Background paper to the expert meeting on:

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 processes

Bridgetown, Barbados, 9-11 October 2012

Executive note

In the contemporary era, the pace of climate change is increasing, as is the frequency of extreme weather events. These events already impose loss and damage which is difficult to deal with by policy and decision makers at multiple levels and by the vulnerable communities they represent due to uncertainty and volatility associated with the increasing pace of such change. In the future, increasing impacts from combinations of extreme weather and slow onset events are expected to induce more loss and damage.

This literature review represents an initial overview and sample of approaches to address loss and damage associated with climate change in four different regions of the world, found in a variety of literature sources. The work focuses on a broad range of loss and damage—partly from weather-related extreme events where approaches like disaster risk reduction, humanitarian and crisis management are prevalent today—and partly from slow onset related climate change events where practices like land and water management, as well as infrastructural and other measures may be put to use.

This review is part of the mandated work for 2012 in the SBI Work Programme on loss and damage, 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." The review forms a resource tool to support discussions between Parties at meetings and negotiations on loss and damage. It also aims to identify relevant examples of how approaches to address loss and damage are used in different developing country regions.

Four groups of approaches are particularly featured in this review: risk reduction, risk retention, risk transfer, and approaches to address slow onset climatic events. These are addressed separately while appreciating that many may be applied in combination to manage loss and damage. The review also aims to identify gaps in the literature where these exist

I. Introduction and methodology

The topic of loss and damage in the context of climate change has gained increasing importance in the UNFCCC climate talks in recent years. This literature review is part of the mandated work for 2012 in the work programme on loss and damage 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 processes, taking into consideration experience at all levels" (Decision 7/CP. 17). Specifically, the mandate requests the secretariat ''To conduct, in collaboration with relevant organizations and other stakeholders, and drawing on existing relevant work and documents, a literature review of existing information and case studies on the topics in the context of this thematic area, to feed into the expert meetings mentioned in paragraph 8(a) of this decision."

A. Methods and organization of the literature review

In this literature review, loss and damage has been broadly defined as t*he actual and/or potential manifestation of impacts associated with climate change in developing countries that negatively affect human and natural systems.* This literature review provides an overview of approaches to address loss (those negative impacts which cannot be repaired or restored like loss of freshwater sources) and damage (negative impacts that can be repaired or restored such as windstorm damage to the roof of a building, or damage to a coastal mangrove forest from coastal surges which affect villages), based on an assessment of current literature and critical analysis.

This literature review employed the following approach. First, the literature review acknowledges recent meta-analyses including an analysis of the IPCC Special Report on Extreme Events (IPCC 2012) and its sources, with a note of the scope of that work (focus on extreme events). The literature review also analyses the UNISDR´s Global Assessment Report 2011 (UNISDR 2011) and its sources, with a note of the scope of that work (focus on disaster risk reduction for natural hazards including weather extremes).

Second, academic and relevant practitioner and policy literature were reviewed using keyword searches for four approaches suggested by Parties (risk reduction, risk retention, risk transfer, and measures to address slow onset climatic processes). The literature reviewed includes:

(a) Peer reviewed journals in English using keywords;

(b) Review of practitioner and policy literature using key word searches;

(c) Review of submitted Nairobi Work Program partner contributions.

Keywords used included (but were not limited to): loss and damage, adaptation, adaptation strategies, risk, risk management, disaster risk reduction, coping, 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, case studies specific to each region. The literature review sought references for the four regions where expert regional workshops will take place: Africa, Latin America, Asia, Small Island Development States (SIDS). Time constraints did not allow a more comprehensive review of all journals, reports, books, governmental documents, and other sources in all relevant languages, which is a drawback in the current sources references.

Third, additional literature searches were undertaken online to fill gaps. Fourth, the almost 200 references and examples as well as gaps where no literature or insufficient literature references existed were analysed. This analysis provides

responses to the five questions in the Annex on thematic area 2 of the work programme on loss and damage: The 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 different approaches, lessons learned from existing efforts, the links and synergies between approaches, and tailoring approaches to national contexts.

It should be noted that the approaches listed in this literature review are not exhaustive and other approaches and varieties may exist, including at a local level.

II. Overview

This section introduces relevant explanations for loss and damage associated with climate change, or 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 events and interactions of these phenomena. Then it touches on the importance of finding appropriate approaches to address this loss and damage continuum—to ensure climate resilient growth even in the face of climate change and the loss and damage which accompanies it.

A. Loss and damage continuum-- interactions between climate variability and climate change

Loss and damage continuum: increasing number of extreme climate 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 (changes over the longer term) events, the latter being a major cause of the former.

Loss and damage includes the full range of climate change related impacts from increasing (in number and intensity, extreme events to slow onset processes and combinations of them. Addressing loss and damage requires an understanding of the kinds of events and processes that are associated with the adverse impacts of climate change. Throughout this document the terms “weather extremes” (usually discrete temporal events) and “slow onset climatic processes” (non-discrete continuous processes) are used. However, the literature review also acknowledges that for many practitioners these distinctions are not as easily made. Climate stimuli interact with human systems in complex ways that drive loss and damage. Addressing loss and damage has two components: first, avoiding the risk of loss and damage in the future through appropriate risk management, adaptation and mitigation, and second, addressing loss and damage when it occurs (trajectory of loss and damage, today and in the future).

Climate change over time: Multiple, interacting temporal and spatial scales. Loss and damage is reflected in historic and present (observed and occurring) manifestations of climate change but also includes potential future loss and damage, which relies on assumptions regarding parameters such as emissions, vulnerability, and exposure variables of the impacted human (or natural) system. Future loss and damage is potentially of unimaginable magnitude—especially considering non-economic values, and the interconnectivity leading to cascading, transnational effects. Atmospheric hazards such as heat waves could become more prevalent as long term ‘process’’ climate change such as increasing temperatures) takes place. The concept of tipping elements in climate, natural and societal systems is an important consideration in addressing potential loss and damage.

Mitigation and adaptation matter: Policy choices affect loss and damage. Choices that reduce climate change impacts through mitigation and adaptation will reduce loss and damage. Climate change impacts are driven by the concentrations of greenhouse gases in the atmosphere, which in turn impacts atmospheric and ocean

temperatures. Negative climate change impacts that cause loss and damage are also linked to how able human systems are to adapt to changes in climate.

Climate change impacts cause loss and damage to 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 to human systems such as loss of habitable land or fresh water). Additionally, characteristics of human systems (like development policy, poverty, etc.) affect the dependency of human systems on natural systems. However, this connectedness does not change the fact that climate change impacts drive the loss and damage, which occurs through the "path" of natural system shifts and their effects on human systems.

B. Context of approaches to address loss and damage – Climate resilient development

There are significant practical implications for policy and planning for adaptation from weather-related extremes in the short term and from both weather-related extremes and shifts in regional climate patterns in the medium and longer term.

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

The box below presents some of the key findings from the IPCC's Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (IPCC 2012).

Text Box 1
Key points from the 2011 IPCC Special Report on Extreme Events

- 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. For the coming two or three decades, the expected increase in climate extremes will probably be relatively small compared to the normal year-to-year variations 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 disaster impacts.
- There is better information on what we expect in terms of changes in 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 measures to reduce risk, transfer risk (e.g. through insurance) and effectively prepare for and manage disaster impact 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 current 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 system.
- In cases where 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 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.

Climate resilient development: Need for approaches that address the full loss and damage continuum. The impacts of loss and damage associated with climate-related stressors such as weather extremes and longer-term climatological shifts can set back socio-economic development and reinforce cycles of poverty across the world. The first expert workshop under the SBI Work Program on Loss and Damage in Tokyo,[1] noted the need for discussions and approaches which are holistic and designed to manage the spectrum of loss and damage under significant uncertainty. Planning "only" for the extreme climate-related events of today could leave countries in a position in the future where scarce resources have been devoted to a static understanding of climate-related adverse impacts. By contrast, planning for

[1] See report of the workshop in FCCC/SBI/2012/INF.3.

approaches to address loss and damage associated with both increasing weather-related extreme events and longer-term shifts in climate patterns are needed. A holistic approach will help smooth development pathways and help cushion the expected negative impacts of loss and damage in the future.

III. Types of approaches with which to address loss and damage

Parties to the UNFCCC have requested support in understanding, planning for, and enacting programs that address potential loss and damage associated with increasing weather-related extreme events and climate change. This section addresses the first and second questions related to thematic area 2 of the UNFCCC Work Programme on Loss and Damage (Decision 7/CP.17 see FCCC/CP/2011/Add.2). These two questions ask what is the full range of approaches and tools that can be used to address the risk of loss and damage and the foundational resource requirements needed in order for different strategies and tools to be effectively applied.

Scope and organization of section three. This section provides an overview of broad groups of approaches that have been used up to the current period, and also those approaches that are relevant for addressing slow onset processes associated with climate change—some of which are currently in place and some which may need to be enacted in the future. Section three is written for the non-specialist with a view to give an overview of major issues related to each approach, with the later regional sections offering more in-depth references for further reading.

The first sub-section introduces a range of approaches associated with risk reduction. The second discusses approaches classed as “risk retention”, and some of the consequences of choosing these approaches. The third looks at “risk transfer” approaches. These three sets of approaches are often currently used to manage extreme weather events (like storms, floods, cyclones, droughts, etc.) but may be applied in different combinations in the future to also address slow onset processes. The fourth sub-section recognizes that slow onset events such as glacial melt, sea level rise, ocean acidification, may require different approaches, and so examines a range of institutional, governance and other approaches to manage slow onset processes which are not necessarily a single “event”.

The sub-sections below explore these considerations, including the foundational resource requirements at a general level. The following section in the paper, section 4, then goes into a more in-depth analysis to answer the remaining questions posed by Parties in Durban related to thematic area 2. The paper now turns its attention to the range of approaches to address loss and damage.

A. Challenge: Matching needs related to loss and damage with the right approaches

A challenge lies in understanding what 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 what approaches may be needed to address loss and damage in the future.

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

(a) choices about mitigation and adaptation which will affect actual and expected climate impacts on natural and human systems;

(b) multiple, interacting temporal and spatial scales (e.g. extreme events will interact with slower climatic processes like storm surges and sea level rise);

(c) the kinds of approaches that are appropriate to a country´s particular circumstance.

These considerations will be discussed in this section and in section 4, when the paper addresses the remaining questions for thematic area 2.

The four groups of approaches outlined in this literature review—ranging from risk reduction, risk retention, risk transfer, and institutional and governance approaches—fit along different parts of the loss and damage continuum. For example, risk reduction and prevention may work well where climate change impacts are of lower magnitude, frequent, 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 sub-sections below introduce a variety of different measures that fit into each of these four broad approach types.

B. Risk reduction

A range of approaches exist today to manage extreme weather events and the loss and damage associated with them. These have been discussed in prominent documents such as the IPCC Special Report on Extreme Events (IPCC 2012) and the ISDR GAR (UNISDR a) 2011). This following sub-section provides a glossary-like overview of measures that are currently used to address extreme weather events. Some of these tools may, in combination, have relevance to also address slower onset climatic processes.

Risk reduction includes a number of approaches, which are designed to reduce the impacts of an adverse potential event—in the context of climate change this would be adaptation to the adverse effects of a weather-related extreme. The text box below provides a definition of risk reduction from UNISDR.[2]

Risk reduction measures are undertaken before an actual extreme event occurs. Risk reduction is often used effectively for those kinds of climate-related stressors which occur often and whose impacts are relatively low. Indigenous knowledge systems, as well as combinations of technology, education, engineering, early warning, etc. have all been used to help societies anticipate and reduce potential loss and damage from weather extremes (usually those which are frequently observed and for which relatively more information is available). Risk reduction measures could be applied with good results for things like frequent storms that may cause annual flooding, recurring small scale droughts, and regular wind storms that may cause minor damage.

[2] A comprehensive approach to disaster risk reduction is laid out in the Hyogo Framework for Action (HFA), adopted by 168 Member States of the United Nations in 2005. The HFA provides a vehicle for cooperation among Governments, organizations and civil society actors to assist in the implementation of the Framework. While the term "disaster reduction" is sometimes used, the term "disaster risk reduction" provides a better recognition of the ongoing nature of disaster risks and the ongoing potential to reduce these risks. "Mitigation" is a term used by disaster risk managers to indicate activities that reduce disaster risk or help ameliorate the impacts. "Mitigation" in the context of climate change is used to indicate reduction of greenhouse gases which cause changes in global temperature and climate systems.

Text 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.

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

The range of measures used to reduce risk before a hazardous event occurs can be divided into structural measures and non-structural measures. Non-structural measures include any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education. These measures require coordination, planning, effective outreach to potentially affected communities, etc. They often require political will but are not necessarily costly to implement. Structural measures are any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems. Structural measures require some political consensus about values 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.

The paragraphs above give an overview of the range of approaches and tools that are typically considered risk reduction measures. Now the paper turns attention to the applicability of risk reduction across different contexts, relative costs and benefits, and foundational requirements to undertake risk reduction to minimize potential loss and damage.

Text Box 4
Structural Risk Reduction Measures -
Focus on infrastructure to product values-at-risk

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 Codes. "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>.

1. What sectors use risk reduction?

Risk reduction is appropriate across all sectors of an economy and in all ecosystem types, although the design specifications differ. For example, most measures around planning—contingency planning in the 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, medical, and other supplies can reduce injuries and other health impacts to people in the immediate aftermath of an extreme event. Similarly, early warning systems have been used for flooding, drought, windstorms and other kinds of weather extremes to give advance notice to the agricultural sector (which may then stockpile grain), to citizens who can undertake measures to secure their equipment and livestock to prevent losses, and in critical infrastructure systems to avoid large failures.

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

2. How cost effective is risk reduction?

The literature widely suggests that the benefits of avoiding and reducing loss and damage outweighs the costs of investing in risk reduction measures. A number of studies have attempted to establish the benefit-cost ratio (e.g. Mechler 2005). Mechler found that the estimated cost-benefit ratios range from 2.5 to 51 times the benefits compared to the cost. The costs of risk reduction, however, affect decision making about disaster risk reduction in non-crisis situations: it may be difficult to justify extensive public investments 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, and benefits for sustained economic growth and welfare.

The table below outlines some of the possible costs and benefits of risk reduction measures that countries could use to determine investment strategies.

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

Potential benefits	*Potential costs*
• Reduction of loss of life, injury • Reduction of property damage and destruction • Reduction of community, personal and local infrastructure disruption • Less business interruption, including closures, shutdowns, un- (under-) employment • 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	• Public expenditure on non-structural and structural measures to reduce risk (structural measures can be very costly, but still less costly than reconstruction) • Incentives to wait and do nothing until international assistance comes after an extreme event (humanitarian assistance is “free” but often arrives with delay or not at all) • Decision makers may be rewarded for responding (“hero effect”), but not for pro-actively reducing risk • Potential increased costs generated by rules and regulations setup to reduce

• Increased awareness in communities of hazards, their impacts and changes in behavior to avoid loss and damage • Improved efficacy of response and recovery • Complement sustainable development, and dampen the negative cycle of hazards and poverty.	risks (such as building codes) • Changes in zoning (e.g. certain areas declared hazardous) may affect property values

Source: Summary of findings from the UNISDR (2011) Global Assessment Report on Disaster Risk Reduction and the IPCC (2007) Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

3. What are the foundational requirements of risk reduction?

The overall approach of risk reduction requires the following elements, but can be seen as a process of building these elements over time (so that countries can get started where they currently are):

(a) **Strong institutional basis for implementation:** political commitment and community participation, institutional, legislative and operational mechanisms for disaster reduction;

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

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

(d) **Addressing underlying risk factors:** requires sustainable use and management of ecosystems, land use and natural resources, and integrating disaster risk reduction strategies and climate change, promoting food security for resilience, integrating disaster risk reduction planning into the health sector and promoting safe hospitals. Protecting critical public facilities and implementing recovery schemes and social safety nets. Promoting income diversification options, integrating disaster risk considerations in land-use planning and building codes, and risk assessment in rural development plans;

(e) **Disaster preparedness for effective response:** requires plans for policy, technical and institutional capacities for management and coordination; coordination and exchange of information; contingency planning, allocation of necessary financial resources including an emergency fund. At a general level, the table below outlines some of the foundational requirements of these non-structural and structural risk reduction approaches.

Non-structural elements generally are less expensive than structural measures but require an ongoing outreach effort to society – one-time efforts in public education will be less effective for example than steady, ongoing efforts to build risk awareness and shape behaviors that reduce the risk that the general population (or any segment thereof) will experience loss and damage from a given event of a given expected frequency or magnitude.

Table 2
Foundational Resource Requirements – Risk Reduction Measures

	Non-Structural	*Structural*
Budget	Non-Structural approaches can be relatively inexpensive but must be done on an ongoing basis (e.g. yearly for	Structural measures can be costly (infrastructure) to build and maintain over infrastructure lifespans of 20

	a decade or two)	– 50 years A country must be in the position to finance a large infrastructure investment
Infrastructure or equipment needed	Early warning systems need effective radio or other location-appropriate communications 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 modeling	Hazard information Risk mapping Engineering
Technical capacity (experts, etc.)	Risk communication	Engineering

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

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

Countries with high exposure 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. Retrofitting of schools, homes and hospitals can be undertaken in cost-effective ways with relative high benefits (such as securing roofs of buildings with hurricane straps). For countries with greater financial means, structural protection measures can be beneficial (but should be weighed against ability to pay for and maintain infrastructural measures).

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 materials useful for training and awareness ranging from good practice in sectors like agriculture, school education programs for children, community-based early warning systems, etc.—they will yield benefits through enhanced resilience and reduced impacts of climatic stressors. Countries, but particularly those 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 effective management of loss and damage must be built.

4. Risk retention

Risk retention definition is defined broadly in this literature review as that group of approaches which allows a country to "self-insure" itself against climatic stressors—through activities such as building the resilience of the population through social protection and related measures, or through financial means like 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, cost efficacy, and the consequences and foundational requirements for appropriate risk retention.

Text box 5
Planned Risk Retention – Financial resources for building resilience

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

Social funds. Social funds are publically funded programs 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 build livelihood security and resilience for poor and vulnerable households. **Social funds represent an innovative approach that are 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.

Text box 6
Inadvertent Risk Retention — Responding to crisis and unexpected rebuilding costs

Emergency Assistance Loans. "[An Emergency Assistance Loan] is limited to circumstances where a member with an urgent balance of payments need is unable to develop and implement a comprehensive economic program 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 by specific transactions, such as 'items donated from external donors to recipient', but should include consideration of a) all related international and domestic actions and programs, 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 and (sic) private resources.

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

Rehabilitation is "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.

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

5. What sectors use risk retention?

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 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 measures have been taken in risk reduction and damage must be financed. The purposeful and planned use of risk retention can be part of a balanced set of complimentary approaches to manage loss and damage; however, unplanned and unforeseen expenses can place significant burden on the public sector, one of the greatest disadvantages of (financial) risk retention. Risk retention at the household level can be achieved through savings accounts for example. Financial institutions that offer savings accounts accessible to vulnerable populations are a foundational requirement for that.

6. How cost effective is risk retention?

Risk retention has the characteristic that—in the absence of a manifestation of an extreme weather event or some other climatic stressor—it appears relative inexpensive to establish self-financing mechanisms. However as the table below indicates, the potential costs can quickly outweigh the potential benefits, especially if a country cannot "afford" the potential loss and damage it faces (e.g. if values at risk are highly exposed, if potential climatic stressors are of a magnitude that would overwhelm country capacities to manage, if a country is highly indebted or if it is closely following a particular development goal 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 the interest rates are higher after disasters. One example is the first contingent loan for natural disasters which the IDB approved for the Dominican Republic in 2009 (IDB, 2012).

Table 3
Costs and benefits of risk retention

Potential benefits	*Potential costs*
• In terms of social protection, ability of programs to target specific groups and build their resilience and ability to manage climatic stressors (variety of programs designed to reduce poverty, enhance livelihoods, reduce food insecurity, etc.) • In terms of financial risk retention: Only pay in the case of an actual climatic stressor	• Public funds need to be dedicated to a special "rainy day fund" in case of climatic stressor which otherwise could be used to pursue other public goals • Risk retention, if not planned well or if the losses exceed available funds, require governments to raise post-disaster capital o 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) o Volatility. a country may divert development loans for emergency purposes but this may sacrifice other objectives (roads, health programs, education) o A country may need to take on additional debt burden (internal or international borrowing • Social and political tensions may arise if a climate stressor is manifest and insufficient resources are available in risk retention scheme

Source: Summary of findings from the UNISDR (2011) Global Assessment Report on Disaster Risk Reduction and the IPCC (2007) Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

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

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 with its own social, economic, cultural and other resources.

A "positive" side of planned risk retention includes efforts to increase the social and economic resilience of particular groups through social safety need and social protection programs. 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 prevent such stressors from derailing progress made in a variety of goals like overall improvements in human welfare. The requirements for such social safety net programs include a mechanism to identify and effectively reach particular groups that need support, as well as ongoing monitoring to determine progress of the groups towards "graduation". Social acceptance and political support, in addition to financial resources are needed for investments in resilience.

Although "inadvertent" (unplanned) risk retention is practiced widely, it can have less visible and implicit consequences when loss and damage does occur such as political instability, longer-term drag on economic growth or forfeiting key development goals because the financial means to achieve them may have been diverted to restitution of loss and damage.

Table 4
Foundational Resource Requirements – Risk Retention Measures

	Resilience – building	*Financial risk retention (paying for the impacts)*
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 public budgets exactly when liquidity is in greatest demand
Infrastructure or equipment needed	Targeting programs to reach the right groups Public outreach / education system Monitoring systems	Sound financial planning and financial forecasting Clear legislation to administer funds

Information and data	Hazard information Risk mapping Weather information Forecasting systems and modeling	Hazard information Risk mapping Weather information Forecasting systems and modeling
Technical capacity and planning (experts, etc.)	Social protection and targeting experts	Financial risk management, esp. in public sector

All countries. The foundational requirements for retaining the financial risks associated with loss and damage include strong financial planning, legislative preparation to ensure appropriate funds and use of funds in the case of a climatic stressor. Perhaps the most important requirements are that a country carefully weigh whether it has the financial resources necessary to retain the potential loss and damages it could incur.

Countries with very vulnerable population groups, high debt or low financial capacity. If a country is highly indebted, but faces very low 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 slow growth rates then it may think twice about the prudence of financial risk retention. A balance should be struck between the economic and social goals (and the finances required to achieve them), and the possibility that loss and damage may require a country to sacrifice budgets allocated to achieving such goals in the case of a climatic stressor. There are cases where development loans have been diverted from 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 and should be carefully considered against other options.

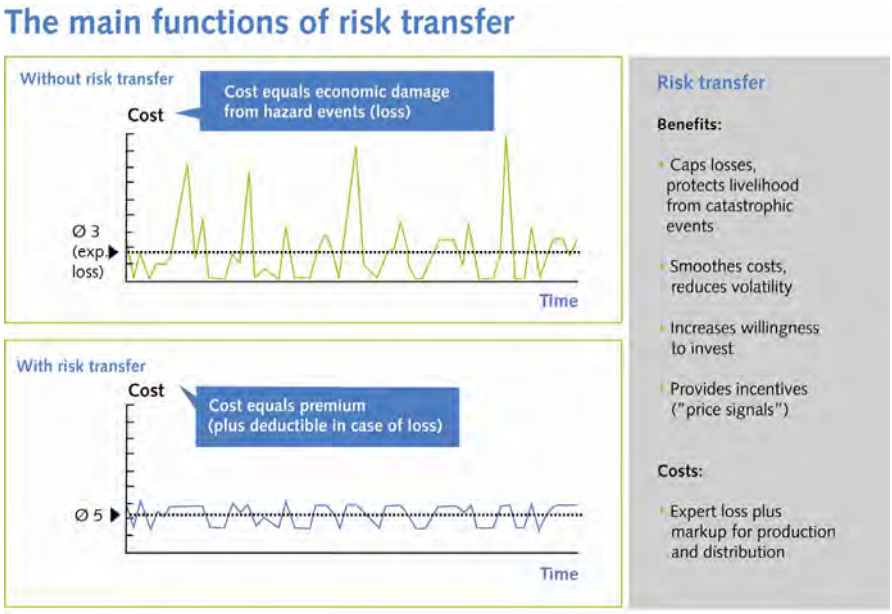
Lower income countries. In the aftermath of heavy devastation in their countries, low-income developing countries may face exhausted tax bases, little reserves and declining credit ratings making external **borrowing** difficult. Planned risk retention can allow countries to bulk up funds in economic better times, which would be available more timely than external aid. Just as the paragraph above indicated, lower income countries may carefully consider social and budgetary parameters—amount of debt desired, budgetary requirements balanced with social and economic goals, 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 a solid risk analysis and risk mapping that indicates to them their risk exposures. Following this an analysis of national financial parameters will help guide decisions on the degree of risk retention that is appropriate for the national context, and the degree of other complementary approaches that could be considered (such as risk reduction and risk transfer).

C. Risk transfer: Financial Risk Management of climatic stressors

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

The graph below (from ECA 2009) illustrates the main functions of risk transfers and outlines how it complements risk reduction and risk retention approaches.

Figure 1
Risk transfer functions, benefits and costs



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

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 when some climatic event occurs—as discussed above this 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 (an insurer, another country or pool of countries, and international financial institution, etc.) with the agreement that if a climatic stressor occurs, then that entity agrees to pay for an amount of the loss and damage. The insurance payout, however, usually does not usually cover the full cost of the damage. On the other hand, an important benefit is that the funds are available faster than external aid, and can be used more flexibly.

Risk transfer does not directly prevent or reduce the risk of damage or loss; however, the financial liquidity provided by this set of approaches can reduce some of the indirect effects of damage, such as human suffering and set-backs to development. Risk transfer approaches help reduce the burden on the public purse to restore public and private infrastructure and services following an extreme weather event (note: almost only used for "events" rather than "processes").

1. What sectors use risk transfer? Public and public-private partnerships.

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

The text box below provides some preliminary definitions of tools that belong to the set of risk transfer approaches.

Text Box 6
Risk transfer – Approaches to share the financial burden of loss and damage

Broad types of risk transfer for weather extremes include the following. Risk transfer / risk 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 loss in return for a premium; if the insured 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 poverty and in some countries car owners are required to purchase automobile liability insurance.

Micro-insurance. Micro-insurance 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. Micro-insurance tends to be provided by local insurance companies with some external insurance backstop (e.g. reinsurance). Micro-insurance 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, where payment is made if a chosen weather-index, such as 5-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 micro-insurance schemes, the Weather-based Crop Insurance Scheme, was established by the Government of India and currently protects more than 700,000 farmers against drought.

Risk pooling. Risks pools aggregate risks regionally (or nationally) allowing individual risk holders to spread their risk geographically. Through spreading risks, 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 earthquake and/or hurricane. The CCRIF was able to secure US$110 million of reinsurance capacity in addition to its own reserves.

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

Catastrophe bonds. A high-yield debt instrument, usually insurance linked, and meant to raise money in case of a weather extreme or earthquakes. It has a special condition that states that if the issuer (insurance or reinsurance company) suffers a loss from a particular pre-defined catastrophe, then the issuer's obligation to pay interest and/or repay the principal is either deferred or completely forgiven.

Source: UNISDR (2011).

2. How cost effective is risk transfer?

The cost effectiveness of risk transfer, compared with 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. This risk layer to be transferred is for more severe and less frequent risks, and where there is some uncertainty. One of the prominent benefits of risk transfer approaches is the ability of tools like insurance to limit losses - at least financial losses - and allow governments a space of certainty within which investments and planning can be undertaken (volatility reduction).

Table 6
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	Public and private funds needed to pay for the costs of risk transfer (such as an insurance premium). Over time, the cost of the premium could be as great as or even slightly exceed the cost of the loss and damage itself.
Caps losses. Risk transfer can reduce volatility of losses. Lower volatility makes it easier to plan for development investments and ensure that those investments are not diverted for unexpected disaster relief efforts.	These funds are needed to cover part of the start up costs for such systems like the installation of weather stations or building up the regulatory and administrative frameworks
Smooths costs for the public sector. Planning ahead and using tools like risk transfer can provide for liquidity when climatic stressors become happen	Some risk transfer tools such as insurance, cat bonds, contingency credit, etc. are "triggered" by a discrete event, rather than a creeping process. Thresholds need to be established which, when passed, can signal that payouts should be made.
A country is ensured that it will have liquidity at the times it is most needed (e.g. in the case of a climatic stressor).	Some residual risk will remain after risk transfer, necessitating careful planning about how these risks will be managed (risk reduction, risk retention, etc.).
The cost of the risk transfer may be less than the costs of retaining risk	
Protects livelihood from catastrophic events	
Increases willingness to invest	
Provides incentives ("price signals") for other kinds of approaches to address loss and damage, esp. risk reduction	

Source: UNISDR (2011) Global Assessment Report on Disaster Risk Reduction**;** IPCC (2007) Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

3. What are the foundational requirements of risk transfer?

Risk transfer approaches require a number of elements for proper design, implementation, and ongoing maintenance. A community, province, country or region consider using risk transfer tools requires a **sound analysis of risks**, including exposure of assets and values-at-risk, vulnerability, and probability of a range of climatic stressors (usually extreme weather events). A combination of ground-data (such as a reasonable met service with time series data about weather parameters) as well as satellite imagery information is needed to establish risk profiles, and the cost of risk transfer relative to the amount of financial protection offered.

Financial capacity at a basic level is needed, including a banking and finance system through which to channel risk transfer payments and payouts efficiently. **A regulatory framework** for insurance is needed to ensure consumer protection (ideally also one that makes provisions for parametric / index based approaches, and for insurance approaches that cater to low-income groups like microinsurance). Reinsurance or other **financial back-up channels** are needed, especially for risk transfer programs that cover low-income segments and covariate shocks like weather extremes, where an entire portfolio is likely to be affected simultaneously. This ensures that if a risk transfer approach is triggered that it is sufficiently capitalized to make all the payout obligations over time.

Table 7
Foundational Resource Requirements – Risk Transfer Measures

	Generalized requirements for risk transfer
Budget	Cost of risk transfer is an equation of the "pure cost of risk", plus the cost of administering the risk transfer
Infrastructure or equipment needed	Weather information and monitoring

	systems
	Forecasting systems and modeling
	Insurance regulation frameworks
	Financial system
Information and data	Hazard information
	Risk mapping
	met service and satellite)
	Risk analysis, risk mapping, hazard- asset- and vulnerability exposures
Technical capacity (experts, etc.)	Risk assessment and modeling experts
	Financial risk, insurance experts

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

Countries with high exposure to slow onset climatic processes. Traditional risk transfer approaches like loss-based insurance payouts may be unsuitable for longer-term foreseeable climate stressors like sea level rise and desertification. Two preconditions for 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, regions and between individuals/entities. For two of the already ongoing changes caused by global warming, that is, sea-level rise and desertification, the "insurability criteria" cannot be fulfilled. Both processes are slow and continuous changes that potentially affect the population of one or more countries. They 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. Further, only rapid and significant reduction of greenhouse gas emissions that lead to global warming could effectively prevent these risks in the long run. For this reason, risk retention and risk transfer alone is hard-pressed to address some of the dire effects of climate change and 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.

Lower income countries. Risk transfer does cost resources in terms of premiums or fees, and investments in necessary information and regulatory frameworks. A risk-layering approach can help low-income countries employ risk transfer approaches selectively. For example, lower income countries may relieve public assistance budgets by setting up risk transfer programs for low-income groups like farmers and herders. Often such programs can be combined with incentives to reduce risk (e.g. through good agricultural practices that reduce erosion, herding practices that reduce animal mortality related to weather stressors, etc.). At the regional level, lower income countries may also find that participation in regional insurance pools (such as the Caribbean Catastrophe Risk Insurance Facility or the Africa Risk Capacity).

D. Managing slow onset climatic processes – Institutions, governance, and other tools

The footnote from 1/CP.16 (Cancun Adaptation Framework) noted that approaches to address loss and damage should consider climatic impacts "including sea level

rise,[3] increasing temperatures, ocean acidification, glacial retreat and related impacts, salinization, land and forest degradation, loss of biodiversity,[4] and desertification.[5]" These slow onset climatic processes are manifest today and they are influenced by climate change as it was assessed in the Fourth Assessment Report of the IPCC (IPCC 2007). This literature review attempts to examine those relevant approaches and draws lessons that could be applicable now and in the future.

Slow onset climatic processes are underway today, and so there are some approaches to examine about how associated loss and damage is addressed, mainly through risk reduction measures and climate change adaptation. For example, there are many experiences in addressing desertification and land degradation through sustainable land management and in addressing loss of biodiversity through ecosystem based adaptation. However, this is probably also the topic under approaches to address loss and damage where most needs to be learned, new approaches tested, and experiences shared, in particular in relation to the applicability of risk sharing measures.

1. What sectors have begun managing slow onset climate processes?

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 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.

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

The regional chapters examine a range of institutional, governance, and other measures used today to manage climatic processes—a mix of examples from which lessons may be drawn. These examples range from relatively new public offices to address climate change impacts (such as climate change focal points within ministries), national committees to monitor and assess current and emerging climatic stressors, national laws about climate change (including slow onset processes), regional agreements on resource management such as regional river basins or human mobility agreements, and other approaches.

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

Much remains to be learned about approaches to address the negative impacts of slow onset climate processes—in this literature review these approaches are least represented. The level of funding that might be required to manage loss and damage related to slow onset climatic processes is highly uncertain and varies greatly between different countries and regions. The degree of connection between natural systems and human systems plays a role in the costs of loss and damage in the longer run, including access to fresh water and habitable, arable land and the ability

[3] Examples of approaches to cope with climate change impacts such as sea level rise are further explored in small island developing states such as the Caribbean Planning for Adaptation to Climate Change and the Coral Triangle Initiative (SIDS, Section 7.2 and 7.5).

[4] Climate change is expected to exacerbate threats to biodiversity, which can result in changes to our ecosystems and population pressure. Despite this, ecosystem-based adaptation is gaining increasing attention which links biodiversity, ecosystem services, and climate change adaptation (Africa, Section 4.3).

[5] While desertification, exacerbated by climate change, affects more than 2 billion people worldwide, greater focus on sustainable land management practices have been placed in both Africa (Section 4.5) and Asia(Section 6).

of the natural system to provide those resources necessary for key societal activities like livelihoods and food security.

Table 8
Costs and benefits of slow onset climate processes

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

Source: IPCC (2007)

How successful individual countries are in implementing adaptation plans will impact significantly on the amount of loss and damage from slower onset climatic processes, though so too will changes in emissions and the rate of climate change itself.

Countries with the highest levels of residual risks are those least able to manage loss and damage in the future. These are also the countries that may be in need of the greatest support to manage loss and damage (Young 2009).

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

The foundational requirements of approaches to manage slow onset climatic processes are not yet fully clear, but some basic elements may facilitate such approaches, including:

(a) Political will;

(b) 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 ways to find joint solutions which are peaceful and equitable.

Table 9
Foundational Resource Requirements – Measures 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, new forms of social organization and population distribution, etc. Such costs will be difficult to finance.
Infrastructure or equipment needed	Communication Community and citizen engagement National dialogue and policy making Regional dialogue	All of the dialogue and planning currently used, plus more intensive regional and national monitoring and coordination approaches Infrastructural measures at new scales Relocation of at-risk populations Transboundary livelihood arrangements in some areas Provisions for fresh water at large scale Large-scale livelihood programs
Information and data	Hazard information Risk mapping Weather information Forecasting systems and modeling Social and physical thresholds	Hazard information Risk mapping Weather information Forecasting systems and modeling Social and physical thresholds
Technical capacity (experts, etc.)	Policy and planning	Policy and planning Infrastructure Weather and climate modeling Thresholds monitoring Economic and financial tools Economic / livelihood alternatives Regional diplomatic relations

E. Enabling environments and managing impacts of climate variability and change

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 have allowed millions access to a set of risk transfer tools.

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

1. Combining approaches to address loss and damage

Combinations of approaches are needed to move from current understanding and knowledge, to an ability to meet future needs related to loss and damage.

Learning effects and innovation. For example, today indigenous knowledge is a valuable source of information about how locally appropriate strategies have been used throughout generations to manage climatic stressors. Yet 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 with local communities in Africa.

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 from climatic stressors. The Bali Action Plan (UNFCCC 2007) calls 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 be effective and to harmonize climate insurance with adaptation, it is essential to align adaptation actions and incentives with prevention and risk reduction.

For example, national laws, institutions and planning processes can help countries set their priorities for managing loss and damage. The foundation for this approach will include basic risk reduction and information about potential loss and damage such as:

(a) Map and avoid high-risk zones;

(b) Build hazard-resistant structures and houses;

(c) Protect and develop hazard buffers (forests, reefs, etc.);

(d) Develop culture of prevention and resilience;

(e) Improve early warning and response systems;

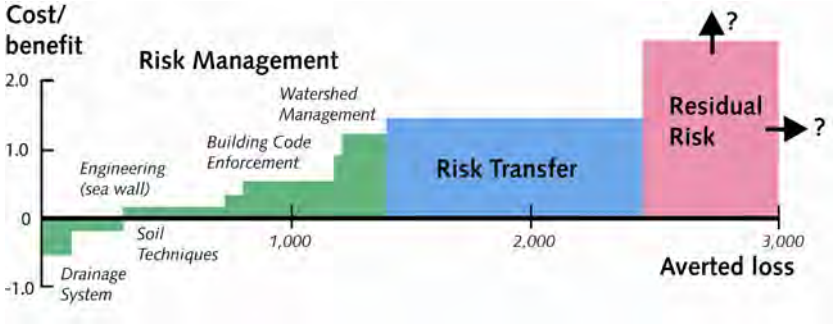
(f) Build institutions, and development policies and plans.

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 approaches to retain parts of its risk (such as through the establishment of social funds, or funds to help self-finance some parts of loss and damage) and transfer parts 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 ameliorate climate change related loss and damage.

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

The figure below illustrates the relative costs and benefits of the spectrum of risk reduction, risk retention, risk transfer, and approaches to manage "residual risks" that will be associated with both weather extremes but in particular slow onset climatic processes.

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



Source: Costs and benefits of investments in risk management (Young 2009, adapted from ECA 2009)

Effective development and risk management is the most cost-effective long-term approach for a variety of risks (Cummins and Mahul 2008). For risk management investments, 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 averted losses exceeds the cost for the measure over a certain time period (such as the lifetime of the investment).

Other kinds of investments such as risk transfer (insurance) are made when risks cannot be reduced further at an efficient rate. Extreme events which happen infrequently but with 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 potential risks and liabilities, state solutions would need to be included in risk transfer solutions with very high severity potential (Arrow and Lind 1970). Such investments involve paying premiums and/or setting aside resources for contingency spending, but make sense when they help 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 funds it needs to address losses when they occur carries a benefit that can exceed these costs.

2. Creating linkages

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

Climate change will necessitate a heightened need to manage, 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 have the responsibility for gathering data about climate-related risks, measure and map risks and raise awareness of them – activities that catalyse and improve overall adaptation efforts and improve the effectiveness and efficiency of limited public and private funding.

National and regional cooperation. 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 of micro- and meso-level, 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 improve the ability of countries to plan and manage loss and damage, and some of this support can 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 issues.

The table below outlines just a few of the innumerable linkages between of 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-run, new approaches may be needed, as the scale of loss and damage changes with more manifest climate change impacts on human and natural systems.

Text Box 7
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. PPPs have also been used for ongoing management and oversight of the pools which require active engagement from both private sector reinsurance partners and government regulators, often as well as additional credit-backing and advisory roles by International Financial Institutions or donor governments

Index-based insurance. As is the case with micro-insurance, 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 administrative and disbursement costs.

Regional pooling. Regional pooling has emerged as a mechanism for increasing the number of policies under coverage which can both lower the costs for policies and eliminate the need for compulsory country schemes

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 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.

Gap: Managing Loss and Damage related to slow onset processes. The major gap exists that innovations today are almost exclusively around management of climatic events, not slow onset climate processes. As some of the potentially greatest loss and damage is expected to come from such slow

processes, there is an urgent need to identify effective combinations of currently-used tools and innovate in approaches to manage slow onset processes.

The examples in this table are approaches that can be combined to achieve more innovative results in avoiding, limiting or better managing loss and damage. Experiences in the chapters below show how approaches like risk transfer (index insurance, regional pooling) have been combined with risk reduction and risk retention. This literature review now turns its attention to many examples and experiences in four regions of the world with approaches to address loss and damage. The vast majority of these approaches are in place today to manage climatic variability (extreme weather events), but some are in place to manage slower onset changes or provide plans or roadmaps for thinking about ways to address the adverse impacts of loss and damage in the future.

IV. Regional Approaches to Address Loss and Damage

This section of the literature review explores the range of approaches outlined above (Section 3, Part I) 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 events (Questions for thematic area 2, from Annex of FCCC /SBI/2011/L.35/Add.1).

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

A. Africa

1. Introduction

In Africa, a range of approaches are currently being used to address loss and damage related to negative climatic impacts. These approaches seek to reduce vulnerability and build resilience, and build capacities 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 impacts related to extreme weather events and slow onset processes. These approaches range from indigenous knowledge and early warning systems to emerging risk transfer schemes, contingency funds as well as investment to address disaster risk in national and local public planning and budgeting (UNISDR, 2011a). Investment in such approaches reduces both the short and long-term impacts of extreme weather and slow onset climatic processes on individual households, communities, and the wider macro-economy, thereby strengthening resilience to climate change impacts (UNISDR, 2011b). Overall, this section will take a closer look at these strategies, offer case studies describing successes and challenges associated with each approach, and will conclude with some gaps in the literature which can be addressed in future analysis.

2. Risk reduction in Africa

Early Warning Systems (EWS)

With increasing frequency and severity of drought and increasing social vulnerability, 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 EWS across Africa. In Africa, several EWS have been developed at regional level including the African Union's Continental Early Warning System which will become fully operational in 2012; the ECOWAS observation and monitoring system and its warning and response network (ECOWARN 2009).

EWS for food and agriculture: There are several national and local EWS in West Africa and the Sahel that take food and nutritional threats into account. For example, Niger's EWS collects food availability and accessibility data twice a year, helping both the government and international community effectively react to the food, nutritional and pastoral crisis that raged in 2010 (FAO, 2011). The Famine Early Warning System Network (FEWSNET)[6] provides early warning and vulnerability 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 briefings and support to contingency and response planning efforts. In Mauritania, following a locust outbreak in 2003 and 2004, surveillance devices were strengthened to allow for regular information gathering, propagation of risk assessment and implementation of adequate response plans (FAO, 2011). In addition, the African Postharvest Losses Information System (APHLIS) uses GIS in food security analysis 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 prioritizing for loss reduction programmes, guidance in development of agricultural policy and the calculation of cereal supply and demand balances of African countries (Rembold et al., 2011).

The Agricultural Information Management System (AIMS) within SADC's Directorate for Food, Agriculture and Natural Resources (FANR) has established a Regional Early Warning System (REWS). REWS provides advance information on food crop yields and food supplies and requirements. The information alerts Member States and stakeholders of impending food shortages/surpluses early enough for appropriate interventions. National Early Warning Units have been established in all Member States to collect, analyse and disseminate early warning information at country level; AIMS produces annual regional Food Security Bulletins and Reports. (SADC. 2010).

Innovative technology: Two case studies are presented by WMO (2006), including the regional Drought Monitoring Centre (DMC) in Nairobi, which monitors drought in the greater Horn of Africa region, and the drought monitoring desk established by the South African Weather Service (SAWS). 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 climate and drought assessment and projection. Furthermore, a long-term climatic information project was started in 1982 and implemented by AGRHYMET and WMO in Mali. The results from the project indicate that 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, analyzing, processing and disseminating climate information, which helps the farmers for decision making in agriculture, reduces the 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).

[6] See http://www.fews.net/Pages/default.aspx

Building local capacity: Munich Re Foundation (2007) presents a case study in Mozambique to highlight the importance of building upon the capacity of local populations in ensuring the security of families and livelihoods. The local, "low tech" flood early warning and response system is based on peoples' own capacities to protect themselves by creating and training local disaster management committees.

Combination of approaches: The African Union, with technical assistance from the World Food Programme (WFP), recently launched the African Risk Capacity (ARC) Project. ARC is an African-owned innovative financial entity that combines contingency funding with early warning and forecasting. Accordingly, Africa RiskView (ARV) was developed as a software application for the estimation of future crop losses and drought impacts on food security, providing African countries with a tool to estimate their financial drought risk and therefore determine the amount of risk transfer funds required from the ARC pool (African Union and WFP, 2012). For the Southern African region, the Agricultural Information Management Systems (AIMS) project combines early warning systems with vulnerability assessments and food security. Networks for a timely collection of climate information are developed, while vulnerability assessments enable a targeting of operations where food insecurity crises and livelihood vulnerability most require it. Additionally, the Regional Food Reserve Facility aims at strengthening disaster preparedness in Southern Africa, including a physical reserve, financial facility and a risk insurance instrument to support farmers in times of disaster including those caused by climate change (SADC, 2010).

Indigenous knowledge

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

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 what crops to plant and where based on sound knowledge of the environment and flexibility in land use, which renders farmers substantially resilient to climate variability (Newsham, Naess and Guthiga, 2011). More recently, indigenous knowledge is being complemented with scientific weather and climate forecasting. For example, a case study from Southern Malawi suggests integrating indigenous knowledge on rain and temperature fluctuation or from the behavior of certain flora and fauna into scientific weather prediction in order to provide more useful information at the village or district level (Kalanda-Joshua, Ngongondo and Mpembeka, 2011).

East Africa: Farmers in Uganda are adapting to the negative impacts of climate change by applying appropriate agricultural technology and methods, such as selecting crop varieties resistant to droughts and flooding, early planting, rudimentary post-harvesting handling techniques, along with intercropping maize, millet and agro-forestry to improve the fertility of coffee and fruit trees (Akullo et al., 2007). In the South-Western highland of Tanzania, farmers use local environmental factors such as early flowering of certain tree species and astronomical factors to predict rainfall (Chang'a, Yanda and Ngana, 2010). The authors of this study suggest that systematic documentation and integration of this knowledge into conventional weather forecasting could help improve the accuracy of seasonal rainfall forecasts under a changing climate.

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, improvement of 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 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 their drying up (Gyampoh, Conway and Persechino, 2009).

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

North Africa: Indigenous knowledge is particularly widespread and important for the management of scarce water resources in arid North Africa. In Morocco, people live within oases relying mainly on traditional water systems (*khattara*), which has been a common form of underground water utilization since several 100 years and managed through traditional water user associations. In Tunisia, a number of traditional water harvesting techniques (such as terraces, *jessour* and *tabias* stone walls) have been revived and complemented with modern technologies in recent years (Bigas, Adeel and Schuster (eds.), 2009).

Infrastructure

Infrastructure – such as roads, bridges, housing, – can play a critical role in building community resilience to extreme climatic events and changes in long-term trends. In Africa, several infrastructure projects and programs have been implemented to improve water efficiency and resilience. The projects range from: solar powered water supply and irrigation systems in Tanzania; wells and community development in Ghana; wells and land dikes for safe water and agricultural production in Mauritania; improved dam and habitat restoration in Mali; integrated rainwater harvesting and management in pastoral communities in Kenya; rainwater harvesting and spring development for better water quality in Uganda; and recycling of waste water for paddy irrigation farming in Tanzania (UNDP and GEF SGP, 2010). Additionally, in response to periods of drought and heavy rains in the last decade, Kenya started the Nairobi Rivers Rehabilitation and Restoration Programme 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 (IPCC 2012 in Field et al,.).

Meanwhile, Egypt has already implemented a range of structural projects designed to withstand current and future climate variability. This includes drains, breakwaters reducing wave heights, beach nourishment, wall reinforcements, and construction of jetties and dykes for the protection of coastal zones (Agrawala et al., 2004).

Despite the measures listed above, 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 basin, which combines several measures for flood management. This includes the establishment of resettlement areas not too far from the productive lowland areas and the installation of elevated support platforms, which can serve as social facilities and as safe-havens or evacuation centers during extreme events (Spaliviero et al., 2011).

Additionally, grain storage provides an adaptation strategy for climate change by ensuring seed stock 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

and agricultural inputs 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, micro-organisms) and physical (e.g. crushing and breaking) damage (SDC and CIMMYT, 2011).

3. Risk retention experiences in Africa

Social protection

Social Safety Nets

Social protection programs are aimed at securing basic needs for 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 program targets two groups: first, it focuses on the chronically poor that need ongoing support to maintain their consumption levels. This group is provided with cash transfers or food payments in exchange for participation in labor-intensive public works projects in order to build community assets. The second target is the 'transient' poor group which requires assistance when faced with localized shocks (Pelham, Clay and Braunholz, 2011). Although the program is still in transition, building 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). Furthermore, the Rural Resilience Initiative (R4) provides a new model which combines the safety net installed through the PSNP in Ethiopia to weather insurance. Particularly, poor households who are highly affected by weather-related shocks, but are not able to pay for insurances, can purchase insurance through their own labor ("insurance-for-work") (WFP and Oxfam America, 2011). Additionally, in support to the PSNP, the WFP and the World Bank are working with the Government of Ethiopia to help develop an integrated national risk management framework through the LEAP project. LEAP combines early warning, contingency planning, and risk profiling and contingency finance to support the flexible scale-up of the national level productive safety nets (UNISDR Africa, 2012).

Cash-transfer schemes

Moreover, there are several cash-based social transfer schemes in Africa, which operate as regular payments of money that 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 program, primarily targeted at orphans and the elderly, has already had a positive impact on a number of districts (UNISDR, 2011b). This program was designed in partnership between the Government of Malawi, UNICEF and the National AIDS Commission (NAC). The preliminary results showed that poor households participating in the program are investing the money to meet immediate basic needs such as food and health, but also in livestock, poultry, seeds and fertilizer, and in small savings (UNICEF, 2008). Nigeria is also implementing a government run-conditional cash transfer program called "Care of the People" (COPE), with the main objective of breaking the intergenerational transfer of poverty and reducing the vulnerability of those living in extreme poverty (Holmes et al., 2011).

Community-led system

Meanwhile, Rwanda demonstrates the benefits of a community-led system of targeting social protection programs. Generally, Rwanda has a number of existing social protection measures including the provision of universal health insurance to 91 percent 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 based on locally relevant criteria, such as the size of land holding. In addition, communities can suggest and lead area-specific programs. Overall, the preliminary evidence shows that poor households can be directly involved in the planning and execution of social protection instruments (ERD, 2010).

Migration and social networks

In Mali, Mauritania and Senegal migrant social networks help to build social capital to increase the social resilience in the communities of origin. Specifically, transfer of knowledge, technology and remittances between the countries of origin and destination countries helped migrants' organizations to initiate and run projects in the food, water and energy sector. In turn, this demonstrated how migration can actually trigger rather than prevent adaptation (Scheffran, Marmer and Sow, 2012).

Ecological sustainability and social resilience

Biodiversity and well-functioning ecosystems provide natural solutions that build resilience and thereby help society 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 (EbA) especially puts forward a strong link between biodiversity, ecosystem services, climate change adaptation and societal resilience. Midgley et al. (2012) present several projects in Africa, where Ecosystem-based Adaptation has successfully been implemented. Among others, these projects include sustainable coastal ecosystem management in Tanzania through ecological infrastructure and local coastal governance, improvement of water security through the creation of work opportunities in cleaning and maintaining river catchments in South Africa, and Namibia's 'bush-to-fuel-project', where farmers are paid to remove the encroaching bush vegetation, while the cut vegetation is converted into wood chips and sold to the private sector as fuel.

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

In Zambia, adaptation to climate change in the form of tree planting leads to farmers' own social protection. In particular, when framers plant trees they protect the soils and crops from drought and erosion, while the farmers' income is enhanced since they are able to protect their cash-crops. Organic fertilization also makes economic sense, as they are the cheaper option compared to chemical fertilizers. Therefore, ecologically sustainable production can lead to increased social resilience of Zambian smallholders (Chaudhury et al., 2011).

Financial risk retention

Based on the experiences of the Ethiopian PSNP (see section on social safety nets above), in the second phase of the PSNP project (2010-2014) a drought risk financing component was introduced to the program. 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 become food-insecure; or if existing beneficiaries require additional months of assistance following weather shocks (African Union and WFP, 2012; Hess, Wiseman and Robertson, 2006). Similarly, the World Bank Treasury started to offer weather derivative products to client countries. The World Bank

intermediated a transaction between Swiss Re and the Government of Malawi in financial drought risk coverage, enabling the import of maize in the case of a national drought-related shortfall in production (has not been used to date) (Syroka and Nucifora, 2010; African Union and WFP, 2012).

The African Risk Capacity (ARC) Project (see also section on early warning) builds on these experiences 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 the ARC allocates money specifically for disaster response, it can eliminate delays in responding to droughts and food shortages, as the countries will not be lacking funds for this purpose. This also prevents the governments from reallocating limited budget resources from other critical country programs to DRM. 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 experiences in Africa

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).

In recent years, there have been number of new approaches and instruments in the insurance sector in Africa. For example, a pilot insurance project in Ethiopia was designed to pay claims to the government based on a drought index that uses a time window between observed lack of rain and actual materialization of losses. This measure was combined with the installation of low-cost automated weather stations. The pilot project increased awareness, understanding of and demand for this type of insurance in the country (Hazell et al., 2010). Although not an approach per se, Norton et al. (2012a) also show that the demand for index insurances in Ethiopia was higher if the concerned farmers participated in experimental simulating games beforehand, which increased financial literacy and the understanding of index insurances among the game participants (Norton et al., 2012b). Another pilot project was conducted in Malawi, which is testing a new way of dealing with drought risk through the use of index-based weather insurance directly to smallholders. Though it is too early to quantify the impacts of this project, interviews show that farmers involved in the project are keen to participate again and some claimed that signing up for this insurance scheme is the preferred way to adapt to variability in climate (Hellmuth et al., 2007).

In 2010 an innovative Index Based Livestock Insurance (IBLI) was introduced in Nigeria. It is based on satellite data which measures the quality of the pastureland every 10-16 days. The data is then incorporated into a statistical model of livestock mortality that the IBLI team developed using historical data from the region. When evolving range conditions predict livestock mortality in excess of a critical threshold (15%) over a predetermined area, the insurance pays pastoralists for their losses, allowing them to manage their individual risk (Carter, Long and Mude, 2011). Similarly, an Index Based Livestock Insurance was tested on a pilot site in Kenya, insuring pastoralists against livestock mortality. Indemnity payments are provided after a shock, when livestock loss has already occurred, based on estimates of forage availability derived from GIS. Payments to damaged clients are a function of area average loss, and not of individual loss. IBLI were well received among the pastoralists and sales went beyond expectations (Mude et al., 2010). Moreover, Traerup (2012) proposes a collective approach to index insurance based on an analysis in rural Tanzania. A collective approach to index insurance is one in which members of informal networks are insured collectively as opposed to individually, decreasing the prevailing barriers to the take-up of insurance.

5. Approaches to address incremental change in Africa

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

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

Policies, legislation and strategies:

In response to floods, the Strategy for Flood Management for the Kafue River Basin was developed in a collaborative and participatory process between WMO, a Zambian expert team and key stakeholders including Government Ministries, local organizations, researchers, NGO's, and local farmers' and fishing associations. The strategy includes various components to be implemented by policy makers such as: flood forecasting system, vulnerability reduction of the floodplain communities through appropriate policies in different sectors, establishment of a Kafue Catchment Council, preparation of watershed development plans and an inter-sector coordination mechanism to plan and implement pre-disaster and post-disaster flood prevention and mitigation measures (APFM, 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, this includes policies on migration of cropping patterns, development of high-temperature-resistant cultivars, reduction in soil productivity loss, cropland expansion, adoption of improved cultivars, and changes in trade patterns. In Mozambique, UNDP and the Ministry of Planning 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 an 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 sub-national 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).

Regarding water governance, the ACP-EU Project 'Improving Water Management and Governance in African Countries' (ACP-EU, UNEP, UNEP-DHI and GWP, 2009) present cases from Gambia, Guinea Bissau and Sierra Leone, which have successfully developed and validated their Integrated Water Resources Management (IWRM) roadmap. The roadmaps aim at raising awareness and promoting the political will to address problems related to water resources, 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:

Aside from the measures listed above, 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)[7] have incorporated climate change adaptation strategies into their national development plans, with three countries indicating that they carry out regional collaboration on strategies such as conservation of generic materials, development and promotion of drought-tolerant species and soil conservation (Makau Nzuma et al., 2010). Furthermore, Tanzania was the first country to locate responsibility for disaster risk management in its economic and financial planning. Particularly, it developed its Zanzibar Strategy for Growth and Reduction of Poverty for 2010–2015 through the Ministry of Finance

[7] The 11 member countries of ASARECA are: Burundi, Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, South Sudan, Sudan, Tanzania, and Uganda.

and Economic Affairs. This has provided a strong push for DRM, from reviewing and harmonizing laws and policies, to infrastructure improvements, capacity building and community-based disaster preparation (UNISDR, 2011b).

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 DRR into development planning, and stakeholder inclusiveness (Field et al., 2012). Aside from this, Egypt has started several coastal protection activities to improve the 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 the National Climate Change Action Plan integrating climate change concerns into national policies (Agrawala et al., 2004).

Namibia established the National Disaster Risk Management Policy 2004, which puts emphasis on disasters of different kinds, severity and magnitude 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 minimise the loss of human life, property and damage to the environment from hazards of natural, technological and ecological origin; and to advocate an approach to disaster risk management that focuses on reducing risks especially to those sections of the population who are most vulnerable due to poverty and a general lack of resources. Furthermore, the Disaster Risk Management Bill has been 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.

Trans-boundary resource management:

Regarding the management and governance of trans-boundary resources, there are several African trans-boundary river basin organizations as well as a number of bilateral or multilateral agreements, for example the Senegal, Niger, Lake Chad, Okavango, Limpopo, Orange and Zambezi basins (Goulden, Conway and Persechino, 2009). The Nile Basin Initiative (NBI) is seen as a first step in addressing trans-boundary dimensions of climate change adaptation, raising awareness and providing training to develop skills in government ministries, non-governmental organizations 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 (OKACOM), has been highly successful as a basin-wide approach to protecting environmental flows in the face of climate change. The project achieved success in strengthening organizations involved in trans-boundary river basin management (USAID, 2009; Le Quesne et al., 2010). Moreover, the Lake Victoria Management Project aims at stabilizing the trans-boundary lake's ecosystem and making it a sustainable source of food, clean drinking water and income. The project is funded by the World Bank and GEF, and implemented jointly by the Republics of Kenya, Tanzania and Uganda (Palaniappan et al., 2010).

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 it is shown with 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 (CBFP) for the integration of adaptation to climate change into policy and planning (UNFCCC, 2007). Composed of participating African countries' forestry ministers, COMIFAC (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).

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

Contingency planning and funding:

Contingency planning is seen as a management tool used to analyze the impact of potential crises and ensure that adequate and appropriate arrangements are made in advance 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 contingency planning for drought events:

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

(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 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, seed distributions) (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 European Union). ALRMP funded a Drought Management Initiative and consolidated a national drought management system with structures at the national, district and community levels. This 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 through the creation of a Drought Management Authority and a National Drought Contingency Fund are also under way (Zwaagstra et al., 2010);

(d) The African Risk Capacity project is principally based on contingency planning. The goal of ARC is to create a facility that allocates resources against probable but uncertain risks. In this way, 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 disaster needs of countries, and each participating country, in advance of joining ARC, creates a contingency plan identifying how ARC funds will be optimized to assist those affected (African Union and WFP, 2012);

(e) In Somalia, contingency planning has also been implemented to prepare for flood events. Several contingency plans for different scenarios were developed, along with an Early Warning System. According to the expected

environmental and food security impacts, the EWS then determines which contingency plan needs to be activated (Choularton, 2007).

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

This literature review 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 these instruments, and their potential for promoting risk reduction and climate adaptation, there are some draw-backs with each approach:

(a) **Risk reduction at community level**. At the community level, people continue to use local knowledge, which provides a valuable foundation in 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 given 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 bio-physical parameters with socio-economic indicators in order to fully characterize drought magnitude, spatial extent and potential impact” (WMO, 2006);

(b) **Risk retention.** Although social protection does not reduce disaster risk in itself, UNISDR (2011b) highlights two reasons as to why it should be part of strategic disaster risk management. First, successful social protection protects household and community assets, helping to avoid disaster losses cascading into other household impacts and outcomes, 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 protect progress, 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 damages from shocks and stresses may not be sufficient in the longer term. For social protection to be resilient to climate change impacts, requires 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 programs can offer affordable economic security to vulnerable communities, UNFCCC (2008) found that fewer than five percent of households and businesses in developing countries actually have insurance coverage for catastrophic risks. Instead, such risks are dealt with by a mix of social networks and informal post-event 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 insurances, but rather on client education 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 adaptations has been noted for the livestock sector in Kenya (Kabubo-Mariara, 2009). Robledo et al. (in press) highlight that unclear land

tenure and legislations forbidding forest use have negative effects on the adaptation of vulnerable populations in Zambia, Mali and Tanzania. Similarly, Drimie and Gillespie (2010) and Jankowska et al. (2012) suggest that the linkages between human (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 and ACPC, 2011). Therefore, as climate change affects many sectors at the local, national and regional level within Africa, policies and legislation will need to become inherently multi-sectoral. The high risk of political tension, civil strife and conflicts related to the effects of climate change on the governance of trans-boundary resources will require multi-level 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 drought management. Contingency planning and effective use of contingency funds needs to be stronger and better integrated with the implementation of livelihood support interventions (Zwaagstra et al., 2010);

(g) **Regional gaps.** For 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 communities of practice between countries that are actively engaged in adaptation projects and those where at present action is lower (Hove, Echeverría and Parry, 2011a). In central Africa, despite many shared climate change challenges, adaptation actions tend to focus on domestic responses to climate change and not on regional actions. Additionally, most policy making 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 given 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). For East Africa, Hove, Echeverría and Parry (2011b) highlight that on-going adaptation initiatives are unevenly distributed, with action in Ethiopia, Kenya, Tanzania, Uganda and Rwanda being significantly greater than action in Burundi, Djibouti, Eritrea and Somalia. Here as well, this situation may create opportunities to foster exchange of knowledge and lessons learned (e.g. through communities of practice).

7. Conclusions on current experiences with approaches to manage loss and damage in Africa

The challenges associated with current strategies to address loss and damage call for:

(a) Improved user-friendliness of, and accessibility to early warning information to promote timely and informed actions by decision-makers and practitioners at different levels;

(b) 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) Integrating 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) Developing 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 as well as local governments; and

(f) Creating a platform for countries to share their lessons learned.

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

B. Latin America

1. Introduction

Latin America is already dealing with climate change impacts, resulting from irregular, unpredictable rainfall patterns, increased incidence of storms and prolonged droughts (Leary and Kulkarni, 2007). The losses associated with hurricanes, droughts, and flooding are growing rapidly -- up to four times the rate of GDP growth. This is a major concern that has motivated many countries in the region to adopt proactive approaches to managing exposure to catastrophes (Andersen et al., 2010).

The first part of this section highlights risk reduction strategies at the national and local level in Latin America ranging from early warning systems, use of indigenous knowledge, building and land use planning, which are employed to manage vulnerable water resources, food security and agriculture. Next, it examines experiences in the region with risk retention strategies including remittances, conditional cash transfer programs, social policies and specific funds designed to absorb shocks. The section then looks at a number of actions used by communities to transfer current levels of risk through financial tools such as innovative insurance schemes, reserves, and catastrophe bonds, placing an emphasis on institutions and organizations, legal frameworks and governance practices used to manage both current and future climate conditions. Several case studies are presented to help illustrate diverse examples of risk management approaches, providing a key reference point for the entire 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—areas where more documentation may be needed or where experiences have not yet been gathered about particular approaches.

2. Risk reduction experiences in Latin America

Early Warning Systems

Effective early warning systems (EWS) are essential in order to prepare for, respond to, and recover from extreme events and disasters. They are immediate and cost-effective measures that can be taken to save lives and livelihoods (FCCC/TP/2008/9). 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 around 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 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 impacts more than its neighbors due to effective EWS and widespread storm education (Brown, 2007). After Hurricane Mitch, a provincial early warning system was set up in

several municipalities of Honduras. In the case of La Masica, this system helped local inhabitants to tackle future natural hazards through 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 the Ministry of Technology and IDB (Planetary Skin Institute.,N.d. Similarly, Latin American countries like Chile are increasingly using statistical data and information portals like the *Sistema de Informacíon de la Diversidad Bilógica y Ambiental de la Amazonía Peruana* (SIMAZONIA) 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 Pueblo Panama includes several actions to mitigate climate change impacts and EWS.Indigenous knowledge

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

(a) The Andes: Communities 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) Bolivia: A century-old irrigation systems – *camellones* – are used during periods of drought. In particular, water is collected in the mountains by way of constructing *qhuthanas*, which are dams collecting and storing water (Galloway McLean, 2010).

(c) Honduras: The village Guarita 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. This method thereby avoids widespread slash and burn techniques and also improves soil fertility (Galloway McLean, 2010).

Infrastructural measures

Structural measures have been used to reduce the effects of climate related extreme events in Latin America such as floods and drought. This includes both interventions that reduce the effects of extreme events such as dikes and embankments, along with strengthening buildings through retrofit programs. For example, the planned or build large dams in Amazonia, Brazil, is an exemplar of large-scale water management. Once this project is complete, it will provide large-scale energy needs and serve major urban centers 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) helped Chile to reduce the risks of drought and fostered water security. The trend still persists whereby Peru, for example, has developed the *Plan Maestro Optimizado* (Investment Master Plans) 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 like the Rímac River Basin in Peru (BMZ, 2010) 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 created in somo cases negative impacts on health, livelihood, forced migration or resettlements, new greenhouse gas emissions and new threats posed by floods and droughts in river basin downstream. (Cesario, Rangel and Andrade-Morraye. 2011).

Sustainable land management measures have also been used by countries to cope with climate change. For example, in Nicaragua farmers make use of contour barriers, green manures, crop rotation and stubble incorporation to tackle climate

change, while in Mexico farmers are testing adaptation measures by implementing drip-irrigation systems, greenhouses and the use of compost (Magrin et al, 2007).

In terms of more community-led initiatives to deal with the adverse effects of climate change, houses in Ecuador are designed using mangle wood and bamboo (that has been used locally for centuries) and which are raised above ground level due to problems of 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 to minimize the amount of material used and to keep the costs down. In turn, this shows how structural measures combined with local knowledge can buffer against the impacts of climate change.

3. Risk retention experiences in Latin America

A number of social protection mechanisms- ranging from conditional transfers, social policies, and special funds- have been adapted in Latin America to protect vulnerable people before, during and after crises. Such mechanisms can indirectly build household resilience and buffer against the impacts of disasters by enabling the accumulation of assets to buffer disaster losses (i.e. Leary and Kulkarni, 2007).

Conditional cash transfer programs

Many countries in Latin America are moving away from ad hoc assistance programs and price subsidies toward well-targeted cash transfers with the aim to reduce poverty in vulnerable households, which are also subject to climate change (Ribe, Robalino and Walker, 2012; UNISDR, 2011). Some prominent examples of conditional cash transfer programs include Brazil's *Bolsa Família* program, which provides small stipends to poor families in exchange for them meeting specific condition including prenatal checkups, maintaining sufficient school attendance or supports girls with a higher scholarship to avoid that they have to stay at home and help their mothers in the household. With 12 million families enrolled, *Bolsa Família* is the largest CCT program (Fried, 2011). Another example is PROGRESA which was introduced by the Government of Mexico in 1997 and re-launched as *Oportunidades* in 2002 (UNISDR, 2011). The main objective of this program is to improve 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). This cash transfer program has helped reduce household vulnerability through asset accumulation and more stable income flows, allowing poor households to better plan their expenses, get credit more easily and pay their debts (Arnold and de la Fuente, 2010). Similar effects have been noticed in conditional cash transfer programs in Colombia (*Famílias en Accion*), El Salvador (*Red Solidaria*), Nicaragua (*Red de Proteccion Social*) and Honduras (*Programa de Asignacion Familiar*) (IPC-IG, 2012).

Furthermore, in Nicaragua, *Atención a Crisis* was implemented from 2005-2006, targeting six municipalities. The program is part of the national Red de Protección Social and aims to provide short-term social safety payments to households affected by drought. The short-term objective of this project was to protect human capital and 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 activity. The program proved to be successful, as after nine months the beneficiary households have protected as well as improved their asset base and hence could better engage in productive activities (UNISDR, 2011).

Funds for natural disasters

In 1996, the Mexican national government established a system of allocating resources for disaster spending (FONDEN) in order to enhance the country's financial preparedness for disaster losses including those caused by climate change events. FONDEN served as a last-resort funding for uninsurable losses, such as emergency response and disaster relief expenditures, in particular payments for

infrastructure that is damaged during a disaster. In addition to this budgetary program, 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 pesos to cover extensive disasters such as recurring mudslides and floods, and needed 25 billion by the end of the year to cover non-assessed losses. To make up for the shortfalls, other government revenues had to be diverted, suggesting that FONDEN is not an all-cure solution (UNISDR, 2011). Mexico has also established the FAPACC, a natural disaster fund dedicated to provide immediate assistance to restore productivity for farmers. It offers contingent payments for damages caused by drought, frost, hail, excess rain, floods and windstorm (UNFCCC, 2008). Aside from this, the IDB grants Contingent Loans for Natural Disaster Emergencies to support countries in their efforts to improve their disaster risk management capability and efficiency (IDB, 2012a). Majority of Latin American countries have asked for these loans (IDB, 2012b). Overall, such loans are expected to allow governments to cover costs during an emergency and in the immediate aftermath of a major events (i.e. expenditures for 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).

C. Risk transfer experiences in Latin America.

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

Insurance

Brazil and Peru: Area-yield index insurance, which aims at providing indemnities to a farmer when the farm experiences a crop loss due to risks affecting yield (Skees, Barnett and Collier, 2008), can be found in Brazil and Peru. For example, in the State of Rio Grande do Sul, the area-yield index insurance provides extensive coverage to farmers and has been well advertised. Similarly, in 2008, La Positive joined with Caja Señor de Luren (Caja) (which has the leading agricultural microfinance credit portfolio in the region) to develop an area-yield index-based insurance program 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).

Bolivia: In Bolivia, an area-yield index insurance called *Fundación PROFIN* has been set-up in four provinces in the North and Central Altiplano regions in which a reference farmer is selected in order to compare whether one's production levels have been adversely affected by environmental factors (Warner et al., 2009).

Mexico: The weather index insurance, *Agroasemex*, was introduced 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 points during key stages of crop growth (IFAD, 2011).

Chile: The Chilean Ministry of Agriculture covers 50 percent of insurance costs to ensure the integration of small farmers into insurance services (Hurlbert and Diaz, n.d.).

Latin America: The Regional Insurance Facility for Latin America (RIFCA) enables countries 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

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 Manizales introduced an innovative collective insurance policy aiming at securing both the public and private sector. 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 to help the most vulnerable people to recover. Meanwhile, the World Bank (2011) highlights the El Niño index insurance project in the coastal region of Piura, which is using highly predictive sea surface temperature values in the Pacific to design innovative insurance coverage for the damages and disruption that El Niño inflicts on Piura's economy. This index is unique because it can signal a severe El Niño event months in advance of its impact on land. Furthermore, payouts are based on a seasonal prediction, so that policyholders receive payment months in advance of catastrophic weather. In turn, this payment can be used to reduce losses and disruptions from the forecasted event. At the moment, the El Niño index insurance is primarily used to increase access to credit in rural areas of Peru, but it also sparked consideration of other applications of forecast index insurance in other areas (World Bank, 2011).

Catastrophe bonds

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

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

Central America and the Dominican Republic: The two have created the Central America Natural Disaster Insurance Facility, initiated by the Inter- American Development Bank and Swiss Re, which provides participating governments with quick access to insurance proceeds following a disaster. It works similarly to the CCRIF, but also offers coverage for hurricane-induced landslides and reflects a more customized approach suited for nations of all sizes, such as weather-related risks for the agricultural sector (Swiss Reinsurance Company Ltd, 2011).

1. Approaches to address incremental change in Latin America

As highlighted in the Global Assessment Report (UNISDR, 2011), development instruments and mechanisms for successful disaster risk management (DRM) and tackling climate change issues need to be facilitated by appropriate risk governance arrangements. With regards to climate change, Latin American countries have strengthened their institutional capacity to tackling climate change issues.

National strategies:

Europe Aid (2009) has identified four institutional means common to Latin America: firstly, Climate Change Units under the command of the International Relations and/or Environmental Quality Directorates (Honduras, Chile, Colombia, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay and Uruguay);

secondly, Climate Change Units (Cuba, Ecuador); thirdly, Directorates or Climate Programmes (Argentina, Bolivia, Brazil, Costa Rica, Ecuador and Mexico); finally, Permanent Inter-Ministerial Committees for supervising and coordinating Climate Change actions (Brazil, Mexico). With regards to the Convention and its Protocol agreements, these national bodies formulate, coordinate and execute measures around climate change.

At the national level, governments have also 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* (CAEM) (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 issues, land management is an important regional issue. The Peruvian government is requiring regional governments to develop Adaptation Plans. 7 out of 24 regions have completed a regional climate change strategy as mandated by national policy. In addition, the Peru SNIP program incentivizes local governments to develop risk management plans. At the national level, Colombia's Integrated National Adaptation Program (INAP) supports Colombia's efforts to define and implement specific pilot adaptation measures and policy options in order to meet the anticipated impacts of climate change (Vergara, 2007).

Multi-level approach:

An emerging trend in Latin American countries is setting-up multi-level approaches. For instance, the Peruvian and Swiss governments have created a program integrating scientific and technological developments into adaptation strategies in Brazil, the government is cooperating with *Rede Brasileira de Pesquisas sobre Mudanças Climáticas Globais* (REDE-CLIMA) (Global Climate Change) to carry out studies on the causes and effects of climate change so that Brazil can find adaptive measures to respond to the problems (MCTI, n.d.). Chile has initiated a "Water dialogue" that is a pilot project aiming at establishing an integrated watershed management by creating a common regional water agenda through cooperation of institutions with various stakeholders (Hurlbert and Diaz, n.d.).

Regional level:

Climate change policies have also been issued at the regional level. For instance, the Sistema de la Intergrácion de Centroamerica (SICA) has issued policies like the 1993 Regional Agreement on Climate Change or the "San Pedro Sula Declaration" (2008), in which the Presidents approved the "Guidelines for the Regional Strategy on Climate Change" (CCAD, 2010). In Central America, the Central American Commission for Environment and Development (CCAD) was established, which consists of SICA's environmental ministries (Keller et al. 2011a). In Southern America, regional action has been limited. Although the Andean Community (CAN) has issued a scoping paper on a strategy for climate change, discussing 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).

2. Analysis of approaches to address loss and damage in Latin America

As outlined above, the literature identifies a number of different measures that Latin America has and/or will take to manage impacts from both extreme as well as slow onset processes. Nevertheless, the literature identifies gaps between needs and action regarding all the risk reduction strategies mentioned:

(a) **Gaps in risk reduction strategies**: Despite the benefits of effective early warning systems, political will to implement sufficient policies and early warning systems seems to be lacking in Latin America (Conger, 2011). This reflects the general finding from the World Meteorological Organization (2010, 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 is still lacking in order to analyze possible future climate scenarios (i.e. Hurlbert and Diaz, n.d.) and the importance of information portals such as SIAMAZONIA are still not acknowledged by governments (Kalliola et al., 2008). With regard to indigenous knowledge, a 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 Northeastern Colombia can no longer rely on horticulture due 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 lose value in the face of El Niño events. Climate impacts have changed, making traditional means to fight floods ineffective (Gila et al., 2009). There is a need to engage the local level, where most disaster occurs, in the DRM planning and implementation;

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

(c) **Issues in risk retention strategies:** Many of the social protection programs listed above are not directly linked to managing extreme events. While they help buffer communities against disaster risk via accumulation of assets to buffer disaster losses, more research is required in this area. Furthermore, a lot of the beneficiaries of this program were children and females, which might also skew the results. Moreover, many policy makers are concerned that recipients might become dependent on the benefits and that such programs 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 can actually decrease the suffered losses from disasters (Wood, 2011). Moreover, Ribe, Robalino and Walker (2012) also comment on how the social protection systems in Latin America have evolved in an ad hoc manner, often producing multiple programs and institutions whose mandates regarding benefits and beneficiaries are unclear (Ribe, Robalino and Walker, 2012);

(d) **Institutional fragmentation:** Institutions lack clear role allocations as the case of CEAM in Mexico shows, there is a lack of cooperation in charge of water management, leading to insufficient enforcement of water laws (UNESCO, 2006). Similar findings were made in the cases of Honduras, Brazil, Costa Rica, Nicaragua and Argentina, where independent actions by water stakeholders lead to fragmentation (OAS, 2006). Additionally, while laws have been established to help poor households, they are still considered the most vulnerable to the impacts of climate change and do not actively participate in the decision-making process. In Peru, for instance, low income groups are often excluded from political decision-making in Tumaco (Lampis, 2010);

(e) **Existing governance arrangements are still not effective in 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 DRM, several short-comings remain. For example, in Sonora, Mexico, where 87 percent 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 by the authorities regarding drought risk management and poverty reduction of local communities (UNISDR, 2011). Moreover, long-term risk reduction strategies, for example flood barriers to resist 1,000-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.

3. Conclusions on current experiences with approaches to manage loss and damage in LAC

Overall, some Latin American countries have developed efficient disaster risk reduction and adaptation strategies, and some even have broader approaches to address loss and damage. However, as the analysis shows, it is difficult to capture all the different functional scales that climate change, vulnerability, and natural hazards operate on and therefore, no single approach would suffice in meeting such challenges. Some possible suggestions to ameliorate such challenges is to strengthen the technical expertise in planning 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. Scientific evidence also plays a decisive role in the process of collecting data on extreme and slow-onset processes to set up appropriate policies and risk management systems. Regionally, trans-boundary institutions, particularly in South America, need to be able to address loss and damage related to extreme events and slow onset climate processes (i.e. Keller, Echeverría and Parry, 2011; UNISDR, 2011).

D. Asia

1. Introduction

In recent years, Asian countries have demonstrated improvements in disaster risk management and the institutional and legislative arrangements and mechanisms that underpin it. For example, despite more and more people living in flood plains and along cyclone-exposed coastlines in East Asia and the Pacific, mortality risk relative to population size is not only a third of what it was in 1980 (UNISDR, 2011). This section summarizes some of the approaches adopted by Asia to offset the impacts of natural hazards and climatic processes including improvements in early warning systems, indigenous knowledge, building and land use planning, social protection to help vulnerable households, risk transfer schemes, as well as the development of regional and sub-regional strategies and frameworks on disaster risk management. All of these will be further examined below and several case studies will demonstrate how investing in enhancing preparedness and response are paying off. This will be followed by an analysis of the strengths and weakness with each approach to help guide future research.

2. Risk reduction

Early Warning Systems (EWS)

Progress has been made in reporting on early warning for extreme events such as cyclones and floods:

(a) Bangladesh: The country is trying to improve forecasting and warning capacity through the establishment of a Storm Warning Center in the Meteorological Department. Further efforts include enhancing the system’s capacity to alert a wide range of user agencies with early warnings and special bulletins. At the local level, volunteers (who are part of the cyclone preparedness program) receive periodic training and take part in drilling practices for effective dissemination of cyclone

warnings and for raising awareness among the population in vulnerable communities (Field et al., 2012);

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

(c) Bhutan: To provide early warning of glacial lake outbursts, the Department of Energy facilitates only one station in Thanza, with 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 therefore will be replaced with an automatic system through the project "Reducing Climate Change-induced Risks and Vulnerabilities from Glacial Lake Outburst Floods in the Punakha-Wangdi and Chamkhar Valleys". The new monitoring system is composed of gauges monitoring glacial lake bathymetry (depth) and sensors, connected to automatic sirens, are installed along the rivers. Under this project, the automated warning system is planned to be expanded to cover more glacial lakes (Meenawat and Sovacool, 2011);

(d) Indonesia: Jakarta, the capital city of Indonesia, is prone to floods. The former EWS mostly aimed at monitoring upstream flash floods and warning systems was based on information on water levels from several checkpoints, leaving about six hours response time for communities along the river banks. Furthermore, this system did not account for flooding due to extreme rainfalls. As such, the system was improved through a wide-ranging multi-stakeholder process in 2008/09. 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 multi-level capacity building activities. This improved the knowledge and understanding of government officials in charge of issuing warnings and hazard information, and led to community awareness for response, evacuation, and coping measures (ADPC, 2010);

(e) Australia: The Ferny Creek Bushfire Alert System (FCBAS) is an emergency communication system, which transmits warning information through 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 complimented by a community education campaign that has proven to be very effective (UNISDR, 2010);

(f) Nepal: In the flood prone areas of lowland Nepal, a community managed EWS 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 from the national grid system. However, it does not rely on the grid system, which is susceptible to failure during periods of heavy rain, when flooding is most likely to occur. Such measures were complimented by awareness raising activities and training in EWS use and operations (UNISDR, 2010);

(g) Hong Kong: Hong Kong is affected on average by six tropical cyclones a 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 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 proven to be very effective (WMO, 2010).

Indigenous knowledge

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

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

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

(j) China: In the Xinjiang area, Fang et al. (2008) describe the Karez technology for drought disaster reduction. 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;

(k) India: The plantation of bamboo is a disaster management technique adopted by people of Assam, 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 also be used for construction material, and for making crafts and paper (Stephen, Chowdhury and Nath, 2008);

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

Infrastructural

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

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

Aside from the cases listed above, in 2003 Japan launched a major retrofitting initiative in order to reduce the vulnerability of the housing stock to extreme events. The government subsidized two thirds of the cost of evaluating houses and 23 percent of the cost of retrofitting houses constructed before 1981. The Housing Finance Corporation provides a 10 percent income tax deduction and low-interest loans to those who retrofit 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).

Someth et al. (2009) have 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 hinders 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 found that the system was very effective, allowing a total of 1,713 ha of rice production yearly (estimates include both inside and outside the reservoir).

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

3. Risk retention

Social protection

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

(a) India: A public guaranteed employment scheme called NREGA (the National Rural Employment Guarantee Scheme), was implemented across India's six poorest states. It was found that wages received through the program 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 improvement in school enrolment, attendance, and performance – particularly among girls (CPRC, 2011). To enhance the capacity of communities to cope with natural hazards, 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 case of disaster, this extra grain is supposed to mitigate the risk of starvation for around 70 vulnerable families in the area (Concern Universal Bangladesh; Cordaid Netherlands, 2011). Overall, such programs contribute indirectly to household resilience by enabling the accumulation of assets to buffer future disaster losses;

(b) The Philippines: The "4Ps"- Program (Pantawid Pamilyang Pilipino Program) is a poverty reduction and social development strategy of the national Government of Philippines. Conditional cash grants are provided to extremely poor households who are also vulnerable to changes in climate. Families have to send their children to school and pregnant women and children have to get regular health checkups, to receive the cash grants which compensate costs for education and health care. Households are selected through the National Household Targeting System for Poverty Reduction (UNESCAP, 2011). Today, the program is the largest social protection program in the Philippines and has produced good targeting outcomes;

(c) Indonesia has implemented a conditional cash transfer program, Keluarga Harapan. Poor households enrolled in the program receive money based on school attendance of children, prenatal checkups for pregnant women, 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 program has shown positive results as school enrollment and immunization increased in households participating in the program (Schelzig Bloom, 2009). Another measure in Indonesia is the implementation of Experimental Climate Field Schools, which serve as a form of improved extension service. In

2005/6, 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, crop choices and their adaptations (Winarto et al., 2008);

(d) The "Enhancing Resilience" programme in Bangladesh has the objective to strengthen 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 flood plains in the north-west and the 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 community-based assets to protect development gains. Altogether about 420,000 people are reached (WFP; SDC, 2011).

Financial risk retention ("self insurance")

(e) An example of an informal insurance scheme in the Filipino culture is a customary that communities support bereaved families. Especially in rural areas, the informal risk sharing of funeral costs is widespread. The amount given depends on the wealth status of the household and the intensity of the personal relationship. The contribution (*Abuloy*) covers usually only the funeral costs and leaves little resources for the bereaved family to readjust their income strategies. 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 is made on how this self-insurance scheme can be used to address loss and damage associated with the adverse effects of climate change, informally it can help communities buffer against financial shocks experienced after disasters, including as a result of climate change, by pooling their resources.

Funds to absorb shocks

(f) A key tool that enables communities to participate in planning and implementing of post-disaster reconstruction is the setting up of special funds. In Sri Lanka, NGOs and community organizations which 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, encouraging organizations to cooperate with one another. The primary objective of this 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).

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

4. Risk transfer

Insurance

In recent years, there have been a number of new approaches and instruments in the insurance sector in Asia. For example, both Mongolia and China are experimenting with index-based livestock insurance programs. In Mongolia, the program 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, a contingent credit provided by the World Bank (Suarez and Linnerooth-Bayer, 2011).

In 2008, a joint index insurance pilot was launched by WFP, IFAD and the Ministry of Agriculture in Yanhu (village in Chenfeng). The policy covered the entire rice crop of 482 households and protects 85 ha of rice with a total insured value of US$56,000. So far, the project was judged as being promising, also due to the strong commitment and collaboration between the Chinese government and the insurer (Hazell et al., 2010).

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

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

In Thailand, an index insurance full-scale pilot project was set up in Pak Chong district in 2007, aiming at maize farmers and addressing drought risk. In 2008, the project covered 388 farmers near 11 weather stations in five provinces of Thailand. Additionally, the insurance companies offered farmers different contract variations, including choices in starting date, sum insured and premium. The project has had a strong demonstration effect and has generated wide interest (Hellmuth et al., 2009). Additionally, as a result of collaboration between MicroEnsure and the Malayan Insurance Company Ltd., the Typhoon Weather Index is the first micro level typhoon index insurance product offered for 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 tracks within a defined distance from the insured farm location. The height of the payment is based on the maximum wind speed at the closest point. In 2009, the Micro level Typhoon Index Insurance Cover was introduced for rice farmers in Panay Island. A total of 446 farmers bought voluntary cover in 2009 (FAO, 2011).

5. Approaches to address incremental change Asia

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

Multi-level approach:

In October 2010, 50 Pacific and Asian regional governments agreed to make risk reduction part of their national climate change adaptation policies and jointly

address the increase in severe weather events. A five-year regional roadmap, 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 this roadmap include sharing information on new technologies, integrating disaster risk reduction into sustainable development policies, and raising awareness on hazards and risks (UNISDR, 2011).

The Lower Mekong Initiative was created in 2009, by the Lower Mekong Countries, in cooperation with the US. Its objectives are to enhance joint efforts in the fields of environment, health, education, and infrastructure development. The U.S. assists in developing environmental programs 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 education support with exchange programs for students and assistance to health care (U.S. Department of State, 2012).

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

National level:

In China, the Emergency Response Law was adopted on August 30, 2007 and functions as the central legal document governing all disaster-related efforts (Field et al., 2012). Along with this, the China Agriculture Special Task Force (AESTF) is a programme of the Government of China with support of UNDP to link farmers more directly to improved technology, latest business models and product markets." Common interest economic entities" are formed that help to integrate farmers, especially in disadvantaged areas, into the market economy. The AESTF has managed to cover over 1,800 countries in China, benefitting over 60% of the large rural population. Furthermore, the average annual income of farmers profiting from the AESTF services increased by 67% compared to their income in 2006 (UNDP, 2011). Aside from this, the Philippines Disaster Risk Management Development Policy Loan with a Catastrophe Deferred Drawdown Option (IBRD - US$500 million) was approved in 2011 (World Bank, 2011b). Although it is too early to indicate progress on the policy, some expected outcomes include: mainstreaming climate change adaptation and disaster risk reduction measures, training programs 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 Program on Climate Change in which priorities for actions and policy making on mitigation and adaptation are described. Under this 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).

In 2007, a national multi-sectoral platform for DRR was established in Sri Lanka, the National Disaster Management Coordinating Committee (NDMCC). It is composed of senior executives from public and private sector organizations, media, academics, I/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. The NCDR consists of 34 members (e.g. ministries, agencies, 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 disaster risk management and to discuss important matters in relation to disaster management. It formulates and promotes the Basic Disaster Prevention Plan, Earthquake Countermeasures Plans, and urgent measures plan for major disasters. Opinions on DRR are offered to the Prime Minister and Minister of State for Disaster Management (Sharma, 2009).

Regional level:

A regional project entitled "Coastal and Marine Resources Management in the Coral Triangle of the Pacific" has been implemented in Timor Leste, Papua New Guinea, Solomon Islands, Fiji, and Vanuatu, Federated States of Micronesia and Palau. Objectives of the project are 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 raise capacity to respond to the adverse impacts of climate change on marine and costal ecosystems (Dohan et al. 2011). The project "Increasing Climate Resilience through Drinking Water Rehabilitation in North Tajikistan" is implemented in seven cities of Northern Tajikistan. In the project area, water supply is of poor quality and supply and delivery infrastructures have been poorly maintained. Measures implemented by the project include encouraging more efficient water use, more reliable and climate resilient water sources, the rehabilitation of water supply infrastructure, and reformation of water utility management (GEF 2010).

The conservation of mangroves and associated habitats is seen as an important natural adaptation strategy. The Pacific Mangroves Initiative aims at increasing the resilience of people of the Pacific Islands to climate change and to improve their livelihoods. Data is collected and analysed to enhance the national baseline information which feeds into 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. In 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

In Indonesia, the Inter-Agency Standing Committee (IASC) has prepared guidelines on inter-agency Contingency Planning (CP) to ensure comprehensive humanitarian response plans. Objective of the CP 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 IASC Contingency Plan "Chapeau" was drafted in 2011.The 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. In the plan, it is determined where responsibilities should lie in the Government, NGOs, and the private sector. In the national budget, there is provision made for funding of disaster reduction activities and a contingency fund to meet the immediate needs of disaster relief, at all administrative levels. Another scope of the plan is to ensure an effective system within the Government to link and coordinate the processes of planning and the management (Government of the People’s Republic of Bangladesh, 2010). Japan has developed a Total Disaster Management System, which is built up of a cycle of prevention, mitigation, preparedness, response, recovery and rehabilitation. In the Disaster Countermeasures Basic Act, the roles and responsibilities of government at national and local levels and relevant stakeholders in the public and private sectors are clarified (OECD, 2009). India has developed the Drought Crisis Management Plan in 2012 in which early indicators for drought are

summarized and a Crisis Management Framework with an overview of responsible departments is given (Ministry of Agriculture. Government of India. 2012).

6. Analysis

As outlined above, the literature identifies that Asia has taken various risk management and adaptation strategies for extreme as well as slow onset processes, but 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 variability. 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, resulting in greater fatalities during Cyclone Sidr's landfall in southwestern coastal Bangladesh. With regard to structural measures, active participation from local residents helps 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 earthquake retrofitting program in Japan despite the generous tax breaks and loans offered by the government (Okazaki, 2010). In turn, 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 conditionalities. These include a lack of trained staff, IT constraints, lack of health facilities and schools, makes it difficult for households to take advantage of cash-transfer programs in Asia. Moreover, there is often a lack of transparency of the selection process, as well monitoring and verifications systems are not systematic enough;

(c) **Risk transfer**. At the local level, households and businesses in Asia are increasingly gaining access to insurance programs 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 accommodated by "credit plus" elements such as training and skill development, 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 DRM through stand-alone projects and programs. Further studies need to show how governments are using existing institutional capacities to bring this forward, along with a stronger focus on slow-onset events and long-term planning.

7. Conclusions on current experiences with approaches to manage loss and damage in Asia

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

E. Small Island Developing States (SIDS)

1. Introduction

Small Island Developing States (SIDS) have 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 narrow range of resources, high population density that increases the pressure on already limited resources, relatively

small watersheds and threatened supplies of fresh water, costly public administration and infrastructure and limited institutional capacities and domestic markets. Moreover, due to the coastal zone concentration 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 to offset the impacts of climate change. This section will examine a broad suite of risk reduction and adaptation strategies ranging from early warning, indigenous knowledge, land use, to social protection and innovative insurance schemes to manage extreme events. This will be followed by the necessary institutional and legal frameworks and practices used to manage both extreme and slow-onset events. It will also offer several case studies showing the success and challenges associated with each particular risk management strategy. Lastly, it will conclude with some gaps posed by literature which can be further addressed in future analysis.

2. Risk reduction experience in SIDS

Early Warning Systems

Effective early warning systems (EWS) are essential in order to prepare for, respond to, and recover from extreme events and disasters. UNISDR (2011a) pointed out that for such systems to be effective, requires an assessment of likely risks and impacts associate with the hazard. Particularly, efforts have been taken by SIDS to strengthen assessment of likely risks and impacts associated with natural hazards:

(a) **Jamaica, Cuba, Trinidad, Tobago, and Guyana** have developed National Disaster Management Databases, to prepare and help recover from natural disasters (Overmars and Gottlieb, 2009). Furthermore, in 2000 the Finnish Government and the World Meteorological Organization officially launched the SIDS- Caribbean Project – Preparedness to Climate Variability and Global Change in Small Island Developing States, Caribbean Region. The main aim of this 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 helped promote public awareness and preparedness to damages inflicted by climatic events (WMO, 2005). Furthermore, in Jamaica informational campaigns have been conducted for informing the public about risks and preparation measures. These initiatives have achieved varying degrees of penetration, and focused on the most frequent events such as hurricanes. Some case studies suggest that the population at risk proved reticent to respond to evacuation instructions and appeals to move to shelters even in relation to the most frequent events including those that had recently led to disasters (ECLAC, 2007);

(b) **The Caribbean**: The Catastrophe Risk Insurance Facility (CCRIF, 2012) has set-up an SMS warning system in which policy holders are informed about possible weather changes via their mobile phones, giving people time to make 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. This system integrates earth observations (e.g. satellite imagery) and forecast models together with on-the-ground data and knowledge to inform regional decision making around 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 in regional government decision-making (Adaptation Partnership 2012);

(c) **The Pacific:** A water monitoring system was established in the Pacific called the **Hydrological Cycle Observation System's (HYCOS).** This project is designed to assist water agencies in 14 Pacific island countries to develop their knowledge and strengthen their resources and technical capacity to collect hydrological data and carry out water resource monitoring.[8] This is done through

[8] For further information on HYCOS please visit their website: <hycos.org/index.php/home>.

hands-on training of staff and new equipment and technology, among other things.[9] 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 Provincial Development and Multi Ethic Affairs, 2009) (projects in all the major watersheds are still ongoing, thus it is too early to highlight the results). Vanuatu has established a Climate Change Unit within the Vanuatu National Meteorological Service (Wickham, Kinch and Lal, 2009), which serves as a focal point for any climate change activities, including early warning system. Aside from this, a Geonode interface has been developed for the Pacific through Pacific Catastrophe Risk Assessment and Financing Initiative, which is a joint Initiative between World Bank, Asian Development Bank and South Pacific Applied Geoscience Commission (SOPAC). This allows the general public to access risk maps, hazard maps and exposure data through the web, 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. In turn, the Navua Local Level Risk Management (LLRM) Project was set-up in order to build upon a previous project, which was an early warning system for flood. The Navua LLRM project extends the early warning system initiative to work closely with the community, local organizations and various levels of government to reduce the area's risk to flooding (Gero and Dominey-Howes, 2010).

Indigenous knowledge

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

(e) *Jamaica:* Farmers in Jamaica employ a number of coping strategies to reduce damages 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 as well as the harvesting and storage of produce. This strategy displayed strong adaptive and coping capacities in the aftermath of a storm (Campbell and Beckford, 2009);

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

(g) Papua New Guinea: Some villages in Papua New Guinea use the *Garamut* (traditional drum) to announce warnings and/or meetings where disaster risk reduction strategies are discussed (Mercer and Kelman 2010). Furthermore, in Manam Island and in Baliau (a village in Papua New Guinea) communities use oral traditions in form of legends, visions and stories to warn against extreme weather events (Mercer and Kelman, 2010).

Infrastructural

SIDS are using a number of structural measures to reduce the effects of extreme events. This includes upgrading vulnerable settlements in ways that 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 income and low cost buildings were re-designed 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 runoff, household roof-water and grey water (Anderson et al., 2011). This approach compensates community-based approaches to landslide risk reduction

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

and could be applicable to vulnerable communities in the developing world. In 2009, the Fiji government allocated F$5.5 million for self-help projects, divisional development projects and rural housing assistance, aimed at reducing urban-rural migration resulting from natural disasters (SOPAC, 2009).

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 as opposed to building sea walls (UNISDR, 2011a). After hurricane Ivan in Jamaica, communities placed concrete blocks on the top of zinc roofs to prevent the 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 events (ECLAC, 2007).

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

3. Risk retention experience in SIDS

Social protection

Some SIDS has adopted social protection mechanisms to protect vulnerable populations before, during and after disasters. For instances, in Solomon Island, after a tsunami in 2007, intra and inter-community initiatives, mainly in the form of social events (e.g. memorial feasts, sport carnivals) and collective actions (e.g. voluntary work), were used by communities to cope with shocks and changes after disasters hit (Schwarz et al. 2011).

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

Funds for disasters

The IDB grants Contingent Loans for Natural Disaster Emergencies to support countries in their efforts to improve their disaster risk management capability and efficiency (IDB, 2012a). Majority of Caribbean countries have asked for these loans (except for French Guiana, Cuba, Barbados, Saint Lucia, Jamaica, etc.) (IDB, 2012b). Overall, such loans are expected to allow governments to cover costs during an emergency and in the immediate aftermath of a major events (i.e. expenditures for 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

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

In the past few years the Government of Vanuatu has released several supplementary budgets for disaster purposes. For example, supplementary was released in 2009 for just over VT110 million in response to several disasters. However, donor funds were also provided but in these instances, unfortunately, not tracked. As a result, the total response effort in monetary terms is not attainable.[10] Moreover, in the Cook Islands, the Cabinet approved the establishment of an emergency fund for disaster relief allocating an initial one off payment of NZD 200,000 in June 2011. To ensure the growth of this fund, the government is looking for potential sources of annual contributions.[11]

Financial risk retention

Several Pacific islands have set up sovereign wealth funds (SWF), as financial instruments that can help 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 to buffer against climate change. Additionally, Tuvalu Island has secured an agreement with New Zealand (under Pacific Access Category and Temporary Labor Scheme) for seasonal work employment. Particularly, up to 75 citizens of Tuvalu are granted access to work in New Zealand each year (International Labor Organization, 2010). This approach helped the country to retain and secure its financial resources after natural disasters (Veitayaki, manoa and Resture, 2007).

In the Caribbean, Haiti's plans to secure economic activities in rural areas includes, targeting the high risk area (agricultural damage, irrigation infrastructure or road damage), strengthening and consolidating infrastructure and funds from the Caribbean Catastrophe Risk Insurance Facility (FAO, 2009). Specifically, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) issues cat bonds for the island states of the Caribbean. The coverage was for relief funds that could be paid out immediately after a catastrophe, but were not intended to provide a substitute for long-term relief. To date, the CCRIF has paid out seven claims totaling about US$32 million (World Bank, 2011).

In 2007, the World Bank established the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) to develop disaster risk assessments tools and practical technical and financial applications to reduce and mitigate the countries' vulnerability to natural disasters. This 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 it is the Pacific Disaster Risk Financing and Insurance, which provides the Ministries of Finance and Planning with tailor-made advisory services to help improve their macro-economic planning against natural disasters and develop a national disaster risk financing strategy as part of their broader disaster risk management and climate change agenda.

4. Risk transfer experience in SIDS

Insurance

The most prominent example of a financial tool used to support post-disaster needs is the Caribbean Catastrophe Risk Insurance Facility (CCRIF), which was established in 2007. This is the first world-wide regional catastrophe pool, which provides government with immediate liquidity in the aftermath of extreme events

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

(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 events.[12] CCRIF uses a catastrophe model to estimate the loss for any actual event, as well as to price the insurance contract and evaluate risk. Specifically, the 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 Saint Lucian and Dominican governments received CCRIF's first payouts with a total of US$0.9 billion to finance urgent post-recovery efforts after a major storm that shook the eastern Caribbean (UNISDR 2011a). In the case of cyclone Earl (August 2010), Anguilla was provided with some early warning forecasts on the potential impact of Earl by the Caribbean Catastrophe Risk Insurance Facility (CCRIF). As a result, emergency agencies were put on standby and emergency shelters were opened in advance of the storm. CCRIF thereby also offers the use of an index to estimate losses caused by hazards, thus enabling payouts to be calculated quickly (Hellmuth et al. (eds), 2009).

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

Aside from this, Dominican Republic was the first to receive money from the Inter American Development Bank's Contingent Credit Facility for natural disaster emergencies. Specifically, the Bank "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, both Central America and the Dominican Republic have created the Central America Natural Disaster Insurance Facility, initiated by the Inter- American Development Bank and Swiss Re, which provides participating governments with quick access to insurance proceeds following a disaster. It works similarly to the CCRIF, but also offers coverage for hurricane-induced landslides and reflects a more customized approach suited for nations of all sizes, such as weather-related risks for the agricultural sector (Swiss Reinsurance Company Ltd, 2011).

5. Approaches to address incremental change SIDS

In order for disaster risk management to be successful, there needs to be strong institutional arrangements, legislation and policy for disaster risk management and climate adaptation (UNISDR, 2011a). Particularly, this review found a number of institutional arrangements and strategies developed by the government (sometimes in partnerships with NGO's) to manage disaster risk in SIDS.

National Action Plans

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

The Pacific Islands Framework for Action on Climate Change was developed to improve and upgrade policies, tools, institutional capacity and governance, to monitoring climate change processes and variability present (SPREP, 2006). Furthermore, the Government of Kiribati is currently finalizing corresponding adaptation options to develop an Adaptation Action Plan. These adaptation options are based on three criteria: an understanding of the risk level; current controls in

[12] For further information on CCRIF please visit their website: <http://www.ccrif.org/>.

place to manage the identified risk; and potential barriers and opportunities to implementation (Simpson et al., 2009).

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

In the Dominican Republic, the government has created institutions and policies that are solely 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 CDM and adaptation in the Dominican Republic (MEPD and CNRE, 2010).

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

Regional level

Papua New Guinea and Salomon Islands collaborated to strengthen data collection for sea level rise within what is known as the Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security, CTI-CFF (CROP, 2011). Along these lines, CTI-CFF countries (including the two listed above) have developed a Region-wide Early Action Plan for Climate Change Adaptation (REAP) as the first deliverable of the CTI-CFF. The aim of the Plan is, amongst others, to put in place effective adaptation measures for coastal communities, investing on the ability to conduct climate change vulnerability assessments, and to plan for improved coastal community resilience.[13]

The Cayman Islands established a National Hurricane Committee (NHC) to respond to tropical cyclones. It consists of a public-private partnership that manages hurricane disaster risk reduction. The committee was successful in 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. This framework formed the basis for the development of Hazard Management Cayman Islands. Although no direct partnership exist with other territories, Cayman Islands continues to participate in regional activities and programs where possible.[14]

The Caribbean Community and Common Market (CARICOM) has set-up a series of projects that have helped to understand the region's vulnerability to climate change, build capacities, engage in adaptation planning, support mainstreaming of adaptation into policy processes, and begin implementation of adaptation measures such as: the "Caribbean Planning for Adaptation to Climate Change" (1997–2001); "Adaptation to Climate Change in the Caribbean" (2001–2004); "Mainstreaming Adaptation to Climate Change" (MACC) (2004–2009); and the "Special Program on Adaptation to Climate Change: Implementation of adaptation measures in coastal zones" (2007–2011) (Medeiores et al., 2011).

[13] For further information on CTI -CFF please visit their website: <http://www.coraltriangleinitiative.org>.

[14] For more details please see the national progress report on the implementation of the Hyogo Framework for Action (2009-2011) for the Cayman Islands - Interim. Submitted for Global Assessment Report 2011. Accessed at PreventionWeb: <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/hfa/15945_cym_NationalHFAprogress_2009-11.pdf>.

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 in flood-prone and landslide areas (UNISDR, 2011a).

Joint initiatives

The Tonga Joint National Action Plan for Climate Change and Disaster Risk Management 2010-2015 (NSAP) was established two years ago and funded by the Global Environment Facility through the United Nations Development Programme, ACP-EU Natural Disaster Facility through the Pacific Islands Applied Geoscience Commission (SOPAC) and the Secretariat of the Pacific Regional Environment Programme (SPREP). Through the process of developing this joint initiative and by involving national experts on vulnerability and adaptation, along with government ministries and NGOS, allows the sharing of information, build capacity, and foster a better understanding of climate change adaptation and disaster risk management (Kingdom of Tonga Disatser Reduction Programme and (SOPAC) Pacific Islands Applied Geoscience Comission. 2012.).

The Pacific Adaptation to Climate Change Project was initiated in 13 participating countries in efforts to promote climate change adaptation as a prerequisite for sustainable development in the Pacific. The project focuses on building capacity of the participating countries to adapt to climate change in key development sectors including: coastal zone management, food security, and water resource management. Specifically, the project is divided by country with: Fiji, Palau, Papua New Guinea and the Solomon Islands focusing on food security; Cook Islands, Federated States of Micronesia, Samoa, Tokelau and Vanuatu, developing coastal management capacity; and Nauru, Niue, Republic of Marshall Islands, Tonga and Tuvalu looking to strengthen their water resource management.[15]

UNDP and World Bank projects

As many small island communities lack the necessary institutional capacity to adapt to climate change impacts, UNDP in collaboration with UNISDR and Least Developed Countries Fund (LDCF) 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 national, provincial, atoll and island levels to enable decentralized and well-informed decision-making.[16]

Under UNDP's 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 (CCA) and Disaster Risk Reduction Measures (DRM)' programme. The aim is to strengthen the public service and communities' response to climate change through: implementation of on-the ground adaptation and disaster risk reduction measures at the community level; integrating CCA and DRR into wider development processes; and support the implementation of Cook Islands' new National Action Plan for Disaster Risk Management and Climate Change Adaptation.[17] The National Action Plan (running from 2011 to 2015) pools together human and financial resources and addresses issues relating to climate change and natural disasters in the Cook Islands Government of the Cook Islands. 2012)..

Meanwhile, the World Bank has played a leading role in establishing regional and national risk retention measures, introduced with the formulation of the CPACC

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

[16] Visit the Asia Pacific Adaptation Network for further information: <http://www.apan-gan.net/adaptation-database/integrating-cc-risks-into-resilient-island-planning-maldives>.

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

(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 particular 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 program of adaptation to climate change in vulnerable coastal areas (Vergara, 2007).

Analysis

Overall, while this section shows 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, EWS equipment is only found at the Meteorological Centre in Nadi, other parts of the country do not have updated early warning systems (SOPAC, 2009). Moreover, several assessment studies (Anderson et al., 2011; SOPAC, 2009; Overmars and Gottlieb, 2009) indicated that early warning systems have poor hazard monitoring capabilities due to limited institutional capacity, qualified staff, and limited monitoring stations in key locations in the hazard prone areas. Furthermore, EWS must take into account the special needs of various segments of the population (e.g. language, hearing and sight impaired) (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 adopted a 'wait and see' approach. This approach can result in greater losses to some households and businesses that were then caught unprepared when flash floods hit;[18]

(b) **Risk retention**. When it comes to social and financial protection tools, in Fiji the government 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 estimated adaptation needs (Flam and Skaerseth, 2009). With regard to sovereign funds in the Pacific, evidence shows that the sovereign funds' effectiveness has been hampered by lack of integration with the budget, institutional weaknesses, and inadequate controls in the These factors, together with weak asset management, have 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 programs 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 percent stated they had some private savings they would use to offset the flood damage costs. Where households and businesses had no insurance, all losses had to be absorbed personally;[19]

(d) **Approaches to address incremental change**. Some institutional frameworks, (such the one for Pacific Island) do not address or specify the role of each member country (SPREP, 2006), making it difficult to garter political action on climate change. While a number of adaptation projects and programs are being implemented, few are taking place at the national level. Specifically, it has been

[18] See the economic assessment of floods in Nadi and Ba: <http://ict.sopac.org/VirLib/TR0425.pdf>.

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

pointed out that the majority of Caribbean countries are building their adaptation capacity solely through participation in regional and global initiatives. More targeted, discrete adaptation projects at the national level may be appropriate to more appropriately respond to country's individual needs (Medeiores et al., 2011).

Conclusions on current experiences with approaches to manage loss and damage in SIDS

Owing to their small size and high exposure to loss and damage associated with the adverse effects of climate change, SIDS concerns and needs in relation to future climate change will differ from 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 in this region. To date, communities continue to take advantage of local knowledge and early warning systems. Additionally, measures have been taken in developing new policies and improving institutional capacity to deal with both extreme and slow-onset events. Moreover, there is greater collaboration both between SIDS and other countries. Despite these promising initiatives, further research and work needs to be done in this area, particularly in the AIMS were limited references were found.

Today, countries and communities are facing an increasing pace of climate change – manifest in changing magnitude and frequency of extreme events. These events already impose loss and damage which are difficult to deal with by the most vulnerable communities due to uncertainty and volatility of such extreme weather. In the future, even more notable impacts from combinations of extreme weather and slow onset climatic processes are expected to bring more loss and damage.

F. Summary of review: Africa

Country	Category of approach	Name of approach	References (please see the reference list for 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 for income opportunities and prevention of desertification	Brüschweilier and Gabathuler (2006)
Burundi	Approaches to address incremental change (DRM)	Regional collaboration on adaptation strategies (ASARECA)	Makau Nzuma et al. (2010)
DRC	Risk retention (ecological sustainability)	Value of biodiversity (mountain gorilla) for ecotourism development	Midgley et al. (2012)
DRC	Risk retention (ecological sustainability)	Safety nets and local adaptation through trading opportunities in NTFP	Nkem et al. (2010)
Egypt	Approaches to address incremental change (policies)	Laws, policies, and National Climate Change Action Plan adopted	Agrawala et al. (2004)
Ethiopia	Risk retention (social security)	Productive Safety Net Program (PSNP)	Del Ninno et al. (2009); Pelham et al. (2011)
Ethiopia	Risk retention (social security)	Rural Resilience Initiative (R4); LEAP	WFP and Oxfam America (2011); UNISDR Africa (2012)
Ethiopia	Risk retention (financial risk retention)	Second phase of PSNP, 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 (IWRM) roadmap	ACP-EU, UNEP and GWP (2009)
Guinea Bissau	Approaches to address incremental change (policies)	Integrated Water Resources Management (IWRM) roadmap	ACP-EU, UNEP and GWP (2009)
Ghana	Risk reduction (Indigenous Knowledge)	Reviving 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 for rehabilitating degraded forests	Blay et al. (2004)
Kenya	Risk reduction (Early Warning Systems)	Drought Monitoring Centre (DMC)	WMO (2006)
Kenya	Risk reduction (Early Warning Systems)	Radio stations for drought warning	UNISDR (2010)
Kenya	Risk reduction (Structural)	Integrated rainwater management in pastoral communities	UNDP and GEF SGP (2010)
Kenya	Risk reduction (Structural)	Nairobi Rivers Rehabilitation and Restoration Programme	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 (IBLI)	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 (ALRMP) with contingency fund	Zwaagstra et al. (2011)
Malawi	Risk reduction (Indigenous Knowledge)	Integration of indigenous knowledge in 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 elderly	ISDR (2011); UNICEF (2008)
Malawi	Risk retention (financial risk retention)	Financial drought risk coverage (World Bank, Swiss Re, 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 dam and habitat restoration	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 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)	Wells and land dikes for safe water and agriculture	UNDP and GEF SGP (2010)
Mauritania	Risk retention (social security)	Migrants' social networks, investments in well construction	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 palm for income opportunities and prevention of 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)	Governmental conditional cash transfer program (COPE)	Holmes et al. (2011)
Nigeria	Risk transfer	Index Based Livestock Insurance (IBLI)	Carter et al. (2011)
Rwanda	Risk retention (social security)	Community-led system of targeting social protection programs, *ubudehe* system	ERD (2010)
Rwanda	Approaches to address incremental change (DRM)	Regional collaboration on adaptation strategies (ASARECA)	Makau Nzuma et al. (2010)
Senegal	Risk retention (social security)	Migrants’ social networks, investments in water development	Scheffran et al. (2012)
Sierra Leone	Approaches to address incremental change (policies)	Integrated Water Resources Management (IWRM) roadmap	ACP-EU, UNEP and GWP (2009)
Somalia	Approaches to address incremental change (contingency planning)	Contingency plans for different scenarios, coupled with EWS	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 adaptation measures to moisture change	Thomas et al. (2007)
South Africa	Risk retention (ecological sustainability)	Improvement of water security through work opportunities in river catchments	Midgley et al. (2012)

South Africa	Risk retention (ecological sustainability)	Fairtrade and organic small-scale enterprise development (Rooibos tea)	Midgley et al. (2012)
South Africa	Risk retention (ecological sustainability)	Community-based REDD reforestation project for livelihood improvement	Midgley et al. (2012)
South Africa	Approaches to address incremental change (DRM)	DRM Act and National DRM Policy	IPCC (2012)
Tanzania	Risk reduction (Indigenous Knowledge)	Rainfall prediction based on observation of environmental and astronomical factors	Chang'a et al. (2010)
Tanzania	Risk reduction (Structural)	Solar powered water supply and irrigation systems	UNDP and GEF SGP (2010)
Tanzania	Risk reduction (Structural)	Recycling of waste water for paddy irrigation farming	UNDP and GEF SGP (2010)
Tanzania	Risk retention (ecological sustainability)	Sustainable coastal ecosystem management	Midgley et al. (2012)
Tanzania	Risk retention (ecological sustainability)	Traditional rules/laws and community-based management for forest protection	Blay et al. (2004)
Tanzania	Risk transfer	Collective index insurance with informal networks	Traerup (2012)
Tanzania	Approaches to address incremental change (DRM)	Zanzibar Strategy for Growth and Reduction of Poverty (including DRM)	ISDR (2011)
Tunisia	Risk reduction (Indigenous Knowledge)	Traditional water harvesting techniques complemented with 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 spring development	UNDP and GEF SGP (2010)
Uganda	Risk retention (ecological sustainability)	Value of biodiversity (mountain gorilla) for ecotourism development	Midgley et al. (2012)
Uganda	Approaches to address incremental change (DRM)	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/WMO (2007)
Zambia	Risk retention (social security)	Ecologically sustainable agriculture leads to social security	Chaudhury et al. (2011)

Regional			
Africa	Risk reduction (Early Warning Systems)	African Risk Capacity (ARC) Project and Africa RiskView (ARV)	African Union and WFP (2012)
Africa	Risk retention (financial risk retention)	African Risk Capacity (ARC) for risk pooling across Africa	African Union and WFP (2012)
Africa	Approaches to address incremental change (contingency planning)	African Risk Capacity (ARC) as a pan-African contingency funding mechanism	African Union and WFP (2012)
Congo basin	Approaches to address incremental change (trans-boundary res.)	Congo Basin Forest Partnership (CBFP)	UNFCCC (2007)
ECOWAS	Approaches to address incremental change (trans-boundary res.)	Transhumance certificates for trans-boundary mobility across livestock corridors	GL-CRSP (2004); UNDP, UNCCD and UNEP (2009)
Lake Victoria	Approaches to address incremental change (trans-boundary res.)	Lake Victoria Management Project (stabilization of ecosystem)	Palaniappan et al. (2010)
Nile basin	Approaches to address incremental change (trans-boundary res.)	Nile Basin Initiative (NBI)	Belay et al. (2010)
Okavango basin	Approaches to address incremental change (trans-boundary res.)	Okavango River Basin Water Commission (OKACOM)	USAID (2009); Le Quesne et al. (2010)
Sahel	Risk reduction (Indigenous Knowledge)	Local knowledge on weather and climate, local adaptation strategies	Nyong et al. (2007)
Sahel	Approaches to address incremental change (trans-boundary res.)	Increased cross-border trade for food security	SWAC and OECD (2006); Heinrigs (2010)
Southern Africa	Risk reduction (Early Warning Systems)	Agricultural Information Management Systems (AIMS)	Southern African Development Community (2010).

G. Summary of review: Latin America

Country	Category of approach	Name of approach	References (please see the reference list for full titles)
Argentina, Bolivia, Brazil, Costa Rica, Ecuador, Mexico	Approaches to address incremental change	Directorates or Climate Programmes	EuropeAid 2009
Bolivia	risk reduction	Camellones	Galloway McLean 2010
Bolivia	risk transfer	Fundación PROFIN	Warner et al 2009
Brazil	risk retention	Bolsa Família program	Fried 2011
Brazil	risk transfer	Rio Grande do Sul, the area-yield index insurance	IFAD 2010
Brazil	Risk reduction	SIMAZONIA	Kalilloa et al. 2008
Brazil, 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 b
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; Puclaro Dam	Sotomayor 2008
Chile	Risk reduction	*Plan Maestro Optimizado*	BMZ 2010
Chile	Risk reduction	Rímac River Basin (artifically connected lake)	BMZ 2010
Chile	Risk reduction	irrigation systems	Hulbert and Diaz
Colombia	risk retention	Colombia's Integrated National Adaptation Program (INAP; P083075)	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	improving 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, Ecuador	Approaches to address incremental change	Climate Change Units Is this a real approach to be included in this table?	EuropeAid 2009
Dominican Republic	risk transfer	Inter-American Development Bank's Contingent Credit Facility for Natural Disasters	Andersen et al 2010
Ecuador	risk reduction	improving housing design	Matra and Nobre 2006
Colombia	Risk reduction	Sustainable land management	Margrin et al. 2007
Haiti	risk transfer	Microinsurance Catastrophe Risk Organisation (MiCRO)	Swiss Re a
Honduras	risk reduction	Quezunga	Galloway McLean 2010
Honduras	Risk retention	*Famílias en Accion*	IPC-IG, 2012
Mexico	risk retention	Oportunidades	UNISDR 2011; Arnold and Fuente 2010
Mexico	risk retention	FONDEN	IPCC 2012; UNISDR 2011
Mexico	Risk retention	*Red Solidaria*	IPC-IG, 2012
Mexico	Risk retention	*Red de Proteccion Social*	IPC-IG, 2012
Mexico	Risk retention	*Programa de Asignacion Familiar*	IPC-IG, 2012
Mexico	risk transfer	Agroasemes	IFAD 2012
Mexico	risk transfer	cat-bond	Michel-Kerjan et al. 2011
Mexico	risk transfer	multi-cat bond	World Bank 2011
Nicaragua	risk retention	Atención a Crisis	Fernandez et al. 2011
Nicaragua	Risk retention	FAPACC	UNFCCC 2008
Nicaragua	Risk retention	guarantee fund for agricultural insurance (Law No. 28939)	Oft 2010
Peru	risk reduction	waru waru (drainage system)	Matra and Nobre 2006
Peru	risk reduction	*Rede Brasileira de Pesquisas sobre Mudanças Climáticas Globais* (REDE-CLIMA)	MCTI
Peru	risk transfer	el Niño index risk insurance	Khali et al. 2007; Suarez and Linneroth-Bayer 2010
Peru	risk transfer	area yield-index insurance La Positive and Caja Señor de Luren	IFAD 2010
Peru	Approaches to address incremental change	*Comisión del Agua del Estado de Mexico* (CAEM)	UNESCO 2006

Peru	Approaches to address incremental change	"Peasant Community" Legislation	Hulbert and Diaz
Peru	Approaches to address incremental change	Water Dialogue	Sotomayor 2008
Regional			
Brazil (main country mentioned)	risk retention	Contingent Loans for Natural Disaster Emergencies	IDB 20102a
IDB	risk transfer	cat bonds for natural disasters Organizations are needed? In this case many more should be included and not only IDB.	World Bank 2011
IDB	risk reduction	Amazonia dam	IPCC 2012

H. Summary of review: Asia

Country	Category of approach	Name of approach	References (please see the reference list for 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 Center	IPCC 2012
Bangladesh	Risk Reduction (Early Warning Systems)	Cyclone Early Warning	Paul and Dutt 2010
Bangladesh	Risk reduction (Indigenous Knowledge)	Mitigation of Cyclone Impact	Parvin et al. 2008
Bangladesh	Risk Reduction (Structural)	Multi-storied cyclone shelters	Paul and Rahman 2006
Bangladesh	Risk Reduction (Structural)	Raised Earthen Cyclone Platforms for Livestock	Paul 2009
Bangladesh	Risk Reduction (Structural)	Structural Improvements in Communities along River Beds	ISDR and UNDP 2008
Bangladesh	Risk Reduction (Structural)	Dhaka Metropolitan Development Plan	UNISDR 2011
Bangladesh	Risk Reduction (Structural)	Community-Based DRR Programme	Zimmermann and Stössel 2011
Bangladesh	Risk Retention (Social Security)	Enhancing Resilience through Food and Cash for Work and Training	WFP/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 Glacial Lake Outburst Floods Early Warning System	Meenawat and Sovacool 2011
Cambodia	Risk Reduction (Structural)	Ring Dike Reservoir	Someth et al. 2009
China	Risk reduction (Indigenous Knowledge)	Drought Mitigation Technology	Fang et al. 2008
China	Risk Retention (Social Security)	Agricultural Extension Special Task Force	UNDP 2011
China	Risk Transfer	Agricultural Index Insurance	Hazell et al. 2010
China	Approaches to address incremental change	Emergency Response Law	IPCC 2012
China	Approaches to address incremental change	National Platform for DRR	Sharma 2009
Hong Kong	Risk Reduction (Early Warning Systems)	Cyclone Early Warning System	WMO 2010
India	Risk reduction (Indigenous Knowledge)	Bamboo Plantation to Mitigate Flood 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 Cardaid Netherlands 2011
India	Risk Retention (Financial Security)	Community Disaster Resilience Fund (CDRF)	NADRR 2009
India	Risk Transfer	Agricultural Index Insurance	Hazell et al. 2010
India	Risk Transfer	Micro-Insurance Service	Linnerooth-Bayer and Mechler 2007

India	Approaches to address incremental change	Drought Crisis Management Plan	Ministry of Agriculture. Government of India. 2012
Indonesia	Risk Reduction (Early Warning Systems)	Improvement of Flood Early Warning System in Jakarta	ADPC 2010
Indonesia	Risk Reduction (Structural)	Flood Mitigation Infrastructure	Jha et al. 2012
Indonesia	Risk Retention (Social Security)	Program Keluarga Harapan	Schelzig Bloom 2009
Indonesia	Risk Retention (Social Security)	Climate Field Schools	Winarto et al. 2008
Indonesia	Approaches to address incremental change	Contingency Plan	IASC Indonesia 2009
Japan	Risk Reduction (Structural)	Housing Retrofitting Initiative	Okazaki 2010
Japan	Risk Reduction (Structural)	Runoff Control Devices	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 Program 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)	Landslide Prevention and Warning Signs	Thapa et al. 2008
Nepal	Risk Retention (Social Security)	Universal Non-Contributory Pension	UNESCAP 2011
Nepal	Approaches to address incremental change	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 Support for 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
Russia	Risk reduction (Indigenous Knowledge)	Indigenous Knowledge of Herders	Magga et al. 2011
Sri Lanka	Risk reduction (Indigenous Knowledge)	Drought Mitigation Technology	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	GEF 2010
Thailand	Risk Transfer	Agricultural Index Insurance	Hellmuth et al. 2009
Regional			

Asia-Pacific	Approaches to address incremental change	Incheon REMAP	UNISDR 2011
Bangladesh, 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	U.S. Department of State 2012
Pacific States	Risk Retention (Social Security)	Coastal and Marine Resources Management in the Coral Triangle of the Pacific	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
Mekong Basin	Risk Reduction (Early Warning Systems)	Mekong River Flood Forecasting System	MRC 2010

I. Summary of review: Small Islands Developing States

Country	Category of approach	Name of approach	References (please see the reference list for full titles)
Solomon	Risk retention (Social protection)	Social events and collective actions	Schwarz et al. (2011)
Jamaica	Risk retention (Social protection)	GRN health and education programme social (safety net initiative)	Ayala (2006)
Regional	Risk retention (Social protection)	Protective buffers to disaster-affected households	Fernandez et al. (2011)
Regional	Risk retention (Financial)	Sovereign Wealth Funds (SWF)	Maas and Carius (2011)
Solomon	Risk retention (Financial)	Medium Term Development Strategy (2008-2012),	NAPA (2009)
Haiti	Risk retention (Financial)	GLCs and statutory boards	Chowdhury (2008)
Niue	Risk retention (Financial)	Community Lifelines and Community Risk funds	SOPAC (2009)
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)	Caribbean Catastrophe Risk Insurance Facility (CCRIF) issues cat bonds	World Bank, 2011
Pacific Islands	Risk retention (Financial)	Pacific Catastrophe Risk Assessment and Financing Initiative	World Bank, 2012
Jamaica	Risk reduction (Indigenous Knowledge)	Crops protections	Campbell and Beckford (2009)
Fiji	Risk reduction (Indigenous Knowledge)	Shifting cultivation and the indiscriminant use of fire	Veitayaki (2006)
Papua New Guinea	Risk reduction (Indigenous Knowledge)	*Garamut*: (traditional drum) to announce warnings	Mercer and Kelman (2010)
Manam Island	Risk reduction (Indigenous Knowledge)	Traditional orals (legends, visions and stories) to warn against extreme events	Mercer and Kelman (2010)
Antigua and Barbuda	Risk reduction (Infrastructure)	Low income and low cost buildings	UNISDR (2011)
Samoa	Risk reduction (Infrastructure)	Mobile flood barriers and mangroves planting	UNISDR (2011)
Fuji	Risk reduction (Infrastructure)	Self-help projects	SOPAC (2009)
Jamaica	Risk reduction (Infrastructure)	Zinc roof building	UNFCCC (2008)
Eastern Caribbean	Risk reduction (Infrastructure)	Surface water management system (drains to capture surface runoff)	Anderson et al. (2011)
Regional	Risk reduction (Early Warning Systems)	Geomatics technologies (internet mapping technologies)	Sutherland (2010)
Jamaica, Cuba, Trinidad,	Risk reduction (Early Warning Systems)	National Disaster Management Data Bases	Overmars and Beth Gottlieb (2009)

Tobago and Guyana			
Fiji	Risk reduction (Early Warning Systems)	Community based flood early warning systems	Ministry of Provincial Development and Multi Ethic Affairs (2009)
Caribbean	Risk reduction (Early Warning Systems)	SIDS- Caribbean Project – Preparedness to Climate Variability and Global Change	WMO
Vanuatu	Risk reduction (Early Warning Systems)	Climate Change Unit	Wickham et al., (2009)
Regional	Risk transfer (Insurance)	Establishment Caribbean Catastrophe Risk Insurance Facility	ASIS, (2008)
Saint Lucian, Dominican and Haiti	Risk transfer (Insurance)	Contingent Credit Facility natural disaster emergencies funds (from CCRIF)	Andersen et al. (2010)
Caribbean	Risk transfer (insurance)	Climate Risk Adaptation and Insurance in the Caribbean	CCRIF 2011
Dominican Republic	Risk transfer (insurance)	Inter American Development Bank's Contingent Credit Facility for natural disaster emergencies	Andersen et al., 2010
Dominican Republic	Risk transfer (insurance)	Central America Natural Disaster Insurance Facility	Swiss Re, 2011
Cayman Island	Approaches to address incremental change	National Hurricane Committee (NHC)	Tompkins, Lemos and Boyd. (2008)
Jamaica	Approaches to address incremental change	Office of National Reconstruction (ONR)	Osei (2007)
Barbados	Approaches to address incremental change	Soil Conservation Act	UNISDR (2011)
Pacific Islands	Approaches to address incremental change	Upgrade policies, tools, institutional capacity and governance	SPREP (2006)
Samoan and Marianas Islands	Approaches to address incremental change	Pacific Islands Climate Change Cooperative (PICCC)	PICCC (2010)
Papua New Guinea and Salomon	Approaches to address incremental change	Coral Triangle Initiative	CROP (2011).
Mauritius	Approaches to address incremental change	Mauritius for Further Implementation (MSI) and Barbados Programme of Action	UNDESA (2010)
Salomon Islands	Approaches to address incremental change	National Climate Change Policy	Wickham et al. (eds), 2012
Pacific Islands	Approaches to address incremental change	The Pacific Islands Framework for Action on Climate Change	SPREP, 2006
Republic of the Marshall Islands	Approaches to address incremental change	The Republic of the Marshall Islands National Climate Change Policy Framework	Government of the Republic of Marshall Islands, 2011
Dominican	Approaches to address incremental change	*Consejo Nacional para el Cambio Climatico*	MEPD and CNRE, 2010

Republic			
Jamaica	Approaches to address incremental change	Office of National Reconstruction	Osei, 2007
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 Disatser Reduction Programme and (SOPAC) Pacific Islands Applied Geoscience Comission. 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>.
Cook Islands	Approaches to address incremental change	Enhancing Resilience of Communities of Cook Islands through Integrated Climate Change Adaptation (CCA) and Disaster Risk Reduction Measures (DRM)' programme	<http://www.adaptation-fund.org/project/strengthening-resilience-our-islands-and-our-communities-climate-change>.

Risk reduction

Risk retention

Risk transfer

Approaches to address incremental change

Annex

References

A. Part I-III

Arrow, K. J. , Lind, R.C. 1970. Uncertainty and the Evaluation of Public Investment Decisions. *The American Economic Review* 60: pp. 364-378

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

ECA (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, UNEP.

Hellmuth M.E., Osgood D.E., 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. International Research Institute for Climate and Society (IRI), Columbia University, New York, USA.

Hoeppe, P., Gurenko, E. (2007). Scientific and Economic Rationales for Innovative Climate Insurance Solutions, in Climate Policy, E. Gurenko (Ed.) Special Issue on

Insurance and Climate Change.

IPCC (Intergovernmental Panel on Climate Change). 2012. *Managing the risks of extreme events and disasters to advance climate change adaptation*, pp. 512-513. Available at <http://ipcc-wg2.gov/ SREX/images/uploads/SREX-All_FINAL.pdf>

IPCC. 2007. Summary for Policymakers, in M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. 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 University Press, Cambridge, UK, 7-22

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

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

UNISDR (United Nations International Strategy for Disatser Reduction). 2011. *Global* Assessment *Report on Disaster Risk Reduction.* Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/home/download.html>.

UNFCCC. 2007. *Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007, Addendum, Part Two: Action taken by the Conference of the Parties at its thirteenth session.* FCCC/CP/2007/6/Add.1

Young, S. 2009. *Ideas for a Holistic Climate Change Adaptation Framework for COP15.* Caribbean Risk Managers Ltd. Castries.

B. Africa References

ACP-EU, UNEP (United Nations Environment Programme), UNEP-DHI Centre for Water and Environment, GWP (Global Water Partnership). 2009. *Roadmaps for water management in West Africa. Case studies from The Gambia, Guinea Bissau and Sierra Leone Development and implementation of IWRM Plans.* Available at <http://www.un.org/waterforlifedecade/iwrm.shtml>.

African Union and WFP (World Food Programme). 2012. *African Risk Capacity - ARC. Sovereign Disaster Risk Solutions: A project of the African Union.* Summary note. 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: OECD. 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. WLIC, 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 Flood Management). 2007. *Strategy for Flood Management for Kafue River Basin, Zambia*. Lusaka: Associated Programme Flood Management (APFM), 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 change 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 (UNU-INWEH); UNESCO.

Blay D, Bonkoungou E, Chamshama SAO, Chikamai B. 2004. *Rehabilitation of Degraded Lands in Sub-Saharan Africa: Lessons Learned from Selected Case Studies*. IUFRO, FORNESSA, European Commission, ETFRN.

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

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 by the International Institute for Sustainable Development (IISD). Available at <http://www.careclimatechange.org/files/toolkit/CARE_Integration_Toolkit.pdf>.

Carter M, 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 PZ 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. World Agroforestry Centre, Nairobi. 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. Humanitarian Practice Network, ODI. London.

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*. Adapatation Partnership, International Institute for Sustainable Development.

SDC (The Swiss Agency for Development) and CIMMYT (International Maize and Wheat Improvement Center). 2011. *Effective Grain Storage for Better Livelihoods of African Farmers Project*. Completion Report 2008-2011. International Maize and Wheat Improvement Center and Swiss Development Cooperation. Available at <http://repository.cimmyt.org/xmlui/bitstream/handle/10883/1323/96625.pdf?sequence=1>.

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?* IDS Working Paper 320, Institute of Development Studies, University of Sussex, Brighton. 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 0905.The World Bank. Washington DC. Available at <http://siteresources.worldbank.org/SOCIALPROTECTION/Resources/SP-Discussion-papers/Safety-Nets-DP/0905.pdf>.

DFID (Department for International Devlopment). 2009. *Building Consensus for Social Protection - Insights from Ethiopia's Productive Safety Net Programme (PSNP)*. London, UK: Department for International Development.

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*. Adapatation Partnership, International Institute for Sustainable 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.

ECOWARN. 2009. *Report of the Workshop on the "Operationalization of the ECOWAS Peace Exchange"*. Available at < parlcent.org/en/wp-content/uploads/2011/04/research_and_reports/Operationalization_of_ECOWAS_Peace_Exchange.pdf >

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 on E.U. cooperation with Africa*. Robert Schuman Centre for Advanced Studies, European University Institute. Florence, Italy. 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>.

GL-CRSP (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, 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>.

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.* Available at <http://www.wfp.org/sites/default/files/Ethiopia.pdf>.

Holmes R, Samson M, Magoronga W and Banke Akinrimisi. 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. Adapatation 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*. Adapatation Partnership, International Institute for Sustainable Development.

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

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>.

IPCC 2012: Summary for Policymakers. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 1-19.

Jankowska MM, Lopez-Carr D, Funk C, Husak GJ and Chafe Z A. 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, August 2010. Water Partnership Programme, WWF 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*. United Nations International Strategy for Disaster Reduction, Regional Office for Africa. UNISDR Africa: Nairobi.

Linnerooth-Bayer K, Warner K, Bals C, Hoppe P, Burton I, Loster T and Haas A. 2010. Insurance mechanisms to help developing countries respond to climate change. Special issue on Climate Change and its Economic Impact on Insurance, 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*. 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 Climat Change Adaptation – Insights from Policy Processes.* Policy Brief No. 042, November 2011, Future Agricultures Consortium, Brighton, UK. Available at <http://www.future-agricultures.org/index.php?option=com_docmanandtask=doc_downloadandgid=1454andItemid=1055>.

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. In: *Environmental Science and Policy*. 13, pp. 498-508.

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

Norton MT, Osgood D, Madajewicz M, Holthaus E, Peterson N, Gebremichael M, Mullally C, Teh TL. 2012b. *Evidence of demand for index insurance: experimental games and commercial transactions in Ethiopia*. 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 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. European Commission Joint Research Centre, Institute for Environment and Sustainability. JRC/IES/MARS, Ispra, Italy.

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*.

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.; Kettlewell, A. 2011. *Adaptive Social Protection in Rwanda - A No-Regrets Approach to Increased Resilience in a Territorial Planning Context.. Paper prepared for the Conference on "Social Protection for Social Justice" Institute of Development Studies, University of Sussex, Brighton, UK, April 13–15.* Available at <http://www.ids.ac.uk/files/dmfile/Siegeletal2011AdaptiveSocialProtectioninRwanda02CSPconferencedraft.pdf>

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.

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

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*. 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 (United Nations Development Programme), UNCCD (United Nations Convention to Combat Desertification) and UNEP (United Nations Environmental Programme). 2009. *Climate Change in the African Drylands - Options and Opportunities for Adaptation and Mitigation.* New York, Bonn, 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. Kigali, Rwanda, 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 (United Nations Environment Programme). 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*. 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 (The 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 Africa (United Nations International Strategy for Disaster Reduction). 2012. Comprehensive Drought Risk Management in Ethiopia: The Livelihoods, Early Assessment and Protection Project (LEAP). *Africa Informs – Special Issue on*

Drought 2012. Pp.54-55. 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>.

UNISDR. 2011a. *Briefing Note 04 - Effective Measures to build resilience in Africa to Adapt to Climate Change.* 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 Many Lives: Good Practices and Lessons Learned*. Available at <http://www.unisdr.org/files/15254_EWSBBLLfinalweb.pdf>.

USAID. 2009. Okavango *Integrated River Basin Management Project (IRBM). Final Report.* Available at <http://www.okacom.org/okacoms-work/partners-and-projects/projects/partner-projects/irbm/irbm-documents/IRBM%20Final%20Report%20-%20August%2031%202009.pdf>

WFP (World Food Programme) and Oxfam America. 2011. *R4 Rural Resilience Initiative. Five year plan*. Available at <http://reliefweb.int/sites/reliefweb.int/files/resources/R4%20Report%20Jan-March%202012-lowres-051612.pdf>.

Wirkus L and Bo̧ge 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 (World Meteorological Organization). 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*. Adapatation Partnership, International Institute for Sustainable Development.

Zwaagstra L, Sharif Z, Wambile A, de Leeuw J, Johnson N, Njuki J, Said M, Ericksen P, Herrero M. 2010. *An assessment of the response to the 2008 2009 drought in Kenya - A report to the European Union Delegation to the Republic of Kenya*. ILRI: Nairobi, Kenya.

C. Latin America References

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. iadb.org. 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 World Bank for GAR 2011 Report. 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 – Adaptation to natural hazards in the Pacifc Island Region. Prepared by World Bank for Policy Note.* Available at <http://siteresources.worldbank.org/INTPACIFICISLANDS/Resources/Natural-Hazards-report.pdf>.

Brown O. 2007. Climate change and forced migration: Observation, projections and implications. Human Development Report 2007/2008. Fighting climate change: Human solidarity in a divided world. *Human development report office. Occasional Paper,* 2007/17. Available at <http://hdr.undp.org/en/reports/global/hdr2007-2008/papers/brown_oli.pdf>.

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

CCAD (Comisión Centroamericana de Ambiente y Desarrollo). 2010. *Regional Strategy on Climate Change - Excecutive 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, R. Andrade-Morraye, M. 2011. Environmental Change and Health Impacts in Amazonia. *UNDP, IHDP UPDATE.* 1(January): pp. 26-33).

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

Europe Aid. 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>.

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>

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 BolsaFamília. *World Development.* 40(5): pp.1042-1053

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

Ghesquiere, F., Mahul, O., Forni, M., 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 2006. IAT 03-13/3. <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 Choularten 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 >.

Hurlbert, MA and Diaz H. N.d. *Water Governance in Chile and Canada - A comparision of adaptive characteristics*. Available at <http://www.adaptgov.com/wp-content/uploads/2012/03/Hulbert-Water-governance-Chile-and-Canada-A76-TAction.pdf>

IDB (Inter-American Development Bank) 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> **.**

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>.

IFAD (International Found 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* 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>

IPC-IG (International Policy Center 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, M. C., Velázquez, G. A.,Fernández-Equiza, A. M. and Gila, O. A. 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. 2011. *Review of Current and Planned Adaptation Action: Central America and Mexico - Belize, Costa Rica, El Salvador,*

Guatemala, Honduras, Nicaragua, Mexico and Panama. Available at <http://www.adaptationpartnership.org/resource/central-america-and-mexico-current-and-planned-adaptation-action>.

Keller, M., Echeverría, D. and Parry, J.-E. 2011a. *Adaptation Action: Central America and Mexico Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Mexico and Panama.* <http://www.adaptationpartnership.org/resource/central-america-and-mexico-current-and-planned-adaptation-action>

Keller, M., Medeiros, D., Echeverría, D. and Parry, J.-E. 2011b. *Review of Current and Planned Adaptation Action: South America. Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay and Venezuela.* Available at <http://www.adaptationpartnership.org/resource/south-america-current-and-planned-adaptation-action>, 20 May 2012

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>.

Lampis, A. 2010. "Challenges to Adaptation for Risk-Prone Coastal Livelihoods in Tumaco, Pacific Coast (Colombia)", *UGEC Viewpoints*. (3): 18-22.

Leary N and Kulkarni J. 2007. *Climate Change Vulnerability and Adaptation in Developing Country Regions - Final Report of the AIACC Project.* Available at <http://start.org/download/publications/AIACCfullreport.pdf>.

Magrin, G., C. Gay García, D. Cruz Choque, J.C. Giménez, A.R. Moreno, G.J. Nagy, C. Nobre and A. Villamizar. 2007. *Latin America. In Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.): Climate Change 2007: Impacts, Adaptation and Vulnerability. Cambridge University Press, Cambridge, UK, 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 – 3 September 2010. Ohrid: Macedonian Association for Earthquake Engineering (MAEE).

MCTI (Ministério da Ciência, Tecnologia e Inovação).N.d. *Action Plan, T and I 2007/2010* . Available at <http://www.mct.gov.br/index.php/content/view/327296.html>

Medeiores, D., Hove H., Keller, M., Echeverría, D. and Parry, J-E. 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.* Available at <http://www.adaptationpartnership.org/resource/caribbean-current-and-planned-adaptation-action>

Michel-Kerjan E, Zelenko I, Cardenas V, 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=1339069171an

did=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, No. 9 - March 2006

OECD (Organisation for Economic Co-operation and Development). 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, D.V. and Manzano-Torres, I.M. 2009. *Institutional change and climate policy in Ecuador.* Available at <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1593771>, 21 June 2012

Planetary Skin Institute. (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 the Participatory Approach (PRA).* Available at <http://www.dpri.kyoto-u.ac.jp/dat/nenpo/no50/ronbunB/a50b0p20.pdf>.

Skees J, Barnett B, 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 Reinsurance Company Ltd. 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) n.d. *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. UNESCO.* Available at <http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/wwdr2-2006/>

UNFCCC (United Nations Framework Convention on Climate Change). *Local Coping Strategies Database.* Available at <http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=142

&id_hazard=&id_impact=&id_strategy=22&id_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 (United Nations International Strategy for Disaster Reduction). 2011. *Global Assessment Report on Disaster Risk Reduction.* Geneva. 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, R. G. 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" at the Institute of Development Studies, UK 13–15 April 2011. Available at <http://www.ids.ac.uk/files/dmfile/GodfreyWood2011Cashtransfersandclimatechangeadaptation CSPconferencedraft.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>.

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>.

D. Asian References

ADPC (Asian Disaster Preparedness Center). 2010. Indonesia. Many Partners, one System: An Integrated Flood Early Warning System (FEWS) for Jakarta. *In:* ISDR (International Strategy for Disaster Reduction)/ITC (International Training Centre/UNDP (United Nations Development Programme). *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, 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 IIED Background Paper, for the 2011 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, J.-E. 2011. *Review of Current and Planned Adaptation Action: Central Asia. Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan*. IISD. Available at <http://www.adaptationpartnership.org/resource/central-asia-current-and-planned-adaptation-action>

Concern Universal Bangladesh; 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>, 21 June 2012.

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.; Parry, J.-E. 2011. *Review of Current and Planned Adaptation Action: The Pacific*. IISD. <http://www.adaptationpartnership.org/resource/pacific-current-and-planned-adaptation-action>

Fang W, He F, Cai J and Shi P. 2008. 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 (Food and Agricultural Organization of the United Nations) Regional Office for Asia and the Pacific, Bangkok. 2011. *Agricultural Insurance in Asia and the Pacific Region.* 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.; Parry, J.-E. 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*. IISD. <http://www.adaptationpartnership.org/resource/east-and-southeast-asia-current-and-planned-adaptation-action>

GEF (Global Environmental 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 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, M.E.; Osgood, D.E.; Hess, U.; Moorhead, A.; Bhojwani, H. (eds.). 2009. *Index* Insurance *and Climate Risk: Prospects for Development and Disaster Management*. Climate and Society, no. 2. International Research Institute for Climate and Society (IRI), Columbia University, New York, USA. Available at <http://www.preventionweb.net/files/10755_ClimateandSocietyIssueNumber21.pdf>

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

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

Linnerooth-Bayer J, 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.

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

MRC (Mekong River Commission). 2010. *Flood Risk Management and Mitigation in the Mekong River Basin*. Proceedings of the 8th Annual Mekong Flood Forum Vientiane, Lao PDR, 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). Learning's' from the Pilot Initiative in India*. Available at <http://www.preventionweb.net/files/11787_CDRFReportOct2009.pdf>.

OECD (Organisation for Economic Co-operation and Development) 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>

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

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>.

PACS (Poorest Areas Civil Society Programme) 2007. *Status of NREGA Implementation on: 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 BK. 2009. Why relatively fewer people died? The case of Bangladesh cyclone Sidr. *Natural Hazards*. 50: pp.289-304.

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 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*. United Nations International Strategy for Disaster Reduction. 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:* Handayani SW and Burkley C (eds.). *Social Assistance and Conditional Cash Transfers - The Proceedings of the Regional Workshop.* 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, Ly S. 2009. Ring dike system to harness floodwater from the MekongRiver for paddy rice cultivation in the Tonle Sap Lake floodplain in Cambodia. *Agricultural Water Management*. 96: pp.100-110.

Stephen I, Chowdhury RD, Nath D. 2008. 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, 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. 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 (United Nations Development Programme). 2011. *Poverty Reduction. Scaling up Local Innovations for Tranformational Change. China Agricultural Extension Special Task Force*. Available at <http://www.undp.org/content/dam/undp/library/Poverty%20Reduction/Participatory%20Local%20Development/China_AESTF_web.pdf>

UNESCAP (Unite 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 (United Nations International Strategy for Disaster Reduction) and UNDP (United Nations Development Programme). 2008. *Linking Disaster Risk Reduction and Poverty Reduction. Good Practices and Lessons Learned*. Available at <http://www.preventionweb.net/files/3293_LinkingDisasterRiskReductionPovertyReduction.pdf>.

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

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

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

WFP (World Food Programme) and SDC (Swiss Agency for Development). 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, Y.T.; Stigter, K.; Anantasari, E.; Hidayah, S.N. 2008. Climate Field Schools in Indonesia: Improving "Response Farming" to Climate Change. *Leisa Magazine*. 24(4): pp. 16-18.

WMO (World Metrological Organization). 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 and Results Philippines Disaster Risk Management Development Loan With a CAT DDO* (P125943). Available at <http://wwwwds.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 State (SIDS) References

Adaptation Partnership. 2012. *Assessing Climate Change Vulnerability and Building Resilience in the Agricultural Sector to Promote Economic Development and Food Security. March 2012.* An Adaptation Partnership Workshop.

Adaptation Partnership. 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.* Available at http://www.preventionweb.net/english/professional/publications/v.php?id=25341

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.* Inter-Regional Inequality Facility Policy Briefs 4. 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.*

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 Partnership (n.d). *Projects: **F**ish Sanctuary Awareness and marker Bouys.* Available at
<http://www.caribsave.org/index.php?id=5>.

CROP (the 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>.

CCRIF (the 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>.

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): 161–183.

DFID (Department for International Development). n.d..*DRR and Climate Change Adaptation Support Fund.* Available at
<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 studies of five countries.* Summary Report. Available at
< http://www.eclac.org/publicaciones/xml/2/41482/resumingfinal.pdf_frances.pdf >

FAO (Food and Agriculture Organization of the United Nations). 2009. *Resilience of Rural Communities to Climatic Accidents: A Need to Scale Up Socio-Environmental Safety Nets.* 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 K.H and Skaerseth J.B. 2009. Does adequate financing exist for adaptation in developing countries? *Climate Policy.* 1: pp.109-114.

Gero, A., K. Méheux and D. Dominey-Howes. 2010. *Disaster risk reduction and climate change adaptation in the Pacific: The challenge of integration.* ATRC-NHRL Miscellaneous Report 4. University of New South Wales

Government of the Cook Islands. 2012. *Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation (JNAP) 2011– 2015.*
Available at:
<http://www.sprep.org/attachments/Climate_Change/Cook_Islands_JNAP.pdf>

Government of the Republic of the Marshall Islands. 2011. *National Climate Change Policy Framework.*Available at
<http://www.sprep.org/attachments/Climate_Change/RMI_NCCP.pdf>

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

Hellmuth, M.E.; Osgood, D.E.; Hess, U.; Moorhead, A.; Bhojwani, H. (eds.). 2009. *Index* Insurance *and Climate Risk: Prospects for Development and Disaster Management*. Climate and Society, no. 2. International Research Institute for Climate and Society (IRI), Columbia University, New York, USA. Available at <http://www.preventionweb.net/files/10755_ClimateandSocietyIssueNumber21.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 (Inter-American Development Bank) 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> .

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

Kingdom of Tonga Disatser Reduction Programme and (SOPAC) Pacific Islands Applied Geoscience Comission. 2012. *The Kingdom of Tonga.. Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management 2010–2015.* Available at <http://www.sprep.org/att/irc/ecopies/countries/tonga/66.pdf>

Le Borgne, E. and Medas, P. 2007. *Sovereign Wealth Funds in the Pacific Island Countries: Macro-Fiscal Linkages.* 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, J-E. 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. Available at http://www.preventionweb.net/english/professional/publications/v.php?id=25341

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 Provincial Development and Multi Ethic Affairs. 2009. *Good Practices in Fiji Flood Management. Expert Group Meeting on Innovative Strategies Towards*

Flood Resilient Cities in Asia-Pacific. Available at <http://www.unescap.org/idd/events/2009_EGM-DRR/EGM-FIJI-PAPER.pdf>.

MEPD (Ministerio de Economía, Planificación, y Desarrollo) and CNRE (Consejo Nacional de Reforma delEstado). 2010. *Anteproyecto de ley: Estrategianacional 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>.

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>.

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>.

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.

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, M.C.,1 Scott, D.,2 New, M.,1 Sim, R.,2 Smith, D.,1Harrison, M.,3 Eakin, C.M.,4 Warrick, R.,11 Strong, A.E.,4 Kouwenhoven, P.,5 Harrison, S.,3 Wilson, M.,3,6 Nelson, G.C.,7 Donner, S.,8 Kay, R.,9, Geldhill, D.K.,4 Liu, G.,4 Morgan, J.A.,4 Kleypas, J.A.,10 Mumby, P.J.,11 Christensen, T.R.L.,4 Baskett, M.L.,12 Skirving, W.J.,4 Elrick, C.,12 Taylor, M.,13 Bell, J.,13 Rutty, M.,2 Burnett, J.B.,14 Overmas, M.,15 Robertson, R.7 and Stager, H.,2. 2009. *An Overview of Modelling Climate Change, Impacts in the Caribbean Region with contribution from the Pacific Islands*, United Nations, Development Programme (UNDP), Barbados, West Indies

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

SPREP (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 Reinsurance Company Ltd. 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.

UNFCCC. 2008. *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries.* Available at

< http://unfccc.int/resource/docs/publications/impacts.pdf>

UNISDR (United Nations International Strategy for Disaster Reduction). 2011a. *Global Assessment Report on Disaster Risk Reduction. Geneva*. 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.* Available at <http://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/hfa/15722_atg_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, 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, 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>.

Wickham F, Clarke J, Yee D and Pauku R (eds.). 2012. *Solomon Islands National Climate Change Policy 2012—2017.* For the Solomon Islands Government through the Ministry of Environment, Climate Change, Disaster Management and Meteorology. Available at <http://www.sprep.org/attachments/Climate_Change/SI_Climate_Change_Policy.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>.

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. n.d. *Pacific Catastrophe Risk Assessment and Financing Initiative. Phase II: 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>.

WMO (World Meteorological Organization). 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.

F. Additional References for SIDS: Not cited but relevant

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.

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. *J Clim*. 22: pp.71–92.

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

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.

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

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 (MECDM)

Yamano H, Kayanne H, Yamaguchi T, Kuwahara Y, Yokoki H, Shimazaki H and Chikamori M. 2007. Atoll island vulnerability to flooding and inundation revealed by historical reconstructions: Fongafale Islet, Funafuti Atoll, Tuvalu. *Global and Planetary Change.* 57(3-4): pp.407-416.