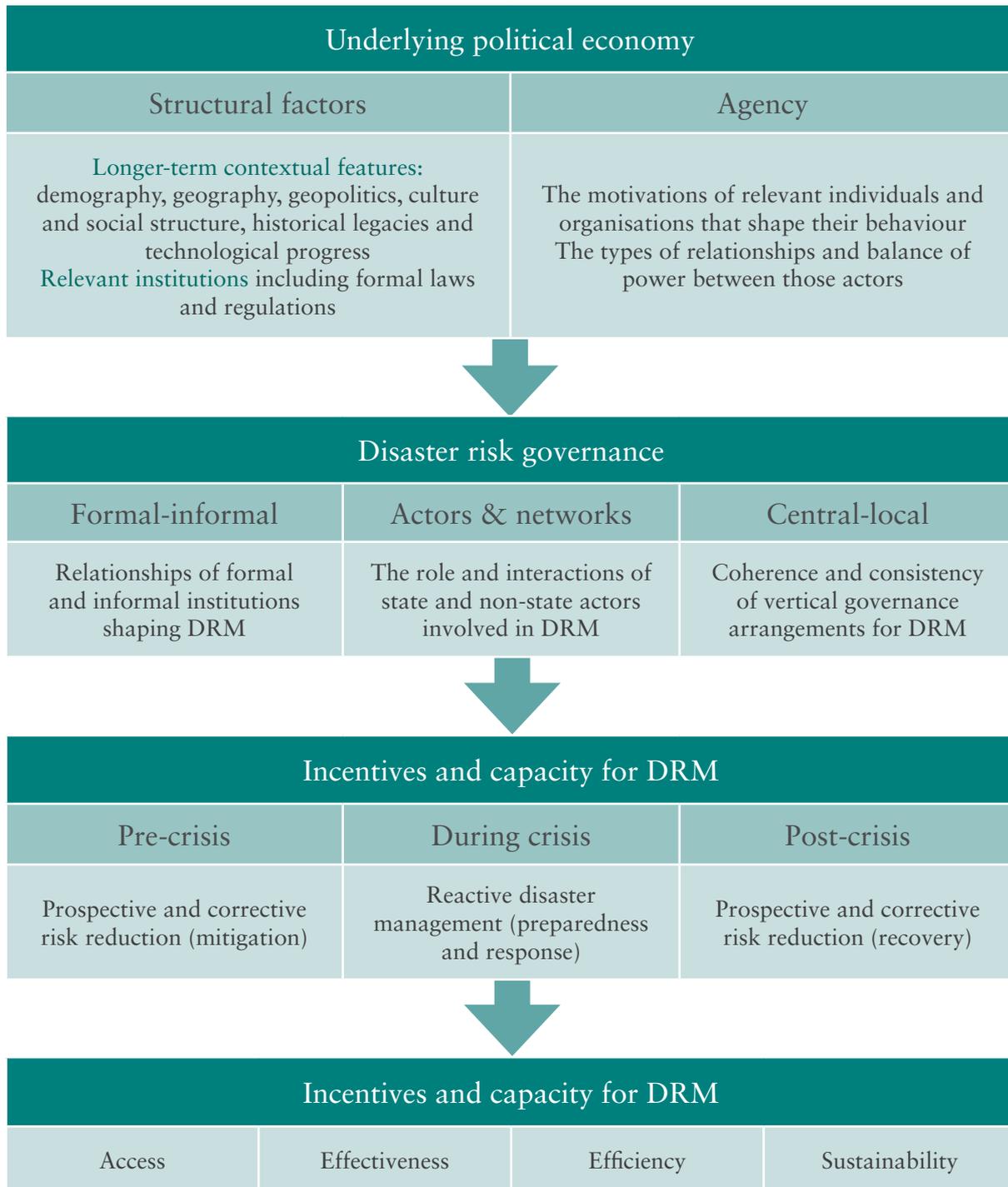
Table 1: Generic characteristics of disaster risk governance

Analytical categories of disaster risk governance	Temporal dimensions of volcanic disaster		
	Pre-crisis	Crisis	Post-crisis
1. Formal and informal relationships	Formal institutions dictate land-use planning decisions but often subverted by informal practices; formal and informal influences on knowledge transfer e.g. for building practices.	Informal institutions govern emergency response.	Mainly formal relationships in planning decisions but also informal (including rent-seeking in relocation/ re-zoning projects).
2. Actors and networks	State agencies responsible for land-use planning.	State agencies dominate evacuations and shelter management. Civil society fills in the gaps, through emergent networks.	State agencies dominate formal reconstruction process, plan relocations and can incentivise retrofitting of roofs. Networks provide livelihood options.
3. Central-local governance arrangements	Local-level autonomy in land-use planning but limited capacity.	Central interference and local dependency on central government and military to manage emergency response. Significant local autonomy in decision-making around communication of warnings, evacuation drills etc.	Often high levels of central interference in reconstruction and relocation decisions.

Figure 1 (below) captures the political economy factors underlying the disaster risk governance characteristics. It illustrates how combinations of these factors shape incentives and capacity for undertaking different DRM activities, and shows four outcomes against which DRM

performance can be measured: access, effectiveness, efficiency and sustainability. The links between these levels of analysis and outcomes for DRM will be tested by STREVA through the analysis of different disaster risk governance systems.

Figure 1: Linking underlying political economy to DRM outcomes via disaster risk governance factors



Source: Adapted from Harris and Wild, 2013.

6

**Learning,
adaptation
and resilience**

6. Learning, adaptation and resilience

6.1 Focusing events and institutional change

Disaster risk governance is concerned with how institutions change or, conversely, are able to remain static for long periods – hence creating opportunities for or constraints on DRM policy reform. Although there is no well-defined body of literature on institutional or policy change in disaster studies, it has been noted that major disasters can act as ‘focusing events’, prompting a flurry of interest in disaster risk, by bringing the failures of existing DRM policies to the attention of the public and policy-makers (Birkland, 2006; Kingdon, 1995). Disasters affecting Latin America during the 1990s for example – including El Niño (1997-1998), La Niña (1999-2000), the 1998 earthquake in Armenia, Colombia, Hurricanes George in the Caribbean and Mitch in Central America (1998), and the landslides and flooding in Venezuela (1999) – all prompted criticism of existing DRM models and led to policy changes (Lavell, 2000). Indeed, international reports on national progress in DRM note that countries often review their existing legislative and institutional structures after a major disaster (UNISDR, 2004, 2007). The Orissa cyclone (1999) and Gujarat earthquake (2001) in India both led to a redesign of national legislative and institutional arrangements; while in Pakistan, a National Disaster Management Commission and National Disaster Management Authority were established after the 2005 earthquake (UNISDR, 2007).

Despite these improvements, it is common for lessons learned and new policies created in the immediate aftermath of a disaster to be short-lived, as other priorities emerge and political commitment is lost (Handmer and Dovers, 2007; Quarantelli, 2000). Following Hurricane Mitch (1998) the government of El Salvador made commitments to building a healthcare system

capable of responding to extreme events, safer housing and a modern national system for DRM; but all were abandoned in favour of a series of neo-liberal reforms, including downsizing of the state, which meant little was done to reduce vulnerability (Wisner, 2001: 256-258). The lessons learned in the wake of Hurricane Mitch were soon forgotten, and when two earthquakes struck the country three years later, there were huge losses that arguably could have been avoided. This example demonstrates the persistence or ‘path dependence’ of institutions in the face of extreme social events (Schreyögg and Sydow, 2010).

6.2 Institutional learning, adaptation and resilience

Processes of policy and institutional change are perhaps better understood through the lens of – adaptation, used in the climate change literature to refer to the ability of a unit to transform its structure, functioning or organisation in response to actual or expected levels of risk, hazard and/or vulnerability thresholds (see Kelly and Adger, 2000; Pelling, 2011). The concept is therefore about a particular type of collective action through which actors learn about climate-related risks and how to manage them more effectively, and is therefore closely linked to disaster risk governance, which is concerned with the institutional arrangements that shape collective action to manage disaster risk. The capacity of groups and individuals to design and implement adaptation or DRM strategies is known as adaptive capacity (Brooks, Adger and Kelly, 2005).

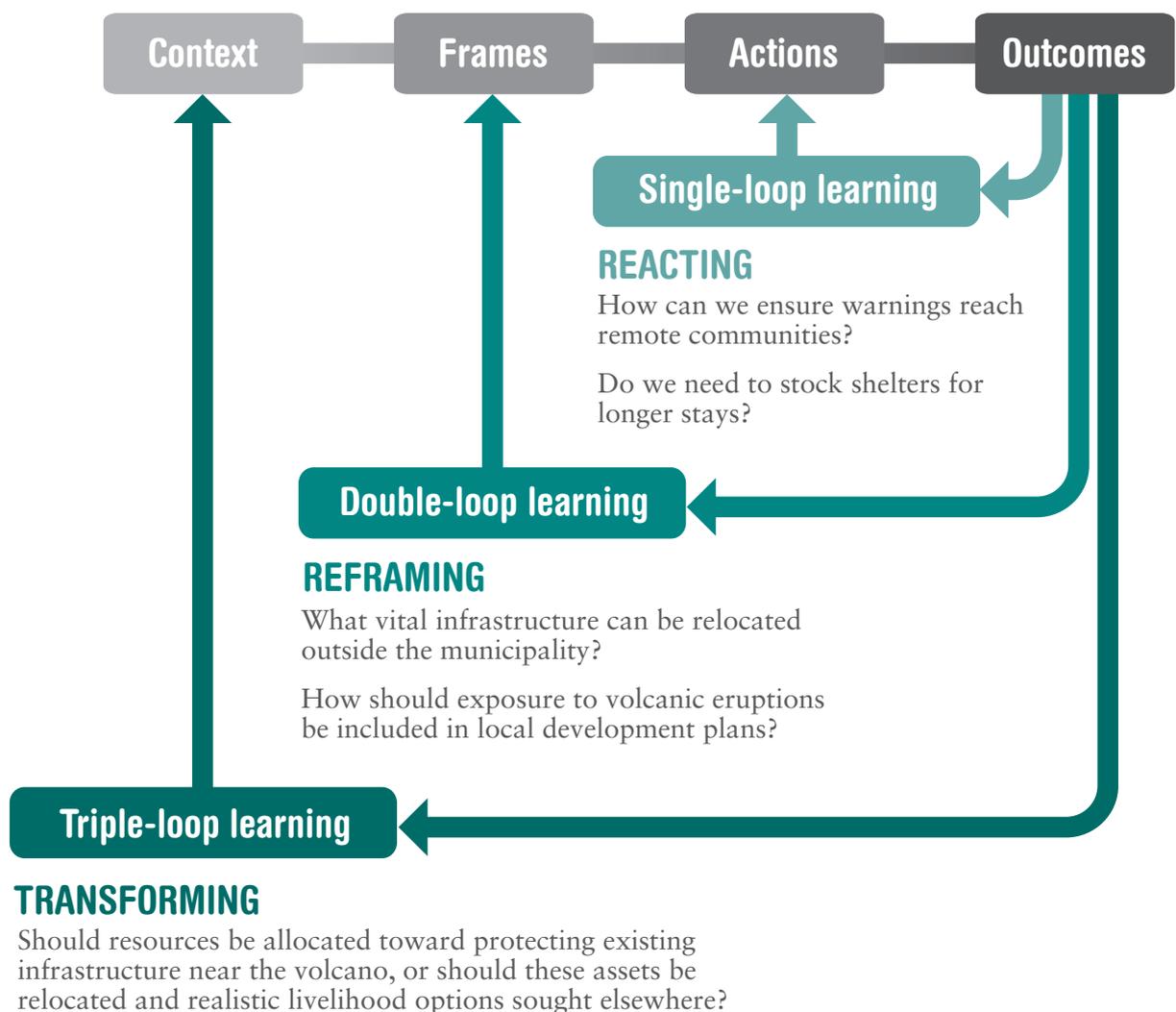
Given the complex dynamics of socio-ecological systems and their interaction with a changing climate, adaptation requires iterative learning processes and management plans that are explicitly designed to evolve as new information becomes available (Morgan et al., 2009;

National Research Council (NRC) 2009). In addition, these iterative learning processes need to be institutionalised in policy and practice, to ensure lessons are not forgotten (Cutter et al., 2008). This type of social learning is defined as ‘the capacity and processes through which new values, ideas and practices are disseminated, popularised and become dominant in society or a sub-set such as an organisation or local community’ (Pelling, 2011: 59). Not all social learning is linked to formal structures, so in order to clarify, the concept of institutional learning is used here instead to refer to social learning that results in changes in formalised or organised practices.

Institutional learning is not linear but rather a stepwise process where actors experiment with

innovation until they meet constraints and new boundaries (Pahl-Wostl, 2009). We can observe it at different scales of governance and through a series of learning ‘loops’, differentiated by the degree to which the learning that takes place promotes transformational change in management strategies (Field et al., 2012). In organisational theory, the learning-loop framework is used to describe three levels of learning cycles within an organisation (Hargrove, 2002, cited in Pahl-Wostl, 2009): single-loop learning refers to an incremental improvement of practices without questioning the underlying assumptions; double-loop learning refers to a revisiting of assumptions within the same normative framework; and triple loop-learning involves a reconsideration of underlying principles (see Figure 2).

Figure 2: Learning loops and their application to volcanic risk management



Source: Adapted from Field et al., 2012.

Single-loop learning focuses primarily on actions. In a flood risk management example outlined by Field et al. (2012), where floodwaters threaten to breach existing defences, flood managers may ask whether dyke and levee heights are sufficient, and make adjustments accordingly. Double-loop learning occurs when the existing flood risk management regime is critically examined to determine whether it is resilient to anticipated shifts in hydrological extremes over a particular time period. This requires a change in the framing of the problem. Triple-loop learning, on the other hand, brings about a change in the context for decision-making. It might entail a more participatory approach to flood risk management, involving additional parties from across cultural, institutional, national and other boundaries that contribute significantly to flood risk (Pahl-Wostl, 2009).

For volcanic risk management, experiences with eruptions often lead to incremental improvements in communications systems, so early warnings about volcanic behaviour are better communicated to people living close to the volcano. Improvements in shelter management also occur as a result of single-loop learning. Double-loop learning is seen when a longer term view of risk is taken and investment in infrastructure begins to move to safer locations further away from the volcano, based on risk assessments. Triple-loop learning would entail a re-evaluation of local (and regional) development models and the development of more permanent infrastructure and economic opportunities in other locations, through deep engagement and consultation with affected communities.

The incremental and transformational shifts in DRM practices that occur as a result of institutional learning (as well as lags and responses to these shifts) will be studied by WP4 of STREVA. Using Figure 1, which links political economy factors to DRM outcomes, STREVA will characterise the disaster risk governance

regimes in each of the four forensic settings, and assess which are more or less adaptive and the institutional and agency factors that affect this. In these regions, with experiences of volcanic crises, the start and end of an eruption may represent important learning thresholds, although further cycles and adaptation are likely to have occurred after the crisis period has ended. Other thresholds such as political instability and changes in government could also be significant and need to be understood better.

The concepts of learning loops and institutional shifts provide useful analytical tools for analysing changes in disaster risk governance. Using time-series data and recall methods, WP4 of STREVA will identify thresholds in governance systems or moments when changes took place as a result of institutional learning. By formulating a model of how institutional leaning and adaptation takes place during and after volcanic disasters, the aim is to develop a theory of change that can be used in volcanic settings elsewhere, including those with no recent experience of disasters acting as focusing events.

WP4 will also engage with other work packages in STREVA to assess the contribution of institutional learning to disaster resilience in volcanic settings, based on the premise that communities are able to adapt and prosper near active volcanoes as a result of processes of social learning about hazards and risk and how to manage those risks. Resilience is therefore seen as the outcome of these broader societal processes. For the forensic volcanoes, this learning is reflected in adaptations that occur at different scales; while in volcanic areas, with no recent experience of disaster, the adaptive capacity of different elements of the system may be a better indicator of resilience. Overall, STREVA will develop a more holistic and interdisciplinary understanding of resilience, of which disaster risk governance is just one aspect.

7

**Disaster risk
governance in
volcanic areas
– a research
agenda**

7. Disaster risk governance in volcanic areas – a research agenda

The concept of disaster risk governance provides a useful analytical tool for understanding how collective action decisions are taken to reduce risk. It also offers an analytical framework for assessing the capacity of governance regimes to learn and undergo institutional shifts or transformations. Disaster risk is dynamic, with hazards, vulnerability and exposure of populations constantly changing, so in order to promote collective action that effectively reduces risk, disaster risk governance systems need to be flexible enough to adapt to these changes. We consider three characteristics of disaster risk governance relevant to understanding collective action for DRM: i) formal and informal relationships, ii) actors and networks and iii) central-local governance arrangements. We must explore these characteristics empirically to ascertain whether they explain adequately why different types of collective action arise in different (governance) contexts and whether they provide a useful framework for understanding and promoting institutional change. We must also examine these characteristics with respect to different kinds of DRM decisions, from reactive, crisis-driven emergency management decisions to corrective and prospective risk reduction, as the goals and processes for each are very different.

Governance regimes in four volcanic areas are being assessed under WP4 of STREVA in terms of these disaster risk governance characteristics. Disasters have occurred in all four areas within the past 20 years, and so it is possible to undertake an evaluation of DRM policies and

practices and institutional influences on these areas using recall methods, in order to explore the dominance of different institutions before, during and after the crisis. By analysing the causes of – and responses to – these volcanic disasters, and characterising the governance regimes surrounding these volcanoes, we can further refine and develop the concept of disaster risk governance.

In addition to the research agenda described above, STREVA has an action-oriented focus. It aims to reduce the risks associated with volcanic activity. This is a particularly challenging task in areas with no recent eruptive history, as levels of political commitment and knowledge of the hazard are likely to be low. Nevertheless, it is in these places where an understanding of effective disaster risk governance, and of other aspects of resilience, is most needed. All stakeholders need to be involved in efforts to understand the processes contributing to –and key components of –resilience, in order to take action. Based on the indicators and theory of change produced during the forensic process, STREVA will work with local partners to strengthen resilience in two high-risk volcanoes with no recent eruptive history, but which show signs of unrest and are less well understood. We will then develop potential volcanic disaster scenarios for each of these trial volcanos, in partnership with local authorities, with the intention of promoting learning and DRM reforms without the need for a disaster to have occurred to initiate these improvements.

References

- Adger, W.N., T.P. Hughes, S.R. Carpenter and J. Rockstrom (2005) 'Socio-ecological resilience to coastal disasters', *Science* 309, 1036-1039.
- Alexander, D. (2002) *Principles of emergency planning and management*, New York: OUP.
- Andersson, K.P. and E. Ostrom (2008) 'Analyzing decentralized resource regimes from a polycentric perspective', *Policy Sciences* 41, 71-93
- Biermann, F. (2007) '“Earth system governance” as a crosscutting theme of global change research,' *Global Environmental Change: Human and Policy Dimensions* 17, 326–337.
- Biermann, F., M.M. Betsill, J. Gupta, N. Kanie, L. Lebel, D. Liverman, H. Schroeder and B. Siebenhüner (2009) *Earth system governance: people, places and the planet. Science and Implementation Plan of the Earth System Governance Project*, Earth System Governance Report 1, IHDP Report 20. Bonn: IHDP.
- Birkland, T.A. (2006) *Lessons of disaster: policy change after catastrophic events*, Washington DC: Georgetown University Press.
- Boin, A., P.T. Hart, E. Stern and B. Sundelius (2005) *The politics of crisis management: public leadership under pressure*, Cambridge: Cambridge University Press.
- Bollin C., H.H. Cárdenas, and K.S. Vatsa (2003) *Disaster risk management by communities and local governments*, Washington DC: Inter-American Development Bank.
- Britton N. (2001) 'A new emergency management for the new millennium?', *Australian Journal of Emergency Management* 16(4), 44-54.
- Brooks, N., W.N. Adger, and P.M. Kelly (2005) 'The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation', *Global Environmental Change* 15(2), 151-163.
- Cammack, D. (2007) 'The logic of African neopatrimonialism: what role for donors?', *Development Policy Review* 25(5), 599-614.
- Chester, D.K., A.M. Duncan and H. Sangster (2012) 'Human responses to eruptions of Etna (Sicily) during the late-Pre-Industrial Era and their implications for present-day disaster planning', *Journal of Volcanology and Geothermal Research* 225-226, 65-80.
- Cumming, G.S., G. Barnes, S. Perz, M. Schmink, K.E. Sieving, J. Southworth, M. Binford, R.D. Holt, C. Stickler, T. Van Holt (2005) 'An exploratory framework for the empirical measurement of resilience', *Ecosystems* 8, 975-987.
- Cutter, S.L. (2006) *Hazards, vulnerability and environmental justice*, London: Earthscan.
- Cutter, S.L., L. Barnes, M. Berry, C. Burton, E. Evans, E. Tate, J. Webb (2008) 'A place-based model for understanding community resilience to natural disasters', *Global Environmental Change* 18(4), 598-606.
- Christoplos, I., J. Mitchell and A. Liljelund (2001) 'Reframing risk: the changing context of disaster mitigation and preparedness', *Disasters* 25(3), 185-198.
- Delica-Willison, Z. And R. Willison (2004) 'Vulnerability reduction: a task for the vulnerable people themselves', in G. Bankoff, G. Frerks and D. Hilhorst (eds.) *Mapping vulnerability: disasters, development and people*, London: Earthscan, 145-158.
- DFID (2006) *Reducing the risk of disasters: helping to achieve sustainable poverty reduction in a vulnerable world: a DFID policy paper*, London: UK Department for International Development.

- DFID (2011) *Defining disaster resilience: a DFID approach paper*, London: UK Department for International Development.
- Donovan, K. (2009) 'Doing social volcanology: exploring volcanic culture in Indonesia', *Area* 42(1), 117-126.
- Dynes, R., E.L. Quarantelli and D. Wenger (1990) *Individual and organizational response to the 1985 earthquake in Mexico City*, DRC Book and Monograph Series 24, Newark DE: University of Delaware, Disaster Research Center.
- Dynes, R.R., K. J. Tierney and C.E. Fritz (1994) 'The emergence and importance of social organisation: the contributions of E.L. Quarantelli', in R. R. Dynes and K.J. Tierney (eds.) *Disasters, collective behavior and social organization*, Newark DE: University of Delaware Press, 9-17.
- 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) (2012), *Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC)*, Cambridge and New York: Cambridge University Press.
- Finot, I. (2005) 'Descentralización, transferencias territoriales y desarrollo local', *Revista de la CEPAL* 86, 29-46.
- Griffin, K. (1981) 'Economic development in a changing world', *World Development* 9(3), 221-226.
- Grindle, M. (2007) *Going local: decentralization, democratization, and the promise of good governance*, Princeton NJ: Princeton University Press.
- Gunningham, N., P. Grabosky and D. Sinclair (1998) 'Smart regulation: an institutional perspective', *Law and Policy*, 19 (4), 363-414.
- Handmer, J. and S. Dovers (2007) *Handbook of disaster and emergency policies and institutions*, London: Earthscan.
- Hargrove, R. (2002) *Masterful coaching*, Revised Edition, San Francisco CA: Jossey-Bass/Pfeiffer, Wiley.
- Harris, D. and L. Wild (2013) *Finding solutions: making sense of the politics of service delivery*, London: Overseas Development Institute.
- Head, J. (2006) 'Merapi more than just a mountain', BBC Online <http://news.bbc.co.uk/1/hi/world/asia-pacific/4994464.stm> [13 March 2007].
- Heijmans, A. (2004) 'From vulnerability to empowerment', in G. Bankoff, G. Frerks and D. Hilhorst (eds.) *Mapping vulnerability: disasters, development and people*, London: Earthscan, 115-127.
- Hewitt, K. (1983) 'The idea of calamity in a technocratic age', in K. Hewitt (ed.) *Interpretations of calamity: from the viewpoint of human ecology*, Boston MA: Allen and Unwin, 3-32.
- IRDR (2011) *Forensic disaster investigations: the FORIN project*, Beijing: Integrated Research on Disaster Risk.
- Joshi, A. (2006) 'Institutions and service delivery in Asia', *Session 3: Realising the potential for poverty reduction Parallel Group 3B: Topic Paper 1*, Asia 2012 Conference.
- Keefer, P. (2009) *Disastrous consequences: the political economy of disaster risk reduction*. Washington DC: World Bank.
- Keefer, P. and S. Khemani (2005) 'Democracy, public expenditures, and the poor: understanding political incentives for providing public services', *The World Bank Research Observer* 20(1), 1-27.
- Kelly, P.M. and W.N. Adger (2000) 'Theory and practice in assessing vulnerability to climate change and facilitating adaptation', *Climate Change* 47(4), 325-352.
- Kerle, N., J. L. Froger, C. Oppenheimer and B.V. De Vries (2003) 'Remote sensing of the 1998 mudflow at Casita volcano, Nicaragua', *International Journal of Remote Sensing* 24(23), 4791-4816.

- Kingdon, J. (1995) *Agendas, alternatives and public policies*, 2nd edition, New York: Harper Collins.
- Kokelaar, B.P. (2002) 'Setting, chronology and consequences of the eruption of Soufriere Hills Volcano, Montserrat (1995-1999)', *Memoir, vol. 21. Geological Society*, 1-43.
- Lavell, A. (1994) 'Prevention and mitigation of disasters in Central America: vulnerability to disasters at the local level', in A. Varley (ed.) *Disasters, Development and Environment*, Chichester: John Wiley, 49-64.
- Lavell, A. (2000) *Desastres durante una década: lecciones y avances conceptuales y prácticos en América Latina (1990-1999)*, San José: Facultad Latinoamericana de Ciencias Sociales.
- Lavell, A., E. Mansilla and D. Smith (2003) *Regional programme for risk management in Central America: ideas and notions relating to concepts and practice*, Panamá: Centro de Coordinación para la Prevención de los Desastres Naturales en American Latina.
- Maskrey, A. (1989) *Disaster management: a community based approach*, Oxford: Oxfam.
- Maskrey, A. (1994) 'Community and disasters in Latin America: strategies for intervention', paper presented to the World IDNDR Conference, 23-27 May, Yokohama.
- Morgan, M.G., H. Dowlatabadi, M. Henrion, D. Keith, R.J. Lempert, S. McBride, M. Small, and T. Wilbanks (2009) *Best practice approaches for characterizing, communicating, and incorporating scientific uncertainty in decision making*, Synthesis and Assessment Product 5.2 of the U.S. Climate Change Science Program, Washington DC: National Oceanic and Atmospheric Administration.
- Moser, C. (2008) *Resilience in the face of global environmental change*, CARRI Research Report 2, Oak Ridge, TN: Community and Regional Resilience Institute.
- Newig, J., D. Günther, and C. Pahl-Wostl (2010) 'Synapses in the network: learning in governance networks in the context of environmental management', *Ecology and Society* 15(4): 24.
- North, D.C. (1990) *Institutions, institutional change and economic performance*, Cambridge: Cambridge University Press.
- NRC (2009) *Informing decisions in a changing climate: panel on strategies and methods for climate-related decision support*, Committee on the Human Dimensions of Global Change, Division of Behavioral and Social Sciences and Education, National Research Council, Washington DC: The National Academies Press.
- Nye, J.S. and J.D. Donahue (2000) *Governance in a globalizing world*, Washington DC: Brookings Institution Press.
- Oates, W. (1977) *The political economy of fiscal federalism*, Lexington MA: Lexington Books.
- Ostrom, E. (1999) 'Institutional rational choice', in P. A. Sabatier (ed.) *Theories of the policy process*, Boulder CO: Westview Press, 35-72.
- Ozerdem, A (1999) 'Tiles, taps and earthquake-proofing: lessons for disaster management in Turkey', *Environment and Urbanisation* 11 (2), 177-179.
- Pahl-Wostl, C. (2009) 'A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes', *Global Environmental Change* 19, 354-365.
- PAHO (1994) *A world safe from disasters: the journey of Latin America and the Caribbean*, Washington DC: Pan-American Health Organization.
- Pelling, M. (2003) *The vulnerability of cities: social resilience and natural disaster*, London: Earthscan.
- Pelling, M. (2011) *Adaptation to climate change: from resilience to transformation*, London: Routledge.
- Pelling, M. and A. Holloway (2006) *Legislation for mainstreaming disaster risk reduction*, Teddington: Tearfund.
- Pierson, P (2004) *Politics in time: history, institutions and analysis*, Princeton NJ: Princeton University Press.

- Posner, P.L. (1998) *The politics of unfunded mandates: whither federalism?*, Washington DC: Georgetown University Press.
- Quarantelli, E.L. (1993) 'Organizational responses to the Mexico City Earthquake of 1985: characteristics and implications', *Natural Hazards* 8(1), 19-38.
- Quarantelli, E.L. (1994) *Emergent behaviours and groups in the crisis time periods of disasters*, DRC Preliminary Paper 206, Newark DE: University of Delaware, Disaster Research Center.
- Quarantelli, E.L. (2000) *Disaster planning, emergency management and civil protection: the historical development of organised efforts to plan for and to respond to disasters*, DRC Preliminary Paper 301, Newark DE: University of Delaware, Disaster Research Center.
- Rashed, T. and J. Weeks (2003) 'Assessing vulnerability to earthquake hazards through spatial multicriteria analysis of urban areas', *International Journal of Geographical Information Science* 17(6), 547-576.
- Renn, O. (2008) *Risk governance: coping with uncertainty in a complex world*, London: Earthscan.
- Rivera, M. J.C. Thouret, J. Mariño, R. Berolatti and J. Fuentes (2010) 'Characteristics and management of the 2006–2008 volcanic crisis at the Ubinas volcano (Peru)', *Journal of Volcanology and Geothermal Research* 198, 19–34.
- Schreyögg, G. and Sydow J. (eds) (2010) *The hidden dynamics of path dependence: institutions and organizations*, Houndmills: Palgrave Macmillan.
- Shah, A. (1998) *Balance, accountability and responsiveness: lessons about decentralization*, Policy and Research Series 23, Washington DC: World Bank.
- Schmidt-Thomé, K. and L. Peltonen (2006) 'Actors, networks and actor-networks in coping with sea-level rise', *Geological Survey of Finland*, Special Paper 41: 51-59.
- Sorensen, A. (2011) 'Uneven processes of institutional change: path dependence, scale and the contested regulation of urban development in Japan', *International Journal of Urban and Regional Change* 35(4), 712-734.
- Stoker, G. (1998) 'Governance as theory: five propositions', *International Social Science Journal* 50(155), 17-28.
- Tearfund (2007) *Turning practice into policy: linking good practice community-based disaster risk management with government policy and practice*, Teddington: Tearfund.
- Tierney, K. (2012) 'Disaster governance: social, political and economic dimensions', *Annual Review of Environment and Resources* 37, 341-363.
- Turner, M. and D. Hulme (1997) *Governance, administration and development*, London: Macmillan.
- Twigg, J. (2004) *Disaster risk reduction: mitigation and preparedness in development and emergency planning*, London: Overseas Development Institute.
- Twigg, J. (2007) *Characteristics of a disaster-resilient community: a guidance note*, London: DFID Disaster Risk Reduction Working Group.
- UNDP (2002) *Human Development Report 2002*, New York and Oxford: Oxford University Press.
- UNISDR (2004) *Living with risk: a global review of disaster reduction initiatives*, Geneva: United Nations International Strategy for Disaster Reduction.
- UNISDR (2005) *Hyogo Framework for Action 2005-2015: building the resilience of nations and communities to disasters*, Geneva: United Nations International Strategy for Disaster Reduction.
- UNISDR (2007) *Disaster risk reduction: 2007 global review*, Geneva: United Nations International Strategy for Disaster Reduction.

- UNISDR (2009) *Global assessment report on disaster risk reduction*, Geneva: United Nations International Strategy for Disaster Reduction.
- Usamah, M. and K. Haynes (2012) 'An examination of the resettlement program at Mayon Volcano: what can we learn for sustainable volcanic risk reduction?', *Bulletin of Volcanology* 74(4), 839-859.
- Weiss, C.H. (1998) *Evaluation: methods for studying programs and policies*, 2nd edition, Upper Saddle River NJ: Prentice Hall.
- Wenger, E. (1998) *Communities of practice: learning, meaning and identity*, Cambridge: Cambridge University Press.
- Whitten, S. M., G. Hertzler and S. Strunz (2012) 'How real options and ecological resilience thinking can assist in environmental risk management', *Journal of Risk Research* 15(3), 331-346.
- WHO (2002) *Understanding civil society issues for WHO*, Civil Society Initiative Discussion Paper 2. Geneva: World Health Organization.
- Wild, L., V. Chambers, M. King and D. Harris (2012) *Common constraints and incentive problems in service delivery*, ODI Working Paper 351, London: Overseas Development Institute
- Wilkinson, E. (2011) 'Decentralised disaster management: local governance, institutional learning and reducing risk from hurricanes in the Yucatán peninsula, Mexico', PhD thesis, University College London, unpublished.
- Wilkinson, E. (2012a) *Transforming disaster risk management: a political economy approach*, ODI Background Note, London: Overseas Development Institute.
- Wilkinson, E. (2012b) 'Why "small is beautiful" in municipal disaster risk reduction: evidence from the Yucatán peninsula, Mexico', *Environmental Hazards* 11(2), 155-171.
- Wisner, B. (2001) 'Risk and the neo-liberal state: why post-Mitch lessons didn't reduce El Salvador's earthquake losses', *Disasters* 25(3), 251-268.
- Wisner, B., P. Blaikie, T. Cannon, and I. Davis (2004) *At risk: natural hazards, people's vulnerability and disasters*, 2nd edition, London: Routledge.
- World Bank (2001) *World Development Report 2000/2001: attacking poverty*, New York: Oxford University Press.
- World Bank (2004) *World Development Report 2004: making services work for poor people*, Washington DC: World Bank and Oxford University Press.



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Overseas Development Institute
203 Blackfriars Road
London SE1 8NJ
Tel +44 (0)20 7922 0300
Fax +44 (0)20 7922 0399

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