United Nations FCCC/SBI/2012/INF.14

Framework Convention on Climate Change

Distr.: General
15 November 2012

English only

Subsidiary Body for Implementation
Thirty-seventh session
Doha, 26 November to 1 December 2012

Item 10 of the provisional agenda
Approaches to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change to enhance adaptive capacity[1]

- Activities to be undertaken under the work programme

A literature review on the topics in the context of thematic area 2 of the work programme on loss and damage: a range of approaches to address loss and damage associated with the adverse effects of climate change

Note by the secretariat

Summary

This literature review presents findings from available scientific evidence and other documentation on a range of approaches employed today in four regions of the world to address loss and damage associated with the adverse effects of climate change. The literature review focuses on the types of approach and their levels of application, in particular examining the foundational resource requirements and cost-effectiveness of and the lessons learned from such approaches. The review follows a regional perspective, corresponding to the regional expert meetings for Africa, Latin America, Asia, and small island developing States which have taken place during 2012 as components of the work programme on loss and damage under the Subsidiary Body for Implementation.

[1] Decision 1/CP.16, paragraphs 26–29.

Contents

I. Introduction, mandate and methodology

1. The topic of loss and damage in the context of climate change has gained increasing importance in the UNFCCC climate change talks in recent years. This literature review is part of the mandated work for 2012 in the work programme on loss and damage under the Subsidiary Body for Implementation (SBI),[2] under thematic area 2, which addresses "a range of approaches to address loss and damage associated with the adverse effects of climate change, including impacts related to extreme weather events and slow onset events, taking into consideration experience at all levels". Specifically, the secretariat was requested to compile a literature review in collaboration with relevant organizations and other stakeholders.[3] It has drawn on existing relevant scientific and practical work and documents to compile a review of existing information and case studies on the topics in the context of thematic area 2, to feed into the expert meetings mentioned in paragraph 8(a) of decision 7/CP.17. This literature review has been prepared with the generous assistance of the United Nations University.

Methods for and organization of the literature review

2. For the purpose of this literature review, loss and damage has been broadly defined as 'the actual and/or potential manifestation of impacts associated with climate change in developing countries that negatively affect human and natural systems'. The review provides an overview of approaches to address loss (negative impacts in relation to which reparation or restoration is impossible, such as loss of freshwater resources) and damage (negative impacts in relation to which reparation or restoration is possible, such as windstorm damage to the roof of a building, or damage to a coastal mangrove forest as a result of coastal surges) on the basis of an assessment of current literature and critical analysis.

3. The following approach was employed for the literature review. Firstly, recent meta-analyses were acknowledged, including an analysis of the 2011 Intergovernmental Panel on Climate Change (IPCC) *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX) and its sources (the focus of which is on extreme events). The 2011 *Global Assessment Report on Disaster Risk Reduction* (GAR) of the United Nations International Strategy for Disaster Reduction (UNISDR) and its sources (the focus of which is on disaster risk reduction in relation to natural hazards, including weather extremes) was also analysed. Secondly, academic and relevant practitioner and policy-related literature was reviewed, using keyword searches related to four approaches to address loss and damage suggested by Parties (risk reduction, risk retention, risk transfer and measures to address slow onset climate events). The literature reviewed includes:

(a) Peer-reviewed journals in English, using keyword searches;

(b) Practitioner and policy-related literature, using keyword searches;

(c) Contributions submitted by partner organizations of the Nairobi work programme on impacts, vulnerability and adaptation to climate change.

4. The keywords searched for include (but are not limited to): loss and damage, adaptation, adaptation strategies, risk, risk management, disaster risk reduction, coping,

[2] Decision 7/CP.17.

[3] Decision 7/CP.17, paragraph 8(d).

vulnerability, natural hazard, risk transfer and risk sharing (e.g. insurance, social safety nets, contingency funds, etc.), early warning, indigenous knowledge, social protection, migration, water, flood, storm, drought, heat waves, desertification, glacial melt, ocean acidification, sea level rise, coastal erosion, food and livelihood security, and case studies specific to each region (e.g. drought and Africa). The literature review sought references to the four regions for which expert meetings on approaches to address loss and damage took place: Africa, Latin America, Asia and small island developing States (SIDS). Owing to time constraints, a more comprehensive review of all journals, reports, books, government documents and other sources in all relevant languages was not possible, which limits the scope of the analysis.

5. Thirdly, additional literature searches were undertaken online to fill gaps in the information on regional approaches. Fourthly, the almost 200 references to and examples of approaches, as well as the gaps where there was no literature on an approach or there were insufficient references to an approach in the literature, were analysed. That analysis provided responses to the five questions related to thematic area 2 of the work programme on loss and damage, contained in the annex to decision 7/CP.17. Thus, the following literature review examines the full range of approaches and tools that can be used to address the risk of loss and damage, the foundational resource requirements of the different approaches, lessons learned from existing efforts, the links and synergies between approaches, and how to tailor approaches to national contexts.

6. It should be noted that the approaches to address loss and damage listed in this literature review are not exhaustive; other approaches and varieties of approaches may exist, including at the local level.

II. Overview

7. This chapter introduces relevant concepts for discussing approaches to address loss and damage associated with climate change, defined as the actual and potential manifestation of climate change impacts that negatively affect human and natural systems. It first explores the continuum of loss and damage, including extreme weather events and slow onset climatic processes and the interaction of these phenomena. Then it touches on the importance of finding appropriate approaches to address said continuum of loss and damage, in order to ensure climate-resilient growth even in the face of climate change and the loss and damage which accompanies it.

A. The loss and damage continuum – the interaction between climate variability and climate change

8. **An increasing number of extreme weather events and slow onset climatic processes**. Loss and damage can arise from a spectrum of negative impacts of climate change, ranging from extreme weather events to slow onset events.

9. Loss and damage includes the effects of the full range of climate change related impacts, from increasing (in number and intensity) extreme weather events to slow onset events and combinations of the two. It is acknowledged, meanwhile, that for many practitioners such a distinction is not so easily made. Addressing loss and damage requires an understanding of the kinds of events and processes that are associated with the adverse effects of climate change. Climate stimuli interact with human systems in complex ways, thereby causing loss and damage. Addressing loss and damage has two components: firstly, reducing the risk of loss and damage in the future, through appropriate risk management,

adaptation and mitigation; and, secondly, addressing loss and damage when it occurs (the trajectory of loss and damage, today and in the future).

10. **Climate change over time: multiple interacting temporal and spatial scales**. Loss and damage is reflected in historical and present (observed and occurring) manifestations of climate change, but the concept also includes potential future loss and damage, the forecasting of which relies on assumptions of parameters such as emissions, vulnerability and the exposure variables of the affected human (or natural) system. Future loss and damage is likely to increase, especially considering non-economic factors and the interlinkages of phenomena leading to cascading, transnational effects. For example, atmospheric hazards such as heat waves could become more prevalent as long-term 'process' climate change, such as increasing temperatures, takes place, with implications for urban dwellers, food production, energy demand, etc. The concept of 'tipping points' in climate, and in natural and societal systems is an important consideration in addressing potential loss and damage.

11. **Mitigation and adaptation matter: policy choices affect loss and damage**. Policy choices that lead to a reduction of climate change impacts through mitigation and adaptation will, in turn, lead to a reduction of loss and damage. Climate change impacts are driven by the concentration of greenhouse gases (GHGs) in the atmosphere, which in turn affects atmospheric and ocean temperatures. Negative climate change impacts that cause loss and damage are also linked to the ability of human systems to adapt to changes in the climate.

12. **Climate change impacts cause loss and damage in human and natural systems**. Loss and damage refers to impacts on human systems, which are often channelled through the negative impacts of climate change on natural systems (for example, sea level rise and glacial melt result from climate change stimuli, and these shifts in natural systems in turn result in loss and damage in human systems, such as loss of habitable land or freshwater). Additionally, characteristics of human systems (development policy, poverty, etc.) affect the dependency of human systems on natural systems. However, this connectedness does not change the fact that it is climate change impacts that cause loss and damage, which occurs in the course of shifts in natural systems which affect human systems.

B. Putting approaches to address loss and damage in context – climate-resilient development

13. There are significant practical implications for policy and planning for adaptation resulting from weather-related extremes in the short term and from both weather-related extremes and longer-term climatological shifts (slow onset) in the medium and longer terms.

14. The impacts of loss and damage related to climate-related stressors, such as weather extremes and longer-term climatological shifts, can set back socioeconomic development and reinforce cycles of poverty across the world. The Fourth Assessment Report of the IPCC (2007) noted that areas already vulnerable to environmental change and environmental-societal shifts are also the most likely to experience the most negative impacts of climate change. Some of those impacts will involve loss of and damage to life, property and other assets important for the sustainable development of countries, including impacts that contribute to constraints on economic production and non-economic losses.

15. Box 1 presents some of the key findings from the IPCC SREX (referred to in paragraph 3 above).

Box 1

Key points from the 2011 Intergovernmental Panel on Climate Change *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*

Even without taking climate change into account, disaster risk will continue to increase in many countries as more people and assets are exposed to weather extremes.

Evidence suggests that climate change has changed the magnitude and frequency of some extreme weather and climate events ('climate extremes') in some regions already.

Climate change will have significant impacts on the severity and magnitude of climate extremes in the future. In the coming two or three decades the expected increase in climate extremes will probably be relatively small compared with the normal year-to-year variation in such extremes. However, as climate change becomes more dramatic its effect on a range of climate extremes will become increasingly important and will play a more significant role in terms of disaster-related impacts.

There is better information on what to expect in terms of changes in climate extremes in various regions (rather than just globally).

High levels of vulnerability, combined with more severe and frequent weather and climate extremes, may result in some places, such as atolls, being increasingly difficult places in which to live and work.

A new balance needs to be struck between taking measures to reduce risk, transfer risk (e.g. through insurance) and effectively prepare for and manage the impacts of disasters in a changing climate. This balance will require a stronger emphasis on anticipation and risk reduction.

In this context, existing risk management measures need to be improved, as many countries are poorly adapted to deal with the current climate extremes and risks, let alone those projected for the future.

Countries' capacity to meet the challenges of observed and projected trends in disaster risk is determined by the effectiveness of their national risk management systems.

In cases in which vulnerability and exposure are high, capacity is low and weather and climate extremes are changing, more fundamental adjustments may be required to avoid the worst disaster-related losses.

Any delay in greenhouse gas mitigation is likely to lead to more severe and frequent climate extremes.

Source: Mitchell T and van Aalst M (2011).

16. **Climate-resilient development: there is a need for approaches that address the full loss and damage continuum**. At the first expert meeting under the SBI work programme on loss and damage, held in Tokyo, Japan, from 26 to 28 March 2012,[4] the need for discussions and approaches which are holistic and designed to manage the spectrum of loss and damage under significant uncertainty was noted. Planning 'only' for the extreme climate-related events of today could leave countries in a position in the future in which scarce resources have been devoted to activities that are based on a static understanding of climate-related adverse impacts (e.g. devoting resources 'only' to climatological hazard

[4] See document FCCC/SBI/2012/INF.3 for the report on the meeting.

relief and response, rather than to a broader spectrum of activities to address loss and damage resulting from climatic stressors). In contrast, there is a need to plan for the implementation of approaches to address loss and damage associated with both increasing weather-related extreme events and longer-term climatological shifts. A holistic approach would help to smooth development pathways and cushion the expected negative impacts of loss and damage in the future.

III. Types of approaches to address loss and damage

17. Parties to the Convention have requested support in understanding, planning for and enacting programmes that address the potential loss and damage associated with increasing weather-related extreme events and climate change. This chapter addresses the first and second questions related to thematic area 2 of the SBI work programme on loss and damage,[5] namely: what is the full range of approaches and tools that can be used to address the risk of loss and damage and what are the foundational resources required in order for different strategies and tools to be effectively applied?

18. This chapter provides an overview both of the broad groups of approaches that have been used to address extreme weather-related events to date and of the approaches that are relevant to addressing slow onset events, some of which are currently in use and some of which may need to be enacted in the future. It has been written with a view to providing an overview of the major issues related to each approach, with the later, region-specific sections in chapter IV below offering a more in-depth review of the approaches for further reading.

19. The first section of this chapter introduces a range of approaches associated with 'risk reduction'. The second discusses approaches classed as 'risk retention'. The third section discusses 'risk transfer' approaches. These three sets of approaches are currently often used to manage extreme weather events (storms, floods, cyclones, drought, etc.), but may be applied in different combinations in the future to also address slow onset events. The fourth section of this chapter recognizes that slow onset events, such as glacial melt, sea level rise and ocean acidification, may require different approaches, and thus examines a range of institutional, governance and other approaches to managing such processes, which are not necessarily a single 'event'.

20. The following sections explore the above-mentioned range of approaches to address loss and damage, including the foundational resource requirements of said approaches, at a general level. Then, in chapter IV below, a more in-depth analysis is conducted in order to answer the remaining questions posed by Parties at the seventeenth session of the Conference of the Parties related to thematic area 2 of the work programme on loss and damage.

A. Challenge: matching loss and damage with the right approaches

21. A challenge lies in understanding which approaches are appropriate to address loss and damage associated with increasing weather-related extreme events and slow onset events influenced by climate change in the present, and which approaches may be needed to address loss and damage in the future.

22. To design approaches that will be appropriate to address loss and damage in a given context, countries will need to understand:

[5] Decision 7/CP.17, annex, chapter II.

(a) That choices on mitigation and adaptation will affect the actual and expected climate change impacts on natural and human systems;

(b) The nature of multiple interacting temporal and spatial scales (i.e. extreme weather events will interact with slower climatic processes like sea level rise);

(c) The kinds of approaches that are appropriate and relevant to particular circumstances.

23. These considerations will be discussed in this chapter and in chapter IV below, in which the third, fourth and fifth questions related to thematic area 2 of the work programme on loss and damage will be addressed.

24. The four groups of approaches outlined in this literature review – ranging from risk reduction, through risk retention and risk transfer, to approaches to address slow onset events – are appropriate for use in different scenarios along the loss and damage continuum. For example, risk reduction and prevention may work well where climate change impacts are frequent but of a lower magnitude and where the links between nature and society can be managed in practical, cost-efficient ways. An example of this would be managing water drainage systems (such as keeping them free of debris) so that slightly heavier or more frequent rain than 'normal' can run off without creating damage. The following sections introduce a variety of different measures that each fit into one of the four broad groups of approaches.

B. Risk reduction

25. A range of approaches exists today to manage extreme weather events and the loss and damage associated with them. Such approaches have been discussed in prominent documents, such as the 2011 IPCC SREX and the UNISDR 2011 GAR. This section provides a glossary-like overview of measures that are currently used to address extreme weather events. Some of these tools may, in combination, also be relevant to addressing slow onset events.

26. Risk reduction includes a number of approaches designed to reduce the impacts of a potential adverse event – in the context of climate change, this would be adaptation to the adverse effects of a weather-related extreme. Box 2 provides the definition of risk reduction of UNISDR.[6]

27. Risk reduction measures are undertaken before an actual extreme event occurs and may be used effectively in the case of climate-related stressors which occur often and have relatively small impacts. Indigenous knowledge systems, as well as combinations of technology, education, engineering, early warning, etc., have all been used to help societies anticipate and reduce the potential loss and damage resulting from weather extremes (usually those which are frequently observed and on which relatively more information is available). Risk reduction measures may be successfully applied to reduce the impacts of

[6] A comprehensive approach to disaster risk reduction is laid out in the Hyogo Framework for Action (HFA) (see <http://www.unisdr.org/eng/hfa/hfa.htm>), which was adopted by 168 Member States of the United Nations in 2005. HFA provides a vehicle for cooperation among governments, organizations and civil-society actors to assist in its implementation. While the term 'disaster reduction' is sometimes used, the term 'disaster risk reduction' better recognizes the ongoing nature of disaster risk and the ongoing potential to reduce it. 'Mitigation' is a term used by disaster risk managers to indicate activities that reduce disaster risk or help to ameliorate the impacts of disaster. In the context of climate change the term 'mitigation' is used to indicate the reduction of GHGs which cause changes in global temperature and climate systems.

events such as frequent storms that may cause annual flooding, recurring small-scale droughts, and regular windstorms that cause relatively minor damage.

Box 2
Disaster risk reduction

The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Source: United Nations International Strategy for Disaster Reduction, see <http://www.unisdr.org/we/inform/terminology>.

28. As indicated in boxes 3 and 4, the range of measures used to reduce risk before a hazardous event occurs can be divided into structural measures and non-structural measures.

Box 3
Examples of non-structural risk reduction measures – focus on planning, early warning and behavioural change

Contingency planning: "A management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations".

Disaster plan: "An agreed set of arrangements for preventing, mitigating, preparing for, responding to and recovering from a disaster. A formal record of agreed disaster management roles, responsibilities, strategies, systems and arrangements".

Disaster risk reduction plan: "A document prepared by an authority, sector, organization or enterprise that sets out goals and specific objectives for reducing disaster risks together with related actions to accomplish these objectives".

Early warning system: "The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss". "The purpose of warnings is to persuade and enable people and organizations to take actions to increase safety and reduce the impacts of a hazard, which can be either quick onset (i.e. cyclones, floods) or slow onset (famine) or man-made (fires, explosion, chemical spills, etc.)".

Forecast: "Definite statement or statistical estimate of the likely occurrence of a future event or conditions for a specific area".

Land-use planning: "The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including the consideration of long-term economic, social and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses".

National platform for disaster risk reduction: "A generic term for national mechanisms for coordination and policy guidance on disaster risk reduction that are multisectoral and interdisciplinary in nature, with public, private and civil-

society participation involving all concerned entities within a country".

Public awareness: "The extent of common knowledge on disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards".

Source: United Nation International Strategy for Disaster Reduction, see <http://www.unisdr.org/we/inform/terminology>.

29. Non-structural measures include measures not involving physical construction that use knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public-awareness raising, training and education. Such measures require coordination, planning and effective outreach to potentially affected communities. They often require political will but are not necessarily costly to implement. Structural measures include any physical construction to reduce or avoid the possible impacts of hazards, or the application of engineering techniques to achieve hazard resistance and resilience in structures or systems. Structural measures require some political consensus on the assets that should be protected, appropriate design, building and maintenance, and considerable infrastructural investment. Combinations of non-structural and structural measures are used today throughout the world.

Box 4
Examples of structural risk reduction measures – focus on infrastructure to reduce the effects of extreme events

Engineering measures: Common structural measures for disaster risk reduction include dams, flood levies, ocean wave barriers, earthquake-resistant construction and evacuation shelters.

Retrofitting: "Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards".

Building code: "A set of ordinances or regulations and associated standards intended to control aspects of the design, construction, materials, alteration and occupancy of structures that are necessary to ensure human safety and welfare, including resistance to collapse and damage".

Source: United Nations International Strategy for Disaster Reduction. <http://www.unisdr.org/we/inform/terminology>.

30. Paragraphs 26–29 above provide an overview of the range of approaches and tools that are typically considered risk reduction measures. The rest of this section is dedicated to addressing the applicability of risk reduction in different contexts, the relative costs and benefits of risk reduction, and the foundational requirements for undertaking risk reduction to minimize potential loss and damage.

1. Which sectors use risk reduction?

31. Risk reduction is appropriate across all sectors of an economy and in all types of ecosystem, although the design specifications differ. For example, risk reduction measures can be used around planning: contingency planning in case of an emergency and disaster risk reduction plans, for example, can be applied effectively at the community level to ensure that all community members have the ability to take care of each other during the first 72 hours of a weather-related emergency situation, when basic services may not be available. Plans to have emergency water, food and medical and other supplies can reduce injuries and other health-related impacts on people in the immediate aftermath of an extreme weather event. Similarly, early warning systems have been used in the event of flooding, drought, windstorms and other kinds of weather extremes to give advance notice

to the agriculture sector (which may then stockpile grain), to citizens who can then undertake measures to secure their equipment and livestock in order to prevent losses, and to critical infrastructure systems so as to avoid large-scale failures.

32. Risk reduction measures and adaptation to climate change have also been used with success in land-use management, illustrating their applicability across a variety of ecosystems. For example, mangroves have been replanted in coastal areas or protected from cutting, in order to reduce the impacts of storm surges, erosion and other coastal hazards. The revegetation of hillsides and other slopes with grasses, bushes or trees has in many areas helped to reduce erosion, landslides and flooding and maintain soil moisture in times of drought. All of these kinds of systems can be implemented and tailored to the needs of different segments of society and sectors.

2. How cost-effective is risk reduction?

33. The literature suggests that the benefits of avoiding and reducing loss and damage outweigh the costs of investing in risk reduction measures. A number of studies have attempted to establish the cost–benefit ratio (e.g. Mechler (2005)). Mechler found that the estimated cost–benefit ratio ranges from 2.5 to 51:1 in terms of the benefits compared with the costs. The costs of risk reduction, however, affect decision-making on disaster risk reduction in non-crisis situations. It may be difficult to justify extensive public investment in risk reduction in the absence of public awareness of extreme weather risks, for example. Some literature suggests, however, that extensive unquantifiable benefits come with sustained investment in risk reduction measures, including dramatic declines in disaster-related mortality (Bangladesh is a prominent positive example), improved community awareness of risks, and benefits in terms of sustained economic growth and welfare.

34. Table 1 outlines some of the possible costs and benefits of risk reduction measures that countries could use to determine their investment strategies.

Table 1
Potential costs and benefits of investing (public) resources in risk reduction

Potential benefits	*Potential costs*
• Reduction of loss of life and injury • Reduction of property damage and destruction • Reduction of disruption to communities, individuals and local infrastructure • Less interruption of business, including closures, shutdowns and unemployment or underemployment • Reduced loss of or damage to culturally and historically important items • Reduced or more effective and targeted expenditure on disaster relief by both governments and private organizations • Increased awareness in communities of hazards, their impacts and necessary changes in behaviour to avoid loss and damage • Improved efficacy of response and recovery • Complements sustainable development and dampens the negative cycle of hazards and poverty	• Public expenditure on non-structural and structural measures to reduce risk required (structural measures can be very costly, but they are still less costly than reconstruction) • Incentive to wait and do nothing until international assistance comes after an extreme weather event (humanitarian assistance is ‘free’, but often arrives with a delay or not at all) • Decision makers may be rewarded for responding to disaster (‘hero effect’), but not for proactively reducing risk • Potential increased costs generated by setting up rules and regulations to reduce risk (such as building codes) • Changes in zoning (e.g. certain areas declared hazardous) may affect property values

Sources: Summary of findings from the 2011 *Global Assessment Report on Disaster Risk Reduction* of the United Nations International Strategy for Disaster Reduction and the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

3. What are the foundational requirements of risk reduction?

35. The overall approach of risk reduction requires the following elements, but can be seen as a process of building up elements over time:

(a) **A strong institutional basis for the implementation of risk reduction measures**: requires political commitment and community participation, and institutional, legislative and operational mechanisms;

(b) **Knowledge and early warning of risks**: requires the collection and use of data on disaster risks, and hence the development and maintenance of the capacity and infrastructure to observe, analyse and forecast hazards, vulnerabilities and disaster-related impacts;

(c) **Awareness-raising and education**: requires information-sharing systems and communication services, and the promotion of dialogue and cooperation among scientific communities and practitioners;

(d) **The addressing of underlying risk factors**: requires the sustainable use and management of ecosystems, land and natural resources; the integration of disaster risk reduction strategies into climate change policies; the promotion of food security for resilience; the integration of disaster risk reduction planning into the health sector and the promotion of safe hospitals; the protection of critical public facilities and the implementation of recovery schemes and social safety nets; the promotion of income diversification options; and the integration of both disaster risk considerations into land-use planning and building codes and risk assessment into rural development plans;

(e) **Disaster preparedness for an effective response**: requires plans in relation to the policy-related, technical and institutional capacities for the management and coordination of the response; the coordination and exchange of information; contingency planning; and the allocation of the necessary financial resources, including an emergency fund.

36. At a general level, table 2 outlines some of the foundational requirements of non-structural and structural risk reduction approaches. Non-structural measures are generally less expensive than structural measures but require ongoing outreach to society: one-time efforts in relation to public education will be less effective, for example, than steady, ongoing efforts to build up risk awareness and shape behaviours, which can reduce the risk that the general population (or any segment thereof) will experience loss and damage as a result of a given event of a given expected frequency or magnitude.

Table 2
Foundational resource requirements of risk reduction measures

	Non-structural measures	*Structural measures*
Budget	• Non-structural approaches can be relatively inexpensive but are often pursued on an ongoing basis (e.g. yearly for a decade or two)	• Structural measures (infrastructure) can be costly to build and maintain over the 20–50 year lifespan of infrastructure • A country must be in the position to finance a large investment in infrastructure
Infrastructure or equipment needed	• Radio or other location-appropriate communication systems e.g. to support early warning systems • Public outreach/education system • Monitoring systems	• Sea level walls • Flood retention walls • Water retention systems (dams) • Building retrofitting
Information and data	• Hazard information • Risk mapping • Weather information • Forecasting systems and modelling	• Hazard information • Risk mapping • Engineering
Technical capacity (experts, etc.)	• Communication of risks	• Engineering

37. The general applicability of risk reduction approaches at all levels (local, national and regional), the benefits of investing publically in risk reduction measures relative to the costs, and the variety of measures that can be tailored to local circumstances make risk reduction the first choice of approach for all countries. However, some special circumstances are worth noting.

38. All countries can choose the right level of public investment in the maintenance of critical infrastructure. Proper maintenance often reduces the vulnerability of economy-sustaining infrastructure (roads, hospitals, schools, ports, etc.). As the actual and expected climate change impacts on natural and human systems become magnified, risk reduction will become an essential starting point for managing loss and damage. Some countries may experience slight changes in the frequency of extreme weather events; more frequent, small events are often successfully addressed using risk reduction approaches.

39. Countries highly exposed to 'high-frequency, low-impact' climatic stressors should consider a range of risk reduction measures, including utilization of indigenous knowledge (such as climate-appropriate livelihood and agricultural systems), early warning and land-use management. The retrofitting of schools, homes and hospitals can be undertaken in cost-effective ways with relatively large benefits (such as securing roofs of buildings with hurricane straps). For countries with greater financial means, structural protection measures

can be beneficial (but the benefits of their implementation should be weighed against the ability to pay for and maintain the infrastructure).

40. Lower-income countries can begin with lower-cost investments in risk reduction and make incremental increases as they progress. Even if initial investments are modest (international organizations and civil-society organizations have developed a large body of material useful for training and raising awareness, such as information on good practice in sectors like agriculture, school education programmes for children, and community-based early warning systems), they will yield benefits through enhanced resilience and by reducing the impacts of climatic stressors. Countries with very vulnerable populations or lower-income countries should invest in risk reduction with the longer term in mind; reducing risk is the foundation upon which the effective management of loss and damage must be built.

C. Risk retention

41. Risk retention is defined broadly for the purpose of this literature review as allowing a country to 'self-insure' itself against climatic stressors, through activities such as building up the resilience of the population through social protection and related measures, or through financial means, such as establishing reserve funds for the purpose of offsetting unexpected financial burdens associated with climatic stressors. This section examines the range of risk retention approaches, where risk retention is applied, the cost-efficacy of risk retention, and the consequences and foundational requirements of appropriate risk retention. Boxes 5 and 6 provide examples of planned and inadvertent risk retention measures.

Box 5
Examples of planned risk retention – financial resources for building up resilience

Contingency loan: Securing the terms of a loan ahead of time (such as with an international financial institution), at a time when interest rates are lower or better than after a natural disaster, when interest rates tend to rise and the need for cash is high.

Social funds: Publically funded programmes that provide block grants for projects to build up community assets, such as community facilities, infrastructure or improved services, including microfinance and microinsurance services, to increase the security and resilience of the livelihoods of poor and vulnerable households. **Social funds represent an innovative approach that is often coordinated as autonomous government agencies**. They serve as a channel for post-disaster community-level financing for disaster risk management.

Reserve fund: Catastrophe reserve funds are typically set up by governments, or may be donated, to cover the costs of unexpected losses.

Box 6
Examples of inadvertent risk retention – responding to crises and unexpected rebuilding costs

Emergency assistance loans: Limited to circumstances where a member with an urgent balance of payments need is unable to develop and implement a comprehensive economic programme because its capacity has been damaged by a conflict, but where sufficient capacity for planning and policy implementation nevertheless exists.

Emergency services: The set of specialized agencies that have specific responsibilities and objectives in serving and protecting people and property in emergency situations.

Humanitarian assistance, such as food aid: The definition of food aid should not just be focused on its source of funding, or on specific transactions, such as 'items donated from external donors to recipient', but should include consideration of (a) all related international and domestic actions and programmes, and (b) the role of non-food resources brought to bear jointly with food to address key elements of hunger problems. As such, food aid can be understood as all food-supported interventions aimed at improving the food security of poor people in the short and long term, whether funded via international, national public or private resources.

Reconstruction: Repairing, rebuilding and otherwise restoring the functionality of infrastructure and other assets following damage resulting from a hazard event. Full reconstruction may depend on the availability of sufficient resources to undertake and complete the repair of the damage.

Rehabilitation: Concurrent with or immediately after relief activities, post-disaster rehabilitation is carried out to restore the normal functions of public services, business and commerce, to repair housing and other structures and to return production facilities to operation.

1. Which sectors use risk retention?

42. Risk retention is used in every public sector, as well as in the private sector and at the household level. Risk retention can be planned, such as an explicit setting aside of public funds for social purposes or for responding to emergency needs. Risk retention can also be used in an unplanned way, such as when insufficient risk reduction measures have been taken and the repair of damage must be financed. The purposeful and planned use of risk retention can be part of a balanced set of complementary approaches to manage loss and damage; however, unplanned and unforeseen expenses can place a significant burden on the public sector, one of the greatest disadvantages of (financial) risk retention. Risk retention can be achieved at the household level by having a savings account, for example. Financial institutions that offer savings accounts accessible to vulnerable populations are a foundational requirement for this.

2. How cost-effective is risk retention?

43. Risk retention has the characteristic that, in the absence of an extreme weather event or some other climatic stressor, it appears relatively inexpensive to establish self-financing mechanisms. However, as table 3 indicates, the potential costs can quickly outweigh the potential benefits, especially if a country cannot 'afford' the potential loss and damage that it faces (e.g. if values at risk are highly exposed, if potential climatic stressors are of a magnitude that would overwhelm the country's capacity to manage them, if a country is highly indebted or if it is pursuing a particular development goal that it does not want to sacrifice). The costs of risk retention are reduced if a contingency loan is set up before loss

and damage occurs, as interest rates are higher after disasters. One example is the first contingent loan for natural disasters, which the Inter-American Development Bank (IDB) approved for the Dominican Republic in 2009.

Table 3
Potential costs and benefits of risk retention

Potential benefits	*Potential costs*

• In terms of social protection, the ability of risk retention programmes to target specific groups and build up their resilience to and ability to manage climatic stressors (there are a variety of programmes designed to reduce poverty, enhance livelihoods, reduce food insecurity, etc.)
• In terms of planned financial risk retention, the benefits are that a country has planned and set aside necessary resources, which can then be paid out in the event of an actual climatic stressor without sacrificing development goals or other policy objectives
	• Public funds need to be dedicated to a special 'rainy-day' fund in case of a climatic stressor, which could otherwise be used to pursue other public goals
	• Risk retention, if not planned well or if the losses suffered as a result of a climatic stressor exceed available funds, requires governments to raise post-disaster capital; hence:
	  • A country is not fully shielded from the impacts of the climatic stressor and may suffer economic drag for some time afterwards (inability to rebuild, repair, continue business and trade, lack of liquidity for investment)
	  • A country may divert development loans for emergency purposes, but this may mean sacrificing other objectives (roads, health programmes, education)
	  • A country may need to take on additional debt (internal or international borrowing)
	  • Social and political tensions may arise if a climatic stressor is manifest and insufficient resources to manage it are available in the risk retention scheme

Sources: Summary of findings from the 2011 *Global Assessment Report on Disaster Risk Reduction* of the United Nations International Strategy for Disaster Reduction and the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

3. What are the foundational requirements of planned risk retention?

44. The foundational requirements of risk retention are, most importantly, a sound understanding of potential loss and damage and the ability of a country to absorb loss and damage by means of its own social, economic, cultural and other resources.

45. A 'positive' side to planned risk retention includes the undertaking of efforts to increase the social and economic resilience of particular groups through social safety nets and social protection programmes. These kinds of (often public) investments can reduce the dependence of vulnerable people or groups on aid (like emergency humanitarian assistance) in the case of a climatic stressor and help to prevent such stressors from derailing the progress made towards achieving a variety of goals, such as overall improvements in human welfare. The requirements for such social safety net programmes include a mechanism to identify and effectively reach particular groups that need support, as well as ongoing monitoring to determine the progress of such groups towards their 'graduation'. Social acceptance and political support, in addition to financial resources, are needed for investments in building up resilience (see table 4).

46. Although 'inadvertent' (unplanned) risk retention is practised widely, it can have less visible and implicit consequences when loss and damage occurs, such as political

instability, longer-term drag on economic growth, or the forfeiting of key development goals because the financial means to achieve them may have been diverted to remedy loss and damage.

Table 4
Foundational resource requirements of risk retention measures

	Resilience-building	*Financial risk retention (covering some of the costs related to impacts of climatic stressors)*
Budget	• Resilience-building approaches require sustained and targeted financing over a period of years	• Self-financing potential loss and damage can be costly and impose itself on the public budget exactly when liquidity is in the greatest demand
Infrastructure or equipment needed	• Programmes targeting specific groups of beneficiaries • Public outreach/education system • Monitoring systems	• Sound financial planning and financial forecasting • Clear legislation to govern the administration of the funds
Information and data	• Hazard information • Risk mapping • Weather information • Forecasting systems and modelling	• Hazard information • Risk mapping • Weather information • Forecasting systems and modelling
Technical capacity and planning (experts, etc.)	• Experts in social protection and targeting	• Financial risk management, especially in the public sector

47. The foundational requirements for retaining the financial risks associated with loss and damage include strong financial planning and legislative preparation to ensure appropriate funds and use thereof in the case of a climatic stressor. Perhaps the most important requirement is that a country carefully weighs up whether it has the financial resources necessary to retain the potential loss and damage it could incur.

48. With regard to countries with very vulnerable population groups, a high level of debt or low financial capacity, if a country is highly indebted, but faces very low-level climatic stressors, then it may be in a position to have a small ‘rainy-day’ fund set aside. But if a country is highly indebted (or even moderately indebted), or facing an economic downturn or experiencing a slow growth rate, then it should consider the prudence of financial risk retention. A balance should be struck between economic and social goals (and the finances required to achieve them) and the possibility that loss and damage may require a country to sacrifice the budgets allocated to achieving such goals in the case of a climatic stressor. There are cases in which development loans have been diverted from financing hospitals, schools and roads in order to fly in emergency water supplies. The economic drag of ex-post self-financed recovery from a climatic stressor can take years to rebound from; therefore the adoption of risk retention measures should be carefully considered against other options.

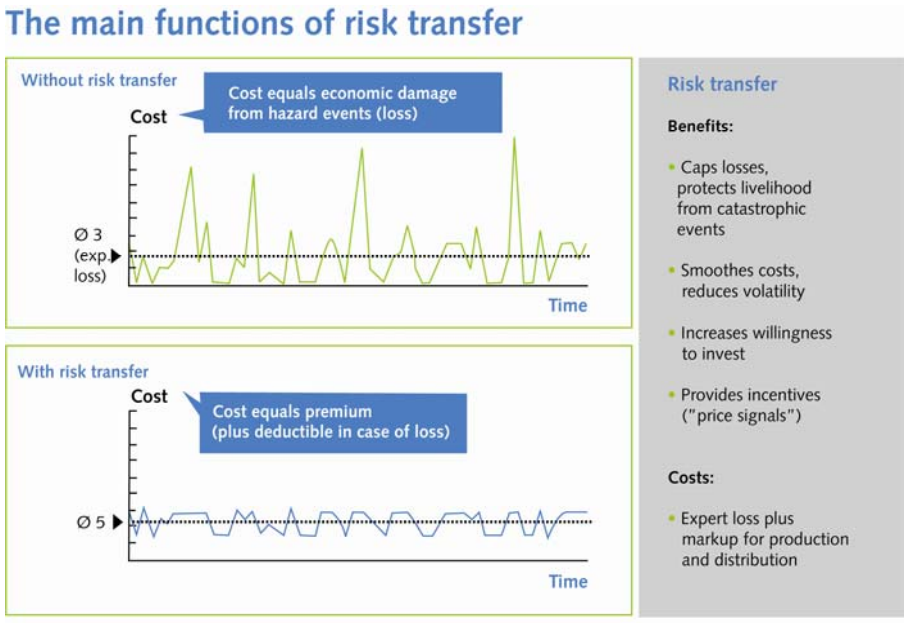
49. In the aftermath of catastrophe, low-income developing countries may face exhausted tax bases, depleted reserves and declining credit ratings, making external borrowing difficult. Planned risk retention can allow countries to bulk up funds in better economic times, which would then be available more quickly than external aid. As indicated in paragraph 48 above, lower-income countries may want to carefully consider their social and budgetary parameters (amount of debt desired, budgetary requirements balanced against social and economic goals, and liquidity needs) when considering whether to retain risk. Many countries retain risk inadvertently by not having appropriate risk management plans in place and are thus often caught unprepared. Lower-income countries would benefit from solid risk analysis and risk mapping, indicating their risk exposure. Following this, an analysis of national financial parameters would help to guide their decisions on the degree of risk retention that is appropriate in the national context and the degree of other complementary approaches that could be considered (such as risk reduction and risk transfer).

D. Risk transfer

50. Risk transfer approaches help to shift the, mostly financial, risk of loss and damage from one entity to another. Risk transfer is usually associated with a fee for the service provided (i.e. paid to the entity assuming responsibility for the part of the risk that is transferred). Risk transfer is undertaken when a country or entity assesses that the potential loss and damage that it could experience could be greater than its ability to manage that loss and damage. There are a range of risk transfer tools, including insurance, catastrophe bonds, conditional risk transfer and combined insurance-credit programmes.

51. Figure 1 illustrates the main functions of risk transfer and outlines how it complements risk reduction and risk retention approaches.

Figure 1
Functions, benefits and costs of risk transfer



Source: Economics of Climate Adaptation Working Group (2009).

52. Risk transfer is used to reduce the uncertainty and volatility associated with potential loss and damage. Without risk transfer a country or household may be faced with the full

financial burden of loss and damage. Such volatility can create challenges for social development and economic stability. With risk transfer, a country (or entity) agrees to pay a fee (premium) to another entity (such as an insurer, another country or pool of countries, or an international financial institution), with the agreement that if a climatic stressor occurs, then that entity will pay for an amount of the associated loss and damage. The insurance payout, however, does not usually cover the full cost of loss and damage. On the other hand, an important benefit is that the funds are available faster than external aid and can be used more flexibly.

53. Risk transfer does not directly prevent or reduce the risk of damage or loss; however, the financial liquidity provided by risk transfer approaches can reduce some of the indirect effects of damage, such as human suffering and setbacks to development. Risk transfer approaches help to reduce the burden on the public purse for restoring public and private infrastructure and services following an extreme weather event (it should be noted that such approaches are used almost only in case of 'events' rather than 'processes').

1. Which sectors use risk transfer?

54. Risk transfer can be used in any sector, but it is often used to protect public infrastructure at the macro level, sectors such as agriculture at the meso level, and the livelihoods of low-income groups at the micro level. Risk transfer programmes are sometimes public and the range of tools involving both the public and private sectors is increasing. Private risk transfer solutions in financial markets are widely available and used by the business sector.

55. Box 7 provides some definitions of tools that belong to the set of risk transfer approaches.

Box 7
Risk transfer – examples of approaches to share the financial burden of loss and damage

Broad types of tools for transferring the risk of weather extremes include the following. Risk transfer/financing frameworks must be tailored to the type of coverage required and the local risk and social conditions.

(Traditional) insurance: Insurance is a contractual transaction that guarantees financial protection against potentially large losses in return for a premium. If the insured entity experiences a loss, then the insurer pays out a previously agreed amount. Insurance is common across most developed countries and covers many types of 'peril'; for example, many homeowners buy fire and theft insurance to protect their property and in some countries car owners are required to purchase automobile liability insurance.

Microinsurance: Microinsurance is characterized by low premiums or coverage and is typically targeted at lower-income individuals who are unable to afford or access more traditional insurance. Microinsurance tends to be provided by local insurance companies, with some external insurance backstop (e.g. reinsurance). Microinsurance can cover a broad range of risks: to date it has tended to cover health and weather risks (including crop and livestock insurance). Weather insurance typically takes the form of a parametric (or index-based) transaction, whereby payment is made if a chosen weather index, such as five-day rainfall amounts, exceeds some threshold. Such initiatives minimize administrative costs and moral hazard and allow companies to offer simple, affordable and transparent risk transfer solutions. One of the largest microinsurance schemes, the Weather-Based Crop Insurance Scheme, was established by the Government of India and currently protects more than 700,000 farmers against the losses associated with drought.

Risk pooling: Risk pools aggregate risk regionally (or nationally), allowing individual risk holders to spread their risk geographically. By spreading risk, pooling allows participants to gain catastrophe insurance on better terms and access collective reserves in the event of a disaster. An example is the Caribbean Catastrophe Risk Insurance Facility (CCRIF), which allows Caribbean governments to purchase coverage for earthquakes and/or hurricanes. CCRIF was able to secure USD 110 million of reinsurance capacity in addition to its own reserves.

Insurance-linked securities: Insurance-linked securities, most commonly catastrophe bonds, offer a way to share risk more broadly with the capital markets. Catastrophe bonds are issued by the risk holder (usually a government or insurance company) and trigger payments upon the occurrence of a specified event. This event may be a specified loss or may be a parametric trigger, such as the wind speed at some location. In 2006 the Government of Mexico issued a catastrophe bond that transfers earthquake risk to investors by allowing the Government not to repay the bond principal if a major earthquake were to hit Mexico.

Catastrophe bond: A high-yield debt instrument, usually insurance-linked, meant to raise money in case of a weather extreme or earthquake. It has a special condition that states that if the issuer (insurance or reinsurance company) suffers a loss as a result of a particular predefined catastrophe, then the issuer's obligation to pay interest and/or repay the principal is either deferred or forgiven (i.e. the loan must not be repaid).

Source: 2011 *Global Assessment Report on Disaster Risk Reduction* of the United Nations International Strategy for Disaster Reduction**.**

2. How cost-effective is risk transfer?

56. The potential costs and benefits of risk transfer are contained in table 5. The cost-effectiveness of risk transfer, compared with that of other approaches to manage loss and damage, depends on the actual and expected loss and damage: in most cases a 'layer' of the risk can be transferred in a cost-effective way, while other layers can be managed through risk reduction and some portion through risk retention. The layer of risk to be transferred is for more severe and less frequent hazards and where there is some uncertainty. One of the prominent benefits of risk transfer approaches is the ability of tools, such as insurance, to limit losses – at least financial losses – and to allow governments a sphere of certainty within which investments and planning can be undertaken (volatility reduction).

Table 5
Potential costs and benefits of risk transfer

Potential benefits	*Potential costs*
• Governments, communities and households benefit when they anticipate and manage weather-related risks before they cause loss and damage • Risk transfer can reduce the volatility of losses. Less volatility makes it easier to plan investments in development and ensure that those investments are not diverted to pay for unexpected disaster relief efforts • Smooths costs for the public sector.	• Public and private funds are needed to cover the costs of risk transfer (such as an insurance premium). Over time, the cost of the premium could be as high as or even slightly exceed the cost of the loss and damage itself • Funds are needed to cover part of the start-up costs for risk transfer systems, such as for installing weather stations or building up the necessary regulatory and administrative frameworks

Planning ahead and using tools like risk transfer can provide liquidity when climatic stressors occur • A country is guaranteed that it will have liquidity at the times when it is most needed (e.g. in the event of a climatic stressor) • The cost of risk transfer may be lower than the cost of retaining risk • Protects livelihoods from the impacts of catastrophic events • Increases willingness to invest • Provides incentives ('price signals') to pursue other kinds of approaches to address loss and damage, especially risk reduction	• Some payouts from risk transfer tools, such as insurance, catastrophe bonds, contingency credit, etc., are 'triggered' by a discrete event rather than an incremental process. Thresholds need to be established which, when passed, trigger a signal that payouts should be made • Some residual risk will remain after risk transfer, necessitating careful planning as to how these risks should be managed (through risk reduction, risk retention, etc.)

Sources: 2011 *Global Assessment Report on Disaster Risk Reduction* of the United Nations International Strategy for Disaster Reduction and the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

3. What are the foundational requirements of risk transfer?

57. Risk transfer approaches require a number of elements in order to ensure their proper design, implementation and ongoing maintenance (table 6). A community, province, country or region considering using risk transfer tools needs to conduct a sound analysis of the risks, including exposure of assets and values at risk, vulnerability, and the probability of a range of climatic stressors (usually extreme weather events). A combination of ground data (such as time series data on weather parameters, provided by a national meteorological service) and satellite imagery information is needed to establish risk profiles and the cost of the risk transfer relative to the amount of financial protection offered.

58. Financial capacity at a basic level is needed, including a banking and financial system through which to channel risk transfer payments and payouts efficiently. A regulatory framework for insurance is needed to ensure consumer protection (ideally one that also makes provisions for parametric/index-based approaches and for insurance approaches that cater to low-income groups, like microinsurance). Reinsurance or other financial backup channels are needed, especially for risk transfer programmes that cover low-income segments and shocks that vary together (covariate risk) like weather extremes, where an entire portfolio of assets is likely to be affected simultaneously. This ensures that if a risk transfer payout is triggered, there is sufficient capital to meet all of the obligations for payouts over time.

Table 6
Foundational resource requirements of risk transfer measures

Generalized requirements for risk transfer	
Budget	• The cost of risk transfer is the 'pure cost of the risk' plus the cost of administering the risk transfer
Infrastructure or equipment needed	• Weather information and monitoring systems • Forecasting systems and modelling

	• Insurance regulation frameworks • Financial system
Information and data	• Hazard information • Risk mapping • Meteorological service and satellite imagery • Risk analysis, risk mapping, and assessment of vulnerability and hazard and asset exposure
Technical capacity (experts, etc.)	• Risk assessment and modelling experts • Financial risk and insurance experts

59. For all countries, there are some limitations to risk transfer approaches. They are not always able to prevent or reduce the likelihood of direct damage and fatalities resulting from extreme weather events. Moreover, they are not always the most appropriate option for managing risk (for example, in terms of cost-effectiveness or affordability). Such limitations are potentially aggravated in the context of climate change (i.e. with more frequent and intense extreme weather events). It may become increasingly difficult to transfer risk, as climate change may change the frequency and magnitude of extreme weather events, which may trigger the use of alternative risk transfer products, such as catastrophe bonds, which pass the risk on to investors in the capital markets rather than to reinsurers.

60. For countries highly exposed to slow onset climatic processes, traditional risk transfer approaches, such as loss-based insurance, may be unsuitable to insure against longer-term foreseeable climatic stressors, such as sea level rise and desertification. Two preconditions for the insurability of disasters are the unpredictability of a specific event, which means that losses occur suddenly and cannot be foreseen, and the ability to spread the risk over time and regions and between individuals/entities. For two of the already ongoing changes contributed to by global warming, that is sea level rise and desertification, the 'insurability criteria' cannot be fulfilled. Both processes are slow and involve continuous changes that potentially affect the population of one or more countries. These can lead to a deterioration of living conditions in developing or poor countries and, in the long term, could threaten the survival of human populations in affected regions. Risk retention and risk transfer alone would be unlikely to sufficiently address some of the dire effects of climate change, which again points to the need for an active search for combinations of existing approaches and innovations to manage loss and damage associated with slow onset climatic processes.

61. Risk transfer costs resources in terms of premiums or fees and investments in the necessary information and regulatory frameworks. A risk-layering approach can help lower-income countries to employ risk transfer approaches selectively. For example, lower-income countries may place less of a burden on public assistance budgets by setting up risk transfer programmes for low-income groups, such as farmers and herders. Often such programmes can be combined with incentives to reduce risk (e.g. through good agricultural practices that reduce erosion, or herding practices that reduce animal mortality related to weather stressors). At the regional level, lower-income countries may also find that their participation in regional insurance pools (such as the Caribbean Catastrophe Risk Insurance Facility (CCRIF) or the African Risk Capacity (ARC) project) could be beneficial.

E. Managing slow onset climatic processes – institutions, governance and other tools

62. In decision 1/CP.16 (Cancun Adaptation Framework), it was noted that approaches to address loss and damage should consider climatic impacts "including sea level rise,[7] increasing temperatures, ocean acidification, glacial retreat and related impacts, salinization, land and forest degradation, loss of biodiversity[8] and desertification[9]". Such slow onset climatic processes are manifest today and are influenced by climate change, as assessed in the Fourth Assessment Report of the IPCC. This literature review attempts to examine the approaches relevant to addressing slow onset climatic processes and details lessons learned that could be applicable now and in the future.

63. Slow onset climatic processes are under way today and so there are already some approaches to addressing the associated loss and damage that can be examined, mainly risk reduction measures and climate change adaptation. For example, much experience has been gained of addressing desertification and land degradation through sustainable land management and of addressing loss of biodiversity through ecosystem-based adaptation. However, this is probably also the area of approaches to address loss and damage where most lessons need to be learned, new approaches need to be tested and experiences need to be shared, particularly in relation to the applicability of risk-sharing measures.

1. Which sectors have begun to manage slow onset climatic processes?

64. Climate change brings with it some loss and damage that risk reduction, risk retention and risk transfer approaches alone cannot address. Combinations of approaches to address the losses resulting from long-term foreseeable risks (residual risks), such as sea level rise, widespread desertification and the loss of geological water sources such as glaciers, will be needed in the future. This residual loss and damage will require the accumulation of resources and may be dealt with using a combination of institutional and governance approaches, management and financial tools.

65. Currently more work is needed to explore the sectoral use of a range of activities to prepare for and manage the loss and damage that is, and will increasingly be, related to slow onset climatic processes.

66. The region-specific sections in chapter IV below examine a range of institutional, governance and other measures used today to manage climatic processes – a mixture of examples is provided, from which lessons may be learned. The examples range from relatively new public offices tasked with addressing climate change impacts (such as climate change focal points within ministries), through national committees tasked with monitoring and assessing current and emerging climatic stressors, and national laws on climate change (including slow onset climatic processes), to regional agreements on resource management, such as relating to regional river basins or human mobility agreements, and other approaches.

[7] Examples of approaches to cope with climate change impacts such as sea level rise include the Caribbean Planning for Adaptation to Climate Change project and the Coral Triangle Initiative (see chapter IV.D below on risk reduction and approaches to address incremental changes in SIDS).

[8] Climate change is expected to exacerbate threats to biodiversity, resulting in changes to our ecosystems. Because of this, ecosystem-based adaptation is gaining increasing attention, which links biodiversity, ecosystem services and climate change adaptation (see chapter IV.A below on risk reduction in Africa).

[9] With desertification, exacerbated by climate change, affecting more than 2 billion people worldwide, a greater focus has been placed on sustainable land-management practices in both Africa (see chapter IV.A below) and Asia (see chapter IV.C below).

2. How cost-effective are tools to manage slow onset climatic processes?

67. Much remains to be learned about approaches to address the negative impacts of slow onset climatic processes – in this literature review such approaches are the least represented. The level of funding that might be required to manage the loss and damage related to slow onset climatic processes is highly uncertain and varies greatly between different countries and regions (see table 7). The degree of connection between natural systems and human systems plays a role in determining the costs associated with loss and damage in the longer run, including access to freshwater and habitable, arable land and the ability of the natural system to provide the resources necessary for key aspects of society, such as sustainable livelihoods and food security.

Table 7
Potential costs and benefits of approaches to address slow onset climatic processes

Potential benefits	*Potential costs*
• Governments, communities and households benefit from anticipating and managing slow onset climatic processes, allowing measures to be undertaken that can limit the associated loss and damage to some extent • Opportunities for restructuring existing institutions and opportunities for regional cooperation with positive effects in other areas, such as trade, cultural exchange and resource management • Advance planning and action will be an essential element of climate-resilient green growth. The countries that proactively begin policy planning and implementation will be ahead of the curve • Lessened negative cultural, social and political impacts	• Largely unknown, but the longer approaches to manage slow onset climatic processes are postponed, the greater the scale of investment required from both public and private funds to address the loss and damage resulting from such processes is likely to be • Challenging political decisions balancing current and future welfare and intergenerational equity and longer-term population distribution (i.e. where it is safe for people and their assets to be and what areas may need to be permanently evacuated) • Some of the impacts of loss and damage resulting from slow onset climatic processes will require fundamental changes to the way society, economies and cultures are organized. Ways must be found to provide as smooth a transition as possible during these changes

Source: Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

68. How successful individual countries are at implementing adaptation plans will have a significant impact on the amount of loss and damage that results from slow onset climatic processes, though so too will changes in emissions and the rate of climate change itself.

69. The countries with the highest levels of residual risk are those that will be the least able to manage loss and damage in the future. They are also the countries that may be in need of the greatest support to manage loss and damage (Warner et al., 2010).

3. What are the foundational requirements of approaches to manage slow onset climatic processes?

70. The foundational requirements of approaches to manage slow onset climatic processes are not yet fully clear (see table 8); however, it is evident that some basic

elements, equally applicable to other themes and issues, may facilitate such approaches, including:

(a) Political will;

(b) A comprehensive and pragmatic approach to searching for and identifying solutions;

(c) Different methods of organization;

(d) Innovative thinking;

(e) Flexible institutions;

(f) Sound climatic information and effective communication systems;

(g) Social involvement and joint solutions which are peaceful and equitable.

Table 8
Foundational resource requirements of approaches to address slow onset climatic processes

	Current approaches	*Future approaches*
Budget	• Policy frameworks • Political and social dialogue • Investments in research and innovation	• Future approaches may range from 'extreme' physical infrastructure investments to new forms of social organization and population distribution. Such approaches will be difficult to finance
Infrastructure or equipment needed	• Communication • Engagement of citizens and communities • National dialogue and policymaking • Regional dialogue	• All of the current dialogue and planning, plus more-intensive regional and national monitoring and coordination approaches • Infrastructural measures on different, possibly larger scales • Relocation of at-risk populations • Transboundary livelihood arrangements for people whose traditional livelihoods have become impossible in areas of origin • Provisions for access to freshwater on a large scale • Large-scale livelihood programmes
Information and data	• Hazard information • Risk mapping • Weather information • Forecasting systems and modelling • Social and physical thresholds	• Hazard information • Risk mapping • Weather information • Forecasting systems and modelling • Social and physical thresholds
Technical capacity (experts, etc.)	• Policy and planning	• Policy and planning • Infrastructure • Weather and climate modelling • Threshold monitoring • Economic and financial tools • Economic/livelihood alternatives • Regional diplomatic relations

F. Enabling environments and managing the impacts of climate variability and change

71. There are different enabling environments in different regions, depending on a variety of factors. For example, certain forms of social organization have made the use of disaster risk reduction very effective in Bangladesh (combined with a high level of political will). Government policy to increase the access of low-income groups to financial risk management tools, including microfinance and microinsurance, combined with large social organizations, including women's groups, has allowed millions access to a set of risk transfer tools.

72. Different countries in Latin America have developed significant experience in integrated disaster risk management, with some countries serving as regional leaders in terms of their experience in risk reduction and planning (such as Columbia), risk retention (such as Mexico with FONDEN, its natural disaster fund, and Honduras and others with social funds) and risk transfer (such as the Eastern Caribbean with CCRIF). In each of these examples, which relate to one of the four sets of approaches laid out in this chapter, other elements of approaches to manage loss and damage are combined.

1. Combining approaches to address loss and damage

73. Combinations of approaches are needed in order to progress from the current understanding and knowledge of loss and damage to the ability to meet future needs related to loss and damage.

74. **Learning and innovation**. Indigenous knowledge is today a valuable source of information on how locally appropriate strategies have been used over generations to manage climatic stressors. However, as climatic stressors change, indigenous knowledge may be combined and supplemented with new knowledge, an experience documented by Patt et al. (2010) in introducing climate observation, regional seasonal forecasts and the use of handheld georeferencing equipment to local communities in Africa.

75. **Risk transfer**. Risk transfer activities must be viewed as part of a climate risk management strategy that includes, first and foremost, activities that prevent human and economic losses resulting from climatic stressors. The Bali Action Plan called for "consideration of risk sharing and transfer mechanisms, such as insurance" to address loss and damage in countries particularly vulnerable to climate change (UNFCCC, 2007). To ensure technical feasibility and sustainability, and to harmonize climate-risk insurance with adaptation, it is essential to align adaptation actions and incentives with the prevention and reduction of exposure and vulnerability to extreme weather events.

76. For example, national laws, institutions and planning processes can help countries to set their priorities for managing loss and damage. The foundation for this approach includes basic risk reduction and gathering information on potential loss and damage, such as by:

(a) Mapping and avoiding high-risk zones;

(b) Building hazard-resistant structures and houses;

(c) Protecting and developing hazard buffers (forests, reefs, etc.);

(d) Developing a culture of prevention and resilience;

(e) Improving early warning and response systems;

(f) Building institutions and establishing development policies and plans.

77. Risk reduction can serve as a 'doorway' through which countries pass in order to realize the additional benefits of proactively finding ways to address loss and damage. As

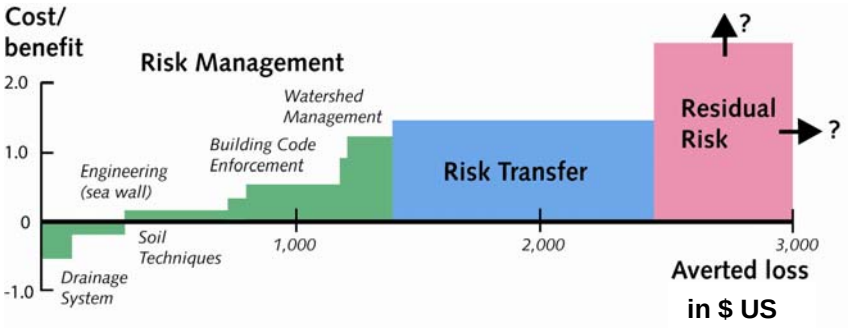
progress in risk reduction is achieved, a country or region may begin building up approaches to retain a part of its risk (such as through the establishment of social funds or funds to help self-finance some parts of loss and damage) and to transfer a part of its risk. For climate-related risks which cannot be further reduced in an efficient way, such as slow onset climatic processes, institutional approaches, governance, adjustments in resource management, planning and other measures can be used to reduce the associated loss and damage.

Cost considerations

78. Combinations of approaches are also needed to reduce the costs and increase the benefits of using limited public and private financing for the management of loss and damage.

79. Figure 2 illustrates the relative costs and benefits of the spectrum of risk reduction, risk retention and risk transfer approaches and approaches to manage 'residual risk' associated with weather extremes, but in particular slow onset climatic processes.

Figure 2
Costs and benefits of different approaches to address loss and damage



Source: Young (2009), adapted from Economics of Climate Adaptation Working Group (2009).

80. Effective economic development and risk management is the most cost-effective long-term approach to managing a variety of risks (Cummins and Mahul, 2008). In terms of investments in risk management, it may be most cost-effective to undertake preventive and risk reduction activities for weather-related risks which happen often (high frequency) but which are not very serious (low severity). Here the value of the averted losses exceeds the cost of the measure over a certain time period (such as the lifetime of the investment).

81. Other kinds of investments, such as risk transfer (insurance), are made when risks cannot be reduced further at an efficient rate. Extreme weather events that happen infrequently but which have large negative consequences (low frequency/high severity) may be financially transferred in combination with prevention and reduction measures. Depending on the magnitude and timescale of the potential risks and liabilities, State-led solutions would need to be included in risk transfer solutions for high levels of risk (low probability, high consequence/severity) (Arrow and Lind, 1970). Such investments involve paying premiums and/or setting aside resources for contingency spending, but make sense when they help to reduce uncertainty about the variability of extreme weather events (Hoeppe and Gurenko, 2007). Premiums must be paid and cash held in reserve, but the guarantee that a vulnerable country will have the funds it needs to address losses when they occur carries a benefit that can exceed such costs.

2. Creating linkages

82. There is a case for creating frameworks or institutions that more closely link approaches to address loss and damage and emphasize complementarities. Some countries

have already established institutions dealing with risk reduction and risk transfer, while others have national climate change focal points but no effective links to risk reduction, risk retention or risk transfer. In most developed countries, risk reduction is dealt with by institutions and arrangements that are separate from those in place for risk transfer mechanisms. In many developing countries there are no established risk transfer mechanisms and therefore no institutions responsible for them.

83. Climate change will bring about a heightened need to manage and reduce risk and prevent losses. It will be increasingly useful to have coordinated mechanisms that incentivize risk reduction and loss prevention and ensure that risk transfer approaches complement and accelerate adaptation. One important benefit of such a risk management approach could be that institutions dealing with risk reduction and risk transfer could also be responsible for gathering data on climate-related risks, measuring and mapping risks and raising awareness of them – activities that catalyse and improve overall adaptation efforts and improve the effectiveness and efficiency of the use of limited public and private funding.

National and regional cooperation

84. National entities can identify and aggregate risk and work with regional centres to manage and transfer risk. Innovative institutional designs have explicitly linked risk reduction and insurance (Hellmuth et al., 2009). National risk management platforms and regional centres could provide an institutional framework for reducing or aggregating the risks at the micro and meso levels, providing technical support and other services that could enhance the ability of micro- and meso-level insurance approaches to serve vulnerable communities. Improved data and technical support would increase the ability of countries to plan for and manage loss and damage, and some of this support could be organized effectively at the regional or international level. Additionally, with international support, regional centres may provide targeted assistance to help manage the spectrum of loss and damage related issues.

85. Box 8 outlines just a few of the innumerable linkages between approaches that can be used in the coming years to address loss and damage (focusing on financial tools combined with other approaches). Over the medium and longer terms, new approaches may be needed as the scale of loss and damage changes, with more manifest climate change impacts on human and natural systems.

Box 8

Examples of innovations in managing climatic stressors that contribute to loss and damage – combining approaches

Public–private partnerships (PPPs): PPPs have been key to the development of catastrophe pools thus far. Initially PPPs have been used to gather the wide range of detailed research and analysis necessary to design the schemes. They have also been used for the ongoing management and oversight of the pools, which require the active engagement of both private-sector reinsurance partners and government regulators, often with international financial institutions or donor governments providing additional credit-backing and playing an advisory role as well. Many examples exist throughout the developed and developing world of public–private partnerships (with varying degrees of public and private participation).

Index-based insurance: As is the case with microinsurance, the use of parametric triggers has greatly facilitated the creation of workable business models for insuring catastrophic risk. The parametric triggers reduce the need for expensive claims-adjustment processes and greatly reduce the

administrative and disbursement costs. Dozens of examples of successes and failures in relation to index-based insurance are available in the literature, with lessons learned well documented in Hellmuth et al. (2009), Warner et al. (2010) and Microinsurance compendium (2008 and 2012).

Regional pooling: Regional risk pooling has emerged as a mechanism for increasing risk diversification, by increasing the extent of the coverage (law of large numbers), which can both lower the cost of policies and eliminate the need for compulsory country schemes. The Caribbean Catastrophe Risk Insurance Facility and the emerging African Risk Capacity project, geared towards food security and risk transfer and management, are examples of cases that have been examined in the literature and considered – with many lessons learned – as successful examples of regional pooling approaches.

Risk layers: The viability of catastrophe pools is often based on their ability to transfer a part of their risk to third parties through risk layering, be it private insurers, reinsurers, government or the donor community. This allows the pools to transfer some portion of the risk to reinsurance and capital markets, even if commercial markets would not be willing to take on the whole risk.

Managing loss and damage related to slow onset climatic processes: A major gap exists in that innovations today almost exclusively relate to the management of extreme weather-related events, not slow onset events. As some of the potentially greatest loss and damage is expected to result from slow onset events, there is an urgent need to identify effective combinations of currently-used tools and to innovate approaches to manage slow onset climatic processes.

86. The examples in box 8 are approaches that can be combined in innovative ways in order to make progress in avoiding, limiting or better managing loss and damage. The experiences detailed in chapter IV below show how approaches such as risk transfer (index insurance or regional pooling) have been combined with risk reduction and risk retention. Hence this literature review now turns its attention to a range of examples of and experiences with approaches to address loss and damage in four regions of the developing world. The vast majority of the approaches are in place today and are aimed at managing climatic variability (extreme weather events), but some are in place with the aim of managing slower onset climatic changes or providing plans or road maps with a view to addressing the adverse impacts of loss and damage in the future.

IV. Regional approaches to address loss and damage

87. This chapter explores the range of approaches, outlined in chapter III above, that have been used to address loss and damage due to the adverse effects of climate change at all levels and for a broad range of sectors and ecosystems, considering both extreme weather events and slow onset climatic processes.

88. It is organized by region and explores examples of approaches employed to date to address specific types of loss and damage in the context of thematic area 2 of the work programme on loss and damage, especially the loss and damage driven by the multiplying, magnifying and intensifying effects of climate change at the international, national, subnational and local levels. Where possible, this literature review reflects on the relative cost-effectiveness of the approaches, as well as on the lessons learned from the efforts undertaken within both the public and private sectors, considering elements of design, limitations, challenges and best practices.

A. Africa

1. Introduction

89. In Africa a range of approaches are currently being used to address the loss and damage related to negative climatic impacts. The approaches seek to reduce vulnerability, build resilience and build up the capacity to advance adaptation (UNFCCC, 2008). An examination of the experience of African countries demonstrates that a number of different approaches have been used to offset the impacts of climate change, including the impacts related to extreme weather events and slow onset climatic processes. The approaches range from using indigenous knowledge and early warning systems to establishing risk transfer schemes and contingency funds, as well as investing in addressing disaster risk in national and local public planning and budgeting (UNISDR, 2011). Investment in such approaches reduces both the short- and long-term impacts of extreme weather events and slow onset climatic processes on individual households, communities and the wider macro-economy, thereby strengthening resilience to climate change impacts (UNISDR, 2011). This section takes a closer look at the strategies employed in Africa, details case studies describing successes and challenges associated with each approach, and concludes by highlighting some gaps in the literature which can be addressed in future analysis.

2. Risk reduction in Africa

Early warning systems

90. With the increasing frequency and severity of drought and increasing social vulnerability in Africa, more emphasis is now being placed on the development of early warning systems and drought preparedness plans that are proactive rather than reactive. Several different cases are examined below, which demonstrate significant improvements and versatility in early warning systems across Africa. Several early warning systems have been developed at the regional level, including the African Union's Continental Early Warning System, which will become fully operational in 2012, and the Observation and Monitoring Centre of the Economic Community of West African States (ECOWAS) and its Warning and Response Network, ECOWARN.

Early warning systems in the area of food and agriculture

91. There are several national and local early warning systems in West Africa and the Sahel that take threats to food and nutrition into account. For example, Niger's early warning system collects data on food availability and accessibility twice a year, helping both the Government and the international community to react effectively to the food, nutritional and pastoral crisis that raged in 2010 (FAO, 2011). FEWSNET, the Famine Early Warning System Network,[10] provides early warning of and information on emerging and evolving food security issues, including monthly food security updates for 25 countries, regular food security outlooks and alerts, as well as providing briefings and support for contingency and response planning efforts. In Mauritania, following a locust outbreak in 2003 and 2004, surveillance devices were strengthened to allow for the regular gathering of information, the propagation of risk assessment and the implementation of adequate response plans (FAO, 2011). In addition, the African Postharvest Losses Information System (APHLIS) uses global information systems (GIS) to analyse food security for Eastern and Southern Africa. APHLIS supports the calculation of post-harvest losses, which are estimated by crop, country and province. This allows for more effective planning and prioritization in relation to loss-reduction programmes, provides guidance for the

[10] See <www.fews.net>.

development of agricultural policy and allows for the calculation of the cereal supply and demand balances of African countries (Rembold et al., 2011).

92. The Agricultural Information Management System (AIMS) within the Directorate for Food, Agriculture and Natural Resources of the Southern African Development Community (SADC) has established a Regional Early Warning System (REWS). REWS provides advance information on food crop yields and food supplies and requirements. Member States and stakeholders are alerted of impending food shortages and surpluses early enough for them to undertake appropriate interventions. National Early Warning Units have been established in all member States to collect, analyse and disseminate early warning information at the country level. AIMS produces annual regional Food Security and Agrometeorological Updates.[11]

Innovative technology

93. Two case studies are presented by the World Meteorological Organization (WMO), including the regional Drought Monitoring Centre in Nairobi, which monitors drought in the Greater Horn of Africa region, and the Drought Monitoring Desk established by the South African Weather Service. Both of these cases show how advanced monitoring technologies and the Internet allow for improved access to and distribution of critical data and information to assist in the assessment and projection of climate and drought. Furthermore, a long-term climate information project was started in 1982 and implemented by the regional institute AGRHYMET and WMO in Mali. The results of the project indicate that the regular provision of agrometeorological information helps farmers to manage the risks associated with increased climate variability. The project has successfully built a framework for gathering, analysing, processing and disseminating climate information, which helps the farmers to make agricultural decisions and reduces risks and increases yields and incomes. The Malian Government has consequently committed itself to funding the project now that external donors have withdrawn (Hellmuth et al., 2007).

Building up local capacity

94. Munich Re Foundation (2007) presents a case study in Mozambique which highlights the importance of building upon the capacity of local populations in order to ensure the security of families and livelihoods. The local 'low-tech' flood early warning and response system is based on the peoples' own capacity to protect themselves by creating and training local disaster management committees.

Combination of approaches

95. The African Union, with technical assistance from the World Food Programme (WFP), recently launched the ARC project. ARC is an African-owned innovative financial entity that combines contingency funding with early warning and forecasting. Accordingly, Africa RiskView was developed as a software application for the estimation of future crop losses and the impacts of drought on food security, providing African countries with a tool to use to estimate their financial drought-related risk and therefore determine the amount of risk transfer funds required from the ARC pool (African Union and WFP, 2012). In the Southern African region, the AIMS project combines early warning systems with assessments of vulnerability and food security. Networks for the timely collection of climate information have been developed, while vulnerability assessments enable operations to be targeted where there are food security crises and livelihoods are the most vulnerable. Additionally, the Regional Food Reserve Facility aims at strengthening disaster preparedness in Southern Africa, including by means of a physical reserve, a financial facility and a risk insurance instrument to support farmers in times of disaster, including that caused by climate change (SADC, 2010).

[11] See <http://www.sadc.int/fanr/aims/rews/index.php>.

Indigenous knowledge

96. For centuries vulnerable communities in Africa have, through local coping strategies, adapted their livelihoods in response to a wide variety of disturbances caused by environmental variability and change, and there is a wide range of case studies documenting such efforts (Macchi et al., 2008).

97. **Southern Africa**. In a case study covering three South African provinces (Limpopo, North West and KwaZulu Natal), Thomas et al. (2007) found a range of specific coping and adaptation strategies employed by farmers to respond to climate shifts. For example, in response to perceived seasonal changes in moisture, farmers increased the planting distance of some crops, planted short-maturing varieties of maize and built stone bunds to reduce soil erosion. In north-central Namibia farmers decide which crops to plant and where on the basis of sound knowledge of the environment and the flexibility of the use of their land, which renders farmers substantially resilient to climate variability (Newsham, Naess and Guthiga, 2011). More recently, indigenous knowledge is being complemented by scientific weather and climate forecasting. For example, a case study on southern Malawi suggests integrating indigenous knowledge on rain and temperature fluctuation or on the behaviour of certain flora and fauna into scientific weather predictions in order to provide more useful information at the village or district level (Kalanda-Joshua et al., 2011).

98. **East Africa**. Farmers in Uganda are adapting to the negative impacts of climate change by applying appropriate agricultural technologies and methods, such as selecting crop varieties resistant to drought and flooding, early planting and employing rudimentary post-harvesting handling techniques, along with intercropping maize and millet, and employing agroforestry to improve the fertility of coffee and fruit trees (Akullo et al., 2007). In the south-western highlands of the United Republic of Tanzania, farmers use local environmental factors, such as the early flowering of certain tree species and astronomical factors, to predict rainfall (Chang'a, Yanda and Ngana, 2010). It is suggested that the systematic documentation and integration of this knowledge into conventional weather forecasting could help to improve the accuracy of seasonal rainfall forecasts in a changing climate.

99. **West Africa**. In Burkina Faso farmers have substantially changed their agricultural practices in the last few decades, in order to increase crop yield and simultaneously reduce yield variability. Techniques include micro water-harvesting, improving fields with stone lines, feeding hay and food residues to animals during the dry season, and dry season vegetable production (Barbier et al., 2009). In addition, as a response to a decrease in rainfall and water shortages, communities in Ghana are actively reviving rainwater harvesting (a traditional way of collecting and storing rainwater in big barrels placed under the roofs of houses). This practice had largely been abandoned when the communities installed wells and boreholes, but has attracted interest again as a result of the lack of rain and water (Gyampoh et al., 2009).

100. **Sahel**. Among pastoralists in the Sahel local adaptation strategies include the use of emergency fodder in times of drought, the multispecies composition of herds, and nomadic seasonal mobility to the wetter southern areas of the Sahel (Nyong, Adesina and Osman Elasha, 2007).

101. **North Africa**. Indigenous knowledge is particularly widespread and important for the management of scarce water resources in arid North Africa. In Morocco people live in oases and rely mainly on traditional water systems (*khattara*), which have been a common form of underground water utilization for several hundreds of years and are managed by traditional water-user associations. In Tunisia a number of traditional water harvesting techniques, such as terraces, *jessour* (ancient system of collecting run-off from long slopes)

and *tabias* (stone walls), have been revived and complemented by the use of modern technologies in recent years (Bigas et al., 2009).

Infrastructure

102. Infrastructure, such as roads, bridges and housing, can play a critical role in building up communities' resilience to extreme climatic events and changes in long-term climatic trends. In Africa several infrastructure projects and programmes have been implemented to improve water efficiency and resilience. The projects include: solar-powered water supply and irrigation systems in the United Republic of Tanzania; wells and community development in Ghana; wells and land dikes for safe water and agricultural production in Mauritania; improved restoration of dams and habitats in Mali; integrated rainwater harvesting and management in pastoral communities in Kenya; rainwater harvesting and the development of springs for better water quality in Uganda; and the recycling of wastewater for paddy irrigation farming in the United Republic of Tanzania (UNDP and GEF SGP, 2010). Additionally, in response to periods of drought and heavy rain over the last decade, Kenya started the Nairobi Rivers Basin Rehabilitation and Restoration Program, which includes the "installation of riparian buffers, canals and drainage channels and clearance of existing channels; attention to climate variability and change in the location and design of wastewater infrastructure; and environmental monitoring for flood early warning" (Field et al., 2012).

103. Meanwhile, Egypt has already implemented a range of structural projects designed to withstand current and future climate variability, including drains, breakwaters to reduce the height of waves, beach nourishment, wall reinforcements, and the construction of jetties and dikes for the protection of coastal zones (Agrawal et al., 2004).

104. It is expensive to build and invest in flood-control structures, especially for poor countries that are vulnerable to climate change. As an alternative, Mozambique has established the "Living with Floods" approach in the Limpopo River Basin, which combines several measures for flood management. It includes the establishment of resettlement areas not too far from the productive lowland areas and the installation of elevated support platforms, which can serve both as social facilities and as safe-havens or evacuation centres during extreme weather events (Spaliviero et al., 2011).

105. Additionally, grain storage constitutes a strategy for adapting to climate change, by ensuring that a stock of seeds is available in the event of poor harvests due to drought (UNEP, 2010). Specifically, the establishment of safe storage for seeds and reserves of food are used as indicators of adaptive capacity in the agriculture sector (CARE, 2010). As a result, farmers in Kenya and Malawi have been successfully trained in metal silo construction, which protects the grain from biological (e.g. insects, rodents and micro-organisms) and physical (e.g. crushing and breaking) damage (SDC and CIMMYT, 2011).

3. Risk retention in Africa

Social protection

Social safety nets

106. Social protection programmes are aimed at securing the basic needs of vulnerable social groups and are rapidly expanding across Africa (Ellis, Devereux and White, 2009). Ethiopia established the Productive Safety Net Program (PSNP) as a response to the frequent droughts in the region (del Ninno, Subbaro and Milazzo, 2009). The programme targets two groups: firstly, it focuses on the chronically poor, who need ongoing support to maintain their consumption levels. This group is provided with cash transfers or food payments in exchange for their participation in labour-intensive public works projects to

build up community assets. The second target is the 'transient' group of the poor, who require assistance when faced with localized shocks (Pelham, Clay and Braunholz, 2011). Although the programme is still in transition, establishing a new government supply chain of cash to rural areas allows for a more predictable and established system to withstand shocks (Pelham, Clay and Braunholz, 2011).

107. Furthermore, the R4 Rural Resilience Initiative provides a new model of social protection programme, combining the safety net installed through PSNP in Ethiopia with weather insurance. Particularly, poor households that are highly affected by weather-related shocks, but are not able to pay for insurance, can purchase insurance in return for their own labour ('insurance for work') (WFP and Oxfam America, 2011). Additionally, in support of PSNP, WFP and the World Bank are working with the Government of Ethiopia to help develop an integrated national risk management framework through the Livelihoods, Early Assessment and Protection (LEAP) project. LEAP combines early warning, contingency planning, risk profiling and contingency financing to support the flexible scaling up of the national-level productive safety nets (UNISDR Africa, 2012).

Cash-transfer schemes

108. Moreover, there are several cash-based social transfer schemes in Africa, whereby regular payments of money are provided to individuals or households, in order to reduce economic vulnerability and address social risk (UNICEF, 2008). For instance, Malawi reported that a pilot cash-transfer programme, primarily targeted at orphans and the elderly, has already had a positive impact on a number of districts (UNISDR, 2011b). The programme was designed by the Government of Malawi, the United Nations Children's Fund and the National AIDS Commission in partnership. The preliminary results show that poor households participating in the programme are using the money to meet their immediate basic needs, such as for food and health, but are also investing in livestock, poultry, seeds and fertilizer and setting aside small amounts of savings (UNICEF, 2008). Nigeria is also implementing a government-run conditional cash-transfer programme, called "Care of the People", with the main objectives of putting an end to the intergenerational transfer of poverty and reducing the vulnerability of those living in extreme poverty (Holmes et al., 2011).

A community-led system

109. Meanwhile, Rwanda is demonstrating the benefits of a community-led system of targeted social protection programmes. Generally Rwanda has a number of existing social protection measures in place, including the provision of universal health insurance to 91 per cent of the population, free education and several social transfers, such as pension benefits (ERD, 2010). The new targeted approach, based on a traditional practice of collective action known as *ubudehe*, allows communities to identify beneficiaries of social protection on the basis of locally relevant criteria, such as the size of their land holding. In addition, communities can suggest and lead area-specific programmes. Overall, the preliminary results show that poor households can be directly involved in the planning and execution of social protection instruments (ERD, 2010).

Migration and social networks

110. In Mali, Mauritania and Senegal, migrant social networks have helped to build up social capital in order to increase social resilience in their communities of origin. Specifically, transfer of knowledge, technology and remittances between the countries of origin of the migrants and their destination countries has helped migrants' organizations to initiate and run projects in the food, water and energy sectors. In turn, this has demonstrated

how migration can actually trigger rather than prevent adaptation (Scheffran, Marmer and Sow, 2012).

Ecological sustainability and social resilience

111. Biodiversity and well-functioning ecosystems provide natural ways of building up resilience and thereby help society to adapt to the adverse impacts of climate change. They also support poverty alleviation by providing safer and more secure livelihoods, especially for the poor and vulnerable (Midgley et al., 2012). Ecosystem-based adaptation creates a strong link between biodiversity, ecosystem services, climate change adaptation and societal resilience. Midgley et al. (2012) present several projects in Africa whereby ecosystem-based adaptation has been successfully implemented. These projects include: sustainable coastal ecosystem management in the United Republic of Tanzania through ecological infrastructure and local coastal governance; the improvement of water security through the creation of opportunities for work in cleaning and maintaining river catchments in South Africa; and Namibia's 'bush-to-fuel' project, in which farmers are paid to remove the encroaching bush vegetation and then the cut vegetation is converted into woodchips and sold to the private sector as fuel.

112. Regarding the management of forest ecosystems, Blay et al. (2004) present several projects, including: joint management as an option for rehabilitating degraded forests and simultaneously enhancing the livelihoods of forest-dependent communities in western Ghana; the restoration of traditional laws and rules for forest protection in the United Republic of Tanzania; and the community-based management of the Duru-Haitemba miombo forest in the north of the United Republic of Tanzania. Furthermore, in the Sahel projects aimed at regenerating and protecting trees have been successful at combating desertification and, at the same time, improving people's living conditions and opportunities to obtain income (e.g. through the improved management of shea trees in Burkina Faso or of palmyra palms in Niger) (Brüschweiler and Gabathuler, 2006).

113. In Zambia adaptation to climate change in the form of tree planting has led to farmers' own social protection. In particular, when farmers plant trees they protect the soil and crops against drought and erosion, while the farmers' income is enhanced since they are able to protect their cash-crops. The use of organic fertilizers makes economic sense, as they are cheaper than chemical fertilizers. Therefore, ecologically sustainable production can lead to the increased social resilience of Zambian smallholders (Chaudhury et al., 2011).

Financial risk retention

114. Based on the experience gained with the Ethiopian PSNP, in the second phase of PSNP (2010–2014) a drought risk financing component has been introduced to the programme. This component coordinates a pool of contingent resources which can be readily and appropriately disbursed: in response to localized, intermediate or severe drought events; in the case that many more households are affected by food insecurity; or if existing beneficiaries require additional months of assistance following weather-related shocks (African Union and WFP, 2012; Hess, Wiseman and Robertson, 2006). Similarly, the World Bank Treasury has started to offer weather derivatives to client countries. The World Bank intermediated a transaction between Swiss Re (a Swiss reinsurance company) and the Government of Malawi in relation to the financial coverage of drought risk, enabling the import of maize in the event of a national drought-related shortfall in production (has not been used to date) (Syroka and Nucifora, 2010; African Union and WFP, 2012).

115. The ARC project builds on the experience gained with the PSNP project in Ethiopia and will provide African governments with timely, reliable and cost-effective contingency funding, primarily for the management of severe drought, by pooling risk across the

African continent. As ARC allocates money specifically for responding to disaster, it can eliminate delays in responding to drought and food shortages, as the countries will not be lacking funds for such a purpose. This also prevents the governments from reallocating the limited budget resources for other critical country programmes to disaster risk management. The ARC contingency funds are quick-disbursing funds that are secured before a climate-related disaster strikes (African Union and WFP, 2012).

4. Risk transfer in Africa

116. By providing financial security against climate extremes, insurance instruments present an opportunity for developing countries, in their concurrent efforts, to reduce poverty and adapt to climate change (Linnerooth-Bayer et al., 2010).

117. In recent years there have been number of new approaches and instruments adopted in the insurance sector in Africa. For example, a pilot insurance project in Ethiopia was designed to pay claims to the government on the basis of a drought index that uses a time window between the observed lack of rain and the actual materialization of losses. This measure was combined with the installation of low-cost automated weather stations. The pilot project increased awareness and understanding of and demand for this type of insurance in the country (Hazell et al., 2010).

118. Although not an approach per se, Norton et al. (2012a) showed that the demand for index-based insurance in Ethiopia was higher if the concerned farmers participated in experimental simulation games beforehand, which increased the participants' financial literacy and understanding of index-based insurance (Norton et al., 2012b). Another pilot project is being conducted in Malawi, which is testing a new way of dealing with the risk of drought through the use of index-based weather insurance provided directly to smallholders. Though it is too early to quantify the impacts of the project, interviews show that farmers involved in the project are keen to participate again and some claimed that signing up for the insurance scheme was their preferred way to adapt to variability in the climate (Hellmuth et al., 2007).

119. In 2010 an innovative index-based livestock insurance (IBLI) was introduced in Nigeria. It is based on satellite data which provide a measurement of the quality of the pastureland every 10–16 days. The data are then incorporated into a statistical model of livestock mortality that the IBLI team developed using historical data from the region. When the statistical model predicts livestock mortality in excess of a critical threshold (15 per cent) over a predetermined area, the insurance pays pastoralists for their losses, thereby allowing them to manage their individual risk (Carter, Long and Mude, 2011).

120. Similarly, an IBLI was tested on a pilot site in Kenya, insuring pastoralists against livestock mortality. Indemnity payments were provided after a shock, when loss of livestock had already occurred, on the basis of estimates of pasture forage availability derived from GIS. Payments to affected clients were a function of the area's average loss and not of individual loss. The IBLI was well received among the pastoralists and sales of the insurance went beyond expectations (Mude et al., 2010). Moreover, on the basis of an analysis conducted in rural areas of the United Republic of Tanzania, Traerup (2012) proposes a collective approach to index-based insurance. A collective approach to index-based insurance is one in which members of informal networks are insured collectively as opposed to individually, thereby overcoming the prevailing barriers to the take-up of insurance.

5. Approaches to address incremental change in Africa

121. Countries require strong institutional arrangements, legislation and policy in order to reduce the potential impacts of climatic phenomena and build up resilience (UNISDR,

2011b). By examining the organizational structures and programmes for risk management in Africa, this review found a number of institutions and strategies developed by governments (sometimes in partnership with non-governmental organizations (NGOs)) to address loss and damage associated with the adverse effects of climate change.

Policies, legislation and strategies

122. In response to floods, the Strategy for Flood Management for the Kafue River Basin was developed by WMO, a Zambian expert team and key stakeholders, including government ministries, local organizations, researchers, NGOs and local farmers' and fishing associations, in a collaborative and participatory process. The strategy includes various components to be implemented by policymakers, such as: a flood forecasting system; the reduction of the vulnerability of the floodplain communities by means of appropriate policies in different sectors; the establishment of a Kafue Catchment Council; the preparation of watershed development plans; and an intersector coordination mechanism to plan and implement pre-disaster and post-disaster flood prevention and mitigation measures (APFM and WMO, 2007). Moreover, Butt, McCari and Kergna (2006) highlighted a number of policy changes that might assist the current and future transition from rain-fed crops to non-rain-fed crops in times of drought in Mali; for example, policies on the migration of cropping patterns, the development of high temperature resistant cultivars, the reduction of loss of soil productivity, the expansion of cropland, the adoption of improved cultivars and changes in trade patterns.

123. In Mozambique, the United Nations Development Programme (UNDP) and the Ministry of Planning and Development are implementing a project seeking to mainstream climate change adaptation mechanisms in Mozambique's policy, development and investment frameworks through capacity-building. The expected outputs include: sector-specific risk and vulnerability assessments; long-term institutional arrangements for the effective coordination of climate change adaptation investments; an enhanced policy framework, including climate-resilient policies for priority sectors; and pilot adaptation projects at the community level (UNDP, 2011). South Africa distinguishes itself from other countries in the region by stating its intention to use public-sector funding to address climate change adaptation. Also of note are the various local and subnational adaptation policies and strategies that have emerged in South Africa over the past five years. These policies and strategies seem to have emerged independently in response to local needs and priorities (Hove, Echeverría and Parry, 2011a).

124. Regarding water management, the African, Caribbean and Pacific–European Union (ACP–EU) project entitled "Improving Water Management and Governance in African Countries" (ACP–EU, UNEP and GWP, 2009) presents cases in the Gambia, Guinea-Bissau and Sierra Leone, which have successfully developed and validated their Integrated Water Resources Management (IWRM) road maps. The road maps aim at raising awareness and promoting the political will to address problems related to water resources, the development of a legal framework as well as an institutional framework oriented towards IWRM, and capacity-building for stakeholders at all levels.

Institutionalizing disaster risk reduction

125. Meanwhile, governments are beginning to make the link between disaster risk reduction, climate change adaptation and development. For example, members of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) have incorporated climate change adaptation strategies into their national development plans, with three countries indicating that they collaborate at the regional level on strategies such as conservation of generic materials, development and promotion of drought-tolerant species and soil conservation (Makau Nzuma et al., 2010). Furthermore,

the United Republic of Tanzania was the first country to place the responsibility for disaster risk management within its economic and financial planning. Particularly, it developed its Zanzibar Strategy for Growth and Reduction of Poverty: 2010–2015 through its Ministry of Finance and Economic Affairs. This has provided a strong push for disaster risk management, from reviewing and harmonizing laws and policies, to infrastructure improvements, capacity-building and community-based preparation for disaster (UNISDR, 2011b).

126. Meanwhile, South Africa's 2002 Disaster Management Act and 2005 National Disaster Management Policy Framework were among the first to focus on: prevention; decentralization of disaster risk reduction; the integration of disaster risk reduction into development planning; and stakeholder inclusiveness (Field et al., 2012). Aside from this, Egypt has started several coastal protection activities to improve its resilience to sea level rise, including the adoption of laws and the installation of hard structures in areas vulnerable to coastal erosion. Egypt has also adopted its National Climate Change Action Plan, integrating climate change concerns into national policies (Agrawala et al., 2004).

127. Namibia established its National Disaster Risk Management Policy in 2004, which places emphasis on disasters of different kinds, severities and magnitudes that occur or may occur in Namibia. The policy gives effect to various human rights, including the right to life, equality, human dignity, a safe environment, the protection of property, health care, food, water, social security and safety nets. The policy seeks, inter alia: to minimize the loss of human life and property and the damage to the environment resulting from hazards of natural, technological and ecological origin; and to advocate an approach to disaster risk management that focuses on reducing risks, especially the risks to the sections of the population that are most vulnerable owing to poverty and a general lack of resources. Furthermore, the Disaster Risk Management Bill was tabled in February 2012 and provides for the establishment of institutions for disaster risk management in Namibia, an integrated and coordinated disaster management approach, declarations of disasters and the establishment of the National Disaster Management Risk Fund.

Transboundary resource management

128. Regarding the management and governance of transboundary resources, there are several African transboundary river basin organizations as well as a number of bilateral or multilateral agreements, for example concerning the Senegal, Niger, Lake Chad, Okavango, Limpopo, Orange and Zambezi basins (Goulden, Conway and Persechino, 2009). The Nile Basin Initiative is seen as a first step in addressing the transboundary dimensions of climate change adaptation, raising awareness and providing training to develop skills in government ministries, NGOs and local communities in each riparian country (Belay et al., 2010). The Okavango Integrated River Basin Management Project, coordinated by the Permanent Okavango River Basin Water Commission, has been highly successful as a basin-wide approach to protecting environmental flows in the face of climate change. The project has achieved success in strengthening organizations involved in transboundary river basin management (USAID, 2009; Le Quesne et al., 2010). Moreover, the Lake Victoria Management Project aims to stabilize the transboundary lake's ecosystem and make it a sustainable source of food, clean drinking water and income. The project is funded by the World Bank and the Global Environment Facility (GEF) and is implemented jointly by Kenya, Uganda and the United Republic of Tanzania (Palaniappan et al., 2010).

129. Similarly, the Government of Chad is leading the "Lake Chad Sustainable Development Support Program", a five-country effort to promote sustainable development in the Lake Chad Basin and reverse the lake's decline. One of the project's specific objectives is to improve the adaptive capacity of the lake's productive systems to climate change (Crawford, Hove and Parry, 2011). As shown by the example of the Congo River

Basin, it is important to build on existing collaboration frameworks, such as those of the Congo Basin Forest Partnership, for the integration of adaptation to climate change into policy and planning (UNFCCC, 2007). Composed of participating African countries' forestry ministers, the Central African Forests Commission coordinates initiatives and actions related to the conservation and sustainable management of the Congo Basin forests and is also coordinating the project "Climate Change Scenarios for the Congo Basin" (Crawford, Hove and Parry, 2011).

130. As an institutional response to drought and desertification, ECOWAS started providing pastoralists with transhumance certificates, together with a travel handbook, in order to ensure their free mobility across the livestock corridors of the ECOWAS member countries through designated entry points. Such passports provide opportunities for pastoralists to cross borders for grazing and therefore to adapt to the challenges posed by climate change through seasonal mobility and migration (GL-CRSP, 2004; UNDP, UNCCD and UNEP, 2009).

Contingency planning and funding

131. Contingency planning is seen as a management tool used to analyse the impact of potential crises and ensure that adequate and appropriate arrangements are made in advance in order to be able to respond in a timely, effective and appropriate way to the needs of the affected population (IASC, 2007). Throughout Africa, many countries have been working on drought contingency planning:

(a) Lesukat (2012) examines the national drought management contingency plans in Ethiopia, Kenya and Uganda. All three countries have similar national drought management components, including national drought management policy, a drought early warning system, a set of district-level contingency plans, a drought contingency (response) fund, and drought coordination and response structures. Further, at the regional level, economic committees have the important role of facilitating cross-border and multi-country ecosystem-based contingency planning (e.g. the Climate and Application Centre of the Intergovernmental Authority on Development (IGAD), which provides seasonal weather forecasts and monitors and analyses the regional impacts of climate change on IGAD member countries);

(b) In 2007 the Government of Niger developed a national contingency plan for food security and nutrition, with the participation of a variety of governmental and non-governmental actors, in order to improve the functioning of its emergency response interventions. The overall objective of the plan is to minimize the impact of food crises by ensuring households' access to staple foods and protecting their assets, mainly via the national security stock and emergency cash resources (e.g. general food distribution, food for work, cash for work, subsidized sales and seed distribution) (Pelham, Clay and Braunholz, 2011);

(c) Kenya has been implementing an Arid Lands Resource Management Project (ALRMP) in the country's drought-prone and marginalized communities (with support from the World Bank and the European Union). ALRMP has funded a Drought Management Initiative and consolidated a national drought management system with structures at the national, district and community levels. The drought management system includes policies and strategies, an early warning system, a funded contingency plan and an overall drought coordination and response structure. Major institutional changes as a result of the creation of a Drought Management Authority and a National Drought Contingency Fund are also under way (Zwaagstra et al., 2011);

(d) The ARC project is based principally on contingency planning. The goal of ARC is to create a facility that allocates resources to use in the event of probable but

uncertain extreme weather events. Thus, the ARC acts as a pan-African contingency funding mechanism for extreme weather emergencies, pooling risk across the continent, and initially providing coverage for severe drought. ARC only partially funds the needs of countries in the event of disaster, and each participating country, in advance of joining ARC, creates a contingency plan identifying how the ARC funds would be optimized to assist those affected (African Union and WFP, 2012);

(e) Contingency planning has also been implemented in Somalia to prepare for floods. Several contingency plans for different scenarios were developed, along with an early warning system. According to the expected impacts on the environment and food security, the early warning system then determines which contingency plan needs to be activated (Choularton, 2007).

6. Analysis of the approaches to address loss and damage employed in Africa

132. This literature review has highlighted a number of approaches to address and adapt to loss and damage associated with the negative impacts of climatic phenomena employed in Africa. Despite the significant benefits of using such instruments, and their potential for promoting risk reduction and climate change adaptation, there are some drawbacks associated with each approach:

(a) **Risk reduction at the community level**. At the community level people continue to use local knowledge, which provides a valuable foundation for identifying measures for climate change adaptation. However, indigenous peoples remain hardly recognized in climate change policies and mechanisms, internationally and nationally, and their own potential to adapt is still barely understood and supported (Salick and Byg, 2007). In addition, local knowledge is mostly invisible, as it is passed down orally, rarely recorded and articulated in local languages. Thus, the external value attached to local knowledge compared with scientific 'expert' data is very low (UNDP, 2012). Meanwhile, monitoring drought still presents some unique challenges, including: "high costs of data, inadequate data-sharing between research institutions and government agencies, lack of standardization of impact assessment methodologies, and lack of integration of biophysical parameters with socioeconomic indicators in order to fully characterize drought magnitude, spatial extent and potential impact" (WMO, 2006);

(b) **Risk retention**. Although social protection does not reduce the risk of disaster in itself, UNISDR (2011b) highlights two reasons why it should be part of strategic disaster risk management. Firstly, successful social protection protects household and community assets, helping to avoid losses resulting from disaster cascading into other impacts on and outcomes for households, such as taking children out of school and sending them to work, or selling off productive assets. The second advantage is that social protection instruments can be used to reach large numbers of disaster-prone households via minor adaptation-targeting criteria and with low additional costs. UNISDR does note that it takes time for households to become sufficiently resilient. During this period it is essential to preserve the progress already made, especially when severe climate or economic shocks threaten to reverse gains. Despite these benefits, Davies et al. (2009) suggest that social protection and disaster risk reduction measures designed to limit damage resulting from shocks and stresses may not be sufficient in the longer term. If social protection is to be resilient to climate change impacts, this requires the consideration of how reducing dependence on climate-sensitive livelihood activities can be part of adaptive strategies;

(c) **Risk transfer**. At the micro level, households and businesses in developing countries are increasingly gaining access to new ways of managing disaster risks, particularly with the emergence of index-based insurance contracts as opposed to traditional loss-based insurance. However, while insurance programmes can offer affordable economic security to vulnerable communities, UNFCCC (2008) found that fewer than 5 per cent of

households and businesses in developing countries actually have insurance coverage for catastrophic risks. Instead such risks are dealt with by means of a mix of social networks and informal post-disaster credit. Lack of insurance may also stunt development because smallholders cannot risk investing in fixed capital or concentrating on profitable activities and crops for fear of losing them and falling into debt (UNFCCC, 2008). Moreover, Norton et al. (2012b) stress that efforts should not focus on increasing demand for index-based insurance, but rather on the education of clients and the development of more effective and improved insurance products;

(d) **Approaches to address incremental change**. While policies and legislation are increasingly incorporating the effects of climate change in Africa, a lack of awareness and policy adaptation has been noted with regard to the livestock sector in Kenya (Kabubo-Mariara, 2009). Robledo et al. (in press) highlight that unclear land tenure and legislation forbidding forest use have had negative effects on the adaptation of vulnerable populations in Mali, the United Republic of Tanzania and Zambia. Similarly, Drimie and Gillespie (2010) and Jankowska et al. (2012) suggest that the linkages between human security (particularly the health sector and climate-induced displacement) and environmental information will need to be more strongly acknowledged in climate change policies;

(e) **Water resources**. In most African countries climate change impacts on water resources are not explicitly taken into account in water sector policies (UNECA-ACPC, 2011). Therefore, as climate change affects many sectors at the local, national and regional levels within Africa, policies and legislation will need to become inherently multisectoral. The high risk of political tension, civil strife and conflicts related to the effects of climate change on the governance of transboundary resources will require multilevel approaches, as well as harmonized and cooperative responses to climate change, involving a strong network of institutions, such as in the Nile River Basin (Wirkus and Böge, 2006);

(f) **Contingency planning**. Regarding contingency planning and funding, a lack of timely access to contingency funds is regarded as a huge constraint in relation to drought management. Contingency planning and the effective use of contingency funds need to be stronger and better integrated with the implementation of interventions to support livelihoods (Zwaagstra et al., 2010);

(g) **Regional gaps**. With regard to Southern Africa in particular, Hove, Echeverría and Parry (2011a) mention that countries are engaged in multiple actions within similar areas of focus, such as agriculture and freshwater resources. Hence, it is important to ensure that current and future initiatives are complementary and build on lessons learned, for example through the establishment of communities of practice involving both countries that are actively engaged in adaptation projects and those in which, at present, there are fewer adaptation actions under way. In Central Africa, despite many shared challenges posed by climate change, adaptation actions tend to focus on domestic responses to climate change and not on regional actions. Additionally, most policymaking is focused on mitigation strategies, while action on climate change adaptation remains minimal (Crawford, Hove and Parry, 2011). In West Africa greater attention should be paid to key sectors which are so far underrepresented in adaptation efforts, such as fisheries, livestock and pastoralism, human health and freshwater resources (De Vit and Parry, 2011). Hove, Echeverría and Parry (2011b) highlight that ongoing adaptation initiatives in East Africa are unevenly distributed, with the action taken in Ethiopia, Kenya, Rwanda, Uganda and the United Republic of Tanzania being significantly greater than the action taken in Burundi, Djibouti, Eritrea and Somalia. Here too this situation may create opportunities to foster the exchange of knowledge and lessons learned (e.g. through communities of practice).

7. Conclusions on Africa's experience with approaches to manage loss and damage

133. The challenges associated with Africa's current strategies to address loss and damage call for:

(a) The improved user-friendliness and accessibility of early warning information, in order to promote the timely and informed undertaking of actions by decision makers and practitioners at different levels;

(b) An enhanced understanding of locally available resources, including community-embedded knowledge and technologies, and their roles in systematic disaster risk management processes, particularly those that are climate related;

(c) The integration of social protection measures with other measures to address loss and damage (like risk reduction, risk transfer and governance) and climate change adaptation;

(d) Effective conditional cash-transfer through innovative local partnerships between civil society, central government and other stakeholders;

(e) The development of a national policy to coherently address loss and damage that is detailed enough to define the roles and responsibilities of different actors in development sectors and local governments;

(f) The creation of a platform for countries to share their lessons learned.

134. Despite some challenges, it is evident that there has been a significant increase in attention, effort and practice with regard to the implementation of effective national and local instruments to offset the impacts of adverse climatic events that can cause loss and damage in Africa. Particularly in countries like Ethiopia, Malawi, Nigeria, Rwanda and the United Republic of Tanzania, there is a growing focus on the shocks and stresses experienced by the socio-ecological system and the capacity for adaptive action, as demonstrated by the existing social protection mechanisms and insurance schemes used to buffer the impacts of climate change.

B. Latin America

1. Introduction

135. Latin America is already dealing with climate change impacts, resulting from irregular, unpredictable rainfall patterns, the increased incidence of storms and prolonged droughts (Leary and Kulkarni, 2007). Losses associated with hurricanes, drought and floods are increasing rapidly – at up to four times the rate of growth in gross domestic product. This is a major concern that has motivated many countries in the region to adopt proactive approaches to managing their exposure to catastrophes (Andersen et al., 2010).

136. The first part of this section highlights risk reduction strategies employed at the national and local levels in Latin America, ranging from early warning systems and use of indigenous knowledge to building and land-use planning, which are employed to manage vulnerable water resources, food security and agriculture. Then it examines the experience gained in the region with risk retention strategies, including remittances, conditional cash-transfer programmes, social policies and specific funds designed to absorb shocks. The section then looks at a number of actions being taken by communities to transfer their current levels of risk by means of financial tools, such as innovative insurance schemes, reserves and catastrophe bonds, placing emphasis on institutions, organizations, legal frameworks and governance practices used to manage both current and future climate conditions. Several case studies are presented to help illustrate the diverse examples of risk

management approaches, providing a key reference point for this entire literature review. Finally, this section concludes with an analysis of the gaps found in the literature on approaches to address loss and damage in Latin America, namely where more documentation on approaches may be needed or where information on experiences with particular approaches has not yet been gathered.

2. Risk reduction in Latin America

Early warning systems

137. Effective early warning systems are essential in order to prepare for, respond to and recover from extreme weather events and disasters. Their implementation is an immediate and cost-effective measure that can be taken to save lives and livelihoods. One example is SERVIR, which is a regional visualization and monitoring system that integrates earth observations (e.g. satellite imagery) and forecast models together with on-the-ground data and knowledge to inform decision-making in relation to disasters, ecosystems, biodiversity, weather, water, climate change, health, agriculture and energy. In Central America, SERVIR has provided real-time monitoring of over 50 natural disasters and has developed a geospatial portal which provides access to regional data and metadata, helping governments in the region to act quickly. Cuba, which is highly exposed to hurricanes, has reduced the associated impacts more than its neighbours thanks to an effective early warning system and widespread education on storms (Brown, 2007). After Hurricane Mitch a provincial early warning system was set up in several municipalities of Honduras. In the case of the municipality of La Masica, the system has helped local inhabitants to tackle future natural hazards through the use of low-cost technology and local participation (Sagala and Okada, 2007). Brazil is also in the process of setting up an early warning system, together with its Ministry of Science and Technology and IDB (Planetaryskin, 2012). Similarly, Latin American countries are increasingly using statistical data, such as Chile (Hulbert and Diaz, n.d.), and information portals, such as the *Sistema de Informacíon de la Diversidad Bilógica y Ambiental de la Amazonía Peruana* (SIAMAZONIA) in Peru (Kalliloa et al., 2008), to help prepare for disasters. The Central American countries and Mexico have jointly set up an early warning system. The *Plan Puebla Panamá* includes several actions to mitigate climate change impacts and an early warning system.

Indigenous knowledge

138. Local communities in Latin America have adapted their livelihoods to take into account a wide variety of disturbances caused by environmental variability, including the development of many traditional systems to combat drought:

(a) Communities in the Andes claim that they have survived floods, such as the one in 2007, by using a number of adaptive strategies, such as rainwater harvesting, soil conservation and specific housing designs (Galloway McLean, 2010);

(b) In Peru farmers are using *waru waru*, or raised-field agriculture, an ancient irrigation and drainage system which combines raised beds with irrigation channels, in order to prevent damage resulting from soil erosion during periods of drought (UNESCO, MOST Policy Research Tool);

(c) In Bolivia a century-old irrigation system (*camellones*) is being used during periods of drought. Water is collected in the mountains by way of constructing *qhuthanas*, which are dams that collect and store water (Galloway McLean, 2010);

(d) The village of Guarita in Honduras prevented massive crop losses caused by Hurricane Mitch by using *quezunga*, a traditional farming method that involves planting crops under trees, whose roots anchor the soil, pruning vegetation to provide nutrients to

the soil and conserve soil water, and terracing to reduce soil erosion. The method avoids widespread slash-and-burn techniques and also improves soil fertility (Galloway McLean, 2010).

Infrastructural measures

139. Structural measures have been used to reduce the effects of climate-related extreme events in Latin America, such as floods and drought. This includes interventions that reduce the effects of extreme weather events, such as the creation of dikes and embankments, and strengthening buildings through retrofit programmes. For example, the planned or built large dams in Amazonia, Brazil, are an exemplar of large-scale water management. Once the project is complete, it will meet the country's large-scale energy needs and serve major urban centres and industrial sectors across the country. At the regional level, the large Amazonian dams could both generate energy and assist in drought management through the storage of hydrological resources (Field et al., 2012). Such a project crosses local, national and transnational jurisdictions. Similarly, the La Laguna Dam (1941) and the Puclaro Dam (late 1990s) have helped Chile to reduce the impacts of drought and fostered water security. The trend for building dams still persists: Peru, for example, has developed the *Plan Maestro Optimizado* (investment master plan) in order to finance large dam projects (*megaproyectos*) (BMZ, 2010). Another popular infrastructural adaptive measure to secure water availability is artificially constructed or connected lakes, such as the Rímac River Basin in Peru (BMZ, 2010), or irrigation systems (Hulbert and Diaz, n.d.). At the same time, when considering the use of structural measures, unintended negative environmental and social consequences should be considered and avoided. For example, dams have caused, in some cases, negative impacts on health and livelihoods, forced migration or resettlements, new GHG emissions and new threats posed by floods and drought in downstream river basins (Cesario et al., 2011).

140. Sustainable land-management measures have also been used by countries to cope with climate change. For example, farmers in Nicaragua make use of contour barriers, green manures, crop rotation and stubble incorporation to tackle climate change, while farmers in Mexico are testing adaptation measures by implementing drip-irrigation systems and using greenhouses and compost (Margrin et al., 2007).

141. In terms of more community-led initiatives to deal with the adverse effects of climate change, houses in Ecuador are built using mangle wood and bamboo (that has been used locally for centuries) and are raised above ground level owing to problems with flooding. These elevated bamboo houses are cheap, long-lasting and flood resistant (UNFCCC, Local Coping Strategies Database). Over the years amendments have been made to the design of the houses to minimize the amount of material used and to keep costs down. This shows how structural measures combined with local knowledge can act as a buffer against the impacts of climate change.

3. Risk retention in Latin America

142. A number of social protection mechanisms, such as conditional cash-transfers, social policies and special funds, have been adopted in Latin America to protect vulnerable people before, during and after crises. Such mechanisms can indirectly build up households' resilience and provide a buffer against the impacts of disasters by enabling the accumulation of assets as a buffer against disaster-related losses (Leary and Kulkarni, 2007).

Conditional cash-transfer programmes

143. Many countries in Latin America are moving away from ad hoc assistance programmes and price subsidies towards well-targeted cash transfers, with the aim of

reducing poverty in vulnerable households, which are also vulnerable in relation to climate change (Ribe, Robalino and Walker, 2012; UNISDR, 2011). Some prominent examples of conditional cash-transfer programmes include Brazil's *Bolsa Família* (family allowance) programme, which provides small stipends to poor families in exchange for them meeting specific conditions, including attending prenatal check-ups and ensuring that their children attend school regularly, or it supports girls by means of scholarships to avoid them having to stay at home and help their mothers. With 12 million families enrolled, *Bolsa Família* is the largest conditional cash-transfer programme in Latin America (Fried, 2011). Another example is PROGRESA, which was introduced by the Government of Mexico in 1997 and relaunched as *Oportunidades* in 2002 (UNISDR, 2011). The main objective of the programme is to improve the education, health and nutrition of poor families by providing cash transfers to families in exchange for regular school attendance and visits to health clinics (UNISDR, 2011). It has helped to reduce households' vulnerability through the accumulation of assets and more stable flows of income, allowing poor households to better plan their expenses, get credit more easily and pay off their debts (Arnold and Fuente, 2010). Similar effects have been noticed as a result of conditional cash-transfer programmes in Colombia (*Familias en Acción*), El Salvador (*Red Solidaria*), Honduras (*Programa de Asignación Familiar*) and Nicaragua (*Red de Protección Social*) (IPC-IG, 2012).

144. Furthermore, the *Atención a Crisis* programme was implemented in Nicaragua from 2005 to 2006, targeting six municipalities. The programme was part of the national *Red de Protección Social* (social protection network) and aimed to provide short-term social safety payments to households affected by drought. The short-term objective of the project was to protect human capital and the physical assets of affected households (through cash transfers). In the long run, *Atención a Crisis* sought to establish conditional cash-transfers coupled with scholarships for vocational training or productive investment grants for small-scale non-agricultural activities. The programme proved to be successful as, after nine months, the beneficiary households had protected as well as improved their asset base and, hence, could better engage in productive activities (UNISDR, 2011).

Funds for natural disasters

145. In 1996 the Mexican Government established a system of allocating resources for spending in the event of disaster (FONDEN) in order to enhance the country's financial preparedness for dealing with disaster-related losses, including those caused by climate change events. FONDEN serves as a last-resort source of funding for dealing with uninsurable losses, such as expenditure on emergency response and disaster relief, in particular payments for restoring infrastructure damaged during a disaster. In addition, in 1999 a reserve fund was created that accumulates the surplus of the previous year's FONDEN budget item (Field et al., 2012). By 2010 FONDEN had already spent 12 billion Mexican pesos to cover the cost of extensive disasters, such as recurring mudslides and floods, and it needed 25 billion by the end of the year to cover the cost of non-assessed losses. To make up for the shortfall, other government revenues had to be diverted, suggesting that FONDEN is not an all-cure solution (UNISDR, 2011). Mexico has also established FAPACC, a natural disaster fund dedicated to providing immediate assistance to famers in order to restore their productivity. It offers contingent payments for damages caused by drought, frost, hail, excess rain, floods and windstorms (UNFCCC, 2008). Moreover, through Law No. 28939, the Peruvian Government has introduced a guarantee fund for agricultural insurance, which aims to protect poor and vulnerable households against climatic and other catastrophic events (Oft, 2010).

146. Aside from the above-mentioned funds, IDB grants Contingent Loans for Natural Disaster Emergencies to support countries in their efforts to improve their disaster risk management and the efficiency thereof (IDB, 2012a). The majority of the Latin American

countries have asked for such loans (IDB, 2012b), which are expected to allow the countries' governments to cover costs during an emergency and in the immediate aftermath of an extreme weather event (i.e. expenditure on emergency medical equipment, vaccines and medication, facilities and equipment for temporary shelters, food for displaced people and livestock, transportation and communications equipment and facilities) (IDB, 2011).

4. Risk transfer in Latin America

147. In order to provide financial security against drought, floods, tropical cyclones and other weather extremes, Latin America has employed a number of financial instruments, including insurance and catastrophe bonds.

Insurance

148. Area-yield index-based insurance, which aims at providing indemnities to a farmer when the farm experiences a crop loss due to extreme weather events affecting yield (Skees, Barnett and Collier, 2008), can be found in Brazil and Peru. For example, in the Brazilian State of Rio Grande do Sul the area-yield index-based insurance provides extensive coverage to farmers and has been well advertised. Similarly, in 2008 two insurance companies, La Positiva and Caja Señor de Luren (Caja) (which has the leading agricultural microfinance credit portfolio in the region), joined together to develop an area-yield index-based insurance programme for cotton farmers in the Pisco Valley (Peru). This partnership allowed La Positiva to gain access to well-established distribution channels, while Caja was able to increase its credit portfolio and offer more loans to cotton growers (IFAD, 2011).

149. In Bolivia an area-yield index-based insurance called *Fundación PROFIN* has been set up in four provinces in the north and central Altiplano regions, whereby a reference farmer is selected against which to assess whether production levels have been adversely affected by environmental factors (Warner et al., 2009).

150. The weather index insurance *Agroasemex* was introduced in Mexico to insure maize and sorghum against drought. Instead of insuring against crop failure, commonly found in traditional agricultural insurance contracts, the new contracts are written against an index describing the relationship between lack of rainfall and crop failure. Farmers receive payouts if rainfall falls below agreed trigger levels during key stages of crop growth (IFAD, 2011).

151. The Chilean Ministry of Agriculture covers 50 per cent of insurance costs in order to ensure the integration of small-scale farmers into insurance services (Hulbert and Diaz, n.d.).

152. The Regional Insurance Facility for Latin America offers countries in Latin America direct access to international reinsurance markets through the demonstration of vulnerability through the creation of country-specific risk-transfer solutions (Andersen et al., 2010).

Innovative risk transfer mechanisms

153. A number of recent innovative disaster risk financing tools have forged even more explicit links between disaster risk financing and disaster risk management (World Bank, 2011). By cross-subsidizing coverage for low-income groups from voluntary payments, the Colombian municipality of Manizales introduced an innovative collective insurance policy aimed at securing both the public and private sectors. This collective insurance policy enabled the municipal Government to design a collective risk transfer instrument and promote an insurance culture in the city (Marulanda et al., 2010). Mexico City has introduced a global insurance against several disasters, in order to help the most vulnerable

people to recover from them. Meanwhile, the World Bank (2011) highlights the El Niño index insurance project in the coastal region of Piura, which is using highly predictive values of sea surface temperature in the Pacific to design innovative insurance coverage for the damage and disruption that El Niño inflicts on Piura's economy. This index is unique because it can signal a severe El Niño related event months in advance of its impact on land. Furthermore, payouts are based on a seasonal prediction, so policyholders receive payment months in advance of catastrophic weather. In turn, this payment can be used to reduce the losses and disruption caused by the forecast event. At the moment the El Niño index insurance is used primarily to increase access to credit in rural areas of Peru, but it has also sparked consideration of other applications of forecast index insurance in other areas (World Bank, 2011).

Catastrophe bonds

154. In 2009 Mexico established a catastrophe bond which provides three-year coverage against exposure to extreme weather events. The Government of Mexico was among the first governments in the world to use catastrophe-related alternative transfer instruments (alternative to traditional insurance and reinsurance) to protect its public finance against extreme weather events with a mix of reinsurance and a catastrophe bond (Suarez and Linnerooth-Bayer, 2011). The case of the Mexican catastrophe bond is also informative because the Mexican Government received positive media coverage and praise from catastrophe specialists (Michel-Kerjan et al., 2011).

155. Costa Rica has made use of the Catastrophe Deferred Drawdown Option, which offers bridge financing if a country declares a state of emergency as a result of a natural disaster. The strategy has been used widely in the region, particularly in 2009, when USD 15 million was drawn from a USD 65 million credit line to respond to natural disasters (World Bank, 2010).

156. Central America and the Dominican Republic have created the Central America Natural Disaster Insurance Facility, initiated by IDB and Swiss Re, which provides participating governments with quick access to insurance proceeds following a disaster. It works in a similar way to CCRIF, but also offers coverage for hurricane-induced landslides and reflects a more customized approach suited to nations of all sizes, such as offering coverage for weather-related risks in the agriculture sector (Swiss Re, 2011).

5. Approaches to address incremental change in Latin America

157. As highlighted in the UNISDR 2011 GAR, development tools and mechanisms for successful disaster risk management and tackling climate change issues need to be facilitated by appropriate risk governance arrangements. With regard to climate change, Latin American countries have strengthened their institutional capacity to tackle climate change issues.

National strategies

158. EuropeAid (2009) identified four institutional means to address the adverse effects of climate change common to Latin America: firstly, climate change units under the command of the international relations and/or environmental quality directorates (Chile, Colombia, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay and Uruguay); secondly, climate change units (Cuba and Ecuador); thirdly, directorates or climate programmes (Argentina, Bolivia, Brazil, Costa Rica, Ecuador and Mexico); and, finally, permanent inter-ministerial committees for supervising and coordinating climate change actions (Brazil and Mexico). With regard to agreements under the Convention and its Kyoto Protocol, the above-listed national bodies formulate, coordinate and execute measures in relation to climate change.

159. At the national level, governments have created institutions and/or policies that are solely dedicated to tackling climate change and/or disaster management issues. Mexico, for example, created the *Comisión del Agua del Estado de Mexico* (Water Commission of the State of Mexico). This decentralized, independent government institution is responsible for formulating water policies and managing Mexico's water resources (UNESCO, 2006). Next to water management, land management is an important regional issue. The Peruvian Congress, for instance, introduced the "Peasant Community" legislation, which ensures the equality of rights and obligations of rural municipalities in ensuring ecological preservation and natural resources (Sotomayor, 2008). The Peruvian Government has mandated regional governments to develop adaptation plans. Seven out of 24 regions have completed a regional climate change strategy as mandated by national policy. In addition, the Peruvian *Sistema Nacional de Inversión Pública* (national public investment system) incentivizes local governments to develop risk management plans. At the national level, Colombia's Integrated National Adaptation Program[12] supports Colombia's efforts to define and implement specific pilot adaptation measures and policy options in order to tackle the anticipated impacts of climate change (Vergara, 2007).

Multilevel approach

160. An emerging trend in Latin American countries is to set up multilevel approaches. For instance, the Peruvian and Swiss Governments have created a programme integrating scientific and technological developments into adaptation strategies (IOPscience, 2009). In Brazil the Government is cooperating with *Rede Brasileira de Pesquisas sobre Mudanças Climáticas Globais* (the Brazilian Research Network on Global Climate Change) (Rede CLIMA) to carry out studies on the causes and effects of climate change, so that Brazil can find adaptive measures to respond to climate change related problems (MCTI, n.d.). Established by the Brazilian Ministry of Science and Technology in its Administrative Order No. 728, dated 20 November 2007, and amended by Ordinance No. 262, dated 2 May 2011, the mission of Rede CLIMA is to generate and disseminate knowledge so that Brazil can meet the challenges posed by the causes and effects of global climate change. Chile has initiated a 'water dialogue', which is a pilot project aimed at establishing integrated watershed management by creating a common regional water agenda through the cooperation of institutions with various stakeholders (Hulbert and Diaz, n.d.).

Regional level

161. Climate change policies have also been issued at the regional level. For instance, the *Sistema de la Integración Centroamerica* (Central American Integration System) (SICA) has issued policies like the 1993 Regional Agreement on Climate Change and the 2008 San Pedro Sula Declaration, in which the Presidents of the SICA member States approved the "Guidelines for the Regional Strategy on Climate Change" (CCAD and SICA, 2010). In Central America, the Central American Commission for Environment and Development was established, which consists of the environmental ministries of the SICA member States (Keller et al., 2011a). In Southern America regional action has been limited. Although the Andean Community has issued a scoping paper on a strategy for addressing climate change, which discusses the regional vulnerabilities and impacts of climate change, a common framework and strategic guidelines are lacking. More collaborative action is taking place through the Ibero-American Network of Climate Change Offices (Keller et al., 2011b).

[12] See <http://www.worldbank.org/projects/P083075/colombia-integrated-national-adaptation-program?lang=en>.

6. Analysis of the approaches to address loss and damage employed in Latin America

162. As outlined in chapter IV.B above, the literature identifies a number of different measures that Latin America has taken and/or will take to manage the impacts of both extreme weather events and slow onset climatic processes. However, the literature also identifies gaps between needs and action, regarding all of the risk reduction strategies mentioned:

(a) **Gaps in risk reduction strategies**. Despite the benefits of effective early warning systems, the political will to implement sufficient policies and early warning systems seems to be lacking in Latin America (Conger, 2011). This reflects the general finding of the WMO (2009), which stated that "many countries reported a need to strengthen national plans, coordination mechanisms and legislation for effective early warning systems". Another common problem is that climatic data used to analyse possible future climate scenarios are still lacking (Hulbert and Diaz, n.d.) and the importance of information portals such as SIAMAZONIA is still not acknowledged by governments (Kalliloa et al., 2008). With regard to indigenous knowledge, the rapidly changing climate is jeopardizing the ability of some to adapt using traditional means. For example, Kronik and Verner (2010) show how indigenous communities in north-eastern Colombia can no longer rely on horticulture owing to the lack of a clearly distinguishable dry season, leading to a loss of potential crop diversity. Furthermore, in Ecuador indigenous knowledge has been shown to have lost value in the face of El Niño related events. Climate change impacts have changed, making traditional means of fighting floods ineffective (Gila et al., 2009). There is a need to engage the local level, where most disasters occur, in the planning and implementation of disaster risk management;

(b) **The limitations of using infrastructural measures to reduce risk**. Dam construction does not necessarily lead to beneficial outcomes at the regional and national levels (i.e. hydroelectric power and water management). As the case of dam construction in Honduras shows, dam construction can often lead to social maladaptation, such as forced migration as a result of flooding, which has led to the spread of diseases and poverty and environmental problems in the local area, such as the erosion and inundation of deltas (Field et al., 2012). Embankments and drainage have also led to further flooding problems (for instance, the embankments have retarded the drainage, causing a higher risk of floods) in Argentina (Iranni et al., 2009). Furthermore, irrigation systems have had pervasive effects on small-scale farmers in Chile; for instance, the Water Code has fostered the commoditization of water and water rights are treated as private property (Hulbert and Diaz, n.d.);

(c) **Issues with risk retention strategies**. Many social protection programmes are not directly linked to managing extreme weather events. While they help to buffer communities against disaster risk via the accumulation of assets to act as a buffer against disaster-related losses, more research is required in this area. Furthermore, a lot of the beneficiaries of such social protection programmes are children and females, which might also skew the results. Moreover, many policymakers are concerned that recipients might become dependent on the benefits and that such programmes might be unsustainable over the long term. Such concerns have blocked the development of safety nets in many countries (Ribe, Robalino and Walker, 2012). In general, there is a lack of sufficient social policy to ensure that conditional cash-transfers actually decrease the losses suffered as a result of disasters (Wood, 2011). Moreover, Ribe, Robalino and Walker (2012) comment on how the social protection systems in Latin America have evolved in an ad hoc manner, often producing multiple programmes and institutions whose mandates regarding benefits and beneficiaries are unclear (Ribe, Robalino and Walker, 2012);

(d) **Institutional fragmentation**. Institutions are not allocated clear roles. As the case of the State Water Commission of Mexico shows, there is a lack of cooperation in

terms of water management, leading to the insufficient enforcement of water-related laws (UNESCO, 2006). Similar findings were made in the cases of Argentina, Brazil, Costa Rica, Honduras and Nicaragua, where independent actions undertaken by relevant stakeholders have lead to institutional fragmentation (OAS, 2006). Additionally, while laws have been established to help poor households, such households are still considered the most vulnerable to the impacts of climate change and they do not actively participate in the decision-making process. In Peru, for instance, the "Peasant Community" legislation has hardly received any legislative support for the poor to actively participate in land planning (Sotomayor, 2008) and low-income groups are often excluded from political decision-making in Tumaco, Colombia (Lampis, 2010);

(e) **Existing governance arrangements** are still not effective at reducing weather-related risks and rarely address slow onset climatic processes. Even though Latin America has invested in developing national policies and strengthening and reforming institutional and legislative systems for disaster risk management, several shortcomings remain. For example, in Sonora, Mexico, where 87 per cent of agricultural land is rain-fed and highly vulnerable to drought, an effective drought early warning system is non-existent, which is due to the low prioritization of drought risk management and the poverty reduction of local communities by the authorities (UNISDR, 2011). Moreover, long-term risk reduction strategies, for example flood barriers to resist thousand-year storm surges (as in the case of installing large dams in Amazonia, Brazil) are still lacking. As such, governments can be seen to prioritize short-term gains over long-term resilience.

7. Conclusions on Latin America's experience with approaches to manage loss and damage

163. Overall, some Latin American countries have developed efficient disaster risk reduction and adaptation strategies, and some even have broader approaches in place to address loss and damage. However, as the analysis shows, it is difficult to capture all of the different functional scales that climate change, vulnerability and natural hazards operate on and, therefore, no single approach would suffice to meet such challenges. A suggestion for how to overcome such challenges is to strengthen the available technical expertise in planning in order to deal with climate change related issues, specifically in emerging cities like Mexico City (OECD, 2010). At the financial level, Latin American countries need to gain a better understanding of how climate-related risks might affect their finances, allowing governments to engage in appropriate strategies to plan for and manage the spectrum of loss and damage associated with climate change. In addition, scientific evidence plays a decisive role in the process of collecting data on extreme weather events and slow onset climatic processes in order to establish appropriate policies and risk management systems. Regionally, transboundary institutions, particularly in South America, need to be able to address the loss and damage related to extreme weather events and slow onset climatic processes (Keller, Echeverría and Parry, 2011; UNISDR, 2011).

C. Asia and Eastern Europe

1. Introduction

164. In recent years, Asian countries have demonstrated improvements in their disaster risk management and the institutional and legislative arrangements and mechanisms that underpin it. For example, despite more and more people living in floodplains and along cyclone-exposed coastlines in East Asia and the Pacific, mortality risk relative to population size is now only a third of what it was in 1980 (UNISDR, 2011). This section summarizes and examines some of the approaches adopted in Asia to offset the impacts of natural hazards and climatic processes, including the use of improved early warning

systems, indigenous knowledge, building and land-use planning, social protection to help vulnerable households, and risk transfer schemes, as well as the development of regional and subregional strategies and frameworks for disaster risk management. In addition, several case studies are used to demonstrate how investing in enhancing preparedness for and the response to disaster is paying off. This is followed by an analysis of the strengths and weaknesses of each approach, with a view to guiding future research.

2. Risk reduction in Asia

Early warning systems

165. Progress has been made in providing early warning of extreme weather events, such as cyclones and floods, in Asia:

(a) Bangladesh is trying to improve its capacity for forecasting and early warning through the establishment of a Storm Warning Centre in its Meteorological Department. Further efforts include enhancing the early warning system's capacity to alert a wide range of user agencies via early warnings and special bulletins. At the local level, volunteers (who are part of the cyclone preparedness programme) receive periodic training and take part in drills for the effective dissemination of cyclone warnings and for raising awareness among the populations of vulnerable communities (Field et al., 2012);

(b) The Mekong River Flood Forecasting System is based on data obtained from agencies in the riparian countries and forecasts which are provided by the Regional Flood Management and Mitigation Centre. Further efforts to improve early warning for flash floods have been made by exploring different methods and forecasting mechanisms (MRC, 2010);

(c) To provide early warning of glacial lake outbursts, the Department of Energy of Bhutan operates just one station in Thanza, which consists of two people equipped with wireless radio sets and a single satellite phone to help monitor glacial lake water levels. However, this system is largely unreliable and will be replaced by an automatic system through the "Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys" project. The new monitoring system will be composed of gauges monitoring glacial lake bathymetry (depth), and sensors, connected to automatic sirens, will be installed along the rivers. As part of the project, the automated warning system is planned to be expanded to cover more glacial lakes (Meenawat and Sovacool, 2011);

(d) Jakarta, the capital city of Indonesia, is prone to floods. The former early warning system was aimed mostly at monitoring upstream flash floods and warnings were based on information on water levels obtained from several checkpoints, leaving only about six hours for communities along the river banks to respond. Furthermore, the system did not account for flooding due to extreme rainfall. As such, the system was improved through a wide-ranging multi-stakeholder process in 2008/2009. Specifically, a community-based early warning service for flooding was integrated into the existing system. Thus, warnings can now be given 36 hours before extreme rainfall hits. Overall, stakeholders from all levels of government and NGOs were involved in different multilevel capacity-building activities. This improved the knowledge and understanding of government officials in charge of issuing warnings and hazard information and increased community awareness in relation to response, evacuation and coping measures (ADPC, 2010);

(e) In Australia, the Ferny Creek Bushfire Alert System is an emergency communication system which transmits warnings by means of three independent, strategically-located sirens. The alarm sounds when an emergency call fulfils special criteria, pointing to a potential threat in the area. This alert provides some extra minutes to

implement the existing fire safety plans, which is important as densely forested terrain severely restricts visibility and precludes the normal visual warning of the outbreak and approach of a bushfire. This approach is complemented by a community education campaign that has proven to be very effective (UNISDR, 2010);

(f) In the flood-prone areas of lowland Nepal, a community-managed early warning system was established in 2006. It consists of five tower systems supporting electrically powered sirens. The system runs on independent battery-charged power sources, recharged intermittently by means of the national grid system. However, it does not rely on the national grid system, which is susceptible to failure during periods of heavy rain, when flooding is most likely to occur. This is complemented by awareness-raising activities and training in the use and operation of the early warning system (UNISDR, 2010);

(g) Hong Kong is affected by, on average, six tropical cyclones per year. It operates a Tropical Cyclone Warning Signal System to warn people of the threat of winds associated with a tropical cyclone. The issue of a certain cyclone warning calls on all people to return home and all activities in the city are shut down. These warnings are given early enough (two hours before the actual issuance of the signal) to enable an orderly shutdown. The system has been in place for many years and has thus far proven to be very effective (WMO, 2010).

Indigenous knowledge

166. Indigenous knowledge, culture and language continue to provide a central foundation for adaptation in various parts of Asia:

(a) In north-west Siberia reindeer herding represents a human-coupled ecosystem which has developed a historically high resilience to climate variability and change. The core survival strategy of reindeer-herding communities is based on the knowledge of how to live in a changing environment. Specifically, herders maintain the diversification of their herds to reduce their vulnerability to the consequences of unfavourable, and unpredictable, conditions (Oskal, 2009). However, industrial development can jeopardize the fine-tuned survival skills of reindeer herders in the Arctic, by blocking or delaying critical migrations between summer and winter ranges (Oskal, 2009);

(b) Parvin, Takahashi and Shaw (2008) found that communities in Hatia Island, Bangladesh, use traditional strategies to adapt to the impacts of cyclones, such as fastening their houses to large trees in the event of a storm;

(c) Fang et al. (2008) describe the *karez* technology employed for disaster reduction in relation to drought, which is used in the Xinjiang area of China. It is a comprehensive traditional irrigation system that helps to make use of underground water efficiently. It is built using simple tools and equipment. It is primarily composed of vertical wells, underground canals, a surface canal and small reservoirs. Due to soil filtration, the water quality is very high and pollution is prevented because of the underground canal;

(d) The plantation of bamboo is a disaster management technique adopted by the people of Assam, in India, to conserve soil and minimize erosion. Planted along rivers, it helps to protect the dams from being breached and prevents rapid run-off from the river channel when the river overflows. Additionally, the bamboo can be used as a construction material and for making crafts and paper (Stephen, Chowdhury and Nath, 2008);

(e) Local communities in Nepal have utilized a range of traditional measures to adapt to landslides. In particular, communities have the ability to recognize the warning signs of potential landslides, including new faults, water sprouting and differences in the angles of trees (Thapa et al., 2008).

Infrastructural measures

167. Structural measures have been used to manage and minimize disaster risk in Asia, including interventions that reduce the effects of extreme weather events, such as cyclone shelters, and strengthening buildings through retrofit programmes and land-use planning. For example, multi-storey cyclone shelters with capacity for 500 to 2,500 people were constructed in coastal areas in Bangladesh to provide the coastal population with a safe refuge from storm surges (Paul and Rahman, 2006). In addition, *killas* (raised earthen platforms), which accommodate 300 to 400 livestock, have also been constructed in cyclone-prone areas to safeguard livestock in the event of storm surges (Paul, 2009).

168. Furthermore, in 2004 Practical Action Bangladesh launched a risk reduction and management project to address issues related to development and disaster, especially among poor communities living along the riverbeds in remote northern Gaibandha. In particular, improvements were made in areas such as disaster warning, rapid evacuation, housing and sustaining livelihoods. As part of the project, a range of technological measures were introduced, such as floating vegetable gardening, pit cultivation techniques and cage aquaculture (UNISDR and UNDP, 2008).

169. In 2003 Japan launched a major retrofitting initiative in order to reduce the vulnerability of its housing stock to extreme weather events. The Government subsidized two thirds of the cost of evaluating houses and 23 per cent of the cost of retrofitting houses constructed before 1981. The Housing Finance Corporation provides a 10 per cent income tax deduction and low-interest loans to those who retrofitted their homes. This well-targeted and generous set of policy measures and subsidies resulted in 31,000 homes and 15,000 other buildings being retrofitted by 2009 (Okazaki, 2010).

170. Someth et al. (2009) investigated the Batheay irrigation system, located in the floodplain of the Mekong River and the Tonle Sap River in Cambodia. The reservoir is formed by a ring dike, which receives floodwater from the Mekong. The reservoir also functions as a paddy field. During the wet season, the ring dike stops the floodwater from entering the reservoir. The gates are opened after harvest to let the floodwater stream inside, while, during the dry season, rice is grown outside the dike. The authors of the study found that the system was very effective, allowing a total of 1,713 ha rice production yearly (estimates include growth both inside and outside of the reservoir).

171. In Chennai, India, an increasing number of floods have been experienced over the last 20 years. Thus, in 2001, the provision of rainwater structures in all types of development (irrespective of size or use) was made mandatory by the Government. After implementation, an increase in groundwater levels and an improvement in water quality were highlighted (Gupta and Nair, 2010).

3. Risk retention in Asia

Social protection

172. A number of social protection mechanisms have been adopted in Asia to enhance households' resilience and to provide a buffer against the impacts of climate change:

(a) A public guaranteed-employment scheme called the National Rural Employment Guarantee Scheme was implemented across India's six poorest states. It was found that the wages received through the programme provided poor rural households with a small additional income to supplement their agricultural earnings (PACS, 2007). Similarly, India's school midday meal scheme was carried out in a number of districts, which resulted in the alleviation of hunger and improvements in terms of enrolment in, and attendance and performance at, school – particularly among girls (CPRC, 2011). To

enhance the capacity of communities to cope with natural hazards, NGO Ramkrishna Loka Seva Kendra, a capacity-building project partner of Concern Universal Bangladesh, is building up a community-managed grain bank in Gosaba Block, West Bengal. Partly saline-resistant seeds were distributed to 51 farmers. After harvesting, they returned a certain share to the grain bank. In the event of a disaster, this extra grain is supposed to mitigate the risk of starvation for around 70 vulnerable families in the area (Concern Universal Bangladesh and Cordaid Netherlands, 2011). Overall, such programmes contribute indirectly to building up households' resilience by enabling the accumulation of assets to act as a buffer against future disaster-related losses;

(b) The "Pantawid Pamilyang Pilipino Program" is a poverty reduction and social development strategy of the national Government of the Philippines. Conditional cash-grants are provided to extremely poor households, which are also vulnerable to changes in the climate. Families have to send their children to school and pregnant women and children have to get regular health check-ups in order to receive the cash grants, which compensate for the costs of education and health care. Households are selected through the National Household Targeting System for Poverty Reduction (UNESCAP, 2011). Today, the programme is the largest social protection programme in the Philippines and has produced good targeted outcomes;

(c) Indonesia has implemented a conditional cash-transfer programme, called "Program Keluarga Harapan". Poor households enrolled in the programme receive money conditional upon children attending school, pregnant women attending prenatal check-ups, and other health-related measures. Payments are only made to the mother or adult females in the household. In turn, the scheme has an additional element of empowering women. Overall, the programme has shown positive results, as enrolment in school and immunization has increased among households participating in the programme (Schelzig Bloom, 2009). Another measure adopted in Indonesia is the implementation of experimental Climate Field Schools (CFSs), which serve as a form of improved extension service. In 2005/2006 an experimental CFS was set up in Indramayu, West Java. In 2007 a second CFS was established in Central Java. These field schools aim to raise farmers' knowledge on climate and improve their response to it. For example, some of the issues discussed at the school include soil and water management, pests and diseases, and crop choices and their adaptation (Winarto et al., 2008);

(d) The "Enhancing Resilience" programme in Bangladesh has the objective of strengthening the resilience of communities and households to natural disasters and the effects of climate change on nutrition and food security. The programme is located in disaster-prone areas along floodplains in the north-west and southern coastal belt of Bangladesh. A combined food and cash for work and training approach is used. Overall, the programme aims to strengthen the economic resources of beneficiaries and to build up community-based assets in order to protect development gains. Altogether about 420,000 people are reached by the programme (WFP and SDC, 2011).

Financial risk retention ('self-insurance')

173. An example of an informal insurance scheme in the Filipino culture is the custom of communities supporting bereaved families. Especially in rural areas, the informal sharing of funeral costs is widespread. The amount given depends on the wealth of the household and the intensity of the personal relationship. The contribution (*abuloy*) usually covers only the funeral costs and leaves little resources for the bereaved family to readjust their income strategy. Some organizations have 'formalized' the practice of *abuloy* and require their members to contribute an ex ante amount of money per month for a death benefit (Matul, Tatin-Jaleran and Kelly, 2011). Although no explicit link has been made between such a self-insurance scheme and addressing loss and damage associated with the adverse effects

of climate change, informally such a scheme can help communities create a buffer against financial shocks experienced after disasters, including as a result of climate change, by pooling their resources.

Funds to absorb shocks

174. A key measure that enables communities to participate in the planning and implementation of post-disaster reconstruction is the setting up of special funds. In Sri Lanka, NGOs and community organizations that help communities after a disaster have worked together to create the CLAPNET Fund. It is managed by various groups, including community representatives from the Women's Bank, and encourages organizations to cooperate with one another. The primary objective of the fund is to support pilot projects that can bring about change; examples include income generation grants to land purchase loans and housing improvement (Archer and Boonyabancha, 2010).

175. In India, the Community Disaster Resilience Fund (CDRF) has been designed to lend funds directly to local at-risk communities and to support them in implementing disaster risk reduction and adaptation measures. CDRF was first launched in eight states, with the selected communities facing multiple hazards and being very vulnerable. Community-based organizations were selected as the managers of the CDRF pilot projects across a cluster of villages. Groups and whole communities were encouraged to contribute labour and access public schemes to fund pilot projects. Recommendations arising from the pilot projects include that disaster risk reduction should be accomplished through poverty reduction and income generation, and that new schemes should be based on the use of traditional knowledge and existing networks (NADRR, 2009).

4. Risk transfer in Asia

Insurance

176. In recent years there have been a number of new approaches and instruments employed in the insurance sector in Asia. For example, both Mongolia and China are experimenting with IBLI programmes. Mongolia's programme was designed in the context of a World Bank lending operation with the Government of Mongolia. It follows a layered system of responsibility and payment, by combining self-insurance, market-based insurance and social insurance. Specifically, it is designed so that herders retain small losses that do not affect the viability of their business, while larger losses are transferred to the private insurance industry and only the layer of catastrophic losses is absorbed by the Government (Mahul and Skees, 2006). The compensation of the Government's potential losses during the pilot phase is based on a combination of reserves and, as a fourth layer, contingent credit provided by the World Bank (Suarez and Linnerooth-Bayer, 2011).

177. In 2008 a joint index-based insurance pilot was launched by WFP, the International Fund for Agricultural Development and the Chinese Ministry of Agriculture in Yanhu (a village in Chenfeng, China). The policy covers the entire rice crop of 482 households and protects 85 ha rice, with a total insured value of USD 56,000. So far the project has been judged as showing promise, not least due to the strong commitment of and collaboration between the Chinese Government and the insurer (Hazell et al., 2010).

178. In India, contracted farmers of PepsiCo have the opportunity to manage the many risks associated with potato-growing through an index-based insurance product, which is sold through ICICI Lombard General Insurance and managed by Weather Risk Management Services. The programme is particularly innovative, as farmers receive weather data and information on how to prevent avoidable crop loss via mobile phones. As a result, information on the weather is sent in a timely and regular manner (Hazell et al., 2010).

179. In India's coastal Andhra Pradesh region, microinsurance services are provided as part of the region's disaster preparedness programme. For example, life insurance policies, including natural disaster risks, are offered to vulnerable families, along with coverage for the risk of floods, landslides, rockslides, earthquakes, cyclones and other natural calamities. In order to limit transaction costs, the insurance premiums are kept low by offering only minimal coverage and dealing only with organized women's groups. The project has proved to be successful and coverage has been extended to more vulnerable families (Linnerooth-Bayer and Mechler, 2007).

180. An index-based insurance full-scale pilot project was set up in the Pak Chong district of Thailand in 2007, targeting maize farmers and addressing the risk of drought. In 2008 the project covered 388 farmers near 11 weather stations in five provinces of Thailand. Additionally, the insurance companies offered farmers variations in their contracts, including choices of starting date, sum insured and premium. The project has had a strong demonstrative effect and has generated wide interest (Hellmuth et al., 2009). Additionally, as a result of the collaboration between MicroEnsure (non-profit insurance intermediary) and the Malayan Insurance Company Ltd., the Typhoon Weather Index is the first micro-level typhoon index-based insurance product offered to smallholder rice farmers in the Philippines. The Typhoon Weather Index is based on remote sensing or satellite data supplied by the Japanese Meteorological Authority (JMA). The system is operated by the JMA satellite tracking system for typhoons. A payment is made if the typhoon is tracked within a defined distance from the location of the insured farm. The amount of the payment is based on the maximum wind speed at the closest point. In 2009 this insurance cover was introduced for rice farmers on Panay Island. A total of 446 farmers bought voluntary cover in 2009 (FAO, 2011).

5. Approaches to address incremental change in Asia

181. There are some positive examples of Asian countries incorporating disaster risk reduction and mainstreaming climate change adaptation into their national, regional and local development plans.

Multilevel approach

182. In October 2010, 50 Pacific and Asian regional governments agreed to make disaster risk reduction part of their national climate change adaptation policies and jointly address the increase in severe weather events. A five-year regional road map, the Incheon REMAP, was approved during the Fourth Asian Ministerial Conference on Disaster Risk Reduction, bringing together climate-sensitive risk management systems at the regional, national and community levels. Some of the main elements of the road map are sharing information on new technologies, integrating disaster risk reduction into sustainable development policies and raising awareness of hazards and risks (UNISDR, 2011).

183. The Lower Mekong Initiative was created in 2009 by the Lower Mekong countries in cooperation with the United States of America. Its objectives are to enhance joint efforts in the fields of environment, health, education and infrastructure development. The United States assists in developing environmental programmes in the Mekong region to address future challenges. An example is "Forecast Mekong", a modelling tool to identify possible effects of climate change and other impacts on the sustainable development of the Mekong River Basin. Other elements include support for education via exchange programmes for students and health-care assistance (United States Department of State, 2012).

184. The project "Transboundary Water Management in Central Asia" (2009–2011) was commissioned by the German Federal Foreign Office. The objectives of the project were to strengthen the capacities of regional water management institutions and to improve the institutional capacities of river basin organizations for selected cross-border rivers. Selected

measures included training and education for the staff of relevant institutions and funding for the purchase of technical equipment (GIZ, 2012).

National level

185. The Emergency Response Law was adopted in China on 30 August 2007 and functions as the central legal document governing all disaster-related efforts (Field et al., 2012). Alongside this, the China Agriculture Special Task Force (AESTF) is a programme of the Government of China, with the support of UNDP, aiming to link farmers more directly to improved technology, the latest business models and product markets. 'Common-interest economic entities' are formed, helping to integrate farmers, especially those in disadvantaged areas, into the market economy. The programme has benefitted over 60 per cent of China's large rural population. Furthermore, the average annual income of farmers profiting from the services of AESTF increased by 67 per cent compared with their income in 2006 (UNDP, 2011). Aside from this, the Philippines' Disaster Risk Management Development Policy Loan, with a Catastrophe Deferred Drawdown Option, was approved in 2011 (World Bank, 2011b). Although it is too early to indicate the progress made with the policy, some expected outcomes include: mainstreaming climate change adaptation and disaster risk reduction measures; and training programmes for national and regional government authorities to conduct post-disaster needs assessments and emergency preparedness drills (World Bank, 2011a). Mongolia has established a National Action Programme on Climate Change, in which priorities for actions and policymaking on mitigation and adaptation are described. Under the programme, several pilot projects and studies have been realized. Concerning adaptation, most work has been done in the field of agriculture and the improvement of the ability of farmers to adapt to a changing climate. Moreover, a National Climate Committee has been set up, which coordinates and directs national adaptation and mitigation activities (Grass et al., 2011).

186. In 2007 a national multisectoral platform for disaster risk reduction was established in Sri Lanka, namely the National Disaster Management Coordination Committee. It is composed of senior executives from public- and private-sector organizations, the media, academia, intergovernmental organizations, NGOs and research institutes and is supposed to coordinate the activities of all stakeholders (Roeth, 2009). In 2005 China established its National Platform for Disaster Risk Reduction (NCDR), which is operated with the support of the UNISDR secretariat. NCDR consists of 34 members (e.g. ministries, agencies and organizations), who are supposed to represent the range of expertise required for promoting and mainstreaming disaster risk reduction into development planning and processes. An associated think tank gives advice to support decision-making. The Central Disaster Management Council in Japan is responsible for ensuring the comprehensiveness of the country's disaster risk management and for discussing important matters in relation to disaster management. It formulates and promotes the Basic Plan for Disaster Prevention, the Earthquake Countermeasures Plan and the Urgent Measures Plan for major disasters. Opinions on disaster risk reduction are offered to the Prime Minister and Minister of State for Disaster Management (Sharma, 2009).

Regional level

187. A regional project entitled "Coastal and Marine Resources Management in the Coral Triangle of the Pacific" has been implemented in Fiji, Micronesia (Federated States of), Palau, Papua New Guinea, Solomon Islands, Timor-Leste and Vanuatu. The objective of the project is to support the conservation and sustainable use of coastal and marine resources in the Coral Triangle region. It includes the implementation of pilot measures to strengthen resilience and increase the capacity to respond to the adverse impacts of climate change on marine and coastal ecosystems (Dohan et al., 2011). The project "Increasing Climate Resilience through Drinking Water Rehabilitation in North Tajikistan" has been

implemented in seven cities in northern Tajikistan. Water is of poor quality in the project area and supply and delivery infrastructures have been poorly maintained. Measures implemented under the project include encouraging more efficient water use, establishing more reliable and climate-resilient water sources, the rehabilitation of the water supply infrastructure and the reformation of the management of the water utilities (GEF, 2010).

188. The conservation of mangroves and associated habitats is seen as an important natural adaptation strategy. The Pacific Mangroves Initiative aims to increase the resilience of the people of the Pacific Islands to climate change and to improve their livelihoods. Data are collected and analysed to enhance the national baseline information which is fed into models to develop climate change scenarios. In each participating country, local and national policies and approaches for the management and restoration of mangroves and corresponding ecosystems are reviewed or, if not existent, developed. At selected sites, specific mangrove pilot management measures are applied. Awareness-raising and capacity development complements the work of the initiative. The project is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2012).

Contingency planning

189. In Indonesia the Inter-Agency Standing Committee (IASC) has prepared guidelines for inter-agency contingency planning, in order to ensure comprehensive humanitarian response plans. The objective of contingency planning is to make sure that adequate arrangements are made in advance, by specific thematic clusters, to ensure an adequate response to disasters (IASC Indonesia, 2009). In Nepal the 'chapeau' of the IASC Contingency Plan was drafted in 2011. IASC Nepal has established cluster leads and each cluster is expected to work with the relevant government counterparts (IASC Nepal, 2011). Bangladesh has set up a National Plan for Disaster Management 2010–2015. The plan determines where responsibilities should lie among the Government, NGOs and the private sector. There are provisions made in the national budget for the funding of disaster reduction activities and a contingency fund to meet the immediate needs of disaster relief, at all administrative levels. An objective of the plan is to ensure an effective system within the Government to link and coordinate the processes of planning for and the management of disasters (Government of the People's Republic of Bangladesh, 2010). Japan has developed a Total Disaster Management System, which comprises a cycle of prevention, mitigation, preparedness, response, recovery and rehabilitation. The roles and responsibilities of government at the national and local levels and relevant stakeholders in the public and private sectors are clarified in the Disaster Countermeasures Basic Act (OECD, 2009). India developed the Drought Crisis Management Plan in 2012, in which early indicators of drought are summarized and a crisis management framework with an overview of the respective departments is provided (Government of India, 2012).

6. Analysis of the approaches to address loss and damage employed in Asia

190. As outlined in chapter IV.C above, the literature identifies that Asia has adopted various risk management and adaptation strategies in relation to extreme weather events as well as slow onset climatic processes, but that there are gaps associated with each approach:

(a) **Risk reduction**. At the community level, households can effectively manage climate variability if they receive early warnings and use traditional strategies to cope with it. However, technical challenges make it difficult to convey useful information to the most vulnerable. Paul and Dutt (2010) found that technical challenges, such as the lack of microphone batteries and sirens that did not work in several places due to the loss of electricity, resulted in more fatalities during Cyclone Sidr's landfall in south-western coastal Bangladesh. With regard to structural measures, the active participation of local

residents helps to foster local ownership and more sustainable outcomes (Zimmermann and Stössel, 2011). For example, only a small minority of risk-prone households participated in the government-sponsored house retrofitting programme in Japan, despite the generous tax breaks and loans offered by the Government (Okazaki, 2010). In addition, persuading households to invest in disaster risk reduction remains a challenge;

(b) **Risk retention**. Fernandez and Olfindo (2011) point out a number of negative aspects that prevent households from complying with the conditions of cash-transfer programmes, including a lack of trained staff, IT constraints and a lack of health facilities and schools, making it difficult for households to take advantage of such programmes in Asia. Moreover, the selection process is often lacking in transparency and the monitoring and verification systems are not systematic enough;

(c) **Risk transfer**. At the local level, households and businesses in Asia are increasingly gaining access to insurance programmes in order to manage disaster risk, including that related to climate change. However, as pointed out by Agrawala and Carraro (2010), for such measures to be effective they must be accompanied by 'credit-plus' elements, such as training and skills development and the monitoring and enforcement of fiscal discipline (on the part of both borrowers and lenders);

(d) **Approaches to address incremental change**. With regard to risk governance, Asian countries continue to deliver disaster risk management through stand-alone projects and programmes. Further studies need to show how governments are using existing institutional capacities to progress this further, and there needs to be a stronger governmental focus on slow onset climatic processes and long-term planning.

7. Conclusions on Asia's experience with approaches to manage loss and damage

191. Despite some challenges, it is evident that there has been a significant increase in attention, effort and practice in relation to implementing effective national and local instruments to offset the impacts of climate change in Asia. Such efforts call for multi-stakeholder collaboration in the decision-making process, with increasing emphasis on community involvement in disaster risk management. Additionally, the approaches employed by Asia could complement one another; thus, synergies need to be explored further.

D. Small island developing States

1. Introduction

192. SIDS display a number of characteristics that make them more vulnerable to the impacts of climate change. The major disadvantages derive from: their small size, which results in a narrow range of resources; their high population density, which increases the pressure on already limited resources; their relatively small watersheds and threatened supplies of freshwater; costly public administration and infrastructure; and limited institutional capacities and domestic markets. Moreover, owing to the large number of people residing in a limited land area, the adverse effects of climate change and sea level rise present significant risks to the sustainable development of SIDS (Wong, 2011). Thus, a number of different approaches need to be taken by SIDS to offset the impacts of climate change. This section examines a broad suite of risk reduction and adaptation strategies employed in SIDS, including early warning, use of indigenous knowledge, land use, social protection and innovative insurance schemes to manage the impact of extreme weather events. This is followed by an analysis of the necessary institutional and legal frameworks and practices used to manage both extreme weather events and slow onset climatic processes. Several case studies showing the successes and challenges associated with each

particular risk management strategy are detailed. Lastly, this section concludes by highlighting some gaps identified in the literature which can be further addressed in future analysis.

2. Risk reduction in small island developing States

Early warning systems

193. Effective early warning systems are essential in order to prepare for, respond to and recover from extreme weather events and disasters. UNISDR (2011a) points out that, for such systems to be effective, an assessment of the likely risks and impacts associated with natural hazards is required. In particular, efforts have been made by SIDS to strengthen the assessment of the likely risks and impacts associated with natural hazards:

(a) Cuba, Guyana, Jamaica and Trinidad and Tobago have each developed a National Disaster Management Database in order to prepare for and help them to recover from natural disasters (Overmars and Gottlieb, 2009). Furthermore, in 2000 the Finnish Government and WMO officially launched the SIDS–Caribbean project "Preparedness to Climate Variability and Global Change in Small island developing States of the Caribbean Region". The main aim of the project was to build stronger national meteorological services and an effective early warning system for extreme weather and climate events in the area. This enhanced meteorological infrastructure in the Caribbean has helped to promote public awareness of and preparedness for damages inflicted by climatic events (WMO, 2005). Furthermore, in Jamaica information campaigns have been conducted to inform the public about risks and preparation measures. These initiatives have achieved varying degrees of penetration and have focused on the most frequent weather events, such as hurricanes. Some case studies suggest that the at-risk population proved reticent to respond to evacuation instructions and appeals to move to shelters, even in the case of the most frequent events, including those that had recently led to disasters (ECLAC, 2007);

(b) In the Caribbean, CCRIF (CCRIF, 2012) has set up an SMS warning system, whereby policyholders are informed about possible changes in the weather via their mobile phones, giving people time to make the necessary preparations. Furthermore, a regional visualization and monitoring system, SERVIR, has provided real-time monitoring of natural disasters, including those that are climate related, in the Caribbean. The system integrates earth observations (e.g. satellite imagery) and forecast models together with on-the-ground data and knowledge to inform regional decision-making on disasters, ecosystems, biodiversity, weather, water, climate change, health, agriculture and energy. It also offers a geospatial portal that provides regional data and metadata to assist regional governments in their decision-making (Adaptation Partnership, 2012);

(c) A water monitoring system called the Hydrological Cycle Observing System (HYCOS) has been established in the Pacific**.** The project is designed to assist the water agencies in 14 Pacific Island countries to develop their knowledge and strengthen their resources and technical capacity to collect hydrological data and monitor their water resources.[13] This is done through the hands-on training of staff and the use of new equipment and technology, among other things.[14] Meanwhile, community-based flood early warning systems have been set up in some of the major watershed areas of Fiji in response to serious flooding events in 2009 (Ministry of Fijian Affairs, Heritage, Provincial Development & Multi-Ethnic Affairs, 2009) (projects in all of the major watershed areas are still ongoing; thus it is too early to ascertain the results). Vanuatu has established a

[13] Further information on HYCOS available at <http://www.pacific-hycos.org/>.

[14] For information on recent (2010) water resource monitoring activities in the Pacific Island countries, see <http://www.pacific-hycos.org/index.php/news-a-updates/74-recent-country-activities>.

Climate Change Unit within the Vanuatu Meteorological Services (Wickham, Kinch and Lal, 2009), which serves as a focal point for any climate change activities, including an early warning system. Aside from this, a geonode interface has been developed for the Pacific through the Pacific Catastrophe Risk Assessment and Financing Initiative, which is a joint initiative of the World Bank, the Asian Development Bank and the South Pacific Applied Geoscience Commission (SOPAC). The interface allows the general public to access risk maps, hazard maps and exposure data online, while also being used by more sophisticated users to access raw data for customized risk analysis or planning;

(d) Navua, Fiji, is an area susceptible to severe flooding, including recent events in 2003 and 2004. The Navua Local Level Risk Management (LLRM) project was set up with a view to building on a previous project, which was an early warning system for floods. The Navua LLRM project extends the early warning system initiative, with the aim of working closely with the community, local organizations and various levels of government to reduce the area's risk of flooding (Gero and Dominey-Howes, 2010).

Indigenous knowledge

194. There are some examples of how SIDS continue to use traditional knowledge to adapt their livelihoods in response to a wide variety of disturbances caused by environmental variability:

(a) Farmers in Jamaica employ a number of coping strategies to reduce damage to their farming systems during flooding. The main damage-reducing strategies are the protection of nurseries, (re)transplanting, crop bracing, lowering yam sticks, cutting trenches, spraying crops and the harvesting and storage of produce. The farmers displayed strong adaptive and coping capacities in the aftermath of a storm (Campbell and Beckford, 2009);

(b) On Gau, an island in Fiji, farmers continue to use traditional practices to safeguard against extreme weather events, including shifting cultivation and the indiscriminate use of fire (Veitayaki, 2006);

(c) Some villages in Papua New Guinea use the *garamut* (traditional drum) to give warnings and/or announce meetings at which disaster risk reduction strategies are discussed (Mercer and Kelman, 2010). Furthermore, on Manam Island and in Baliau (a village in Papua New Guinea) communities use traditional oral methods, in the form of narrating legends, visions and stories, to provide warnings about extreme weather events (Mercer and Kelman, 2010).

Infrastructural measures

195. SIDS are using a number of structural measures to reduce the effects of extreme weather events, including upgrading vulnerable settlements in such a way as to reduce risks, and allowing communities to participate in planning and budgeting processes. For example, after Hurricane Georges, Antigua and Barbuda took on a reconstruction project to reduce the level of impact on the poor and vulnerable. In particular, low-cost buildings were redesigned to withstand future climate extremes (UNISDR, 2011b). In the Eastern Caribbean a comprehensive surface water management system has been developed through the construction of drains to capture surface run-off, household roof water and grey water (Anderson et al., 2011). This approach complements community-based approaches to reduce the risk of landslides and could be applicable to vulnerable communities in the developing world. In 2009 the Fiji Government allocated 5.5 million Fiji dollars to self-help projects, divisional development projects and rural housing assistance, aimed at reducing urban to rural migration resulting from natural disasters (SOPAC, 2009).

196. In the case of SIDS threatened by sea level rise, such as Samoa, relatively low-cost measures, such as using mobile flood barriers and planting mangroves, were deemed more cost-effective than building sea walls (UNISDR, 2011a). After Hurricane Ivan, communities in Jamaica placed concrete blocks on the top of zinc roofs to prevent their roofs from being blown away, which became a common practice in the country (UNFCCC, 2008). Jamaica receives foreign financial assistance in the form of loans for retrofitting infrastructure affected by major weather events (ECLAC, 2007).

197. Furthermore, CARIBSAVE is working with the Bluefields Bay Fishermen's Friendly Society in Jamaica to assist with the training of community members on how to build and install marker buoys, which will also raise awareness of the importance and relevance of protecting fish stocks in order to enhance vital resources in the face of climate change and other pressures. To date, the project involves constructing, building and installing over 50 marker buoys to demarcate the boundaries of the fish sanctuary in Bluefields Bay (CARIBSAVE, n.d.).

3. Risk retention in small island developing States

Social protection

198. Some SIDS have adopted social protection mechanisms to protect vulnerable populations before, during and after disasters. For instance, on Solomon Islands, after a tsunami in 2007, intra- and intercommunity initiatives, mainly in the form of social events (e.g. memorial feasts and sport carnivals) and collective actions (e.g. voluntary work), were used by communities to cope with shock and changes after the disaster hit (Schwarz et al., 2011).

199. In 2001 the Government of Jamaica launched its social safety net initiative, the "Programme of Advancement through Health and Education", in order to replace the former system, which consisted of limited public assistance, food stamps and external relief. The new programme consists of a health and education grant, with the aim of increasing human capital by conditioning the receipt of benefits on requirements for school attendance and health-care visits (Ayala, 2006). The programme has succeeded in encouraging households to send their children to school regularly and has increased the use of preventive health care for children (Levy and Ohls, 2007). While the programme does not reduce disaster risk in itself, it can enhance households' resilience to disaster by enabling the accumulation of assets to act as a buffer against the associated losses (de Janvry, Sadoulet and Vakis, 2010). Furthermore, in response to the 2008 economic crisis, protective buffers were introduced to the programme to safeguard the beneficiaries' purchasing power, which shows how existing cash-transfer programmes can be adapted to accommodate additional payments to disaster-affected households (Fernandez, Jadotte and Jahnsen, 2011).

Funds for disasters

200. IDB grants Contingent Loans for Natural Disaster Emergencies to support countries in their efforts to improve their disaster risk management and the efficiency thereof (IDB, 2012a). The majority of the Caribbean countries have asked for such loans (except for Barbados, Cuba, Guyana, Jamaica and Saint Lucia) (IDB, 2012b), which are expected to allow the countries' governments to cover costs during an emergency and in the immediate aftermath of a major weather event (i.e. expenditure on emergency medical equipment, vaccines and medication, facilities and equipment for temporary shelters, food for displaced people and livestock, transportation and communications equipment and facilities) (IDB, 2011). Moreover, the Disaster Risk Reduction and Climate Change Adaptation Support Fund was set up in the Caribbean to support the region's disaster risk reduction efforts and

responses to the effects of climate change, which is recognized as a key risk to growth and poverty reduction (DFID, n.d).

201. In the past few years the Government of Vanuatu has released several supplementary budgets for disaster-related purposes. For example, a supplementary budget was released in 2009 for just over 110 million vatu in response to several disasters. In addition to the supplementary budgets, donor funds were provided, but, in these instances, were unfortunately not tracked. As a result, the total response effort in monetary terms is not attainable.[15] Moreover, the Cabinet of the Cook Islands approved the establishment of an emergency fund for disaster response, allocating an initial one-off payment of 200,000 New Zealand dollars in June 2011. To ensure the growth of the fund, the Government is looking for potential sources of annual contributions.[16]

Financial risk retention

202. Several Pacific Islands have set up sovereign wealth funds as financial instruments that can assist citizens after natural disasters. Particularly, Maas and Carius (2011) point out that sovereign wealth funds allow countries to access the necessary financial resources for adaptation, as well as create a stable and reliable environment as a buffer against climate change. Additionally, Tuvalu has secured an agreement with New Zealand (under the Pacific Access Category and Temporary Labour Scheme) on seasonal employment, whereby up to 75 citizens of Tuvalu are granted access to work in New Zealand each year (International Labour Organization, 2010). This approach has helped the country to retain and secure its financial resources after natural disasters (Veitayaki, Manoa and Resture, 2007).

203. In the Caribbean, Haiti's plans to secure economic activities in rural areas include targeting the high-risk areas (agricultural damage, irrigation infrastructure and road damage), strengthening and consolidating infrastructure and obtaining funds from CCRIF (FAO, 2009). Specifically, CCRIF issues catastrophe bonds to the island States of the Caribbean. The coverage is for relief funds that can be paid out immediately after a catastrophe but are not intended to provide a substitute for long-term relief. To date, CCRIF has paid out seven claims totalling about USD 32 million (World Bank, 2011).

204. In 2007 the World Bank established the Pacific Catastrophe Risk Assessment and Financing Initiative to develop disaster risk assessment tools and practical technical and financial applications to reduce and mitigate countries' vulnerability to natural disasters. The initiative will contribute to improved post-disaster analysis and future disaster risk reduction planning for example, by reducing fiscal shocks through catastrophe financing, such as budget reserves, contingency facilities or catastrophe insurance, or by establishing new building codes and rapid post-disaster assessments (World Bank, 2012). An essential component of the initiative is the Pacific Disaster Risk Financing and Insurance, which provides the countries' ministries of finance and planning with tailor-made advisory services to help them to improve their macroeconomic planning for natural disasters and to develop a national disaster risk financing strategy as part of their broader disaster risk management and climate change agenda.

4. Risk transfer in small island developing States

Insurance

205. The most prominent example of a financial tool used to fund post-disaster needs is CCRIF, which was established in 2007. It is the first worldwide regional catastrophe pool,

[15] See <http://ict.sopac.org/library/download/index/478?file=PR21.pdf>.
[16] See <http://ict.sopac.org/library/download/index/479?file=PR23.pdf>.

which provides governments with immediate liquidity in the aftermath of extreme weather events (Mitchell, Mechler and Harris, 2011). It is designed to contain the fiscal costs of disasters and bridge the liquidity gap in the immediate aftermath of extreme weather events.[17] CCRIF uses a catastrophe model to estimate the loss from any actual event, as well as to price the insurance contract and evaluate risk. Specifically, CCRIF pays out a pre-agreed amount of money if a certain wind speed and/or rainfall amount (the trigger) is exceeded, irrespective of any proven loan default loss that the financial institution has suffered (CCRIF, 2012). Premiums are kept low as CCRIF pools the risks of its members, serving as a risk aggregator (Warner et al., 2010). In late 2007 the Governments of Saint Lucia and the Dominican Republic received the first payouts from CCRIF, a total of USD 0.9 billion to finance urgent post-disaster recovery efforts after a major storm shook the Eastern Caribbean (CCRIF, 2011). In the case of Cyclone Earl (in August 2010), Anguilla was provided with some early warning forecasts of the potential impact of Earl by CCRIF. As a result, emergency agencies were put on standby and emergency shelters were opened in advance of the storm. CCRIF also offers the use of an index to estimate losses caused by hazards, thus enabling payouts to be calculated quickly (Hellmuth et al., 2011).

206. Furthermore, the "Climate Risk Adaptation and Insurance in the Caribbean" programme is being implemented within the Munich Climate Insurance Initiative in partnership with German insurer Munich Re, MicroEnsure (non-profit insurance intermediary) and CCRIF. The programme seeks to help vulnerable people to better cope with extreme weather events by implementing products that combine risk reduction and insurance for low-income groups, such as small-scale farmers and day labourers, in the region (CCRIF, 2011).

207. The Dominican Republic was the first to receive money from the Contingent Credit Facility for Natural Disaster Emergencies of IDB. Specifically, IDB "provides ex ante contingent financing for economic relief and interim recovery, and subsequent rehabilitation and reconstruction efforts can be supported by sector investment loans where applicable" (Andersen et al., 2010). Moreover, Central America and the Dominican Republic have created the Central America Natural Disaster Insurance Facility, initiated by IDB and Swiss Re, which provides participating governments with quick access to insurance proceeds following a disaster. It works in a similar way to CCRIF, but also offers coverage for hurricane-induced landslides and reflects a more customized approach suited to nations of all sizes, such as by covering weather-related risks in the agriculture sector (Swiss Re, 2011).

5. Approaches to address incremental change in small island developing States

208. In order for disaster risk management to be successful, there need to be strong institutional arrangements, legislation and policy for disaster risk management and climate adaptation in place (UNISDR, 2011a). This literature review found a number of institutional arrangements and strategies developed by governments (sometimes in partnership with NGOs) to manage disaster risk in SIDS.

National action plans

209. Solomon Islands has recently launched its National Climate Change Policy, with a view to taking ownership of planning and implementing adaptation, risk reduction and mitigation actions (Wickham et al., 2012).

210. The Pacific Islands Framework for Action on Climate Change was developed to improve and upgrade policies, tools, institutional capacity and governance, and to monitor climate change processes and variability (SPREP, 2006). Furthermore, the Government of

[17] Further information on CCRIF available at <http://www.ccrif.org/>.

Kiribati is currently finalizing adaptation options, in order to develop an adaptation action plan. The adaptation options are based on three criteria: an understanding of the level of risk; current controls in place to manage the identified risk; and potential barriers to and opportunities for implementation (Simpson et al., 2009).

211. The National Climate Change Policy Framework of the Marshall Islands was the result of effective efforts to identify the nature of the climate change related challenges affecting the region. To ensure that sustainable development is not undermined, the policy builds on former national policies and incorporates the management of climate change risks and impacts (Republic of the Marshall Islands, 2011).

212. In the Dominican Republic the Government has created institutions and policies that are dedicated to tackling climate change and/or disaster management issues. For instance, the *Consejo Nacional para el Cambio Climatico* is a high-level multi-ministry coordinating body responsible for the clean development mechanism and adaptation in the Dominican Republic (MEPD and CNRE, 2010).

213. The Government of Jamaica responded to the onslaught of Hurricane Ivan through the establishment of a number of policies and institutional responses. The most recent was the Office of National Reconstruction, which was established to take charge of relief and reconstruction and donations to finance relief measures (Osei, 2007).

Regional level

214. Papua New Guinea and Solomon Islands have collaborated to strengthen data collection in relation to sea level rise within what is known as the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) (CROP, 2011). Countries involved in CTI-CFF (including the two mentioned above) have developed a Region-wide Early Action Plan for Climate Change Adaptation as the first deliverable of CTI-CFF. The aim of the plan is, among other aims, to put in place effective adaptation measures in coastal communities, investing in the ability to conduct climate change vulnerability assessments, and to plan for the improved resilience of coastal communities.[18]

215. The Cayman Islands has established a National Hurricane Committee to respond to tropical cyclones. It consists of a public–private partnership that manages hurricane-related disaster risk reduction. The committee was successful at mainstreaming disaster risk reduction, by embedding risk management in all areas of policymaking (Tompkins, Lemons and Boyd, 2008). Additionally, legislation for disaster risk management has been drafted and is currently being reviewed, and the Cayman Islands has developed a Framework for Disaster Risk Management, which formed the basis for the development of the Hazard Management Cayman Islands agency. Although no direct partnerships exist with other territories, the Cayman Islands continues to participate in regional activities and programmes where possible.[19]

216. The Caribbean Community and Common Market has set up a series of projects that have helped to understand the region's vulnerability to climate change, build capacity, engage in adaptation planning, support the mainstreaming of adaptation into policy processes, and begin the implementation of adaptation measures, such as: Caribbean Planning for Adaptation to Climate Change (1997–2001); Adaptation to Climate Change in the Caribbean (2001–2004); Mainstreaming Adaptation to Climate Change (2004–2009);

[18] Further information on CTI-CFF available at <http://www.coraltriangleinitiative.org>.

[19] For more details, see the "National progress report on the implementation of the Hyogo Framework for Action (2009–2011) – interim" for the Cayman Islands (submitted for the preparation of the UNISDR 2011 GAR). Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/hfa/15945_cym_NationalHFAprogress_2009-11.pdf>.

and the Special Program for Adaptation to Climate Change: Implementation of Adaptation Measures in Coastal Zones (2007–2011) (Adaptation Partnership, 2011).

217. In Barbados the existing Soil Conservation Act is used as the driving force for implementing structural and non-structural disaster-mitigation efforts. Measures include the relocation of communities living in flood- and landslide-prone areas (UNISDR, 2011a).

Joint initiatives

218. The Tonga Joint National Action Plan for Climate Change and Disaster Risk Management 2010–2015 was established two years ago and is funded by the GEF through UNDP, the ACP–EU Natural Disaster Facility through SOPAC and the Secretariat of the Pacific Regional Environment Programme. The process of developing this joint initiative and the involvement of national experts on vulnerability and adaptation, along with government ministries and NGOs, allowed the sharing of information, the building of capacity and the fostering of a better understanding of climate change adaptation and disaster risk management (Kingdom of Tonga, 2012).

219. The Pacific Adaptation to Climate Change Project was initiated in 13 participating countries in an effort to promote climate change adaptation as a prerequisite for sustainable development in the Pacific. The project focuses on building the capacity of the participating countries to adapt to climate change in key development sectors, including coastal zone management, food security and water resource management. The project is divided by country, with Fiji, Palau, Papua New Guinea and Solomon Islands focusing on food security; Cook Islands, Micronesia (Federated States of), Samoa, Tokelau and Vanuatu focusing on developing capacity for coastal management; and Marshall Islands, Nauru, Niue, Tonga and Tuvalu looking to strengthen their water resource management.[20]

United Nations Development Programme and World Bank projects

220. As many small island communities lack the necessary institutional capacity to adapt to climate change impacts, UNDP, in collaboration with UNISDR and the Least Developed Countries Fund, will provide funds to assist the Government of Maldives to systematically assess the costs and benefits of different adaptation options in the fields of land-use planning and coastal protection, and to develop the necessary institutional and individual capacity at the national, provincial, atoll and island levels to enable decentralized and well-informed decision-making.[21]

221. Under its Adaptation Fund project, UNDP, with support from the Climate Change Coordination Unit and Emergency Management Cook Islands, has initiated the "Enhancing Resilience of Communities of Cook Islands through Integrated Climate Change Adaptation and Disaster Risk Reduction Measures" programme. The aim is to strengthen the public service and communities' response to climate change through: the implementation of on-the-ground adaptation and disaster risk reduction measures at the community level; the integration of climate change adaptation and disaster risk reduction into wider development processes; and supporting the implementation of the Cook Islands' new National Action Plan for Disaster Risk Management and Climate Change Adaptation.[22] The National Action Plan (running from 2011 to 2015) pools together human and financial resources and

[20] See <http://www.sprep.org/Pacific-Adaptation-to-Climate-Change/about-pacc>.

[21] See the website of the Asia Pacific Adaptation Network for further information, available at <http://www.apan-gan.net/adaptation-database/integrating-cc-risks-into-resilient-island-planning-maldives>.

[22] Although it is too early to highlight any results, this is one effort to build up communities' resilience in the Pacific. Further information available at <http://www.adaptation-fund.org/project/strengthening-resilience-our-islands-and-our-communities-climate-change>.

addresses issues relating to climate change and natural disasters in the Cook Islands (Cook Islands, 2012).

222. Meanwhile, the World Bank has played a leading role in establishing regional and national risk retention measures, introduced with the formulation of the Caribbean Planning for Adaptation to Climate Change project in 1997. The project's overall objective was to support Caribbean countries in preparing to cope with the adverse effects of climate change, particularly sea level rise in coastal and marine areas. The project focused particularly on: identifying areas particularly vulnerable to the adverse effects of climate change and sea level rise; developing an integrated management and planning framework for cost-effective response and adaptation to the impacts of climate change on coastal and marine areas; enhancing regional and national capabilities to prepare for the advent of climate change through institutional strengthening and human resources development; and identifying and assessing policy options and instruments to help initiate the implementation of a long-term programme of adaptation to climate change in vulnerable coastal areas (Vergara, 2007).

6. Analysis of the approaches to address loss and damage employed in small island developing States

223. Overall, while it is evident that SIDS are beginning to take on a number of risk management and adaptation strategies, gaps still remain, including:

(a) **Risk reduction**. Early warning systems are still lacking in many SIDS. For example, in Fiji early warning system equipment is found only at the Meteorological Centre in Nadi, while other parts of the country do not have updated early warning systems (SOPAC, 2009). Moreover, several studies (Anderson et al., 2011; SOPAC, 2009; Overmars and Gottlieb, 2009) have indicated that early warning systems in SIDS have poor hazard monitoring capabilities owing to limited institutional capacity, qualified staff and monitoring stations in key locations in the hazard-prone areas. Furthermore, early warning systems must take into account the special needs of various segments of the population (e.g. language needs, or hearing and sight impairments) (UNISDR, 2011b). Equally important, the current warning system may not be as effective as it could be, as some community members may not understand the flood warnings because they contain 'technical jargon'. Moreover, some households and businesses have adopted a 'wait-and-see' approach, which can result in greater losses for those that are then caught unprepared when flash floods hit;[23]

(b) **Risk retention**. When it comes to social and financial protection tools, in Fiji the Government's pro-poor initiatives are not well targeted, often not reaching poor households (SOPAC, 2009). Meanwhile, a considerable gap exists between the actual supply of funding and the estimated funding needs for adaptation (Flam and Skaerseth, 2009). With regard to sovereign funds in the Pacific, evidence shows that the sovereign funds' effectiveness has been hampered by a lack of integration into the budget and institutional weaknesses, while inadequate control of these factors, together with weak asset management, has sometimes led to substantial financial losses and undermined fiscal policy (Le Borgne and Medas, 2007). Ribe, Robalino and Walker (2012) maintain that the social protection systems in the Caribbean have evolved in an ad hoc manner, often producing multiple programmes and institutions whose mandates regarding benefits and beneficiaries are unclear;

(c) **Risk transfer**. Among households, insurance is still rare. For example, in the Ba district in Fiji only 2 per cent of households reported having any insurance, although 20 per cent stated that they had some private savings that they would use to offset the cost of

[23] Economic assessment of floods in Nadi and Ba, in Fiji, available at <http://ict.sopac.org/VirLib/TR0425.pdf>.

flood damage. Where households and businesses have no insurance, all losses have to be absorbed personally;[24]

(d) **Approaches to address incremental change**. Some institutional frameworks (such the one for the Pacific Islands) do not address or specify the role of each member country (SPREP, 2006), making it difficult to garner political action on climate change. While a number of adaptation projects and programmes are being implemented, few are taking place at the national level. Specifically, it has been pointed out that the majority of Caribbean countries are building up their capacity for adaptation solely through their participation in regional and global initiatives. More targeted, discrete adaptation projects at the national level may be required in order to respond more appropriately to countries' individual needs (Adaptation Partnership, 2011).

7. Conclusions on the experience of small island developing States with approaches to manage loss and damage

224. Owing to their small size and high exposure to the loss and damage associated with the adverse effects of climate change, the concerns and needs of SIDS in relation to future climate change will differ from those of other countries. This unique situation requires more emphasis to be placed on the types of approaches to address loss and damage associated with the adverse effects of climate change that are employed in SIDS. To date, communities continue to take advantage of local knowledge and early warning systems. Additionally, measures have been taken to develop new policies and improve institutional capacity to deal with both extreme weather events and slow onset climatic processes. Moreover, there has been greater collaboration both among SIDS and with other countries. Despite some promising initiatives, further research and work needs to be done in this area, particularly with regard to the AIMS project, to which limited references were found.

225. Today, countries and communities are facing an increasing pace of climate change, which is manifest in the changing magnitude and frequency of extreme weather events. Such events already cause loss and damage which is difficult for the most vulnerable communities to deal with, owing to the uncertainty and volatility of such extreme weather. In the future, the even more notable impacts of the combination of extreme weather events and slow onset climatic processes are expected to cause even more loss and damage.

[24] See <http://ict.sopac.org/VirLib/TR0425.pdf>.

V. Tabular summary of regional approaches to address loss and damage

A. Summary of the literature review: Africa

Country	Category of approach to address loss and damage	Name/description of approach to address loss and damage	References (please see the reference list in chapter VI below for the full titles)
Burkina Faso	Risk reduction (indigenous knowledge)	Local agricultural adaptation strategies to reduce yield variability	Barbier et al. (2009)
Burkina Faso	Risk retention (ecological sustainability)	Protection of shea trees in order to create opportunities for income and to prevent desertification	Brüschweilier and Gabathuler (2006)
Burundi	Approaches to address incremental change (disaster risk management)	Regional collaboration on adaptation strategies (ASARECA)	Makau Nzuma et al. (2010)
Democratic Republic of the Congo	Risk retention (ecological sustainability)	Value of biodiversity (mountain gorilla) for the development of ecotourism	Midgley et al. (2012)
Democratic Republic of the Congo	Risk retention (ecological sustainability)	Safety nets and local adaptation through trading opportunities in NTFP: Non-timber forest products	Nkem et al. (2010)
Egypt	Approaches to address incremental change (policies)	Laws, policies and adoption of National Climate Change Action Plan	Agrawala et al. (2004)
Ethiopia	Risk retention (social security)	Productive Safety Net Program	Del Ninno et al. (2009); Pelham et al. (2011)
Ethiopia	Risk retention (social security)	R4 Rural Resilience Initiative; Livelihoods, Early Assessment and Protection project	WFP and Oxfam America (2011); UNISDR Africa (2012)
Ethiopia	Risk retention (financial risk retention)	Second phase of Productive Safety Net Program, with drought risk financing component	Hess et al. (2006); African Union and WFP (2012)
Ethiopia	Risk transfer	Pilot insurance project combined with weather stations	Hazell et al. (2010)

Ethiopia	Approaches to address incremental change (contingency planning)	Institutional management of drought contingencies	Lesukat (2012)
Gambia	Approaches to address incremental change (policies)	Integrated Water Resources Management road map	ACP–EU, UNEP and GWP (2009)
Guinea-Bissau	Approaches to address incremental change (policies)	Integrated Water Resources Management road map	ACP–EU, UNEP and GWP (2009)
Ghana	Risk reduction (indigenous knowledge)	Revival of traditional rainwater harvesting techniques	Gyampoh et al. (2009)
Ghana	Risk reduction (structural)	Wells and community development	UNDP and GEF SGP (2010)
Ghana	Risk retention (ecological sustainability)	Joint management of rehabilitation of degraded forests	Blay et al. (2004)
Kenya	Risk reduction (early warning systems)	Drought Monitoring Centre	WMO (2006)
Kenya	Risk reduction (early warning systems)	Radio stations for the transmission of drought warnings	UNISDR (2010)
Kenya	Risk reduction (structural)	Integrated rainwater management in pastoral communities	UNDP and GEF SGP (2010)
Kenya	Risk reduction (structural)	Nairobi Rivers Basin Rehabilitation and Restoration Program	IPCC (2012)
Kenya	Risk reduction (structural)	Silo construction for the reduction of post-harvest losses	SDC and CIMMYT (2011); Tefera (2012)
Kenya	Risk transfer	Index-based livestock insurance	Carter et al. (2011); Mude et al. (2010)
Kenya	Approaches to address incremental change (contingency planning)	Institutional management of drought contingencies	Lesukat (2012)
Kenya	Approaches to address incremental change (contingency planning)	Arid Lands Resource Management Project, with contingency fund	Zwaagstra et al. (2011)
Malawi	Risk reduction (indigenous knowledge)	Integration of indigenous knowledge into scientific climate forecasting	Kalanda-Joshua et al. (2011)
Malawi	Risk reduction (structural)	Silo construction for the reduction of post-harvest losses	SDC and CIMMYT (2011); Tefera (2012)

Malawi	Risk retention (social security)	Pilot cash-transfer programme for orphans and the elderly	ISDR (2011); UNICEF (2008)
Malawi	Risk retention (financial risk retention)	Financial coverage for drought risk (World Bank, Swiss Re and the Government of Malawi)	Syroka and Nucifora (2010); African Union and WFP (2012)
Malawi	Risk transfer	Index-based weather insurance for smallholders	Hellmuth et al. (2007)
Mali	Risk reduction (early warning systems)	Provision of agrometeorological information (AGRHYMET/WMO)	Hellmuth et al. (2007)
Mali	Risk reduction (structural)	Improved restoration of dams and habitats	UNDP and GEF SGP (2010)
Mali	Risk retention (social security)	Migrants' social networks; investments in renewable energy and electrification	Scheffran et al. (2012)
Mali	Approaches to address incremental change (policies)	Policy changes for the transition from rain-fed crops to non rain fed crops	Butt et al. (2006)
Mauritania	Risk reduction (early warning systems)	Locust early warning system	FAO (2011)
Mauritania	Risk reduction (structural)	Construction of wells and land dikes for safe water and agriculture	UNDP and GEF SGP (2010)
Mauritania	Risk retention (social security)	Migrants' social networks; investments in the construction of wells	Scheffran et al. (2012)
Morocco	Risk reduction (indigenous knowledge)	Traditional water system (*khattara*) and water-user associations	Bigas, Adeel and Schuster (2009)
Mozambique	Risk reduction (early warning systems)	Community-based flood early warning and response system	Munich Re Foundation (2007)
Mozambique	Risk reduction (structural)	"Living with Floods" approach in the Limpopo River Basin	Spaliviero et al. (2011)
Mozambique	Approaches to address incremental change (policies)	Mainstreaming climate change adaptation mechanisms in policies	UNDP (2011)
Namibia	Risk reduction (indigenous knowledge)	Indigenous land unit framework	Newsham et al. (2011)
Namibia	Risk retention (ecological sustainability)	"Bush-to-fuel" project – bush vegetation sold to the private sector as fuel	Midgley et al. (2012)
Niger	Risk reduction (early warning systems)	Monitoring of food availability and accessibility	FAO (2011)

Niger	Risk retention (ecological sustainability)	Protection of palmyra palms in order to create opportunities for income and to prevent desertification	Brüschweilier and Gabathuler (2006)
Niger	Approaches to address incremental change (contingency planning)	National contingency plan for food security and nutrition	Pelham, Clay and Braunholz (2011)
Nigeria	Risk retention (social security)	"Care of the People", governmental conditional cash-transfer programme	Holmes et al. (2011)
Nigeria	Risk transfer	Index-based livestock insurance	Carter et al. (2011)
Rwanda	Risk retention (social security)	Community-led system of targeting social protection programmes; traditional practice of *ubudehe*	ERD (2010)
Rwanda	Approaches to address incremental change (disaster risk management)	Regional collaboration on adaptation strategies (ASARECA)	Makau Nzuma et al. (2010)
Senegal	Risk retention (social security)	Migrants' social networks; investments in water management	Scheffran et al. (2012)
Sierra Leone	Approaches to address incremental change (policies)	Integrated Water Resources Management road map	ACP–EU, UNEP and GWP (2009)
Somalia	Approaches to address incremental change (contingency planning)	Contingency plans for different scenarios, coupled with early warning system	Choularton (2007)
South Africa	Risk reduction (early warning systems)	Drought Monitoring Desk (South African Weather Service)	WMO (2006)
South Africa	Risk reduction (indigenous knowledge)	Local measures to adapt to moisture change	Thomas et al. (2007)
South Africa	Risk retention (ecological sustainability)	Improvement of water security through opportunities for work in river catchments	Midgley et al. (2012)
South Africa	Risk retention (ecological sustainability)	Development of fairtrade and organic small-scale enterprises (Rooibos tea)	Midgley et al. (2012)
South Africa	Risk retention (ecological sustainability)	Community-based REDD[25] reforestation project for livelihood improvement	Midgley et al. (2012)
South Africa	Approaches to address incremental change (disaster risk management)	Disaster Risk Management Act and National Disaster Risk Management Policy	IPCC (2012)

[25] Reducing emissions from deforestation and forest degradation in developing countries.

United Republic of Tanzania	Risk reduction (indigenous knowledge)	Rainfall predictions based on the observation of environmental and astronomical factors	Chang'a et al. (2010)
United Republic of Tanzania	Risk reduction (structural)	Solar-powered water supply and irrigation systems	UNDP and GEF SGP (2010)
United Republic of Tanzania	Risk reduction (structural)	Recycling of wastewater for paddy irrigation farming	UNDP and GEF SGP (2010)
United Republic of Tanzania	Risk retention (ecological sustainability)	Sustainable management of coastal ecosystems	Midgley et al. (2012)
United Republic of Tanzania	Risk retention (ecological sustainability)	Traditional rules/laws and community-based management of the protection of forests	Blay et al. (2004)
United Republic of Tanzania	Risk transfer	Collective index-based insurance with informal networks	Traerup (2012)
United Republic of Tanzania	Approaches to address incremental change (disaster risk management)	Zanzibar Strategy for Growth and Reduction of Poverty (including disaster risk management)	ISDR (2011)
Tunisia	Risk reduction (indigenous knowledge)	Use of traditional water harvesting techniques, complemented by the use of modern technologies	Bigas, Adeel and Schuster (2009)
Uganda	Risk reduction (indigenous knowledge)	Local responses to natural disasters	Akullo et al. (2007)
Uganda	Risk reduction (structural)	Rainwater harvesting and development of springs	UNDP and GEF SGP (2010)
Uganda	Risk retention (ecological sustainability)	Value of biodiversity (mountain gorilla) for the development of ecotourism	Midgley et al. (2012)
Uganda	Approaches to address incremental change (disaster risk management)	Regional collaboration on adaptation strategies (ASARECA)	Makau Nzuma et al. (2010)
Uganda	Approaches to address incremental change (contingency planning)	Institutional management of drought contingencies	Lesukat (2012)
Zambia	Approaches to address incremental change (policies)	Strategy for Flood Management for Kafue River Management	APFM and WMO (2007)
Zambia	Risk retention (social security)	Ecologically sustainable agriculture, leading to social security	Chaudhury et al. (2011)

Regional			
Africa	Risk reduction (early warning systems)	African Risk Capacity project and Africa RiskView	African Union and WFP (2012)
Africa	Risk retention (financial risk retention)	African Risk Capacity project for risk pooling across Africa	African Union and WFP (2012)
Africa	Approaches to address incremental change (contingency planning)	African Risk Capacity project as a pan-African contingency funding mechanism	African Union and WFP (2012)
Congo Basin	Approaches to address incremental change (transboundary resources)	Congo Basin Forest Partnership	UNFCCC (2007)
ECOWAS	Approaches to address incremental change (transboundary resources)	Transhumance certificates for transboundary mobility across livestock corridors	GL-CRSP (2004); UNDP, UNCCD and UNEP (2009)
Lake Victoria	Approaches to address incremental change (transboundary resources)	Lake Victoria Management Project (stabilization of ecosystem)	Palaniappan et al. (2010)
Nile Basin	Approaches to address incremental change (transboundary resources)	Nile Basin Initiative	Belay et al. (2010)
Okavango Basin	Approaches to address incremental change (transboundary resources)	Okavango River Basin Water Commission	USAID (2009); Le Quesne et al. (2010)
Sahel	Risk reduction (indigenous knowledge)	Use of local knowledge on weather and climate; local adaptation strategies	Nyong et al. (2007)
Sahel	Approaches to address incremental change (transboundary resources)	Increased cross-border trade for food security	SWAC and OECD (2006); Heinrigs (2010)
Southern Africa	Risk reduction (early warning systems)	Agricultural Information Management System	Southern African Development Community (2010)

B. Summary of the literature review: Latin America

Country	Category of approach to address loss and damage	Name/description of approach to address loss and damage	References (please see the reference list in the annex to this document for the full titles)
Argentina, Bolivia (Plurinational State of), Brazil, Costa Rica, Ecuador and Mexico	Approaches to address incremental change	Directorates or climate programmes	EuropeAid (2009)
Bolivia (Plurinational State of)	Risk reduction	Century-old irrigation system (*camellones*)	Galloway McLean (2010)
Bolivia (Plurinational State of)	Risk transfer	*Fundación PROFIN*, area-yield index-based insurance	Warner et al. (2009)
Brazil	Risk retention	*Bolsa Família* (family allowance) programme	Fried (2011)
Brazil	Risk transfer	Rio Grande do Sul, area-yield index-based insurance	IFAD (2010)
Brazil	Risk reduction	*Sistema de Informacíon de la Diversidad Bilógica y Ambiental de la Amazonía Peruana*, information portal	Kalilloa et al. (2008)
Brazil and Mexico	Approaches to address incremental change	Permanent inter-ministerial committees for supervising and coordinating climate change actions	EuropeAid (2009)
Central America	Risk transfer	Central American Natural Disaster Insurance Facility	Swiss Re (2011)
Chile	Risk retention	*Chile Solidario* and *Programa Puente*	Fernandez et al. (2011)
Chile	Risk reduction	*Camino del Agua*	Sotomayor (2008)
Chile	Risk reduction	La Laguna Dam and Puclaro Dam	Sotomayor (2008)
Chile	Risk reduction	*Plan Maestro Optimizado* (investment master plan)	BMZ (2010)
Chile	Risk reduction	Rímac River Basin (artificially connected lake)	BMZ (2010)
Chile	Risk reduction	Irrigation systems	Hulbert and Diaz (n.d.)
Chile, Colombia, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay and Uruguay	Approaches to address incremental change		EuropeAid (2009)
Colombia	Risk reduction	Sustainable land management	Margrin et al. (2007)
Colombia	Risk retention	Integrated National Adaptation Program	Vergera (2007)
Colombia	Risk transfer	Collective security policy in Manizales	Marulanda et al. (2010)
Columbia	Risk reduction	Sustainable land management	Margrin et al. (2007)

Costa Rica	Risk reduction	Improvement of housing design	Matra and Nobre (2006)
Costa Rica	Risk transfer	Catastrophe Deferred Drawdown Option	World Bank (2010)
Cuba	Risk reduction	Provinces tackling hazards through low-cost technology and local participation	Sagala and Okada (2007)
Cuba and Ecuador	Approaches to address incremental change	Climate change units	EuropeAid (2009)
Dominican Republic	Risk transfer	Contingent Credit Facility for Natural Disaster Emergencies of IDB	Andersen et al. (2010)
Ecuador	Risk reduction	Improvement of housing design	Matra and Nobre (2006)
Haiti	Risk transfer	Microinsurance Catastrophe Risk Organisation	Swiss Re (2011)
Honduras	Risk reduction	Use of *quezunga*, a traditional farming method	Galloway McLean (2010)
Honduras	Risk retention	*Familias en Acción*, conditional cash-transfer programme	IPC-IG (2012)
Mexico	Risk retention	*Oportunidades*, conditional cash-transfer programme	UNISDR (2011); Arnold and Fuente (2010)
Mexico	Risk retention	FONDEN, natural disaster fund	IPCC (2012); UNISDR (2011)
Mexico	Risk retention	*Red Solidaria*, conditional cash-transfer programme	IPC-IG (2012)
Mexico	Risk retention	*Red de Protección Social*, conditional cash-transfer programme	IPC-IG (2012)
Mexico	Risk retention	*Programa de Asignación Familiar*, conditional cash-transfer programme	IPC-IG (2012)
Mexico	Risk transfer	*Agroasemex*, weather index insurance	IFAD (2012)
Mexico	Risk transfer	Catastrophe bond	Michel-Kerjan et al. (2011)
Mexico	Risk transfer	Multi-catastrophe bond	World Bank (2011)
Nicaragua	Risk retention	*Atención a Crisis* programme	Fernandez et al. (2011)
Nicaragua	Risk retention	FAPACC, natural disaster fund	UNFCCC (2008)
Nicaragua	Risk retention	Guarantee fund for agricultural insurance (Law No. 28939)	Oft (2010)
Peru	Risk reduction	Use of *waru waru*, an ancient irrigation and drainage system	Matra and Nobre (2006)
Peru	Risk transfer	El Niño index risk insurance	Khali et al. (2007); Suarez and Linneroth-Bayer (2010)
Peru	Risk transfer	Area-yield index-based insurance with La Positiva and Caja Señor de Luren	IFAD (2010)
Peru	Approaches to address incremental change	*Comisión del Agua del Estado de Mexico* (Water Commission of the State of Mexico)	UNESCO (2006)

Peru	Approaches to address incremental change	“Peasant Community” legislation	Hulbert and Diaz (n.d.)
Peru	Approaches to address incremental change	‘Water dialogue’	Sotomayor (2008)
Regional			
Brazil (main country mentioned)	Risk retention	Contingent Loans for Natural Disaster Emergencies	IDB (2012a)
IDB	Risk transfer	Catastrophe bonds for natural disasters	World Bank (2011)
IDB	Risk reduction	Planning and building of large dams in Amazonia	IPCC (2012)

C. Summary of the literature review: Asia

Country	Category of approach to address loss and damage	Name/description of approach to address loss and damage	References (please see the reference list in the annex to this document for the full titles)
Australia	Risk reduction (early warning systems)	Bushfire early warning system	UNISDR (2010)
Bangladesh	Risk reduction (early warning systems)	Establishment of a Storm Warning Centre	IPCC (2012)
Bangladesh	Risk reduction (early warning systems)	Cyclone early warning system	Paul and Dutt (2010)
Bangladesh	Risk reduction (indigenous knowledge)	Mitigation of impact of cyclones	Parvin et al. (2008)
Bangladesh	Risk reduction (structural)	Multi-storey cyclone shelters	Paul and Rahman (2006)
Bangladesh	Risk reduction (structural)	Raised earthen platforms for the protection of livestock during cyclones	Paul (2009)
Bangladesh	Risk reduction (structural)	Structural improvements for communities living along riverbeds	ISDR and UNDP (2008)
Bangladesh	Risk reduction (structural)	Dhaka Metropolitan Development Plan	UNISDR (2011)
Bangladesh	Risk reduction (structural)	Community-based disaster risk reduction programme	Zimmermann and Stössel (2011)
Bangladesh	Risk retention (social security)	“Enhancing Resilience” programme – food and cash for work and training	WFP and SDC (2011)
Bangladesh	Approaches to address incremental change	National Plan for Disaster Management	Government of the People’s Republic of Bangladesh (2010)
Bhutan	Risk reduction (early warning systems)	Automatic early warning system for glacial lake outburst floods	Meenawat and Sovacool (2011)
Cambodia	Risk reduction (structural)	Ring dike reservoir	Someth et al. (2009)
China	Risk reduction (indigenous knowledge)	Use of the *karez* technology (traditional irrigation system) for drought mitigation	Fang et al. (2008)
China	Risk retention (social security)	Agriculture Extension Special Task Force	UNDP (2011)
China	Risk transfer	Agricultural index insurance	Hazell et al. (2010)
China	Approaches to address incremental change	The Emergency Response Law	IPCC (2012)

China	Approaches to address incremental change	National Platform for Disaster Risk Reduction	Sharma (2009)
Hong Kong	Risk reduction (early warning systems)	Cyclone early warning system	WMO (2010)
India	Risk reduction (indigenous knowledge)	Planting of bamboo in order to mitigate floods and soil erosion	Stephen et al. (2008)
India	Risk reduction (structural)	Flood Alleviation Scheme	Gupta and Nair (2010)
India	Risk retention (social security)	National Rural Employment Guarantee Scheme	PACS (2007)
India	Risk retention (social security)	School midday meal scheme	CPRC (2011)
India	Risk retention (social security)	Community-managed grain bank	Concern Universal Bangladesh and Cordaid Netherlands (2011)
India	Risk retention (financial security)	Community Disaster Resilience Fund	NADRR (2009)
India	Risk transfer	Agricultural index insurance	Hazell et al. (2010)
India	Risk transfer	Microinsurance service	Linnerooth-Bayer and Mechler (2007)
India	Approaches to address incremental change	Drought Crisis Management Plan	Government of India (2012)
Indonesia	Risk reduction (early warning systems)	Improvement of the flood early warning system in Jakarta	ADPC (2010)
Indonesia	Risk reduction (structural)	Infrastructure for flood mitigation	Jha et al. (2012)
Indonesia	Risk retention (social security)	“Program Keluarga Harapan”, conditional cash-transfer programme	Schelzig Bloom (2009)
Indonesia	Risk retention (social security)	Climate Field Schools	Winarto et al. (2008)
Indonesia	Approaches to address incremental change	IASC Contingency Plan	IASC Indonesia (2009)
Japan	Risk reduction (structural)	House retrofitting initiative	Okazaki (2010)
Japan	Risk reduction (structural)	Devices for controlling run-off	Yoshikawa et al. (2010)
Japan	Approaches to address incremental change	Central Disaster Management Council	Sharma (2009)
Japan	Approaches to address incremental change	Total Disaster Management System	OECD (2009)
Kazakhstan	Approaches to address incremental change	State System on Disaster Prevention and Mitigation	Sharma (2009)
Kazakhstan	Approaches to address incremental change	Desertification Prevention Program	Bizikova et al. (2011)

Mongolia	Risk transfer	Index-based livestock insurance	Mahul and Skees (2006); Suarez and Linnerooth-Bayer (2011)
Mongolia	Approaches to address incremental change	National Action Programme on Climate Change and National Climate Committee	Grass et al. (2011)
Nepal	Risk reduction (early warning systems)	Flood early warning system	UNISDR (2010)
Nepal	Risk reduction (early warning systems)	Preventing and recognizing the warning signs of landslides	Thapa et al. (2008)
Nepal	Risk retention (social security)	Universal non-contributory pension	UNESCAP (2011)
Nepal	Approaches to address incremental change	IASC Contingency Plan	IASC Nepal (2011)
Philippines	Risk retention (social security)	Poverty Reduction and Social Development Strategy	UNESCAP (2011); Fernandez and Olfindo (2011)
Philippines	Risk retention (financial security)	Community sharing of funeral costs	Matul et al. (2011)
Philippines	Risk transfer	Typhoon Weather Index	FAO (2011)
Philippines	Approaches to address incremental change	Philippines Disaster Risk Management Development Policy Loan	World Bank (2011a/b)
Russian Federation	Risk reduction (indigenous knowledge)	Use of the indigenous knowledge of herders	Magga et al. (2011)
Sri Lanka	Risk reduction (indigenous knowledge)	Use of technology for the mitigation of drought	Madduma Bandara (2008)
Sri Lanka	Risk retention (financial security)	CLAPNET Fund	Archer and Boonyabancha (2010)
Sri Lanka	Approaches to address incremental change	National Disaster Management Coordinating Committee	Roeth (2009)
Tajikistan	Risk retention (social security)	“Increasing Climate Resilience through Drinking Water Rehabilitation” project	GEF (2010)
Thailand	Risk transfer	Agricultural index insurance	Hellmuth et al. (2009)
Regional			
Asia-Pacific	Approaches to address incremental change	Incheon REMAP, a five-year regional road map	UNISDR (2011)
Bangladesh and Nepal	Risk transfer	Microfinance	Agrawala and Carraro (2010)
Central Asia	Approaches to address incremental change	Transboundary water management	GIZ (2012)
Lower Mekong	Approaches to address incremental change	Lower Mekong Initiative	United States Department of State (2012)

Mekong Basin	Risk reduction (early warning systems)	Mekong River Flood Forecasting System	MRC (2010)
Pacific States	Risk retention (social security)	“Coastal and Marine Resources Management in the Coral Triangle of the Pacific” project	Dohan et al. (2011)
Pacific States	Approaches to address incremental change	Pacific Mangroves Initiative	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2012)

D. Summary of the literature review: small island developing States

Country	Category of approach to address loss and damage	Name of approach to address loss and damage	References (please see the reference list in the annex to this document for the full titles)
Antigua and Barbuda	Risk reduction (infrastructure)	Redesign of low-cost buildings	UNISDR (2011)
Barbados	Approaches to address incremental change	Soil Conservation Act	UNISDR (2011)
Caribbean	Risk reduction (early warning systems)	SIDS-Caribbean project "Preparedness to Climate Variability and Global Change in small island developing States of the Caribbean Region"	WMO (2005)
Caribbean	Risk retention (financial)	Contingent Loans for Natural Disaster Emergencies	IDB (2012b)
Caribbean	Risk retention (financial)	Disaster Risk Reduction and Climate Change Adaptation Support Fund	DFID (n.d.)
Caribbean	Risk retention (financial)	Issuance of catastrophe bonds by the Caribbean Catastrophe Risk Insurance Facility	World Bank (2011)
Caribbean	Risk transfer (insurance)	"Climate Risk Adaptation and Insurance in the Caribbean" programme	CCRIF (2011)
Cayman Islands	Approaches to address incremental change	National Hurricane Committee	Tompkins et al. (2008)
Cook Islands	Approaches to address incremental change	The "Enhancing Resilience of Communities of Cook Islands through Integrated Climate Change Adaptation and Disaster Risk Reduction Measures " programme	<http://www.adaptation-fund.org/project/strengthening-resilience-our-islands-and-our-communities-climate-change>
Cuba, Jamaica, Guyana and Trinidad and Tobago	Risk reduction (early warning systems)	National Disaster Management Databases	Overmars and Gottlieb (2009)
Dominican Republic, Haiti and Saint Lucia	Risk transfer (insurance)	Contingent Credit Facility for Natural Disaster Emergencies funds (from the Caribbean Catastrophe Risk Insurance Facility)	Andersen et al. (2010)
Dominican Republic	Risk transfer (insurance)	Contingent Credit Facility for Natural Disaster Emergencies of IDB	Andersen et al. (2010)

Dominican Republic	Risk transfer (insurance)	Central America Natural Disaster Insurance Facility	Swiss Re (2011)
Dominican Republic	Approaches to address incremental change	*Consejo Nacional para el Cambio Climatico*, a high-level multi-ministry coordinating body	MEPD and CNRE (2010)
Fiji	Risk reduction (early warning systems)	Community-based flood early warning systems	Ministry of Fijian Affairs, Heritage, Provincial Development and Multi-Ethnic Affairs Provincial Development & Multi-Ethnic Affairs (2009)
Haiti	Risk retention (financial)	Government-linked companies and statutory boards	Chowdhury (2008)
Jamaica	Risk reduction (indigenous knowledge)	Crop protection	Campbell and Beckford (2009)
Jamaica	Risk reduction (infrastructure)	Building of zinc roofs	UNFCCC (2008)
Jamaica	Approaches to address incremental change	Office of National Reconstruction	Osei (2007)
Jamaica	Approaches to address incremental change	Office of National Reconstruction	Osei (2007)
Manam Island	Risk reduction (indigenous knowledge)	Traditional oral methods (legends, visions and stories) of giving out warnings about extreme weather events	Mercer and Kelman (2010)
Marshall Islands	Approaches to address incremental change	National Climate Change Policy Framework	Republic of the Marshall Islands (2011)
Mauritius	Approaches to address incremental change	Mauritius for Further Implementation and Barbados Programme of Action	UNDESA (2010)
Niue	Risk retention (financial)	Community lifelines and community risk funds	SOPAC (2009)
Papua New Guinea	Risk reduction (indigenous knowledge)	Use of the *garamut* (traditional drum) to announce warnings	Mercer and Kelman (2010)
Papua New Guinea and Solomon Islands	Approaches to address incremental change	Coral Triangle Initiative	CROP (2011)
Samoa	Risk reduction (infrastructure)	Mobile flood barriers and mangrove planting	UNISDR (2011)
Samoan and Marianas Islands	Approaches to address incremental change	Pacific Islands Climate Change Cooperative	PICCC (2010)
Solomon Islands	Approaches to address incremental change	National Climate Change Policy	Wickham et al. (2012)
Solomon Islands	Risk retention (financial)	Medium-Term Development Strategy (2008–2012)	NAPA (2009)
Vanuatu	Risk reduction (early warning systems)	Climate Change Unit	Wickham et al. (2009)

Regional			
Pacific Islands	Risk retention (financial)	Pacific Catastrophe Risk Assessment and Financing Initiative	World Bank (2012)
Pacific Islands	Approaches to address incremental change	The Tonga Joint National Action Plan for Climate Change and Disaster Risk Management 2010–2015	Kingdom of Tonga (2012)
Pacific Islands	Approaches to address incremental change	Pacific Adaptation to Climate Change Project	<http://www.sprep.org/Pacific-Adaptation-to-Climate-Change/about-pacc>
Pacific Islands	Approaches to address incremental change	Upgrading of policies, tools, institutional capacity and governance	SPREP (2006)
Pacific Islands	Approaches to address incremental change	The Pacific Islands Framework for Action on Climate Change	SPREP (2006)
Regional	Risk retention (financial)	Sovereign wealth funds	Maas and Carius (2011)
Regional	Risk reduction (early warning systems)	Use of geomatic technologies (internet mapping technologies)	Sutherland (2010)
Regional	Risk transfer (insurance)	Establishment of the Caribbean Catastrophe Risk Insurance Facility	CCRIF (2012)

Risk reduction

Risk retention

Risk transfer

Approaches to address incremental change

VI. References

A. Chapters I to III

Arrow KJ and Lind RC. 1970. Uncertainty and the Evaluation of Public Investment Decisions. *The American Economic Review*. 60: pp.364–378.

Cummins D and Mahul O. 2008. *Catastrophe Risk Financing in Developing Countries: Principles for Public Intervention*. Washington D.C.: World Bank.

Dercon S and Hoddinott J. 2005. Health, shocks, and poverty persistence. *In*: S Dercon (ed.). *Insurance against poverty*. Oxford: Oxford University Press.

Economics of Climate Adaptation Working Group. 2009. *Shaping climate-resilient development: A framework for decision-making*. A report of the Economics of Climate Adaptation Working Group. ClimateWorks Foundation, European Commission, Global Environmental Facility, McKinsey & Company, Rockefeller Foundation, Swiss Re and the United Nations Environment Programme (UNEP).

Hellmuth ME, Osgood DE, Hess U, Moorhead A and Bhojwani H (eds.). 2009. *Index insurance and climate risk: Prospects for development and disaster management*. Climate and Society No. 2. New York: International Research Institute for Climate and Society, Columbia University.

Hoeppe P and Gurenko E. 2007. Scientific and Economic Rationales for Innovative Climate Insurance Solutions. *In*: E Gurenko (ed.). *Climate Policy*. Special Issue on Insurance and Climate Change.

IPCC AR4 WG1. (2007). Solomon, S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M and Miller HL (eds.). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press.

IPCC AR4 WG2. (2007). Parry ML, Canziani OF, Palutikof JP, van der Linden PJ and Hanson CE (eds.). Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press.

IPCC AR4 WG3. (2007). Metz B, Davidson OR, Bosch PR, Dave R and Meyer LA (eds.). Climate Change 2007: Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge and New York: Cambridge University Press.

IPCC AR4 SYR. (2007). Pachauri RK and Reisinger A (eds.). Climate Change 2007: Mitigation of Climate Change. Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva: Intergovernmental Panel on Climate Change.

Mechler R. 2005. *Cost-benefit analysis of natural disaster risk management in developing countries*. Working paper. Eschborn: Deutsche Gesellschaft fuer Technische Zusammenarbeit.

Microinsurance compendium (2008 and 2012). *Protecting the poor. A microinsurance compendium. Volume II*. Available at <http://www.climate-insurance.org/dbfs.php?file=dbfs:/MunichReFound_2012__Protecting_the_poor.pdf>.

Mitchell T and van Aalst M. 2011. *Headlines from the IPCC Special Report on Extreme Events.* Overseas Development Institute and Red Cross/Red Crescent Climate Centre.

Patt A, Suarez P and Hess U. 2010. How do small-holder farmers understand insurance, and how much do they want it? Evidence from Africa. *Global Environmental Change*. 20: pp.153–161.

UNISDR (United Nations International Strategy for Disaster Reduction). 2011b. Available at <http://www.undp.org/content/dam/undp/library/crisis%20prevention/disaster/asia_pacific/Global%20Assessment%20Report%20on%20Disaster%20Risk%20Reduction.pdf>.

Warner K, Zissener M, Kreft S, Hoeppe P, Bals C, Linnerooth-Bayer J, Haas A, Gurenko E, Loster T and Burton I. 2010. *Solutions for Vulnerable Countries and People. Designing and Implementing Disaster Risk Reduction & Insurance for Adaptation*. Policy Brief. United Nations University, Institute for Environment and Human Security.

B. Africa

African Union and WFP (World Food Programme). 2012. *African Risk Capacity – ARC. Sovereign Disaster Risk Solutions: A Project of the African Union.* Summary note prepared by the African Risk Capacity Project Team. Available at <http://www.africanriskcapacity.org/generaldocuments.html>.

Agrawala S, Moehner A, El Raey M, Conway D, van Aalst M, Hagenstad M and Smith J. 2004. *Development and Climate* Change *in Egypt: Focus on Coastal Resources and the Nile.* Paris: Organisation for Economic Co-operation and Development. Available at <http://www.oecd.org/dataoecd/57/4/33330510.pdf>.

Akullo D, Kanzikwer R, Birungi P, Alum W, Aliguma L and Barwogeza M. 2007. *Indigenous knowledge in agriculture: A case study of the challenges in sharing knowledge of past generations in a globalized context in Uganda.* World Library and Information Congress 2007, Durban. Available at <http://archive.ifla.org/IV/ifla73/papers/120-Akullo_Kanzikwera_Birungi_Alum_Aliguma_Barwogeza-en.pdf>.

APFM (Associated Programme on Flood Management) and WMO (World Meteorological Organization). 2007. *Strategy for Flood Management for Kafue River Basin, Zambia*. Lusaka: APFM and WMO. Available at <http://www.preventionweb.net/files/2733_StrategyZambiaEn.pdf>.

Barbier B, Hamma Y, Karambiri H, Zoromé M and Somé B. 2009. Human Vulnerability to Climate Variability in the Sahel: Farmers' Adaptation Strategies in Northern Burkina Faso. *Environmental Management*. 43: pp.790–803.

Belay AA., Semakula HM, Wambura GJ and Jan L. 2010. SWOT Analysis and Challenges of Nile Basin Initiative: An Integrated Water Resource Management Perspective. *Chinese Journal of Population, Resources and Environment*. 8(1): pp.8–17.

Bigas H, Adeel Z and Schuster B (eds.). 2009. *Seeing Traditional Technologies in a New Light. Using Traditional Approaches for Water Management in Drylands*. United Nations World Water Assessment Programme. Side publications series. United Nations University, International Network on Water, Environment and Health, and United Nations Educational, Scientific and Cultural Organization.

Blay D, Bonkoungou E, Chamshama SAO and Chikamai B. 2004. *Rehabilitation of Degraded Lands in Sub-Saharan Africa: Lessons Learned from Selected Case Studies*. Special Programme for Developing Countries, Forestry Research Network of Sub-Saharan Africa, European Commission and European Tropical Forest Research Network.

Brüschweiler S and Gabathuler E. 2006. *Coping with Drought*. Swiss Agency for Development and Cooperation.

Butt TA, McCari BA and Kergna AO. 2006. Policies for reducing agricultural sector vulnerability to climate change in Mali. *Climate Policy*. 5(6): pp.583–598.

CARE. 2010. *Toolkit for Integrating Climate Change Adaptation into Development Projects. Digital Toolkit – Version 1.0 – July 2010.* Toolkit produced by CARE International, with technical input from the International Institute for Sustainable Development. Available at <http://www.careclimatechange.org/files/toolkit/CARE_Integration_Toolkit.pdf>.

Carter MR, Long E and Mude A. 2011. *The IBLI Colour Legend: Translating Index-Based Mortality Predictions into Meaningful Signals.* 14 Brief no. 2011–02. Available at <http://www.agriskmanagementforum.org/farmd/sites/agriskmanagementforum.org/files/Documents/I42011-02-color-legend-kenya.pdf>.

Chang'a LB, Yanda P.Z. and Ngana J. 2010. Indigenous knowledge in seasonal rainfall prediction in Tanzania: A case of the South-western Highland of Tanzania. *Journal of Geography and Regional Planning*. 3(4): pp.66–72.

Chaudhury M, Ajayi OC, Hellin J and Neufeldt H. 2011. *Climate change adaptation and social protection in agroforestry systems: enhancing adaptive capacity and minimizing risk of drought in Zambia and Honduras*. ICRAF Working Paper No. 137. Nairobi: World Agroforestry Centre. Available at <http://www.worldagroforestry.org/downloads/publications/PDFs/WP11269.PDF>.

Choularton R. 2007. *Contingency planning and humanitarian action. A review of practice*. Network Paper No. 59. London: Humanitarian Practice Network, Overseas Development Institute.

Crawford A, Hove H and Parry JE. 2011. *Review of Current and Planned Adaptation Action: Middle Africa. Angola, Cameroon, Central African Republic, Chad, Republic of the Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon and São Tomé e Principe*. Adaptation Partnership, International Institute for Sustainable Development.

Davies M, Guenther B, Leavy J, Mitchell T and Tanner T. 2009. *Climate Change Adaptation, Disaster Risk Reduction and* Social *Protection: Complementary Roles in Agriculture and Rural Growth?* Working Paper No. 320. Brighton: Institute of Development Studies, University of Sussex. Available at <http://www.ids.ac.uk/files/dmfile/Wp320.pdf>.

Del Ninno C, Subbaro K and Milazzo A. 2009. *How to make public works work: A review of the experiences*. SP Discussion Paper No. 0905.Washington, D.C.: World Bank. Available at <http://siteresources.worldbank.org/SOCIALPROTECTION/Resources/SP-Discussion-papers/Safety-Nets-DP/0905.pdf>.

De Vit C and Parry JE. 2011. *Review of Current and Planned Adaptation Action: West Africa. Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo*. Adaptation Partnership, International Institute for Sustainable Development.

DFID (Department for International Development). 2009. *Building consensus for social protection: Insights from Ethiopia's Productive Safety Net Programme (PSNP).* London: Department for International Development

Drimie S and Gillespie S. 2010. Adaptation to climate change in Southern Africa: factoring in AIDS. *Environmental Science and Policy*. 13: pp.778–784.

Ellis F, Devereux S and White P. 2009. *Social Protection in Africa*. Cheltenham: Edward Elgar Publishing Limited.

ERD (European Report on Development). 2010. *The 2010 European Report on Development. Social protection for inclusive development. A new perspective in EU cooperation with Africa*. Florence: Robert Schuman Centre for Advanced Studies, European University Institute. Available at <http://ec.europa.eu/europeaid/how/public-consultations/documents/erd_2010_social_protection_for_inclusive_development_en.pdf>.

FAO (Food and Agriculture Organization of the United Nations). 2011. *Disaster Risk Management Strategy in West Africa and the Sahel, FAO (2011–2013).* Available at <http://www.fao.org/fileadmin/templates/tc/tce/pdf/DRM_Strategy_Sahel_2011-2013_web.pdf>.

Field CB, Barros V, Stocker TF, Qin D, Dokken DJ, Ebi KL, Mastrandrea MD, Mach KJ, Plattner GK, Allen SK, Tignor M and Midgley PM. (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*. Cambridge and New York: Cambridge University Press.

Global Livestock CRSP. 2004. *Improving Pastoral Welfare in Ethiopia and the Role of the Pastoral Affairs Standing Committee (PASC).* Research Brief 04-04. Pastoral Risk Management Project. Available at <http://glcrsp.ucdavis.edu/publications/?project=parima>.

Goulden M, Conway D and Persechino A. 2009. Adaptation to climate change in international river basins in Africa: a review. *Hydrological Sciences Journal*. 54(5): pp.805–828.

Gyampoh BA, Amisah S, Idinoba M and Nkem J. 2009. Using traditional knowledge to cope with climate change in rural Ghana. *Unasylva 231/232*. 60: pp.70–74.

Hazell P, Anderson J, Balzer N, Hastrup-Clemmensen A, Hess U and Rispoli F. 2010. *The Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihoods*. Available at <http://www.ifad.org/ruralfinance/pub/weather.pdf>.

Heinrigs P. 2010. *Security Implications of Climate Change in the Sahel Region: Policy considerations.* Sahel and West Africa Club and the Organisation for Economic Co-operation and Development.

Hellmuth ME, Moorhead A, Thomson MC and Williams J. (eds.). 2007. *Climate Risk Management in Africa: Learning from Practice*. Available at <http://portal.iri.columbia.edu/portal/server.pt/gateway/PTARGS_0_5024_1171_0_0_18/Climate0and0Society0No1_en.pdf>.

Hess U, Wiseman W and Robertson T. 2006. *Ethiopia: Integrated Risk Financing to Protect Livelihoods and Foster Development*. Discussion Paper. Available at <http://www.wfp.org/sites/default/files/Ethiopia.pdf>.

Holmes R, Samson M, Magoronga W and Akinrimisi B. 2011. *The potential for cash transfers in Nigeria*. Available at <http://www.odi.org.uk/resources/docs/7326.pdf>.

Hove H, Echeverría D and Parry JE. 2011a. *Review of Current and Planned Adaptation Action: Southern Africa. Botswana, Comoros, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Zambia and Zimbabwe*. Adaptation Partnership, International Institute for Sustainable Development.

Hove H, Echeverría D and Parry JE. 2011b. *Review of Current and Planned Adaptation Action: East Africa. Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, United Republic of Tanzania and Uganda*. Adaptation Partnership, International Institute for Sustainable Development.

IASC (Inter-Agency Standing Committee). 2007. *Inter-Agency Contingency Planning Guidelines for Humanitarian Assistance*. Available at <http://www.humanitarianinfo.org/iasc/pageloader.aspx?page=content-products-productsandsel=13>.

Jankowska MM, Lopez-Carr D, Funk C, Husak GJ and Chafe ZA. 2012. Climate change and human health: Spatial modeling of water availability, malnutrition, and livelihoods in Mali, Africa. *Applied Geography*. 33: pp.4–15.

Kabubo-Mariara J. 2009. Global warming and livestock husbandry in Kenya: Impacts and adaptations. *Ecological Economics*. 68: pp.1915–1924.

Kalanda-Joshua M, Ngongondo C and Mpembeka F. 2011. Integrating indigenous knowledge with conventional science: Enhancing localised climate and weather forecasts in Nessa, Mulanje, Malawi. *Physics and Chemistry of the Earth*. 36: pp.996–1003.

Le Quesne T, Matthews JH, Von der Heyden C, Wickel AJ, Wilby R, Hartmann J, Pegram G, Kistin E, Blate G, Kimura de Freitas G, Levine E, Guthrie C, McSweeney C and Sindorf N. 2010. *Flowing forward: Freshwater ecosystem adaptation to climate change in water resources management and biodiversity conservation*. Water Working Notes, Note No. 28. Water Partnership Programme, World Wildlife Fund and the World Bank.

Lesukat M. 2012. *Drought Contingency Plans and Planning in the Greater Horn of Africa. A desktop review of the effectiveness of drought contingency plans and planning in Kenya, Uganda and Ethiopia*. UNISDR, Regional Office for Africa. Nairobi: UNISDR Africa.

Linnerooth-Bayer K, Warner K, Bals C, Höppe P, Burton I., Loster T and Haas A. 2010. Insurance mechanisms to help developing countries respond to climate change. *The Geneva Papers on Risk and Insurance – Issues and Practice. Special issue on Climate Change and its Economic Impact on Insurance*. 34: pp.381–400.

Macchi M, Oviedo G, Gotheil S, Cross K, Boedhihartono A, Wolfangel C and Howell M. 2008. *Indigenous and Traditional Peoples and Climate Change*. Available at <http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf>.

Makau Nzuma J, Waithaka M, Mbithi Mulwa R, Kyotalimye M and Nelson G. 2010. *Strategies for Adapting to Climate Change in Rural Sub-Saharan Africa. A Review of Data Sources, Poverty Reduction Strategy Programs (PRSPs) and National Adaptation Plans for Agriculture (NAPAs) in ASARECA Member Countries*. International Food Policy Research Institute Discussion Paper 01013. Available at <http://www.ifpri.org/sites/default/files/publications/ifpridp01013.pdf>.

Midgley G, Marais S, Barnett M and Wågsæther K. 2012. *Biodiversity, Climate Change and Sustainable Development – Harnessing Synergies and Celebrating Successes.* Final Technical Report. South African National Biodiversity Institute, Conservation South Africa and Indigo Development and Change.

Mude AG, Chantarat S, Barrett CB, Carter MR, Ikegami M and McPeak JG. 2010. *Insuring Against Drought-Related Livestock Mortality: Piloting Index Based Livestock Insurance in Northern Kenya.* Available at <http://www.munichre-foundation.org/NR/rdonlyres/1BE24769-0524-474B-B3ED-EA6BDF817C9C/0/S3_MIC09_Paper_Ikegami.pdf>.

Munich Re Foundation. 2007. *Flood-warning system in Mozambique. Completion of the Búzi project*. Available at <http://www.preventionweb.net/files/2919_LosterFloodwarningSystemIntoAction02Mozambique2007.pdf>.

Newsham A, Naess LO and Guthiga P. 2011. *Farmers' Knowledge and Climate Change Adaptation: Insights from Policy Processes in Kenya and Namibia.* Policy Brief No. 042. Brighton: Future Agricultures Consortium.

Nkem J, Kalame FB, Idinoba M, Somorin OA, Ndoye O and Awono A. 2010. Shaping forest safety nets with markets: Adaptation to climate change under changing roles of tropical forests in the Congo Basin. *Environmental Science and Policy*. 13: pp.498–508.

Norton MT, Osgood D, Diro R and Gebremichael M. 2012a. *Do experimental games increase take-up rates for index insurances? A randomized control trial approach*. Draft paper. New York: Columbia University.

Norton MT, Osgood D, Madajewicz M, Holthaus E, Peterson N, Gebremichael M, Mullally C and Teh TL. 2012b. *Evidence of demand for index insurance: experimental games and commercial transactions in Ethiopia*. New York: Columbia University.

Nyong A, Adesina F and Osman Elasha B. 2007. The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. *Mitigation and Adaptation Strategies for Global Change*. 12(5): pp.787–797.

Palaniappan M, Gleick PH, Allen L, Cohen M., Christian-Smith J and Smith C. 2010. *Clearing the Waters. A focus on water quality solutions*. Nairobi: UNEP.

Pelham L, Clay E and Braunholz T. 2011. *Natural Disasters: What is the Role for Social Safety Nets?* SP Discussion Paper No. 1102. Available at <http://siteresources.worldbank.org/SOCIALPROTECTION/Resources/SP-Discussion-papers/Safety-Nets-DP/1102.pdf>.

Rembold F, Hodges R, Bernard M, Knipschild H and Léo O. 2011. *The African Postharvest Losses Information System (APHLIS). An innovative framework to analyse and compute quantitative postharvest losses for cereals under different farming and environmental conditions in East and Southern Africa*. Ispra: European Commission Joint Research Centre, Institute for Environment and Sustainability, Monitoring Agricultural Resources Unit.

Robledo C, Clot N, Hammill A and Riché B. In press. The role of forest ecosystems in community-based coping strategies to climate hazards: Three examples from rural areas in Africa. *Forest Policy and Economics*.

SADC (Southern African Development Community). 2010. *Proceedings of the First Regional Agricultural Information Management System Technical Committee Meeting.* Volume II: Full Report. Meeting held on 10–12 March 2010, in Johannesburg, South Africa. Gaborone: Food, Agriculture and Natural Resources Directorate, SADC Secretariat. Available at <http://www.sadc.int/fanr/aims/index.php>.

Salick J and Byg A. 2007. *Indigenous Peoples and Climate Change*. Oxford: Tyndall Centre for Climate Change Research. Available at <http://www.ecdgroup.com/docs/lib_004630823.pdf>.

Scheffran J, Marmer E and Sow P. 2012. Migration as a contribution to resilience and innovation in climate adaptation: Social networks and co-development in Northwest Africa. *Applied Geography*. 33: pp.119–127.

Siegel P, Gatsinzi J and Kettlewell A. 2011. *Adaptive Social Protection in Rwanda: A No-Regrets Approach to Increased Resilience in a Territorial Planning Context.* Paper prepared for the international conference on Social Protection for Social Justice, held at the Institute of Development Studies, University of Sussex, Brighton, United Kingdom, on 13–15 April 2011.

Spaliviero M, De Dapper M, Mannaerts CM and Yachan A. 2011. Participatory approach for integrated basin planning with focus on disaster risk reduction: the case of the Limpopo River. *Water*. 2011(3): pp.737–763.

SWAC (Sahel and West Africa Club) and OECD (Organisation for Economic Co-operation and Development). 2006. *Food security and cross-border trade in the Kano-Katsina-Maradi corridor*. Joint mission report. West African Borders and Integration Series, WABI/DT/30/06. Available at <www.oecd.org/dataoecd/0/49/38490617.pdf>.

Syroka J. and Nucifora A. 2010. *National Drought Insurance for Malawi*. World Bank Policy Research Working Paper No. 5169. Available at <http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2010/01/11/000158349_20100111161125/Rendered/PDF/WPS5169.p>.

Tefera T. In press. Post-harvest losses in African maize in the face of increasing food shortage. *Food Security*.

Thomas RJ. 2008. Opportunities to reduce the vulnerability of dryland farmers in Central and West Asia and North Africa to climate change. *Agriculture, Ecosystems and Environment*. 126: pp.36–45.

Thomas DSG, Twyman C, Osbahr H and Hewitson B. 2007. Adaptation to climate change and variability: Farmer responses to intra-seasonal precipitation trends in South Africa. *Climatic Change*. 83(3): pp.301–322.

Traerup SLM. 2012. Informal networks and resilience to climate change impacts: A collective approach to index insurance. *Global Environmental Change*. 22: pp.255–267.

UNDP (United Nations Development Programme). 2012. *Drought Risk Management: Practitioner's perspectives from Africa and Asia*. Available at <http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/sustainable%20land%20management/Drought%20Risk%20Management%20-%20Practitioner's%20Perspectives%20from%20Africa%20and%20Asia.pdf>.

UNDP. 2011. *Climate Change Adaptation Action and Mainstreaming in Mozambique*. Project Document. Available at <http://www.undp-aap.org/resources/publications/mozambique-aap-project-document>.

UNDP and GEF SGP (Global Environment Facility Small Grants Programme). 2010. *The Community Water Initiative. Fostering Water Security and Climate Change Mitigation and Adaptation*. Available at <http://www.preventionweb.net/files/15256_CWILocalAdaptationtoClimateChangeKn.pdf>.

UNDP, UNCCD (United Nations Convention to Combat Desertification) and UNEP (United Nations Environment Programme). 2009. *Climate Change in the African Drylands: Options and Opportunities for Adaptation and Mitigation.* New York, Bonn and Nairobi: UNDP, UNCCD and UNEP.

UNECA (United Nations Economic Commission for Africa). 2009. *Financing Climate Change Adaptation and Mitigation in Africa: Key Issues and Options for Policy-Makers and Negotiators*. Paper prepared for the Third Financing for Development Conference on Climate Change, held in Kigali, Rwanda, on 21–22 May 2009. Available at <http://www.uneca.org/adfvii/documents/FINAL-PAPER-FINANCING-CC130509.pdf>.

UNECA and ACPC (African Climate Policy Centre). 2011. *Climate Change and Water in Africa: Analysis of Knowledge Gaps and Needs*. Working Paper 4. Available at <http://new.uneca.org/Portals/acpc/documents/working_papers/WP4_Water%20Gaps.pdf>.

UNEP. 2010. *Connecting the Dots: Biodiversity, Adaptation, Food Security and Livelihoods.* Available at <http://www.unep.org/dec/PDF/publicationconnectingdots.pdf>.

UNFCCC. 2008. *Mechanisms to manage financial risks from direct impacts of climate change in developing countries*. Technical Paper. FCCC/TP/2008/9. Available at <http://unfccc.int/resource/docs/2008/tp/09.pdf>.

UNFCCC. 2007. *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries.* Available at <http://unfccc.int/resource/docs/publications/impacts.pdf>.

UNICEF (United Nations Children's Fund). 2008. *Q&A The Malawi Social Cash Transfer Pilot.* Available at <http://www.unicef.org/malawi/MLW_resources_qasocialcashpilot.pdf>.

UNISDR. 2011a. *Effective measures to build resilience in Africa to Adapt to climate change.* Briefing Note 04. Available at <http://www.unisdr.org/files/24012_briefingnote04africa.pdf>.

UNISDR. 2011b. *Global Assessment Report on Disaster Risk Reduction*. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/download.html>.

UNISDR. 2010. *Early Warning Practices can Save Lives: Selected Examples. Good Practices and Lessons Learned*. Available at <http://www.unisdr.org/files/15254_EWSBBLLfinalweb.pdf>.

UNISDR Africa. 2012. Comprehensive Drought Risk Management in Ethiopia: The Livelihoods, Early Assessment and Protection Project (LEAP). *Africa Informs: Special Issue on Drought 2012*. pp.54 and 55. Available at <http://www.unisdr.org/files/26438_isdrafricainformsspecialissuesondro.pdf>.

UNISDR Africa. 2010. *Inventory of National Coordination Mechanisms, Legal Frameworks and National Plans for Disaster Risk Reduction in Africa*. Available at <http://www.unisdr.org/files/18926_africadrrinventoryfinal.pdf>.

USAID (United States Agency for International Development). 2009. *Okavango Integrated River Basin Management Project (IRBM).* Final Report.

WFP and Oxfam America. 2011. *R4 Rural Resilience Initiative.* Quarterly Report, January–March 2012. Available at <http://reliefweb.int/sites/reliefweb.int/files/resources/R4%20Report%20Jan-March%202012-lowres-051612.pdf>.

Wirkus L and Böge V. 2006. Transboundary water management on Africa's international rivers and lakes: current state and experiences. *In*: W Scheumann and S Neubert (eds.). *Transboundary Water Management in Africa: Challenges for Development Cooperation*. Bonn: German Development Institute. pp.15–102.

WMO. 2006. *Drought monitoring and early warning: concepts, progress and future challenges*. Available at <http://www.wamis.org/agm/pubs/brochures/WMO1006e.pdf>.

Zubrycki K, Crawford A, Hove H and Parry JE. 2011. *Review of Current and Planned Adaptation Action: North Africa. Algeria, Egypt, Libya, Morocco, Sudan, Tunisia and Yemen*. Adaptation Partnership, International Institute for Sustainable Development.

Zwaagstra L, Sharif Z, Wambile A, de Leeuw J, Johnson N, Njuki J, Said M, Ericksen P and Herrero M. 2010. *An assessment of the response to the 2008–2009 drought in Kenya.* Report to the European Union Delegation to the Republic of Kenya. Nairobi: International Livestock Research Institute.

C. Latin America

Andersen T, Marcel M, Collich G, Focke K and Durante JJ. 2010. *Natural Disasters Financial Risk Management. Technical and Policy Underpinnings for the Use of Disaster-Linked Financial Instruments in Latin America and the Caribbean.* Technical Notes No. IDB-TN-175. Inter-American Development Bank, Institutional Capacity and Finance Sector. Available at <http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=35428799>.

Arnold M and de la Fuente A. 2010. *Conditional cash transfer programs in Mexico: Progresa – Oportunidades.* Prepared by the World Bank for the 2011 Global Assessment Report on Disaster Risk Reduction. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Arnold_and_de_la_Fuente_2010%20TS%20pdf.pdf>.

Bettencourt S, Croad R, Freeman P, Hay J, Jones R, King P, Lal P, Mearns A, Miller G, Pswarayi-Riddihough I, Simpson A, Teuatabo N, Trotz U and van Aalst M. 2006. *Not if but when – Adapting to natural hazards in the Pacific Islands Region.* A policy note. Prepared by the World Bank. Available at <http://siteresources.worldbank.org/INTPACIFICISLANDS/Resources/Natural-Hazards-report.pdf>.

BMZ (German Federal Ministry for Economic Cooperation and Development). 2010. *Adaptation to Climate Change in the Rímac River Basin.* Draft for Discussion. With Kfw Entwicklungsbank. Available at <http://www.kfwentwicklungsbank.de/ebank/DE_Home/Sektoren/Wasser/Klimawandel/River_Basin_Snapshot_Rimac.pdf>.

Brown O. 2007. *Climate change and forced migration: Observation, projections and implications.* Human Development Report Office, Occasional Paper 2007/17. pp.1–35. Available at <http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/brown_oli.pdf>.

CCAD (Comisión Centroamericana de Ambiente y Desarrollo) and SICA (Sistema de la Integración Centroamericana). 2010. *Regional Strategy on Climate Change*. Executive Document. Available at <http://www.uncsd2012.org/rio20/content/documents/regionalstrategyelsalvador.pdf>.

CCRIF (Caribbean Catastrophe Risk Insurance Facility). 2012. *Climate Risk Adaptation and Insurance in the Caribbean*. Project Brochure No. 2. Available at <http://www.ccrif.org/sites/default/files/CRAI/ClimateRiskAdaptationInsurance_Caribbean_brochure.pdf>.

Cesario M, Rangel Cesario R and Andrade-Morraye M. 2011. Environmental change and health impacts in Amazonia. *IHDP Update* (magazine of the International Human Dimensions Programme on Global Environmental Change). 1: pp.26–33.

Conger L. 2011. *Managing Natural Disasters*. Inter-American Dialogue. Available at <http://www.thedialogue.org/page.cfm?pageID=32andpubID=2751>.

EuropeAid. 2009. *Climate Change in Latin America*. Available at <http://ec.europa.eu/europeaid/where/latin-america/regional-cooperation/documents/climate_change_in_latin_america_en.pdf>.

Field CB, Barros V, Stocker TF, Qin D, Dokken DJ, Ebi KL, Mastrandrea MD, Mach KJ, Plattner GK, Allen SK, Tignor M and Midgley PM. (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*. Cambridge and New York: Cambridge University Press.

Fried BJ. 2011. Distributive Politics and Conditional Cash Transfers: The Case of Brazil's Bolsa Família. *World Development*. 40(5): pp.1042–1053.

Galloway McLean K. 2010. *Advance Guard. Climate Change Impacts, Adaptation, Mitigation and Indigenous Peoples*. Available at <http://www.unutki.org/downloads/File/Publications/UNU_Advance_Guard_Compendium_2010_final_web.pdf>.

Ghesquiere F, Mahul O, Forni M and Gartley R. 2006. *Caribbean Catastrophe Risk Insurance Facility: A solution to the short-term liquidity needs of small island states in the aftermath of natural disasters*. Submission to the World Bank. IAT 03-13/3. Available at <http://siteresources.worldbank.org/PROJECTS/Resources/Catastrophicriskinsurancefacility.pdf>.

Gila OA, López V and Diéguez AU 2009. *Ecuador Case Study Report*. Available at <http://www.each-for.eu/documents/CSR_Ecuador_090126.pdf>.

Hellmuth ME, Mason S, Vaughan C, van Aalst M and Choularton R. 2011. *A better climate for disaster risk management*. Available at <http://portal.iri.columbia.edu/portal/server.pt/gateway/PTARGS_0_5643_7757_0_0_18/CSP3_Final.pdf>.

IDB (Inter-American Development Bank). 2012a. *HO-X1016: Contingent Loan for Natural Disaster Emergencies*. Available at <http://www.iadb.org/en/projects/project,1303.html?id=HO-X1016>.

IDB. 2012b. *IDB Borrowing Countries*. Available at <http://www5.iadb.org/idbppi/aspx/ppProcurement.aspx?planguage=ENGLISH>.

IDB. 2011. *IDB expects to provide more than $500 million to help Latin America and Caribbean prepare for natural disasters*. Available at <http://www.iadb.org/en/news/webstories/2011-03-10/financial-risk-management-of-natural-disasters,9149.html> .

IFAD (International Fund for Agricultural Development). 2011. *Addressing climate change in Latin America and the Caribbean*. Available at <http://www.ifad.org/operations/projects/regions/pl/pub/climate.pdf>.

IFRC (International Federation of Red Cross and Red Crescent Societies). 2012a. *Analysis of legislation related to disaster risk reduction in Brazil*. Available at <http://www.ifrc.org/PageFiles/86951/1213800-IDRL_Analysis_Brazil-EN-LR.pdf>.

IFRC. 2012b. *Analysis of legislation related to disaster risk reduction in the Dominican Republic*. Available at <http://www.ifrc.org/PageFiles/86951/1206800-IDRL_Analysis_Dominican%20Republic-EN-LR.pdf>.

IOPscience. 2009. *An integrated cross-sector and cross-institution approach to reduce climate change induced disaster effects in a South American context*. Available at <http://iopscience.iop.org/1755-1315/6/39/392022>.

IPC-IG (International Policy Centre for Inclusive Growth). 2012. *Cash Transfer Programmes in Latin America and the Caribbean*. Available at <http://www.ipc-undp.org/PageNewSiteb.do?id=123andactive=3>.

Irianni M, García MC, Velázquez GA, Fernández-Equiza AM and Gila OA. 2009. *Argentina Case Study Report*. Available at <http://www.each-for.eu/documents/CSR_Argentina_090126.pdf>.

Kalliola R, Toivon T, Miyakawa V and Mavila M. 2008. *Open access to information bridges science and development in Amazonia: lessons of the SIAMAZONIA service*. Available at <http://iopscience.iop.org/1748-9326/3/3/034004/pdf/1748-9326_3_3_034004.pdf>.

Keller M, Echeverría D and Parry JE. 2011a. *Review of Current and Planned Adaptation Action: Central America and Mexico. Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Mexico and Panama*. Adaptation Partnership, International Institute for Sustainable Development. Available at <http://www.adaptationpartnership.org/resource/central-america-and-mexico-current-and-planned-adaptation-action>.

Keller M, Medeiros D, Echeverría D and Parry JE. 2011b. *Review of Current and Planned Adaptation Action: South America. Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru,*

Suriname, Uruguay and Venezuela. Adaptation Partnership, International Institute for Sustainable Development. Available at <http://www.adaptationpartnership.org/resource/south-america-current-and-planned-adaptation-action>.

Kronik J and Verner D. 2010. *Indigenous People and Climate Change in Latin America and the Caribbean*. Available at <http://ibcperu.org/doc/isis/13340.pdf>. pp.7–402.

Lampis A. 2010. Challenges to adaptation for risk-prone marine-related livelihoods in Tumaco, Pacific Coast (Colombia). *UGEC Viewpoints*. 3: pp.18–22.

Leary N and Kulkarni J. 2007. *Assessments of Impacts and Adaptation to Climate Change*? Final Report of the AIACC Project. Available at <http://start.org/download/publications/AIACCfullreport.pdf>.

Magrin G, Gay García C, Cruz Choque D, Giménez JC, Moreno AR, Nagy GJ, Nobre C and Villamizar A. 2007. Latin America. *In*: ML Parry, OF Canziani, JP Palutikof, PJ van der Linden and CE Hanson (eds.). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press. pp.581–615

Marulanda MC, Barbat AH, Cardona OD and Mora MG. 2010. *Design and implementation of seismic risk insurance to cover low-income homeowners by a cross-subsidy strategy*. The 14th European Conference on Earthquake Engineering, 30 August to 3 September 2010. Ohrid: Macedonian Association for Earthquake Engineering.

MCTI (Ministry of Science and Technology). n.d. *Action Plan 2007–2010*. Summary Document. Available at <http://www.mct.gov.br/index.php/content/view/327296.html>.

Medeiores D, Hove H, Keller M, Echeverría D and Parry JE. 2011. *Review of Current and Planned Adaptation Action: The Caribbean. Antigua and Barbuda, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago*. Adaptation Partnership, International Institute for Sustainable Development. Available at <http://www.adaptationpartnership.org/resource/caribbean-current-and-planned-adaptation-action>.

Michel-Kerjan E, Zelenko I, Cardenas V and Turgel D. 2011. *Catastrophe Financing for Governments: Learning from the 2009–2012 MultiCat Program in Mexico.* OECD Working Papers on Finance, Insurance and Private Pensions, No. 9. Available at <http://www.oecd-ilibrary.org/docserver/download/fulltext/5kgcjf7wkvhb.pdf?expires=1339069171andid=idandaccname=guestandchecksum=2A876C59B3BFE06FB2BB15F85D03B694>.

Mitchell T, Mechler R and Harris K. 2012. *Tackling exposure: Placing disaster risk management at the heart of national economic and fiscal policy*. Available at <http://cdkn.org/resource/tackling-exposure-placing-disaster-risk-management-at-the-heart-of-national-economic-and-fiscal-policy/?loclang=en_gb>.

OAS (Organization of American States). 2006. Water Management and Climate Change: Lessons from Regional Cooperation. *Policy Series*. 9.

OECD. 2010. *Cities and Climate Change*. Available at <http://resilient-cities.iclei.org/fileadmin/sites/resilient-cities/files/Images_and_logos/Resilience_Resource_Point/6._OECD__2010__Cities_and_Climate_Change.pdf>.

Ortega-Pacheco DV and Manzano-Torres IM. 2009. *Institutional change and climate policy in Ecuador*. Available at <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1593771>.

Planetaryskin. n.d. *Brazil Natural Disaster Early Warning System. The Critical Importance of EWS*. Available at <http://www.planetaryskin.org/rd-programs/disasters/brazil-early-warning-system>.

Ribe H, Robalino DA and Walker I. 2012. *From right to reality: incentives, labor markets, and the challenge of universal social protection in Latin America and the Caribbean*. Washington, D.C.: World Bank Publications.

Sagala S and Okada N. 2007. *Managing Early Warning Systems for Tsunami Prone Communities: Preliminary Analysis of the Needs for Participatory Approach (PRA).* Available at <http://www.dpri.kyoto-u.ac.jp/dat/nenpo/no50/ronbunB/a50b0p20.pdf>.

Skees J, Barnett B and Collier B. 2008. *Agricultural Insurance Background and Context for Climate Adaptation Discussions*. Available at <http://www.munichre-foundation.org/NR/rdonlyres/4B38B133-17EA-4BAC-A4F8-2F8D5AB11916/0/20080821_SkeesBarnettCollierOECDPaper.pdf>.

Suarez P and Linnerooth-Bayer J. 2011. *Insurance-related instruments for disaster risk reduction*. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Suarez_and_Linnerooth-Bayer_2011.pdf>.

Swiss Re. 2011. *Closing the financial gap. New partnerships between the public and private sectors to finance disaster risks*. Available at <http://media.swissre.com/documents/pub_closing_the_financial_gap_W1.pdf>.

UNESCO (United Nations Educational, Scientific and Cultural Organization). MOST Policy Research Tool. Waru waru, a cultivation and irrigation system used in flood-prone areas of the Altiplano. Available at <http://www.unesco.org/most/bpik19-2.htm>.

UNESCO. 2006. *Water, a shared responsibility*. The United Nations World Water Development Report 2. Available at <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr2-2006/>.

UNFCCC. Local Coping Strategies Database <http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=142andid_hazard=andid_impact=andid_strategy=andid_region=3>.

UNFCCC. 2008. *Mechanisms to manage financial risks from direct impacts of climate change in developing countries*. Technical paper. FCCC/TP/2008/9. Available at <http://unfccc.int/resource/docs/2008/tp/09.pdf>.

UNISDR. 2011. *Global Assessment Report on Disaster Risk Reduction*. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/download.html>.

Vergara W. 2007. *Visualizing Future Climate in Latin America: Results from the application of the Earth Simulator*. Available at <http://siteresources.worldbank.org/INTLAC/Resources/SDWP_Future_Climate.pdf>.

Warner K, Ranger N, Surminski S, Arnold M, Linnerooth-Bayer J, Michel-Kerjan E, Kovacs P and Herweijer C. 2009. *Adaptation to Climate Change: Linking Disaster Risk Reduction and Insurance*. Available at <http://www.preventionweb.net/files/9654_linkingdrrinsurance.pdf>.

Wood RG. 2011. *Is there a role for cash transfers in climate change adaptation?* Background paper prepared for the international conference on Social Protection for Social Justice, held at the Institute of Development Studies, University of Sussex, Brighton, United Kingdom, on 13–15 April 2011. Available at <http://www.ids.ac.uk/files/dmfile/GodfreyWood2011CashtransfersandclimatechangeadaptationCSPconferencedraft.pdf>.

World Bank. 2011. *Innovation in Disaster Risk Financing for Developing Countries: Public and Private Contributions*. Available at <http://www.ruralfinance.org/fileadmin/templates/rflc/documents/DRFI_WRC_Paper_FINAL_April11_pdf.pdf>.

World Bank. 2010. *Latin America: Getting Better At Disaster Prevention with High-Tech Support*. Available at <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/LACEXT/0,,print:Y~isCURL:Y~contentMDK:22617044~pagePK:146736~piPK:146830~theSitePK:258554,00.html>.

D. Asia

ADPC (Asian Disaster Preparedness Center). 2010. Indonesia: Many partners, one system: An integrated Flood Early Warning System (FEWS) for Jakarta. *In*: UNISDR, International Training Centre and UNDP. *Local Governments and Disaster Risk Reduction. Good Practices and Lessons Learned. A contribution to the "Making Cities Resilient" Campaign*. Available at <http://www.preventionweb.net/files/13627_LocalGovernmentsandDisasterRiskRedu.pdf>.

Agrawala S and Carraro M. 2010. *Assessing the Role of Microfinance in Fostering Adaptation to Climate Change*. OECD Environmental Working Paper No. 15. OECD publishing. Available at <http://www.oecd.org/dataoecd/31/36/44844835.pdf>.

Archer D and Boonyabancha S. 2010. *Seeing a disaster as an opportunity, harnessing the energy of disaster survivors for change*. Case study prepared for the International Institute for Environment and Development Background Paper for the 2011 Global Assessment Report on Disaster Risk Reduction. Available at <www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Archer_and_Boonyabancha_2010%20TS%20pdf.pdf>.

Bizikova L, Hove H and Parry JE. 2011. *Review of Current and Planned Adaptation Action: Central Asia. Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan*. Adaptation Partnership, International Institute for Sustainable Development. Available at <http://www.adaptationpartnership.org/resource/central-asia-current-and-planned-adaptation-action>.

Concern Universal Bangladesh and Cordaid Netherlands. 2011. *Best Practices of Communities affected by Disasters in Bangladesh, India and Nepal*. Available at <http://www.preventionweb.net/files/26723_26723bestpractices.pdf>.

CPRC (Chronic Poverty Research Centre). 2011. *Social assistance and the 'dependency syndrome'*. CPRC Policy Brief No. 22. Available at <www.chronicpoverty.org/uploads/publication_files/PB%2022.pdf>.

Dohan R, Hove H, Echeverría D, Hammill A and Parry JE. 2011. *Review of Current and Planned Adaptation Action: The Pacific. Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.* Adaptation Partnership, International Institute for Sustainable Development. Available at <http://www.adaptationpartnership.org/resource/pacific-current-and-planned-adaptation-action>.

Fang W, He F, Cai J and Shi P. 2008. China: Karez Technology for Drought Disaster Reduction in China. *In*: UNISDR. *Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region.* Available at <http://www.unisdr.org/files/3646_IndigenousKnowledgeDRR.pdf>.

FAO. 2011. *Agricultural Insurance in Asia and the Pacific Region*. Bangkok: Regional Office for Asia and the Pacific. Available at <http://www.fao.org/docrep/015/i2344e/i2344e00.pdf>.

Fernandez L and Olfindo R. 2011. *Overview of the Philippines' Conditional Cash Transfer Program: The Pantawid Pamilyang Pilipino Program (Pantawid Pamilya).* Available at <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/07/08/000333038_20110708021205/Rendered/PDF/628790BRI0Phil0me0abstract0as0no010.pdf>.

Field CB, Barros V, Stocker TF, Qin D, Dokken DJ, Ebi KL, Mastrandrea MD, Mach KJ, Plattner GK, Allen SK, Tignor M and Midgley PM. (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.* Cambridge and New York: Cambridge University Press.

Gass P, Hove H and Parry JE. 2011. *Review of Current and Planned Adaptation Action: East and Southeast Asia. Cambodia, China, Democratic People's Republic of Korea, Indonesia, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Philippines, Thailand, Timor-Leste and Viet Nam*. Adaptation Partnership, International Institute for Sustainable Development. Available at

<http://www.adaptationpartnership.org/resource/east-and-southeast-asia-current-and-planned-adaptation-action>.

GEF (Global Environment Facility). 2010. *Project Identification Form. Increasing Climate Resilience through Drinking Water Rehabilitation in North Tajikistan*. Available at <http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/Climate%20Change/Tajikistan%20-%20%284422%29%20-%20Increasing%20Climate%20Resilience%20through%20Drinking%20Wat/2010-12-07%20%20ID4422%20%284263%29%20%20PIF%20%20revised.pdf>.

German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. 2012. *Pacific Mangroves Initiative*. Available at <http://www.bmu-klimaschutzinitiative.de/en/projects?p=1andd=525>.

GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit). 2012. *Transboundary Water Management in Central Asia*. Available at <http://www.gtz.de/en/weltweit/europa-kaukasus-zentralasien/tadschikistan/29994.htm>.

Government of India. 2012. *Crisis Management Plan – Drought (national)*. Ministry of Agriculture, Department of Agriculture & Cooperation. Available at <http://agricoop.nic.in/DroughtMgmt/cmp2012.pdf>.

Government of the People's Republic of Bangladesh. 2010. *National Plan for Disaster Management 2010–2015*. Disaster Management Bureau, Disaster Management and Relief Division. Available at <http://www.dmb.gov.bd/reports/Nataional%20Plan%20for%20Disaster%20%282010-2015%29%20Final%20Version.pdf>.

Gupta AK and Nair SS. 2010. Flood risk and context of land-uses: Chennai city case. *Journal of Geography and Regional Planning*. 3(12): pp.365–372.

Hazell P, Anderson J, Balzer N, Hastrup Clemmensen A, Hess U and Rispoli F. 2010. *Potential for Scale and Sustainability in Weather Index Insurance for Agriculture and Rural Livelihoods*. Available at <http://www.ifad.org/ruralfinance/pub/weather.pdf>.

Hellmuth ME, Osgood DE, Hess U, Moorhead A and Bhojwani H. (eds.). 2009. *Index insurance and climate risk: Prospects for development and disaster management*. Climate and Society No. 2. New York: International Research Institute for Climate and Society, Columbia University. Available at <http://www.preventionweb.net/files/10755_ClimateandSocietyIssueNumber21.pdf>.

IASC Indonesia. 2009. *Inter-Agency Contingency Plan.* Draft. Available at <http://ochaonline.un.org/indonesia/AboutUs/IASCContingencyPlanning/tabid/4329/language/en-US/Default.aspx>.

IASC Nepal. 2011. *Contingency Plan "Chapeau"*. Draft. Available at <http://www.un.org.np/sites/default/files/2012-03-26-IASC-Contingency-Planning.pdf>.

Linnerooth-Bayer J and Mechler R. 2007. Disaster safety nets for developing countries: extending public–private partnerships. *Environmental Hazards.* 7: pp.54–61.

Mahul O and Skees J. 2006. *Piloting Index-Based Livestock Insurance in Mongolia*. Available at <http://www.globalagrisk.com/Pubs/2006_IBLI_skees1-mongolia.pdf>.

Matul M, Tatin-Jaleran C and Kelly E. 2011. *Improving Client Value from Microinsurance: Insights from India, Kenya, and the Philippines*. Available at <http://www.ilo.org/public/english/employment/mifacility/download/mpaper12_clientvalue.pdf>.

Meenawat H and Sovacool B. 2011. Improving adaptive capacity and resilience in Bhutan. *Mitigation and Adaptation Strategies for Global Change.* 16(5): pp.515–533.

MRC (Mekong River Commission). 2010. *Flood Risk Management and Mitigation in the Mekong River Basin*. Proceedings of the 8th Annual Mekong Flood Forum, held in Vientiane, the Lao People's Democratic Republic, on 26–27 May 2010. Available at <www.mrcmekong.org/assets/Publications/conference/8th-annual-flood-forum.pdf>.

NADRR (National Alliance for Disaster Risk Reduction). 2009. *One Year Later.... Community Disaster Resilience Fund (CDRF). Learnings from the Pilot Initiative in India*. Available at <http://www.preventionweb.net/files/11787_CDRFReportOct2009.pdf>.

OECD. 2009. *Japan. Large-Scale Floods and Earthquakes*. OECD Reviews of Risk Management Policies. Available at <http://www.oecd-ilibrary.org/docserver/download/fulltext/0309031e.pdf?expires=1339774588andid=idandaccname=ocid53021578andchecksum=F4B34E471DC57061AFCCB653C90BA421>.

Okazaki K. 2010. *Incentives for Safer Buildings. Lessons from Japan*. Contribution to the 2011 Global Assessment Report on Disaster Risk Reduction. Geneva: UNISDR. Available at <www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Okazaki_2010.pdf>.

Oskal A, Turi JM, Mathiesen SD and Burgess P. 2009. *EALÁT. Reindeer Herders Voice: Reindeer Herding, Traditional Knowledge and Adaptation to Climate Change and Loss of Grazing Lands.* Kautokeino/Guovdageadnu: International Centre for Reindeer Husbandry. ISBN 978-82-998051-0-0.

PACS (Poorest Areas Civil Society Programme) 2007. *Status of NREGA Implementation. Grassroots learning and ways forward*. 2nd Monitoring Report. Available at <www.empowerpoor.org/downloads/Revised%20Report%20status%20of%20NREGA%20101007.pdf>.

Parvin G, Takahashi F and Shaw R. 2008. Coastal hazards and community-coping methods in Bangladesh. *Journal of Coastal Conservation*. 12(4): pp.181–193.

Paul A and Rahmann M. 2006. Cyclone mitigation perspective in the islands in Bangladesh: a case study of Swandip and Hatia Islands. *Coastal Management*. 34(2): pp.199–215.

Paul BK. 2009. Why relatively fewer people died? The case of Bangladesh's Cyclone Sidr. *Natural Hazards*. 50: pp.289–304.

Paul BK and Dutt S. 2010. Hazard warnings and responses to evacuation orders: the case of Bangladesh's cyclone Sidr. *The Geographical Review*. 100(3): pp.336–355.

Roeth H. 2009. *The Development for a Public Partnership Framework and Action Plan for Disaster Risk Reduction in Asia*. UNISDR. Available at <http://www.preventionweb.net/files/12080_TheDevelopmentofPublicPartnershipFr.pdf>.

Schelzig Bloom K. 2009. Conditional Cash Transfers: Lessons from Indonesia's Program Keluarga Harapan. *In*: SW Handayani and C Burkley (eds.). *Social Assistance and Conditional Cash Transfers. The Proceedings of the Regional Workshop.* Asian Development Bank. Available at <http://www.adb.org/sites/default/files/pub/2009/proceedings-social-assistance-cct.pdf>.

Sharma A. 2009. *Progress Review of National Platforms for DRR in the Asia and Pacific Region.* UNISDR. Available at <http://www.unisdr.org/files/12082_ProgressReviewofNationalPlatformsfo.pdf>.

Someth P, Kubo N, Tanji H and Ly S. 2009. Ring dike system to harness floodwater from the Mekong River for paddy rice cultivation in the Tonle Sap Lake floodplain in Cambodia. *Agricultural Water Management*. 96: pp.100–110.

Stephen I, Chowdhury RD and Nath D. 2008. India: Soil and Water Conservation through Bamboo Plantation: a Disaster Management Technique Adopted by the People of Nandeswar, Assam. *In*: UNISDR. *Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region.* Available at <http://www.unisdr.org/files/3646_IndigenousKnowledgeDRR.pdf>.

Suarez P and Linnerooth-Bayer J. 2011. *Insurance-Related Instruments for Disaster Risk Reduction*. Contribution to the 2011 Global Assessment Report on Disaster Risk Reduction. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Suarez_and_Linnerooth-Bayer_2011.pdf>.

Thapa MB, Luintel YR, Gauchan B and Amatya K. 2008. Nepal: Indigenous Knowledge on Disaster Mitigation: Towards Creating Complementarity Between Communities' and Scientists' Knowledge. *In*: UNISDR. *Indigenous Knowledge for Disaster Risk Reduction: Good Practices and Lessons Learned from*

Experiences in the Asia-Pacific Region. Available at <http://www.unisdr.org/files/3646_IndigenousKnowledgeDRR.pdf>.

UNDP. 2011. *Poverty Reduction. Scaling up Local Innovations for Tranformational Change.* China Agriculture Extension Special Task Force. Available at <http://www.undp.org/content/dam/undp/library/Poverty%20Reduction/Participatory%20Local%20Development/China_AESTF_web.pdf>.

UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific). 2011. *The Promise of Protection. Social Protection and Development in Asia and the Pacific*. Available at <http://www.unescap.org/commission/67/documents/theme-study-Promise-of-Protection.pdf>.

UNISDR. 2011. *Global Assessment Report on Disaster Risk Reduction.* Available at <www.preventionweb.net/english/hyogo/gar/2011/en/home/download.html>.

UNISDR. 2010. *Early Warning Practices can Save Lives: Selected Examples. Good Practices and Lessons Learned*. Available at <http://www.preventionweb.net/files/15254_EWSBBLLfinalweb.pdf>.

UNISDR and UNDP. 2008. *Linking Disaster Risk Reduction and Poverty Reduction. Good Practices and Lessons Learned*. Available at <http://www.preventionweb.net/files/3293_LinkingDisasterRiskReductionPovertyReduction.pdf>.

United States Department of State. 2012. *Lower Mekong Initiative.* Available at <http://www.state.gov/p/eap/mekong/>.

WFP and SDC. 2011. *Building Resilience: Bridging Food Security, Climate Change Adaptation and Disaster Risk Reduction*. An Overview of Workshop Case Studies. Available at <http://www.preventionweb.net/files/24163_workshopbuildingresiliencecasestudi.pdf>.

Winarto YT, Stigter K, Anantasari E and Hidayah SN. 2008. Climate Field Schools in Indonesia: Improving "Response Farming" to Climate Change. *Leisa Magazine*. 24(4); pp.16–18.

WMO. 2010. *Guidelines on Early Warning Systems and Application of Nowcasting and Warning Operations*. Available at <http://www.wmo.int/pages/prog/amp/pwsp/documents/PWS-21.pdf>.

World Bank. 2011a. *Philippines – Disaster Risk Management Development Policy Loan with a Catastrophe Deferred Drawdown Option (CAT-DDO).* Program Document. Report No. 60950-PH. Available at <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2011/08/23/000386194_20110823001701/Rendered/PDF/609500PGD0R201051000Official0Use090.pdf>.

World Bank. 2011b. *Implementation Status & Results. Philippines. Disaster Risk Management Development Loan with a CAT DDO* (P125943). Available at <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/EAP/2012/02/27/66CD5DA9519DE8F5852579B100573078/1_0/Rendered/PDF/P1259430ISR0Di027201201330357934926.pdf>.

Zimmermann M and Stössel F. 2011. *Disaster Risk Reduction in International Cooperation: Switzerland's Contribution to the Protection of Lives and Livelihoods.* Available at <http://www.preventionweb.net/english/professional/publications/v.php?id=17901>.

E. Small island developing States

Andersen T, Marcel M, Collich G, Focke K and Durante JJ. 2010. *Natural Disasters Financial Risk Management: Technical and Policy Underpinnings for the Use of Disaster-Linked Financial Instruments in Latin America and the Caribbean.* Available at <http://ideas.repec.org/p/idb/brikps/11118.html>.

Anderson MG, Holcombe E, Blake JR, Ghesquire F, Holm-Nielsen N and Fisseha T. 2011. Reducing landslide risk in communities: Evidence from the Eastern Caribbean. *Applied Geography*. 31: pp.590–599.

Ayala F. 2006. *The Programme for Advancement through Health and Education (PATH), Jamaica.* Policy Brief 4. Inter-Regional Inequality Facility. Available at <http://www.odi.org.uk/resources/details.asp?id=1070andtitle=programme-advancement-through-health-education-path-jamaica>.

Brown O. 2007. *Climate change and forced migration: Observation, projections and implications.* Human Development Report Office, Occasional Paper 2007/17. pp.1–35. Available at <http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/brown_oli.pdf>.

Campbell D and Beckford C. 2009. Negotiating Uncertainty: Jamaican Small Farmers' Adaptation and Coping Strategies, Before and After Hurricanes – A Case Study of Hurricane Dean. *Sustainability.* 1: pp.1366–1387.

CARIBSAVE. n.d. Fish Sanctuary Awareness and Marker Buoys project <http://www.caribsave.org/index.php?id=5>.

CCRIF. 2012. *Climate Risk Adaptation and Insurance in the Caribbean*. Project Brochure No. 2. Available at <http://www.ccrif.org/sites/default/files/CRAI/ClimateRiskAdaptationInsurance_Caribbean_brochure.pdf>.

Cook Islands. 2012. *Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation 2011– 2015*.

CROP (Council of Regional Organisations in the Pacific). 2011. *Pacific Plan 2011. Annual progress report.* Available at <http://www.forumsec.org/pages.cfm/newsroom/publications/pacific-plan-progress-reports.html>.

de Janvry A, Sadoulet E and Vakis R. 2010. Protecting vulnerable children from uninsured risks: Adapting conditional cash transfer programs to provide broader safety nets. *Well-being and Social Policy.* 6(1): pp.161–183.

DFID. n.d. DRR & Climate Change Adaptation Support Fund <http://projects.dfid.gov.uk/project.aspx?Project=113647>.

ECLAC (Economic Commission for Latin America and the Caribbean). 2007. *Information on disaster risk management. Case study of five countries.* Summary report. Available at <http://www.eclac.cl/cgibin/getProd.asp?xml=/publicaciones/xml/9/33649/P33649.xmlandxsl=/mexico/tpl-i/p9f.xslandbase=/mexico/tpl/top-bottom.xslt>.

FAO. 2009. *Resilience of Rural Communities to Climatic Accidents. A Need to Scale Up Socio-Environmental Safety Nets (Madagascar, Haiti).* Policy Brief. Available at <http://www.fao.org/docs/up/easypol/757/rural_cmmnty_resilience_climatic_accdts_204en.pdf>.

Fernandez A, Jadotte E and Jahnsen J. 2011. *Addressing disaster risk through conditional cash transfer and temporary employment programs in Latin America and the Caribbean.* Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Fernandez_et_al._2011.pdf>.

Flam KH and Skaerseth JB. 2009. Does adequate financing exist for adaptation in developing countries? *Climate Policy*. 1: pp.109–114.

Gero A, Méheux K and Dominey-Howes D. 2010. *Disaster risk reduction and climate change adaptation in the Pacific: The challenge of integration*. Australian Tsunami Research Centre & Natural Hazards Research Laboratory, Sydney Miscellaneous Report 4. Sydney: University of New South Wales.

IDB. 2012a. *HO-X1016: Contingent Loan for Natural Disaster Emergencies*. Available at <http://www.iadb.org/en/projects/project,1303.html?id=HO-X1016>.

IDB. 2012b. *IDB Borrowing Countries*. Available at <http://www5.iadb.org/idbppi/aspx/ppProcurement.aspx?planguage=ENGLISH>.

International Labour Organization. 2010. *Decent Work Country Programme: Tuvalu.* Available at <http://www.ilo.org/public/english/bureau/program/dwcp/download/tuvalu.pdf>.

Kingdom of Tonga. 2012. *Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management 2010–2015.*

Le Borgne E and Medas P. 2007. *Sovereign Wealth Funds in the Pacific Island Countries: Macro-Fiscal Linkages.* International Monetary Fund Working Paper, WP/07/297. Available at <http://www.imf.org/external/pubs/ft/wp/2007/wp07297.pdf>.

Levy D and Ohls J. 2007. *Evaluation of Jamaica's PATH Program: Final Report.* Available at <http://www.mathematica-mpr.com/publications/PDFs/JamaicaPATH.pdf>.

Maas A and Carius A. 2011. *PD15: Creating space for action: options for small island states to cope with global environmental change.* Available at <http://www.bis.gov.uk/assets/foresight/docs/migration/policy-development/11-1149-pd15-creating-space-for-action-small-island-states.pdf>.

Medeiores D, Hove H, Keller M, Echeverría D and Parry JE. 2011. *Review of Current and Planned Adaptation Action: The Caribbean. Antigua and Barbuda, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago*. Adaptation Partnership, International Institute for Sustainable Development. Available at <http://www.adaptationpartnership.org/resource/caribbean-current-and-planned-adaptation-action>.

MEPD (Ministerio de Economía, Planificación, y Desarrollo) and CNRE (Consejo Nacional de Reforma del Estado). 2010. *Anteproyecto de ley: Estrategia nacional de desarrollo de la República Dominicana 2010–2030*. Santo Domingo: Ministerio de Economía, Planificación, y Desarrollo. Available at <http://www.end.gov.do/download/Anteproyecto_de_Ley_de_END_RD_2010_2030.pdf>.

Mercer J and Kelman I. 2010. Living alongside a volcano in Baliau. Papua New Guinea. *Disaster Prevention and Management.* 19(4): pp.412–422.

Ministry of Fijian Affairs, Heritage, Provincial Development & Multi-Ethnic Affairs. 2009. *Expert Group Meeting on Innovative Strategies Towards Flood Resilient Cities in Asia-Pacific. Good Practices in Fiji Flood Management.* Available at <http://www.unescap.org/idd/events/2009_EGM-DRR/EGM-FIJI-PAPER.pdf>.

Mitchell T, Mechler R and Harris K. 2012. *Tackling exposure: placing disaster risk management at the heart of national economic and fiscal policy*. Climate & Development Knowledge Network. Available at <http://cdkn.org/resource/tackling-exposure-placing-disaster-risk-management-at-the-heart-of-national-economic-and-fiscal-policy/?loclang=en_gb>.

Osei PD. 2007. Policy responses, institutional networks management and post-Hurricane Ivan reconstruction in Jamaica. *Disaster Prevention and Management.* 16(2): pp.217–234.

Overmars M and Gottlieb SB. 2009. *Adapting to climate change in water resources and water services in Caribbean and Pacific small island countries.* Available at <http://www.worldwatercouncil.org/fileadmin/wwc/Library/Publications_and_reports/Climate_Change/PersPap_03._Small_Island_Countries.pdf>.

Republic of the Marshall Islands. 2011. *National Climate Change Policy Framework.*

Schwarz AM, Béné C, Bennett G, Boso D, Hilly Z, Paul C, Posala R, Sibiti S and Andrew N. 2011. Vulnerability and resilience of remote rural communities to shocks and global changes: Empirical analysis from Solomon Islands. *Global Environmental Change.* 21(3): pp.1128–1140.

Simpson MC, Scott D, New M, Sim R, Smith D, Harrison M, Eakin CM, Warrick R, Strong AE, Kouwenhoven P, Harrison S, Wilson M, Nelson GC, Donner S, Kay R, Geldhill DK, Liu G, Morgan J.A., Kleypas JA, Mumby PJ, Christensen TRL, Baskett ML, Skirving WJ, Elrick C, Taylor M, Bell J, Rutty M, Burnett JB, Overmas M, Robertson R and Stager H. 2009. *An Overview of Modelling Climate Change Impacts in the Caribbean Region with contribution from the Pacific Islands*. Summary document. Barbados: UNDP.

SOPAC (Secretariat of the Pacific Community). 2009. *Relationship between Natural Disasters and Poverty: A Fiji Case Study.* Available at <http://www.unisdr.org/files/11851_11851R25PovertyAFijiCaseStudylowres.pdf>.

SPREP (Secretariat of the Pacific Regional Environment Programme). 2006. *Pacific Islands Framework for Action on Climate Change 2006–2015.* Available at <http://www.sprep.org/att/publication/000438_PI_Framework_for_Action_on_Climate_Change_2006_2015_FINAL.pdf>.

Swiss Re. 2011. *Closing the financial gap. New partnerships between the public and private sectors to finance disaster risks.* Available at <http://media.swissre.com/documents/pub_closing_the_financial_gap_W1.pdf>.

Tompkins L, Lemos M and Boyd E. 2008. A less disastrous disaster: Managing response to climate-driven hazards in the Cayman Islands and NE Brazil. *Global Environmental Change.* 18: pp.736–745.

UNISDR. 2011a. *Global Assessment Report on Disaster Risk Reduction.* Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/download.html>.

UNISDR. 2011b. *Antigua and Barbuda. National progress report on the implementation of the Hyogo Framework for Action (2009–2011) – interim.* Submitted for the preparation of the 2011 Global Assessment Report on Disaster Risk Reduction. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/hfa/15722_atg_NationalHFAprogress_2009-11.pdf>.

UNISDR. 2011c. *Cayman Islands. National progress report on the implementation of the Hyogo Framework for Action (2009–2011) – interim.* Submitted for the preparation of the 2011 Global Assessment Report on Disaster Risk Reduction. Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/hfa/15945_cym_NationalHFAprogress_2009-11.pdf>.

Veitayaki J. 2006. Caring for the Environment and the Mitigation of Natural Extreme Events in Gau, Fiji Islands: A Self-help Community Initiative. *Island Studies Journal.* 1(2): pp.239–252.

Veitayaki J, Manoa P and Resture A. 2007. *Addressing climate change and sea level rise in the Pacific Islands.* Available at <http://www.spc.int/lrd/index.php?option=com_docmanandtask=cat_viewandgid=315andlimit=5andlimitstart=10andorder=dateanddir=ASCandItemid=10>.

Vergara W. 2007. *Visualizing Future Climate in Latin America: Results from the application of the Earth Simulator*. Available at <http://siteresources.worldbank.org/INTLAC/Resources/SDWP_Future_Climate.pdf>.

Warner K, Zissener M, Kreft S, Höppe P, Bals C, Linnerooth-Bayer J, Haas A, Gurenko E, Loster T and Burton I. 2010. *Solutions for Vulnerable Countries and People. Designing and Implementing Disaster Risk Reduction and Insurance for Adaptation.* Available at < http://www.ehs.unu.edu/file/get/5326>.

Wickham F, Clarke J, Yee D and Pauku R. 2012. *Solomon Islands National Climate Change Policy 2012—2017*. Ministry of Environment, Climate Change, Disaster Management and Meteorology.

Wickham F, Kinch J and Lal P. 2009. *Institutional capacity within Melanesian countries to effectively respond to climate change impacts, with a focus on Vanuatu and the Solomon Islands.* Available at <http://www.preventionweb.net/files/11817_InstitutionalcapacitywithinMelanesi.pdf>.

WMO. 2005. *The SIDS–Caribbean Project. Preparedness to Climate Variability and Global Change in Small Island Developing States of the Caribbean Region*. Available at <http://www.wmo.int/pages/prog/dra/ram/documents/WMO_SIDS_E_light.pdf>.

Wong P. 2011. Small island developing states. *Climate Change.* 2: pp.1–6.

World Bank. 2012. *Disaster Risk Reduction and Financing in the Pacific: A Catastrophe Risk Information Platform Improves Planning and Preparedness.* Available at

<http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:23176294~menuPK:141310~pagePK:34370~piPK:34424~theSitePK:4607,00.html>.

World Bank. 2011. *Innovation in Disaster Risk Financing for Developing Countries: Public and Private Contributions.* Available at <http://www.ruralfinance.org/fileadmin/templates/rflc/documents/DRFI_WRC_Paper_FINAL_April11_pdf.pdf>.

World Bank. n.d. *Pacific Catastrophe Risk Assessment and Financing Initiative. Phase 2: Disaster Risk Reduction and Financing in the Pacific*. Available at <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/EXTEAPREGTOPRURDEV/0,,contentMDK:22739959~pagePK:34004173~piPK:34003707~theSitePK:573964,00.html>.

Additional references for small island developing States (not cited, but relevant)

Alfaro-Pelico RI. 2012. *Small Island Developing States and Climate Change: Effects, Responses and Positions beyond Durban (WP).* Working Paper 1/2012. Available at <http://www.realinstitutoelcano.org/wps/wcm/connect/ec147c8049e5f095a5aabf39d72a98ae/WP_Alfaro-Pelico_Small_Islands_Climate_Change_Durban.pdf?MOD=AJPERESandCACHEID=ec147c8049e5f095a5aabf39d72a98ae>.

Bouwer LM and Aerts JCJH. 2006. Financing Climate Change Adaptation. *Disasters*. 30(1): pp.46–63.

Dickinson WR. 2009. Pacific atoll living: How long already and until when? *GSA Today.* 19: pp.4–10.

Meehl GA, Arblaster JM, Branstator GW and van Loon H. 2008. A coupled air–sea response mechanism to solar forcing in the Pacific region. *Journal of Climate.* 21: pp.2883–2897.

Park W, Keenlyside N, Latif M, Stroh A, Redler R, Roeckner E and Madec G. 2009. Tropical Pacific climate and its response to global warming in the Kiel climate model. *Journal of Climate*. 22: pp.71–92.

Stucki V and Smith M. 2011. Integrated Approaches to Natural Resources Management in Practice: The Catalyzing Role of National Adaptation Programmes for Action. *Ambio.* 40(4): pp.351–360.