Working with a Changing Climate, Not Against It

Hydro-Meteorological Disaster Risk Reduction (DRR):
A Survey From Lessons Learned From Resilient
Adaptation to a Changing Climate

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Hydro-Meteorological Disaster Risk Reduction: A Survey of Lessons Learned for Resilient Adaptation to a Changing Climate

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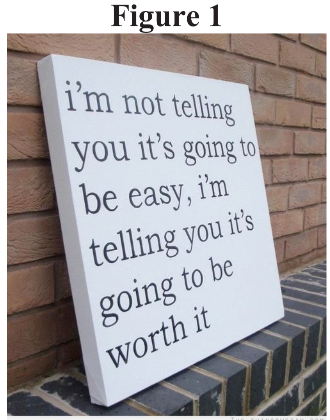
QUICK SUMMARY

INTRODUCTION

How societies approach a number of issues concerning risk that involve interactions between the natural and socio-economic worlds are strongly influenced by a belief that science, especially technology, "will save us." Today societies expect to save themselves from the anomalous behavior of a variable and changing climate through such new technologies. This perspective is often reinforced by a distinction that is still commonly made between the "physical" and the "social" sciences with the former being based on "hard" facts while the latter is being based on debatable (or so-called "soft") findings. The general belief by policy makers that "technology in the answer," should evoke the response "But what was the question?" What this means is that the belief that physical science is ***the*** answer, however, overemphasizes the role of technology and runs the risk of drawing attention away from the equally important societal dimensions of disaster risk reduction (DRR).

Figure 1



Source: www.thethingswesay.com

At local to global levels, DRR is hard to achieve, despite many positive programs and other efforts to protect human lives and livelihoods, as well as the ecosystems and the built environment on which societies depend. Recognizing the continued prevalence of this distinction between the natural and the social sciences enables one to understand the lessons learned about hydro-meteorological DRR efforts in the face of a changing and uncertain climate future.

What is, What Ought to be, and What could be

British historian E.H. Carr (1939) highlighted the differences between what was desired from the international politics at the time period between WWI and WWII (1919-39); that is, the “what ought” to have been, and what the actual politics turned out to be. The “what is” vs. the “what ought to be” analytical model that resulted from his analysis can be usefully applied to hydro-meteorological hazards and disasters. For example, an institution’s published plans for programs for its DRR projects or for its longer-term development (CCA) efforts can be assumed to represent its highest expectations for success. Its publications represent that organization’s understanding of “what ought to be” accomplished from its support. To be sure, however, most often circumstances arise that cause projects to fall short of those most desired (idealistic) outcomes. Unforeseen constraints, obstacles, intervening variables and the like tend to impinge on the best intentions of project stakeholders in producing what the reality of the actual world becomes—the “what is.”

Figure 2 “what is” vs. the “what ought to be”

Towards Climate-proofing

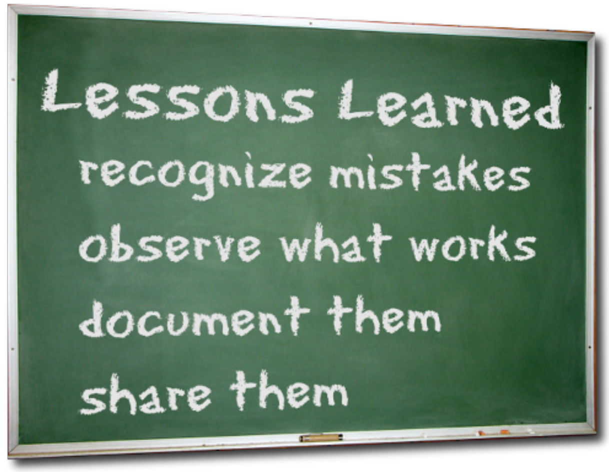
New technologies, which are constantly being designed or proposed to protect society from the vagaries of atmospheric and environmental processes, can be thought of as attempts toward “**climate-proofing**.” But there is as yet no cure-all technology that can assure a society that it has been protected from the adverse impacts of a variable, extreme or changing climate.

A climate-proofed society represents “what ought to be,” the societal goal that is often sought in theories, reports and campaign promises but that is, in the end, likely unattainable. However, steps *towards* climate-proofing can be effective and must certainly be pursued. Therein lies the societal challenge of effective DRR. The notion of “**satisficing**” merits consideration with regard to climate-proofing. Satisficing involves being satisfied with an outcome by sacrificing the “perfect” for the “good enough,” which can save lives and reduce economic losses. For those hazards that cannot be avoided, governments can work toward preparing societies to resiliently adapt to the consequences of a changing climate. Satisficing represents realistically “**what could be**”.

“Lessons Identified” are not the same as “Lessons Learned”

Lessons are more easily identified than learned, a difficult-to-challenge statement. For an identified lesson to be considered learned it must be evaluated, tested and—if truly useful—applied. Of course, at the end of reports can be found lengthy lists of recommended actions that should be taken to improve upon whatever activities were assessed in those reports. Those recommended actions are typically synopsized in the final report’s executive summary. When one reads the full report closely, however, many other take-home messages (i.e. potential lessons) can be identified within the text that had not been highlighted as lessons even though they still meet all the criteria for being considered as such. In other words, many more lessons are embedded in a document than are labeled as lessons or appear as recommendations.

Figure 3 Lessons Learned



Why Bridge and Blend DRR and CCA

UNISDR defines DRR as "The concept and practice of reducing disaster risks through systematic efforts to analyze 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" (UNISDR 2013a). According to a UN official, however, "Only 4% of the estimated $10 billion US [in 2006] in annual humanitarian assistance is devoted to prevention" (Schwartz 2006). A shift toward prevention through preparedness and capacity building at the community level will require a much larger percentage of assistance devoted to DRR.

Hydro-meteorological extremes such as severe storms, floods, flash floods and droughts are responsible for a major share of disasters around the globe annually and an increasing number are measuring up as "**Superstorms**." The apparent increase of such events in recent years has prompted longer-term (CCA) development specialists to turn their attention away from the distant future and back toward the present realities of humanitarian agencies (DRR) to see how such agencies are responding to disaster situations. The CCA community is aware that extreme hydro-meteorological events are likely to change in frequency, intensity, magnitude, location and extent of societal impacts. In addition, CCA specialists are concerned about how emergency and humanitarian responses in the short to mid-term might significantly affect an ability to achieve gains in broader longer-term development objectives.

A primary challenge, facing humanitarian and development organizations, centers on developing more effective linkages between DRR and CCA. More generally, development researchers are repeatedly making calls for "**mainstreaming**" DRR and CCA within development policy.

Bridging short-term humanitarian and longer-term development planning and activities has been identified by the USAID, among other organizations, as central to the success of new policy guidance to build resilience. To this end, attention now focuses on how to bridge DRR and CCA efforts among different organizations and even within them. To be sure, there is an ongoing conflict between here- and-now emergency and humanitarian risk-reducing preparedness and response to hydro-meteorological hazards and disasters and sustainable development planning for an uncertain climate future.

Some of the principle challenges to the integration of DRR and CCA include fragmentation of funding and implementation of resources, entrenched interests at different spatial and temporal scales, differing systems of norms, and different kinds and sources of knowledge as well as of funding (Birkmann & Teichman 2010). DRR could benefit from CCA's proactive approach, which might better ensure that risk reduction projects incorporate changing climate scenarios into their programs and actions. By such means, a longer-term perspective for DRR could increase the longer-term resilience of projects that will eventually be affected by climate change.

DRR programs can reduce the ever-present risk of enormous social, cultural and psychological burdens associated with hazards and disasters, not only in terms of protecting lives and livelihoods but also in terms of reducing the economic and psychological costs at household to regional and transboundary levels. Sharing with stakeholders the notion of "satisficing" would help to better match expectations about DRR with what can realistically be achieved.

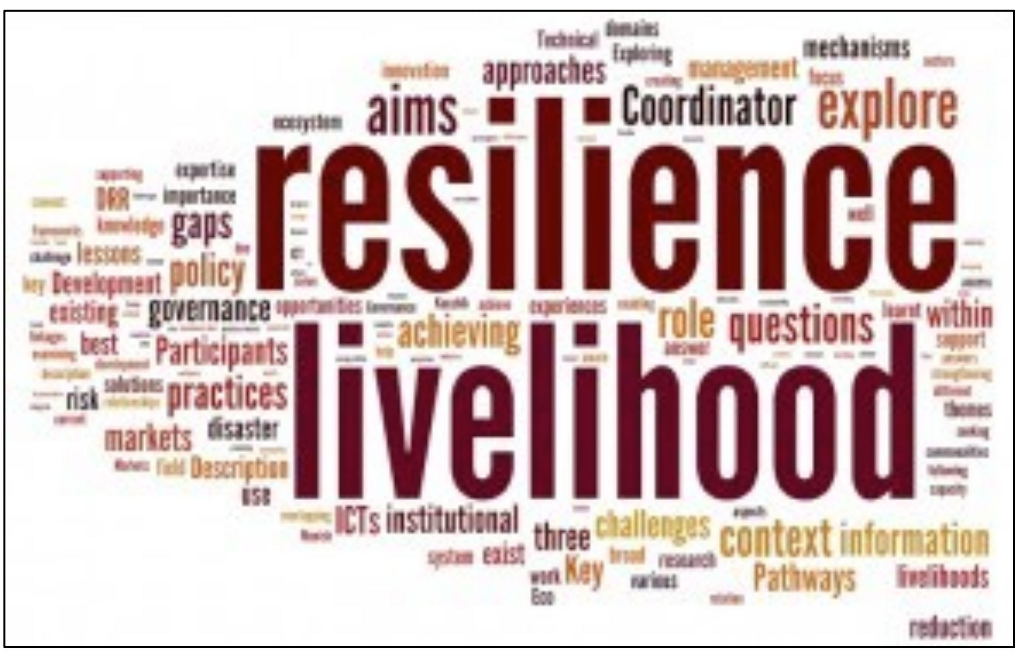
Effectively bridging (or blending) DRR-related preparedness planning mechanisms with CCA initiatives can help to mitigate, if not altogether avoid, many of the complications that tend to arise along development pathways when disasters impinge on community development programs, forcing alterations, if not setbacks, in development prospects.

Bridging DRR and CCA is a necessity. However, even more necessary is blending their overlapping concerns, while they continue to pursue different but equally important missions. One possibility might be to go beyond bridging by creating a fund that would be designated for blended DRR-CCA activities in which the partners drawn from both "camps" truly demonstrate their collaboration.

Resilience and Resilient Adaptation

USAID's 2012 report *Policy Guidance for Building Resilience to Recurrent Crisis* is a potential bell-weather for the CCA and DRR communities. The document reflects a realization among international assistance organizations of the need to shift focus from adaptation to "resilience." The shift toward resilience is a marked departure from previous trends in development, that emphasized at one time or another, the concepts of vulnerability, adaptation, and sustainable development. The relationship between vulnerability and resilience is of particular interest because of the widespread use of the former in the development community. Resilient communities are likely to remain vulnerable to changing hydro-meteorological hazards. Hazards can also be expected to appear where they had not occurred before, increasing the exposure of relatively resilient communities.

Figure 4 Resilience Word Cloud



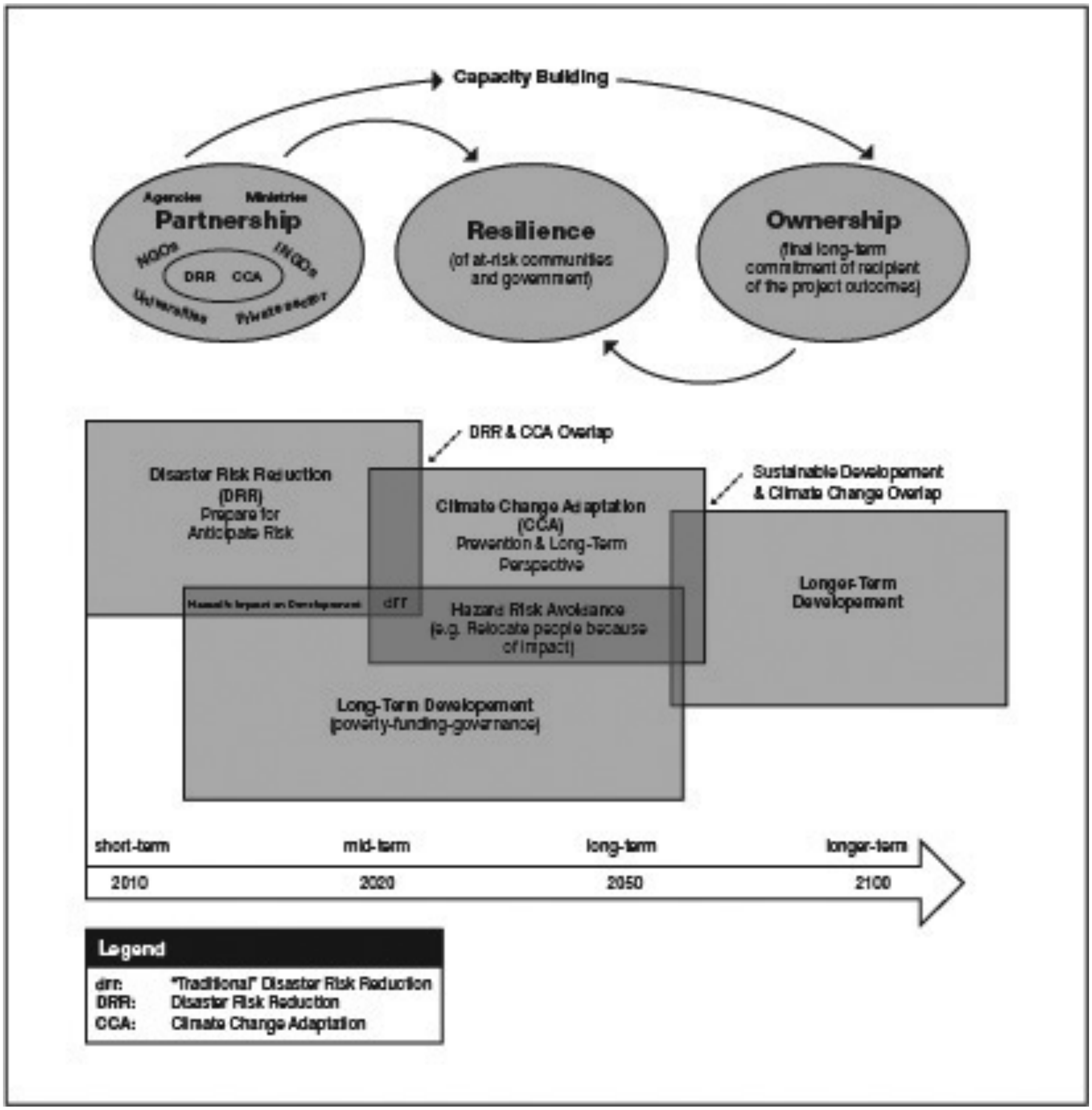
"**Resilient adaptation**" is "a flexible, incremental approach to adjusting to and coping with the foreseeable adverse or beneficial impacts of an uncertain changing climate" (Glantz et al. 2008). It is more than just putting two popular concepts together. It is a concept from social psychology (Luthar 2003) ***of use by analogy*** for bridging DRR and CCA because it generates ideas about how societies might realistically (e.g., flexibly) adjust to an uncertain, longer-term, incrementally changing climate future. It may also help to identify new societal options for coping with the impacts of hydro-meteorological hazards and disasters while proving useful in operationalizing a vision of resilient communities, providing a framework through which the concepts of "resilience" and "adaptation" can be meaningfully merged.

The blending of resilience and adaptation at the overlapping margins of their separate missions directly supports the planning approach of USAID that calls for "layering, integrating, and sequencing" humanitarian recovery efforts with longer-term development actions. It entails incrementally coping with both short- and long-term consequences of climate variability and change in ways that are mutually reinforcing. Each community—DRR and CCA—can in this way benefit from closer collaboration and knowledge sharing.

Given that DRR and CCA communities share their goal of creating resilient societies in the face of changing climate and environmental conditions, bridging (better yet blending) can help to improve efficiency, effectiveness and sustainability of their projects' and programs' outcomes. Benefits can be attained through sharing of lessons identified and by working to blend, where beneficial, activities at the different times scales at which they operate. **One idea, suggested earlier, is to set up a special unique targeted fund to foster specific truly blended activities of a DRR-CCA partnership.**

The following graphic (Figure 5) is an attempt to put order to the several overlapping concepts of the DRR-CCA "playing field."

Figure 5 The DRR-CCA "Playing Field



Case Studies

The Greater Horn of Africa (GHA)

Hydro-meteorological risk prediction has clearly improved in the GHA, because of the timely initial support from OFDA for ICPAC (IGAD Climate Prediction and Applications Center) and its RCOFs (Regional Climate Outlook Forums) as well as in part from the continued support of other international agencies. Additional investment is of critical importance today to strengthen the effectiveness of the 2-way "communication stream" between climate experts and the users of their climate-related products. Communication problems are especially prevalent in local communities, where access to climate information is still significantly curtailed by (1) a lack of communication infrastructure; (2) the use of technical terminology in the dissemination and understanding of climate information; and (3) limited understanding of climate and weather processes. There is a need for increased focus, resources and research for improving the dissemination of relevant climate products to those most in need of them—those known to be at-risk of hydro-meteorological hazards and disasters. In fact, the potential ***victims are the true first responders*** (e.g. "zero-order responders," ZORs) when a disaster occurs, because they fend for themselves before outside help appears on the disaster scene. In this regard feedback from the receivers of climate information including early warnings should be explicitly fostered and incorporated into climate information products.

The Lower Mekong Basin (LMB)

At the end of its regional flood forecasting projects the MRC (Mekong River Commission) includes a section on lessons identified. The lessons identified and highlighted by various donor organizations (e.g., ECHO) engaged in hydro-meteorological DRR in the LMB are, however, similar to those identified during this review which suggests that those lessons had not been implemented and that chronic problems related to building institutional capacity in flood forecasting continue to persist. For example, it appears that increased coordination and cooperation among donor agencies for the various flood-related projects they support would likely improve the longevity of successful time-limited pilot projects. Sometimes when a project ends, however, the recipient organization must wait for new funding for the project to start again. To avoid such disruptions in continuance of the pilot project agreed upon, pre-planned, sunset strategy with an eye toward recipient ownership would be needed. Staff retention at DRR-related organizations (e.g. the MRC or NGOs) following the end of a project is an acknowledged problem as it creates job insecurity and the departure of newly trained DRR staff.

The Hindu-Kush Himalayan Region (HKH)

Asia Flood Network (AFN) activities were launched in 2001 with OFDA support and its latest project ended in 2013. AFN's longevity demonstrates the program's sustainability. Under the AFN umbrella several projects were funded by other donor institutions that followed up on OFDA initiatives. Among these activities, training sessions for NHMSs were provided, and have continued to be supported until recently (as of 2013). Another useful outcome of the project has been the publication of disaster management manuals, developed by International Centre for Integrated Mountain Development (ICIMOD) in partnership with some local communities and NGOs. Although the manuals involved local communities in disaster management activities, their involvement appears to have been quite limited, however. For example, it appears that the feedback loop in the warning system is not routinely pursued in most DRR activities. In general, attention given to "ordinary" (indigenous) local knowledge remains limited even though it needs to be better integrated into risk management plans. In the context of climate change, real-world observations of disasters have shown that advances in technologies alone will not effectively reduce disasters' impacts on societies. Moreover, additional longer-term training for the staff of the NHMSs in the region would effectively build capacities within and among these institutions.

Central America and the Caribbean

The Central American Flash Flood Guidance (CAFFG) is considered a successful system. Additional training is required for the staff in the National Hydrological and Meteorological Services (NHMSs) to significantly build capacities within the region's hydro-meteorological institutions. Training must also involve stakeholders to enhance their accurate interpretation of early warnings and to encourage strong support for the program from governmental agencies. This would help to foster eventual program ownership by the host countries. Partnerships should also be built among decision-makers and climate scientists in making explicit the feedback mechanisms inherent in Early Warning Systems (EWSs). Also, the end-to-end system (E2E) can be strengthened with increased collaboration with the at- risk communities, the actual users of the warnings. Communication and risk education has not yet been fully implemented in the CAFFG. These apparent gaps are opportunities for future activities.

RANET (Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information)

In addition to infrastructure challenges to deliver weather-related information to remote communities or to mobile people, helping users know their information needs and better providing them with such information is necessary. Lay users of weather, climate and water information are innovative, often informally incorporating such information into their decisions. Innovations include, but are not limited to using social media platforms (i.e. Facebook or Twitter). Nevertheless, satellite-based broadcast communications are still critically important to geographically marginalized communities, as governments seek to provide them with hydro-meteorological services, especially early warnings. Therefore, using remote training material is necessary. A desired outcome of RANET and DRR and CCA communications-related development projects is that they lead to ownership once donor support has ended.

<u>Insights from Other Project Evaluations</u>

1) Evaluations studies, particularly those made public, tend to emphasize positive outcomes. While focusing on successes is understandable, it runs the risk of leading to conclusions and continued support for programs that seem unwarranted or unreliable.

2) It is difficult to connect specific programs to outcomes and difficult to measure reduction in damages before an event has occurred. A drought in the same place at different points in time may have different consequences, as societies, like climate, are dynamic and change in unexpected ways. Assessing what might have occurred in the absence of an intervention is difficult and resource intensive.

3) Having clear goals and measurement criteria before program implementation is necessary for consistent monitoring. Collecting baseline data, whether from a previous or recent disaster or estimates based upon initial development and capacity patterns, is essential to monitoring progress. Time should be allowed to elapse before assessing how and whether projects continued once the implementation phase has ended; however, not too much time should pass because institutional and participant memories of programs will likely fade and lessons will be lost.

4) Development actors around the world are struggling with the challenge of synchronizing various kinds of aid and ensuring that humanitarian, development, and climate variability and change adaptation programs are synergistic rather than isolated, redundant or counteractive. Agencies and NGOs around the globe must share experiences and learn from successes and challenges in a more formal and structured way.

Concepts as "*Social Inventions*"

Social inventions in the form of concepts can have as great an impact on individual, group and societal behavior as does the development of new technologies. Concepts, however, have to compete for the attention of the public and policymakers in a way similar to how corporations compete in developing popular slogans for their products to capture attention and encourage brand loyalty. Notably, these inventions might also provide opportunities for disaster-related decision makers to more effectively base their pronouncements about hazard realities as they are and not on what they believe is "what ought to be" in the modern world. The 32 concepts discussed in the base report and executive summaries are noted in the following graphic. A few examples then follow the graphic (Figure 6).

Figure 6 Thirty-two Concepts

1.The 'Rs' of DRR 2.Satisfice 3.Foreseeability 4.Re-functioning 5."Social Inventions" 6.Improvisation (by Zero Order Responders, ZORs) 7.Lessons Identified/ Lessons Learned 8.Creeping Environmental Problems (CEPs) 9. Drought follows the plow (DFP) 10.Re-educate 11.Resilient Adaptation 12.Grain Storage Improvements 13.Climate Change Risk Disclosure (CCRD) 14.CCR (+B)D development 15.Late Warning Systems 16."Sunsetting" DRR Assistance Programs 17.Reversed Triage: Help the bottom group first 18.Hotspots; Flashpoints (hotspots pyramid) 19."The 3 'O's" (outreach, outputs, outcomes) 20.Disaster Risk Reduction (DRR) Bank 21.Forecasting by Analogy (FBA) and the search for "lessons" 22.Mitigating the impacts of CCA (Climate Change Adaptation) 23.Assigning a "Project Scribe" 24."End2End+ feedback" Forecast System 25.DRR RANN (Research Applied to National Needs) 26."Ordinary Knowledge" as a usable concept 27.Working with a changing climate, not against it 28."Partnership vs. Ownership" (to bridge DRR and CCA) 29.Climate Proofing 30.Risk Taking, risk aversion... and "*risk making*" 31.Decision Making Under Uncertainty (DMUU) 32.Decision Making Under Foreseeability (DMUF).

Improvisation: Most victims in a disaster, regardless of type, are forced to fend for their families under great stress and deprivation of basic needs. They are the true first-responders to their needs in such situations. Can at-risk communities learn ways to improvise in the first few days following a disaster? Can the DRR community learn from past disasters how people improvised until help arrived? Sharing ad hoc improvisations with DRR trainers from around the globe can be used to inform those developing preparedness measures.

Project Scribe: A major problem with identifying lessons from any time-limited activity relates to when those lessons are to be identified. The reality is that memories and interest of those who participated in a given project tend to fade with time, even in the short term. To counter this, at the onset of a DRR activity assign a "record keeper" (in essence, a scribe) to record lessons from participants throughout the project.

DMUF: Decisions are constantly being made under uncertainty, whether one has half, 2/3rd or 90% of the information needed for a decision; urgency requires that a decision must be made. With information in hand and drawing on previous knowledge a likely outcome is foreseeable though not assured. Despite the remaining uncertainty, there is also a foreseeable (likely) desired outcome.

The 3 O's: These are outreach, outputs and outcomes. Outreach includes any activity where ideas are shared: workshops, lectures, and discussion groups. Outputs are often measured by the number of reports printed, articles published, numbers of participants, workshops convened and the like. Outcomes are the most desired but also the most difficult to measure, especially in the short term. Organizations favor quantifiable outputs as a measure of success of an activity. Outputs, however, are not the same as the expected longer lasting impacts that activities are expected to have, such as capacity building of institutions or communities.

Communications: The forecast of an impending hazard is only one, albeit important, part of an early warning system that also includes dissemination and clarity of the warning, timely reception and response to the forecast, and feedback to the forecasters about the use as well as relevance of their products to various sectors and at various levels of civil society. These and other important components beyond the forecast itself (e.g., timeliness and clarity of warning, methods of dissemination) are very important aspects of communication for CCA as well as for DRR. The value of a timely warning is diminished if each phase of the entire communications process is not functioning. This is not just a tech issue.

A “Lessons Learned about Lessons Learned” Summit

Why: Philosopher Santana was noted as having said, “Those who do not learn from history are doomed to repeat it.” People around the globe have, through trial and error, been forever learning tactical and strategic coping responses to their local hydro-meteorological hazards and disasters. Much of what they have learned in their local environments could, if shared be of value to others facing similar hazards far away.

Who: Corporations, educators, government agencies, the military and other security organizations, among others, have engaged in searching for and collecting lessons resulting from their activities. There is a sub-field of researchers focused on the theory and practice related to learning lessons. An Internet search exposes widespread writings on lessons, positive and negative, in science, culture, politics and the application of science to societal concerns.

When: Some organizations wait till a project has ended in order to seek lessons or guidance with regard to future responses to hazards and disasters. Others undertake mid-course reviews of their activities to change those activities that seem in need of correction. Still others favor using a “scribe” from the outset of an activity to record possible lessons throughout the project for later evaluation. Using a scribe circumvents the problems associated with a loss of memory about lessons that might have been identified but not recorded by participants.

Where: In just about every local community country, corporation or government ministry around the globe lessons are sought in one form or another. Foreign assistance agencies, specifically, often review their projects to identify and evaluate the impact of their work, matching progress against the project’s mission statement.

How: Searching for lessons has been carried out in formal, structured and routine ways or can be undertaken in an informal, ad hoc way. Some organizations collect lessons, organizing and guarding them for reuse at a future time. A "lessons learned" process could identify and store lessons for internal use, not wanting to expose to outsiders bad corporate management practices.

In sum, a Lessons Learned gathering could identify and share insights on how best to use previous lessons that had often been learned at great expense to life, livelihood, and property.

Hydro-Meteorological Disaster Risk Reduction: A Survey of Lessons Learned for Resilient Adaptation to a Changing Climate

Introduction

How a society approaches a number of issues that involves interactions between the natural and socio-economic worlds is strongly influenced by a belief that science, especially technology, "will save us." Today, society expects to be saved by new technologies from the anomalous behavior of a variable and changing climate. This perspective is apparently reinforced by a distinction commonly made between the "physical" and the "social" sciences: the former is based on "hard" facts whereas the latter is based on debatable (so called "soft") findings. The general belief by policy makers that "technology is the answer," should evoke a challenging response "But what was the question?" The belief that physical science is the answer, however, overemphasizes the role of technology and runs the risk of drawing attention away from the equally important societal dimensions of disaster risk reduction (DRR). Whether on the local or the global scale, DRR is hard to achieve, despite positive programs and efforts to protect human life, livelihoods, ecosystems and the built environment. Recognizing the prevalence of this distinction between the natural and the social sciences enables one to understand the lessons learned about hydro-meteorological DRR efforts in the face of a changing and uncertain climate-related future.

The explicit focus of this survey is DRR in terms of hydro-meteorological hazards and disasters. Societies and individuals have been "jousting" with variable, extreme and changing climates for millennia at local to regional levels, with varying degrees of success. Throughout that time, human interactions with climate processes were mainly based on trial and error as well as on societal expectation about natural processes such as seasonal variations and extremes. Through a cultural learning curve based on trial and error, different societies devised best practices for their specific locations that seem to work at given points in time to enable them to cope with local hydro-meteorological hazards and to recover from hazardous events that may have proven devastating.

In many ways, societies today are not much different than those in the past, except that we now have cutting-edge technologies and innovative approaches for coping with the impacts of rapidly changing climate processes. Recognizing and accepting the trial and error aspects of DRR efforts today is clearly a major positive step forward in identifying coping mechanisms. In addition, doing so, keeps most societies aware that they face uncertain climate fluctuations, changes and extremes both today and in the future. New technologies, which are designed to protect society from the vagaries of atmospheric and environmental processes, can be thought of as attempts toward climate-proofing. But there is as yet no cure-all technology or managerial tool that can assure a society that it has been climate-proofed. To be sure, while climate-proofing can take place at site-specific locations such as in a greenhouse, a controlled environment, no society to date can claim to be immune from climate-, water- or weather-related variability, hazards and disasters. Still, climate-proofed immunity constitutes the "what ought to be," the societal goal that is often sought in theories and reports and campaign promises but that is, in the end, likely unattainable, although steps towards climate-proofing can be effective and must certainly be pursued. Herein is the societal challenge for effective DRR.

Many agencies from industrialized countries provide assistance to developing countries that may not have the means—technological, financial or social—to cope with hydro-meteorological extremes such as droughts, floods and flash floods. USAID is one such agency, through the Office of Foreign Disaster Assistance (OFDA) and Food for Peace (FFP).

While completing this OFDA-supported survey of a set of projects, selected with OFDA, from Asia, sub-Saharan Africa, Central America and the Caribbean, it became clear that many intervening variables created gaps between expectations of what ought to have been the outcomes of these projects and what the actual outcomes turned out to be.

Identifying intervening variables, as both obstacles and constraints, provided insights into lessons that could or should have been drawn from previous DRR activities, and that could be applied to the planning of future projects to make them more effective, as well as more efficient in the use of limited resources for such activities. In addition to identifying lessons learned from this particular set of previously supported projects, in the following we have also sought to identify ways in which DRR strategies, tactics and activities may be bridged with climate change adaptation (CCA) and longer-range planning activities in the face of an uncertain hydro-meteorological future.

This survey is entitled "Hydro-meteorological Disaster Risk Reduction: Lessons Learned for Resilient Adaptation to a Changing Climate." It was undertaken with the assumption that all humanitarian and emergency aid activities yield direct and indirect benefits to varying degrees to donor and aid recipients alike. In this survey, we tended to focus on both good and bad lessons with the intention of noting what worked well but more importantly of improving upon those aspects of the reviewed projects that could be improved. Disaster risk reduction is difficult to accomplish, even for the industrialized countries. Perhaps this is an example of what Martin Luther King, Jr. referred to, in a Human Rights context, as "trying to finish the unfinishable." The funds available for prevention or preparedness for hazards and disasters are insufficient to help everyone everywhere in all at-risk locations. But funding alone could never be enough to reduce risk; it can only serve in a catalytic way to encourage governments to be pro-active in the face of an uncertain climate future. Support for DRR and CCA education and training are important investments towards educating civil society about the need and "best practices" for coping with such an uncertain climate future.

From Planning to Outcomes:

"What ought to be," "What is," "What could be"

Development agency project planning documents usually reflect the expectations and desired outcomes of both donors and those responsible for carrying out projects. Such documents are filled with nicely worded mission statements, objectives, and goals and are interspersed with all the most current concepts, such as capacity building, risk reduction, data sharing, reducing adverse impacts, timely warnings, effective warning systems, and so forth. The sentiments surrounding such planning documents and their supporting PowerPoint presentations are most always overtly positive, representing in hopeful language the development professionals' understanding of "what ought to be" achieved by project's end. Yet all projects have problems of one kind or another, and many of these problems are not controllable by the professionals who are responsible for carrying out those projects. Such problems often appear unexpectedly along the course of project completion, dampening the expectations of that "what ought to be."

In "The Twenty Years' Crisis," British historian E.H. Carr (1939) reviewed the international politics of the twenty-year period between 1919 and 1939, from the end of World War I to the onset of World War II. In it, he compellingly highlighted the differences between what was desired from the international politics of the period, that is, what ought to have been, and what the actual politics turned out to be. The "what is vs. what ought to be" dichotomy that can be used as an analytical model that resulted from his study can be usefully applied to hydro-meteorological concerns that deal with hazards and disasters. For example, an organization's published public plans for programs for disaster risk reduction (DRR) or for its longer-term development (CCA) projects can be assumed to represent its highest expectations for success, e.g., outcomes. In other words, such publications represent that organization's expectation of "what ought to be" accomplished. It is fair to assume that every humanitarian assistance project will produce at least some benefits to the recipient and to the donor, even if the project's overarching goals are not achieved, which is likely a legitimate assumption.

Often, if not always, however, unforeseen circumstances can arise that cause projects to fall short of their desired outcomes. Such circumstances include constraints, obstacles, intervening variables, etc., and diminish the best intentions of project stakeholders to produce the reality; that is, the actual world—the "what is."

USAID (2012) policy guidance report serves as a good example of an institution's vision of "what ought to be," providing a pathway for the Agency on how it plans to improve its DRR activities while at the same time enhancing its *longer-term*, CCA-related sustainable development prospects. As a result of its repeated notations on the importance of the task, the report provides several examples of what its staff is to do, at least in theory, for the foreseeable future to bring together these two seemingly quasi-independent activities (DRR and CCA) within the Agency into a more interactive bridged or blended working relationship. What will actually be the outcome of this USAID vision in the real world—the "what is"—is yet to be determined.

Applying "What is," "What ought to be" and "What could be"

What "ought to be" from a DRR perspective: Fewer people are affected by natural hazards over the years because such hazards have fewer costs in terms of lives and livelihoods lost, cause less damage and result in significantly less socio-economic disruption. DRR recipients of funding and technology take *ownership* of the pilot projects or other activities that prove successful.

What "is": For a variety of reasons the costs as well as the impacts of hydro-meteorological disasters are increasing each year, collectively causing higher losses of life, disruptions to livelihoods, damage to property and derailment of economic development progress.

"What ought to be" in regard to DRR programs: For example, each component of an early warning system (EWS) from forecast preparation to dissemination to reception and understanding by the at-risk people is given adequate attention and funding. This means not only to improve forecasting techniques and accuracy but also to foster resilience in the face of regional risks among societies and to foster an eventual ownership of projects and programs among key national institutions and among at-risk communities in disaster-prone countries. How things “ought to be,” however, is quite subjective and depends on which “mental model” (or filter) one uses to view the world.

“What is” in regard to DRR programs: Today there is an apparent emphasis on improving climate prediction technologies, which remain uncertain and probabilistic, despite ongoing improvements in scientific understanding. Key institutions involved in DRR projects tend to be grounded in physical science training if not background. This, however, can inadvertently lead to an overshadowing of other important aspects of a holistic EWS such as effective risk communication, awareness raising and enhancing risk preparedness.

Organizations oriented primarily towards a science and technology perspective tend to favor the End-to-End (E2E) chain-like model of disaster planning, preparedness, response and recovery for DRR. This model is operational and believed to be effective to some degree for reducing natural disaster impacts on societies. In conformity to the dictates of this model, major investments are considered in cutting-edge technology and technical expertise as being not only necessary but as being essential. They are, therefore, given a high priority, for example, as with a focus on perfecting hydro-meteorological forecast models and on improving transboundary data collection. The high costs of doing so are justified as being a relatively small price to pay to generate valuable scientific knowledge, quantitative data and improved forecast capability, if not now then, as is often the case, at some time in the future.

Evidence suggests, however, that technological improvements alone may not directly benefit local at-risk communities that are affected by natural hazards. In reality, such technological advances do not occur in a vacuum; society must be able to understand their outputs (e.g. forecasts, early warnings, and the like) and directly benefit from their science-based findings. Mention of such scientific and technological advances by the media can also unrealistically heighten a community’s expectations about potential benefits, which are likely difficult to achieve in the near term. In situations like this, vulnerability to natural hazards is not likely to decrease and may even inadvertently increase, if people have been led to believe that modern technologies are able to protect them from the variability of climate, water and weather. As another example of science and technology-based media hype, the notion of “climate-proofing” of a society --- any society, rich or poor, industrial or agrarian --- has been receiving considerable attention in scientific as well as in popular media with regard to climate change and sometimes with regard to drought. While this is a “feel good” idea—one that is in the “what ought to be” realm—it would be difficult, if not impossible, to achieve at the societal scale in the real world. When people hear about waterproofing for example, they do not think of buying a raincoat that is 70% waterproof. The phrase, however, suggests that science can 100% climate proof a society, which is not the case. Climate proof is a misleading notion that would better be stated as “**toward climate proofing**,” which better reflects the reality of societal wishes and attempts toward reducing risk even though it may not be successful in reducing risk at the 100% level.

Significantly, after decades of favoring technology transfer and scientific capacity building, it has become clear that attention and resources are urgently needed to address more effectively the “societal” side of the disaster risk reduction equation—risk education, raising awareness about hydro-meteorological risks and identifying and implementing lessons about what societies might find do-able to reduce their exposure to climate, water and weather-related risks.

A focus on societal aspects can encourage local at risk communities to understand better why they need to take ownership of DRR efforts so that they can better cope with the consequences of a changing but still uncertain climate future. It is important to keep in mind that ideas and not just technology can be used to motivate people to take effective and appropriate action when coping with hazards and disasters. Such ideas that motivate individuals and communities can be viewed as “**social inventions**.”

A main point is that seeking ways to close the gap between “what ought to be” and “what is” for disaster risk reduction under conditions of a changing global to local climate should encourage the individuals who make up societies to think not only in terms of “what is” and “what ought” but also about the possibilities of “what could be.”

DRR and CCA: Reasons for and challenges to integration

Considerable efforts by humanitarian assistance and development organizations are now focused on figuring out how they can more effectively bridge DRR activities and CCA activities both among different organizations as well as within them. It is a conflict between some aspects of here-and-now emergency humanitarian responses to hydro-meteorological hazards and disasters and some aspects of sustainable development planning for the future. The following pages present an overview of the possibilities for and the problems encountered in efforts to bridge, blend or integrate DRR and CCA. These two communities obviously must blend at least some of their common concerns and activities. The following list of concerns is shared by both DRR and CCA, even though their specific missions require them to work on very different timeframes, have different tasks and rely on different vocabularies. The list collectively suggests that there can be an ideal relationship between DRR and CCA where their concerns overlap. Perhaps identifying more comprehensively such a list of common concerns can generate new approaches to effectively bring these communities together. As one example, a common pool of funds could be established to support only those activities in which the DRR and CCA communities truly collaborate.

DRR and CCA both Fall under Disaster Risk Management and …

- Seek to avoid or at least reduce risk to hazards;
- Seek to foster adaptive capacity;
- Seek to foster societal resilience;
- Face an uncertain climate future, guesstimates notwithstanding;
- Have overlapping time frames (short to midterm; midterm to longer term);
- Focus on hydro-meteorological hazard;
- Could benefit from more knowledge from each other;
- Seek to increase (enhance) societal resilience;
- Reduce vulnerability of at-risk populations;

- All DRR activities have a CCA aspect ***and*** all CCA activities have a DRR aspect;
- Are concerned about rural and urban sustainable development; and
- Are concerned about hazard risk management (but on different time scales).

Background on DRR

Disaster Risk Reduction (DRR) has become a popular notion since the World Conference for Disaster Reduction was held in Kobe, Hyogo, Japan in mid-January 2005. The conference produced the Hyogo Framework for Action (HFA), a guideline for undertaking DRR activities. Activities are presently underway to review and establish a new framework for the post-2015 ten-year period (referred to as HFA2). The UN International Strategy for Disaster Reduction (UNISDR) stated the purpose for the first HFA as follows:

> The Hyogo Framework for Action (HFA) is the first plan to explain, describe and detail the work that is required from all different sectors and actors to reduce disaster losses. It was developed and agreed on with the many partners needed to reduce disaster risk — governments, international agencies, disaster experts and many others — bringing them into a common system of coordination. The HFA outlines five priorities for action, and offers guiding principles and practical means for achieving disaster resilience. Its goal is to substantially reduce disaster losses by 2015 by building the resilience of nations and communities to disasters. This means reducing loss of lives and social, economic, and environmental assets when hazards strike. (http://www.unisdr.org/we/coordinate/hfa)

OFDA has followed the HFA as closely as possible. DRR has been a necessary emphasis by OFDA on disaster preparedness in addition to its disaster response focus (e.g. traditional might now be represented by "DRR"). Interestingly, prevention, preparedness and "mitigation" (defined as softening the possible impacts) have always been a part of the natural hazards community's concern about hazards and disaster impacts and research. Today, DRR, which now increasingly incorporates an emphasis on preparedness and not just response, has become much more prominent and important to the development community in light of mounting concern about climate change and its potential to increase the frequency, intensity and magnitude of extreme hydro-meteorological events.

Background on CCA

Climate change concern and adaptation efforts and funding globally were given a boost since 2007 for various scientific, political and humanitarian reasons, one of which was the shared 2007 Nobel Peace Prize awarded to the IPCC's 4th Assessment Report (AR4) on climate change and to Gore's "An Inconvenient Truth" filmed Keynote presentation. The 2007 Prize captured worldwide attention about the mounting science-based early warnings of global warming and its potential consequences for societies and ecosystems. The climate research applications community has been predominantly focused for more than a decade on how to adapt to the consequences of both climate variability as expressed in its extremes and of the possible impacts of climate change, which are expected to become more obvious from now on and continuing throughout the remaining nine decades of the 21st century.

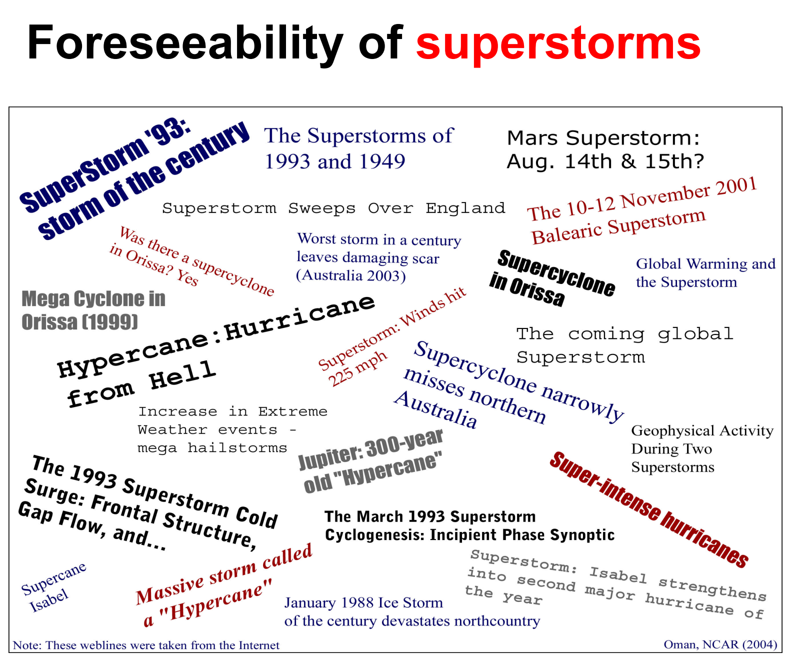
The climate change research community's adaptation efforts have been focused on sustainable development in the face of a slowly warming climate. ***Prevention*** of climate change, however, has not been a major consideration. It has not, for example, been well noted in IPCC reports, although prevention with regard to hazards and disasters has consistently been a major concern within the natural hazards research community. Until recently, adapting to and coping with the consequences of climate change impacts on societies and ecosystems has been the highest priority of the CCA community.

A variable, fluctuating climate, as well as an increasingly warmer atmosphere, affects all living things. As a result, many societal and ecological processes, activities, and problems can directly ***or indirectly*** fall under the umbrella of climate change. In this regard, climate influences just about every living thing and is much like the concern for national security. The general belief is that in the long run there will be no place on the planet to hide from the direct or indirect consequences of global warming. Yet, climate change researchers continue to assert that as yet no single extreme hazard and disaster event can be linked conclusively (as yet) to global warming.

Why care about merging CCA, DRR, and other kinds of development?

A major focus today of climate scientists is about the projected increases in the frequency, intensity, magnitude and changes in geographic location of climate-change-related, high-impact, and possibly record-setting events. Attention-getting disasters today seem to be caused by hydro-meteorological extremes, which have increasingly been labeled "***Superstorms***." The reality of extremes being labeled as 'super' has encouraged if not required longer-term development specialists to begin as a part of their broader (compared to DRR) development objectives to look at how humanitarian agencies respond to climate-, water- and weather-related disasters.

Figure 7 Superstorms Slide



The headlines in this slide were taken from the Internet. Each one is from an article that explicitly refers to "super" in terms of storms from the past, the present, as well as expected ones in the future. Since 2004 when this slide was made several more storms have been labeled as super, e.g., SuperTyphoon Haiyan (2013) and SuperStorm Sandy (2012). Question: What can be worse than a SuperStorm? Answer: A season of SuperStorms!

As alluded to in this and following sections of this report, a primary challenge facing humanitarian and development organizations is redefining the relationship between DRR and CCA, and other kinds of development frameworks. There has been a growing recognition in the areas of complementarity and in tensions between these two fields, and even calls for greater integration between them (Shaw, Pulhin, & Pereira 2010; Tearfund 2006). Several of these researchers argue that such integration would open space for each field to learn from the strengths and weaknesses of the other and contribute to more efficient use of resources (Shaw et al. 2010; Tearfund 2008). Calls have also been made repeatedly for "mainstreaming" DRR and CCA within development policy making processes more generally (O'Brien et al. 2008; Schipper 2009; Schipper and Pelling 2006; Tearfund 2006).

USAID (2012) has identified the need for similar changes in both its external approach and its internal processes in its Policy and Program Guidance Document, *Building Resilience to Recurrent Crisis* ([henceforth, referred to as Policy Guidance] http://www.usaid.gov/sites/default/files/documents/1870/USAIDResiliencePolicyGuidanceDocument.pdf). The report attests to the concern within USAID about how to bring together its in-house experts whose missions are focused on DRR humanitarian and emergency response and those who are focused on CCA, longer-term economic development. Thus, bringing together humanitarian and long-term development planning and programs will be a key indicator of the success of USAID's new policy guidance. Such changes are meant to improve the agency's effectiveness in both DRR and short-term emergency responses and in its longer term sustainable development planning, taking climate change in account. By requiring closer cooperation, interaction, or integration between these two autonomous mandates, USAID exposes an important "lesson identified" for improving efficiency and effectiveness in its DRR efforts.

Despite these hopes and wishes, bridging DRR and CCA is not a simple task. The following section explores similarities, differences, challenges and other considerations related to the bridging, blending or integrating of CCA and DRR. It concludes with a SWOCT review (strengths, weaknesses, opportunities, constraints, threats) of DRR and CCA, separately and if they were to be integrated. The discussion also suggests what might be lost in each of these fields if the two concepts were to become integrated.

What are the key similarities between CCA and DRR?

Commonalities between the two fields include concern with improving disaster response, reducing vulnerability and increasing resilience. Both the DRR and the CCA communities are focusing-in on climate-, water- and weather-related disasters: the DRR community because it is its core concern, and the CCA community because planning for future disasters is fast becoming a primary concern for policymakers. The DRR community has put a greater emphasis and a share of its resources into anticipating, preparing for and educating the public (civil society) about how communities can better cope with the hydro-meteorological hazards they currently face.

Armed with knowledge about their preparedness, communities can be expected to better fend for themselves as zero-order responders—a phrase that appropriately sees at-risk people as active responders as a disaster plays out but who are usually described primarily as passive victims of a disaster—as they await the arrival of so-labeled first-responders (e.g. police, the military, firemen, medical personnel) when a direct threat emerges as a disaster from a foreseeable hydro-meteorological hazard. In a way, therefore, humanitarian organizations have by circumstance undergone 'mission creep' in order to better and more effectively fulfill their mission of protecting life, livelihoods and property. Similarly, the longer-term development community's activities have been greatly influenced by the wide-ranging implications of climate change as well as by today's growing threat of hazards becoming disasters, in essence, looking back (to present-day hazards and disasters) to gain a glimpse of what the future might be like with regard to impacts and responses to hydro-meteorological events.

In reality, there is no clear boundary between CCA and DRR activities. The first decade of the 21st century witnessed an increase in the number of CCA projects, some of which dealt with current hazards, thereby underscoring an overlapping of actions that were usually of concern for emergency assistance and for DRR projects. Preparing for climate change and reducing weather-related hazard risks are quite similar, and both activities entail on-going processes that include information generation, awareness raising, planning, and monitoring (Klein, Nicholls, & Thomalla 2003). Adaptive capacities have to be considered in both approaches; however, CCA by definition focuses on longer-term issues than does DRR. As such, adaptation was originally promoted only in regards to future climate change impacts but has been shifting towards current undertakings that also manage present climate hazard impacts. This shift in CCA attention can be seen as a transition that has been justified by the influence of global warming on current climate events and extremes though, as noted earlier no single event can yet be blamed on climate change.

What are the key differences between CCA and DRR?

CCA is concerned primarily with identifying ways for societies to adapt sustainably to an increasingly warmer climate but over decadal periods beginning around 2020 or 2030, or even 2040. As such, coping with disasters has been only one of the many concerns of the CCA community, which focuses its activities on reducing carbon emissions (mitigation), adapting to changing environmental conditions, developing new non-polluting energy sources, protecting tropical forests, modeling and monitoring atmospheric changes, and so forth. Its direct involvement in disaster reduction is an example of the CCA community's 'mission creep' (mentioned above) into today's disaster preparedness planning in the face of uncertain regional and local climate variability and extremes.

Several researchers have argued that CCA's more forward-looking perspective will be essential to ensure that DRR activities remain viable in the face of climate change (Mitchell & van Aalst 2008; O'Brien et al. 2008; Shaw et al. 2010). In return, CCA may become more inclined to consider slow-onset or creeping environmental problems such as rising sea-levels, loss of biodiversity and changing water resources in the near to midterm future (Shaw et al. 2010).

There are significant differences in the tools and approaches that CCA and DRR use in addressing hazards. DRR has a history of interventions and specific tools that have yet to be well-developed in CCA (Mitchell & van Aalst 2008; O'Brien et al. 2008). DRR also has a tradition of considering local actors and local knowledge, whereas CCA has largely been dictated by global policy processes and privileges scientific expertise (Shaw et al. 2010). Finally, DRR is generally more inclusive of societal factors that contribute to risk, whereas CCA is generally focused mainly on climate drivers (Tearfund 2006).

What are the primary challenges to integration?

A complete integration of institutions governing DRR and CCA policy as an often stated goal is likely to be a drawn-out process involving power disputes between various entrenched organizations or units within an organization. The principle challenges to bridging and blending as well as integration include but are not limited to the following: fragmentation of funding and implementation of resources, entrenched interests, different spatial and temporal scales, differing systems of norms, and different kinds and sources of knowledge (Birkmann & Teichman 2010). In particular, reconciling a top-down CCA agenda, which is driven by multilateral organizations with a bottom-up (local) approach common to DRR, may be especially difficult.

Currently, agencies, funding sources and approaches are largely separate. For example, much DRR funding comes from humanitarian budgets, whereas most funding for CCA comes from environmental ministries. Such a separation has also meant the development of different terminologies, which further complicates cooperation and communication between the two fields. As another example, 'mitigation' in the context of climate change refers to a reduction in CO_2 emissions, whereas in DDR it is used much more broadly, referring to efforts to reduce potential damages from known natural hazards (Schipper 2009).

Within USAID, bridging requires meaningful changes in the way these groups interact; they can no longer remain as autonomous fields of operation within the same agency. To successfully achieve this bridging, however, is USAID's primary challenge, one that results primarily from the following factors: the two communities have different mandates, they are focused on different aspects of development, they have differing missions, they have different timeframes of concern, they employ different approaches to fulfilling their missions, they require different resource streams and amounts, they have different ways to access funds, and they have different timeframes and measures for evaluating success or failure. Bridging these two communities will be easier said than done, even though they do have a common interest in addressing disaster risk reduction by building resilience in societies at-risk to hydro-meteorological hazards and disasters.

The USAID (2012) Policy Guidance document is in essence a formal public notice about a shift in direction for a large foreign assistance bureaucracy. This shift in mindset and approach to make humanitarian and longer-term development activities more beneficial to donors and recipients alike will take some time to implement to the fullest extent. Whether this new direction in policy guidance for programs takes hold and proves more effective at fulfilling USAID's mission than past directions remains to be seen. Only time will really tell, as sustainable outcomes from DRR projects are seldom identified overnight. In the meantime, discussion continues about how to link, complement, bridge, blend or integrate DRR and CCA, the two autonomous development-related themes that exist within USAID.

How precisely might DRR and CCA be integrated?

Clearly, a need has been recognized to assure that both communities stay focused on their core concerns, while "blending" or "overlapping" their activities when it comes to disaster preparedness, with DRR focusing more on the short-term and CCA focusing more on longer-term matters of sustainable development. OFDA's DRR has a long and laudable record in responding to innumerable climate-, water- and weather-related hazards and disasters over decades. It has shifted in recent years a portion of its attention and funding to disaster risk reduction. Thus, DRR and CCA fall in a general way under the umbrella of Disaster Risk Management (DRM).

The relationships between DRR, CCA, and DRM as symbolized by the groundnut (see image) are captured as two independent peanuts (DRR and CCA) encased in a nutshell (DRM). What this means is that although they are autonomous in their jurisdictions, each (DRR and CCA) works separately towards effective disaster risk management.

Figure 8

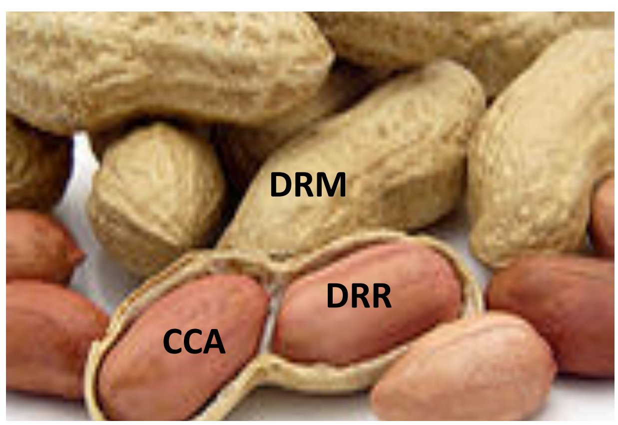
Bridging DRR with CCA:

The groundnut as a symbol

DRR: Disaster Risk Reduction

CCA: Climate Change Adaptation

DRM: Disaster Risk Management; the overarching objective (shell) of both DRR and CCA, each with its own time frame for its mission



Another way to look at the relationships between DRR and CCA is through their jurisdictions as defined by their primary missions: DRR's is to cope with disasters and CCA's is to identify ways to prepare for the consequences of global warming some decades in the future. DRR is a bounded jurisdiction that tolerates relatively limited mission creep (specifically into disaster preparedness); while CCA's jurisdiction, on the other hand, is potentially all-encompassing and relatively unbounded.

How does the mainstreaming of DRR and CCA differ from simple integration?

Several organizations call for the "mainstreaming" of DRR into CCA or the "mainstreaming" of CCA into DRR. "Mainstreaming" suggests a higher degree of integration than does blending or complementing or even the bridging of these two fields. Debates have appeared recently over which should be the mainstream for disaster-related hydro-meteorological risk management and which should be integrated into that mainstream.

Mainstreaming is not a new concern. Tearfund (2006) developed indicators and performance targets to determine the levels of success achieved in mainstreaming activities between disaster relief and long-term development institutions. Their description of how levels of attainment are defined is both informative and important. The report noted that its definitions of success in mainstreaming is suggestive and can be modified by organizations to fit their particular missions and modus operandi (La Trobe and Davis, 2005). Tearfund's four levels of attainment are as follows:

Defining levels of attainment

> **Level 1: 'Little or no progress'** Level 1 represents little or no progress with mainstreaming. The organization undertakes disaster risk reduction in an ad hoc manner and has little or no awareness of the relevance and importance of adopting a systematic approach to reducing disaster risks within its relief and development processes.

Level 2: 'Awareness of needs' Level 2 refers to an early stage of mainstreaming. The organization has a growing level of awareness and understanding of the value and requirements of mainstreaming, and recognizes the need for action. (It may also have **decided** to take action.)

Level 3: 'Development of solutions' Level 3 refers to an intermediate stage in mainstreaming, where there are identifiable actions to consolidate the gains made in Level 2. The organization is developing plans and tools to address the requirements of integrating risk reduction into its relief and development processes.

Level 4: 'Full integration' Level 4 refers to a situation where risk reduction is fully absorbed into relief and development processes. The organization places high importance on reducing disaster risks in a sustainable programme of action at multiple levels and within multiple sectors, and there is a comprehensive demonstration of practice. Thus Level 4 describes a situation where DRR is 'institutionalized'. However, this is not to suggest that an optimum level of attainment has occurred: there is still a need for further progress.

Tearfund (2006) notes that the purpose of defining target levels was to enable organizations to monitor their progress in attempting at mainstreaming, specifically, enabling them:

> To recognize where they are, or what stage they have reached, in mainstreaming risk reduction activities into their ongoing relief and development work.
>
> To identify priority issues to be addressed and develop a mainstreaming strategy over a period of time, with definable, realistic and measurable goals. (p.3)

The process of mainstreaming should be viewed as open-ended: while organizations should aim to achieve Level 4, they should also aim to make continuous improvements to their approach.

What might be gained from integrating DRR and CCA?

Potential synergies between the fields of DRR and CCA provide compelling reasons for greater linkages between the two fields as well as for each to adopt elements of the other in the name of efficiency and effectiveness. CCA could benefit from using the tools already established by DRR, including methods for engaging local communities, while keeping its focus on longer-term vulnerability reduction. Conversely, DRR could benefit from CCA's proactive approach, which might better ensure that both risk reduction and disaster relief programs incorporate changing climate scenarios into their programs and actions. Assuming a longer-term perspective within the field of DRR could possibly increase the resilience of projects that will eventually be affected by climate change.

CCA proponents sometimes suggest that DRR programs that seek to "get life back to normal," to "build back better," or to "bounce back" are short-sighted in that the tendency is to rebuild communities by getting life back to normal as soon as possible but in the same risky locations as before the disaster struck. In this way, these CCA proponents often critique such DRR actions as examples of "unsustainable development" or even maladaptation in the context of a changing climate. Yet it is understandable that victims of a disaster would want to return to a semblance of normalcy, risky conditions notwithstanding, at least for the immediate and short to mid-term future. Doing so may be a viable tactical objective as it provides more time for the CCA community to identify ways to move settlements out of harm's way or to protect them from the foreseeable hazards they will face if they remain in harm's way.

What might be lost in a merger of CCA and DRR?

Disasters are usually conceptualized in terms of human losses, not in terms of environmental losses (i.e. biodiversity, coral reefs, etc.). Climate change adaptation emphasizes loss of resilience in biological systems more than does DRR, which tends to be anthropocentric in its focus. Merging the two, however, runs the risk that climate change would become the primary hazard of focus to the detriment of other sources of vulnerability. Likewise, uncertainty in precisely how climate change will affect specific locations might lead to greater paralysis of action. There is also a risk that political support for funding DRR might be undermined in areas where the climate change issue is still considered to be controversial politically.

To be sure, the values underlying each separate approach are certainly worth protecting before any attempt at merging or integrating the approaches is carried out. One might argue, for example, that CCA, being situated within environmental ministries and largely being framed as an environmental issue, draws strength from "eco-centric" values and its strong support from the environmental community. In contrast, with its roots in humanitarian relief, DRR is more oriented towards prevention and relief of human suffering. It would be useful to explore how political support for each cause is mobilized in order to see if bridging, blending or integrating might inadvertently undermine support.

What are the strengths and weaknesses of DRR and of CCA?

The following tables (1 and 2) summarize the strengths and weaknesses of CCA and DRR as discussed above and are intended to be used to help organize plans to bridge, blend or integrate the two fields. The following tables are based on a SWOC/T categorization: strengths, weaknesses, opportunities, constraints and threats for DRR and for CCA.

Table1 DRR SWOC
by M.H.Glantz, M-A. Baudoin and A. Tozier de la Poterie (December 2013)

S	W	O	C	Threats
Improve effective and efficient use of funds “Training of Trainers” (capacity building) Creates societal awareness Donor acts as catalyst for new knowledge and new approaches Communities prepare for future, but uncertain, hydro-met events Creates awareness of RISKS and ways to see results of efforts early Gets life back to some degree of normalcy Can organize government agencies and local communities around the DRR theme Can concentrate on a known hazard or hazards Targets hazards Targets at-risk people Can do pilot projects to test what works Focused on short-term	Focus is on the short term Focus on getting things back or close to normal DRR community has its own vocabulary Many do not see DRR in the same way: there are broad and loose definitions Does not consider longer-term sustainability in its projects Often acts through top-down, End-to-End model Reports are not usable at the village level Trained trainees do not stay in the job they were trained for Support is limited due to demands for help elsewhere Different views on what is an EWS (each component) Capacity Building is a process requiring more time and funding than a traditional DRR program might provide Poorly defined DRR boundaries and as a result	**GENERATE** Generate awareness; prepare society to take effective ownership of disaster preparedness and response **INFORM** Identify longer-term community needs that can be passed on to CCA people or to Sustainable Development people **FINE TUNE** To better define its administrative jurisdiction to avoid “mission creep” **ANALOGICAL THINKING** Can use analogous situations from other locations as a starting point to develop a DRR program, using analogies with caution **DEVELOP** To develop a seamless bridge with longer-term development needs **ENHANCE** Enhance both CCA and DRR by bridging or blending them DRR can use “**teachable moments**” for improving its	Never enough resources to do “perfect job” (“What ought to be”) Donor budget cycles Hazards are constantly occurring somewhere else on the globe requiring a response Issue-attention cycle of government, agencies, media, and researchers Cultural and political differences make sharing experiences difficult In regional DRR (transboundary river basins) language becomes a problem Administrative budgets are limited and targeted to specific areas: CCA or DRR or Sustainable Development Limits of predictability of hazards magnitude, intensity, location, frequency Projects speak in terms of what ought to be instead	Hydro-met hazards exist and recur Lack of infrastructure Lack of absorptive capacity Capacity building of locals Hazards do not respect borders A wrong forecast New type of hazard to a location Occurrence of a rare “super hazard” Changes in the characteristics of a region’s known hazards Unplanned changes in societal characteristics Scientific uncertainty Areas are data-sparse Low resolution models for limited areas

"DRR" has become symbolic to the hazards and development world since Hyogo Framework [e.g. it's become a "social invention"] Focus on resilience of communities *Bottom-up processes and a tradition of including local actors. Incorporation of local knowledge* *Established tools and methods* *Holistic perspective that integrates both physical and social components of vulnerability* Highly visible impacts and responses; can show effectiveness and efficiency in response Can identify 1st and 2nd order at-risk people to educate and train (E & T) and foster TOT Visibly assisting people in need	mission creep can occur Outcomes (results) are expected to occur soon after a program is implemented *What is meant by inclusion of local actors varies widely across contexts* At-risk populations, regions – all are affected in a region or country *Tension between immediate disaster response and the need for longer-term planning (bureaucracies)* *Possibility that reconstruction post-disaster will lead to later vulnerability* *Tendency to assess risk based on historical patterns (rather than considering longer-term change)* *Tendency to shift risk into the future with large infrastructure projects* *(Arguably) A focus only on shorter-term vulnerability reduction (not incorporating climate change)*	response to recurring hazards in a given area (e.g. drought) [NB: for CCA, one cannot see results for efforts for a long time] Consider "<u>**satisficing**</u>" for DRR (NOT "shoot for the PERFECT") <u>**Resilient adaptation**</u> can help to merge DRR and CCA thinking DRR considers <u>**prevention**</u>; could get CCA to do the same, not just adapt and mitigate *DRR is under pressure to become more forward looking*	of what could be (recognizing limits) Poor recipient infrastructure Donor's "chicken-egg problem": focus on economic development and then DRR or DRR while considering development? Bureaucratic rivalries in both donor and recipient countries *Low visibility. Attention focused on disasters after a major event, but support then wanes*	

Table 2 CCA SWOC (Sustainability-Development-Resilience-Adaptation) by M.H.Glantz, M-A. Baudoin and A. Tozier de la Poterie (December 2013)

S	W	O	C	Threats
CCA is becoming relevant in political and development circles as well as in academia [name recognition of a problem/process] Focus is on mid- and longer-term sustainability Can mobilize resources more easily with CCA as a reason rather than DRR Education Many scenarios are being developed for CCA in future decades *Addresses both long-term risks to humans and to ecosystems* *Reliance on expert knowledge (academics and others) and expertise, and hence the ability to draw funds* *Top-down global agenda with high visibility* IPCC –National governments to ministries and then local governments *Emphasis on reducing vulnerability of at risk populations and societies in the*	Focus is on longer-term development Not integrated with DRR Has to take a back seat to disaster response and early recovery Susceptible to mission creep because everything can be linked to the atmosphere Mission creep diffuses the money available for any specific project Adaptation has many meanings Climate projections still uncertain; not clear how to respond to them as there are different ones Hard to link specific extreme event impacts to climate change Time frame for expected major changes due to climate change expressed as decades. Too far out for people to act now Conflicting time frames of DRR and CCA In financial or other situations	People are concerned about CCA, so many initiatives for education and trainings exist Climate change affects everything so CCA can go into many socio-economic sectors CCA activities can be useful for coping with climate extremes and variability CCA and DRR are increasingly being seen as in need of being meaningfully linked Use of resilient adaptation can help cope best with an uncertain future for which new information supersedes or reinforces existing information Many concepts can be used to get at CCA: sustainability, resilience, adaptation, acclimatization, compensation, mitigation MANY ROADS TO ROME Climate is always changing and people have to adjust to changed conditions	CCA is too broad a concept (acronym) Those who challenge climate change science can slow down meaningful support and activities Separate institutional units deal with CCA and DRR Seemingly ordinary words are redefined for CCA's purpose Global warming consequences for local level still have scientific uncertainties Difficult for public and policy people to focus on distant future while trying to survive the present Primary countries responsible for climate change do not take responsibility for it CCA does not speak of prevention as an option Harder to see measures of true	Global warming Awareness at the local level is still missing [Cambodia] EMEs are expected to increase in frequency, intensity, magnitude, and to occur in new areas CCA-related surprises are to be expected Too general of a concept for guidance Adaptation has too many interpretations CCA is in a way a short-hand (slogan), a social invention for climate change-related Local impacts are still uncertain to people

longer-term Symbolic of the need to consider the climate change issue in forthcoming policies Focused on mid- to long-term future Focus on sustainable development	climate change concern has a lower priority Scenarios are heuristic devices with a short shelf life; outmoded by new societal and scientific information *Lack of focus. Almost anything can be classified as CCA* *A relatively new discipline with few "official" established methods* *Top-down global agenda could also be viewed as a weakness, as the carrying out of adaptation plans is likely to take place at a local level* *Over-focus on climate drivers as opposed to other, societally-driven sources of vulnerability* *Reliance on expert knowledge and expertise,* discussed often using scientific jargon *Long-term projections are not reliable—particularly at local levels* due to coarse model resolution. Yet, at larger scales there may be better reliability	Adaptation to an expected change is sustainable over time CCA is the new driver in regard to environmental change— natural or human induced; governments are developing plans to create awareness Can use CCA to address chronic societal ills and adverse environmental trends To take climate change importance down the societal food chain to local communities	success to CCA outcomes Decades may pass before benefits of CCA are seen Human nature: humans don't like change (Eric Hoffer, <u>Ordeal of Change</u>) Tendency to rely on Formal Expertise; neglect of indigenous and ordinary knowledge The symbol won't mean anything to the public; it is caught on in a world where acronyms are popular but won't work with the public	

Resilience

The Who, What, Where, When, Why, and How of Resilience

What is resilience?

In both academia and in practice the term resilience has been used to mean a variety of different things (Ahmed 2006; Alexander 2013). Interestingly, the Oxford English Dictionary notes that resilience was originally defined as "the act of avoiding" and only later, in the early 1600s, took on its modern denotation of the "action of rebounding."

In academia, the term was first used in the field of ecology in the early 1970s to describe the ability of an ecosystem to persist in the face of a shock (Holling 1973). Although precise definitions vary, two kinds of stability have emerged as important properties of resilient systems. *Engineering resilience* refers to the rate at which a system rebounds to previous conditions and functioning after a shock (Ahmed 2006), while *ecosystem resilience* refers to the "Magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control behavior" (Resilience Alliance as quoted in Ahmed 2006).

In the social realm there are three commonly cited components of resilience:

> The amount of disturbance a system can absorb and still remain within the same state [or a variation thereof];
> The degree to which a system is capable of self-organization (versus lack of organization, or organization forced by external factors); and
> The degree to which a system can build and increase the capacity for learning and adaptation (Folke et al. 2002).

The introduction of humans into the resilience equation requires accounting for the fact that humans have the ability to anticipate and plan for the future, or to choose not to do so. In contrast, for ecosystems, resilience is a stimulus-response process (Folke 2006).

These components of resilience—the ability to absorb shocks, to anticipate and avoid harm, and to bounce back or reconfigure after a disturbance—remain fundamental to the meaning of resilience in the context of international development.

As noted earlier, in its 2012 policy guidance document (*Building Resilience to Recurrent Crisis*), USAID explicitly outlined a major shift from its previous focus on the concepts of DRR and sustainable development (SD) in a time of rapidly changing climates to an institutional focus on building resilient communities. In this document, USAID defines resilience as "the ability of people, households, communities, countries and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth" (USAID 2012:9).

When did resilience gain prominence?

Though the term resilience gained academic prominence in the field of ecology in the early 1970s (Holling 1973), more recently, the concept has been adapted to analyses of social-ecological systems (SESs) (e.g., see Folke 2006). Over the last few years, development and humanitarian aid agencies have increasingly incorporated resilience into their programming (Bailey 2013; IDRC 2012; Twigg 2009). USAID's December 2012 policy document represents a significant shift in nomenclature that is congruent with similar shifts in the language of reports from other international agencies and NGOs.

The shift toward resilience is a marked departure from previous trends in development that emphasized vulnerability, adaptation, and sustainable development. The relationship between vulnerability and resilience is of particular interest and importance because of the widespread use of the former in the development field. Although resilience is often considered the "flip-side" of vulnerability, this is too narrow a characterization. Resilient communities are likely to remain vulnerable to some hazards, and in the face of climate change are almost certain to remain vulnerable to hydro-meteorological hazards. Furthermore, hazards will likely appear in areas in which they had not been experienced before. In these ways, communities that have significant absorptive, adaptive and transformative capacities, but that also have high levels of exposure or sensitivity to or inexperience with certain types of shocks, can still be vulnerable (Miller et al. 2010).

Areas of difference and commonality exist between resilience and vulnerability, as does significant room for greater integration of the two terms. What needs to be better recognized is that resilience studies tend to approach analysis more in terms of system dynamics, interconnections, thresholds and feedbacks, while vulnerability studies tend to approach more isolated analytical units, such as livelihoods (Miller et al. 2010). Better understanding that these two approaches to shocks and change are potentially complementary and could lead to an integrated approach that looks at how social and political processes interact with broader systems and the natural environment leading to greater or lesser adaptive capacity overall and within specific areas. Integration, as is increasingly pursued in SES research, has the potential to combine natural and social data in innovative and important ways.

Who is using resilience?

In the last few years, resilience has become a "buzzword" in the development community. To be sure, USAID, Chatham House (UK), DFID, Save the Children, UNDP, GFDRR, the IDRC, Mercy Corps and countless other organizations have increasingly begun to focus on resilience in their policies and reports (Bailey 2013; IDRC 2012; Twigg 2009). This usage reflects recognition of the need for new approaches as well as of the ability of the resilience concept to encompass both short- and longer-term responses, both of which are essential if hydro-meteorological hazards associated with climate change as well as climate variability are to be responded to effectively.

Why is resilience important?

USAID acknowledges the need for changes in its activities in order to improve responses to recurrent crises in the developing world and to reduce overall spending on humanitarian assistance. Despite decades of humanitarian and development assistance from a wide range of governmental and non-governmental donors, many areas remain chronically vulnerable and require repeated assistance. Previously, resilience had been overshadowed by other development-related concepts, such as vulnerability, sustainability and adaptation. Now, however, resilience is seen as a "fresh," positive approach because it draws attention to both short-term and longer-term responses and processes. As such, it is believed to have the potential to bridge or blend, if not integrate, humanitarian emergency and disaster-related responses with longer-term development actions that also take climate change into account. Additionally, it might also serve as a unifying principle across as well as within agencies and sectors. It, therefore, has the potential to reduce the financial costs of humanitarian aid and to promote long-term progress.

Where could resilience be used?

Resilience can be used as a guiding principle within international humanitarian and development organizations and as an overriding mission for actions in the field. An assistance organization can create a "Culture of Resilience" where the concept of resilience is seen to dominate as the goal for sustainable development now and in the future.

How might resilience be used?

Given the many variations on the resilience theme, encouraging those who use the term to make their definitions explicit is important. Because the concept is poised to be the prominent, if not *the* dominant, term for the rest of this decade, it is important to avoid misunderstanding or miscommunication about problems being addressed or resilience-related solutions being proposed.

Despite championing the move to resilience, the 2012 USAID policy document does not actually outline exactly how the goal of resilience will be achieved or how progress toward building resilience might be measured. Even in the report what is meant by "facilitate inclusive growth" is not clearly expounded. In other reports on resilience, other development agencies tend to associate the concept with partnership, stakeholder involvement, and project ownership, which suggests potential avenues for resilience-directed project implementation. In this way, resilience implies the development of partnerships with different institutions (civil society, the private sector, etc.) as well as between different units working on separate issues (i.e. sustainable development, emergency or humanitarian assistance, DRR, CCA) within USAID. Although overlap is common in the activities and goals of bureaucratic units within an organization, effective communication among those units is often lacking, a problem that needs to be overcome if a resilience focus is to have its intended effect.

The concept of resilience could be used to bridge CCA and DRR and to "integrate, layer and sequence" humanitarian actions (USAID 2012). In the face of a changing climate, defining the timeframe over which interventions are expected to make communities more resilient is necessary. Additionally, in the wake of a disaster, focus on different kinds of resilience may mean more emphasis on short-term or mid-term actions. Rapidly bringing life "back to normal" after a shock corresponds to engineering resilience; whereas attempts to restructure communities to be able to "bounce back better" or undertake new functions to reduce their overall longer-term vulnerability to future shocks may entail structural and functional changes, more compatible with the notion of ecosystem resilience. Thus, the question needs to be asked: Does a community wish to return to previous structures and functions at all costs? In some circumstances, communities may even want to consider **"re-functioning,"** which suggests large-scale or even total changes that would make institutions more resilient to known present-day threats as well as to perceived future ones.

The nature and timing of these transitions is essential to on-the-ground application of these concepts. At what point in the process of "layering, integrating, and sequencing" should an emphasis on a "bouncing back" lead to a focus on building new structures.

Those structures would be more resistant to foreseeable future shocks similar in nature that might occur more frequently or with greater intensity and magnitude?

The use of resilience as an umbrella term draws immediate attention to the urgent need for USAID to clarify which characteristics of resilience are important to development processes and to humanitarian responses. Doing so will entail further efforts to modify the concept from the ecological for use in the development realm.

"Resilient Adaptation" provides another way of operationalizing the concepts of resilience and of adaptation. The term originates in social psychology (Luthar, ed. 2003), but suggests that it may prove useful to USAID in operationalizing its vision of creating resilient communities. Resilient adaptation provides a framework through which to merge the independent concepts of resilience and adaptation. It can be defined as "a process that is a flexible, incremental approach to adjusting to and coping with the foreseeable adverse (or beneficial impacts) of an uncertain changing climate" (Glantz 2008), and is meant to blend DRR and longer-term adjustment actions.

As previously noted, resilience broadly refers to the ability to bounce back. The term adaptation, on the other hand, while also having many definitions, refers generally to changes in human or natural systems in response to an anticipated or experienced shock. In the context of climate variability and change, it refers to any adjustments in economic or social behavior that reduce societal vulnerability to climatic change. Given these definitions, merging resilience and adaptation is directly related to USAID's goal of "layering, integrating, and sequencing" humanitarian recovery efforts and longer-term development. It entails incrementally coping with both short- and long-term consequences of climate variability and change in ways that are mutually reinforcing. In this way, resilient adaptation provides a framework through which short-term challenges can be foreseen and responded to but that does not lose sight of the downstream implications of longer-term resilience. It acknowledges that although there is considerable uncertainty associated with planning for the future, there are "knowable surprises" for which taking anticipatory action if not to prevent than at least to mitigate is possible.

The acronym PASWIRO defines the steps for assessing proposed adaptations to climate change using the resilient adaptation framework. The following Table summarizes key PASWIRO steps.

Table 3 PASWIRO steps
By M.H. Glantz 2013

	Action	Explanation
P	*Problem* identification (underlying and proximate)	This includes identifying biophysical and social impacts as well as residual risks of climate change in order to identify appropriate adaptation measures.
A	*Adaptations* proposed in responding to a changing climate	Evaluate potential adaptation activities in relation to goals. The evaluation process must consider both strengths and weaknesses at various levels (i.e. national, regional, local, household), particularly in the long-term.
S	*Strengths* (or value) of that adaptation	Strengths include economic, ecological and social benefits and how these are likely to hold up over time.
W	*Weaknesses* of the adaptation	Weaknesses refer to continued or exacerbated risks as well as to new risks that may arise from proposed adaptations over time.
I	*Impacts* of the adaptation (social, ecological, etc.)	What are the expected impacts of the adaptation? What are impacts that were not expected?

	Action	Explanation
R	*Resiliency* level for the short-, mid- and longer-term	Resilient adaptation requires continuous reassessment of the effectiveness of the adaptation at various timescales as well as changes in responses to emerging information.
O	*Opportunities* expected to be generated by the adaptation	What are the intended and unintended positive consequences of the adaptation process?

The application of the concept of resilience by practitioners is still in its infancy (Miller et al. 2010). Therefore, more attention must be given to how to operationalize the concept. In a recent report on resilience as applied to famine management, for example, Bailey (2013) suggested that absorptive capacity, adaptive capacity, and transformative capacity can be considered to fall along a continuum, with the former signifying the need for little change and the latter representing the need for the intensive restructuring. In the case of famine and drought management, the study suggested that each category of resilience could be translated into the activities presented in the following Table. Although Bailey's actions for transformative capacity remain quite vague, attempts to develop concrete actions represent a necessary step in the right direction.

Table 4 Components of Resilience and Actions

Components of Resilience	Actions
Absorptive Capacity	• Improve EWSs and access to weather forecasts and information on resource health (forage, etc.) • Strengthen safety nets • Help recover assets after a shock
Adaptive Capacity	• Diversify livelihoods • Access technologies, markets and weather data to improve local decision-making • Promote accumulation and diversification of assets to reduce risk • Increase human capital through access to education and health
Transformative Capacity	• Improve governance and flexibility of drought programs

Based on Bailey (2013)

An opposing view on using the concept of resilience

Many Scholars have either questioned or criticized the growing emphasis on resilience linked to CCA in development activities. Some have pointed out that the original roots of resilience in ecological science have little to do with social science and humanities (Cannon & Müller-Mahn, 2010). In the natural science approach, the idea of a resilient system relies on its exposure, physical or ecological characteristics – the definition does not integrate livelihood conditions. A focus on resilience in the development community would, it is argued, reduce the attention given to people-centered issues, which are previously supported by the concept of vulnerability, in favor of a focus on hazards. Climate predictions would gain more importance than reducing the vulnerability of societies (as In the case of DRR activities). Therefore, if the adoption of resilience as the focus of humanitarian and development work is to be useful, practitioners need to take care to further develop the societal components of the resilience framework.

Vulnerability vs. Resilience

Both vulnerability and resilience emphasize, in a general sense, the response of systems to stressors, but they typically take different approaches in their analyses. Three core elements of resilience are absorptive capacity (or persistence), adaptive capacity, and transformative capacity (Bailey 2013; Miller et al. 2010). Although usage varies across studies and organizations, the fundamental properties of vulnerability are often considered to be exposure, sensitivity, coping capacity and adaptive capacity. Depending on their definitions, sensitivity and coping capacity may resemble absorptive capacity, and both approaches use the concept of adaptive capacity. There is current confusion surrounding the definition of resilience in the field of development studies. The many interpretations of this term are explained by Gaillard (2010), who argues that when using concepts such as vulnerability or resilience in relation to development aid, (supporting either DRR or CCA), these terms are taken out of their theoretical context in order to serve different purposes. The result is a lack of clarity and agreement regarding their definitions and a lack of operationalization of the idea of resilience. According to Klein et al. (2003), resilience has become an umbrella concept for a range of desirable attributes for a system to have, yet cannot be clearly translated into policy or management activities.

Lessons Learned

"Lessons learned and they sure run deep
They don't go away and they don't come cheap…"
Lyrics by Tracy Lawrence,
American country music

About Lessons Learned

This study is about lessons learned (LL) drawn from a review of a subset of OFDA's recent DRR hydro-meteorological projects and activities. The overriding purpose of the review has been to identify issues that arise in selected DRR activities that can affect the effectiveness or efficiency in achieving their "desired" sustainable outcomes. To do so for specific projects in this review, it is useful at first to look beyond the projects at the concept of "lessons learned."

There is a substantial and growing literature on "organizational knowledge" which includes an important component, "lessons learned." LL is actually a sub-field of Knowledge Management (KM). A web search reveals a considerable amount of literature—academic, popular and informal (grey)—focused on LL. That body of literature, collectively, covers just about any question one might have about LL: about what they are, how to identify them, who should record them, when to record them, how to standardize an LL questionnaire, how to store, catalogue and retrieve them, and how to disseminate them for re-use by others. There are articles as well about why individuals or organizations tend not to "learn" lessons or reuse them, why some disaster organizations have even identified again the same lessons that had been identified following the same type of previous disasters. Just about every organization seems to look for lessons. American country singer, Tracy Lawrence, once wrote lyrics about their importance, noting "The whole world turns on lessons learned." There is even a tongue-in-cheek article on the Internet identifying "100 ways to avoid learning lessons from experience" (www.nickmilton.com/2009/10/100-ways-to-wreck-organisational-lesson.html).

The goal stated by Weber et al. (2000) was to improve the quality and validity of LL to enhance their credibility and, therefore, their likely future reuse. They proposed, "Lessons learned processes are knowledge management solutions for sharing and reusing knowledge gained through experience (i.e. lessons) among an organization's members… A lesson learned is a validated working experience that, when applied, can positively impact an organization's processes" (358).

In a report for UN Environment Program Spilsbury et al. (2007) wrote "there is considerable published academic and informal (grey) literature on 'lessons learned' and most of these aim to convey knowledge gained through experience, in some specified field of study or action, as means to enhance future performance" (3).

An important point to note at the outset of this discussion is that most lessons that are "identified" tend to focus on what has been "learned" from activities that did not meet expectations. As a result, a search for lessons often tends to be negative in tone in the sense that constraints to successful outcomes are highlighted because they were found to have had an adverse impact on reaching a project's stated goals. As a result of a focus on constraints, activities that actually worked well are often seen as being needless of comment. Yet, lessons-learned researchers in general suggest that recognizing some successes along with the constraints provides a level of objectivity to a project's or program's LL review.

Defining a Lesson and a Lesson Learned

The Free Dictionary defines a "lesson" in the following way:

a. An experience, example, or observation that imparts beneficial new knowledge or wisdom.

b. The knowledge or wisdom so acquired.

The first definition (a) suggests an event … the identification of a lesson. The second definition (b) suggests a process that includes not only identification of a lesson but also the use of it to enhance an individual's or an organization's knowledge.

At first, teasing out lessons learned seems like a straightforward task. We all do it, individuals, groups and government agencies alike. During or after an activity, we try to see how we could have done it more effectively and more efficiently. We can identify lessons from personal experience or by reading about or reviewing projects and documents and by interviewing people who, for our concern here, participated in selected OFDA programs. And, through interviews, questions can be asked about various projects: what worked; what didn't; or if interviewees had to do the project all over again, given would they go about doing it the same way? If not, what might they change?

Drawing meaningful lessons from a project, however, is not a straightforward task. For example, some discussions exist over **what constitutes a lesson** (for our concern here, in a given DRR or CCA situation). Other discussions center on **when** to search for lessons: at the onset of a project's planning process, during the project, once the project had ended or even well after a project ended. Nevertheless, every hazard- and disaster-related review, assessment, retrospective or hind casting review ends with a final section devoted to lessons in the form of recommendations, way forward, or next steps for what to do differently now or in the future, if faced with a similar situation. In this way, it makes sense for humanitarian assistance organizations --- international, governmental agencies and NGOs --- to use past experience to improve future planning (again, for our concern, for DRR or for CCA).

What is . . . a lesson learned?

As suggested above, it appears that most organizations and individuals as well are in support of learning lessons from their past experiences as well as experiences of others to improve their activities. Given the widespread differences among management and individual perceptions of reality, one is not likely to find (or develop) a universally accepted view of what constitutes a lesson learned because organizations and individuals have different reasons for collecting them.

While organizations cannot readily modify the strict definition of a lesson, they have a lot more leeway to define a "lessons learned" in their own way to fit their own concern and needs. A review of the lessons learned literature failed to uncover a proverbial "silver bullet," that is, a single lessons-learned-template that can meet the interests of all those concerned about drawing out lessons from their differing activities. For example, what one organization, group or person might identify as a DRR or a CCA weakness on which a lesson might be drawn, others might consider to be a strength. Some examples of organizations that take the search for lessons follow.

According to the *Lessons Learned Handbook* of the North Atlantic Treaty Organization (NATO 2011):

> Lessons can be derived from any activity. They are a product of operations, exercises, training, experiments, and day-to-day staff work. During the course of our activities most of us will recognize ways of doing things more easily or efficiently that can be passed on to our colleagues and successors to help them avoid problems and do even better than we did before. *The challenge facing any organization is to build a culture within which we all feel comfortable and motivated to share our knowledge in a productive way (italics added)*.

The US Government's Federal Emergency Management Agency (FEMA 2013), as part of the US Department of Homeland Security, maintains the *Lessons Learned Information Sharing* (LLIS). This electronic library of homeland security-related reports and other documents is open only to the conventionally defined "first responders" and on a proprietary basis, though the website does not say that. Lessons are not shared with just anyone [NB: I was rejected when I applied for access though I work on ***applying*** lessons learned for disaster risk reduction!] The type of information the LLIS (*www.llis.dhs.gov*) collects and archives is as follows:

- **Lessons Learned:** Knowledge and experience, positive or negative, derived from actual incidents, such as the 9/11 attacks and Hurricane Katrina, as well as those derived from observations and historical study of operations, training, and exercises.
- **Best Practices:** Exemplary, peer-validated techniques, procedures, good ideas, or solutions that work and are solidly grounded in actual operations, training, and exercise experience.
- **Good Stories:** Exemplary, but non-peer-validated, initiatives (implemented by various jurisdictions) that have shown success in their specific environments and that may provide useful information to other communities and organizations.
- **Notes from the Field:** Brief updates related to initiatives and activities generally developed by field-based staff to share experiences and knowledge during and/or soon after an event.
- **Trend Analysis:** Study comparing similar events, activities, capacities, or capabilities over a predetermined time period to detect patterns or relationships between factors or variables.
- **Practice Notes:** Brief descriptions of innovative practices, procedures, methods, programs, or tactics that an organization uses to adapt to changing conditions or to overcome an obstacle or challenge.

WHAT is the difference between Lessons Learned and Lessons Identified?

Lessons drawn from the consequences of climate-, water- and weather-related hazards and especially disasters are immediately labeled as learned. Many lessons labeled as having been 'learned,' however, are in fact lessons that have only been identified and **there is a significant difference between a lesson identified and a lesson learned**. For an identified lesson to be categorized as having been learned, further attention and action must be taken: only after it has been tested and validated as being of value it can be considered as having been learned.

Along the same lines, Donahue and Tuohy (2006) published an informative article in the *Journal of Homeland Security Affairs* entitled “Lessons We Don’t Learn: A Study of the Lessons of Disasters, Why We Repeat Them, and How We Can Learn Them.” The article is based on a review of lessons drawn from major security-related US disasters and, by analogy, may be of interest to those involved in seeking lessons related to DRR and CCA activities. They wrote:

> Despite these widespread activities, however, the term ‘lessons learned’ is often a misnomer. Our experience suggests that purported lessons learned are not really *learned*; many problems and mistakes are repeated in subsequent events. It appears that while review of incidents and the identification of lessons are more readily accomplished, *true learning* is much more difficult. Reports and lessons are often ignored, and even when they are not, *lessons are too often isolated and perishable, rather than generalized and institutionalized*. (*italics added*).

One could argue that the phrase itself --- ‘lessons learned’ --- has actually been part of the problem for resolving issues related, for example, to enhancing early warning dissemination or to improving existing coping practices in response to future hazards or for preparation for the occurrence of foreseeable disasters. It can be seen as a problem because the ‘lessons learned’ phrase suggests to civil society that someone or some organization has been given the responsibility and authority to make sure that problems identified from a recent hazard- or disaster-related experience will not happen again—at least in terms of the severity of adverse societal and environmental consequences. The unfortunate reality, however, is that no organization may have been given the responsibility or authority to address those identified lessons or not provided with resources adequate to address them effectively. In most disaster situations it seems that, although a number of organizations become directly involved in given disaster and in DRR, each identify its own set of lessons, but few work together to cross-check their lessons with those identified by others.

While most humanitarian and development organizations have at some point engaged in a search for and discovery of 'lessons learned' and 'best practices' (NB: Some people see these as the same thing), it is unclear in most cases whether lessons have truly been learned or only identified and labeled as learned. This point was recognized by Spilsbury et al 2007) in a report for UNEP entitled "Lessons Learned from evaluation: A platform for sharing knowledge." They observed, "lessons learned should more accurately be regarded as lessons ***to be*** learned" (3).

Figure 9

Thus, keeping in mind the distinction between a lesson identified and a lesson learned is critical for improving DRR and for CCA prospects. As is well known, one extreme hydro-meteorological event --- whether climate-, water- or weather-related --- can set back hard won economic development gains for years (e.g., Hurricane Mitch impacts in Honduras [Glantz & Jamieson 2000]). Therefore, increased effort and resources need to be available for DRR as informed by CCA activities and scenarios.

Why . . . identify lessons?

Many organizations (government agencies, NGOs, INGOs, corporations, among others) are interested in identifying LL drawn from their ongoing or past activities, programs and projects as well as from their internal management mechanisms. They do so with varying degrees of success, and for many reasons. For example, they may be directed or required to do so; they may do so to improve the effectiveness of operations or to enhance bureaucratic efficiency; they may do it for cost-benefit reasons or to improve profit margins; they do it to reduce adverse impacts on life and livelihoods, protect ecosystems and human-built environments, or any combination of the above.

USAID, like many organizations, has developed guidelines describing how to identify "lessons learned" from its sponsored and supported activities. A review of its website identified several lessons learned reports linked to a wide range of projects. Most recently, it explicitly stated its recognition of the importance of lessons in a review of its development assistance programs that led to its recent Policy Guidance document for "Building Resilience to Recurrent Crisis" (USAID 2012).

Corporations have also been extremely interested in LL in order to capitalize on their strengths and overcome their weakness in the name of corporate efficiency and effectiveness. To allow mistakes to be repeated in the corporate world does not bode well for a healthy "bottom line" or return on investment. They may consider their lessons as proprietary in order not to give any advantage to their competitors.

Why… " To reuse lessons or not to reuse lessons. That is the question."

One could argue that **the heart of the matter with regard to LL --- the reason to care about them at all --- is whether they are potentially useful for future planning for development**. That is a big consideration not only to for-profit corporations but also to emergency and humanitarian assistance agencies. While many lessons are gleaned each year from each and every hydro-meteorological hazard or disaster, the hope, if not the expectation, is that the lessons will be of benefit ***if*** reused in future decision-making processes. Thus, whether or how identified lessons are evaluated for validity and relevance is an important consideration for possible reuse. Are the identified so-called "lessons learned" ever looked at again (i.e., re-viewed) for possible use in future decision-making processes? If not, why use resources to identify them in the first place? If validated for relevance, how then are they to be catalogued for easy identification? Are the settings from which the lessons were drawn described?

For a variety of reasons, it is highly possible if not likely that many identified lessons may have little "re-use potential," even to the same decision makers or to the same organizations or for a similar project for which the lessons had originally been discovered. Donahue and Tuohy (2006) addressed some of the reasons that responder organizations to emergencies—disasters, really—tend not to use lessons from others or from the past, even if it is a past with which they are familiar. Their article provides several take-home messages about the disincentives for reusing previously acknowledged lessons. The following bullets provide some of those messages:

- Concern about attribution and retribution from identifying lessons;
- Different meanings to terminology create misinterpretations (false sense of understanding);
- Focus of reporting is imbalanced and on the negative; focus on what to do and not what not to do;
- Smaller but valuable lessons are usually omitted;
- Reports are not distributed effectively;
- Don't focus on conferences, as that is not where the lessons need to be presented;
- There is also the problem of "trust," even among units within the same organization;
- Fear of mentioning a lesson learned being seen by others as self-criticism;
- Lessons learned exercise must be done without blame;
- Identify positive as well as negative lessons;
- Use a facilitator to tease out the lessons with a degree of objectivity;
- Not everyone in a LL session will agree on all the lessons selected; and
- Find ways to make implementation of recommended solutions visible.

Disagreements are foreseeable about every aspect of “lessons learned,” such as how to identify them, how to use them or how to share them. While objective criteria can be used to identify and categorize either specific lessons or generalizable ones, an element of subjectivity will always exist in such processes. Despite the problems noted above, the authors support seeking lessons as lessons can (hopefully) be passed on seamlessly.

Trust is a key factor in enhancing reuse of lessons from previous hazards and disasters for future DRR and CCA planning considerations. Why should one believe in and accept the lessons identified by a group in a different organization or for that matter by another group within the same organization? Why trust the lessons identified by researchers some years earlier, when people feel they have better information today? Teasing out lessons from individuals within a group is also not without difficulty, because interviewees might sense they are being used to criticize their group’s activities to their personal detriment.

Another reason for not reusing lessons is that, as time passes, interest in a particular past disaster episode and concern about its victims fades away rather quickly (e.g., people “discount the past”). Issues perceived by leaders, the media or the public to be relatively more pressing politically, soon overshadow interest in a previous disaster. It may also be overshadowed, as new emergencies arise elsewhere, diverting attention and resources to other locations and to other victims (“the issue-attention” cycle: Downs 1972).

By now in this section it is clear that many organizations assume that it is useful to review a project, program or activity for its lessons to enhance efficiencies and effectiveness of future activities and for program management. Milton (2009), however, has suggested a corporate perspective: “a lesson identified for reasons other than for sharing or re-use in future decision making is of interest to historians but not necessarily to knowledge building for future use or value, regardless of whether the lesson is about positive or negative outcomes.” Spilsbury et al. (2007) provide an additional perspective to Milton’s “re-use” criterion, suggesting that lessons identified or learned are not the most important outcomes of an LL activity. Instead, they claim that most important is the discussion that surrounds attempts to identify lessons for reuse. And Weber et al (2000) propose that for LL to be fully effective, an organization's LL process should typically involve the following tasks: *collecting, validating, storing, disseminating and reusing* (362). While Weber and colleagues were admittedly pursuing an approach to cataloguing lessons learned which they acknowledged would prove unlikely to be carried out by most organizations. They also, noted why lessons learned in an institutional context are not necessarily effective (358):

> **First**, the selected representations of lessons typically are not designed to facilitate reuse, either because (a) they do not clearly identify the process to which the lessons apply, (b) their contribution to that process, or (c) their pre-conditions for application. **Second,** these systems are usually not integrated into an organization's decision-making process, which is the primary requirement for any solution to successfully contribute to KM [knowledge management] activities (see also Reimer 1998).

Spilsbury et al. (2007) identified yet another deterrent to the reuse of lessons already archived in a database:

> The United Nations Environment Programme's (UNEP) Evaluation and Oversight Unit (EOU) maintains a database of lessons derived from evaluations conducted over the past several years. A UNEP report provided an important cautionary note about those lessons in the database. However, 'lessons' presented in evaluation reports are often of highly variable quality and limited utility. *They are often platitudes borne of a felt need to demonstrate engagement in the 'knowledge society' or simply to satisfy the specified evaluation requirements*. In addition, even when high quality lessons are developed they are seldom communicated effectively to their intended audience (3; *italics added*).

How . . . to identify a lesson?

Some organizations have developed structured, systematic approaches to identifying lessons. UNDP, for example, has fostered a method to identify an activity's strengths, weaknesses, opportunities and constraints (a SWOC review).

A review of the lessons learned literature yields fruitful insights about gathering such lessons. An Internet article (Milton 2009) entitled "What is a lesson learned?" presented a practical approach to identifying lessons from a corporate perspective. Milton provided no less than five definitions of "lesson learned," noting that "there is a lot of fuzziness about the topic, and this can really hamper the delivery of value through lessons identification, sharing and re-use." He then proposed "steps a lesson has to go through before it can be considered learned":

1. **Reflect on experience**. Think back (and discuss as a team) what happened.
2. **Identify learning points**. Where is there a difference between what was planned, and what actually happened? Either a positive or a negative difference.
3. **Analyze**. Why was there a difference? What were the root causes?
4. **Generalize**. What is the learning point? What should be done in future activity to avoid the pitfall, or repeat the success? At this stage we have a lesson identified.
5. **Take Action**. A lesson needs to be accompanied by an action if it is to be considered Learned.

Milton concludes that "it will be a useful lesson, if others can learn from it, and for others to learn from it, it needs to be instructional."

Although a fair percentage of such LL reports and articles focuses on organizational management issues, they do collectively provide insights for LL reviews for disaster-related activities. One example is Cornell University's LL-related program CPMM (2009), which proposed the following LL search procedures:

> (1) Don't wait till the end of a project to do a postmortem search for lessons learned from carrying out the project. It should be an integral part of the project from the outset as a built-in aspect of the project.

(2) A member (or two, to reduce subjectivity) of the project should be designated as the "scribe(s)" to keep a running 'diary' in the format of a SWOC (Strengths, Weaknesses, Opportunities, Constraints) about the functioning of the project, identifying during the lifetime of the project, for example, (a) what is going well; (b) what isn't going well that we want to fix; what can we do to improve?

(3) The positive aspects of a project must be explicitly recorded in the 'diary' as well as the negative aspects. Most traditional searches for lessons tend to focus on negative issues or project weaknesses. Yet both are important for making future projects more effective and efficient. SWOC assessments can do just that, highlighting a project's strengths and weaknesses while the project is still in progress.

(4) An organization should maintain a lessons learned "idea bank" for archiving and categorizing LL from its DRR and CCA projects and programs. Such a collection of lessons identified can guide planners in developing future DRR and CCA activities (see also Weber et. al 2000 for a corporate perspective on Lessons Learned).

Identifying lessons is truly important to organizations seeking to improve their operational effectiveness and efficiency. The reuse potential of those lessons is equally important!

When . . . to conduct a lessons learned survey?

One very important problem with identifying lessons relates to when those lessons should be noted. Some people suggest lessons learned about a project can be identified in a mid-course project workshop, while others suggest they can be identified after the project has ended. Both of these approaches have both value and drawbacks. For example, with regard to the latter approach, it is difficult for people to remember all the lessons that might have been learned during the project lifetime. Some people have moved on to other, unrelated projects. This leads to questions about how long after the project has finished should a search for lessons learned be undertaken. Memories fade with time, even in the short-term.

Abudi (2010) suggests best timing for post-project lessons learned reviews.

> We all have good intentions to do so, but often we don't get around to effectively capturing lessons learned from projects. Often, if we do try to capture lessons learned, we do so at the very end of the project . . . For longer projects though, it is difficult to wait until the end to attempt to capture what is learned. Too often team members are ready to move on, or they have forgotten much of what should likely be captured. Better to track lessons learned throughout the project, as much as possible…
>
> By tracking these situations throughout the project, everything is fresh in your head, as it has just occurred. You can then compile the information at the end and develop a more comprehensive lessons learned.

This raises the issue of assigning a "project scribe," an idea raised, discussed and addressed by some authors and noted in our concepts section. See also, for example, M. White and A Cohan, A Guide to Capturing Lessons Learned" (www.conservation gateway.org)

Concluding Thoughts

The often-repeated adage by Spanish-born American philosopher George Santayana is quite relevant: "*Those who do not learn from history* are doomed to repeat it" (emphasis added). Perhaps even more relevant for the 21st century's information overload, shortening of attention spans, and passage into a new century, however, is the statement by Irish statesman Edmund Burke in the late 1700s: "*Those who do not know* history are doomed to repeat it" (*italics* added).

"Lessons learned and they sure run deep
They don't go away and they don't come cheap
Oh, there is no way around it
'Cause this world turns on lessons learned."

(Lyrics by Tracy Lawrence, American country music artist)

Case Survey: Greater Horn of Africa (GHA)

DRR in Sub-Saharan Africa

Sub-Saharan Africa (SSA) is highly exposed to climate events and extremes, and highly vulnerable to their impacts. With climate change being set on the front stage, multiple reports have highlighted how this sub-continent will be extremely affected by increased hydro-meteorological hazards, such as drought and floods in the future. In this context, CCA is often presented as the answer to reduce present and future vulnerability of African populations. With no clear limit between climate variability and climate change, CCA's and DRR's field of activities now tend to overlap: both deal with a "changing climate". DRR has, however, a long experience of projects and programs conducted on the African continent, an experience that could benefit those working in the field of CCA.

Following a long-established focus of the practice of DRR on disaster responses and recovery, recent changes have been observed on this field, e.g., among OFDA's DRR programs led in SSA. Risk preparedness and prevention have gradually gained weight among those working on DRR issues; these "forward-looking" activities are even more stressed out today, as climate change could increase hydro-meteorological risks while funding for DRR tend to stagnate. Hence, many aid agencies have endorsed a new goal, to enhance the resilience of society in the face of an uncertain climate future. In the present report, we identify strengths and weaknesses, as well as constraints and opportunities in the current practice of DRR in SSA, and in light of past OFDA's interventions. Lessons that reflect both shortcomings and successes of such interventions are highlighted to, hopefully, serve as improving future activities of aid agencies that foster the resilience of the society. Moreover, these lessons could serve as basis to develop a necessary partnership between DRR and CCA, a collaboration promoted today within academic literature and within aid agencies' publications.

Introduction

Africa is confronted every year by climate anomalies that can lead to disasters. Mitigating, if not avoiding the impacts of such events on societies has been a major concern for African governments as well as for the international community. Avoiding or limiting loss of life and of livelihoods, economic disruption, and destruction of infrastructure and property during and in the aftermath of a climate-related disasters is all the more important, because African leaders are already challenged by other significant issues, including chronic poverty, major diseases, civil disorder, etc. Even though many believe that Africa is becoming the new frontier of global development (World Bank 2012), climate-related hazards could dampen this optimism.

Besides the obvious necessity of reducing the human costs of disasters, the international community must also be concerned about the increasing financial costs associated with humanitarian assistance following such events. Even as climate change impacts will induce changes in the magnitude and frequency of hydro-meteorological ~~disasters~~ extreme events in the coming years, thereby increasing risks, the budgets of agencies like USAID/OFDA that are charged with responding to such events are likely to increase only marginally if at all. Therefore, these agencies will have to re-visit and re-adjust their current practices in order to address current and future challenges that will continue to affect developing countries in general, and especially in Africa.

In this regard, agencies are seeking to become more efficient, when working on DRR issues. Activities in this field involve response to and recovery from climate extremes and high-impact events as well as thinking ahead and forward planning (MRC 2010). DRR, therefore, can provide decision makers at all levels with tools to reduce the heavy costs associated with present and future climate-, water- and weather-related extreme events. These tools can also be used to increase spending on preparedness.

For decades now, the development community has funded DRR activities in Africa in order to mitigate or avoid altogether risks associated with hydro-meteorological hazards. Our report reviews selected DRR activities in SSA implemented by USAID/OFDA in the

Greater Horn of Africa (GHA) between 2002 and 2005. This work is based on a review of relevant documents related to these projects as well as on academic and other literature. The review is supported by interviews with various actors involved in DRR activities in SSA to assess what currently works and what could be improved in terms of disaster response and preparedness in the region.

The purpose of this report is (1) to highlight current strengths, weaknesses, opportunities and constraints (SWOC) related to disaster risk reduction; and (2) to draw "lessons from lessons learned about disaster risk reduction" that can be useful to both African governments and aid agencies, especially USAID/OFDA. Our approach also looks back at lessons that were drawn from past disasters' impacts in this region, such as those resulting from the major El Niño of 1997-98.

The review is structured in the following way: in the first section, the methodology and scope of the research are presented with some key definitions. A second section provides information on hydro-meteorological risks in SSA and highlights several lessons about DRR that were identified over the past 15 years. Section three highlights the major trends in the practice of DRR in SSA and explains recent shifts in practices promoted by some aid agencies. Section four reviews a selected OFDA program applied in the GHA between 2002 and 2005, and section five analyzes the current management of hydro-meteorological risks in this region in light of what activities were previously supported by OFDA. The section is concluded with a SWOC assessment for hydro-meteorological disaster risk reduction in SSA.

The conclusions made in this report in terms of lessons that have been identified could, somehow, be linked to the new DRR approach recently promoted by USAID (2012) on disaster risk management. Yet, our report was initiated well before the release of this new policy guidance agenda. The new agenda recognizes the need to change the approach of DRR in the face of recurrent crises, especially in regions such as the GHA. A new tactic to ensure the *resilience* of African societies in the face of upcoming challenges promotes a more integrated approach to DRR and attempts to foster "*longer-*

term development." Collaborations and partnerships are also enhanced in an attempt to bridge the gaps between various fields of activity, such as humanitarian assistance, DRR and CCA, as well as to work in synergy with other organizations from the private sector and civil society (see USAID 2012; UNISDR 2013).

Methodology

An examination of OFDA projects, including a review of OFDA's annual reports on Africa from 2005 to 2011, informed the core of this report. Selected OFDA programs were then evaluated based on a review of relevant project documents. Additionally, written surveys were administered and on-site interviews were conducted in Nairobi, Kenya in February 2013 with various representatives of climate institutions and users of climate forecasts in the GHA. Emails interviews with relevant key actors involved in different OFDA activities were also undertaken. The primary goal of these interviews was to assess OFDA activities in and support of DRR in the region. Since this particular support ended 8 years ago, interviews were also held with actors currently involved in climate institutions or from climate sensitive sectors in order to evaluate the current status of DRR in Kenya and possibly in the GHA region as well. A list of these written and on-site interviews is available in the bibliography of the report.

The review is primarily aimed at OFDA support to DRR in SSA. A first constraint encountered for this review has to do with access to OFDA documents related to specific projects, which proved difficult to locate. Furthermore, because the activities studied ended eight years ago, many of the actors involved had moved on professionally, while others had little memory of the project's specific contents. Midterm and detailed final evaluation reports for the projects were also not found, even when such reports were to have been completed by project personnel. Information gaps resulting from these constraints, as presented at the end of this chapter, are identified as weaknesses, which can, however, be seen as opportunities to improve future activities.

Another limitation in the scope of this research is that most interviews were conducted with representatives of Kenyan institutions. As such, Kenya tends to be overly represented in this review, so our results may not be applied to all countries of the GHA or of SSA in general. Further research to compare case studies within this region would be necessary to generalize some of the lessons about DRR that conclude this report.

For the sake of clarity, some of the terms used in this report are defined and elaborated. This is necessary because of the nature of DRR and CCA and other types of aid, all of which tend to use similar terms but are defined slightly differently. This tendency has led to much confusion, especially when integration is sought, such as of DRR with CCA. What often happens is that the actors working in each specific field talk past each other, even though they are using the same terms. This decreases communication efficacy and delimits success in desired outcomes.

> *Disaster Risk Reduction* – a strategy that minimizes the effects of natural hazards by reducing the vulnerability of societies to loss of life and livelihood (White et al. 2004). DRR is the means by which the lessons from past devastations can be identified and applied to planning for the future. Although DRR encompasses a broad set of activities, it is generally associated with early warnings, preparedness, and response and recovery activities (MRC 2010).
>
> *Early Warning System (vs. Early Warning)* – a system that helps society to cope better with natural or anthropogenic hazards by translating climate predictions into "user-friendly" warnings and action plans. For early warning systems (EWS) to be efficient, warnings must be accurate and reliable, and they must reach relevant institutions and the public in a timely manner (Glantz 2003). Goals of an EWS can be multiple beyond the primary issuance of early warnings and generally include awareness raising, education on risk, impacts and vulnerability assessments.

Vulnerability and needs assessment – a process that examines available information to identify factors causing vulnerability and to pinpoint needs (MRC 2010).

Lessons identified (or drawn) – lessons are identified by looking at past events and observing nature (Glantz et al. 2011).

Lessons learned – lessons are learned when actions are taken based on previous experience (i.e. lessons identified) to avert or mitigate the impacts of hazards (Glantz et al. 2011).

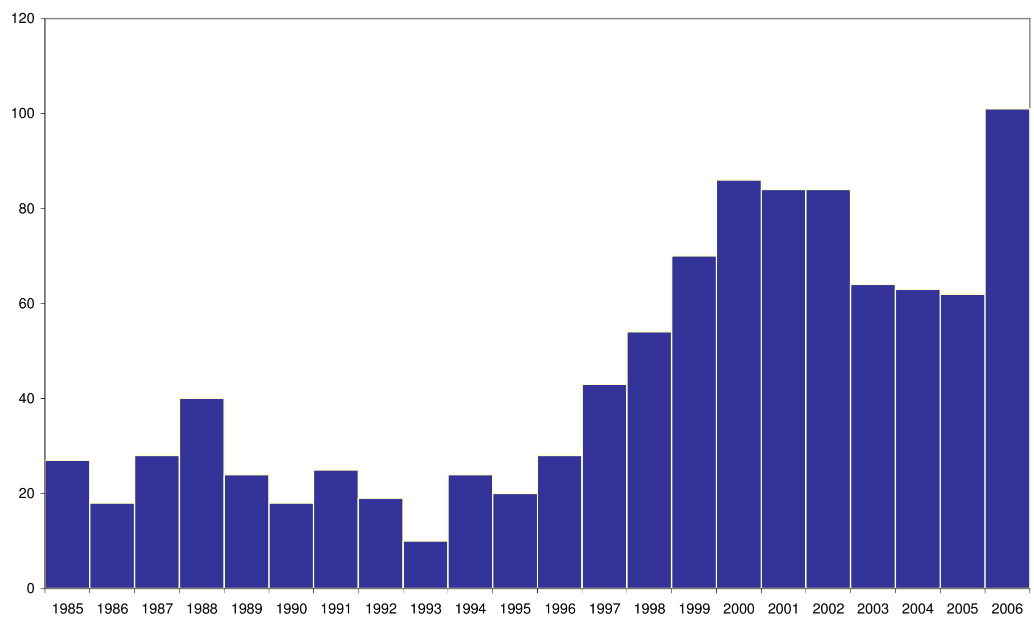
End-to-End + Feedback (E2E2E) – a model used to ensure that all components of a system (an EWS, for instance), from the producer of a product to its end-user, are consulted at all stage of the process and that the feedbacks from end-users are actually used to improve the product. It is a revision of the often too technocratic End-to-End (E2E) model of disaster planning and response that tends to dominate the field.

Hydro-Meteorological Hazards in Sub-Saharan Africa: Impacts and "Lessons Learned"

The continent of Africa is highly prone to disasters and will continue to be greatly affected by climate extremes. In 2011 alone, 206 million people globally were affected by disasters, including 106 million by floods and 60 million by drought. Most of these victims were located in the Horn of Africa (Clark 2012). The increasing number and intensity of disasters in this region over recent years (Figure 10) has been amplified by vulnerabilities related to the inadequate human, economic and infrastructure developments, including a high population growth, increasing urbanization, and dangerous locations for resettlement of displaced poor communities.

In this context, the frequency of hydro-meteorological-related disasters due to storms, floods and droughts have direct negative impacts on development gains in what is one of the poorest regions in the world. The most vulnerable communities often carry the greatest burden of these events, where lives are seasonally and interannually at risk to hydro-meteorological hazards. The particular sensitivity of SSA to hydro-meteorological events and extremes further underscores the necessity of DRR activities in this region.

Figure 10 Number of reported disasters in SSA, from 1985 to 2006



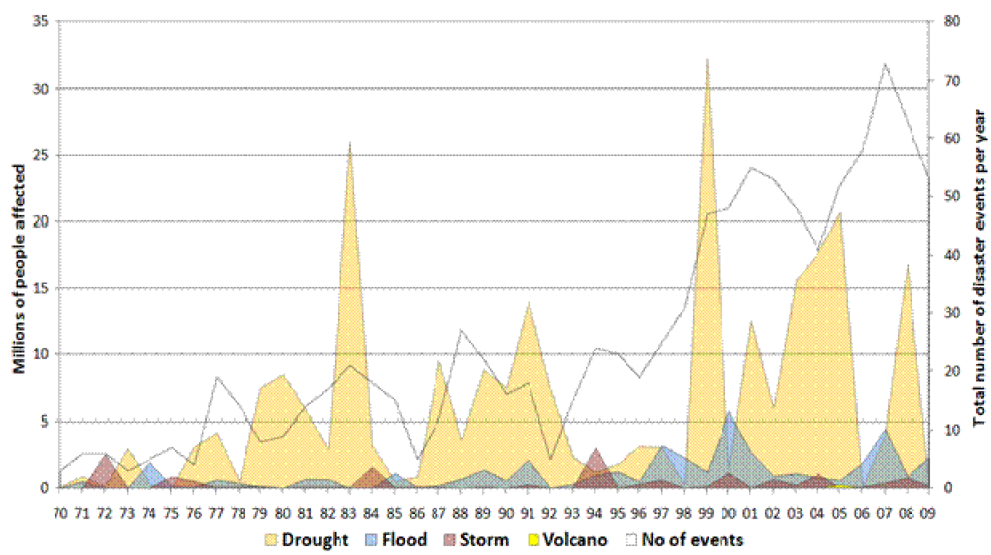
Source: EM-DAT: The OFDA/CRED International Disaster Database – www.em-dat.net – Université Catholique de Louvain, Belgium.

Major hydro-meteorological disasters in the SSA region over the past 20 years have raised awareness at the international level about the risks associated with climate-, water- and weather-related hazards. Events such as the El Niño of 1997-98 and the heavy floods in Mozambique in 2000 also illustrated the various strengths and weaknesses of national government and international humanitarian assistance organization planning and response to disasters impacts. In this way, high-impact hydro-meteorological events can be seen as "teachable moments" that provide instructive contexts through which better preparations for similar events, at least in the near- to mid-term future, can be made

(Glantz et al. 2011). Such teachable moments also provide "opportunities" to identify lessons that can be applied to reduce future impacts of hydro-meteorological events and extremes.

The climate in SSA is highly variable, and **droughts** constitute the lower tail of rainfall distribution in the region (IRI 2005). Droughts are defined as slow-onset, "creeping" natural hazards that are difficult to monitor and predict due to the large number of indicators, such as changes in lake levels, precipitation variables, soil moisture, etc., needed to be taken into account for forecasting to even begin to be adequate (Tannehill 1947; Glantz 2009). Whether absent or abundant, rainfall extremes can influence overall food security, increase the spread of infectious diseases and force people to migrate from their villages. In the GHA, most farmers, in particular, are highly vulnerable to drought because they rely on rain-fed subsistence agriculture. In general, hydrological stressors are among the most common climate-related disruptions in the SSA region (see Figure 11).

Figure 11 Number of reported disasters, type and number of people affected in SSA



Source: World Bank, 2012

Floods also threaten lives, economic activities, property and infrastructure in SSA. Vulnerability to impacts is increased by dangerously situated settlements or by households that rely mainly on one principal climate-dependent livelihood activity, such as farming. Different types of floods have been identified. For instance, "flash floods" are sudden events with little time for warning and response, while other flood events are more progressive, in the sense that they are building up over days of heavy rainfall to create swollen rivers. In the latter case, flooding can, to some extent, be anticipated. In some areas, in fact, floods are frequent, expected and predicted seasonal events, while in others they typically only occur suddenly and unexpectedly.

Droughts and floods in SSA are in part associated with El Niño and La Niña events, which together make up the extremes of the El Niño-Southern Oscillation (ENSO) (Glantz 1991; 2000). El Niño is the recurrent, quasi-periodic appearance of warm sea surface water in the central and eastern equatorial Pacific. Conversely, anomalous cold sea surface temperatures in the equatorial Pacific are referred to as La Niña events. The 1997/98 El Niño and 1998-2000 La Niña episodes provide a good illustration of disasters associated with hydro-meteorological extremes in the region. These two events led to significant loss of life, destruction of infrastructure and economic costs. The relatively quick-onset destruction of property and agricultural products that came from the El Niño flooding was soon followed by the droughts generated by La Niña, which lingered for two subsequent years and further affected agriculture and livestock, exacerbating food-security issues. Such drought-driven water shortages also disturbed domestic and industrial consumption as well as power generation. For instance, Kenya depends on hydropower to generate 50% of its electricity (Oludhe et al. *unpublished research paper*); severe droughts in 2000 caused major power shortages that led to important economic losses as well as a request for a US$50 million urgent loan from the World Bank. Floods in Mozambique, on the other hand, reduced the annual growth rate from 8% to 2% in 2000 (WMO 2008). As these examples indicate, water management issues constitute a major problem and concern for governments in SSA countries.

According to the IPCC (2007), the adverse effects of climate change in SSA have already been observed and are expected to occur this century. These include increased hydrological stresses (expected by 2020); increased and increasingly rising temperatures; more and less predictable extreme events (storms, dry spells, etc.); gradual changes in precipitation, with increased rainfall variability; and a worsening of coastal erosion. Despite the lead-time provided for adaptation to these effects, however, major gaps remain in the study of climate change impacts in SSA. Impacts, for instance, are highly variable at the local level (UNECA 2011), especially in the arid, semiarid and tropical sub humid areas of SSA, and predictive skills and technologies within regional institutions are not yet capable of providing accurate forecasts. At the same time, a lack of both qualitative and quantitative long-term climatic data, mostly at the local level, has also affected research in this field. For instance, there are eight times fewer meteorological stations in SSA than is recommended by the World Meteorological Organization (Hellmuth et al. 2007:10).

Though some locations may actually see some climate change-related benefits, at least in the short-term, it is more likely that negative impacts will be felt and be exacerbated by the various natural hazards, disasters and development challenges already affecting the region. The point is that SSA is already vulnerable to hydro-meteorological events.

Vulnerability to such extreme climate-related events is ~~also~~ strongly linked to development levels and socio-cultural characteristics of African societies. For instance, livelihood conditions in rural African areas are characterized by a high reliance on rain-fed agriculture, which, along with~~;~~ livestock form the basis of food security and income generation for many households in SSA. Approximately 70% of the rural population depends on uncertain rainfall for food production, which suggests that subsistence livelihoods are exposed to climate risks on a daily basis (Hansen et al. 2011). In this context, extreme hydro-meteorological events constitute additional risks for already challenged livelihood conditions. Therefore, improvements in climate risk predictions, risks and vulnerability assessments, and investments in preparedness, education and community risk awareness are key factors for EWSs, which build resilience to extreme events, which are expected to intensify in the coming decades (SREX 2012). This observation calls for increased collaboration among the DRR and the CCA communities, as they are both concerned with such increases in hydro-meteorological risks. Both communities could learn from such collaboration.

The notion of foreseeability, which uses past experiences with disasters as teachable moments, can provide lessons for the DRR community. Foreseeable lessons, for example, can be drawn by looking back at past tragedies, at their impacts on societies and ecosystems, and at the various social, institutional and governance weaknesses they exposed. Prompted by our review, the following section briefly describes three notable disasters, mentioned earlier, that affected SSA in the past 15 years in order to highlight ~~some~~ important lessons about DRR.

The impacts of the 1997-98 El Niño (Glantz 2000)

In mid-1997, a major El Niño event developed over the central and eastern equatorial Pacific. The warming of sea surface temperatures across this part of the equatorial Pacific triggered a number of climate-related disasters around the world that led to a loss of life and depletion of food and water reserves, among other problems. The global costs of this event are estimated at having been in the range of US$32 to US$96 billion (Sponberg 1999).

Because of the high cost of this particular event, the UN General Assembly developed a strategy to help nations prevent, mitigate and recover from the damages caused by El Niño events. This initiative took place as a part of the International Decade for Natural Disaster Reduction. A review of El Niño impacts in various countries of SSA was also conducted in order to highlight lessons that could help reduce future disasters caused by such extreme climate events.

In Ethiopia, for instance, one of the lessons drawn was the necessity to better identify regions and sectors vulnerable to ENSO extremes by conducting impact and vulnerability assessments. Such assessments would help prepare adequate measures to face subsequent events. Problems in forecasting capacities were also identified as requiring improvement, with the strengthening of local-level skills that would enable vulnerable regions to issue forecasts relevant for their local areas, which often have their own specific micro-climates, emphasized.

In Kenya, El-Niño-related floods exposed weaknesses in transportation and health infrastructures; for instance, roads and bridges were highly vulnerable to weather disasters. Identifying such weaknesses in advance (i.e. before a similar disaster occurs) and designing adequate plans were recommended in order to better prepare for the next and future events.

The case of floods in Mozambique in 2000 (Hellmuth et al. 2007)

Mozambique is a country prone to floods. In 2000, the country faced exceptional flooding that saw large towns such as Xai-Xai and Chokwe, as well as other smaller towns and villages completely inundated for two months. About 650,000 people were displaced and at least 700 died. The economic damage was estimated at around 20% of GDP.

This disaster exposed lessons that could improve DRR in Mozambique. Although Mozambique's policy and planning for flood events is generally good due to its past experience~~s~~, the magnitude of the floods in 2000 was so overwhelming, that a few shortcomings in the national flood early warning system were revealed. For instance, the event exposed how government meteorologists lacked the capacity and the equipment to forecast flooding in time and within a short-time frame. In response, suggestions were made to improve skills and equipment in order to better target flood warnings at the local level in the future. The disaster also underscored the need to improve communication by coordinating information releases to the public to avoid the contradictions contradictory. Information on floods released by the media also came too late, with journalists only beginning to inform the public about even the possibility of flooding when the disaster was already underway. Furthermore, the warnings were not well understood by many people, resulting in a recommendation that early communication on risk be improved across civil society. An additional lesson drawn from this disaster was the need to enhance financial and human resources available to prepare for and handle such disasters. Finally, lessons were drawn from aid agency interventions, especially that such agencies should act earlier and respond to requests for pre-flood preparedness instead of providing support only after a disaster has occurred.

Droughts in Ethiopia (Hellmuth et al. 2007)

Ethiopia has a diverse climate characterized by ~~an important~~ variability that presents a significant challenge to its people, about 75% of whom rely almost entirely on small-scale, rain-fed agriculture. Poverty, environmental degradation and other challenges further increase these people's vulnerability to extreme climate events and especially to droughts. As droughts killed many hundreds of thousands of Ethiopians in both 1972-73 and again in 1983-84, as well as at other times, the government has taken various measures to tackle this important issue. For example, a national EWS was set up in 1976 and improved during the following years. Funds for drought preparedness and to ensure food security were also secured as part of Ethiopia's drought strategy.

These and other efforts in DRR have led to considerably more security for most Ethiopians since the significant droughts of 1983-84. For example, in 2002 drought was forecast in Ethiopia, but the country was able to respond to the challenge by relying on its EWS and preparedness strategy. Mitigation measures were put in place before the disaster struck, and early warning helped the in-country communities and international emergency assistance donors to prepare to deliver relief on time.

Despite these important strengths in the practice of DRR in Ethiopia, however, the drought of 2002 did point to possible ways the system could be improved. For instance, it revealed a shortage of trained personnel and equipment in the meteorological services that really constrained the timeliness of forecasting services. The lesson, therefore, was to train more staff, to strengthen analytical capacity at the district level and to build more stations to collect relevant climatic data, especially to cover the more remote areas that are too often neglected but where many vulnerable people live. The droughts also highlighted flaws in communication within the meteorological service and between the service and its users. A lesson on this important point was identified to improve linkage between the meteorological service and relevant user groups, which have to be identified first. Among these potential groups, farmer communities, comprised of zero order responders, (a concept described earlier) are often neglected when they should be prioritized.

Conclusions on lessons learned

Disasters, such as those correlated with the occurrence of the El Niño and La Niña events at the end of the 1990s, have severe impacts in SSA for a number of reasons, including a weak regional level of development, the high vulnerability of the population and problems regarding disaster management. Past disaster events, however, constitute "teachable moments" as noted earlier that highlight lessons that can be used to improve future management and responses to hydro-meteorological risks.

The following lessons, specific to the SSA region, have been stressed in the literature for the past 15 years (i.e. Glantz 2000a; Glantz et al. 2003; Few et al. 2003; Hellmuth et al. 2007; Merrey et al. 2008; Holloway et al. 2010; World Bank 2010b; UNISDR 2012, and several others):

- Improve understandings of climate patterns and the quality of climate products;
- Set up EWS and adequately disseminate the timely information they provide;
- Strengthen regional networks to enhance regional climate research and to share experience and knowledge;
- Develop and strengthen communication between the climate scientist community and the range of potential climate information users;

- Prepare strategies and contingency plans based on climate predictions as well as impact, risk and vulnerability assessments to support fast responses to disaster;
- Increase regularity in disseminating climate products;
- Create institutions that train people in climate affairs;
- Enhance forecast accessibility, using comprehensive language (versus probabilistic language) and accessible media;
- Assist users in interpretation and applications of seasonal forecasts;
- Increase awareness of climate risks among institutions, acknowledging that stakeholders must be aware of the usefulness of climate information in decision-making;
- Increase public education on risk to improve societal responses;
- Link DRR activities to development issues and strategies; and
- Avoid the project approach to disaster intervention that stops when the funds end, since "drop-and-go" programs often fail to ensure continuity through the building of local and national skills.

These lessons are often presented as "lessons learned," but they should only be considered to have been learned if they have been tested and applied. Otherwise, they remain only as "lessons identified."

Managing hydro-meteorological risks in SSA: past and recent trends in the practice

The growing number of reported disasters in the SSA not only highlights the region's exposure to hydro-meteorological risks but also indicates weaknesses in the management of such risks in the region. Such weaknesses were exemplified in the previous section, through case studies of disasters in SSA that occurred in the past 15 years. They are also exemplified in more recently observed climate-related hazards and their impacts in SSA. For example, there were strong warnings in December 2010 about the food security crises that were to hit the Great Horn of Africa in 2011, which threatened the lives and livelihoods of some 9.5 million people. Although droughts and related food crises were predicted, governments were unprepared and unable to mitigate the disaster. For their part, the international humanitarian aid community also did not respond adequately upon the issuance of warnings, and mobilized resources after people had died and others had gone into debt or lost their livelihoods (UNISDR 2012).

This example indicates the urgent need to continually improve the risk preparedness of African governments and also the education and awareness of populations at risks. It also raises concerns about the support of the international community in terms of DRR in the region. As has been shown previously, weaknesses in the way aid agencies have historically tackled hydro-meteorological risks in SSA have shown systemic failures in response. One problem is that support from the international community is often delivered *after* many of the impacts of a disaster have already been experienced and observed. What this means is that due to this dominant risk management practice that focuses on post-disasters responses, funds are given out each year to provide short-term humanitarian assistance and relief (see Table 5), but less funds have been invested to enhance a national sense of "ownership" or in the national capacities necessary to deal with such disaster risks. With recent USAID (2012) policy guidance, this could change in the future.

The point is that a shift in funding practices to focus more on pre-disaster preparedness initiatives like awareness campaigns and mitigation response planning would likely lead to better outcomes for less money—limited funds for disaster planning and response, that is, could be stretched further than under presently, post-disaster focused funding practices. The development community's resurgent interest in building resilience is recognition of this need.

Table 5 Humanitarian Natural Disaster funding (worldwide) compared to estimated disaster damage, between 2004 and 2011

	Humanitarian disaster funding/year ($ billions)[319]	Estimated damage from natural disasters/year ($ billions)[320]	Funding/damage %
2004	0.59	136.20	0.43
2005	7.62	214.20	3.56
2006	0.26	34.10	0.76
2007	0.82	74.40	1.10
2008	1.40	190.50	0.73
2009	0.31	41.30	0.75
2010	6.43	123.90	5.19
2011	1.45	366.00	0.40
Average	2.36	147.58	1.62

Source: Ferris & Petz 2012

Significant amounts of spending worldwide each year on humanitarian assistance along with the likelihood that disaster events will increase in the future in the context of changing climates means that improving DRR practices is an important matter for planners, decision makers and scholars alike. Considerable research has been published over the past decade that promotes such a shift of emphasis from disaster response and recovery to preparedness and awareness raising (see Holloway 2003, Holloway et al. 2008 & 2010 and Vermaak et al. 2004). In contrast, aid agencies' funding in the field of DRR have continued to largely focus on disaster responses, as illustrated by the 2010-2011 interventions that responded to drought in the GHA region.

Changes, through greater emphasis on preparedness, have, however, been on the way for years now, as various aid agencies gradually came to acknowledge past problems in the way they have dealt with hydro-meteorological risks in sub-Saharan Africa. Concerns for a better approach to DRR with a new emphasis on the concepts of *resilience* and *partnerships* and *ownerships* were, for instance, recently raised within USAID (2012) and within the UNISDR (2013). Such a shift in DRR support and practices from response to prevention and from short-term to long-term commitments is expected to not only improve disaster management in SSA but also reduce the fast-expanding costs of humanitarian assistance (Holloway 2010). Furthermore, a partnership with the development community is expected to address the significant "deficit" in social and economic development in SSA, a deficit that contributes to making societies vulnerable to hydro-meteorological hazards. Finally, partnerships are being promoted to build bridges between the DRR and the CCA communities in order to better tackle the impacts of climate change that are, according to climate science projections, likely to increase the number and intensity of hydro-meteorological hazards in SSA in the years and decades to come.

Enhancements of DRR practices have also been initiated in SSA in efforts to improve climate science and climatic data collection, seasonal predictions and early warning of related climate extremes and associated risks. Regional climate centers as well as climate forums and early warning programs have been established in the three main regions of SSA to provide weather and climate advisories with predictions and early warnings (IRI 2001a; IRI 2001b). The three main regional climate centers in SSA are:

- ACMAD (African Center of Meteorological Application for Development) is a pan African inter-governmental organization located in Niamey, Niger that is comprised of climate experts and focuses on climate research as well as on improving the capacity of African National Meteorological Services;
- ICPAC (*IGAD Climate Prediction and Applications Center*), called DMCN (Drought Monitoring Centre in Nairobi) until 2004, is located in Nairobi. This specialized institution of IGAD[1] represents the GHA, including the Great Lakes region, and provides seasonal climate outlooks to the region as well as capacity building support to its members; and
- DMC (Drought Monitoring Center) is located in Gaborone, Botswana and is now practically a department of the Southern African Development Community (SADC), representing Southern Africa.

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[1] The Intergovernmental Authority on Development is a regional African political and economic institution that enhances development in the GHA.

[2] The chart is based on the annual spending presented in OFDA's annual reports from 2005 to 2011. In FY 2010 and 2011, the amounts for disaster responses include the categories "disaster response" and "disaster response with DRR components", with preparedness and mitigation being represented the category:

Each regional climate center aims at improving climate prediction and forecasting skills of the National Hydro-Meteorological Services (NHMS) from the countries included in their focus area in order to enable member states to respond to or reduce climate-related risks. The centers collaborate at the regional level and with international climate expert institutions such as (among others) the World Meteorological Organization (WMO), the International Research Institute for Climate and Society (IRI) and the National Oceanic and Atmospheric Administration (NOAA). These institutions provide technical support, upon request from the SSA regional climate centers. The WMO coordinates regional activities related to meteorology and water in Africa.

At the national level, the NMHS coordinate climate observations and activities, and collect and analyze relevant climatic data. These meteorological institutions are ultimately responsible for providing national climate information and updates to relevant "users" (essentially Ministries, national institutions and INGOs) who represent climate sensitive sectors. These users can then draw on this climate information to improve decision-making in their particular field of activity, consequently reducing climate risk impacts on societies and economic sectors.

ICPAC: What it is and what does it do?

ICPAC is the climate center for the GHA (plus the Great Lake region). Initially named the DMCN, it was created in 1989 and adopted as a specialized institution of IGAD in 2004. ICPAC is located in Nairobi, Kenya, and, as a regional climate information provider, serves the eight member States of IGAD: Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan, South-Sudan and Uganda. It also serves the non-member states of IGAD: Burundi, Rwanda and Tanzania. IGAD is headquartered in Djibouti.

Various international institutions technically support ICPAC, including the WMO and IRI. It has received funding from the African Development Bank (ADB), research institutions such as the University of Nairobi (UNo) and the Kenyan Meteorological

Department (KMD), and from international agencies such as the WMO, UNISDR and USAID OFDA.

Goals and activities

ICPAC's main goal is to provide timely climate information in the GHA to enable member states to cope with climate-related risks (including water and weather) and to minimize the impacts of climate and climate-related extreme events. Its various objectives are to provide timely climate information to improve the technical capacities of producers and users of such information, improve dissemination at the national level, expand climate knowledge in the sub-region and maintain a quality database for risk and vulnerability assessments.

ICPAC implements various region-wide activities, such as acquiring climate data from its member states; processing these data to monitor, predict and provide early warning in the sub-region; networking with the WMO and the NMHS; developing, training (capacity building) and applying climate tools to assess risks; networking among the NHMS; and organizing regular Climate Outlook Forums (called COFs). The main outputs of ICPAC's activities are ten-day, monthly and seasonal climate/weather bulletins, climate watch and El Niño updates, and annual climate summaries.

Importantly, ICPAC does not conduct climate-monitoring activities by itself; the NHMS in the IGAD area send their primary climatic data to ICPAC, which analyzes the data to prepare seasonal forecasts. ICPAC also supports capacity building sessions to strengthen forecasting skills for the staff of the meteorological services in the GHA. Training is conducted several days before the release of the GHA Climate Outlook Forum (the GHACOF).

The Climate Outlook Forums (COFs)

As mentioned earlier, an important task of ICPAC continues to be the regular organizer and convener of the Climate Outlook Forums for the GHA (the GHACOF). Regional COFs (RCOF) are organized in Western Africa, in the Greater Horn and in Southern Africa, respectively, by ACMAD, ICPAC, and DMC/SADC, with the goal of providing a pre-seasonal forecast for each specific African region. The first RCOF was organized in 1997 in Southern Africa, and the experience was soon followed in East and West Africa, respectively, in February and May 1998 (Patt et al. 2007). Since then, the COFs have taken place on a regular basis in the three African regions, and a pre-seasonal forecast is released before each major rainy season. The forecast also indicates possible societal implications of climate predictions. It can serve as an early warning to potential risks from hydro-meteorological hazards in the three regions of SSA.

In the GHA, before each COF a "pre-COF" training session is conducted at ICPAC in Nairobi, during which the NHMS of member countries are able to model their national forecasts using their climatic data. During the GHACOFs, experts from international, regional and national climate institutions (e.g. representatives of the WMO, IRI, the UK Meteorological Office, etc.) work together to provide a pre-seasonal consensus forecast at the regional level for the GHA by aggregating national climatic data brought by each NHMS. Parallel to these climate-focus meetings, workshops for users are conducted during which climate experts from the NHMS and specialists from climate-affected sectors such as food security have the opportunity to meet and discuss the potential societal impacts of climate. These sessions are important to raise awareness on risks and to enable users to use the seasonal forecast for decision-making in their specific sector once they return home after the COF.

Notably, the GHACOFs' main outcome, a pre-seasonal climate outlook resulting from a consensus among climate experts, is not meant to be directly usable by the receiving countries. It provides regional information, made by aggregating national climate data brought to ICPAC by each NHMS. It provides a glimpse, that is, of what might be expected regionally during the next rainy season in the GHA.

OFDA's involvement in SSA

In 1990, in a concerted effort to reduce the risks associated mainly with extreme geological hazards in developing countries, the United Nations launched the International Decade for Natural Disaster Reduction (IDNDR). Concluding this decade-long effort in 1999 was the establishment of the UN International Strategy for Disaster Reduction (ISDR), which shifted to focus on hydro-meteorological hazards and disasters as well as other types of disasters. To these initiatives was added the Hyogo Framework for Action (HFA), which was adopted in 2005 as an important step in recognizing the necessity of improving risk management at international and national levels. The HFA provides various guidelines to implement DRR at the national level. It encourages governments to focus on disaster preparedness through such actions as improving forecasting skills and disseminating *timely* early warnings. Under the HFA, African governments are responsible for planning mitigation and response strategies to hydro-meteorological risks as well as for educating people and relevant institutions about disaster risks. In addition, aid agencies and international institutions support DRR activities that are consistent with the goals of the HFA.

OFDA has been involved in SSA to support such DRR activities. Despite the significant contributions of OFDA to DRR in this region, OFDA recognized "problematic" tendencies, which have been identified through a review of OFDA's annual reports, published between 2005 and 2011. They are detailed here as they provide opportunities to improve future activities from OFDA's DRR agenda.

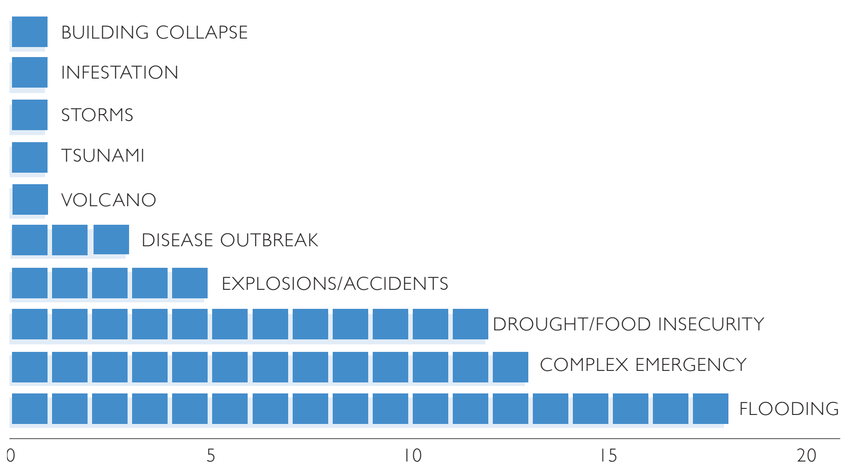
(1) "Complex emergencies", or disasters linked to conflict, tend to receive far more attention and investments from OFDA than interventions in the field of management of hydro-meteorological risk have;

(2) Most of the projects implemented in the context of hydro-meteorological disasters in SSA tend to be short-term response strategies focused on providing emergency supplies and relief to the victims of disasters; and

(3) Few DRR activities seem to be actually integrated in or linked with other existing development plans, as a way to ensure continuity when funding ended.

Complex Humanitarian Emergencies (CHE) constitutes a significant category of disasters' intervention for OFDA; such disasters are related to civil or military conflicts and are highly politicized internationally. Though an important category of disaster in East and Central Africa, however, hydro-meteorological risks (combining floods and droughts) arise twice as often as CHEs (see Figure 12), yet receive less funding from OFDA, as stated earlier. It is important to note that CHEs and their consequences last longer, and may be geographically broader in scope, than do specific drought or flood events in specific locations.

Figure 12 Number of disasters declared in East and Central Africa by type (FY 2003-2012)



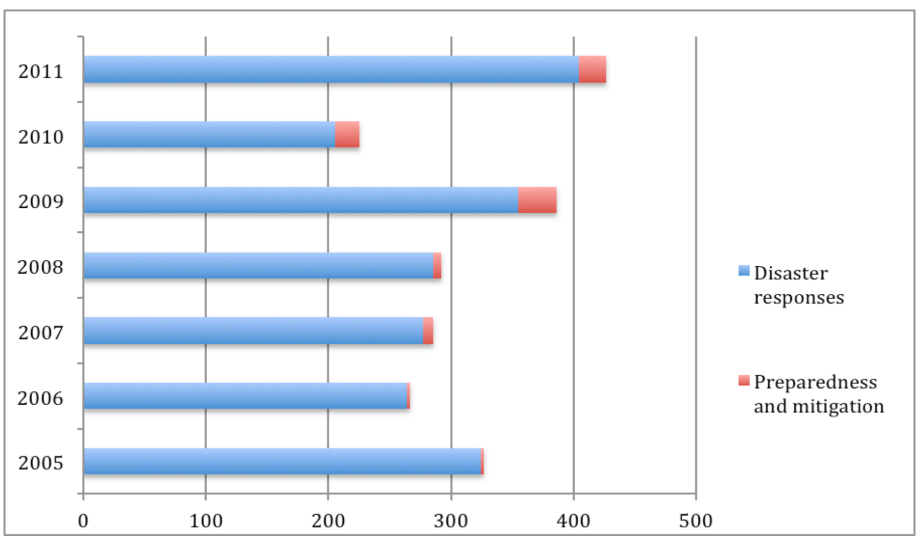
Source: OFDA 2012

For instance, in 2010 OFDA spent a total of US$210 million for country projects in Africa related to disaster response, disaster response with DRR components and DRR.

The majority of that amount, $182 million, was directed towards CHEs while the remaining US$28 million was dedicated to hydro-meteorological risks.

Another point is that most of the funding for hydro-meteorological risks tend to be invested in quick disaster responses that provide emergency supplies and recovery support to societies affected by hydro-meteorological hazards (Figure 13). For example, in FY2010 OFDA invested $16 million of that $28 million that was not dedicated to CHEs in direct response to flooding in Africa, providing necessary emergency relief supplies, health care, shelters and food to victims. Such humanitarian assistance is of course necessary for emergency relief when people need help to "bounce back" as quickly as possible from devastating events. Nonetheless, these activities are not aimed at—and do not contribute to—enhancing preparedness to cope with future climate stresses, an important concern for the climate change community, for instance.

Figure 13 OFDA's spending in disaster responses and disaster preparedness & mitigation between 2005 and 2011. Amounts are presented in millions of US$[2]



Source: OFDA annual reports from 2005 to 2011.

[2] The chart is based on the annual spending presented in OFDA's annual reports from 2005 to 2011. In FY 2010 and 2011, the amounts for disaster responses include the categories "disaster response" and "disaster response with DRR components", with preparedness and mitigation being represented the category: "DRR". Amounts include the total spending for each country as well as on regional programs in Africa.

OFDA's annual reports also highlight the implementation of several pilot projects that were designed to improve the preparedness and future response capacity of societies to the recurrence of foreseeable hydro-meteorological events. Figure 5 shows, however, that these activities involved a relatively small percentage of OFDA funding compared to its emergency responses. Another tendency in the way OFDA promotes preparedness to future hydro-meteorological risks at the local level is a focus on short-term projects (2-3 years) aimed at the implementation of one technology, such as the use of drip-irrigation kits to preserve water. Mainstreaming such efforts into local or national development strategies would require longer-term support.

As an example of 'weak' mainstreaming with existing development path, OFDA supported DRR activities in Kenya in 2009 in order to reduce drought-related risks by improving access to water in pilot areas and by training farmers on water storage and soil conservation techniques, but these projects were limited only to those very pointed objectives. As documented in OFDA's annual reports from 2005 to 2011, similar initiatives were piloted in other countries as well.

A report published in 2008 by the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) provides useful insights as it evaluates specific OFDA's risk preparedness projects implemented between 2003 and 2006 in Zimbabwe and Zambia (report from Merrey et al. 2008; FANRPAN 2008). Both projects studied by Merrey et al. (2008) were focused on risk preparedness in order to reduce small-scale farmers' vulnerability to droughts. In this purpose, farmers in selected areas of Zimbabwe received treadle pumps and drip-irrigation kits in Zambia. In the report, the authors evaluate these activities and underscore different issues that were not correctly addressed and had compromised the project outcomes in terms of long-term vulnerability reduction to droughts.

One of the problems raised is the lack of vulnerability assessments before both the implementation of both projects. As a result, both projects mis-targeted their respective beneficiaries. Women were, for instance, not well involved despite their important contributions to food production within the recipient communities. Another issue is the lack of partnerships with relevant local actors such as NGOs and local institutions, which resulted in a poor integration of the project activities with existing local development plans and therefore undermining project continuation after financial support had ended. Finally, the review also emphasized problems with promoting one specific technology to reduce drought-related risks—the treadle pumps and drip kits for Zimbabwe and Zambia, respectively—while other socio-economic development issues, such as access to markets to sell harvests, market development and the building of local capacities to repair the irrigation equipment, were apparently not considered. This reflects a lack of integration of DRR plans with other development activities and the top-down orientations and short-term commitments in project implementation.

Observations about weaknesses in DRR programs, made in the previous section, are neither limited nor specific to OFDA alone. In reality, development projects are frequently planned based on short-term commitments by donors, with many legitimately being referred to as “drop-and-go” activities. This trend reflects the tendency of aid agencies to look for quick-success measurement parameters. In this way, many organizations tend to confuse outputs with outcomes as they measure the success of their projects. As such, outputs then become ends in themselves instead of means to achieving the expected outcome of increased resilience, the metric by which aid agencies justify increasing their support for short-term objectives over longer-term commitments. The problem is that this short-term approach often fails to target the most vulnerable communities and does not ensure continuation when the project ends.

Because of the recurrence of “common” disasters in SSA (such as drought impacts), many researchers have studied and identified the multiple factors that undermine the possibilities to effectively reduce, over the long term, disaster risks in Africa: (1) the lack of accurate risk predictions and reliable forecasts in SSA; (2) the lack of preparedness among governments to cope with disaster impacts; and (3) problems in risks communication and risk awareness, especially at the local level. Hellmuth et al. (2007), for instance, underscore the poor capacities in SSA to produce and elaborate quality forecasts. Difficulties in collecting and analyzing climatic data are pointed out: too few skilled personnel and institutions to proceed with relevant studies as well as too few stations to collect data. Furthermore, most African states lack action plans to be able to respond early to disaster risks; only Uganda reportedly has such a strategy (UNISDR 2012).

Additionally, Hellmuth et al. (2007) and Holloway et al. (2010) discuss problems in transmitting timely information and warnings to the potential victims of disaster, especially but not only in remote areas. Communication obstacles include the use of non-familiar language and complex terminology when disseminating forecasts to the local communities, the lack of efficient communication infrastructures and the use of inappropriate media with limited broadcast potential. Trust issues at the local level also weaken the effectiveness of risk alerts because of past inaccuracies or cultural obstacles such as religious or traditional beliefs (Hansen 2011).

Highlighting such constraints on effectiveness of DRR activities is important to indicate where aid agencies could act to make a difference in the field of DRR. Fortunately, many opportunities to improve DRR practices abound and some of the constraints noted earlier have been addressed to varying degrees of success, as, for instance, through OFDA's recent DRR programs in SSA. Furthermore, there is continuous research on new technologies to improve climate predictions (e.g. using satellite data and the Internet). New technologies and new risk-reduction tools as well as innovative funding mechanisms, such as risk insurance for small-scale farmers and the use of low-technology communication tools to increase and improve the dissemination of seasonal forecasts that are gradually being developed and implemented are in need of widespread dissemination throughout SSA. Alternative approaches of DRR are also being explored and have been suggested (e.g., Hellemuth et al. (2007), Mercer et al. (2010), Holloway et al. (2008 & 2010) and Vermaak et al. (2010)). These alternative mechanisms support the use of participatory methods and indigenous as well as ordinary knowledge to reduce disaster risks at the local level.

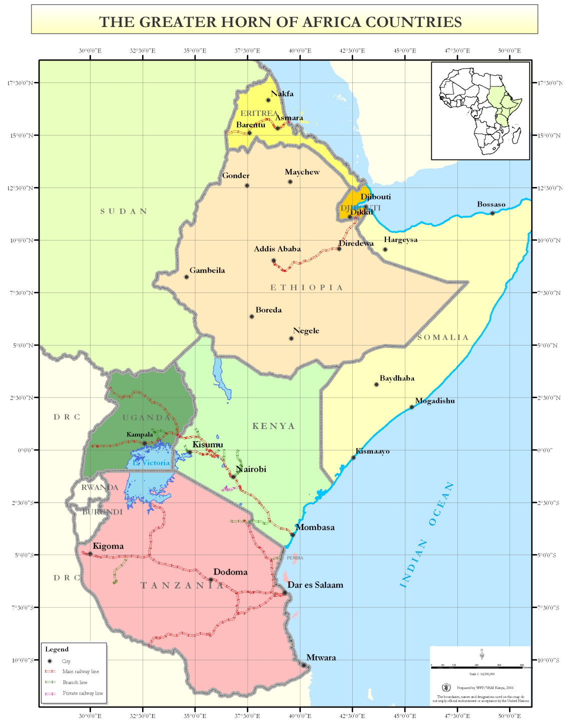
Scholars have also finally suggested bridging DRR, development and CCA activities. Among other reasons, Schipper and Pellin (2006) and O'Brien et al. (2008) have underscored that an increase in climate hazards under climate change poses new threats to the development agendas, as it accentuates and exacerbates food insecurity, chronic poverty and economic losses. Mercer (2010) justifies partnerships between DRR and CCA to avoid overlapping projects. Collaboration between DRR and sustainable development practitioners is also useful in order to tackle the multiple development challenges that affect the possibilities of predicting risks in SSA and that contribute to making societies less vulnerable to hydro-meteorological hazards.

Not surprisingly, these suggestions were recently acknowledged by international institutions such as the World Bank (2010); USAID (2013); and UNISDR (2012), each of which has been facing the ballooning costs of its *ex post facto* disaster interventions. Agencies seem to increasingly acknowledge shortcomings of the past in the face of recurrent hydro-meteorological hazards in SSA. They have initiated discussions that have been closely followed by a shift of focus from response and recovery activities to preparedness and longer-term development commitments, as observed in their reports.

Agendas from aid agencies such as USAID also stress new commitments to increase adaptive capacities, to improve the conduct of risk assessments, to improve the socio-economic conditions of the vulnerable and, in time, to enhance long-term development progress and resilience (see, for instance, USAID's "New Way of Doing Business" on www.devex.com). In it, they acknowledge the necessary partnerships to be established between the DRR community and other aid agency groups, including those involved in long term sustainable development and in CCA.

DRR activities in SSA: reviewing selected OFDA projects in the GHA

Figure 14 Map of The Greater Horn of Africa- Source: reliefweb.int



OFDA has funded DRR programs that sought to enhance hydro-meteorological risk preparedness in SSA. Some of these OFDA's programs, implemented over a short-term, did yield long-term outcomes in terms of ownership of their activities by the host country, and in terms of building bridges to other source of funding to carry on DRR initiatives. Eventually, such programs, despite their initial short-term grants succeeded to promote a long-term support for DRR in SSA.

One example of this key catalyst role of OFDA in SSA is reviewed here through the analysis of a particular DRR program implemented between 2002 and 2005 in the GHA – (Figure 5). This section highlights the strengths and weaknesses as observed when the project ended and identified longer-term outcomes from this specific program by assessing the present state of DRR in the GHA in light of the support provided by OFDA. Lessons are identified that can be useful for future DRR activities.

The discussion that follows is based on available documents including the project's proposal and the final report as well as on interviews, with some key actors. The project, "Regional Climate Prediction and Risk Reduction in the Greater Horn of Africa," focused on the GHA and was conducted in partnership with ICPAC. Actions were conducted at three different levels, with distinct objectives:

(1) At the regional level OFDA reinforced the DMCN (now ICPAC), establishing it as a platform that provides: (a) technological support to the NHMS of the GHA in order to monitor their own national forecasts; (b) training and capacity building sessions for the members of the NHMS; (c) and a place for exchange and interaction among these NHMS;
(2) At the national level, staff from the NHMSs received training on new forecasting technologies at ICPAC; and
(3) At the local level several demonstration projects were conducted in order to show the utility of utilizing appropriate and accurate forecasts in decision-making for various stakeholders and in different climate-sensitive sectors. These projects were also aimed at reducing vulnerability to climate risks within local communities.

The IRI proposal for the "Regional Climate Prediction and Risk Reduction in the Greater Horn of Africa" project was submitted in December 2001 and the project commenced in July 2002. OFDA's support in the GHA had, however, started earlier, back in 1998, with the funding of climate research and capacity building outreach through IRI and WMO.

The 2002-2005 project aimed at reducing disaster risks and promoting sustainable economic development in the GHA. In this project, IRI and WMO were also financial intermediaries between USAID and ICPAC. IRI sub-contracted the OFDA award to the WMO and to the University of Nairobi, to which some of the funding was dispersed to implement the project. One of the practical reasons for these sub-contracts was to reduce the high overhead costs of Columbia University, where IRI was located. The regional technical institution that implemented the project was ICPAC to improve climate prediction and early warning in the GHA and to decrease risk, vulnerability and disaster losses. ICPAC collaborates with the NHMS in capacity building and in the provision of pre-season climate outlooks.

Other partners involved in the project included: USAID Famine Early Warning System Network (FEWSNET), the University of Nairobi, FEWS/USGS, the International Center for Research in Agro-forestry (ICRAF), the International Crop Research Institute for the Semi Arid Tropics (ICRISAT), the Inter-African Bureau for Animal Resources (IBAR), the Red Sea Livestock Trade Commission (RSLTC), the International Animal Health Organization (OIE), Texas A&M University, the World Food Program (WFP), KenGen, and the Network of Climate Journalists in the Greater Horn of Africa (NECJOTHE GHA).

In this project, regional COFs were used as vehicles for coordinating activities with all stakeholders involved, for capacity building and for knowledge transfer. The WMO helped to coordinate activities at the regional level and, with IRI, provided climate expertise during the pre-COFs training sessions.

Of note is that this project constituted Phase II of a previously initiated (1998) USAID-funded program in the GHA. During Phase I, climate forecasters from IGAD countries participated in capacity building sessions conducted on a regular basis by the DMCN in order to upgrade and standardize the techniques and products of seasonal forecasts across the region. At the end of Phase I, integrating dynamic climate model predictions in the region was possible; Phase II was meant to build on and maximize those predictive skills in the GHA.

A survey of climate-sensitive institutions, following Phase I of the project, also underlined a high degree of interest among various users in and subsequent demand for climate information and tailored products. This request was included in Phase II through activities supporting the application of tailored forecasts in specific sectors. Finally, the end of Phase I also highlighted that at the local level rural communities required assistance in interpreting climate information for their own decision-making. These "uncovered needs" were to be addressed in Phase II.

According to the project proposal for Phase II (IRI 2001a&b) improving anticipation and management of climate hazards such as droughts and flooding in the GHA is necessary if sustainable development goals are to be reached. In this context, the project's main goal was "*to improve monitoring, prediction and applications for early warning of climatic hazard events in support of disaster reduction and other regional sustainable development objectives"* (IRI 2001a; IRI 2001b).

The project proposal delineates several specific objectives in order to reduce hydro-meteorological risks and to promote sustainable development. These objectives are complemented with indicators for monitoring progress and a list of activities to implement in order to achieve desired outcomes. The objectives were as follows:

<u>Objective #1</u>: to improve regional climate models and products (for indicators and activities, see Table 2). Indicators focus on measuring the increase in human resources and in the technical capacity of regional/national climate scientists and operational meteorologists (outcomes expected after two years).

Table 6 Indicators and Activities for Objective 1

Indicators	ACTIVITIES
- Regional forecast skills improved over current statistical approach - Number of countries issuing national forecasts based on blended methods increased from zero to at least five - Capacity building workshop evaluations improve over pre-project levels.	1.1 Downscaling of regional climate products; running of regional climate experiments with IRI. 1.2 Skill assessments and calibration of regional products currently being generated through IRI collaborations. 1.3 Visit of climate scientists from each participating NMHSs to DMCN for three months within the two project years. 1.4 Visit of climate scientists to international climate centers, including IRI. 1.5 Support to scientific and technical staff developing regional model products. 1.6 Conduct two training workshops to develop the skills of climate experts in prediction and seasonal forecasting. 1.7 Organize four pre-rainy season capacity building training workshops for experts from NMHSs; release of consensus regional climate outlook at the end of the workshop.

Adapted from the IRI project proposal (2001a; IRI 2001b)

Objective #2: to increase the availability and application of tailored products for reducing vulnerability to climate extremes and for adapting to climate change (for indicators and activities, see Table 3). Indicators focus on measuring the development of sector-specific climate information products in collaboration with key intermediaries such as the USAID FEWSNET and food and livelihood security partners (outcomes expected after two years).

Table 7 Indicators and Activities for Objective 2

Indicators	ACTIVITIES
– Increased availability of tailored forecast products (e.g. for pastoral risk reduction) – Increased availability of atlases for climate risk zonation – Increased availability of standardized regional climate change indices.	2.1 Develop tools for interpretation of seasonal climate forecasts for applications to risk reduction in sectors such as pastoral communities. 2.2 Risk zoning and development of decision support tools that can be used for the assessment of issues related to regional climate extremes 2.3 Develop regional climate change monitoring, detection and attribution capacities.

Adapted from the IRI project proposal (2001a&b)

Objective #3: is to support more effective application of climate products and services to reduce natural disaster losses and promote sustainable development (for indicators and activities, see Table 4). Indicators focus on measuring the outreach and extension to the national level (outcomes were expected after two years).

Table 8 Indicators and Activities for Objective 3

Indicators	ACTIVITIES
- Increased number of NMHS able to participate in virtual conferencing opportunities - Increase in the number of national assessments conducted	3.1 Pilot application projects to demonstrate forecast benefits [NOAA OGP] 3.2 Regional capacity building workshop on methods for using climate information in risk reduction in pastoral communities. 3.3 Survey existing capacity for virtual conferencing, develop infrastructure and run trial virtual conference contributions demonstrating the potential use of virtual conferencing technology 3.4 Factor meteorological information and early warning products in national and regional disaster preparedness policies. 3.5 Forecast message development and testing.

Adapted from the IRI project proposal (2001a; 2001b)

Each of the three main project's objectives was complemented by clear indicators and quantified targets that were expected to measure success at the end of the project (see IRI 2001a&b). The project revolved directly around building DMCN capacities (e.g. ICPAC) and the NHMS of member countries. The improved climate products were also expected to benefit the larger development community. Finally, local communities involved in pilot projects were expected to directly benefit from implemented activities, while methods developed were over time also expected to benefit other communities that had not been directly involved.

At the end of the project in 2005, a final report was published for USAID/OFDA by IRI. The report does not provide a global evaluation of the project and its outcomes but reviews the activities implemented during the period March 2002 to February 2005, some of their achievements and the remaining challenges for follow-up stages. Notably, the report does not include indicators and specific targets mentioned in the project proposal. Some of the data from the final report were crosschecked with recent interviews with representatives of the NHMS in the GHA, the main coordinators of two of the demonstration activities[3] and other scientists involved in the project. The project's outcomes at its final stage in 2005 are presented in the following sections.

Forecasting skills and the quality of forecasts in the GHA

The final report assesses improvements of forecasting skills of NHMS staff in the GHA based on their having participated in training sessions at ICPAC before each COF during the project's lifetime. For instance, a meteorologist from the Ethiopian National Meteorological Agency states that the contribution of ICPAC to the forecast skills in Ethiopia was extremely important. In addition, meteorologists from the Kenyan Meteorological Department (KMD) and ICPAC benefited from additional training in a four-month visit to ICPAC and to IRI as well as one post-doctoral position.

[3] Interviews were conducted with Chris Oludhe from ICPAC, who was responsible for the Tana River project, and with Professor Robinson from the University of Nairobi, who was responsible for the farmer-level decision-making project.

ICPAC was strengthened as a regional platform that enhances collaboration and promotes data sharing. One of the major contributions of the OFDA project to this institution was an improvement of regional forecasting science through the installation of a super computer to process regional climate data. That in itself improved technological capacity for the region. The project also introduced experimental downscaled forecasts, which were aimed at overcoming the constraints of general, small-scale forecasting in the region. Information at finer scales is in fact needed by decision makers to make appropriate climate-, water- and weather-related decisions. Downscaled forecasts were produced by using dynamical models, which required improvements of skills that were strengthened during the workshops conducted by ICPAC. The use of downscaled forecasts has limitations, however, and at the end of the project, whether the technique has been implemented routinely or not in the region was unclear.

Users' understanding of climate products

The COFs were intended to be outreach opportunities towards various sectors. In this sense, the final report mentions capacity-building sessions for "users" that were conducted in parallel with each COF to improve users' understanding and interpretation of climate predictions in regard to potential impacts on their sectors.

During the project's lifetime, "users" collectively included representatives of media services in the GHA. Journalists were trained to better understand climate prediction and to improve dissemination of such information at national and local levels. As a result of OFDA's program, the Network of Climate Journalists in the Greater Horn of Africa (NECJOGHA) was established around 2004. This network aimed at training journalists to better understand seasonal forecasts and their related societal impacts. It also attempted to organize national branches of climate journalists in the different member countries of ICPAC by providing capacity building sessions for journalists reporting on climate change issues in the GHA and other regions. Its website (see: http://www.necjogha.org) included important news and networking opportunities on climate-related issues in the GHA. At the end of the project, however, whether the media in the different countries had successfully reached this goal of having trained journalists to understand the climate science was unclear but likely successful in general. The reality is that in many countries, weather-related news continues to be broadcast by forecasters with very little experience in journalism [*personal communication, Tsegay Wolde-Georgis January 2013*].

The final report contains no clear data enabling a review of the project's success at attempts to improve the understanding and the use of climate products by different categories of users. The report, however, mentions that users representing the following categories were invited to and participated in the COFs during the project lifetime: agriculture and livestock, water management, DRR, and health. The report also highlights many remaining challenges for users, including the need to improve communication among the region's NHMS, users and the at-large public. Another necessary improvement noted in the final report concerns the limited collaboration in the project with members of local NGOs or representatives of civil society, who are also potential users of climate forecasts but were not invited to the COFs.

In sum, data in the final report illustrate the great contribution of ICPAC (strengthened by OFDA support) in improving forecasting skill in the region. It also suggests a limited success in applying the E2E feedback loop, which implies interactions with the users of climate information.

Demonstration projects

The final IRI report provided information regarding the state of the five demonstration projects that were implemented as part of this OFDA program. These activities were conducted in various communities of Kenya and were "designed to improve specific outcomes through managing risks associated with climate variability" (IRI 2005). They demonstrated how to use forecasts as tools in decision-making in order to reduce climate risks within various sectors that participated in the workshop sessions of the COFs. A larger goal was to enable stakeholders to replicate such tools, which were designed to integrate climate risks in sectoral decision-making outside of the pilot areas. A review of the final report coupled with discussions with the project coordinators involved in these activities provided the following information.

Demonstration Project 1: *Utility of climate information-based stream flow forecasts: Hydropower stabilization and flood risk management in the Tana River Basin, Kenya*

- **Context:** Kenya is highly dependent on hydropower, which had been adversely affected by droughts in the past and especially in 1999-2000. Heavy economic losses have resulted from power failures.
- **Main goal:** The project promotes the use of climate forecasts to develop scenarios that help maintain hydropower generation and agricultural irrigation along the Tana River Basin during times of climate-related stress.
- **Activities:** In order to avoid the risks of power shortages in the future, the project supported the use of seasonal forecasts to develop climate scenarios and manage hydropower generation. Activities were expected to foster development of a user-friendly interface for reservoir managers based on the input of climate information. The interface would enable managers to use seasonal climate forecasts to predict supply of water (for energy, urban use and agriculture), and to manage and prevent flood damages with the preparation of contingency plans (see the following project).
- **Results:** At the end of the project, new software was developed to enable users and managers of the reservoir to use seasonal climate information for decision making. The software was developed in collaboration with IRI and a Brazilian institution, which sent a computer expert to help set up the system. Chris Oluhde, a climate scientist from ICPAC, visited IRI for a month for training and to provide data to test the software. The software was intended to help reduce the likelihood of power shortages during drought, reduce flooding during heavy rain events and provide agriculture with enough water for irrigation. The technology could also be used to reduce flood impacts on people in the lower basin of the Tana River.

By the end of the project, these predicted uses had not yet been applied; more tests had first to be conducted. It was reported that KenGen[4] was to provide data to test the software but refused to do so. Resolution to the issue could not be made as the project's life came to an end in mid-June 2004.

Demonstration Project 2: *Flood livelihood impact assessment for contingency planning: the case of the Lower Tana River Basin, Kenya*

- **Main goal:** The project promotes the use of seasonal climate forecasts to better coordinate and prepare humanitarian aid for quick responses to floods affecting people living in the lower basin of the Tana River.
- **Activities**: A stream flow model and flood hazard mapping were built and used to prepare flood scenarios.
- **Results:** At the end of the project, outcomes highlighted potential losses to flooding of vulnerable pastoralist and agro-pastoralist communities; adequate food assistance necessary to recover from flood impacts had been calculated.

At the end of the project, recommendations were made to use these results to build contingency and preparedness plans to provide quick assistance to vulnerable communities in flood-prone areas. The project ended, however, before outputs could be tested. Furthermore, the project did not involve communities that live in the basin but was conducted by expert consultants (from the United States Geological Survey – USGS).

[NB: The results from the first two demonstration projects indicated the possibility of improving water management in reservoirs by using seasonal climate predictions. The utility of forecasts as a tool for decision making was demonstrated by the regular use of the new software that had been developed. Improved water management using forecasts would stabilize hydropower generation and reduce or mitigate flood impacts. To reach this expected outcome, recommendations were made to improve communications

[4] KenGen is the Kenya Electricity Generating Company.

between relevant authorities, including KenGen and regional, local and international institutions. Additionally, involvement of users and relevant experts starting from the initial design of projects was also recommended].

<u>Demonstration Project 3:</u> *Improving agricultural production through farm-level decision-making: the case of Machakos, Kenya*

- **Main goal:** The project aims at evaluating the potential of using climate forecasts as tools to guide farmers' economic activities and, potentially, reduce impacts of climate stresses on agriculture.
- **Activities:** During the pilot project, farmers participated in workshops led in farmers' communities in the Machakos District of Kenya in order to assess their comprehension of climate forecasts and to identify what responses they might implement to predicted climate stresses. Farmers were also able to test for themselves the various solutions and techniques to improve yields under specific climate conditions such as droughts and see which ones were best to adopt.
- **Results:** At the end of the project, findings suggested that use of such a forecast has the potential to improve harvests when combined with other interventions, such as timely distribution of climate information and technical support that enables farmers to use this information.

At the end of the project, however, more detailed evaluations were still needed. The final report recommended engaging in dialog with relevant partners such as the Ministry of Agriculture and meteorological services to improve and extend the use of forecasts in farming activities.

<u>Demonstration Project 4:</u> *Food Security Outlooks for contingency planning in the GHA*

- **Context:** Risks of food insecurity are great in the GHA due to high climate variability, climate extremes and existing socio-economic conditions in the region.

- **Main goal:** The project promotes a better understanding of the link between climate fluctuations and food security in the GHA to assess if, and how, climate forecasts could be used to predict food shortages and improve humanitarian aid. As an outcome of the project, forecasts were expected to be used on a regular basis to elaborate and review contingency plans.
- **Activities:** During the project, research was conducted to improve the interpretation of climate data in term of food security. A partnership between the Food Security Outlook (FSO, which is comprised of food production specialists) and the COF (comprised of climate specialists), was launched in order to study the possibility of using forecasts to generate food production scenarios.
- **Results:** The collaboration between climate and food security experts led in 2004 to the first FSO associated with the GHACOF, which was the first attempt in the GHA to systematically incorporate climate forecast information into regional food production analysis. During these meetings, climate and food experts worked together to translate climate hazards into impacts on food production. A second FSO forum was held in February 2005.

When the project ended, recommendations were made to carry on this association between food and climate experts in order to improve the results about climate impacts on food production. Further steps to maintain and improve the use of climate forecasts to decrease food insecurity in the GHA included participation of the World Food Program (WFP), FEWSNET[5] and other relevant institutions (such as IGAD) in order to support research and establish a permanent regional food security network with regularly convened forums. A report including recommendations was written to the attention of the users. This document was not, however well-distributed to users, which suggests that the food security community was not the driver of the experimental workshop—the climate scientists were. The FSO have been organized after the project's end, however,

[5] FEWS is a USAID-funded project providing food security early warning systems to all countries in the GHA. FEWS develops monthly early warning reports focused on the food security situation on regional and national levels. These reports are disseminated to institutions that may have contacts at grassroots levels. FEWS is not directly involved with local communities and its contacts with intermediate institutions are limited to report distribution (see Curry 2001).

sources indicate that the partnership between climate scientists and food security experts is weak.

Demonstration Project 5: *Protecting pastoralist livelihoods by protecting the livestock trade between the GHA and the Middle East through control of Rift Valley Fever (RVF)*

- **Context:** RVF has destabilized the livelihoods of millions of pastoralists in the GHA who depend on the export of live animals to the Middle East. Arab countries import millions of live animals for ceremonial slaughter according to Islamic law just prior to Ramadan. When fears of an RVF outbreak is high, however, such countries often ban importation of live animals, which can lead to the significant disruption of livelihoods for small-scale pastoralists in Somalia, Kenya and Eastern Ethiopia.
- **Main goal:** The project constitutes an attempt to forecast RVF epizootic outbreaks by developing a model to help policymakers mitigate trade impacts. The RVF risk model is designed to predict environmental conditions associated with RVF viral activity, which is linked to mosquito breeding. The RVF predictive model was intended to provide early warnings to importers of live animals so that interventions could be made before imports were blocked.
- **Activities:** Studies ~~to~~ that map and predict RVF were conducted by epidemiologists and experts across Kenya.
- **Results:** No model was developed at the end of the project.

At the end of the project, more analyses were found necessary to be able to evaluate the feasibility of developing such an RVF model. Considerable funding would also be needed if such model were to be operationalized on the ground.

In addition to some technical problems, one of the biggest constraints of this project was the political nature of the Rift Valley Fever Predictive Model idea. Although the Red Sea Livestock Commission was consulted adequately, national governments that export live animals were not. Ethiopia, for example, which has the largest animal population, was not a part of initial project development. The Inter-African Bureau for Animal Resources (IBAR-AU) in Nairobi thought that it would be very easy to obtain data for its model but did not consider the socio-political sensitivity of such issues, as a model that predicts outbreaks could easily lead to earlier embargoes being made by Middle Eastern countries that would then have time to find alternatives in other areas. Changes in personnel at IRI also led to the downscaling of the problem.

Many of these pilot projects demonstrated the utility of climate forecasts in decision-making in various sectors, as indicated in the final report. Yet, none of the results were adopted or scaled up by the end of the OFDA project; further research and funding were necessary. The projects also demonstrated the challenges of working successfully on issues that are multi-sectoral and multi-national and are in need of additional scientific research. Pilot projects yield interesting insight, even if the goods were not always achieved.

There was neither monitoring nor evaluation of the project during the implementation of OFDA grants and no final workshop at the end to survey what has been done, to find if the targets were achieved or to discuss potential next steps. The professional departure of the Africa Regional Program director from IRI at the end of the project in June 2005 left the program led by a committee composed of diverse interests in addressing DRR.

Based on the project proposal, the final report by IRI and information compiled during interviews with key actors, an overview of the project's achievements when it ended was prepared (see Table 5).

Table 9 Goals, Activities and Achievements of the OFDA Project

Goals	Activities applied	Achievements
Improved regional climate models and products	- Meteorologists from Kenya were trained during a four-month attachment to IRI and ICPAC; - Capacity building of	- The skills of the meteorologists from the NHMS in the GHA improved; - Climate products were

	forecasting skills in the GHA was regularly supported during training sessions before each of the COFs; - Advanced forecasting techniques such as high-resolution dynamical models and downscaling techniques using the IRI Climate Predictability Tool were applied.	regularly issued in the GHA after each of the COFs; - Seasonal predictions in each member country were improved by using advanced forecasting techniques at ICPAC.
Increased availability and application of tailored products	- Demonstration projects were conducted in order to develop tools and techniques to address climate-related problems in decision-making in climate-sensitive sectors; - Users, including media, were trained during the COFs to gain improved understandings of climate products.	- The demonstration projects show that tailored climate products are useful for decision-making in climate-sensitive sectors. Tools were developed to address climate-sensitive issues; - Progress in communication between climate experts and the media and in media understandings of climate information was achieved, leading to the establishment of the NECJOGHA.
More effective application of climate products and services to reduce natural disaster losses	- The COFs were regularly organized (twice a year) by ICPAC in partnership with IRI and WMO.	- The NHMS of the GHA were able to participate at regular COFs and their related training sessions during the project lifetime.

A review of the final report combined with the interviews also highlights various remaining challenges to address, activities to carry on or analyses to conduct, at the end of the project in 2005.

- Continue capacity building and training of NHMS staff in downscaling techniques;
- Widespread use of IRI Climate Prediction Tools in all countries of GHA;
- Operationalize tailored climate products in all countries of GHA;
- Strengthen networks and knowledge management among member countries;
- Facilitate access to demonstration project results in all countries;
- Improve communication of climate information, mostly with the public, using appropriate language and media to reach a larger audience;
- Improve media's capacity to disseminate climate information;
- Conduct more analysis when necessary and upscale demonstration projects results by applying them in other areas and in other countries; and
- Create a forum where stakeholders of climate-sensitive sectors of the countries in GHA can share information and experience in managing climate risks in their own sectors.

Applying these further steps was recommended in the final report, which was thought to lead to better development outcomes and a strengthening of DRR in the GHA.

Ongoing Disaster Risk Reduction in SSA

This section looks at long-term outcomes from the past OFDA's support to DRR in the GHA reviewed in the previous section. Despite a dominant focus on disaster response over the past decade, the program applied by OFDA and ICPAC in the GHA between 2002 and 2005 focused on risk preparedness by improving forecasting skills and by increasing the accuracy of climate predictions in SSA. Though remaining challenges were highlighted in a final report at the end of the program, long-term outcomes were also identified.

A first significant impact of this program, which also contributed to the establishment of ICPAC as a Regional Climate Center, is the enhancements of early warnings and of the dissemination of forecasts and their understanding among some categories of users.

However, gaps in risk communication and education among others, identified as lessons to apply earlier in this report, tend to remain and constrain the capacity to take early action in response to early warnings in the GHA. It seems that some of the past lessons on DRR in SSA still need to be used in order to enhance the way African societies respond to climate hazards.

This section analyzes the progress made in DRR in the GHA as of today. Results are noted in light of the support provided by OFDA between 2002 and 2005 and its long-term outcomes. Strengths and weaknesses in the current practice of DRR are identified in order to suggest ways to improve future interventions in this field.

Although the primary scope of this examination was initially intended to be in SSA, most of the examples presented here are specific to the GHA and some are even more specific for Kenya. This can be explained as most interviews were conducted in Nairobi with Kenyan representatives of user categories (e.g. Ministries, universities and NGOs) and with Kenyan meteorologists. In addition, small-scale farmers in Kenya were interviewed as end-users of the prediction products so as to provide insights on the use of forecasts from a local perspective. Many of the findings also relate to the GHA, as written questionnaires were distributed to 10 meteorologists out of eight countries' NHMS in the GHA (out of 11 countries member of ICPAC), to the NECJOGHA and because ICPAC is a platform that serves this entire region of the GHA. Interviews were completed by Internet search and with academic literature to conduct the present analysis.

It should be noted that assessing OFDA's direct or precise contribution to disaster risk reduction in the region was not possible, as the selected projects for this review ended at least eight years ago. As a result, among the 10 representatives of NHMS members of ICPAC that were interviewed, only four had memories of the OFDA program; six others neither recall this support nor had heard of OFDA until the interview. This could be explained by the fact that the respondents from some of the NHMS are new in the service or that some NHMS have only been recently established (e.g. South Sudan).

Despite such constraints in assessing the direct impacts of OFDA's program, this study acknowledges the key role for OFDA as a catalyst for improving climate predictions in the GHA, by strengthening ICPAC and regional capacity. OFDA support also served as a bridge to funding from other donor organizations that supported follow-up stages to DRR improvements in the GHA. **These are two major long-term outcomes (being a catalyst and serve as a bridge to other funding) from OFDA's DRR program in the GHA that need to be highlighted.**

The present analysis revolves around three main questions selected on the basis of the specific objectives of OFDA's 2002-2005 project and its potential long-term outcomes:

1) Have forecasting skills and climate predictions improved in SSA during the past decade?
2) How good is the dissemination of the forecasts to different categories of users, including end-users (e.g. vulnerable communities)?
3) How are the seasonal forecasts used and useful for different categories of user?

The two first questions relate to early warnings and the third relates to early action. Findings are expected to highlight whether or not past "lessons learned" on DRR were effectively applied and to underscore new lessons for future planning.

Forecasting in the GHA: Skills of meteorologists and the quality of the current climate products

During the OFDA project, much attention focused on improving forecasting skills and the accuracy of the forecast in the GHA in order to enhance risk preparedness. As a result, today:

- *Climate scientists from ICPAC and meteorologists from the National Meteorological Services of the GHA have improved their skills.*

Meteorologists continue to be trained during ICPAC workshops before each COF;

- *Great enhancements in seasonal predictions were acknowledged* by the climate scientists from the GHA and by some categories of users in Kenya;
- *Most NHMS of the GHA regularly participate in COFs and describe the forums as very important*, mostly for the pre-COF training sessions;
- *The regularity of the release of forecasts has also been improved* with the recent establishment of a third annual ~~the~~ GHACOF; and
- *OFDA's support to ICPAC served as a bridge to other funding*, while climate scientists from other aid agencies continue to provide technical backup during training sessions at ICPAC.

Improvements are still necessary regarding forecasting activities:

- *Forecasts are not produced with regard to various users' needs*, because the interactions between climate scientists and different categories of users, especially at the local level, is limited;
- *Despite improvements, most forecasts are still coarse and regional in nature*; they do not provide clear information usable at the local level;
- *ICPAC (and its forecasting activities) is perceived by some as Kenya-biased*, or as an extension of the KMD that serves (or served, due to recent improvements) essentially the needs of Kenya regarding seasonal predictions; and
- *The member states of ICPAC have different abilities and skills to produce and release their national seasonal forecasts*. Some nations have limited capacities (equipment and skilled staff) to collect climatic data at the national level and to conduct the related analysis.

OFDA has contributed to making ICPAC the resilient climate center it is today: a regional platform that promotes exchange, technical support and capacity building for meteorologists in the GHA. Interviews at NHMSs confirmed the present importance of

ICPAC's training sessions for their staff, the opportunities to access and to learn using new forecasting technologies, and the chance ICPAC provides to exchange and share data, experience and knowledge[i]. Some member states of ICPAC, however, would not yet benefit from these various opportunities provided by ICPAC: interviews with ICPAC members revealed the absence of Eritrea and Somalia (two summer-rainfall countries) during the regular pre-COF training sessions because of their restrained capacities.

<u>Financial resources:</u> Following the OFDA project, ICPAC (which, as noted, replaced the DMCN in 2007) received funding from IGAD as one of its specialized institutions. These financial resources primarily covered staff salaries. Grants have also been sought from various donors, regional and international institutions, and banks to complement resources made available through IGAD and to conduct research activities.

<u>Staff</u>**:** Most of the climate scientists currently working at ICPAC were involved in the OFDA project; they were able to keep their position and status within this institution after the original project ended. These scientists are climate experts as well as professors at the University of Nairobi. The capacity to expand the staff are, however, limited according to an interview with members of ICPAC due to funding constraints that restrict abilities to hire more meteorologists and open new research departments.

<u>Collaboration</u>**:** As a platform for training and exchange, ICPAC is connected essentially with the NHMS of the GHA and especially with Kenyan meteorologists. Interviews with several members revealed that ICPAC's outreach to potential users of forecasts, especially the local NGOs and communities, is limited as it neither receives nor seeks feedback regarding the use of its climate products. ICPAC is essentially focused on climate-centered activities and receives little information about users' specific needs regarding forecasts, a statement supported by the conclusions drawn from review of OFDA's project final report in the previous section**.**

ICPAC is responsible for organizing the GHACOFs, forums that have been conducted on a regular basis since 1997 (see Table 6).

Funding: COFs used to be organized by ICPAC in collaboration with the IRI and the WMO during the period of the project. Afterwards, ICPAC took over the COFs' organization, with support from other financial resources; these funds are essentially to cover travel expenses of COF participants. Recent support has come from USAID/OFDA, ADB, World Bank and UNISDR, among others.

Organization: The GHACOFs used to be conducted twice a year, before each of the two important rainfall seasons in the GHA countries: in February/March in anticipation of the March to May (MAM) season and in August/September in the anticipation of the September to December (SOND) season. MAM and SOND both constitute important rainfall seasons over the equatorial parts of the GHA region. Recently, however (since 2011; see Table 6), a third COF session was added in May/June in order to provide climate predictions in anticipation of the June to August (JJA) season, which constitutes an important rainfall season over the northern and western parts of the equatorial sector of the GHA for the "summer rainfall countries" of IGAD.

GHACOF	Date	Venue
9th GHA climate outlook forum	Feb 20-21, 2002	Eldoret, Kenya
10th GHA climate outlook forum	Aug 26-28, 2002	Nairobi, Kenya
11th GHA climate outlook forum	Mar 2-5, 2003	Entebbe, Uganda
12th GHA climate outlook forum	Aug 27, 2003	Nairobi, Kenya
13th GHA climate outlook forum	Feb 25-27, 2004	Nairobi, Kenya
14th GHA climate outlook forum	Aug 25-26, 2004	Nairobi, Kenya
15th GHA climate outlook forum	Mar 2-4, 2005	Mombasa, Kenya
16th GHA climate outlook forum	Aug 31-Sept 2, 2005	Nairobi, Kenya
17th GHA climate outlook forum	Mar 1-3, 2006	Nairobi, Kenya
18th GHA climate outlook forum	Aug 31-Sept 1, 2006	Nairobi, Kenya
19th GHA climate outlook forum	Mar 5-7, 2007	Nairobi, Kenya
20th GHA climate outlook forum	Sept 5-6, 2007	Nairobi, Kenya
21st GHA climate outlook forum	Feb 27 to 29, 2008	Entebbe, Uganda
22nd GHA climate outlook forum	Aug 28-29, 2008	Mombasa, Kenya
23rd GHA climate outlook forum	Feb 25-27, 2009	Nairobi, Kenya
24th GHA climate outlook forum	Aug 24-25, 2009	Nairobi, Kenya
25th GHA climate outlook forum	Feb 25-26, 2010	Kisumu, Kenya
26th GHA climate outlook forum	Sept 2-3, 2010	Arusha, Tanzania
27th GHA climate outlook forum	Feb 28, 2011	Nairobi, Kenya
28th GHA climate outlook forum	June 17, 2011	Entebbe, Uganda
29th GHA climate outlook forum	Sept 1-3, 2011	Kigali, Rwanda

30th GHA climate outlook forum	Feb 27-29, 2012	Kempinski, Djibouti
31st GHA climate outlook forum	May 29-30, 2012	Zanzibar, Tanzania
32nd GHA climate outlook forum	Aug 29- 31, 2012	Bujumbura, Burundi
33rd GHA climate outlook forum	Feb 18-20, 2013	

Table 10 COFs since 2002 (dates and venues)

Training sessions occur in the weeks prior to each COF. During these sessions, ICPAC assists NHMS staff to analyze their national climatic data on temperature, precipitation and wind (if available) and climate scientists from the region produce and downscale national forecasts based on the data they had collected at the national level. Previously, IRI funded visits from a post-doc as well as a scientist from the region to help with the training and the forecast development. However, it was reported that these post-docs tended to then leave their national meteorological service posts in order to work with IRI. Today, whether IRI continues to support during pre-COF training sessions is uncertain. Regardless, technical support is still provided by climate scientists from other climate and development aid institutions. For instance, during a visit at ICPAC in February 2013, British climate scientists were present to assist meteorologists and help monitor forecasts for the MAM season. This suggests that OFDA's former support to ICPAC continues to serve as a bridge to other aid agencies that today provide the technical backing required during the training sessions at ICPAC.

After working on their national climate forecasts, the NHMS of the GHA participate in the COFs. Though these conferences have been organized at different locations since 2011, they are often organized in Nairobi (see Table 6), which is likely due to ICPAC being headquartered there. Due to this trend and the long absence of seasonal predictions related to the JJA season, some senior climate experts in the GHA have noted that ICPAC and the related the GHACOF are Kenya-biased. ICPAC has been perceived as an extension of the KMD and the meteorological department of the University of Nairobi with little concern about the needs of the other GHA countries. This suspicion has also been fueled by the fact that OFDA's project strengthened ICPAC and gave it the management of pilot activities that were only conducted in Kenya, even though their results were supposed to be generalizable for the whole the GHA.

The criticism regarding ICPAC and the GHACOF was especially leveled by the summer-rainfall country members: Table 6 underlines that the COFs have not yet been organized in many of these countries (i.e. Eritrea, Ethiopia, Somalia and Sudan), although it also indicates recent changes regarding the location and timing of the COFs. For example, in recent years they have been held at various places outside of Kenya. Furthermore, since 2011 they have been conducted three times per year, producing forecasts for the JJA rainy season and effectively addressing the major criticism of the summer-rainfall countries. Criticisms are, however, still reported by some sources who stated that ICPAC supports the national climate outlook activities of the summer rainfall countries without the related workshops and training activities [*personal communication, Tsegay Wolde-Georgis January 2013*].

In addition to providing technical support to the NHMSs as well as training for their staff and COF organization, ICPAC hosts a website through which the following climate products are regularly released and are accessible:

- *The decadal bulletin*, which summarizes the past 10-days rainfall activities in several regions of the GHA and their impacts on agriculture. Positive and negative environmental and socio-economic impacts of the observed rainfall are described. On the basis of the past 10-days rainfall observation, climate outlooks are provided for the following 10-days.
- *The monthly bulletin*, which describes rainfall trends for the past month with associated socio-economic and physical impacts; on the basis of past month rainfalls, predictions for the following month are provided (a "climate outlook" resulting from COFs consensus) with expected impacts; and
- *The COF's outcome*, a pre-seasonal regional forecast issued three times a year before each major rainy season in the GHA.

These products are derived from the NHMS climatic data, as ICPAC's forecasting activities depend on climatic information collected at the national level in the member countries. Climate products are designed for the NHMS and climate experts and are released in English. Interviews with various members of ICPAC, with 10 meteorologists from the NHMS and with different categories of users, including a representative of the Ministry of Arid Lands in Kenya and a professor from the University of Nairobi, indicate that the quality and the accuracy of these forecast products in the GHA have obviously improved over the recent years.

Without questioning these enhancements, obstacles to the improvement remain~~s~~ of forecasts that are specific to local micro-ecological zones and are not too coarse for use at the local level. One source suggests that the NHMS are conservative in their dissemination of information for fear of being responsible for a "wrong" forecast, as might have been the case in the past.

The NHMS themselves have finally pointed out various suggestions in order to provide better forecasts at the national and local levels:

- The necessity of improving knowledge about intra-seasonal rainfall variability was underlined by a meteorologist from KMD;
- A refresher course~~s~~ on climate analysis was suggested by a meteorologist from Uganda;
- Several meteorologists (from Rwanda, Burundi and Sudan) asked for more capacity building training for their staff, including an update of the equipment used to train the meteorologists at ICPAC;
- The need to recruit more personnel to work on forecasts at the national level was highlighted by meteorologists from Uganda and South Sudan;
- The need to establish more climatic stations was underlined by South Sudan;
- The benefit of introducing dynamical models at the national level as well as better instruments to monitor climate was suggested by meteorologists from Ethiopia, Burundi, Sudan, South Sudan and Uganda (this was an improvement mentioned in the final IRI report of the OFDA project); and

- The need to improve the downscaling technology in order to provide more accurate and reliable climate predictions at the local level were underscored by meteorologists from KMD, climate experts from ICPAC and representatives from both the Ministry and the university.

The significant disparity between member states of ICPAC regarding equipment, infrastructure and human capacity to collect and analyze climatic data is an interesting finding from the questionnaires distributed to the NHMSs. This finding is interesting because a project with a regional scope such as the one assessed in this report (as in other case studies) sometimes assumes that all countries have equal ability and benefit the same way from activities that enhance climate predictions at this level. As this review indicates, however, whereas Kenya is often viewed as having been privileged when it comes to available staff and infrastructure resources, South Sudan, as one of many examples, lacks adequate infrastructure to even collect and analyze climate data let alone skilled staff to conduct research and analyze such data. This disparity suggest that efforts to improve the forecasts in the GHA should first assess each state's specific needs in order to ensure the provision of basic infrastructure (such as climate stations) and the necessary skills to ensure that all national meteorological services in the region are fully functional.

Through its support to ICPAC, OFDA has contributed to significant improvements in forecasting activities in the GHA, e.g. by introducing the use of advanced forecasting techniques in ICPAC to deal with climatic data from the member countries. Yet, uncertainties and probabilities are likely to remain within the forecasting science despite constant improvements. Hence, focus should be set on educating potential users so that they can interpret climate products and forecasts for what they are (probabilistic products) with the necessary caution.

Forecasts' outreach: who receives and understands the forecasts

The COFs were initially intended to improve forecasts' outreach towards various socio-economic sectors sensitive to climate events by enhancing communication between climate scientists and representatives of Ministries and society, and by improving their understandings and interpretations of climate products. Additionally, training for the media, introduced during OFDA's 2002-2005 program, aimed at improving the quality of forecast dissemination at the national level after each COF.

Today, the COFs still enhance communication of relevant climate products:

- *Most NHMSs from the GHA are represented during the COFs*; they are able to communicate what they have learned during the forum afterwards at the national level;
- *Some user categories in Kenya have good contacts with KMD and ICPAC* (e.g. Ministries and the Meteorological Department at the University of Nairobi); they receive seasonal predictions and regular climate updates from the meteorologists;
- *Communications between climate scientists and journalists during the COFs has been maintained*; the NECJOGHA still interacts with meteorologists during the COFs.

Yet, significant problems were identified in forecast production and communication to the society, some of which were previously mentioned at the end of the OFDA project. These problems are especially evident at local levels and are related to dysfunctions in the EWS in the GHA:

- *Neither ICPAC nor NHMS conducts follow-ups after the COFs to assess what users do with forecasts;* therefore, whether users are able to use the forecasts in decision-making when they return home has not been verified;
- *Despite improvements in COF's participation numbers, important categories of potential users (i.e. local NGOs) are still not represented*; COFs are essentially attended by climate scientists;

- *NECJOGHA tends to emphasize its status as an important regional institution over its ability to better communicate at the national level*, especially in terms of communication of the forecasts;
- *Tenacious barriers to the dissemination and in the understanding of forecasts remain evident in many countries of the GHA*. These include the use of complex terminology, unfamiliar language and the difficulties to reach local communities especially in remote areas; and
- *Education is not perceived yet as a relevant sector for the EWS in the GHA* though it could foster interest in forecasts, improve their understanding and raise awareness about climate risks.

Since OFDA's project, participants to the COFs from the "users' category" have mainly been representatives of ministries, national institutions and INGOs. They are informed, during parallel sessions at the COFs, about the potential impacts of predicted climate trends on their particular fields of activity. After the COFs, such users are supposed to formulate appropriate policies or take necessary measures based on the potential impacts of seasonal predictions.

However, one of the realities of the COF system is that the drivers are the climate scientists who receive hands-on training about converting existing data to develop a functional forecast, while users are "only" invited as guests to listen and give presentations. No mechanism has been arranged as yet for workshop participants to share their experiences and fill gaps in climate information when they have returned to their "non-climate" institutions after each COF. While ICPAC follows up with climate-related capacities, it does not do so with the non-direct climate users after the COFs.

Participation of these users in the COFs is also unclear. For example, only one participation list (for the GHACOF32) was found for this review. Additional interviews conducted with a representative of the Kenyan Ministry of Arid Lands and with a professor at the University of Nairobi, the later having been a program coordinator on the OFDA project between 2002 and 2005, depicted current users' participation, including

Ministries, as restricted by financial constraints. With fewer funds available today to organize COFs and to cover travel expenses, the advantage for funding is likely being given to climate experts (possibly from Kenya) who continue to be perceived as the most dominant participants.

A review of the GHACOF32 participation list supports the previous statement. Most participants were, indeed, meteorologists from NHMS, from the University of Nairobi and from ICPAC. One participant was from the WMO, and another was a representative of a climate-sensitive sectoral Ministry. This cursory review suggests that COF's outreach or concern to other potential categories of users remains limited. One source from Kenya, however, indicates recent changes with an increased participation of representatives of Ministries and INGOs who use their own financial resources to attend COFs. Because feedback was not forthcoming from other users in the GHA, generalizing the result further with, for example, a review of other Ministries' participation was not possible. But it is likely that national governments would send representatives to the COFs when they are held on their territory; and with the recent diversification of the COF's location, it is possible that the COF's participants will come from other ICPAC member countries not just Kenya.

The core issue remains in the very limited participation of other user categories that represent civil society. Field research in Kenya suggest that representatives such as local NGOs are not aware of, do not attend and are not invited to the COFs, which was already the case during OFDA's support to the COFs; furthermore, no small NGOs were partners in the project**.** Discussions with a representative of the One Acre Fund working in Kenya, for example, confirmed this previous statement, as well as responses from NHMS regarding their interactions with civil society and its local representatives. The NHMS only acknowledged their broad connections with large INGOs such as the Red Cross and the World Food Program (WFP), to whom NHMSs distribute their seasonal forecasts, were mentioned.

The lack of participation of small NGOs to the COFs could be explained by the following factors: (1) funds to cover travel expenses in these organizations are limited; (2) those outside of directly climate-related agencies tend to lack awareness of the COFs; (3) the GHACOF's organizers have failed to address the concerns of the various, secondary sectors; and (4) other potential users are unfamiliar with the terminology used by climate scientists during the COFs, which discourages their participation. Some members of the NHMS underscored the complexity of the language used at the COFs as a problem.

Inviting small NGOs to the COFs and involving them to work more closely and regularly with the climate scientists could be one way to insure that the forecasts better reflect organizational needs and provide those organizations with useful and usable information at the local level. This invitation has still not been extended to them by ICPAC (see Patt et al. 2007). Furthermore, even very small NGOs should be invited to the COFs, especially when their activities are directly related to food-crop production, a sector highly dependent on climate and precipitation. The point is that, unlike the Ministries who are invited, these organizations are in direct contact with the local communities, members of which are the end-users of forecasts. The relevance of this suggestion came through clearly in discussions for this review with the representative of the One Acre Fund, who expressed interest in ICPAC products once made aware of their website and who was especially interested after visiting the site and responding positively to its available climate products. This result shows the potential use of the COF's seasonal forecasts to this specific category of user, which has markedly close associations with civil society and local communities.

As a conclusion, after more than 30 workshops related to COF, it is time to address adequately the strategy of improving and delivering climate information to users. Even more, follow-ups need to be conducted after the workshops that bring users together in order to assess what they do after returning to their home institutions. Importantly, these observations suggest that the problem about forecast communication during COFs in the GHA is not necessarily a shortage of money, but the lack of mechanisms to make mid-course corrections to a system that might not be working well in terms of its connections with the civil society and its representatives.

Journalists are still represented at the COFs through the NECJOGHA's participation. M. Patrick Luganda as the director of this network, which was established as a result of the OFDA's project, describes it as a turning point in the dissemination of climate information in the GHA. During the COFs, NECJOGHA's members help clarifying language and participate in drafting COF statements as well as in debates during the meetings. In this way, they are provided with the opportunity of working close with forecasters on climate information dissemination with regional and international organizations, including ICPAC, ACMAD, WMO, IRI and various NHMSs.

The expertise of the NECJOGHA is also recognized at the international level, according to its leader. Its members have assisted building the capacity of media and scientists in Southern and Western Africa for instance. Senior NECJOGHA members have also been invited to other African or Asian regional COFs to share experience and to train journalists on climate reporting issues, and expert journalists have been invited by the WMO to participate in international meetings and to serve as communication experts. Finally, the network still organizes workshops and training sessions at the regional and local levels to build capacities of local media in reporting climate forecast information to the public. The NECJOGHA website (http://www.necjogha.org/) provides open-access information to anyone interested in communicating and sharing climate data.

One of the key elements to understand the current role of the NECJOGHA is the relationship between journalists and the NHMS in each country that is a member of ICPAC, during and after the COF. Following this conference, journalists have a role to play in the dissemination of climate products in each individual country. As climate outlook documents are not to be used *per se* at the national scale (due to their broad regional scope and use of probabilistic terms), the user is advised to contact the national meteorological agency for relevant climate predictions (for the national to local levels).

Journalists from the NECJOGHA must as well refer to their own NHMS in order to obtain relevant climate information to disseminate at the national and local levels.

On this matter, responses from the NHMS in the GHA indicate relatively limited knowledge of the NECJOGHA at the national level with variation from one country to another. Moreover, even when aware of the NECJOGHA, the meteorologists pointed out that they had very limited interactions with the network. Typically, interaction occurs during or just after the COF to ensure clear communication of the forecasts to the media community, when seasonal climate forecasts are later released at the national level.

After the COFs, the NHMSs disseminate relevant climate information to the different categories of users – essentially in Ministries and INGOs plus journalists – in their own countries. The users then disseminate relevant information to communities at the local level. In this model, the sole responsibility of distributing climate-related information locally is with the national meteorological agency; ICPAC often restrains itself from becoming involved in local climate information distribution.

Interviews with the NHMSs highlight the lack of benchmarks regarding the way they release the forecasts at the national level. More likely, seasonal forecasts are disseminated during national press conferences held with the media, right after each COF in most countries of the GHA. Various types of media are used for dissemination of information, such as radio, TV, newspaper and the Internet. It should be noted that using cell phones as a tool to disseminate information on climate is not yet common in the GHA, except in some pilot areas in SSA, such as in Mali or in pilot zones of RANET. Interviews with Kenyan farmers suggest, no less, that their use would be an improvement in forecast dissemination to end-users—while radio is intermittent for farmers, everyone carries a cellphone most of the time (see Archer, 2003).

One source also suggested that, at least for the northern GHA countries that depend on summer rainfall, there is no such forecast dissemination process at the end of each COF in February and September.

Forecasts' outreach is difficult to evaluate because each country is responsible for its national dissemination. Additionally, there is no follow-up after the COFs by ICPAC or the NHMSs. Responses from the majority of the NHMSs in the GHA suggest also that they do not receive feedback from users after the COFs, which essentially are climate-sensitive ministries and a few major INGOs or networks such as the Red Cross, the WFP and FEWSNET.

Feedback was nonetheless collected, during personal interviews, with the ministry users of these climate products. For instance, the Ethiopian Meteorological Agency has a list of users to which it distributes regularly by fax and by email monitoring and forecast information. Many users appreciate the information because it keeps them informed about the status of the rains as well as of the outlook for the next 10 to 30 days [*personal communication, Tsegay Wolde-Georgis, January 2013*]. Similarly, discussions with a member of the Kenyan Ministry of Arid Lands provided insights into the relationship between meteorologists and state representatives in Kenya. Findings indicate regular contacts between members of "climate-sensitive sector" ministries concerned with, for example, agriculture and livestock, water resources and health and Kenyan meteorologists. Concerned ministries send a representative to attend each of the COFs, and they also receive climate updates directly from the KMD on a weekly basis through emails. They finally communicate with climate scientists either to address concerns or to give feedback regarding the climate products they have received. These results are, however, specific to Kenya, because similar interviews were not conducted in other countries of the GHA.

Users from the Ministries from climate-sensitive sectors are left to decide about forecast communication at the local scale. The case study in Kenya highlights how the Ministry of Arid Lands communicates relevant information by releasing a brochure with recommendations to district officers, to churches, to some communities, and so forth. Sometimes it sends a representative to the district level and local communities to provide face-to-face information and explain the likely outcomes of the seasonal predictions.

Despite differences among member states of ICPAC, communication on forecasts at the local level remains restricted—information does not reach all local communities, especially those in isolated areas. The following dissemination problems with local communities were underlined by some of the representatives of the NHMS as well as in the literature (see Archer 2003; Hansen et al. 2011).

- Meteorologists from South-Sudan and Ethiopia underlined *the necessity to build a better communication infrastructure* to reach a larger number of local communities;
- A meteorologist from Tanzania mentioned the *need to raise awareness of climate risks and of forecast releases* among the local communities so that they are interested in receiving this information, which also implies the *need to resolve trust issues in the forecasts*, a point mentioned by Hansen et al. (2011) and repeated later in this report;
- *Better media and appropriate timing to release forecasts would also increase the scope of forecast dissemination* (Archer 2003). On this matter, meteorologists from Burundi suggested the establishment of community radio or TV system to release forecasts in this country, where forecasts are currently issued only through the Internet and so have a very limited outreach to local communities.

Investment and research to improve local communication media—as well as the quality of the information delivered (e.g. research into the use of cell phones, RANET and community radio)—could contribute to improving the geographic scope of forecast dissemination and help to reach more communities, especially in remote areas.

However, adequate dissemination of climate information is not the sole issue. More communication gaps affecting the understanding and interpretation of the forecasts are identified here, some of which were already acknowledged in the final report of the OFDA project. These key obstacles are (1) complex terminology, (2) the dominant use of English to communicate, and (3) a lack of education and awareness about climate risks among the public.

(1) Climate experts from each member country of ICPAC are responsible to translate forecasts into understandable, user-friendly terms. Respondents from some of the NHMS have recognized that, despite an attempt to simplify the language used, seasonal predictions remain coarse and the use of probabilistic terminology is still significant (e.g. probability of rain at a 'normal', 'below normal' or 'above normal' level). Such complexity undermines understanding of forecasts among different categories of users, including some highly educated users. An interview with the Kenyan Ministries suggests that efforts were underway to facilitate interpretation of forecasts, as KMD now releases climate products in terms of amount of precipitation expected and compares it to previous seasons. Doing so would help users and local communities understand a forecast's implications for societal impacts.

(2) Another limitation is the wide use of English to disseminate forecasts in most cases in the GHA — except possibly in pilot projects in some countries of the GHA, as, for example, in Uganda and Ethiopia, or in pilot areas of RANET. Therefore, forecasts are often not understood by those end-users not familiar with English; i.e., providing that they ever have access to such information.

(3) Finally, the NHMSs highlighted the lack of understanding of the forecasts, the lack of education about climate risks and about the utility of forecasts as a third communication gap, especially with regard to the local communities. The fact is that most local farmers do not understand meteorology and are likely not aware of its potential benefits. This problem is illustrated in many scientific research findings on DRR in SSA, like, for example, publications by Archer (2003), Hansen *et al.* (2011) and Shah *et al.* (2012). A meteorologist from Uganda suggested improving the skills of local officers so that they are able to explain climate risks to villagers. Another way to improve the understanding of a forecast would be through education. Notably, however, education is not yet considered a "climate-sensitive" sector, which means that it is not yet perceived as a

vehicle to make the public aware of climatic risks and of the potential usefulness of seasonal forecasts. Education can, nonetheless, foster interest in, and understanding of, early warning at all levels.

In conclusion, besides problems in the dissemination scope of the forecasts, many challenges remain that also weaken the possibilities to correctly interpret forecasts among all user categories in the GHA. Perhaps, such challenges were not well understood or dealt with during the 2002-2005 OFDA's DRR program in the GHA, which at that time focused on improving regional climate predictions.

Today, climate products essentially remain non user-friendly, as well as regional or national and coarse resolution in nature. These aspects undermine their use to make agronomic decisions by farmers who often lack the relevant education to understand the forecasts as they are now produced. Furthermore, extension agents in agriculture are often not trained in interpreting such information and, as a result, there is sometimes a "mechanical" interpretation of forecasts without a more nuanced understanding of their probabilistic nature. The absence of multidisciplinary-trained individuals who are able to communicate in the language of both the climate and non-climate scientists must be addressed.

Disaster risk management: using forecasts for decision-making

Results from previous analysis suggest that the quality of forecasts and forecasting skills have continued to improve in the GHA, with OFDA as a catalyst to such improvements. Similarly, the dissemination and interpretation of forecasts among *some* categories of users and more specifically in Kenya have increased. Significant communication barriers remain, however, especially with end-users and likely throughout the GHA. Moreover, enhancements to early climate information or early warnings by themselves do not directly necessarily lead to early actions to mitigate or avoid disaster risks. In all situations, the EW and the forecasts must meet various conditions in order to be useful for decision-making that reduces disaster risks.

Patt et al. (2007) state that, among the necessary conditions, useful forecasts (1) must be specific to particular user needs, (2) forecasters need to work with potential users to develop forecasts and (3) communication must be comprehensive because most people have difficulties understanding probabilistic forecasts: these conditions are barely met in the GHA. Additionally, the EW should not only provide enough time to make pro-active decisions that mitigate the impacts of hydro-meteorological hazards (Glantz 1999), but decision makers and civil society should also have the capacity to implement such pro-active decisions in a timely way.

Today, many barriers remain to the effective uses of forecasts in the GHA and contribute to what appears to be low utility of forecasts for decision-making:

- *Potential uses of climate products in the GHA, promoted through pilot activities during OFDA's program, were not further explored and tested*. This is due to the use of short-term grants to support the pilots, no ownership of the activities by ICPAC, and late consultations of relevant institutions;
- *At the national levels, African governments have limited capacities to use forecasts for decision-making;* they are constrained by a lack of funds and weak preparedness planning; and
- *At the local level, climate products are used less:* rural communities lack the financial capacity and security, the education on risks and the trust in the forecasts that are necessary to effectively use these products.

Furthermore, coordination and feedback from the user sector about how seasonal forecasts are used or about how they could be improved are limited, which further compromises the ability of meteorologists to produce relevant and useful climate forecasts.

Interviews with ICPAC staff members and with three project coordinators, C. Oludhe from ICPAC, Wolde-Georgis T. (CCB Researcher, formerly of IRI) and R.K. Ngugi from the University of Nairobi revealed that the several OFDA's project pilot initiatives that were launched in Kenya in order to demonstrate the use of forecasts in decision making in various sectors and at the local level were neither continued nor up-scaled after OFDA funding ended (Table 11). The exception is the Machakos pilot project on farm level decision-making that was completed after the end of OFDA project, because the coordinator was able to secure funding from other donors, such as from the European Union (EU). Not only were the other projects not extended, they were not even completed, such as the RVF project and the reservoir management model that were interrupted mid-way and not completed.

Table 11 Feedback on the Demonstration Projects

Pilot projects implmented by OFDA (2002-2005)	Achievements	Current status	Reseaon for current status
Hydropower stabilization and flood risk management in the Tana River Basin, Kenya.	- Software to improve hydro-power production was developed; - Training of ICPAC experts on the software was conducted; - Representatives of the energy sector (KenGen) were made aware of the utility of climate products.	Project never completed. The software has never used.	- All relevant institutions were not involved in the early stages of the project, leading to conflicts and refusal to share data in the aftermath; - Lack of funds to continue/ conduct remaining necessary analysis.
Flood livelihood impact assessment for contingency planning in the Lower Tana River Basin, Kenya.	- A streamflow model was developed, as well as flood risk maps, livelihood baselines and contigency plans; - Findings were published.	The models and plans were never applied. Results were never upscaled.	- Lack of funds to implement and upscale results.
Improving agricultural production through farm-level decision-making: the case of the Eastern Province, Kenya.	- Results demonstrated how tailored information for farmers can be used to identify resource management decisions; - Findings were published by Ngugi et al. (2011) after the end of the project.	The project was completed in the same District of Machakos in Kenya (i.e. not up-scaled) after OFDA project ended.	- The principal investigator of the project (PI) from IRI was able to secure funds to complete activities in Kenya after OFDA funding ended.

Food Security Outlooks for contingency planning in the Greater Horn of Africa.	- The FSO was associated with COF, and two meetings were conducted in 2004 and 2005; - The network was recognized as an opportunity to translate climate data from COFs into concrete impacts on the agricultural sector.	The relationship between climate experts from ICPAC and food specialists weakened when the project ended, despite interest from the WMO. Representatives from the food-production sector (such the FEWSNET), however, are still represented during the COFs.	- Lack of funding; - Very low involvement of the user community (the food security community) that was perceived as a guest rather than a driver of the initiative; - Lack of follow-up by ICPAC.
Protecting pastoralist livelihoods by protecting livestock trade between the GHA and the Middle East through the control of Rift Valley Fever (RVF).	- A prototype environmentally-based RVF risk model neared completion.	The project was never completed despite interest from the Middle East livestock Commission, IBAR and Kenya.	- Departure of the project coordinator when OFDA funding ended; - Refusal to collaborate from many countries such as Ethiopia due to the lack of prior consultation, and other potential impacts of the early warning to the livelihoods of pastoralists.

One key reason for not completing or up-scaling pilot activities and their results is the nature of the grants related to these projects. In many cases, when the money from a short-term grant ends, the donors are primarily interested in receiving final reports and the stakeholders who are involved in the implementation of these projects are interested in receiving other grants for other projects once those reports are submitted. Secondary to both granter and grantee, it seems, is the actual continuation of the project, even if it is successful. This evaluation likely applies to the OFDA grants for DRR in the GHA.

In addition, a weak involvement and lack of follow-up from ICPAC, which never really "owned" the pilot activities, explain why these projects were left aside due to a lack of funds when the grants ended, except in the case of the Machakos pilot activity for which the coordinator remained involved even after initial funding ended. Finally, conflicts and weak collaboration and consultation between relevant institutions from the beginning and little involvement of the potential users of the projects are additional reasons why most of these activities never made it past (or even through) their pilot phases.

The case of the Tana River hydropower project is an interesting example of these problems, illustrating how a lack of coordination and initial consultation among all relevant institutions from the beginning of a project can compromise the implementation of promising activities. This project was significant for Kenya because it related to the generation of hydropower energy, which is important for the country's economy and electricity supply. The project was, however, never completed and contradictory explanations were provided by ICPAC and by a former IRI expert. According to ICPAC, the model has not yet been completed because the current Director of KenGen is not involved in the COF and has not yet been convinced in the potential use of climate products to better manage the Tana River reservoir. Additionally, funds have not been made available to complete the streamflow model with relevant analysis. An alternative explanation is that KenGen refused to share data because of the lack of previous consultation, which has been confirmed by the project PI from IRI. KenGen was not initially involved in this pilot project, so, when ICPAC asked KenGen to provide relevant data to conduct the necessary analysis for the streamflow model, a conflict arose. The outcomes might have been different had KenGen been consulted at the very beginning of this demonstration activity.

Beside these pilot activities, some of which nonetheless had promising outcomes, the specific use of forecast for real-world application is hard to evaluate because of the absence of follow-up by ICPAC or the NHMSs after each COF. Specific information about forecast uses by ministries has, however, been collected in the field through interviews. For instance, the Ethiopian Ministry of Health receives climate data from the national meteorological service and makes regular malaria early warnings to those that are vulnerable to epidemics (personal communication, Wolde-Georgis).

More specific data were collected about Kenya during an interview with M. James Odure, a representative of the Kenyan Ministry of Arid Lands. First of all, responses from KMD indicated that most forecasts are issued early enough to allow relevant users to make the necessary decisions. Delays can be observed occasionally for the MAM season's predictions. Therefore, preparedness is important, as plans should already be available at the ministry level. At this level, for example, after each COF the "climate-sensitive" Kenyan Ministries hold a national meeting during which the implications of forecasts for each sector are explained and recommendations are prepared. Each Ministry then must decide how to communicate and apply recommendations to the local level, to district officers as well as to local communities.

Recommendations are generally prepared by the ministries, (or committees), *after* the seasonal forecasts have been released, but no mention was made of *pre-existing* strategies to respond to specific hydro-meteorological risks. Whether these recommendations are actually applied is also unclear. The discussion with the representative suggests a lack of financial resources from the government to apply DRR strategies or contingency plans in response to climate predictions and to predicted (and foreseeable) risks. [NB: Based admittedly on this single interview from one individual country of the GHA, the point is that forecasts at the national level, despite the presence of early warnings (assuming that the forecasts are issued early enough to all the members of ICPAC, information we cannot confirm here), are seen as being of low utility.]

However, the point is illustrated through the 2010-2011 droughts in the GHA (UNISDR 2012), during which early actions were missing despite early warnings about the droughts and their potential impacts. Lack of early action from African governments can perhaps be explained by (1) a lack of the resources necessary to implement adequate policies; (2) a lack of preparedness to face specific climate-related risks, (3) a possible lack of awareness by some ministries or other forecasts users of the climate product, and (4) a lack in credibility of climate-related forecasts. Although Kenyan institutions seem to be aware of the release of seasonal forecasts, the situation could be different in other states for which specific data is lacking.

This specific case study in Kenya indicates that three components—preparedness plans, resources and awareness—must be present to ensure an effective EWS, as forecasts by themselves are not sufficient but are one part of a broader system (EWS) that remains deficient in the GHA. The interview with the representative of the Ministry of Arid Lands also highlighted that, due to restricted capacities, the government turns to foreign aid for support, when a disaster has been predicted. But the long administrative process and the necessity of assembling strong evidence that a disaster is about to occur often results in late support that tends to arrive from the international community after a disaster has occurred. This was also illustrated in the case of the 2010-2011 droughts in the GHA.

Forecasts also appear to be underused in the GHA at the local level, for instance to guide farmers' decision making, a situation which contrasts with encouraging results from the pilot project in the Machakos District of Kenya as well as with research by Archer (2003) in Southern Africa and by Hansen (2011) in SSA. Their research highlights many reasons to use the seasonal predictions for agricultural decisions in Africa.

In addition to constraints related to the dissemination and interpretation of the forecasts especially in remote rural areas, a review of existing literature as well as interviews conducted with small-scale farmers in rural areas around Nairobi underscore various problems that many smallholders encounter in applying forecasts for their own benefit: (1) a lack of trust in the forecasts, (2) a lack of understanding of seasonal predictions and their concrete implications, a point detailed above (see also Robinson 2011), and (3) a lack of capacity (financial and material) to use these forecasts to develop and pursue adequate responses. These problems should be addressed to enhance forecasts' uses among the rural communities.

Interviews in the field revealed that many farmers in Kenya tend to perceive forecasts as both "inaccurate" and "without value"; they usually rely on their own knowledge about the local climate by observing clouds, winds and other proxy environmental indicators. Similar findings are supported by research findings from Kenya by Hansen (2011) and Shah et al. (2008), both of whom explain that farmers because of past wrong predictions and because of existing traditional knowledge often question the reliability of seasonal forecasts. Hence, promoting a better understanding of meteorology, through education that somehow is blended with traditional knowledge, would better explain how to interpret and use such climate products as forecasts.

Another limitation to the use of forecasts at the local level is the farmers' lack of financial capacities to implement adequate responses even though they may have received early warnings. This problem is directly linked to development issues in rural Africa. Most small-scale farmers do not have many options to supplement their economic activities and they are often unable to obtain the necessary inputs in a timely fashion (Glantz 1997). For instance, they are unlikely to buy short-cycle varieties of seeds to respond to a predicted shortened rain season without external financial support. Beside poverty, Lallau (2008) and Gubbels (2012) have related this absence of flexibility of farmers regarding their economic activities to the lack of social protection networks such as crop insurance in most countries of SSA. The lack of social nets also explains why African small-scale farmers are more reticent to implement new, allegedly "climate-proof" strategies for fear of losing the few goods they do possess. The truth is that the risks for them of changing their usual practices are perceived as being greater than the risks described in forecasts, especially when those practices have generally proven successful in the long past of their lives and the generations before them.

Different ways to overcome barriers to the use of forecasts have been identified in previous research. Providing farmers with accurate and locally useful forecasts is one of them, but would not be sufficient to resolve trust issues; doing so requires education as well as enhanced dialog between local farmers and climate scientists (the feedback loop from the End-to-End model) so that climate products can reflect user needs, making them demand-driven and not supply-driven, as they currently tend to be. Using insurance to cover all risks when farmers use new agricultural practices that are guided by climate predictions could be another solution. Not only would pilot farmers enjoy the benefits (in terms of increased yields) of using climate predictions to guide agricultural practices, but farmers around them would also be able to see potentially improved harvests, e.g., a "demonstration effect."

Using traditional knowledge, when working on local predictions, would be an added value to the forecasters and to the forecast uses, because this knowledge has a great influence on the way farmers respond to possible hydro-meteorological stresses (Archer 2003). Finally, the problem of a low use of forecasts might also be related to who delivers climate products: farmers have mentioned that they do not feel that the government provides high value advice. Because of the current apparent lack of trust in climate scientists, other actors closer to the local population like small NGOs or skilled individuals who are able to communicate in the language of both the climate and non-climate scientists would be more appropriate delivers of climate forecasting products to rural communities.

Summary: Strengths, Weaknesses, Opportunities and Constraints (SWOC)

Before summarizing the strengths, weaknesses, opportunities and constraints (SWOC) of DRR in the GHA, the primary goal of this survey should be mentioned. Our primary goal, through this assessment of positive and negative aspects of the EWS in SSA, is to identify and highlight lessons that could be useful to OFDA and other institutions involved in DRR activities, in order to improve their future interventions and inform planning activities. Though weaknesses and shortcomings were pointed out in the previous section, we have also underscored several times the key catalyst role OFDA provided to ICPAC. ICPAC has become today a significant regional climate center. Improvements are nevertheless important and warranted in the context of climate change and expected increased hydro-meteorological risks in the region.

One way to approach an overview of OFDA's past support to the GHA and of ICPAC's current strategy to manage hydro-meteorological risks is through a SWOC analysis. This tool is used, for instance, by the UNDP to evaluate different programs or activities in a particular field (Glantz 2009). The method is useful to summarize the current strengths of DRR activities in the GHA, the weaknesses and constraints that challenge DRR and, more importantly, and to identify possible opportunities to improve via lessons learned. The SWOC can highlight interesting observations useful for national government or aid agencies that consider the application of new DRR interventions or improvements to existing ones in SSA, particularly regarding weaknesses identified in this system as well as opportunities to overcome them (MRC 2010). Constraints and weaknesses also provide opportunities to enhance strengths.

A SWOC analysis of DRR in SSA

STRENGTHS

- OFDA's support was clearly a catalyst for ICPAC: ICPAC is today an autonomous institution providing important training, technical support and collaboration opportunities among the NHMSs in the GHA.

- OFDA's support enhanced the prospect and served as a bridge to other funding sources and technical support: climate experts from other aid agencies provide technical backup during pre-COF training sessions.
- The technologies introduced during the OFDA project contributed to improving the climate science in the region: interviews have confirmed an improved quality of forecasts and EWS in the GHA.
- Some tools introduced by OFDA during its project provide capacity building elements: skills of climate experts in Kenya and understanding of climate products among some categories of users were clearly enhanced.
- The dissemination of the forecasts among some categories of users has improved: this was observed in Kenya, essentially among Ministries and UNo.
- COFs ensure the regular issuing of seasonal forecasts: these climate products are released three times per year and COFs facilitate meetings and interactions between the NHMS of the GHA.
- The NECJOGHA is a resilient science media network: it continues to strengthen climate journalism in the GHA.

WEAKNESSES

- ICIPAC did not "own" the pilot activities implemented through OFDA's DRR program: they were not continued neither were there follow-ups when the funding ended.
- Forecasting activities in the GHA tend to be Kenya-biased: ICPAC was at the core of the whole project, and all pilot activities were conducted in Kenya. As a result, forecasting in the GHA is platform-dependent as it depends on ICPAC's equipment, and significant disparities in forecasting and dissemination capacities among member states exist. Moreover, the need of some members in terms of seasonal predictions—essentially the summer rainfall states—have not yet been fully addressed.
- Neither mid-term evaluation of the COFs nor progress monitoring of ICPAC's activities were conducted during or after OFDA's program: as a result, no adjustment of the system has been identified as necessary. Successes and limits in

the EWS are not communicated, though it would be important for identifying lessons for future applications.

- ICPAC has known little changes over the past decade: it would, however, benefit from input of new/additional staff and equipment.
- COFs and activities at ICPAC are climate-centered: since OFDA's project ended, there has been little if any follow-up with the users on the uses of forecasts.
- Soft DRR solutions have not yet been adequately promoted: most of the attention to improve the EWS in the GHA was, and still is, on improving the quality of the forecasts while other "soft" components, e.g. mechanisms for the COF workshop participants to share and use their experiences once back home, assessments of end-users needs or filling the significant communication gaps with end-users, have not been addressed yet.
- Forecasts still need to be improved: the forecasts for the GHA remain regional and probabilistic in nature.
- Preparedness of users to respond to EW was not fostered: e.g. ministries representing climate-sensitive sectors in Kenya do not have plans to face hydro-meteorological risks.
- Education is not yet perceived as a sector that should be integrated into DRR activities: its potential to promote risk awareness at the local level and to improve the understanding of forecasts and avoid mechanical interpretation has been overseen. This gap is partly responsible for the low utility of forecasts, especially at the local level.
- Few/no partnerships have been developed between ICPAC and local NGOs: this category of potential users remains largely unaware of the COFs, does not attend user workshops and does not receive climate products or climate updates from the NHMS.

OPPORTUNITIES

- ICPAC, as a regional climate platform, can benefit from new interests: for instance, by donors such as the G8 who support climate-related capacity building.

- Staff skill-enhancement and equipment upgrade in ICPAC are always possible: it would ensure ICPAC's continued value to the region.
- ICPAC could be used to introduce education on climate change's likely impacts on seasonal and interannual variability: such opportunities are increasing with increased interest in climate change.
- ICPAC can foster synergies and greater collaboration among meteorologists: it does it already among the NHMSs of the IGAD area.
- Quality of the forecasts can improve: the science keeps on moving forward.
- COFs are opportunities for increased outreach towards various sectors; climate-sensitive sectors' representatives at all level (ministry and civil society) could be systematically invited to those conferences.
- ICPAC's activities can be enhanced: for instance, the post OFDA Climate Information for Development (ClimDev) program and the establishment of the African Climate Change Policy Center (ACPC) at the UNECA are new opportunities to enhance implementation of ICPAC's objectives.
- Results and successes from some of the pilot activities and from RANET Africa could be up-scaled (and adjusted) to new pilot areas in the GHA.
- Demands for climate information by users continue to increase: this is especially the case with climate variability and change.
- Opportunities to foster the dissemination of climate products are multiple: dissemination and understanding can, for instance, be enhanced during national or local workshops, and through research on the use of new media such as cellphones.
- Local knowledge can be used to improve DRR activities: such use would also foster interactions between climate scientists and local communities.
- DRR activities can be bridged with other issues to be improved: possibilities for bridging are being studied (in this report) with development and CCA for more efficiency.
- The NECJOGHA provides an ongoing opportunity to strengthen climate journalists: through this network, journalists can learn and understand climate products.

CONSTRAINTS

- The frequent use of short-terms grants by aid agencies typically does not ensure the ownership of a project by the recipient country: this is illustrated through the pilot activities, several of which were not continued once OFDA's funding ends.
- The EWS in the GHA is "top-down": there are still few interactions between the climate experts, users and end-users. Furthermore, it appears that given its limited resources, interest for developing such interactions with end-users is weak at ICPAC.
- Financial support to ICPAC is weak: ICPAC is forced to spend resources to look and apply for grants in order to conduct research activities.
- There are as yet neither bridges nor interactions between local NGOs and ICPAC and, as a result, these potential local users are not represented at the COFs.
- At the local level, people do not "trust" the forecasts and do not understand meteorology: lack of education as well as doubts in the government's capacity to provide useful advisement remain strong in rural areas of the GHA.
- Education is not perceived as yet as an important component of an EWS: focus and investments remains on improving forecast to ensure better EW, but not on how to interpret or use the EW to take action.
- The NECJOGHA appears to be too centered on its unique status: though it is an important network in Africa, it should also focus on improving its relations with the different NHMS in the GHA and communication of climate information.

Lessons about "lessons learned" in DRR

Lessons are easier to identify than to learn! Many reports have highlighted lessons from past disasters in SSA and for similar hydro-meteorological events around the globe; but a current review of the practice of DRR in the GHA indicates that such lessons are often not applied. Hence, in a recent report, Rob Bailey (2013) asks, "why [are] early warning systems which have dramatically improved over the last 20–30 years . . . good at predicting crises but bad at triggering preventive action?"

Bailey's statement reflects both positive and negative sides of the EWS as applied in SSA today. On the bright side, clear improvements have been made and are ongoing in climate science and forecast accuracy. The present review acknowledges the key role OFDA played in this field. OFDA not only contributed to introduce the use of advanced technologies for forecasts' improvements, but was also a catalyst for ICPAC. This center has now a regional status, and is acknowledged as regional climate center by the WMO.

Yet, using forecasts for preventive actions remains an issue, a proverbial "weak link" in an EWS chain. This was, for instance, exemplified during the recent droughts in the GHA (2010-2011): though early warnings were released early enough to allow time for anticipation and preparation (Bailey 2013), a food crisis affecting the region nonetheless occurred. Apparently, neither African governments nor international aid agencies provided timely responses.

Risk awareness and risk preparedness remain one of the weakest links of the EWS in the GHA. And, as a chain is only as strong as its weakest links, this situation compromises the effectiveness of the whole system. Of course, improvements in the EW have been made over the last few decades. Aid agencies have undertaken a useful shift of focus from disaster response and recovery to risk preparedness and prevention. Another necessary step now would be to see risk preparedness not only as a climate-science centered issue that essentially relies on science and technologies improvements, but also as a societal matter. Civil society requires much education, awareness raising, and capacity building. Despite constant improvements in the climate science, warnings and forecasts will remain at least partly not so useful; hence, stakeholders' preparedness, awareness and understanding of such products should be improved if EWs are to be routinely used in decision-making today.

Moreover, communication appears to be a significant problem in disaster management in the GHA. This needs to be addressed as much as, if not more than, the gaps in knowledge about the climate system and in monitoring. To progress further to decrease risk and vulnerability, such gaps must be closed if societal responses to recurrent natural hydro-meteorological hazards, amplified in the context of climate change, are to be greatly improved.

Some of the key lessons identified in this report, through the evaluation of the OFDA DRR program in the GHA, are summarized in the following list. Some are negative, others positive. Both are useful. Some are similar to those drawn from disasters that occurred in SSA over the past decades, while others are proof of the improvements made in DRR during the last decade. These lessons demonstrate OFDA's contribution to DRR in the GHA. They highlight the significance of disaster reduction activities, and suggest potential ways to improve such practice in a context of a changing climate in which hydro-meteorological risks are likely to increase.

1. *DRR is inseparable from development issues and vice versa*. Over recent years, economic and human developments have modified societies' vulnerability to adverse climate events. In the GHA, a high degree of poverty and limited capacities among national governments currently undermine the ability to use early warnings and forecasts in decision-making. Therefore, partnerships to enhance research and associate DDR activities with development plans are necessary. If such concerted efforts are not taken, climate events and their impacts will likely continue to burden the most vulnerable communities, their governments and humanitarian organizations, even when reliable early warnings about risks are available.

2. *The climate science should be improved in SSA (better forecast, higher resolution models)*. The case study in the GHA demonstrated that this is especially the case in terms of downscaling techniques and the release of accurate and reliable forecasts that are usable at the local level. Improvements in the physical sciences

are also necessary to strengthen local trust in climate products. For example, the founding of a Climate Affairs Masters Program at Mekelle University in Ethiopia in collaboration with CCB and with funds from the Soros Foundation has had an overall effect of strengthening DRR in Africa.

3. *Long-term commitments to DRR and to bridge with or integrate this issue into development strategies are necessary to ensure resilient outcomes and ownership*. An agency should ensure that the activities it initiates will be completed and that the results will be applied even when the funding ends. Ownership by the host state implies hiring long-term staff, providing training and capacity building as well as integrating projects into existing national strategies and policies and involving all relevant sectors. If short-term investments in DRR as stand-alone projects continue, spending in this field is likely to increase for aid agencies because no sustainable results could be achieved and many issues related to development would not be addressed. These risks are illustrated through the short-term grant demonstration activities launched by OFDA in Kenya during its 2002-2005 project. These projects were managed by ICPAC but with weak instructional and staff involvement and no early consultation of all relevant institutions. As a result, most of these activities were not completed and their findings were not applied.

4. *ICPAC's main strength is ~~in~~ capacity building for the NHMS in the GHA and it should continue on this path*. Findings from pilot activities should be shared with other NHMS and follow-up on the use of climate products after COFs should be conducted. Doing so would foster the role of ICPAC as a regional institution. If the sharing of relevant findings is not promoted, not only might ICPAC continue to be perceived as Kenya-centric, but it would also be possible that application of findings to other areas would not be possible. Moreover, if follow-ups are not conducted on the use of climate products, their utility at the local level and for other users might remain unclear.

5. *Local needs and vulnerabilities should be assessed, through a multidisciplinary approach, before conducting any DRR activities*. Assessments are as much a part of early warning systems as is climate science. Without assessing needs and vulnerabilities, producing useful, "demand-driven" and tailored climate products that are specific to the needs of users is not possible. These products will be neither used nor understood by users and fundamental issues related to forecast dissemination and interpretation will persist, especially at the local level (as highlighted through the case study in Kenya).

6. *All projects should include activities to monitor progress, evaluate results and discuss next steps; furthermore, such reports should be made public*. If evaluation activities are not conducted, proceeding with necessary mid-term adjustments to identify what is necessary as next steps and to draw lessons to apply in other projects is not possible. In the same way, aid agencies should look for lessons in past activities before preparing new projects so as not to repeat past mistakes.

7. *Education and training of users of climate products are significant components of EWSs that are neglected too often*. Educating on risks and on the use of forecasts is important for warnings to be effectively received and used. Early warnings by themselves, however, are not a guarantee of reducing risks. If education is not enhanced, different categories of users, including local communities, are not able to use warnings, especially if they do not understand them, or make appropriate decisions. In this situation, despite the technologies being in place, disasters are not reduced. In this OFDA project specifically, even though forecast skills were improved, broad user training was lacking. As a consequence, even if some categories of users did participate in the COF training workshops, they were unable to share what they learned with their home institution, failing to benefit effectively from using climate information for decision-making.

8. *Significant differences exist between countries regarding collection of climatic data, climate monitoring and information dissemination capacities. Such disparities must be identified and addressed to avoid biases in regional projects*. In planning a regional DRR project such as those of OFDA in the GHA, the fact that states have different "levels" of capacity must be recognized and addressed through country-centered projects (instead of regional activities) that bring each country in a region to the same level of capacity from which to move forward in building further capacity. If specific needs at the national level are not assessed when conducting a regional project, biases are likely to appear in achieving regional integration and in conducting forecasting and DRR activities, such as was observed in the GHA with the differences between, for example, Kenya and South Sudan.

9. *Significant gaps in climate information communication that must be identified and addressed in SSA remain a hindrance to improving DRR*. Even though projects such as RANET have tried to fill communication gaps using satellite radio and low-tech communication devices, this idea remains very limited in many countries. Furthermore, climate information released to the NHMSs from such systems is often too high complex and probabilistic for general understanding. This information is also limited to the national level, as station level forecasts are not provided. In this context, climate information cannot be a useful decision-support tool. Ideally, retailed farm-level information would be available and delivered with understandable and actionable options for farmers.

10. *Take into account local knowledge about climate and seasonal patterns into forecast production*. People at the local level are witnesses of their own local climate (for which scientists typically lack data) and have significant knowledge about seasonal trends. As the science at this scale is not yet accurate, a lot can be learned from the local people. Therefore, climate scientists must interact more directly with local communities and should not neglect local knowledge. Without

such interactions, trust issues would remain fundamental at the local level and would continue hindering the use of forecasts in such communities.

11. *Identifying, consulting and involving all relevant institutions at the beginning of a project is important for conducting all relevant analysis and applying findings.* In the case study in Kenya for instance, KenGen should have been consulted at the very beginning of the Tana River Basin management demonstration activity instead of becoming an adjunct to ICPAC. As a result, at the end of the OFDA grant, this pilot activity (as well as others) ended. This is an indicator of the constraints of the interactions between ICPAC and the users of climate information and must be solved to ensure successful efforts in DRR in the GHA in the future.

12. *Gaps in the use of climate information at national and local levels have to be identified and filled.* Differences in the capacities of users in converting climate information into actionable products, which is especially important at the local level, must be identified. Therefore, climate products should not only be relevant to all categories of potential users but should also be delivered using appropriate communication devices in user-friendly and usable terms. Conducting follow-ups of the COFs in order to assess what is done with seasonal forecasts and in order to pinpoint potential improvements of products could identify gaps in the use of climate products. A user department, created within ICPAC or as an independent organization, could deal with these issues. Additionally, climate products should be issued and available to all potential users, including small NGOs.

Case Survey: The Lower Mekong Basin (LMB)

> *The Lower Mekong Initiative (LMI) is a multinational partnership effort initiated by the United States in 2009 to promote greater cooperation in the Mekong sub-region. The effort is focused on six Pillars: Agriculture and Food Security, Connectivity, Education, Energy Security, Environment and Water, and Health, Gender and other crosscutting issues. LMI has been designed to serve as a forum for LMI partners to develop shared responses to the most pressing cross-border development challenges.* June 2013 www.usaid.gov/vietnam/lower-mekong-initiative-lmi >

The Mekong River Basin

The author of a popular coffee table book entitled "Great Rivers of the World" suggested, "The Mekong River could rightly be considered the Nile of Indochina. Every year from July to October, it invades the alluvial plains of Cambodia and southern Vietnam and deposits a precious layer of silt" (Novaresio 2006:183). The Mekong is one of the world's 12 longest rivers. On its 4,200 km journey from its headwaters on the Tibetan Plateau, it passes through the Southwest corner of China (Yunnan Province), Lao PDR, Burma, Thailand, Cambodia and Vietnam before flowing into the South China Sea. This river delta is often regarded as the rice bowl of Asia as it produces the biggest amount of rice in the continent.

The following three paragraphs about the Lower Mekong Basin (LMB) are taken from a Mekong River Commission (MRC 2011b:2-3) succinct description of the river, the population, livelihoods and food security.

> **The Mekong River** flows for almost 4,800 km from its source in Tibet into the East Sea, draining a basin area of 795,000 km2 and with a mean annual discharge of approximately 475 km3. The per capita water resources are high relative to other international river basins. The flow from the Lancang-Upper Mekong Basin

contributes 16% of the average annual flow in LMB but up to 30% of dry season flow. There is a very large difference between wet and dry season flow, caused by the southwest monsoon, generating wet and dry seasons of about equal length. Inter-annual variability is large in terms of river discharge, areas flooded, and the start and end of the wet and dry seasons. The seasonal cycling of water levels at Phnom Penh causes the large water flow reversal to and from the Great Lake via the Tonle Sap, with the associated flooding and drying creating a rich ecology. The Mekong is the second most bio-diverse river in the world after the Amazon, and supports the world's largest fresh water capture fishery of about 2.3 million tons per year.

The LMB population living within the basin in 2007 was estimated at 60 million, with about 90% of the population of Cambodia (13 million), 97% of the population of Lao PDR (5.9 million), 39% of the population of Thailand (23 million), and 20% of the population of Viet Nam (17 million in the Delta and 3 million in the Central Highlands). Population growth in the basin is 1-2% in Thailand, Viet Nam and Cambodia, and 2-3% in Lao PDR. Although urbanization is occurring in all LMB countries, about 85% of the basin's population lives in rural areas.

The livelihoods and food security of most of the rural population are closely linked to the river system, with over 60% of the economically-active population having water-related occupations that are vulnerable to water-related shocks and degradation. Millions of poor people depend on capture fisheries for food security and income. While all LMB countries are making good progress towards achieving the MDGs, about 25% of the population of Cambodia and Lao PDR has incomes below the poverty line, with much higher percentages in many rural areas. Food security and malnutrition pose great challenges. About half of all households have no safe water supply and half of all villages are inaccessible by all-weather roads. Throughout the LMB, inequalities are generally increasing between urban and rural groups.

Approximately 60+ million people identifying with several ethnic groups live in the basin. Roughly 30 million people live in the flood plain (Cogels 2005). China's contribution to the Mekong flow from glacier melt in Tibet is on the order of 16-18%, but that contribution is extremely important to continued river flow in the Lower Mekong Basin (LMB) during the dry season.

Table 12 Flow and Catchment Area Contributions of the Six Mekong River Basin Countries

	China **Upper basin**	**Burma** **Upper basin**	**Lao PDR** **Lower basin**	**Thailand** **Lower basin**	**Cambodia** **Lower basin**	**Vietnam** **Lower basin**	**Total**
Area (km^2)	165,000	24,000	202,000	184,000	155,000	65,000	**795,000**
Catchment (%)	21	3	25	23	20	8	**100**
Flow (%)	16	2	35	18	18	11	**100**

From the MRC as reported in http://mekongriver.info/mekong-basin

Floods are an annual event in the Lower Mekong Basin. Flooding of the main stem and its tributaries is an important source for regional biodiversity wealth and ecosystem health, fish abundance and soil fertility. But flooding also causes loss of life and property, damage to agriculture and rural infrastructure, and disruptions in social and economic activities, including livelihood disruptions, for people living throughout the basin but especially in the LMB. Climate variability from year to year, ENSO extremes of El Niño and La Niña and particularly the southwest monsoon are the natural causes of the annual floods. People in the delta live with the recurring floods and receive both the positive and negative outcomes of the phenomena.

Under current seasonality of climate in the region, the level of the Mekong River starts to rise in May and reaches its peak in mid-August/early September in the upper reaches and in mid-September/early October in the delta region. The flood patterns and their consequences are, however, very different as river water makes its way downstream after leaving the Upper Mekong Basin states of China and Myanmar and flows into the LMB countries of Lao PDR, Thailand, Cambodia and Vietnam.

Than (2006:141) placed the region into a broader geographic context: "The Mekong region … is the poorest in Southeast Asia. Sandwiched between the booming part of Southeast Asia and rapidly emerging China, the region has immense potential. Yet, like the river that runs through it, the economic potential of the Mekong region is so far just that—potential." The river is increasingly being viewed for its potential, with the river's underutilized waters being eyed for greater agricultural production and dams-related hydropower generation to feed energy-stressed economies in the Mekong Basin.

Disparities in the LMB

Several reports, even those touting the great economic potential behind the Mekong River and its tributaries, point to the inequities that exist among and within countries in the LMB. Thailand has a stronger economy, for example, when compared to the three other states in the lower basin. Pech and Sunada (2008:223) have provided a brief description about water disparities among the LMB states, noting "Levels of dependency of people on the river's water and related resources are very high, particularly among the rural poor, who depend heavily on subsistence livelihoods. However, the rich resources and the benefits derived from the river system are unevenly distributed both in time and space."

An emerging concern in the LMB is about dam construction along the main stem of the Mekong. Dams for hydropower generation and reservoirs along the stem can greatly alter the flow regime or the river and its tributaries in foreseeable ways, depending on the number of them to be constructed and their locations. The downstream countries especially those at the tail end of the river, Cambodia and Vietnam, are most at risk to changes in volume and in timing of flow that enters their territory, even in the absence of climate-related hazards and potential disasters. The LMB countries not only have climate change impacts to be concerned about but excessive impoundments of water resources along the river course. Dam construction along the river may well exacerbate such existing inter-state inequalities. There is a belief that "water flows uphill to money." Societal safeguards are needed to level the proverbial playing field making access to water an equity and human rights issue.

It is a well-known political fact that the four Lower Mekong Basin countries do not have equal access to funds and their economies are at different levels of development. If, for example, donor support for pilot projects for community awareness of flash flood DRR in the region were to end abruptly, only Thailand and Vietnam are likely to have the capacity to continue with follow-on projects. As a Mekong River Commission Technical Paper confirms, "For instance, Thailand and Vietnam could apply more data-demanding tools because they have more complete climate data than Cambodia and Lao PDR." Cambodia and Laos, on the other hand, would be forced by circumstances to wait for the support of another donor (MRC 2010).

Thus, the impacts and consequences of climate, water and weather variability and change will likely be distributed and dealt with unevenly throughout the region, exacerbating the economic disparities that already exist in the LMB. Keep in mind that as the climate changes on all time scales, so too do all aspects of a society ("You can't put your foot in the same river twice"). Ceteris paribus (all things being 'equal') does not apply, when looking at climate-environment-society interactions.

The Mekong River Commission (MRC): A Regional Hub for the LMB

The MRC is a major inter-governmental regional river basin organization (RBO) that provides an institutional framework through which the 1995 Mekong Agreement for Regional Cooperation in the Mekong Basin can be implemented. MRC's mandate (www.fao.org/docrep/004/ac146e/AC146E03.htm) is as follows:

> To cooperate in all fields of sustainable development of the water and related resources of the Mekong River Basin including, but not limited to irrigation, hydropower, navigation, flood control, fisheries, timber floating, recreation and

> tourism, in a manner to optimize the multiple-use and mutual benefits of all riparians and to minimize the harmful effects that might result from natural occurrences and manmade activities.

As an international regional river basin organization, the MRC receives support from the Mekong's riparian countries and from international donor agencies from different industrialized countries, both categories of which provide support that is in line with their organizations' missions, concerns and programs based on their perception of LMB needs and MRC requests for assistance to strengthen regional cooperation.

The funding arrangements provided to the MRC give the appearance of "development in parts" as opposed to development according to a regional master plan for the basin—it seems that success is determined as follows: a plan is devised; a matrix of regional tasks, needs and wishes proposed; donors then get to select the part(s) of the matrix they choose to fund. As a result, development gaps are created, and additional funds from additional donors are sought to fill those gaps. Perhaps there is no good example today of all donors getting together in order to engage in developing a holistic plan for a region or a country's development. As a result, the process is in no way holistic but in reality is "development in parts."

Its mission is to keep communities and their governments (both are key stakeholders) safe from the river's waters, while at the same time serving by way of their seasonal forecasts subsistence farmers and fisher folk who depend on normal (i.e., expected) seasonal Mekong streamflow and rainfall in support of their livelihoods. Now, in light of growing climate change concerns in the region, the MRC will be required to detect subtle changes in the expected flow of the seasons. Like many such transboundary river management organizations around the globe, the MRC's resources are constrained, allowing for little if any time or staff to undertake more than their prescribed tasks guided by their annual responsibilities.

The Mekong River system supports biodiversity to the benefit of ecosystems and to the settlements dependent on them for their wellbeing. As all are well aware, however, the main stem and its tributaries seasonally overflow their banks, which is a constant risk and a threat to life, livelihoods and to the natural and built environments.

The MRC staff is responsible for monitoring the transboundary river flow in the LMB, which places considerable pressure on the staff of the regional organization because it has to serve many masters, innumerable stakeholders and humanitarian assistance donors with disparate interests, needs and demands. Each stakeholder or donor may be concerned with identifying various effective and efficient pathways to bridge to some degree its short-term humanitarian interests in DRR with its longer-term concerns about a need for CCA activities in the region. MRC is responsible for flood forecasting streamflow variations and changes on seasonal, inter-annual and decadal scales. Some degree of flooding or drought conditions occurs each year in some part of the LMB. Every so often major devastating floods take place. Riverine flooding in the Mekong River is a slow-developing event annually that affects the lives of the people of the Lower Mekong River Basin, whereas flash floods typically are local in extent, highly destructive, and come and go in a matter of hours.

Forecasting streamflow is a difficult task. If a forecast is correct it has many fathers, as the saying goes; if the forecast is wrong, however, it is an orphan and the responsibility and blame likely fall on the forecasters and the forecasting system. Forecasts cannot be taken lightly as each early warning issued sparks its own set of reactions and consequences, both good and bad; when a forecast is issued, the fact is that someone is listening and ready to react to it.

A forecast can be thought to have failed for any one of a number of plausible reasons: it could have been dead wrong in that what happened was the opposite of what had been forecast (i.e. no flood was expected and no flood was forecast, given the existing rainfall and runoff information; yet a destructive flood did occur). Was it a model-based error, a data analysis error, a human error or a true surprise of Nature? Nature is not scripted; heavy or prolonged devastating rains can occur on short notice in the LMB.

Alternatively, a flood forecast may have been correct but the reliable warning issued for a flood event may not have provided enough lead time for those being warned to respond. A forecast might fail to generate responses in society because previous forecasts had been issued but no adverse events had occurred so the forecast was viewed as a "false alarm." The point is that forecasts do not come with guarantees and a societal level of preparedness must be maintained along with constant vigilance through monitoring.

Forecasters know this reality, but the people they are giving their forecasts to might not be as aware of the nuances of the science of climate, water and weather involved in forecasting their variability, extremes or change.

Forecasts, no matter how perfect, can evoke different responses that depend on the views of the recipients, such as, for example, whether or not recipients tend to be more risk averse or risk taking. Even seemingly clear words used in a forecast can have differing meanings in different languages and, therefore, prompt different responses.

A useful example of a situation in which perceptions altered the use of a forecast took place with the forecast of the onset of the 1997-98 El Niño event. Three countries—Peru, Kenya and Costa Rica—each received the forecast of an impending major El Niño event at the same time in July 1997. The Peruvian government used the forecast to seek funds from the World Bank to prepare for the adverse consequences that were sure to occur as Peru is at ground zero for El Niño events. Costa Rica's national meteorological service prepared a credible forecast presentation to the government but was told not to issue the forecast by the political leaders because, as they argued, the occurrence of a full-blown El Nino was only a probability of occurrence and not assured! The leaders also noted that the government did not have resources for those who might want help to prepare for the event's eventual impacts.

When the Kenyan government received the El Nino forecast in mid Northern Hemisphere summer it decided to wait several months to see if the onset of El Niño had taken place. Each of these responses had different outcomes, some better than others for the affected populations. The point is that there is no guarantee of "best responses" to a "best forecast" (Glantz 2001).

For a forecast to be effective—(understandable, reaching its targeted audiences, timely)—each aspect of the entire EWS must function like clockwork, as each element is dependent on the other elements: the value of the total EWS, must be greater than the sum of its parts. The MRC's forecasting operation is (or should be) the output of the technical subsystem of a larger people-oriented regional EWS. Kelman and Glantz (Forthcoming 2014:1) stressed this point:

> [Each] EWS needs to be viewed as a social process which often involves technical components embedded in their social context. That leads to a preference for a 'First Mile' approach for designing EWS, which involves communities from the beginning of an EWS development, rather than a 'Last Mile' approach, which adds people and communities toward the end of the design process. By keeping people and communities at the centre of an EWS from the beginning, the EWS can contribute to daily life and livelihoods, thereby supporting wider disaster risk reduction and sustainable development endeavors, rather than being a separate system waiting to be triggered only when a hazard appears.

HYCOS

The WMO's concept for a Mekong-HYCOS (Hydrological Cycle Observing System) is supportive of attempts to collect, share and analyze regional hydrological and meteorological data among the Mekong Basin states. HYCOS is a "Hydrological Information System for the Mekong River Basin." It aims to establish a well-functioning (i.e. reliable, accurate and timely) hydro-meteorological data collection and transmission system at the regional transboundary river basin level, while also strengthening relevant national and regional hydro-meteorological capacities and reinforcing real-time data and information needs for flood-related early warning systems. As of 2012, the Mekong-HYCOS project is operational: 49 real-time stations are plugged into a platform for regional data sharing.

> The Mekong-HYCOS is an MRC project. Since 2006, it has upgraded existing hydro-meteorological stations in Cambodia, Lao PDR, Thailand, Viet Nam and China with state of-the-art equipment and tools as well as operating systems to meet the standards of the World Meteorological Organization, the project's partner. (www.mrcmekong.org/news-and-events/events/symposium-on-mekong-hydrological-cycle-observation-system/)

This is a major step forward as a regional data collection and sharing mechanism and as well complements OFDA's regional activities. To date, the Mekong-HYCOS has been funded by Agence Française de Développement (AFD) and Fonds Français pour l'Environnement Mondial (FFEM). The HYCOS project and its hydro-meteorological network has started handing over its operations to the MRC's member countries starting in 2012 and more recently the member countries have been in the process of maintaining them in their respective countries and also sharing the data with the MRC Flood forecasting unit on a regular basis.

The MRC and the FMMP (Flood Mitigation and Management Program)

The most recent MRC FMMP document is essentially a plan of action for 2011-2015. It puts into context the MRC's current activities and flood forecast-related future plans. As a successor, it is a new phase of the FMMP activities that had been carried out from 2004-2010. The recent FMMP document (MRC 2011a: p. i) makes it clear that major changes in the MRC's activities were sparked by extreme adverse impacts of hydro-meteorological events. For example, various reports about river forecasting for the LMB continue to highlight the impacts on regional flood concerns during the year 2000 flood.

> Up until the Year 2000 Flood, MRC flood management activities were essentially limited to the provision of mainstream flood forecasts along the Mekong River. Following the devastation caused by the Year 2000 Flood, the MRC Council instructed the Secretariat to prepare a flood mitigation and management strategy (FMM Strategy). After a comprehensive consultative process with the four Member Countries, the Strategy was published and approved by the Council in

2001.

The MRC responded by establishing a permanent FMMP under its Technical Support Division. The FMMP provides a regional disaster risk management program through which to explore progress towards and opportunities for integrating climate change into disaster risk management at the regional level. Today, "the FMMP 2011-2015 Programme Objective is that basin management and development in the Lower Mekong Basin is guided by up-to-date flood risk management and mitigation practices aimed at reducing the negative impacts of floods, while maintaining the environmental benefits of floods" (p. ii). The MRC FMMP 2011 provides a brief history of the FMMP.

As noted earlier, the Mekong River is still seen as an insufficiently tapped resource for regional economic development. Polack (2010:8), in her report "Strengthening Climate Resilience (SCR)—through Climate Smart Disaster Risk Management," mentions that the notion that 'big is beautiful' remains part of the energy-generation narratives and is framed as being the only route out of poverty for people in the Lao PDR and Cambodia. Polack's report encourages foreign investment for large hydropower together with the intensification of agriculture through large irrigation schemes. However, emerging assessments continue to confirm that large-scale hydropower on the Mekong also poses one of the greatest disaster risks for downstream populations and countries in terms of irreversible damage to natural ecosystems as well as to the world's largest freshwater fishery, and to food security, economic development and political stability in the lower reaches of the river.

In an ADPC report Perwaiz (2010) notes that:

> MRC through its FMMP is providing assistance to its Member Countries in adopting holistic flood management initiatives that address the interaction between beneficial aspects of floods and the risks posed by the annual flood events to the basin communities through development and implementation of flood preparedness programs (FPP). The FPP assign equal emphasis on both preparedness and emergency interventions of flood management. They also

> promote participatory approach in order to enhance the consensus and ownership among the provincial and district level stakeholders.

Thus, regional cooperation as well as cooperation among donors are viewed as essential for successful integrated water resources management.

Because no one will likely be spared from either the direct or indirect consequences of climate, water and weather variations, extremes or changes, everyone can be considered an end-user of the region's hydro-meteorological services. It is important to recognize that not all stakeholders are direct victims of flood events but that all victims are stakeholders, because different groups and sectors have their own needs or requirements, the type, format and delivery mechanisms of meteorological and hydrological services and products will need to vary accordingly. People and communities known to be at-risk to hydro-meteorological hazards are stakeholders with much more at stake than those likely to be indirectly affected in less-threatening ways.

The MRC (2013) forecast process, which reflects these FMMP considerations of various needs and requirements, is best described in its own words that follow:

> During the June-November flood season, the Regional Flood Management and Mitigation Centre [RFMMC] releases daily flood forecasts and warnings. Data from 138 hydro-meteorological stations was used to predict water levels at 23 forecast points on the Mekong River system. The FMMP communicates these daily bulletins by fax, e-mail, and on the MRC home page and a dedicated Flood Forecasting Website to National Mekong Committees, Non-Governmental Organizations, the media, and, most importantly, the public.
>
> The Programme's daily warnings provide government agencies and communities in Cambodia and Lao PDR with advanced notice of rising water levels. Other preparedness tools provided by the Programme include flood markers and community billboards that provide clear information on current and predicted water levels. Through online postings, radio communication, dissemination of guidebooks as well as workshops, FMMP strives to reach a wide audience throughout the entire Mekong Basin.

> In the Mekong's tributaries, flash flooding from intense rainfall is the largest risk to life and property for people and infrastructure. The FMMP is also developing a flash flood guidance system for tributary rivers. This tool will be used to indicate the likelihood of flooding of small streams over wide areas.

The concerns about flooding in the Lower Mekong Basin require the four governments in the region to adopt a transboundary perspective to understand the causes and to propose solutions. Cogels (2005), addressing the 3rd Annual Mekong Flood Forum, noted "the FMMP is a good example of an integrated approach to water resource management that fits well with the MRC's new orientation and commitment to integrated water resource management [IWRM] at basin level, our vision for development in the region." The FMMP is successful for water resource management because it requires an integrated, holistic and balanced approach to flood management that draws on an expanding knowledge base. It is responsible for five components:

- Establishment of a Regional Flood Centre
- Structural Measures and Flood-proofing
- Mediation of Transboundary Flood Issues
- Flood Emergency Management Strengthening
- Land Management

Cogels also notes that "Partnerships are one of the cornerstones of the MRC's new Flood Management and Mitigation Programme." Importantly, he goes even further having "acknowledged the important inputs and continued support of our member countries and associated line agencies, ***and the donors for their ongoing support*** with the implementation of the FMMP."

OFDA has supported the MRC from its beginning in order to strengthen flood risk management and especially to establish the MRC as the regional center for flood warning. As a result of OFDA's role, the regional flood center is operational. Other donors have also contributed to the MRC in order to further strengthen its flood forecasting and its EWS capabilities. The MRC is now capable of monitoring the river waters and providing forecasts to LMB countries with a 48-hour lead-time. The objectives of MRC's Flood Early Warning System—a subsystem embedded within a larger social system—are as follows:

- To increase flood forecasting capacity
- To strengthen flood warnings
- To increase early warning information transfer to LMB communities
- To facilitate increased community responsiveness to the needs of at-risk populations
- To develop tools, methods and protocols with community-based partners and
- To train flood-vulnerable populations to effectively use MRC flood information

According to the MRC (2011a:4), member countries agreed "to embed capabilities regarding flood management and flood mitigation in a permanent infrastructure, the Regional Flood Management and Mitigation Centre (RFMMC)." The Phnom Penh-based RFMMC helped state agencies in the four riparian countries manage flooding through data and tools that make timely flood-forecasting and impact-mitigation possible.

> The RFMMC is now a permanent physical centre of the Mekong River Commission Secretariat (MRCS), referred to as the Office of the Secretariat in Phnom Penh (OSP). Under FMMP 2004-2010, RFMMC provided a home for a number of FMM activities, including the core river basin management responsibilities of flood forecasting and the provision of flood warning information. In designing FMMP 2011-2015, MRC has decided that FMM functions during 2011-2015 should support the operation and key functions of the established RFMMC, and not be treated simply as follow-on to FMMP 2004-2010 (MRC 2011a: i)

In the earlier phases and components of MRC's FMMP, a joint program was implemented on flood preparedness and emergency management in technical collaboration with ADPC (Asia Disaster Preparedness Center, Bangkok) with joint support from the European Commission Humanitarian Aid Department (ECHO) and Germany's GTZ (Gesellschaft Fur Technische Zusammenarbeit). In this collaborative work, under the MRC, several projects have been addressed on many problems related to frequent flooding faced by the riparian countries. This was undertaken by working closely with provincial, district and commune authorities and working at the local level in order to address the needs of communities and people vulnerable to flooding. ADPC's technical knowledge and training of authorities and stakeholders involved with flood management focused on insuring that the relevant authorities, together with the local communities, would be properly prepared for floods and the damage they may cause.

Core activity areas included are: Flood Preparedness Programs (FPP) development, FPP Implementation, Capacity Building for Flood Risk Reduction, Flood Awareness and Education, knowledge sharing/documentation, Integration of Flood Risk Reduction into the local development planning process, and so forth. Community-based disaster risk reduction and flood risk management measures were central to these projects and were successful in enabling community-based institutions and systems in several pilot districts in the FMMP program target areas (http://www.adpc.net/fpp/).

The MRC FMMP 2011-2015 document lists the Development Partners that are now actively involved in supporting flood management efforts in the LMB. They include, in order of support: USAID/OFDA, the Canadian Space Agency (CSA), the European Commission (EU), UNESCO/IHE Institute for Water Education Cooperation, the World Meteorological Organization (WMO), and the World Wide Fund for Nature. A brief paragraph in the MRC document about these organizations' contributions to the MRC showed that each supporting donor organization pursued a different line of support for the MRC (6). The MRC explicitly acknowledges OFDA's role by highlighting its key catalytic and supportive activities that fostered the development of MRC's flood-related forecasting and early warning activities. The acknowledgement reads as follows:

> The US Agency for International Development, through its Office for Foreign Disaster Assistance, collaborates with MRC on operations and research in meteorology, hydrology, flood management, capacity building of emergency personnel in MRC Member Countries, development programmes in Mekong River Basin, dissemination of flood preparedness, forecasting and warning information to community level. Under FMMP 2004-2010, OFDA provided valuable support for the improvement of flood forecasting and warning in the

MRCS and Member Countries. As early as 2003, OFDA/NOAA introduced a village-level flood forecasting and warning system in Cambodia. In 2006 OFDA/HRC introduced the Flash Flood Guidance System (FFGS) to MRCS. RFMMC will need future back-up support from OFDA/HRC for its FFGS.

MRC's comment about the catalytic role of OFDA is important to mention. As is often the case, support for having been a catalyst is seldom explicitly recognized, once initial projects have evolved after several years. The MRC did what many organizations often do not do: It recognized the value of OFDA's early critical support they received for regional flood forecasting for the Mekong.

The FMMP 2011-2015 document provided a summary of lessons learned from the previous 2004-2010 period of activities, based on a report of The Joint Danish-Netherlands Review Mission (see MRC 2011a: p. i footnote 2). The following chart of lessons is from the report (p.5).

Table 13

Table 1.3 Lessons Learned from FMMP 2004-2010 taken up in FMMP 2011-2015 Project Design

FMMP 2004-2010 Lessons	Reflected in FMMP 2011-2015 Design
Programme Design and Approach	
Approach and design influenced by Year 2000 flood and broad Donors interest Consequently, five individual programme components designed as "stand-alone". No prioritization required as all components funded by different Donors. No clear understanding and agreement on the responsibilities of FMMP, NMCs and LAs. Fragmented M&E due to funding of the programme component by different Donors. Location in Phnom Penh complicated coordination with other MRC programmes.	Approach and design elaborated in a participatory manner together with national stakeholders and lead agencies from the very first moment in the formulation process onwards. A core programme with additional interrelated activities. Major role of national stakeholders and lead agencies in the prioritization of products and the programme. Full agreement on the roles and responsibilities of various parties through the signing of MOUs. Awareness amongst MRC management regarding need for coordination and collaboration between MRC programmes.
Implementation at Country Level	
Limited insight into the product chain from production to the end users.	Clear insight into the product chain through the elaboration and agreement on roadmaps for key products including responsibilities, time frame and milestones.
Capacity Development	
Capacity building not systematically pursued as programme components were funded and implemented through different Donors. No clear understanding and agreement regarding the responsibilities of Line Agencies for capacity building of the provincial, district and community levels. No FMMP Coordinator for capacity development as FMMP 2004-2010 consisted of five fairly independent components.	Priorities for capacity building indicated by the individual NMCs. Appointment of a capacity building coordinator under FMMP 2011-2015.

Table 13 provides some useful insights: **first**, a reference to the 2000 flood event that generated donor interest and served as a catalyst to action for improving the forecasting of river flow in the LMB. The 2000 flood also sparked 'broad' donor interest and regional to local support; **second**, no sense of local priorities for projects is apparent, as many projects seem to have been based on tactical or strategic interests of the various donors. There is a tendency for funding to focus primarily on the science and technology side of the EWS with apparently lower priority given to end users' immediate needs; **third**, capacity building was limited and based on donor support restrictions; **fourth**, donor coordination and integration of relevant groups were weak, as were linkages between FMMP and the national centers; **fifth**, regional disparities reduce effectiveness. For example, although data for input to forecasts from the Upper Mekong Basin states has become more available, downstream data for forecasts are most needed by the countries in the LMB; **finally**, the title of the chart suggests that time was lost before the importance of end users to the FMMP was finally realized. Overall, however, there are many positive lessons from the project review as well: the review gave the FMMP good marks for its activities. Applying those well-identified lessons about problems encountered will make the new FMMP more effective and efficient.

Such program reviews with special attention to lessons learned provide insights to donors on the needs of recipients and exposes potential opportunities for important donor support for hydro-meteorological DRR activities that are in need of strengthening.

The Changing Global Climate Setting for the LMB

The climate science community has been providing warnings for at least four decades that a human-induced global climate change is gradually taking place (e.g. SCEP 1970; SMIC 1971). Only recently, one might argue, have those warnings been officially recognized and accepted with the awarding of the 2007 Nobel Prize to the Intergovernmental Panel on Climate Change (IPCC) and to former US Vice President Gore for his documentary, *An Inconvenient Truth*. Following the Nobel Prize announcement, funding support for climate change programs and projects sharply increased. Development organizations, arguably, seemed to increasingly favor climate change-related projects (e.g. we refer to these as “longer-term” development) over projects focused on societies affected by variability and extremes today and in the near- to mid-term. Since that time, researchers and academic organizations have become increasingly concerned with how to bridge, link and blend DRR and CCA activities.

Heightened awareness at the political and institutional levels of climate change aside, keep in mind that people at the level of families and communities have been and continue to be on the frontlines of the consequences of a changing climate. These people, individually and collectively, have been constantly adjusting over the past several decades to subtle, almost imperceptible but cumulative changes. Those observers in the global North who live outside of these local communities cannot see those incremental changes, even with increasingly sophisticated technologies.

Technologically focused researchers should understand ~~is~~ that individuals in local communities have in fact been coping with a changing climate all along, unknowingly. In their own way they have already been bridging the gap between more formal, scientific conceptualizations of DRR and CCA. In fact, local communities are often repositories of unrecorded “ordinary knowledge” about how their local lives and about environmental conditions that have changed over the past few decades. These virtual repositories are like untapped DRR-CCA bridging or blending “idea banks” waiting to be drawn from for their insights and knowledge about innovation and improvisation in the face of a changing climate.

More recently, some of the suggested consequences of global warming have begun to appear earlier than even the researchers had expected. For example, the melting of land and sea ice at the North Pole seems to be accelerating at a pace faster than the climate-related, model-based scenarios had previously suggested (Vergano 2013; Vidal 2013). The consequences for ecosystems and human activities of global temperature increases will manifest themselves and be felt at the local, national and regional levels worldwide;

there is no place on the planet to escape from the influence of climate change—and the Mekong River Basin is no exception.

For people and their governments in the Lower Mekong region, this reality means that they are facing an uncertain regional climate future not at some future date later in the century but now and over the next few decades. A phrase that might sensitize the public to this new awareness of accelerating environmental change is "2020 is likely to become the new 2050." This means that changes in the frequency, intensity, magnitude and location of hydro-meteorological extremes that had been expected to occur several decades from now are likely to occur a lot sooner, even as early as the year 2020, instead of 2050. For example, scientists are increasingly observing hydro-meteorological extremes at magnitudes once, not too long ago, seen only every couple of decades occurring with greater frequencies. They have come to refer to these more common extreme events as "Superstorms" (Glantz 2003).

As the MRC Strategic Plan 2011-2015 reports, "predicted changes in precipitation and temperature will affect the Mekong River flows, e.g., the increased flows in the wet season will heighten the risk of flooding and the longer dry seasons may increase the risk and severity of drought. The Mekong Delta is especially vulnerable to climate change in terms of sea-level rise and sea water intrusion" (MRC 2011d:15) [NB: web source at the end of page 167]. This projection is especially plausible and may occur sooner than first expected under a "business as usual" scenario with respect to the continued increases in emissions of greenhouse gases worldwide.

The sobering fact is that the buildup of these gases in the atmosphere is likely to continue at ever increasing rates, as emissions intensify and especially when taking into consideration the sharp increases around the globe in exploration for and production and use of fossil fuels by countries dependent on them to achieve their long-term development goals. In light of this too-often-dismissed reality, chances for a meaningful curtailment of fossil fuel dependence any time soon appear negligible. In fact, the carbon dioxide content in the atmosphere reached 402 ppm this past spring, the highest level in the past 800,000 years (http://thinkprogress.org/climate/2014/04/09/3424704/carbon-dioxide-highest-level/).

Coping with first- and second-order (i.e. downstream) impacts in a statistically determined, so-called stationary climate regime presents its own difficulties to every society, including coping with climate, water or weather variability and extremes. Although we can expect regional and local climate regimes to change with human-induced global warming, we cannot, as yet identify in advance how they will change or where or when. We are, to mix metaphors, in uncharted climate waters.

Changes worldwide will not occur in simultaneous, lock-step fashion, however. This means that regional and local changes will manifest themselves at different times, in different locations and at different scales and magnitudes around the globe in ways that will likely challenge the capabilities and ingenuity of even the best-prepared societies. Because such changes are not likely to appear simultaneously or in any reliable probabilistic manner a significant constraint has been placed on generating a necessary concerted global action.

Although we know that the global climate system changes at all-time scales, most observers agree that human activities are strengthening if not accelerating the naturally occurring greenhouse effect. As a result, societies—armed with historical records and pre-historical proxies as well as with model-based glimpses and scientific discussions of what future interactions between a warmer atmosphere and warmer ocean might hold for them in regard to high-impact regional and local hydro-meteorological hazards and potential disasters—now face an increasingly uncertain future.

Climate Change and Adaptation Initiative (CCAI) of the MRC

Climate change is no longer just a threat in the Lower Mekong Basin. Its impact is present and is affecting the livelihoods of millions that rely on the river's natural resources. Changes in temperature, rainfall, river flow and flooding as a result of climate change affect agriculture and fisheries and, as a result, reduce food security especially for the poor. Additionally, a predicted rise in sea level will increase salinity and floods in the Mekong Delta, causing damage to crops in the most productive area of the basin. The MRC works to determine the impacts of climate change, and how the organization can help Mekong countries better adapt to these changes. MRC's Climate Change and Adaptation Initiative (CCAI) is a collaborative effort among MRC Member Countries -- Cambodia, Lao PDR, Thailand and Viet Nam, to demonstrate and share adaptation strategies. With its emphasis on a basin-wide approach, the Initiative ensures that climate change adaptation is harmonized with effective strategies, plans at various levels and is applied at priority locations throughout the basin. Sharing how people adapt to climate change through local strategies is a unique and effective initiative by the MRC and its partners.

As part of the CCAI, the MRC is developing an adaptation planning process through pilot projects at demonstration sites in all four Member Countries. The planning will draw on local knowledge and local adaptation strategies to identify practices that can be scaled up to the region as a whole. Adaptation planning is based on demonstration, knowledge sharing, and learning to continuously improve methods and results. Implementation of the adaptation planning process will be promoted at the local level, for relevant sectors, and at the basin-wide and transboundary levels.

The MRC's CCAI is working with institutions, specialists, programs and communities in the basin to develop adaptation plans and implementation strategies specific to each Member Country. The initiative provides on-the-job advice and mentoring and learning-exchange visits for government staff with other countries and other sites. In addition, the CCAI develops training and advisory manuals so that proven methods and approaches can be applied more widely. To communicate key messages related to climate change, the Initiative produces reader-friendly posters, cartoons, and grassroots comics in riparian languages, and applies them as campaign tools to raise awareness on climate change in the basin (http://www.mrcmekong.org/about-the-mrc/programmes/climate-change-and-adaptation-initiative/).

Climate Change Impacts in the LMB

The Lower Mekong Basin is expected to be among the critical regions which will be most affected by climate change and it consequences, a claim legitimately made by most major river basin organizations around the globe. The likelihood of this expectation coming to pass is worrying, as populations who will be directly or indirectly affected by adverse changes in the Mekong basin number in the tens to hundreds of millions. The IPCC indicates that temperatures as well as annual rainfall and runoff will increase and sea level will rise, as noted earlier, which means that salt-water intrusion will increasingly affect the productivity of the Mekong Delta and the livelihoods of delta inhabitants. Estimates suggest that about 30 percent of Vietnam's Mekong Delta region will be inundated if a one-meter sea level rise occurs, a projection that is expected to come about by 2100 if not earlier (MRC 2010, State of the Basin Report).

Existing scenarios of regional climate change

Within the past few years, the MRC (2009b) reported:

> Climate change is expected to result in modifications to weather patterns in the LMB in terms of temperature, rainfall and wind, not only in terms of intensity but also in terms of duration and frequency of extreme events. Seasonal water shortages, droughts and floods may become more common and more severe, as may saltwater intrusion. Such changes are expected to affect natural ecosystems and agriculture and food production, and exacerbate the problems of supplying increased food demand to growing populations. The impacts of such changes are likely to be particularly severe given the strong reliance of the LMB communities on natural resources for their livelihoods. (p. **5)**

Several studies have attempted to identify the potential future climate situation that could result in the region with global warming. Most of these studies could not, however, quantify the uncertainty around future climate projections. A recent study undertaken for Australia's CSIRO (Eastham et al. 2008 as cited in MRC2009b:5-6) attempted to redress some of the limitations of these earlier studies based on an IPCC scenario (A1B). It made the following projections by 2030 for the region:

- A basin wide temperature increase of 0.79 deg C, with greater increases for colder catchments in northern areas of the basin;
- An annual precipitation increase of 0.2 m, equivalent to 15.3%, predominantly from increased wet season precipitation;
- An increase in dry season precipitation in northern catchments and a decrease in dry season precipitation in southern catchments, including most of the LMB;
- An increase in total annual runoff of 21% that will maintain or improve annual water availability in all catchments, but with pockets of high levels of water stress remaining during the dry season in some areas such as northeastern Thailand and
- Tonle Sap [Cambodia];
- An increase in flooding in all parts of the basin, with the greatest impact in downstream catchments on the main stream of the Mekong;
- Changes to the productivity of capture fisheries that require further investigation, although predictions indicate that storage volumes and levels at Tonle Sap, a major source of capture fisheries, will increase; and
- A possible 3.6% increase in agricultural productivity but with overall increases in food scarcity as food production in excess of demand reduces with population growth; further investigations are required to take into account the effects of flooding and crop damage on these predictions.

MRC's Strategic Planning: Basin Development Plan

The MRC's Basin Development Plan (BDP) is the heart of the MRC's Strategic Plan, 2011-2015. It calls for the effective and sustainable utilization, management and conservation of Mekong water and related resources. The BDP website refers to the "circle of ownership" in the LMB based on the partnership between the MRC as a regional river basin organization and the member countries. One BDP report (2011) [NB: web source at the end of this paragraph] introduced the notion of a Foreseeable Future Situation (FFS), which is in essence a scenario about an uncertain climate, economic and demographic future in the region. The BMP sets out the shared understandings of the opportunities and risks of the national plans for water resource development in the LMB. The Strategy established a number of Strategic Priorities and related Strategic Actions to optimize development opportunities and minimize uncertainty and risks associated with them. The BDP represents a move towards comprehensive Integrated Water Resource Management (IWRM) of the LMB (http://www.mrcmekong.org/assets/Publications/basin-reports/Assessment-of-Basin-wide-dev-Scenarios-MainReport-2011.pdf).

The Strategy called for a 'Basin Action Plan' (MRC: May 2013) [NB: web source at the end of this paragraph], comprising four 'National Indicative Plans' and one 'Regional Action Plan', to set out how the Strategy should be implemented. These five plans have now been prepared. The Regional Action Plan and the four National Indicative Plans describe in total over 200 projects needed to implement the Basin Development Strategy. Most of these projects are enabling and non-structural projects. About half of the projects can be undertaken at the national level. Most of these will be implemented by national line agencies and river basin organizations. The other half of the projects needs to be implemented at the regional level with the cooperation of all MRC Member Countries. MRC Programs and their national partners will implement most of these projects. In addition, eight bilateral projects have been put forward in the National Indicative Plans. At the end of 2012, half of the regional projects and a significant portion of the national projects had been taken up and are being implemented. The remaining projects face funding or capacity constraints (www.mrcmekong.org/assets/Publications/strategies-workprog/MRC-Basin-Action-Plan-May2013.pdf).

USAID interest in the LMB

USAID has responsibility for long-term development assistance as well as for short-term emergency humanitarian assistance. In December 2012, USAID released a new, game-changing document in terms of the way the Agency will conduct its DRR and CCA activities. In the past, these two USAID missions were undertaken as more or less separate operations in-house and in the field, in theory and in practice, and institutionally. The December 2012 document, "Policy Guidance for Building Resilience for Recurrent Crisis," in contrast, seeks to change this dichotomized internal structure. This document highlights the need for focusing on bridging the two seemingly autonomous activities of long-term and emergency assistance in order to enhance societal resilience in regions at risk of hydro-meteorological hazards. This represents a paradigm shift that, if successful, promises to replace the divide between disaster response and longer-term development with a simultaneous and integrated approach, or at least a blending or bridging, between the two. There are differing opinions about whether DRR should be "mainstreamed" into CCA or whether it should be the other way around. Then, mainstreaming these activities into the policy process is seen to have great potential.

USAID's expectation is that "rather than simply addressing issues as part of a perceived "continuum" from emergency relief to longer-term development, practitioners of resilience programming will likely need to design projects capable of addressing immediate and longer-term needs simultaneously" (22), and that "most notably, humanitarian relief and recovery programs are no longer conceived of as an end in themselves, but as a foundation and platform upon which new and existing resilience and development investments must and will build" (14). The desire to implement these suggestions seems real, as suggested in the document's closing statement: "We recognize that our humanitarian assistance and development assistance are interdependent, and that interdependence must be reflected in our operations" (24).

The United States has a special interest in fostering socio-economic development in the LMB states. The long-standing political interest of the US in the Mekong region started in the 1950s and has morphed into economic development and humanitarian assistance concerns. The region now appears to be a priority for the US government. A range of projects under the US State Department's Lower Mekong Initiative (LMI) began in 2009 and includes other US government agencies beside USAID and OFDA. In 2011 the USGS developed education and training programs to share with local scientific capacity and with the MRC. For example,

> Forecast Mekong: This U.S. Geological Survey-led multi-year project covers a range of projects and training related to ecological monitoring, data analysis, visualization and mapping tools. New programming will focus on basin water quality in response to requests from Mekong River Commission members, as well as additional programs which address food security in the Mekong Delta. (http://www.state.gov/r/pa/prs/ps/2012/07/194963.htm)

Furthermore, as part of the Lower Mekong Initiative,

> The United States will assist in developing environmental programs in the Mekong region to help address future challenges. The programs include the development of 'Forecast Mekong', a predictive modeling tool to illustrate the impact of climate change and other challenges to the sustainable development of the Mekong River Basin…The United States is also active in supporting projects that promote the sustainable use of forest and water resources, preserve the tremendous biodiversity of the Mekong Basin, and increase access to safe drinking water. (www.state.gov/p/eap/mekong/)

USAID/RDMA's Regional Environment Office is working with the Lower Mekong Initiative (LMI) countries (Myanmar, Thailand, Cambodia, Vietnam, and Laos) to develop a regional approach to sustainable environmental management and strengthen capacity to manage shared water resources. Over a five year period, the USAID/RDMA helped the Mekong shift its development trajectory toward sustainable, green growth by supporting two new complementary programs, Sustainable Infrastructure for the Mekong (SIM) and Mekong Partnership for the Environment Project (MPE).

LMI points out that the new investments—especially in large-scale infrastructure and agriculture—can have significant social, environmental, and economic impacts over the short and long term. Without sound social and environmental safeguards, projects such as hydropower dams in the Lower Mekong River Basin (Thailand, Cambodia, Vietnam, and Laos) will disrupt the river's major fisheries and degrade the food security, livelihoods, income opportunity, water availability, and transportation options for approximately 60 million people. Similarly, the conversion of natural forests into palm oil, rubber, timber and other commercial agricultural commodities, as well as for the development of roads, dams, mines and pipelines, threaten biodiversity in the Lower Mekong countries (http://www.usaid.gov/asia-regional/sustainable-mekong).

USAID recently funded the DAI, a US-based development company, to undertake a project for the 2011-2016 period entitled "Adaptation and Resilience to Climate Change" (ARCC). The goals of this climate-change-related capacity building development project are as follows:

> Identifying the environmental, economic, and social effects of climate change in the lower basin; and assisting highly exposed and vulnerable rural populations in ecologically sensitive areas to increase their ability to cope with climate change impact on water resources, agricultural systems, biodiversity, ecosystems, and livelihood opportunities upon which they depend to sustain them. A central objective of ARCC is to bridge the knowledge gap between high-level science and on-the-ground community responses (http://dai.com/our-work/projects/southeast-asia%E2%80%94mekong-adaptation-and-resilience-climate-change-arcc).

The problems confronting those with responsibility for 'dealing' with hydro-meteorological hazards in the LMB are numerous. Not only are the "hazards" confronting governments and their people in the region physical in nature, but they are also socio-economic, cultural and political as well.

Many of the socio-economic changes that are taking place in each of the LMB states will have an impact on the water resources in the basin. These changes include an increase in the demand for forest products and expected increases in water demands from the agricultural sector (including expansion of irrigation). Inland fisheries are at risk to "any changes to the flood-pulse through, for example, the construction of dams, weirs or other infrastructure [that] are likely to reduce fisheries production" (MRC 2011d:13). Furthermore, hydropower development, river navigation, an increase in mining and in adverse environmental impacts as well as potential decreases in water quality, and so forth, are other possible risks to water resources.

Societal changes can also be seen as having a major influence on the region's ability to prepare for, cope with, adapt to, and recover from hydro-meteorological problems in an effective, efficient, resilient and sustainable way. The Asian Development Bank (ADB 2012) succinctly noted the need to develop social as well as technological responses to reduce vulnerability and to enhance resilience in the LMB: "Floods and droughts in the Lower Mekong Basin can have a major impact on farming, food supply, and infrastructure, but reducing the risk isn't just about building hardware, it's also about equipping communities with the skills to plan, predict, and prepare for climate change." ADB goes on to write:

> The direct cost of droughts in the Lower Mekong Basin is severe, causing massive losses in rice yields and reducing livestock and fisheries. Extreme weather is dangerous to the lives of families and farmers, and the cost of recovering from weather-related emergencies erodes their ability to save and invest in their futures. The 2004-2005 drought, for example, cost an estimated $42 million in the Mekong Delta, in addition to triggering localized food shortages. (www.adb.org/news/adb-help-mitigate-risk-floods-droughts-lower-mekong-basin)

Another USAID/RDMA project that supports various MRC countries among others is the project called ADAPT (www.adaptasiapacific.org) which is targeted to assist Asia-Pacific Accessing Climate Change Adaptation Funds for Asia and the Pacific. The ADAPT Asia-Pacific project is designed to help nations in the region to obtain financing for actions to address climate change. ADAPT Asia-Pacific program is funded through USAID's Regional Development Mission for Asia (RDMA) and implemented by AECOM. The following countries were eligible to participate in ADAPT Asia-Pacific:

Bangladesh, Cambodia, India, Indonesia, Lao PDR, Maldives, Mongolia, Nepal, Philippines, Sri Lanka, Thailand, Timor-Leste and Vietnam. Eligible nations in the Pacific include: Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, and Solomon.

The principal objective of ADAPT Asia-Pacific is to establish a fully functional and self-sustaining adaptation project preparation facility that will not only support preparation of specific projects, but also build the capacity of the region's governments to independently access climate adaptation funds. To establish a sustainable project preparation facility, ADAPT Asia-Pacific works closely with funding organizations and government agencies from countries across the region in focused activities in five key areas: (1) sustainable regional knowledge sharing platform; (2) annual forum to bring adaptation funds and project proponents together; (3) climate change adaptation project capacity building program; (4) technical assistance in preparing funding proposals; and (5) overarching program management and coordination for the aforementioned four technical tasks. As cross-cutting themes, ADAPT Asia-Pacific will promote regional networking, gender and other social equity issues.

OFDA: what it is and what it does

A review of OFDA's activities as outlined in its annual reports over a 10-year period identified the use of the more than 70 action verbs (shown below) to describe its wide-ranging global responsibilities and activities in regard to both its direct and indirect DRR, humanitarian and emergency responses to hydro-meteorological disaster events.

Figure 15 Action Verbs taken from OFDA's Activities

**adapted.adopted.addressed.airlifted.assessed.averted.benefited.
built.contributed.cooperated.created.deployed.developed.distrib
uted.empowered.enabled.facilitated.embarked.funded.implemen
ted.improved.initiated.invested.led.organized.participated.plann
ed.prepared.procured.promoted.prioritized.purchased.redeclare
d.rehabilitated.sponsored.strengthened.supplied.supported.tailo
red.targeted.trained.transporte.traveled.utilized.worked.**

In a recent statement USAID/OFDA (2012a) succinctly summarized its mission in the following way:

> OFDA responds to all types of foreign natural disasters, including earthquakes, volcanic eruptions, cyclones, floods, droughts, fires, pest infestations, and disease outbreaks. OFDA also provides assistance when lives or livelihoods are threatened by catastrophes, such as civil conflict, acts of terrorism, or industrial accidents. Disasters cause loss of life or injury, damage to private or public infrastructure, and interruption of livelihoods. Foreign disasters comprise both acts of nature and acts of humankind that disrupt economic and social activities.
>
> OFDA not only responds to disasters but also works with disaster-prone countries to prevent, mitigate, and prepare for the effects of potential disaster scenarios. This includes assistance relating to disaster preparedness, and to risk reduction activities, to lessen adverse impacts of, and to enhance the prediction of and contingency planning for, natural disasters abroad. Disaster planning and preparedness identifies the hazards present in a country or region; the vulnerability of people and infrastructure; and the resources available for relief, rehabilitation, and reconstruction. Mitigation or risk reduction measures implement activities to reduce loss of life, livelihoods, and property by reducing vulnerability.

A major OFDA concern, irrespective of climate change, is DRR. Increasingly, though, climate change has emerged as a key concern with regard for DRR considerations, whereas thirty years ago the key concerns centered on disruptive seasonal and inter-annual variability and extreme hydro-meteorological events.

"Recognizing the benefits in lives and resources saved, OFDA provides Disaster Risk Reduction (DRR) activities to reduce risks to vulnerable people and property posed by natural and human-caused hazards" (2). DRR activities take many forms, including but not limited to:

- Building capacity of national and local disaster management entities and communities on timely and effective response and preparedness;

- Provision of technical assistance in national disaster planning for institutions, officials, and other individuals in disaster-prone countries to improve disaster management;

- Implementation of community-based DRR, such as community-focused tsunami preparedness; and

- Strengthening hazard early warning system capacities (2).

Still, identifying the precise role and contribution of OFDA in some of the activities in which it is or has been associated over the past decade or so is not an easy clear-cut task. USAID in general and specifically OFDA have been actively involved in several hydro-meteorological hazard and disaster related programs and projects in Southeast Asia, sometimes acting alone but often in collaboration with partners including other humanitarian organizations and recipient governments. In several instances, OFDA's support for activities in the LMB was ongoing, while at other times it was supportive of specific time-limited, catalytic pilot projects related to river flood and flash flood forecasting. Although funding for some of these pilot projects did come to an end, OFDA's initial support for them on several occasions proved crucial in a catalytic way, as other international donors stepped in to provide follow-on support to projects.

Asia Flood Network (AFN)

Since 2001, USAID/OFDA has supported the AFN to strengthen the capacity of regional and national institutions in climate, weather and hydrological forecasting. Through AFN, USAID/OFDA and its regional partners were directly focused on reducing vulnerability to the hydro-meteorological hazards of high-risk communities by promoting information sharing of hydro-meteorological data, managing and forecasting in trans-boundary river basins. USAID/OFDA and MRC collaboration on flood mitigation led to AFN and expansion of similar activities in South Asia in partnership with the International Centre for Integrated Mountain Development (ICIMOD). AFN aimed to reduce vulnerability to flood hazard in Asia with objectives to:

- Build regional/national capacities on climate, weather, and hydrological forecasting and warning;
- Encourage hydro-meteorological data and information exchange in trans-boundary river basins; and
- Improve dissemination of forecasts and warnings to the users and population at risk.

Flash flood guidance system for LMB

One of the activities under AFN is the development of a lower Mekong flash flood guidance system. OFDA implemented a flash flood guidance system for the LMB. The Hydrologic Research Centre (HRC) in San Diego in cooperation with the U.S. National Weather Service (U.S. NWS) jointly implemented a flash-flood mitigation program in Cambodia, Lao PDR, Thailand and Vietnam. Based on HRC's experience, and with financial support of the USAID/OFDA, a system was established based on remote sensing of critical meteorological parameters and available global and local spatial data sets rather than implement a series of systems based on in-situ automatic and/or manual hydro-meteorological monitoring networks.

The MRC Flash Flood Guidance System (MRCFFGS) is designed as a diagnostic tool for meteorological and hydrologic services to analyze weather-related events that can initiate flash floods (e.g., heavy rainfall, rainfall on saturated soils), thereby allowing its users to make a rapid evaluation on the potential for a flash flood for a specific location. The system provides values of flash flood guidance and flash flood threat for small stream basins - the basins most prone to flash flooding. The system is not based on simply identifying areas of heavy rainfall. The technical method that would be used to produce this guidance is the same that has been proven over the last 30 years as a result of operational use by the U.S. NWS. This method is based on physically related hydrologic modeling involving soil water accounting and capacity of the draining channel at a level of minor flooding (bank-full) conditions. Evaluations of the threat of flash flooding may be done over hourly to six-hourly time scales (depending on timely reporting of hydro-meteorological data). Satellite rainfall estimates (Hydroestimater) have been used together with available in-situ rainfall gauge data to obtain bias-corrected estimates of current rainfall volume over the region. It used these bias-corrected satellite rainfall data to update soil moisture estimates and to evaluate flash flood threat.

The development of the system was initiated in 2005. The system, including the delivery of capacity building for the MRCFFGS operators of 4 national line agencies, was fully completed by August 2009. By the end of October 2009 MRC's Regional Flood Management and Mitigation Center (RFMMC) in Phnom Penh, Cambodia accepted the MRCFFG System for operational use. Daily monitoring of the MRCFFG has been conducted since, and information of flash flood risk areas, thereby indicating the name of villages, districts and provinces, were updated daily in the MRC website (http://ffw.mrcmekong.org/mrcffgs.htm).

On its "Flood Early Warning Systems in the Mekong River Basin" report, OFDA comments:

> In January 2003, USAID/OFDA and MRC began an innovative demonstration project to strengthen warnings to communities most at-risk to floods. The project works with the most flood-vulnerable communities in Cambodia to develop useful and understandable flood information for these communities. In addition, the project develops tools, methods, and protocols --- with the help of community-based implementing partners --- to enable flood vulnerable populations to effectively prepare and respond to MRC flood information. This 5-year program began in January 2003 and ended in December 2007 (www.pacificdisaster.net/pdnadmin/data/documents/1258.html).

Supporting this statement is a US NWS press release from 2007, which noted that:

> Cooperation among OFDA, NOAA and the USGS is multiyear and was formalized in 2003 under the Asia Flood Network (AFN) initiative." Later the

> Hydrologic Research Center "joined the partnership, principally in preparing a regional flash-flood guidance system for the lower Mekong Basin…. AFN seeks to identify and fill gaps in end-to-end [E2E] flood forecasting and early warning, while complementing other OFDA-funded early warning and mitigation activities in the region…. The AFN is intended to strengthen the capacity of regional and national hydro-meteorological institutions in climate, weather and flood forecasting, while directly involving communities at risk in reducing vulnerabilities to hydro-meteorological hazards…. The principle output is enhanced capacities of hydro-meteorological, disaster-response, and regional organizations to monitor, forecast, and issue flood-related information to Asian communities at risk of floods. (www.nws.noaa.gov/iao/BLT_AFN.php)

In 2004, with regard to the flood risk management program, with continued assistance from OFDA, the CRC (Cambodian Red Cross) and the American Red Cross expanded the flood EWS to 34 more villages in five flood-prone provinces of Cambodia (Cogels 2005). This program did not include climate change adaptation (CCA). Soon after, however, a commitment was made to address Cambodia's community needs to increase awareness and understanding about and prepare for climate change. Funding for resilience to climate change activities was then sought (i.e. Kingdom of Cambodia 2010; 2012).

Projections of climate change in the LMB countries

An MRC Technical Report (2009b: xii-xiii) provides a brief overview of the climate futures for each of the four LMB states, claiming "accurate information on the climate change situation at the national level in each of the LMB countries is very limited. Available information is often drawn from global or regional level models with varying degrees of relevance to the national level. Quantitative information is lacking and most of the data is presented in terms of broad potential trends in climatic conditions." The report then goes on to provide some detail for each of these countries:

> In **Cambodia** it is predicted that there will be an increase in mean annual temperature of between 1.4 and 4.3°C by 2100 (IPCC 2007). Mean annual rainfall

is also predicted to increase, with the most significant increase experienced in the wet season. As with the other countries in the LMB, flooding and droughts are expected to increase in terms of frequency, severity and duration. The potential impacts of climate change include changes to rice productivity, with increases in wet season crops in some areas and decreases in others; acceleration of forest degradation including the loss of wet and dry forest ecosystems; inundation of the coastal zone and higher prevalence of infectious diseases (e.g., IPCC 2012).

In **Lao PDR** an increase in mean annual temperature is predicted together with an increase in the severity, duration and frequency of floods; most probable in floodplain areas adjacent to the Mekong. The impacts of climate change are predicted to include agricultural and infrastructure losses due to increased storm intensity and frequency; land degradation and soil erosion from increased precipitation and a higher prevalence of infectious diseases.

In **Thailand** an increase in mean annual temperature is predicted together with an increase in the length of the hot season, with a higher number of days with a temperature greater than 33°C, and a corresponding decrease in the length of the cold season. Higher rainfall intensity is expected in the cold season. Some river basins are expected to face water shortages and an increase in flood and drought frequency is predicted. The impacts of climate change are expected to include changes in rice productivity, with increases in wet season crops in some areas and decreases in others; damage to wetland sites from reduction in water availability; and damage to the coastal zone from changes to coastal erosion and accretion patterns.

In **Viet Nam** an increase in annual average temperature of 2.5°C by 2070 is predicted with more significant increases probable in highland regions. The average annual maximum and minimum temperatures are also expected to increase. An increased incidence in floods and droughts is predicted, together with changes to seasonal rainfall patterns and an increased incidence and severity of typhoons. A possible sea level rise of 1.0 m by 2100 has been identified. It is estimated that there would be direct effects on 10% of population from 1.0 m sea level rise and losses equivalent to 10% of GDP due to the inundation of 40,000 km^2 of coastal areas. Salinity intrusion in the Mekong Delta region is expected to increase, resulting in changes to cropping patterns and productivity and negative effects on aquatic and terrestrial ecosystems. A higher prevalence of infectious diseases is also forecasted.

Considering such projections about the potential consequences of climate change, how is a country—or, in this case, a regional river basin organization (the MRC) focused primarily on transboundary issues—to prepare for an uncertain and variable future climate regime? Adaptation planning appears to have been the way chosen by the MRC. An appraisal based on a 2010 MRC report assessed the various adaptation planning approaches to identify the ones most suitable to regional needs of the LMB. This MRC document is instructive and sparks thoughts about a range of DRR issues relating to floods and droughts that face the individual governments of the region and their regional institutions. It also provides insights about its regional needs in coping with and adapting to regional climate change in sustainable and resilient ways.

While such attention has been drawn by humanitarian and development agencies to the idea of **adaptive capacity**, little explicit mention has been made of the need to enhance institutional, national or regional **absorptive capacity**. Absorptive as well as adaptive capacity building are central needs that can be met through sustainable DRR education and training activities.

Disaster Risk Reduction and Climate Change Adaptation: from autonomy to cooperation

Concern over DRR and how to bridge it to CCA is not just an academic exercise. It is a real concern of decision makers in both the international and the national humanitarian assistance communities, regardless of whether their assistance is intended for quick emergency response to hydro-meteorological hazards and disasters or for longer-term sustainable development activities that bear in mind the potential consequences of changing climate regimes.

Many socio-economic adjustments to variations in local and regional climate, water and weather conditions, regardless of the remaining scientific uncertainty that keeps us from completely understanding those conditions, have unwittingly—and also wittingly—been underway over the past few decades. In other words, the convergence of DRR and CCA has been taking place informally and for the most part unobserved (even to development specialists) at the local level worldwide for years. Acknowledging this reality and accepting it brings to light how for academic, bureaucratic (institutional) and planning purposes DRR and CCA have always been separated and thought of as autonomous activities. Review of this history suggests that each had been developed with different bureaucratic jurisdictions but with overlapping and related missions. The need for the separation of the two has in the past, however, been more intellectual and academic than operational.

The MRC (2010) report on adaptation was honest in its appraisal, noting, for example, that "despite the existence of many of these [adaptation] planning tools, decision-makers still struggle with adaptation" (2). Part of the problem has been that there are several approaches to adaptation planning that are, in general, competing against one other. Such competition makes it even more difficult for national to local decision-makers to agree on policies about which adaptation pathway to pursue. There is also a 'conflict' among various official definitions and perceptions about traditional DRR. For example, what USAID refers to as "traditional DRR" (what we labeled earlier as DRR) is primarily a focus on disaster *response and recovery,* and today DRR (Disaster Risk Reduction) is more progressive, it emphasizes prevention and preparedness for disasters and to some extent climate change adaptation.

The MRC (2010) interestingly noted that: "at the same time, methods and tools that only focus on recovery and response are not considered in this review, because they do not address the ideas of thinking ahead and forward planning." (4). The point is that to be effective a DRR program focused on sustainable development or on CCA cannot really be separated from disaster response and recovery. Today, both donors and recipients are focused on developing meaningful and effective ways to integrate, bridge or blend DRR and CCA activities.

For its part the CCA community of researchers and policymakers wants to bring within its administrative (bureaucratic) jurisdiction not only thinking about climate change and its consequences to the end of the 21st century but also now operationalizing ways to reach backwards in time to the present. This means that CCA is increasingly becoming directly involved in contemporary DRR issues. As Fussel (2007: p. 273) observed, "adaptation assessment has become more inclusive over time, linking future climate change with current climate risk and other policy concerns." The GFDRR (Global Facility for Disaster Reduction and Recovery 2011:PN) leadership workshop report supports this view:

> "From a development perspective, integrating CCA analysis and measures in DRR interventions is increasingly becoming a basic issue of due diligence, *while CCA investments that do not simultaneously address current climate risks could fall short of meeting countries' development needs*" (emphasis added).

The problem is that the two worlds of climate change adaptation and humanitarian aid through emergency response and recovery are in the process of 'merging' in unplanned and likely inefficient ways. Both the CCA and the DRR communities are, however, concerned about what is perhaps the most worrisome side of a changing climate—the uncertainties surrounding the frequency and intensity of occurrences of hydro-meteorological hazards and disasters. Despite their differences, DRR and CCA do share some similarities about regions at risk to recurring hazards and foreseeable disasters occurring now and in the near term (MRC 2010).

The problem is that comments such as the following continue to appear now and again in MRC adaptation planning reviews, exposing an underlying but premature belief: “once the impact of climate change has been assessed, possible adaptation measures and strategies are analyzed and their expected results are estimated” (8). This underlying belief is likely based on the assumption that now (or in the near future), distinguishing between “normal” seasonal and inter-annual climate impacts and those impacts that are definitively identified as having been caused by global warming is (or soon will be) possible. This assumption is, however unrealistic, fostered in part by media coverage of and searches for a major scientific breakthrough. Climate science research is not yet able to live up to such an expectation. In truth, uncertainties about future climate change related hydro-meteorological impacts still dominate and for the most part influence the thinking of policy planners in developing regions, despite the hype and rumors that no single hydro-meteorological event can at this point be definitively linked to climate change.

Bridging an expanded role of what USAID (2012:11) referred to as “traditional DRR,” which focuses on response and recovery and gives limited attention to preparedness, with an expanding role of CCA has become all the more important in recent years because of growing desires to “mainstream” DRR into policy and other decision making processes (including into CCA planning). Notably, recent years have also seen the opposite suggestion, that is, to mainstream CCA into DRR emergency and humanitarian activities of preparedness, response and recovery.

Mainstreaming

The mainstreaming of adaptation refers to "integrating awareness of climate change into all stages of a country's decision-making with regard to development planning processes" (MRC 2009). Cambodia, for example, has had an interest over the past several years in making a stronger attempt to mainstream climate change issues into its policy planning process. To this end, several proposals were prepared to solicit support from international donors for building resilience and for mainstreaming resilience into development planning activities. As a result of its efforts and commitments to enhancing its climate change activities, the Kingdom of Cambodia (2012) noted that:

> Cambodia is one of the countries selected worldwide for the Pilot Program for Climate Resilience (PPCR), which aims to demonstrate ways to integrate climate risk and resilience into development planning. With support from ADB and the World Bank Group, the Government of Cambodia (the Government) prepared the Strategic Program for Climate Resilience (SPCR), comprising 7 investment projects and the proposed technical assistance (TA). ADB then circulated a draft TA concept paper for comment by government ministries, civil society organizations, development partners and other stakeholders. A consensus emerged on the need to strengthen capacity of key stakeholders to mainstream climate resilience into development planning. (1).

"Mainstreaming Climate Resilience into Development Planning" is clearly in line with the USAID shift to a resilience framework, as recently elaborated in its resilience Policy Guidance document.

Among considerations to be made in providing support to Cambodia for mainstreaming are the following comments, which reflect the concerns of other donor organizations, on climate change-related hydro-meteorological future threats that the Kingdom is likely to face (see ADB 2012).

> Cambodia is highly vulnerable to climate change. Its high vulnerability is attributed to its low adaptive capacity and high reliance on climate-sensitive sectors such as water resources and agriculture. Infrastructure-related losses from

> impacts of climate change such as floods are also high. The 2011 floods alone, for example, caused an estimated $451 million in damages and $174 million in losses. Analysis of 14 general circulation models suggests that rainy season will commence later, wet season rainfall will increase (bringing more flooding) and dry season rainfall will decrease (leading to droughts). Damage from typhoons may be severe in the future. Cambodia's 435 km coastline and large parts of the Mekong River flood plain may be affected by sea level rise, which is projected to make more areas vulnerable to floods, salinity intrusion, and coastal inundation with adverse implications for food and water security, and infrastructure stability. Climate change thus poses a serious threat to sustainable development in Cambodia. (1).

High impact hydro-meteorological extreme events capture the attention of policy makers and, as a result, most proposals to or reports for potential donors, contain brief statements about this nation's vulnerability to climate change in order to highlight the urgency of its national needs.

Seasonality and "mainstreaming" DRR and CCA

It is important to reiterate that "mainstreaming" has also been taking place at the local level, constituting a hidden mainstreaming often not taken into account by planners. People at the grassroots level of society are mired in the "here and now," as they are forced to cope with climate, water, and weather variability and extremes on a daily, weekly, intra-seasonal, inter-seasonal and inter-annual basis. To them, mainstreaming likely refers to incorporating changing climate considerations and specific activities into their understandings of changes in "seasonality" and its expected variability and extremes. The consequences of these changes for human and ecological processes as these people have come to know and expect them will have tremendous effects on their future coping capacities.

Quite naturally, agencies involved in traditional DRR can be expected to want to expand their activities to encompass prevention and preparedness programs, as has been the case especially in regions that are known to be at risk to recurrent hazards (seasonally or annually—and even on decadal time scales). Doing so involves DRR efforts for known specific recurring hazards. In fact, DRR-related organizations would be remiss for not trying to get a step ahead of and prepare for the possibility that a hazard could foreseeably become a disaster especially in known hazard-prone regions.

As the MRC noted (2009b), “It is necessary to think how we will adjust not only to these specific changes but to the new uncertainty about our future climate.” This statement is another example of the overlapping of concerns of those seeking to foresee the seasonal variability of today's hazards with the concerns of those seeking to prepare society for the consequences of climate change that are believed to be several decades away. These overlapping concerns and activities can be “blended” together in such a way as to reduce competition among organizations and bureaucratic units within an organization in order to develop responses to hazards and potential disasters in a more timely, coordinated and effective way.

Mainstreaming attempts to bridge or blend DRR and CCA activities, while maintaining their separate identities is, however, necessary. Such blending will be beneficial for improving societal mechanisms for coping with the changing characteristics of hydro-meteorological hazards and their possible impacts both now and into the future.

Importantly, the MRC (2009b) also identified general problems (lessons really) for DRR program managers to be aware of, based on MRC’s experiences:

- Many methods and tools are available for adaptation planning, but limited guidance on selecting appropriate ones to use is available;
- Training and sensitization about what adaptation is and how it can be approached is necessary;
- Methods are not “plug and play”; therefore, skill and training are required and data is needed;
- No single approach can successfully support adaptation planning;
- Expert judgment is most important;

- Include a system for monitoring progress from which real lessons can be drawn for application elsewhere; and
- Tools need to be continuously reviewed, as further resources for follow-up or ongoing monitoring may be unavailable.

In sum, bridging or blending DRR missions and operational guidelines with CCA longer-term development considerations is occurring informally as well as through formal programs from bottom up (i.e. civil society) as well as from top down (i.e. from government ministries and donors).

Climate Change Impacts in the LMB, with emphasis on Cambodia

Various organizations throughout the Mekong Region and in Cambodia are coping with inter-annual variability and extreme hydro-meteorological events in the present, but they must also prepare for the foreseeable future regional consequences of global warming, as well as for surprises.

The following section describes the results of discussions with MRC staff, stakeholders and government and non-governmental agencies in Cambodia. Primarily an agrarian country, the Kingdom of Cambodia is highly vulnerable to the impacts of climate, water and weather variability, fluctuations, extremes and changes. Cambodia is especially vulnerable to weather-related disasters, as more than 80% of its population consists of subsistence farmers (Ministry of Environment 2011). Adverse impacts of flood and drought include increased damage such as reduced crop yields, decreased water availability and increased risk to vector and water-borne diseases. For example, based on data from the Cambodia National Mekong Committee (CNMC) in the past five years, Cambodia's paddy production was damaged by as much as 70% by floods, and 20% and 10%, respectively, by droughts and diseases (MRC 2013:13).

With regard to public health Cambodia's Ministry of Environment (MOE 2011) has projected that, under changing climate conditions, Cambodia may also experience an increasing incidence of malaria, up by an estimated 16% from its current rate. Natural disasters also disrupt the functioning of fragile ecosystems that in turn trigger changes that exacerbate existing poverty and childhood malnutrition. In addition, the country's poor and underdeveloped health infrastructure will aggravate the country's health problems and further press already strained government capacities.

The Mekong River Commission (MRC)

The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) along with regional partners in Asia (ICIMOD, ADPC, etc.) worked on the Asia Flood Network (AFN) in cooperation with the Hydrologic Research Center (HRC) in the USA through the AFN-supported Lower Mekong Flash Flood Guidance (FFG) project.

Lam and Katry (2013) provide a brief timeline for the project:

> The development of the system was initiated in 2005. The system, including the delivery of capacity building for the MRCFFGS operators of 4 national line agencies, was fully completed by August 2009. By the end of October 2009 the MRCFFG System was accepted for operational purposes by MRC's RFMMC… Daily monitoring of the MRCFFG has been conducted since, and information of flash flood risk areas, thereby indicating the name of villages, districts and provinces, were updated daily in the MRC website.
>
> Since October 2009 until now the MRCFFG System successfully detected several flash flood risk areas, especially during severe weather conditions, such as low pressure, ITCZ or tropical storms, and provided this information on time to the concerning line agencies and public, as well as to the MRC website.

A major challenge of the project, as mentioned by the MRC, appears to be the retention of its staff with technical knowledge and experience. For example, in November 2012 only one trained person remained in the MRC, and this person had been 'borrowed' for a period of time from another LMB country, though two scientists had been sent to HRC in order to enhance the overall capacity of FFG (as of November 2012).

The MRC FFG has become operational in the Regional Flood Management and Mitigation Center (based in Phnom Penh, Cambodia). Development of the flash flood guidance system was supported by OFDA. As Lam and Katry (2013) noted,

> The MRC Flash Flood Guidance System (MRCFFGS) is designed as a diagnostic tool for meteorological and hydrologic services to analyze weather-related events that can initiate flash floods (e.g. heavy rainfall, rainfall on saturated soils), thereby allowing its users to make a rapid evaluation on the potential for a flash flood for a specific location. The system provides values of flash flood guidance and flash flood threat for small stream basins—the basins most prone to flash flooding. The system is not based on simply identifying areas of heavy rainfall.

Also mentioned in the interview was that the current FFG technology would benefit from further strengthening to suit the country's needs; additional research is essential and it was proposed that MRC should take the lead on research and development. To do so, however, the MRC would need additional technical staff for research and development in order to fully operationalize the FFG. The project goal was to operationalize the FFG in the Lower Mekong Basin countries by 2010, which has been successfully done (MRC/AMFF-7 2009; Lam and Kaltry 2013). The authors also provided some recommendations (which could be considered as lessons identified):

- For greater reliability, the MRCFFG system needs to be improving some parameters (such as bias correction factor);
- So that it can be used for early warnings for people living in flash flood risk areas, information should be streamed on the MRCFFG system to concerned authorities and NGOs; and
- The connection between RFMMC and National FFG operators for the region must be maintained in order to exchange experiences learned from FFG operations after each flash flood season. (https://ams.confex.com/ams/93Annual/webprogram/Paper216889.html)

A series of capacity building activities on flood risk management, forecasting and early warning under the FFG project was carried out in the region. Even so, an end-to-end (E2E) "bridge" has yet to be realized between the early warning system and civil society's community-level understanding or interpretation of a forecast. For example, despite many development activities, the 2011 flood was considered to have been the worst in Cambodia's history. The damage to infrastructure and agricultural crops has been estimated at more than US$500 Million (MRC 2011c). The water level rose and receded three times as a result of flash flooding and of Mekong River flooding. The perception is that the early warning system failed to work, as was also suggested in many local newspapers.

The vital role of the MRC flood forecasting division relies (heavily, one could say) on the "secondment" process, with the length of stay of "borrowed" personnel at MRC being determined by the member state from which the seconded person comes, usually for a year or two. The secondment practice facilitates a two-way sharing of knowledge and capacity between the MRC and its member countries. It also helps to keep personnel costs at reasonable levels and can assist in reinforcing and heightening national stakeholder ownership. Although the secondment process has centered on technical needs, positive secondment experiences in the MRC have also tended to "bubble up" to management and policy levels. As helpful as the secondment process is, however, the MRC still needs secured support in order to gather a sustainable core staff that amounts to a skilled critical mass for operationalizing regional flood forecasting systems.

The Department of Meteorology (DOM)

In Cambodia, the DOM is the nation's meteorological services provider. It is responsible for monitoring weather disturbances and for providing warning to the government and the public. The DOM is under the Ministry of Water Resources and Meteorology (MOWRAM) and has the following mandates: a) Install and manage the weather monitoring network throughout Cambodia; b) Monitor weather conditions in the region;

c) Issue weather forecasts and provide warnings on weather conditions to relevant ministries and to the public via the media; and d) Solicit and integrate regional partnerships in data and information sharing, research and training. In its current capacity, DOM provides basic services for DRR in the country.

When compared to other countries in the region, however, Cambodia's DOM apparently lags behind in terms of equipment and forecasting technologies such as numerical weather prediction and climate modeling, a point mentioned by DOM staff. It has a research and development unit, but the unit is yet to be fully operationalized. With its currently existing physical and human resource constraints, the department has difficulty to accommodate the growing demands from the various socio-economic weather-sensitive sectors of the economy.

After Typhoon Ketsana in 2009, the DOM was confronted with the big challenge to improve its weather forecasting capabilities. The fact that a large portion of the country had been severely impacted by the typhoon led to the creation of a major rehabilitation program, with assistance coming from foreign donors including USAID/OFDA. The upgrading of the DOM's capabilities was, however, apparently not given the highest consideration in terms of these rehabilitation efforts.

Various socio-economic sectors in Cambodia have lacked awareness and, therefore, knowledge about the potential value of using hydro-meteorological information for decision-making in their respective socio-economic sectors. Because the need for client-specific services has also not been widely recognized by the different sectors in the country, educating them on the use of hydro-meteorological information in their decision-making processes is a necessary component of DRR. Thus, while DOM appears to be performing its core tasks, all would benefit from collaborating with the country's climate- and weather-sensitive sectors.

The aftermath of Typhoon Ketsana and the flooding of 2011 provided an opportunity to promote dialogue and foster partnerships between the DOM and the country's major socio-economic sectors as well as an opportunity to enable the DOM to deliver its services more effectively. As the consequences of a changing climate continue to unfold, however, the region's National Meteorological and Hydrological Services (NMHS) will be faced with increasing demands and challenges to provide more accurate, timely and user-friendly forecasts, information and products. These are the core aspects of support that DOM provides to DRR agencies and to an early warning system.

In Cambodia, the DOM is currently under great stress because of its lack of trained staff. Regardless, the DOM will, however, have to develop different strategies to address the needs of EWS stakeholders across the country. In moving forward, therefore, what needs to be remembered is that in less developed countries the capacity building of the NMHS staff in the area of interpreting forecast products received from other meteorological centers may have to be given a higher priority than, for example, installing high-speed computing systems. The transboundary nature of weather-related phenomena requires understanding of priorities in building collaborative relationships among national hydro-meteorological services in the region. One way that this can be done is through enhanced data sharing and cooperation in the region, a process that is currently being fostered by the WMO (1999) through Mekong-HYCOS.

Currently, MOWRAM is coordinating with MRC to implement the country's vision for water resources management. To realize this vision, however, DOM needs to improve its provision of weather forecasts and seasonal outlooks. Currently, the major concern of DOM in Cambodia is to strengthen its services by undertaking the following initiatives:

- Institutional strengthening
- Capacity building
- Improvement of telecommunication systems
- Enhancement of its observation network
- Improvement in its forecasting capacity through advanced studies and training
- Improvement of severe weather monitoring capabilities, especially for typhoons and floods that approach the Indochina Peninsula

- Improvement of precision in rainfall monitoring
- Establishment of a real-time data transmission system
- Installation of Automatic Weather Stations

The goal of Meteorological Services is to provide and deliver useful credible products and services such as forecasts and warnings as well as hazard information to meet country or local needs, especially when an extreme weather-related event occurs. This set of services and products not only comprises forecasting and warning products but also a wide variety of data products, hazard information and analyses. It also provides the services of experts for specific EWS-oriented studies and research, products design and support in decision-making. For this, it is critical that a meteorological service has adequate core capacity for observation and monitoring and operational forecasting. The forecast system should yield accurate timely forecasts via access to and analysis of a wide variety of numerical weather products, monitoring information and integrated guidance systems with up-to-date tools, software and functionalities.

Observation networks are essential for many dimensions of meteorological and hydrological EWSs for real-time hazard monitoring and for model verification and adjustment. It is also essential for climatological matters and hazard analyses. Thus, meteorological services have to manage real-time and historical observation networks with sufficient space and time coverage. These basic capacities require essential supporting functions and activities such as data management, product development and relevant IT and telecommunication.

Data management includes quality control as well as access and exchange at national and regional levels. Product development capacities are essential to guarantee the provision of adequate products according to users' needs. Feedback, represented by a 3rd "end" (e.g. represented as E2E+Feedback or E2E2E), explicitly links recipients of forecasts with those responsible for producing forecasts via a feedback loop. The users' perspective is a useful input to those responsible for producing forecasts as early warnings, advising forecasters as to whether the information they provide to civil society really serves its members as the earliest warning possible. In this way, the "end-to-end-to-end" model to replace the traditional "end-to-end" model for an EWS for DRR should be advocated and normalized across the entire spectrum of forecast users.

For more efficient DRR there is a constant need to identify, assess and monitor hazard risks and to enhance EWS. The capacity of DOM across all levels (national and sub-national) is, however, limited because of insufficient funding, outdated communication systems and lack of equipment (as emphasized by DOM officials). For example, during Typhoon Ketsana in 2009, residents of local communities in the affected provinces were unable to communicate in a timely manner with authorities, resulting in higher levels of damage than might otherwise have been the case.

Nevertheless, as a key provider of national climatological data, DOM continues to play a crucial role in climate change studies. The most urgent area to be looked into is the capacity of the DOM in terms of human resources development, its partnerships with other national agencies and its collaboration with other meteorological centers in the region. Considering the current situation of DOM, additional resources and interventions would be required from the government and from foreign donors for the department to be able to undertake such activities.

DHRW (Department of Hydrology and River Work)

The DHRW, which is also under the umbrella of MOWRAM, is in charge of all hydrological activities in Cambodia. DHRW consists of five offices: Administration, Research and Flood Forecasting, Water Quality Analysis, Hydrological Works, and River Bank Management.

The DOM is one of the six technical departments of the MOWRAM, which is mandated to install and manage the weather monitoring network throughout Cambodia; monitor weather condition happening in the region; and issue weather forecast and provide warning on weather condition to relevant ministries and public via media. In dealing with hydro-meteorological hazards, DOM partners with the DHRW, which is responsible for flood forecasting and warning. As regards to its duties and responsibilities, DOM has special relationships and responsibilities with several ministries and state bodies such as Ministry of Environment, Ministry of Agriculture Forestry and Fishery, National Committee for Disaster Management, Ministry of Public Works and Transport (MPWT), Ministry of Labor and Social Welfare (MLSW), Ministry of Industry, Mines and Energy (MIME), and the Cambodian Red Cross (CRS).

DOM has the following responsibilities, as reported on its website (http://www.dhrw-cam.org/):

- To prepare a plan for installation of hydrological stations on the main streams to serve water resources development;
- To prepare short-, medium- and long-term strategic plans on protection of erosion, sedimentation and river banks;

- To research and monitor surface and ground water regimes by managing installed hydrological stations and collating data to serve various water-related sectors;
- To implement and monitor water levels, water discharge and sediment in the river basin;
- To implement water quality monitoring at the main hydrological stations;
- To study and research on hydrological phenomena, models, computations, and surface and ground water potentials;
- To manage and exchange hydrological information;
- To issue forecasts and early warnings of possible flood and drought and implement appropriate mitigation measures in good time; and
- To establish a GIS (geographical information system) relevant to all river basin features, hydrological networks and locations of water resources development infrastructures, and so on.

The American Red Cross and USAID/OFDA supported a "Community-Based Flood Early Warning System" (CBFEWS) project, implemented by the DHRW, from 2002 to 2007. For the project, several community volunteers were trained to read and transmit rainfall data to the Red Cross Central Office, which forwarded it to the DHRW for flood forecasting and to do a vulnerability assessment to implement flood preparedness measures in flood-prone communities. The project was successful at local levels by building the capacity of communities and training volunteers to respond to disasters.

Cambodian Red Cross (CRC)

One of the four core objectives of the CRC for implementing its 2010-2014 program is "To continue promoting Disaster Management". The three other objectives are health and care in the community, the promotion of humanitarian values and human dignity, and organizational and resource development. To ensure success and effectiveness in the implementation of these core areas, CRC builds safety systems for disaster preparedness and capacity for disaster risk reduction and responses in support of disaster management.

CRC continues to strengthen its cooperation with relevant ministries, institutions, organizations and agencies to deepen partnerships and to gain stronger technical and financial support. Based on discussions with disaster-related officials, CRC's main concern has been centered on food security and the factors that can adversely affect it (CRC Newsletter 2012, 4:4).

Climate change is a relatively recent concern for CRC. As such, few direct lessons have been as yet learned by CRC about coping with climate change consequences, though it has considerable experience in dealing with the consequences of hydro-meteorological hazards and disasters. Without question, dealing with today's climate, water and weather variability and extremes can provide many insights into coping with the consequences of changes in variability and extremes, many of which are increasingly more likely to become attributable to human-induced climate change. This is a current example of the blending of DRR and CCA efforts at the grassroots level that is already taking place.

To CRC, climate change is just one of the many risks that Cambodians face. It is also concerned with the impacts of droughts on food production and availability at the community level. The Kingdom of Cambodia (2006) National Adaptation Programme of Action to Climate Change (NAPA) documents highlight key gaps in information: few climate change studies and relatively limited research capacity for climate change impacts on agriculture and water resources, lack of availability of good quality data and of formal mechanisms for data and information sharing, and lack of technical expertise, among others.

As noted earlier, the community-based flood EWS was a successful program supported by USAID/OFDA from 2002 to 2007 in collaboration with the American Red Cross and the CRC. Community volunteers were trained to read and transmit rainfall data to the Red Cross Central Office and then to the DHRW so that it could be used for flood forecasting. Villagers were provided with cellphones, flood markers and flood information boards. Once processed by DHRW, the data was then returned to the community in the form of a flood forecast or a warning bulletin. The project also involved vulnerability assessments as well as the implementation of flood preparedness measures in flood-prone communities.

An early warning project "Community-Based Flood Mitigation and Preparedness (CBFMP)" ran between 1998 and 2001 and was supported by the American Red Cross. It was an effort to reduce the vulnerability of rural villagers in Cambodia to natural disasters by establishing sustainable, replicable non-governmental mechanisms for disaster mitigation and preparedness. The project was carried out under ADPC's USAID/OFDA-funded Asian Urban Disaster Mitigation Program and was jointly implemented by CRC, Participating Agencies Cooperating Together (PACT) and the International Federation of Red Cross and Red Crescent Societies (IFRC) [www.adpc.net]. Finally, CRC works with the Royal Cambodian Government to ensure that the emergency needs of all victims are addressed.

The OFDA-supported community-based flood risk management project aimed to make flood-prone communities more self-reliant by identifying solutions and mobilizing local resources. Villagers born and raised in a community and using their indigenous or “ordinary knowledge” can readily identify their community's priority flood mitigation needs and are often aware of the difficulties that they face in addressing those needs. Because of the widespread subsistence nature of villagers' livelihoods in LMB countries, a strategy is necessary to overcome the lack of resources that severely inhibits implementing DRR initiatives that villagers might otherwise undertake. Program design, for example, can consider targeting clusters of adjacent communities to share the benefits of projects. Doing so would provide a larger pool of resources (like insurance, or repositories of local experience) from which to draw, thus enabling more effective flood mitigation activities.

The flood management project helped create a community-based flood mitigation strategy by utilizing traditional community processes to mobilize people and initiate community activities. Further emphasizing the community-based aspects of the program was thought to enhance the empowerment of local communities. Involving community leaders and village residents in promoting broad-based community participation in this empowerment and sense of ownership of the project helped participants to realize that other avenues of support could be pursued. Providing communities with alternative forms of assistance engenders a form of self-help that, although depending on outside resources, has the effect of organizing and mobilizing the community.

Also noted in interviews was that CRC Volunteers, of which there are about 15,000, may in general lack adequate understanding of concepts that would better enable them to carry out their tasks on preparedness and response to hydro-meteorological or other hazards and disasters. More formalized training related to climate change and its foreseeable consequences would enhance their understanding of the connection between DRR and CCA and empower them as voices of DRR as well as CCA while working at the grassroots level in the provinces.

Although every one of the 11 national Red Cross societies in Cambodia has been asking for CCA and DRR information, CRC has lacked sufficient funding to provide it. Among other things, this means that they do not have the financial support necessary to effectively mainstream CCA into DRR. In fact, DRR activities of CRC exist only in a few provinces, even though there are 24 branches of CRC in the country.

The CRC is separate from the government, but the government assists CRC's National Committee for Disaster Management (NCDM), which is the national-level group dealing with disasters. Though the CRC is not a lead agency on disasters, it works closely with other first responders. However, CRC has a nationwide and comprehensive structure from national- to community-level throughout the country. This network could be utilized if additional resources were provided to effectively build capacity in rural communities.

CRC appears impressive. It is supported by the leadership of its governing bodies at all levels and is well-known for its strong commitment, active advocacy, devotion, sacrifice, clear-sighted goals, humanitarian spirit, and volunteerism. It has earned strong support from inside the country as well as from organizations abroad.

The Director of Disaster Management in CRC mentioned that climate change was first introduced to the CRC as an "actionable" concern in 2008. He noted that Cambodia used to have four distinct seasons but now there are really only three. Also, Cambodia gets more frequent high winds, thunderstorms and lightning. It used to be windy followed directly by rain, but now the rain comes later.

OFDA provided flood EWS support from 2003-2007 to CRC, and warning systems were implemented in three pilot provinces. At that time, the concept of climate change was not very familiar to most Cambodians. In 2006, however, the government set up the National Committee on Climate Change (NCCC), which involved high-level representation from 20 ministries and later the Prime Minister acted as its honorary chairperson. In 2006, Cambodia's NAPA was also completed. At the time, climate change concerns can be said to have appeared on the government's radar screen. Still, civil society needs a good deal of help to better understand climate change and what it might mean for different regions, countries and river basins.

The point is that even today many people in rural Cambodia are not familiar with climate change, at a time they increasingly need to be made aware of and educated about it. To this end, it was suggested that more reports on climate change and CCA need to be translated into Khmer. Furthermore, communities need to enhance awareness and capacity building programs. The greatest issue is that, even as such decreases in awareness education are occurring, events are becoming more and more unpredictable, leading to greater misfortune and increased uncertainty. In 2006, for example, CRC ceased monitoring and community-outreach activities; a week later a major flood occurred. In contrast, six years later (2012), a forecast of flooding that did not occur still had an impact on food security, because a number of farmers who heard that there was a high possibility of the onset of an El Niño event decided not to plant.

Cambodia Disaster Risk Management

NCDM (National Committee for Disaster Management)

The Royal Government of Cambodia established the NCDM in 1995 not only to provide timely and effective emergency relief to victims of disasters but also to develop preventive measures to reduce loss of life and property.

The NCDM is a ministerial level agency headed by the Prime Minister with membership comprised of all ministers as well as representatives of the Royal Cambodian Armed Forces, the CRC and the Civil Aviation Authority. Composed of five main departments, NCDM performs the following functions:

- Manage data on disaster risk and develop reports on the state of hazards;
- Propose resource reserves for disaster intervention in emergency response;

- Build capacity and develop human resources for disaster management;
- Coordinate and implement disaster management policies;
- Exchange and share information; and
- Coordinate and mobilize resources for disaster response.

The year 2009 was a milestone for Disaster Risk Management in Cambodia. The government in March launched the "Strategic National Action Plan (SNAP) for Disaster Risk Reduction (2008-2013). The objective of SNAP was to foster a multi-stakeholder partnership to reduce the social, economic and environmental impacts caused by natural and human induced hazards by incorporating DRR into policies, strategies and plans across all sectors at all levels. The UNISDR and the ADPC provided technical support in the development of SNAP with primary funding coming from the European Commission.

MOWRAM

The role of MOWRAM, through the Department of Meteorology (DOM) and the Department of Hydrology and River Works (DHRW), in disaster risk management is to provide flood and weather forecasting and early warning information to national and sub-national government agencies, local authorities and the public through television, national radio and local newspapers. As a complement, the Regional FMMC of MRC is responsible for producing and disseminating flood forecasts and early warnings for its member states in the LMB, including in Cambodia. At the local level, the CRC plays an important role in disseminating flood forecasts to communities.

OTHER ACTIVITIES

There are several other actors in the field of Disaster Risk Management in Cambodia. They are, however, relatively uncoordinated and external support is fragmented. These actors have produced many reports containing good recommendations.

For disaster risk reduction and management, accurate and timely weather and flood forecasts and warnings are required. More real-time hydro-meteorological data and information; quality controlled databases for hazard, vulnerability and risk maps; and strong cooperation/coordination/linkages with DRRM agencies and stakeholders are necessary. Likewise, good communication facilities, trained technical staff and educated end-users are necessary, if DRRM is to be more effective.

The National Strategic Development Plan 2006-2010 called for resource mobilization to implement the NAPA. Historical trends and climate projections have been prepared by the Climate Change Department using the PRECIS model (Providing Regional Climate Integrated System). Based on data from 1960-2000, the Cambodian climate (rainfall, temperature and even seasonality) has been shown to have already changed, and future rainfall patterns are expected to continue to change.

From the derived climate change scenarios for Cambodia, there is a need for better coordination among national agencies and other stakeholders, including cooperation from the region to put forward activities that include improvements on data management systems to mainstream CCA and DRR and studies on the impacts of climate change on the different economic sectors.

NCDM in collaboration with World Bank and ADPC implemented a substantial project which is focused on three key components including multi-hazard risk assessment in Cambodia, strengthening of early warning systems in Cambodia by improving E2E early warning systems and Disaster Management Information Center (DMIC) within NCDM and development of guidance materials for structural proofing and design provision of various buildings and codes in the flood plains.

MRC and Lessons for the Lower Mekong Basin

The MRC Secretariat and many of its donors believe in reviewing MRC activities for the purpose of identifying lessons, good ones as well as bad ones. Doing so is a part of the transparency that exists in MRC's projects. In fact, their PowerPoint presentations contain slides that identify specific as well as general lessons gleaned from an on-going or ended project, noting aspects of a project that were successful as well as goals that were not reached. Various reports include charts and lists that highlight identified lessons.

This process of continually seeking to improve an organization's activities by identifying what worked and what didn't work is, of course, important for any organization. The search for lessons provides opportunities for mid-course correction as well as for post mortem "could have or should have" after-thoughts after the project had run its course.

To its credit, MRC reports often contained lessons identified, along with mission and goal statements and comments about what is needed to achieve them.

In this way, the MRC has done due diligence in preparing its 2011-2015 Strategic Plan. It did so by touching base with all key stakeholders relevant to its mission as a regional river basin organization. These stakeholders included LMB members, Upper Basin Partners, Donor Partners and even other River Basin Organizations such as the one for the Danube and others around the globe. The new Strategic Plan opens with the following Note (v):

> This Strategic Plan not only has the consensus of the MRC's Member Countries but also reflects, to the greatest extent possible, the feedback received from our stakeholders, on the key challenges and opportunities facing the Mekong River Basin and those collective actions needed to address the challenges and capitalize on the opportunities.

In this document, aspirations as well as needs have been clearly identified. For example, the report's vision statement represents the desired "what ought to be" outcomes for the LMB regional development:

- Food is plentiful and varied;
- Local livelihoods are resilient to external shocks;
- Riparian populations enjoy the fullest of human development potentials and choices;
- The Mekong River system is healthy and rich in biodiversity; and
- The riparian population enjoys an equitable share of the benefits and risks associated with the utilization of water and related resources of the Basin.

At the same time the report identifies what is needed to achieve those outcomes: strengthening of commitment to the MRC's Integrated Water Resource Management by LMB states; bringing about greater equity between the LMB members (Thailand being the most developed and Lao PDR and Cambodia the least developed) and within the states between urban and rural populations, heightened awareness about the potential consequences of a changing global climate, and so forth. Also sought as a goal is greater autonomy for the MRC-based on achieving financial security by 2030.

MRC went through a lengthy and thorough process to design a pathway for its future development while also having identified potential risks (e.g. obstacles) that might be encountered along the way (p. 71-75).

> Risk #1: The momentum of economic development and the prospect of short-term benefits of water resources developments overshadow the long-term costs and/or projected environmental and social impacts of proposed water development proposals in the LMB.
>
> Risk #2: MRC fails to attract sufficient financial support because donor funding becomes scarce and shifts to other less developed regions.
>
> Risk #3: Financial plan for increased Member Country contributions to OEB after the end of 2014 does not conclude 2014.
>
> Risk #4: Fully "riparianized" MRC Secretariat fails to maintain and improve standards of technical and professional competence for regional cooperation.
>
> Risk #5: Member Country agencies are not committed to taking full responsibility

for national level activities according to the agreed roadmap of core functions implementation and decentralization.

Risk #6: Relevant Member Country agencies lack clear financial plans to implement selected core RBM functions at national level.

Risk #7: Inadequate coordination at national level and insufficient engagement of relevant line agencies will prevent closer linkages between regional and national efforts.

Risk #8: A large proportion of Member Country agencies lack sufficient staff capacities to take greater responsibility in the implementation of some core RBM functions.

Risk #9: A large number of mainstream dam proposals in the LMB are concurrently submitted to MRC for prior consultation processes and the need for extensive civil society engagement thereby stretches the resources of MRC staff.

Risk #10: Cooperation with upstream riparian countries does not increase as expected.

In February 2013 the UNISDR sent a team to Cambodia survey DRR activities in that country. UNISDR's survey and country-specific questionnaire and findings of the recent survey (UNISDR February 2013) provide Cambodian input to the post-2015 Hyogo Framework for Action (e.g., HFA2). The survey contains a local Cambodian perspective about DRR and CCA, including comments on "lessons learned," on successes in mainstreaming (integrating DRR into development) and on "future issues to be considered in the post-2015 Framework for DRR."
(http://www.preventionweb.net/files/31995_posthfaconsultationcambodia.pdf)

Lessons from OFDA/USAID-MRC related DRR interventions and initiatives

OFDA/USAID programs, particularly in the areas of flood forecasting and DRR, have a long history of supporting MRC member countries in the Lower Mekong Basin. As noted earlier, OFDA/USAID support was significant in establishing the MRC's flood forecasting system networks (through MRC Flood Forecasting Center in Cambodia, MRC-FMMP, and AFN), strengthening the community-based flood forecasting systems (through MRC's FMMP in collaboration with National Red Cross chapters from the MRC countries, the American Red Cross, ACF, ECHO, MRC-FMMC and others). They supported MRC for developing the flash flood guidance (FFG) system, strengthening community-based DRR processes. In this continuous support, OFDA/USAID programs have supported both the scientific upstream developments of MRC's flood forecasting systems for both riverine and flash floods and also attempted to strengthen the community-based risk reduction measures linked to the flood forecast systems in target countries.

Some of the key lessons that emerged during this survey/review of OFDA engagements in this region that are noted below are categorized as follows: (1) strengthening flood forecasting and dissemination systems in MRC's Lower Mekong Basin countries; (2) strengthening of various layers of government agencies and from capacity building initiatives; (3) efforts in raising awareness, public education and establishing a process for fostering a "Culture of Safety"; (4) integration (mainstreaming) of flood risk reduction into DRR and development plans and; (5) resource mobilization for DRR and EWS activities.

1. **Lessons from strengthening flood forecasting and dissemination systems in MRC countries:**

   - OFDA/USAID supported activities to the FMMP program of the MRC have helped to establish a broader system for the MRC Flood forecasting system, a process for ***improved access to and dissemination of flood early warning*** from national to community (i.e. commune) level. Some of the community-level flood forecasting activities are conducted through demonstration projects involving various stakeholders. Local authorities and community people saw flood Information Boards and Flood Marks as good tools for flood preparedness by vulnerable communities to effectively prepare for, respond to and cope with floods. However, these developments were for the main river stem. Further actions are needed to establish a tributary-level flood forecasting dissemination system, interpretation, local referencing and engaging procedures of operation for enabling sustainability at the community level. A great need for the above issues was expressed by at-risk communities in the flood plains seeking to enhance the successful application of this scientific development by making a concrete societal application of it in other locations.

- The ***phasing out*** of the ***HYCOS project*** is underway and has begun with the handing over of Operation and Maintenance responsibilities of the HYCOS project stations from the MRC to its member country NHMSs. However, at this point in time, the NHMSs do not have the necessary adequate mechanisms for the continued functioning and maintenance of these. This could be a critical factor in coming years.

- Apparently, initiatives under the existing programs were more focused on the pilot sites and at the pilot project level. But, what is required is to go beyond piloting and to move towards a ***longer-term programmatic approach and up scaling to a wider geographical area*** to ensure that the flood management and mitigation policy objectives become solidly embedded (i.e. mainstreamed) into the national disaster management strategies of the MRC's Member Countries.

- At this point many of the flood management and mitigation tools developed by the MRC through existing support programs have a basin-wide approach and need to be applied to support local-level interventions. Some continued (follow-up) support is needed in order to ***integrate basin-wide to local level interventions*** for enhancing community engagement and resilience.

- While the existing support programs access to river stage-level flood forecasting information was strengthened, a ***lack of adequate information exists that would be particularly useful with interpretations for the saving and safety of the livelihoods*** of the communities.

- Continued innovative flood forecast information with interpretations for specific sector and livelihood activities (e.g. agriculture, fisheries) are crucial to reduce the risk of negative impacts by floods on the livelihoods of the people living in Lower Mekong River Basin.

2. **Lessons from the strengthening of various layers of government agencies and from capacity building initiatives:**

- Enhanced ***capacity building initiatives for the provincial, district and commune level disaster management authorities*** on Planning for Flood Preparedness and Emergency Management, community-based flood forecasting system and risk management, Search & Rescue, Swimming Lessons for Children, and Teachers Training on School Flood Safety were found to be encouraging for continued skill development and interest by various levels of stakeholders.

- Experience indicates that the increase in ***capacity building initiatives for the key officials*** of the provincial, district and commune Disaster Management (DM) committees has led to a better flood preparedness in the selected provinces in MRC member countries --- mainly in Cambodia, Lao PDR, Thailand and Viet Nam. The initiatives for flood preparedness and emergency management have helped the targeted provinces to better prepare for floods. This was found to be particularly important for enhancing communication, coordination and cooperation among stakeholders, as well as for the consistency of national disaster management and mitigation policy implementation.

- Active involvement of national government and local authorities at provincial, district and commune levels in the formulation and implementation of the ***Flood Preparedness Programs (FPP)*** has been a major step to ensure consistency, ownership and sustainability, in addition to the activity of ***integrating Flood Risk Reduction (FRR) into local development plans***.

- The ***Community-Based Flood Management (CBFM) trainings*** for commune-level disaster management officials aimed to improve the practical skills in flood management and to strengthen their capacities in flood preparedness planning and implementation were found useful. These trainings enabled them to manage and mitigate the negative impacts of floods with greater skills and enthusiasm.

- More focused ***training on the community-based flood forecasting systems*** are crucial needs, which were not fully touched upon in the existing capacity building initiatives, including the establishment of observation systems (flood markers), information sharing and dissemination systems, development of risk resource and evacuation maps linking EWS, development of Standard Operating Procedures (SOP) for the local communities, and with provisions for interpretation of flood information for livelihoods and local referencing.

3. Lessons on the efforts in raising awareness, public education and establishing a process for fostering a "Culture of Safety":

- A great deal of activity on raising awareness and public education were undertaken in the existing programs supported by OFDA/USAID and others in this area; ***School-based DRR*** activities brought encouraging results from the various related activities; ***Partnership and capacity building*** of concern of line ministries on flood awareness activities i.e., Posters and Information Booklet, Cultural Shows, and Flood Information Billboards and the like were carried out in the earlier initiatives. However, these ***initiatives still require being up scaled through the adequate establishment of standards for communication and coordination along with policy support*** for their wider use. At the same time, the activities undertaken remained only within the pilot sites and were not used in a widespread manner for various reasons including the lack of a replication planning process and the lack of a resource mobilization plan to carry out broader application.

- More work is ***needed to establish a process to foster a "Culture of safety"*** through a sustained CBDRR and awareness program at the community level. Until now, the existing programs were doing well in establishing a process through school safety programs and engagements. However, this process needs to be up-scaled in a systematic manner for enhancing wider societal resilience building for flood preparedness.

- Promoting ***public-private partnerships*** between authorities and private sectors for public awareness activities has not reached its potential in these programs.

4. Lessons from integration (mainstreaming) of flood risk reduction into DRR and development plans:

- The ***provincial and district level disaster preparedness planning processes*** by the DM committee members were found useful in institutional capacity and confidence building of the local DM officials to deal with the annual flooding. The experiences of the provincial and district levels officials also show that they were able to demonstrate their improved capacities in that they coordinated better in recent disasters than they had earlier. A ***Flood Preparedness Program (FPP) manual*** was found useful, but it remains in need of follow-up guidance, which has been lacking.

- The strengthening of the integration (mainstreaming) of flood risk reduction into DRR and the development process can help to ***define the role and the responsibilities of Provincial disaster management offices*** (i.e. PCDM/ DCDM Secretariat) as well as line departments in implementing DRR and disaster emergency response.

- ***The Sectoral DRR Plan*** and its implementation was considered a new innovative approach and model to ensure the mainstreaming/integration of DRR into specific socio-economic sectors. To do so, each sector would allocate its resources or be able to mobilize resources from its development partners for implementation. It was also realized that the integration of Flood Risk Reduction into Local Development Planning through local socio-economic development planning processes is a crucial step for sustainability of DRR activities and it needs to be strengthened in the future.

5. Lessons on resource mobilization for DRR and EWS activities:

- One of the key lessons to emerge was the issue of ***resource mobilization for sustaining DRR and EWS actions*** at the local level. These require longer-term measures with budget availability and identifying mechanisms for innovative and efficient mobilization of resources. Requirements exist for every level including regional (MRC), national (NDMOs, NHMS, Sectors), and provincial, district and commune levels.

- Challenges exist given the ***insufficient resources to support*** each line department, scaling up and implementation of DRR Plans at the local level. The challenges of resource availability and mobilization make it difficult to replicate the pilot initiatives in other areas and provinces. OFDA/USAID programs have not as yet addressed these challenges, particularly to sustain efforts made either in the upstream scientific developments (including climate change adaptation, CCA) or at the local-level downstream DRR process.

Concluding Observation

A major issue arose during the SWOC exercise for flood-related DRR: reports prepared by different organizations at different times publish information that is in direct conflict with other reports on similar issues. Ascertaining why this conflict is so prevalent is difficult and requires study. Statements in such reports, however, often seem so overly authoritative and assertive in tone that not questioning their positive statements and success stories is difficult to avoid (e.g. ADPC 2010).

This problem is so persistent that sometimes goals that are noted as constraints or weaknesses in a report can be found in other parts of the same document to have been listed as successes. For example, MRC is said in some reports to be effective at communications and awareness raising from the national to the local level, but other reports call for assistance to be provided to enhance their communications and generate awareness at the local level as well as—somehow—among government workers. Both views can find support for its argument in other reports and articles. Which statement or report is a reviewer to believe?

Are these reports being prepared in positive terms for donors, even though statements at the end of the reports, presented as recommendations or lessons learned, identify the very same praised activities as being in need of more assistance? This raises a concern that the process of identifying lessons learned for a project's report may be like a safety value for the recipient preparing the report to show donors that they acknowledge shortcomings, which, of course, supports the need for additional funding—and many organizations only subsist on that 'additional funding'.

Common to all groups in the AFN-Mekong region is the request for longer-term support—'additional funding'—for their activities from donors. When the funding ends, and in the absence of a seamless string of follow-up funders, a hiatus period tends to leave projects on the proverbial backburner, as future funds are sought. Given the numerous funders in the donor community, for some pilot projects that come to an end the recipients might shelf the project's continuance hoping for the support of another donor to follow up on the initial pilot project. They might choose to do so rather than step forward to support even especially innovative projects with their own resources. This raises a question about their willingness to take ownership of a development project or perhaps to their original commitment to the pilot project in the first place. This, however, is not unreasonable on the part of the recipient of the grant, but needs to be considered on the part of the donor, because many projects are submitted to donors because they include an explicit capacity building component. Here it may be useful to consider the concept of "satisficing" and the adage "The perfect should not become the enemy of the good."

The question then centers on "good enough" or "when has enough capacity been 'built' before the recipient takes ownership of the activity?

APPENDIX for the MEKONG LOWER BASIN Case

Mekong River Commission
Basin Development Plan Programme, Phase 2 (April 2011)
Assessment of Basin-wide Development Scenarios pp. 2-3
www.mrcmekong.org/assets/Publications/basin-reports/Assessment-of-Basin-wide-dev-Scenarios-MainReport-2011.pdf

The Mekong River Basin

The Mekong River flows for almost 4,800 km from its source in Tibet through China, Myanmar, Lao PDR, Thailand, Cambodia and Viet Nam via a Delta into the East Sea, draining a basin area of 795,000 km2 and with a mean annual discharge of approximately 475 km3. The per capita water resources are high relative to other international river basins. The flow from the Lancang-Upper Mekong Basin contributes 16% of the average annual flow in LMB but up to 30% of dry season flow3. There is a very large difference in wet and dry season flow, caused by the southwest monsoon, generating wet and dry seasons of about equal length. Inter-annual variability is large in terms of river discharges, flooded areas, and the start and end of the wet and dry seasons. The seasonal cycling of water levels at Phnom Penh causes the large water flow reversal to and from the Great Lake via the Tonle Sap, with the associated flooding and drying creating a rich ecology. The Mekong is the second most bio-diverse river in the world after the Amazon, and supports the world's largest fresh water capture fishery of about 2.3 million tons per year.

The LMB population in 2007 was estimated at 60 million, with about 90% of the population of Cambodia (13 million), 97% of the population of Lao PDR (5.9 million), 39% of the population of Thailand (23 million), and 20% of the population of Viet Nam (17 million in the Delta and 3 million in the Central Highlands) living within the basin. Population growth in the basin is 1-2% in Thailand, Viet Nam and Cambodia, and 2-3% in Lao PDR. Although urbanization is occurring in all LMB countries, about 85% of the basin's population lives in rural areas.

The livelihoods and food security of most of the rural population are closely linked to the river system, with over 60% of the economically-active population having water-related occupations that are vulnerable to water-related shocks and degradation. Millions of poor people depend on capture fisheries for food security and income. While all LMB countries are making good progress towards achieving the MDGs, about 25% of the population of Cambodia and Lao PDR has incomes below the poverty line, with much higher percentages in many rural areas. Food security and malnutrition pose great challenges. About half of all households have no safe water supply and half of all villages are inaccessible by all-weather roads. Throughout the LMB, inequalities are generally increasing between urban and rural groups.

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End of Project Evaluation of the ECHO Supported Project

Capacity Building for Flood Preparedness Programs (Sub-Component 4) of Flood Management and Mitigation Program (FMMP)

Grant No: ECHO/DIP/BUD/2008/02013

European Commission Support to Mekong River Commission

01 February 2010 to 08 March 2010

Evaluation Undertaken By Christopher M. Nixon

Within the report **a number of lessons learned and associated recommendations have been identified**. These are categorised as "programmatic" and "future actions". The programmatic items relate to observations of how the programme operates on a day-to-day basis. In general these are administrative and monitoring issues to enhance programme performance. The future action items relate more specifically to considerations and topics for future phases of the programme. It is inappropriate to summarise and include all recommendations in the executive summary - indeed doing so would eviscerate the essential details for implementation, which may consequently be out of context. **Below however is a brief summary of the more significant recommendations.** The reader is however, referred to the body of the report for a more comprehensive list of recommendations, and their details.

• systematic monitoring and evaluation of the project should be undertaken against a simplified system based on the pre-agreed logframe objectives and the objectively verifiable S.M.A.R.T. indicators, across the breadth and depth of the project;

• additional advocacy is required (example Cambodia) to ensure ownership of the project as support for national policies, rather than a standalone donor project;

• it is desirable and conducive to improved ownership to transparently share with national counterparts, details of the budgets and disbursements and to secure agreement on prioritizing budgets and disbursements;

• in order to overcome inertia, through differing priorities or capacity in sectoral line ministries and departments, capacity of key officials in key departments at provincial and district level is recommended;

• wherever possible the FMMP initiatives and FPPs should be harmonised with and integrated to larger initiatives rather than duplicating or running in parallel;

• capacity building of counterparts and project staff on the differing roles and modalities of the various stakeholders (NGOs, Red Cross, UN, Intergovernmental Organisations, Multilateral Donors, etc) is needed;

• there continues to be a need to focus stakeholders and the project on preparedness, and in particular longer range preparedness;

• to address the constraints on compiling all the comprehensive data required under the FPP template, it would be desirable to provide a guideline summary that identifies and prioritises the key features and data required for an FPP that may in the short term only comprise approx 50 to 70 percent of the ideal data;

• the number of trained practitioners within the NDMOs should be increased to provide a national full time cadre of experienced trainers whose skills can be deployed as trainers and as a technical resource;

• instead of duplicating or replicating the activities of NGOs and the Red Cross the project should seek to leverage its position and networks as an inter-government initiative, to undertake the more challenging activities that are beyond the scope or capacity of Red Cross, NGOs and other stakeholders;

• support to the programme, should continue with the minimum of discontinuity;

• small scale essential hardware should be provided to support key flood monitoring and mitigation activities; and

• the future needs of the project and its likely extension should be considered along with potential avenues of support for the crucial activities. In this respect activities should be prioritised, with their likely duration and resource requirements identified, and potential sources of support. In parallel a compatible exit and handover strategy needs to be agreed with counterparts.

ECHO. Pp. 33-40

Section 7. LESSONS LEARNED and RECOMMENDATIONS

Lessons learned are general for all the three countries, except where specifically stated otherwise. **Following each "experience" is the proposed recommendation.** Experiences (and associated recommendations) have been subdivided into general "programmatic" aspects, and considerations for "future actions."

Programmatic Experience and Recommendations:

1.) **Experience:**

There is a need that a greater depth and breadth of the stakeholders have a holistic understanding of the project structure. This should emphasize the relationship of project activities to effective outputs and outcomes, plus the synergies and interactions with other projects and initiatives. Activities and results should not be seen in isolation, hence the impacts on other activities/ results by changing the nature or schedule of an activity should be understood.

Recommendation:

Project objectives and indicators should be simple and clear. Project staff and national stakeholders at all levels should have a holistic understanding of the objectives and indicators. Where necessary capacity building of staff and stakeholders in project monitoring should be undertaken.

2.) **Experience**:

The evaluator and a number of stakeholders have identified there is an apparent need for systematic monitoring and evaluation throughout the project at all operational levels in order to keep it "on course" and focused on the principal and specific objectives. This need not be complex so long as it is systematic, and should be simple.

This monitoring should be against the pre-agreed objectives, and objectively verifiable indicators. Objectives, results and indicators should be SMART and understandable at all levels of the project participants. This will assist in maintaining the focus of the project, its schedule for activities and deliverables. It will also highlight areas where "course correction" is needed in a timely manner, and ensure focus on key or relevant objectives and activities, rather than on potentially more subjective or less relevant activities (ECHO 2010, p. 33).

Systematic routine monitoring and evaluation will also assist in keeping a focus on the activities, deliverables and timelines of the more complex and more challenging objectives, such as mainstreaming the integration of the FMMP into the development framework. This in turn will enhance the likelihood of these objectives and results being materialized. Where circumstances result in objectives being unrealistic, the objectives and indicators should be amended, by agreement, to reflect achievable and meaningful outcomes. What is important is to "demystify" project monitoring and evaluation so that project staff and national counterparts and stakeholders have a mutual and common understanding of the process and indicators. It is also important for the partners and stakeholders to understand that by whatever name "monitoring and evaluation" is referred to it is no more than a systematic and consistent approach to the normal and uncomplicated everyday process of assessing suitability of actions and deliverables - in much the same way as even laymen assess goods and services for suitability of purpose.

Recommendation:

Systematic monitoring and evaluation of the project should be undertaken against the pre-agreed logframe objectives and the objectively verifiable S.M.A.R.T. indicators, throughout the project. Project objectives and indicators should be simple and clear. Project staff and national stakeholders at all levels should have a holistic understanding of the objectives and indicators. Where necessary capacity building of staff and stakeholders in project monitoring should be undertaken. Where circumstances change, the objectives and indicators should be modified accordingly.

3.) **Experience**:

The overlap of production of new IEC materials for the SFSP (in Cambodia) with the MoEYS DRR curriculum development appears to have arisen as earlier phases of the project had undertaken awareness activities in the earlier absence of MoEYS curriculum. It seems consultation with the MoEYS before preparing the SFSP IEC materials was initially therefore, not emphasized sufficiently (reports and interviews suggest consultation initially focused at DoEYS level). Stakeholder analysis and other parameters at the design phase (such as stakeholder activities or interests) may change. Consequently these design parameters and analyses should be reviewed throughout the implementation to determine if changes in stakeholders or changes in their projects and initiatives require re-evaluation of initially planned deliverables and activities. This may avoid overlaps and gaps occurring between the project and its key partners and stakeholders.

Recommendation:

Stakeholder analysis and other parameters at the design phase (such as stakeholder activities or interests) need to be reviewed and updated regularly for changes during the project implementation.

4.) **Experience**:

It is important to recognize that other key stakeholders (such as PSDD, DoP in Cambodia), necessarily operate in different structures and with differing priorities and flexibilities from an individual project. In a short duration project such as the ECHO project, it may therefore be difficult or unrealistic to align key activities and priorities with those of such external stakeholders. Project timelines and the associated objectives and results need to be realistic in recognizing such constraints or find viable alternative solutions.

Recommendation:

Project timelines and the associated objectives and results need to be realistic in recognizing that external stakeholders (such as PSDD or Ministries) may have different priorities and timelines that are not consistent or compatible with a short project.

5.) **Experience**:

In some instances "Partners" have been considered to be any organisation operating within the general target area, or an organisation undertaking similar though unrelated activities to the project activities. In other contexts "Partners" have a defined role and share in the implementation of the project. Roles and definitions of "partners" need to be clearer to the project participants so that opportunities for synergies or outreach are not lost and overlaps with other initiatives are minimised. There also needs to be improved clarity over what activities constitute "participation" or "support", compared to "consultation", or "informing" stakeholders. This should improve the project's inclusiveness, encourage appropriate outreach and a proactive approach to involving potential or actual partners rather than informing them. Similarly the project needs to have improved clarity in respect of other development concepts such as "integration" or "institutionalization" of activities and concepts. In project reports it appears that activities "implemented" or "integrated" into school curricula support, etc, have been reported as “institutionalized” where this may not be readily appropriate in the short term or in the context of this project (ECHO 2010, p. 34-35).

Recommendation:
The role and definition of “Partners” needs clarification. In this respect it is also important to distinguish between “participation”, “consultation” and “informing”, regarding project activities. Similarly the project needs to clarity in the development aspects of “integration” or “institutionalization”.

6.) **Experience**:

There have been instances where NGOs and other partners were not invited to participate in detailed planning and section of FPP projects, or where insufficient notice was provided to NGOs and Red Cross to participate in workshops or planning sections with the DMCs. In order for participation of the relevant stakeholders to be effective, their priorities and operational constraints must be considered, especially in providing adequate advance notice and consultation of events and workshops.

Recommendation:

Participation by partners must be concrete, recognizing their priorities, schedules and constraints to secure their active participation in workshops and other activities.

7.) **Experience**:

There is a very strong practical and operational focus at sub-national level. Particularly with the absence of funding of national level stakeholders in MRCS-ADPC ECHO IV, it is necessary to reaffirm and advocate to the national level stakeholders for their practical and resource support. The MRCS-ADPC ECHO IV project should be considered as part of the national development projects, receiving appropriate consideration for allocation from national budgets rather than solely be funded as a standalone externally funded project.

Recommendation:

Additional advocacy is required (example Cambodia) to ensure ownership of the project as support for national policies, rather than a standalone donor project.

8.) **Experience**:

In some instances noted in the report, participants appear to view the project narrowly. The project participants must in practice, at every level, see the project as part of an overall development mosaic. This requires constant and meaningful consultation and participation with a wide range of stakeholders. It is necessary to recognise that some stakeholders (such as Education and other line Ministries and Departments) have specific mandates and authorities on which the project cannot encroach without participation and approval.

Linkages to, and synergies with, other projects and initiatives also need to be recognised and pursued in a meaningful manner. It was perceived that the project is, occasionally, in some contexts seen in isolation, rather than as a component of interlinking national and regional development assistance projects. This appeared evident even within the project team.

Recommendation:

The project staff and stakeholders need to recognise the project as part of an overall development matrix supporting national and regional policies rather than an independent initiative. The mandates of line ministries must be recognised and the project must in addition to consultation, ensure meaningful participation by, and approval of, specific sector activities where needed.

9.) **Experience**:

There is a risk that the effectiveness of an otherwise sound activity may be constrained by the effectiveness of its delivery. The total requirements for an activity to be effective and sustainable should be considered along with the resources this may require. For example: effective teaching requires not only the technical messages and lesson plans, but also adequate timing for teaching and the communication and pedagogic skills to ensure effective transmission of the messages (ECHO 2010, p. 36).

This was not only apparent in the teaching components, but also in requests of PCDM / DCDM trainers that communication, listening and local sensitivity skills be included in the ToTs. In general it seems that ToTs that are now 5 day duration with practical information sharing are considered effective. In some areas, particularly in Viet Nam it was highlighted that specific training skills are incorporated in the ToT and in the teacher orientations, though this does not seem universal across the project. However, in both the Flood Preparedness activities at commune training level and at some of the schools participating in SFSP, training was found to be excessively challenging and less effective. There were concerns in all three countries that the volume of information was difficult for commune/village people to assimilate. It would be ideal to address these local capacities and to include such material in all teaching / training activities. Suggestions have been made to make smaller teaching blocks for training at commune level, as well as incorporating communication, listening and sensitivity skills in the training of officials

Recommendation:

The total requirements for an activity to be effective and sustainable needs to be considered along with the resources this may require plus the local context and capacity. For example: training and teaching will require not only the technical messages but also the skills and techniques to facilitate effective communication and learning on the part of the trainer, ability to learn effectively on the part of the student. Capacity building should not be limited to technical messages only and should consider the effectiveness and appropriateness of the methods and detail employed. It should also consider the local absorptive capacity of individuals and communities. It is also desirable to incorporate communication, listening and sensitivity skills in the training of district and commune officials, as a minimum

10.) **Experience**:

Initially it had been indicated in Lao–PDR that while there had been success in incorporating FPP initiatives into the local planning process, to date success in implementation had not been realised. In practice quite detailed discussions at district and one village level indicated that at least three initiatives from the FPP were in the process of implementation, funded from NT2 downstream project and village funds. In another instance it was identified that in 2009, the provincial authorities had received USD 10,000 specifically for DRR activities, some of which had been committed to flood preparedness. In Cambodia the DCDM similarly shared details of the Prek Prasab FPP which had been updated as a DCDM initiative. It is therefore important to be cautious in drawing conclusions on sustainability as projects may be funded from a variety of sources. This highlights the need for both excellent communication and an understanding by all stakeholders of key indicators of progress and success.

Recommendation:

There is a need for enhanced communication and understanding of key success indicators, across the depth and breadth of stakeholders and that these are disseminated. This can also be combined with increased "operational experience sharing" at provincial and national levels, as suggested by counterparts

11.) **Experience**:

It is recurrently expressed as a matter of sensitivity that assistance funds designated for the target countries are not channeled through the national budgetary and budget management processes. National counterpart agencies would prefer to be partners in the management of the project and take ownership through increased responsibilities and participation, rather than solely recipients. While it may not be entirely feasible to channel funds wholly through the national budget channels, it would certainly be desirable to facilitate national counterparts having access to information and the opportunity to comment on the disbursement of the project budget, which is ostensibly for their national benefit. Based on several interviews it seems that details of budgets and disbursements under the budget are not routinely shared with national counterparts (ECHO 2010, p. 36).

Recommendation:

Despite the project being grant funded it would be desirable and conducive to improved ownership to transparently share with National counterparts, details of the budgets and budget disbursements. It would also be desirable to secure their agreement on prioritising budgets and disbursement when these are targeted to support the national policies and initiatives for which the counterparts are responsible. This does not require that funds are actually transferred to counterparts, but rather they become active partners in the programme implementation and responsibilities. This should also build capacity for sustainable counterpart management and "taking over" of projects.

Experiences and Recommendations for Future Actions:

12.) **Experience**:

The majority of recommendations from the previous Phase III has been, or is in the process of being implemented. Some it was not possible to verify in the current evaluation (such as use Sphere indicators for the improvement of the safe areas, protection of water points with fences, increasing number of latrines at safe areas, etc).

Others are in process or planned (such as updates of the training with additional DRR topics, upscaling the project to new areas, etc). Still other recommendations (such as the use of simulation drills) are being utilised in only a few locations. Some recommendations such as simplifying district level training, providing an effective programme monitoring system and provision of small scale hardware have again been found to be germane and recommended for follow-up action.

Recommendation:

Review the previous, Phase III, evaluation recommendations where these have not been implemented, and particularly give consideration to resourcing and implementing key areas that have again been identified in the Phase IV evaluation and recommendations (such as but not limited to, simplifying district and commune training, programme monitoring, and provision of hardware).

13.) **Experience**:

While it has been possible to increase the frequency of FPP activities integrated into local development plans, this is often by coordinating the planning of sector line ministries and departments. The priorities and capacity of these sectoral departments may not align with the DMCs priorities. It may be desirable to support the DMC at provincial and district level in building capacity within, and advocating to, sectoral departments.

Recommendation:

In order to overcome inertia, through differing priorities or capacity in sectoral line ministries and departments, capacity of key officials in key departments at provincial and district levels is recommended.

14.) **Experience**:

There is a need to more carefully harmonise and integrate FPP initiatives, rather than duplicate (as in the SFSP content and IEC). The instance of incorporating FPP into an existing PDRRAP (in Cambodia) is a more positive model to follow.

Recommendation:

Wherever possible the FMMP initiatives and FPPs should be harmonised with and integrated to larger DRR initiatives rather than duplicating or running in parallel. The instance of incorporating FPP into an existing PDRRAP is a positive model. There is also merit in transferring local lessons into the greater GMS area and vice versa.

15.) **Experience**:

There is an apparent need, particularly in Viet Nam (and a lesser degree in Laos PDR) to understand the relative roles and operating modalities, strengths and weaknesses of NGOs / INGOs, Intergovernmental, UN and other agencies and their funding criteria and project criteria. With this understanding the detail design of FPP projects and selection of activities should seek to secure earlier participation of all the relevant stakeholders and potential resources (ECHO, p. 37-38).

Recommendation:

Capacity building of counterparts and project staff on the differing roles and modalities of the various stakeholders (NGOs, Red Cross, UN, Intergovernmental Organisations, Multilateral Donors, etc) is recommended. It would be desirable to solicit the participation of these organisations for this purpose. As noted elsewhere, the emphasis of the intergovernmental stakeholders should be towards leveraging the sustainability of the programme and facilitating the more challenging components, rather than duplicating NGO and Red Cross capabilities.

16.) **Experience**:

It is noted that at present “preparedness” frequently refers to short term preparedness such as on receipt of early warning (e.g. moving animals to safe ground securing food, etc) and it is in this respect, more an early “response”. It continues to be important to add additional focus to longer range preparedness.

Recommendation:

There continues to be a need to have the stakeholders and project focus on preparedness, and in particular long range preparedness, as well as short term preparedness.

17.) **Experience**:

In Cambodia and Lao PDR where FPPs are prepared following the standard MRCS / ADPC templates it was discussed that the majority of FPPs while still very useful, contain approx 50 to 70 per cent of the ideal content of risk maps, assessments, data etc. It was suggested that it may be some time before the DM committees can collect all data and as a result it might be desirable to produce an FPP summary that emphasises the priority data for collection – rather that leaving determination to individual committees. Although the Viet Nam planning does not follow the same template, similar considerations in respect of the achievable level of planning were mentioned.

Recommendation:

To address the constraints on compiling all the recommended comprehensive data required under the FPP template, it would be desirable to provide a guideline summary that identifies and prioritises the crucial features and data required for an FPP that may in the short term only comprise approx 50 to 70 percent of the ideal data.

18.) **Experience**:

It is recognised that all three target countries encounter, to a greater or lesser degree, human resource and / or capacity constraints, and that all share a desire to expand the pilot project. Given limited funding, and the potential attrition of trained personnel it is necessary to assure institutional knowledge. In Viet Nam there is apparently a proactive approach already of engaging retired or promoted personnel to teach additional staff. This should be encouraged in all the target countries as an institutional practice rather than a project response. Additionally stakeholders were canvassed regarding expanding the number of trained resource persons within the NDMO's to form an enhanced national cadre of operationally based ToT personnel who are not specifically tied to a particular district or province. This would enable them to provide a consistent set of training messages at any location, irrespective of being within or outside designated project areas. As a national cadre they would be full time trainers and evaluators, who could undertake ToT in new areas, follow-up and conduct ToT refreshers, as well as being a technical resource to evaluate and support any province, district or commune as needed. In this role they also serve as a means of disseminating and quality assuring best practices. With one exception, this scheme was considered favourably by all stakeholders with whom it was discussed in the three countries.

Recommendation:

It is recommended to increase the number of trained practitioners within the NDMOs to provide a full time cadre of experienced trainers whose skills can be deployed operationally to any location. As a national cadre they would be full time trainers and evaluators, who also act as a technical resource and as a means of disseminating and quality assuring best practices. Additional support should be obtained from the engagement or seconding as consultants of retired and promoted staff for preserving institutional knowledge. It will also be prudent to liaise with NGOs and other projects who have undertaken ToT initiatives, and to harmonise all such initiatives for consistency in the "National cadre" (ECHO 2010, p. 38).

19.) **Experience**:

There have been limited instances where the project has, seemingly replicated the type of activities of others or not obtained the benefits of other initiatives by NGOs etc. The project can readily duplicate the activities of others (e.g. NGOs) quite simply though this may not be most value adding. However, donors, intergovernmental organisations and their projects have enhanced access to, and leverage with, both National Government Agencies / Ministries, and other donors. Quite often this access is not readily available to NGOs.

It would be prudent to capitalise on this resource by leveraging the more challenging aspects that NGOs would be challenged by (such as mainstreaming and institutionalising DRR into National Development plans and priorities) or leveraging for adoption of the less attractive but essential FPP components in CIPs, DIPs and PIPs. NGOs would continue to undertake the activities that best suit their resources, capacity and priorities (such as grass roots level awareness, capacity building, etc).

Recommendation:

Instead of replicating the activities of NGOs and the Red Cross the project should seek to leverage its position and networks as an inter-government initiative, to undertake the more challenging activities that are beyond the scope or capacity of Red Cross, NGOs and other stakeholders. This could typically include:

- National level advocacy and support tor integration of DRR into sector line ministries development plans; and
- Facilitating or implementing essential “grass roots” activities that are unattractive to, or cannot be implemented by, NGOs or others.

20.) **Experience**:

At the present time, and until DRR activities can be mainstreamed into the development projects (in Cambodia and Lao PDR) with suitable priority, and the development projects can be funded there is doubt as the ability to maintain current momentum. There is also the need to insure against loss or erosion of the successes and significant prior investments of the project. I n Viet Nam it is acknowledged there is a greater capacity and likelihood of maintaining momentum, though ongoing assistance is still requested.

While capacity building and even a degree of institutionalization can be initiated within a series of short projects, it is unrealistic to expect or require these to be fully sustainable without ongoing nurturing and evaluation. The evaluator therefore advocates for ongoing support of the project through incremental phases. This would be consistent with the "Principles And Good Practice Of Humanitarian Donorship", which suggest that "While stressing the importance of transparent and strategic priority-setting and financial planning by implementing organisations, explore the possibility of reducing, or enhancing the flexibility of, earmarking, and of introducing longer-term funding arrangements."

Future support should recognise the need to review and evaluate the earliest interventions and current interventions. These can be reinforced or "course corrected" as appropriate as well as taking stock of lessons learned and sustainability issues identified through several years of operations. Ideally a longer term commitment to funding would allow some of the more challenging activities to be robustly institutionalized.

Longer term funding will in addition to enabling continuity and planning across broader horizons, produce some economy of scale and overhead over short interventions and avoid the potential hiatus of programme restarts and completions.

Recommendation:

It is recommended that support to the programme, continue with the minimum of discontinuity. Longer term funding is consistent with the "Principles And Good Practice Of Humanitarian Donorship", and the need to provide suitable time for activities to gestate, mature and be shaped through operational use. This will also allow a "look back" on earlier activities for operational lessons learned, benefits or weaknesses that may have been identified through longer ongoing operations. It is proposed that longer funding horizons should therefore be considered (ECHO 2010, p. 39).

21.) **Experience**:

In order to preserve the investment and successes to date and to enhance the sustainability of the project there is a need to enable the provincial district and commune / village to undertake the full range of flood preparedness and mitigation measures. In this respect there are compelling arguments to find appropriate means to overcome the practical challenges and constraints on providing small but essential hardware and ensuring its maintenance. (This recommendation is consistent with recommendations from Phase III)

Recommendation:

Small scale essential hardware (early warning loud hailers, latrines to safe areas, essential tools, project monitoring support, etc) should be provided to support key flood monitoring and mitigation activities.

22.) **Experience**:

Due to the success to date of the FMMP, communities and counterparts now appreciate that flood damage is not inevitable, and can be mitigated. It is also recognised to be a high priority activity. It is important therefore not only to advocate for sustainable funding, but to manage the expectations of the government and community stakeholders with their increased awareness.

Recommendation:

The future needs of the project and its likely extension should be considered along with potential avenues of support for the crucial activities. In this respect activities should be prioritised, with their likely duration and resource requirements identified, and potential sources of support. In parallel a compatible exit and hand over strategy needs to be agreed with counterparts.

Case Study: The Hindu-Kush Himalayan Region (HKH)

About DRR in the Himalayan region

The Himalayan region is highly exposed to flood risks, especially flash floods. Such disasters have the particularity of being quick onset, leaving little time to react and effectively respond. Furthermore, flash floods are not easily predictable, especially in mountainous areas, due to the multiple factors that cause or accentuate their adverse characteristics (natural and human factors).

DRR has been promoted in the Hindu-Kush Himalayan (HKH) region by regional climate center International Centre for Integrated Mountain Development (ICIMOD) as well as through development assistance programs such as those supported by OFDA. For years now, a key focus has been on improving the forecasting science in order to better predict flood and flash flood events. However, due to the geological context of mountainous areas in the HKH region and due to geopolitical tensions among the states in the region, collecting relevant data to produce accurate forecasts remains a challenge. Though progress is certainly ongoing, the science of flood and flash flood forecasters remains uncertain. Risk prediction is further challenged by climate change and it's not yet completely foreseen impacts in mountain areas.

Yet saving lives remains a fundamental goal for aid agencies and governments. On this matter, it should be noted that forecasting technologies do not by themselves make up an EWS; such a system also comprises of important components, especially working at the local level that must be strengthened whether or not the science is clear. The necessity to focus and invest more financial and human resources in communication, risk awareness and preparedness for the vulnerable communities is highlighted in the following report. Our conclusions point out the need for a locally based flexible DRR approach, as opposed to technology-centered measures that appeared to be favored and promoted by regional climate centers and foreign humanitarian aid agencies. These lessons could hopefully be considered as a guide to future DRR interventions that seek to mitigate flood and flash flood risks and impacts.

This report also underscores the useful contribution of OFDA to flood and flash flood risk reduction in the HKH, especially through significant progress made in the forecasting science over the past decade. OFDA was a catalyst to such progress, propelling, and serving as a bridge to other funding, such as the AFN initiative.

Hence, with its successful past experience in this field, OFDA should use highlighted constraints and weaknesses to DRR to build on strengths and improve future DRR interventions. OFDA's key role has been important and timely as climate change risks increase for flood and flash floods in the HKH region.

Context

Flash floods risk and impacts in the HKH region

The HKH extends some 3,500 km across Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan (Figure 1). It provides the direct livelihood basis for more than 210 million people and is the headwaters for 10 large Asian river systems, which collectively support another 1.3 billion people as they flow down mountain slopes and valleys to the plains and into the delta regions of South and Southeast Asia before emptying into the sea (ICIMOD 2012b).

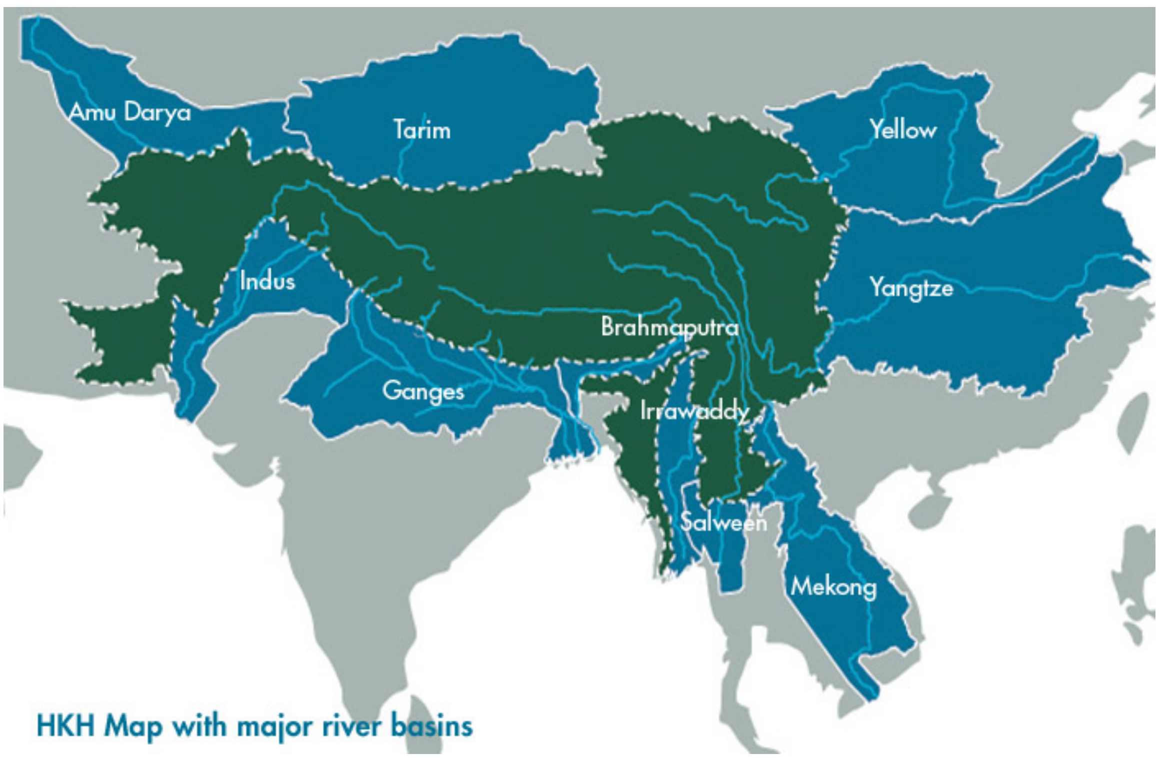
Among flood-related events, flash floods are frequent in mountainous areas (Jonkman 2005) and, according to Montz and Gruntfest (2002), can be primarily characterized by:

(1) Their sudden occurrence with little lead time for warning;
(2) Their swiftness and overall violent impacts;
(3) Their predominately localized scale;
(4) Their association with other events, such as landslides or riverine floods.

Such floods generally occur after (1) a localized, high intensity cloudburst that results in rapid swelling of water levels, (2) a landslide, (3) a dam outburst or (4) a glacial lake outburst (GLOF).

The HKH region is constituted by a climatic and geological setting noteworthy especially for its monsoonal precipitation patterns, steep slopes, significant rates of erosion and rugged terrain, all of which make it prone to flash flooding (Shrestha et al. 2008). Flash flood risk in the region tends to be highest in the summer due to the rapid melting of mountain snows combined with extreme monsoonal rain events. For instance, 80% of the annual rainfall in Nepal occurs between June and September, during the summer monsoon. Furthermore, landslides, which can also be related to intense rainfalls during the summer monsoon, and seismic activity both can also lead to flash flooding by creating unstable natural dams (as a result of landslides) on swiftly flowing rivers. In such a scenario, massive volumes of water collect behind these dams until the pressure becomes too great and a violent outbreak release of accumulated snowmelt water occurs and a torrent of water rushes downriver, literally scouring the landscape as it washes away everything in its path—giant boulders, trees, houses, hydroelectric plants, etc. (Shrestha 2008). Such risks have been amplified in recent years by widespread deglaciation in the HKH region, which is likely attributable to climate change. This probability is corroborated by the IPCC, which by 2001 had already noted "a widespread increase in the risk of flooding for many human settlements" in the HKH region (IPCC 2001:5). With further temperature increases under scenarios of even greater warming over the next several decades, the number of GLOFs (glacier lake outburst floods) in the region is also expected to rise (Jianchu et al. 2006).

Figure 16 The Hindu Kush-Himalayan Region and its Major Basins



Source: http://www.icimod.org

The human costs of such flooding over the entire twentieth century have been calculated at 100,000 people killed and 1.4 billion people affected worldwide (Jonkman 2005). Significantly, these numbers continue to increase with each passing year, and research has indicated that human costs have been higher in Asia than elsewhere in the world

(Jonkman 2005). The noteworthy point here specifically, however, is that though all types of flooding are consequential worldwide in terms of loss of life, property, agricultural land and wealth, in Asia flash floods are the number one hydro-meteorological disaster due to a combination of climatic, geological and human factors (Shrestha 2008). These events cause the loss of at least five thousand lives annually (Jianchu et al. 2006). But flash flooding is not a risk that only affects developing countries. In southern France in 1999, for just one example, a flash flood killed 27 people (Montz and Gruntfest 2002), which seems egregious but is actually consistent with a study from Jonkman (2005) showing that flash flooding tends to result in a higher average rate of mortality per event than other similar hazards. Disasters related to flash floods, it should be noted, are also as a result of human activities such as heedless settlement development on floodplains, inadequate urbanization (e.g. preventing necessary water infiltration), deforestation (e.g. increasing erosion and runoff), and failure of drainage systems.

Floods and flash floods have affected millions of people over the last decades, resulting in loss of life, livelihood and property. Although past events can surely been seen as having been disastrous, they should also be seen as providing *teachable moments*—in that they can be used to highlight what worked and what didn't, when planning and responding to past flood events in order to better prepare for similar impacts in subsequent events.

To demonstrate the concept of *teachable moments*, three case studies of flood-related events in the HKH region are briefly described in what follows and lessons were identified following those events that could be considered into planning for future events.

Floods in Bangladesh (Mallick et al. 2005)

Composed of a deltaic river system with an annual flow of ~1,500 billion cubic meters of water, Bangladesh is prone to normal flooding every year. Even though normal floods are a blessing for farmers, they also cause much hardship to marginal peoples and damage to their economic assets. In 1987 and 1988, for example, the country was affected by flooding that killed more than 3,000 people and inundated about half the country. Again in 2004, the country faced unprecedented inundations linked to the summer monsoon that severely affected lives, settlement, agricultural and industrial production, and other assets. Three types of flooding are most common in Bangladesh: *summer monsoonal* when rivers overflow, *localized* due to intense rainfall events, and *flash floods*. The normalness and diversity of flood types in Bangladesh have consistently highlighted flood management problems there and have long resulted in efforts to increase flood preparedness at various stakeholder levels.

Some of the lessons identified from past disasters have included the urgent need for flood preparedness at the national level. The necessity to empower the poor was also highlighted to increase communities' capacity to mitigate risks and vulnerabilities to disasters. Together, NGOs and groups in Bangladesh have engaged in actions to help the government understand the necessity to integrate community perspectives into actionable plans for flood preparedness. These processes have also helped lead to a recognition that communities need flood information communicated by means available to them in their contexts and in language that they can understand, if such local level people are to become proactive in responding to the threats with which they ultimately must contend. They are the zero-order responders to disasters, well before the traditional first responders arrive on the scene.

As existing forecast warnings were shown to be not easily understandable, a new information system was built, based on an integrative process for data collection and dissemination. In addition, flood committees were established at different levels in the country.

Disasters such as floods that have affected Bangladesh have demonstrated the necessity for collaboration among key actors, including government institutions, NGOs and local communities. One of the main lessons to be drawn here is that local people have developed their own strategies to live with frequent risks like flooding. Integrating this local knowledge in flood mitigation measures is essential to local empowerment. Yet people, especially the poor and other marginalized, also need preparedness information and resource support from the government and other actors. Flood preparedness must be integrated within livelihood promotion.

Flash flood in Pakistan in 2001 (Mustafa 2003)

Pakistan is a country prone to floods; they occur practically every 2-3 years, causing considerable loss of life and property. In 2001 for instance, Islamabad, the capital of Pakistan, and a twin city, Rawalpindi, experienced a devastating flash flood triggered by monsoon rains. About 400,000 people were affected, most of them being the poorest residents of these cities. The official monetary loss from this disaster was around US$250 billion for a country with a GDP of only US$60.5 billion. Relief aid, provided in the aftermath of the disaster, was haphazard, untargeted and inadequate.

Several lessons were identified from this event. One lesson was of the necessity for increased partnerships and coordination between governmental and non-governmental agencies (as oppose to giving arbitrary relief). Of further importance in Pakistan, where the government tends to ignore local NGOs, which leads to haphazard relief efforts deployed by multiple, uncoordinated entities, is the necessity to better target and involve most vulnerable populations in the recovery process. This lesson implies undertaking assessments to understand better the vulnerabilities and capacities of local communities. Empowerment of these most vulnerable populations is necessary in order to better address longer-term vulnerability issues. Another lesson identified is the need to target gender specifically. Although women have a significant role in urban communities, they tend to be neglected in planning as a result of the patriarchal structure of the country. In all, these lessons call for a better coordination between different entities at various levels as well as a stronger focus on the most vulnerable when relief assistance is provided in the aftermath of flash floods. The necessity to link relief assistance to long-term development activities was also noted.

Glacier Lake Outburst Floods in Nepal (Kattelmann 2003)

GLOFs are recognized as the primary natural hazard in Nepal. The huge devastation from a single large event can be greater than the devastation of even some of the most terrible natural disasters, such as earthquakes. A GLOF can release millions of cubic meters of water in a few hours. The outburst in the Khumbu Himal in August 1985, for example, completely destroyed a US$4 million hydroelectric project but fortunately had a relatively limited human cost (only four or five people were killed because most villagers in the surrounding area were away for a festival). But dozens of bridges and homes and hectares of agricultural land were destroyed by the event.

This event awakened the government of Nepal as well as the international community to the hazard of GLOFs. Following the disaster, recommendations were made in order to better prepare for such risks in the future. The necessity to conduct inventories of glacial lakes and to assess risks for existing communities and development projects was underscored. Research also pointed out that better methods of drainage should be developed at the local level to reduce flood risks. Information and warnings about GLOF risks also were disseminated to the communities at-risk and the necessity of setting up EWS in vulnerable communities was emphasized. Developing such systems has been constrained, however, by a lack of funding. Finally, the devastating impacts of GLOF events demonstrate the need for governmental and non-governmental agencies to have preparedness and contingency plans ready. Risk reduction measures must be in place in advance and implemented in parallel with decisions made at the community level that are based on local experiences of such events.

Conclusions on lessons identified

Most of the lessons identified in the aftermath of flash flood events in the HKH relate to two levels, the governmental and the local. At the governmental level, past experience pleads for more cooperation and coordination between governments and non-governmental entities so that response and recovery efforts are not dispatched or arbitrary but better coordinated and targeted. In addition, the scope of past disasters highlight the need for preparedness—plans must be readied at national and local levels, and must be updated as well as implemented once a flashflood warning is issued or a flood strikes. At the local level, different cases on flash flooding in the HKH would benefit from increased involvement of local communities in flash flood management and, though difficult, from a better dissemination of on-time warnings towards those at risk. Their recognition by governmental entities is necessary, and their understanding (ordinary knowledge) about risk mitigation must be taken into account in mitigation planning. Needs and gaps at this level must be identified and filled in order to target the most vulnerable communities, to promote local empowerment, to deal with development issues, and to increase resilience.

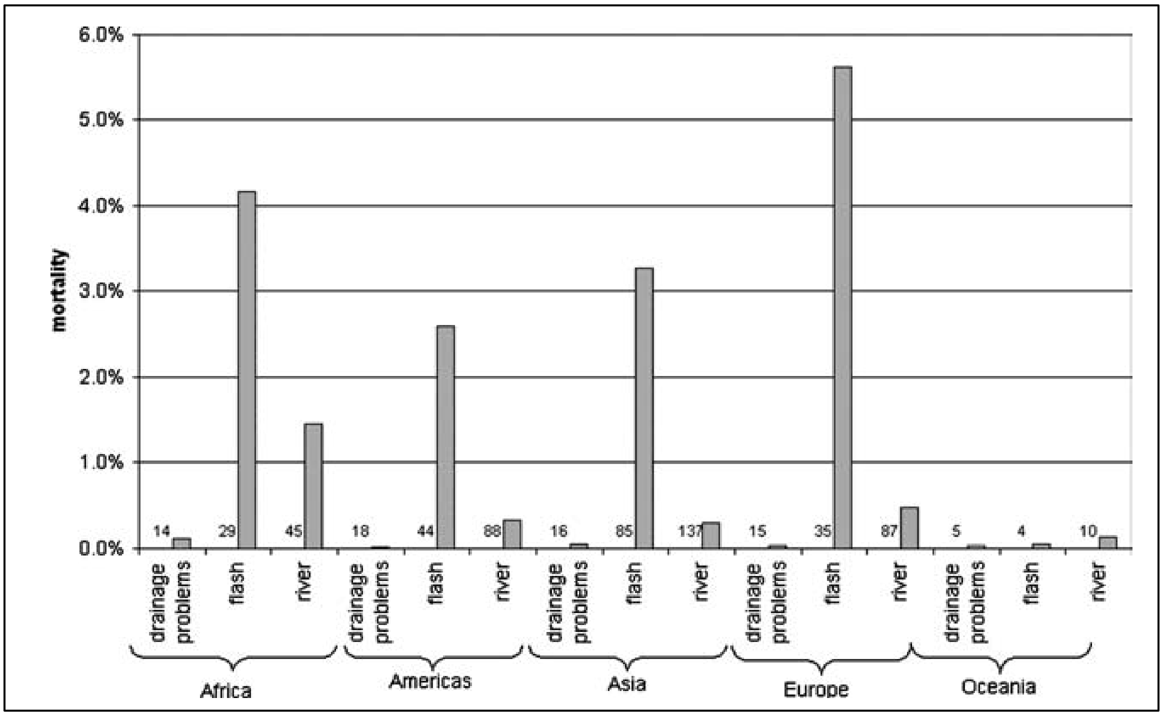
Some of these lessons, drawn from past disasters, have not been completely taken into account. The recent Monsoon floods that hit Nepal and India in June 2013 have left hundreds of people missing or dead and destroyed millions of US$ worth of property and infrastructure. Yet, most of the lessons identified afterward have proven to be similar to the one mentioned earlier: they relate to the need for better dissemination of risk information and early warnings for the communities at risk. Hence, establishing institutional mechanisms that use technological advances in forecasting is more than needed. Finally, they also highlight a need for better land management and carefully planned infrastructure in the mountain environment (ICIMOD 2013).

Flood management in the HKH

Existing problems in managing flash floods

Among flood-related problems and the resulting potential disasters, flash floods occur more frequently than other types of floods, result in a higher number of deaths (see Figure 2) and are also the most difficult type of floods to predict in mountainous countries (Jianchu et al. 2006, see Table 1 which compares riverine and flash floods).

Figure 17 Average Mortality Per Event by Continent and Flood Type



Jonkman, S.N. 2005. Global perspectives on loss of human life caused by floods. Nat. Hazards, 34:151-175

Table 14 Features of Riverine Floods and Flash Floods

	Riverine floods	Flash floods
Features	• slow water level rise beyond natural channels • reaches peak flow within hours to days • slow recession (within several hours to days) • mostly coinciding with high baseflow levels • medium to long lag times	• rapid water level rise above natural channels • reaches peak flow within minutes up to a few hours • rapid recession (within minutes to a few hours) • often dissipating quickly • not necessarily related to baseflow levels • short lag times
Causes	• prolonged seasonal precipi-tation of low to high intensity • seasonal snow and glacial melt	• very high intensity rainstorms/ cloudbursts • rapid snow/glacial melt • dam (both artificial and natural) breaks
Associated problems	• inundation	• often carry high sediment and debris loads • very high hydraulic force and herewith erosive power
Frequency	• annually during rainy season	• occasional, any time during the year
Affected areas	• river plains and valleys • local to regional extent • large areas can be affected	• river plains and valleys • alluvial fans • mostly local extent • generally small to medium areas are affected
Issues	• with appropriate technology and measures in place forecasting is easily possible	• very difficult to forecast
Potential mitigation measures	• real-time flood forecasting • community preparedness and awareness • appropriate emergency measures	• early warning systems • community preparedness and awareness • appropriate emergency measures

Source: Jianchu et al. 2006

Forecasting floods and flash floods and issuing warnings are often perceived of as the two ends of an EWS. This is the E2E model. Preparedness is necessary to respond to the issued warning, due to the particularly quick onset of flash floods. Though true preparedness has been shown to include many coordinated factors such as raising risk awareness among a population, promoting education, and enhancing the dissemination of early warnings among society (Glantz et al. 2007), when applied in the field and through projects and programs, flash flood preparedness is often reduced solely to forecasting technologies. While a reliable flood forecasting system is important in establishing an effective, functional early warning system. The problem is that such forecasting systems require accurate rainfall estimations, but in many regions of the HKH estimations often rely on data from a sparse hydro-meteorological station network that uses antiquated technologies that are not accurate enough to measure rainfall in the way required by today's precision technologies. In addition, data are often available only after significant delays, further limiting the operational use of state-of-the-art forecasting technologies (Shrestha et al. 2008).

In combination, these two factors of sparse data and time lags tend to undermine the possibility that flood forecasting might provide on-time warnings to governments and communities at risk. A need exists, therefore, for upgrades in technologies and equipment in the region that would enable more efficient and effective data collection and analysis. Enhancing real-time observations, combined with hydro-meteorological models, for instance, would enable the production of more accurate and timely forecasts and warnings. The point is that meteorological data such as rain intensities and distributions needs to be more accurate and the rainfall-runoff relationship better understood using models if forecasts and early warnings are to improve (Montz and Gruntfest 2002). At this point, visible improvements in this field are observed; yet, many uncertainties remain due to the complex nature of flash floods.

Data collection, needed to forecast floods and prepare warnings, sometimes involves difficult trans-border issues. In the HKH region, floods are trans-national boundary disasters, which means, for example, that the breaching of a dam or unscheduled water releases from a dam in one upstream country can dramatically inundate another with the flooding, causing death and destruction of the built environment. This was the case in 2000 when a dam across the Yigong River in Tibet breached and caused significant damage and loss of life in Arunchal Pradesh, India (Shrestha et al. 2006). Thus, rivers respect no borders; flood problems cannot be solved by national initiatives alone. A regional approach involving regional cooperation and information sharing among countries, regional consultations and research for common solutions to shared problems is essential to better forecast and mitigate flash flood risks.

At the opposite end from forecasting along the flash flood mitigation system spectrum is the dissemination of information and warnings. Once forecasts have been produced, timely warnings must be disseminated and in accessible (understandable as well) formats to vulnerable populations. Yet uncertainties in risk prediction remain, particularly for complex flash floods, and cannot be neglected by decision-makers who might otherwise decide to wait before taking costly measures when a warning is released (Montz and Gruntfest 2002). In addition to uncertainties, common time lags exist between the issuance of a forecast and decisions made by officials to deliver warnings and take appropriate measures for mitigation. These time lags can have catastrophic results, due to the quick-onset, sometimes surprising nature of flash floods. In this context, preparedness strategies for governmental and non-governmental entities and well as for at-risk communities must be available in advance to generate familiarity with them to enable quick responses to emergency situation.

It's important to note that, a flash floods event's first victims must be recognized. Indeed, those who are first impacted by such events should be considered zero-order responders. This is especially true in situations of quick onset disasters, because immediately after an event they respond *in situ*, acting to protect themselves and their families and then their communities before those traditionally considered to be "first responders" ever make it to the disaster scene. Of course, improvements in forecasting will always be required in order to mitigate flash flood impacts through earlier warnings, but new technologies have been in development for decades and to date they have had only limited success in operationalization.

Acknowledging and legitimizing the role of zero-order responders is critically important. Not only acknowledgement of the role of local people, however, but also better understanding how they receive, trust and respond to flash flood warnings to reduce their own vulnerability in a sustainable way is a significant part of the flash flood mitigation process and this must not be overshadowed by the search for new technologies. Zero order responders should be surveyed once reconstruction from the disaster's impacts has occurred. They can provide useful information about how they had improvised until the traditional first responders arrived to assist them. Due to the nature of flash floods and the current difficulties in forecasting them, it seems clear that sustained partnerships must be developed among hydrometeorology, social science and local communities in order to improve the abilities of every society to cope with this type of disaster.

Collecting relevant data to predict flood and flash flood, providing accurate rainfall predictions, openly collaborating with neighbor states to share relevant climate information, having preparedness plans ready at the governmental level, communicating with, and raising risk awareness among zero-order responders are the multiple key challenging issues to be addressed to significantly reduce the impacts of floods and flash floods in the HKH regions. Several initiatives that took place in the past decade have contributed to address these gaps in the E2E warning systems. As an international agency supporting DRR in developing countries, OFDA, in collaboration with regional institutions, has played, and still plays, a role in this movement to enhance DRR in the HKH.

ICIMOD: what it is and what it does

The International Centre for Integrated Mountain Development, ICIMOD, (Figure 18), based in Kathmandu, Nepal, is a regional intergovernmental center that focuses on learning and sharing knowledge on natural hazards such as flash floods and on promoting awareness of such hazards (Jianchu et al. 2006). It was founded in 1983.

ICIMOD brings together a partnership of regional member countries, institutions and donors. There are eight member countries, all of which are located in the HKH region: Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan.

ICIMOD's primary goal is to promote the development of an economically and environmentally sound mountain ecosystem and to improve living conditions of populations in the HKH region (Shrestha 2008). ICIMOD acts as a resource center catalyzing transboundaryprograms on challenging topics like globalization and climate change. It works to assist mountain people in understanding these challenges, adapting to them and exploiting opportunities to be found within them. ICIMOD also aims to strengthen networks among regional institutions, working with mountain communities in fragile ecosystems upstream and downstream (http://www.icimod.org/?q=abt). Since 2001, ICIMOD has been engaged with other regional partner countries on flood disaster mitigation projects.

Figure 18 ICIMOD Headquarters, Katmandu, Nepal

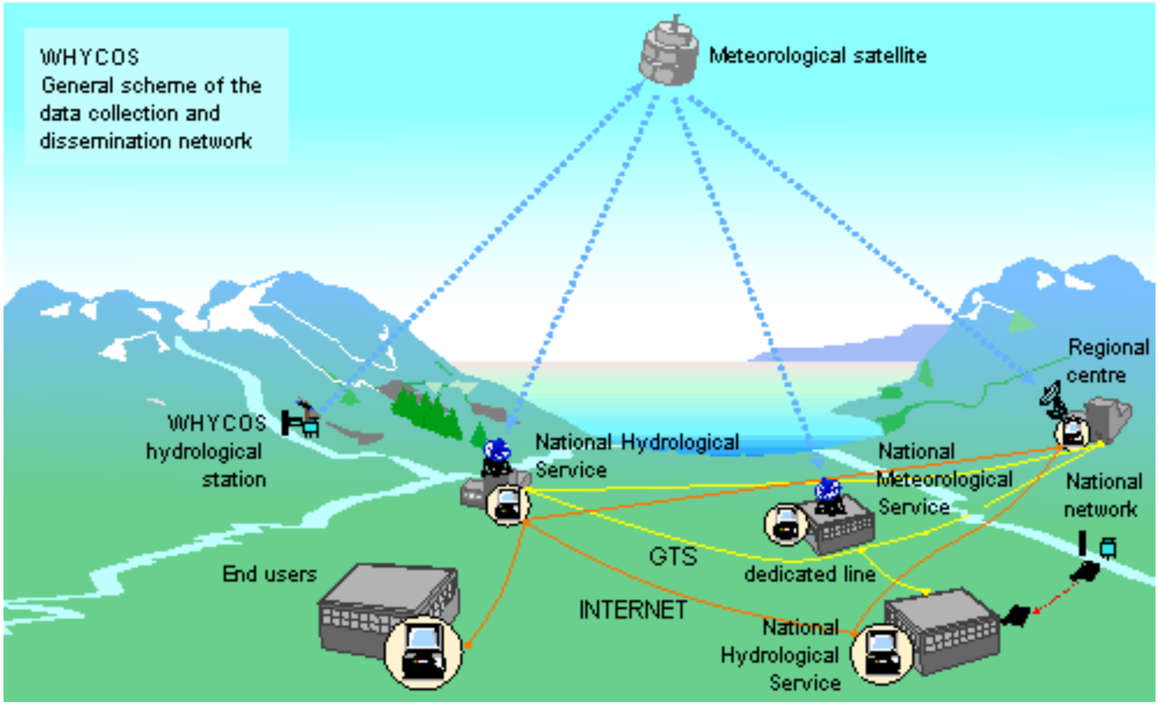
Source: http://www.nws.noaa.gov/iao/BLT_AFN.php

Promoting collaboration for flood mitigation

Since flooding in the HKH region is a transboundaryissue, ICIMOD promotes regional cooperation for water and flood management. The center receives technical and financial support for this initiative from various international institutions. In 2001, ICIMOD started a project to implement the World Hydrological Cycle Observing System (WHYCOS) in order to establish an efficient and operational flood information system based on real-time data and information on a regional level. OFDA has provided funds to support this project from its outset. WHYCOS is a global program developed by the WMO in response to the scarcity or absence of accurate and timely data on water resources in real time. It brings together regional components that are implemented independently and that remain responsive to local needs. Each component consists of several hydrological services that are located in similar hydrological regions.

WHYCOS has adopted the E2E model for forecasting. Figure 4 depicts this model, which includes the processes of data collection, validation and dissemination for each regional component of WHYCOS, including ICIMOD and its regional partner institutions and NHMSs in the HKH region. In the model, at-risk populations are considered as end-users or recipients of forecast information that has been collected through remote sensing, validated by partner institutions (like ICIMOD in this case) and disseminated to member countries. Dissemination and early warning are situated at the end of the chain, but all three elements—forecasting, validation and dissemination—are equally significant, according to the model, for ensuring mitigation of natural disasters and reducing loss of life and property (see http://www.whycos.org for further details). According to the WMO, implementation of the WHYCOS program in the HKH region is currently in a stage of advanced development.

Figure 19 WHYCOS E2E System for Forecasting



Source: http://www.whycos.org/cms/content/how-does-whycos-work

The NHMSs are country-specific institutions that are members of the WMO. These national bodies are in charge of operational hydrology and water-resources assessment activities. Due to the impacts of climate change, NHMS is being faced with increasing demands to provide accurate and timely forecasts at all levels. Different levels of support and capacity exist for each country's NHMS institution, however, resulting in varying levels of success for forecasting and early warning systems.

OFDA's involvement through the Asia Flood Network

In order to manage floods and flash floods in South Asia, to improve the climate science and forecasting technology, and to better issue warnings and information to at-risk populations, various programs have been generated throughout to the HKH region over the last decades and especially since the early 2000s. These programs, of which a few are reviewed in this report, have essentially sought to establish a region-wide flood information system that covers entire transboundary river basins. They also aim at improving dissemination of warnings to vulnerable communities. The programs that are studied in this report are led by ICIMOD, which partners with hydro- meteorological institutions in the HKH region. ICIMOD receives support from various international institutions and donor agencies, and OFDA is among them. It has provided seeding funds to this institutions as well as funding to support several specific flood mitigation projects.

USAID/OFDA is committed to saving lives and livelihoods and also to reducing the socio-economic impacts of flooding through preparedness and mitigation programs. A review of OFDA's annual Fact Sheet over a 10-year period (2002 to 2011) identified multiple disaster preparedness activities oriented towards the mitigation of hydro-meteorological hazards in the HKH region. In particular, this review highlights (but is not limited to) the following categories of activities in which OFDA has been involved for over 10 years in the HKH region:

- Promoting information sharing and lessons learned as well as networking with disaster managers;
- Technology transfer and applications for flood-forecasting;
- Sponsoring Transboundary River Forums;
- Developing training programs for local and national disaster management agencies;
- Implementing the AFN in both the Mekong and the Ganges-Brahmaputra-Megna river basins; and
- Providing technical assistance to ICIMOD for hydro-meteorological disasters.

This brief review of the different programs for flood mitigation in the HKH region that were supported by OFDA between 2002 and 2011 (see OFDA's informational Fact Sheets) indicates activities that essentially focus on improving the climate science and flood prediction models through (1) technical support and capacity building sessions for the NHMS of the region and (2) technology transfer. In addition, OFDA has also contributed to enhancing information sharing in the HKH region by funding various workshops and high-level consultations at the regional level in partnership with ICIMOD.

Sharing among the region's countries is important as floods have a regional scale and include transboundary water issues. It appears that few activities supported by OFDA, however, specifically target vulnerability assessments, risk communication or risk awareness of vulnerable communities, the people which are the end-users of the flood forecasts. They are also the first victims when flooding strikes: hence, there are, here, major opportunities for future DRR projects.

The AFN, initiated by OFDA (in conjunction with other institutions) around 2001, is consistent with this E2E approach to DRR. This initiative has essentially focused on technology improvements/transfer and capacity building of the climate scientists who are charged with producing forecasts on which to act.

The AFN (Asia Flood Network)

The AFN is an HKH regional initiative launched by OFDA and ICIMOD in the early 2000s with the general goal of fostering regional cooperation for flood and flash flood risk prediction, in order to mitigate the loss of lives and property. It has been one of OFDA's primary programs in this region since 2001. OFDA also provided technical support through NOAA and USGS. OFDA's stated goal in supporting this initiative is to reinforce flood risk management capacity in order to reduce flood and flash flood impacts on lives, livelihoods, infrastructure and environments. In this way, OFDA seeks to promote sustainable development. Since 2001 until today, through AFN, a number of programs and projects were conducted with support from OFDA as well as other donors. These various programs had a common purpose of mitigating flood and flash flood impacts, saving lives and limiting property losses in South and Southeast Asia.

AFN's primary goal is to strengthen the capacity of regional and national hydro-meteorological institutions for climate, weather and hydrological forecasting, while also directly involving at-risk communities in reducing vulnerability to hydro-meteorological hazards. The four objectives of AFN are:

(1) to identify and fill in gaps in flood and river forecasting and early warnings;

(2) to strengthen regional and national institutions on hydro-meteorological forecasting;

(3) to promote data and information sharing between member states; and

(4) to improve dissemination of forecasts and warnings to all regional users, including at-risk local populations.

Two primary activities were carried out towards realizing these objectives: (1) flood forecasting science improvements were made through the use of advanced hydro-meteorological modeling of watersheds and river deltas and through regional hydro-meteorologist training and capacity building, and (2) improvement in dissemination of the warnings to users and at-risk population was implemented by filling gaps in the E2E flood forecasting and early warning model.

The AFN targets two different regions in South and Southeast Asia. This program was initially developed to address issues around riverine flooding in the Mekong river basin. The success of the network in this region suggested its potential for the Ganges-Brahmaputra-Megna (GBM) river basins, where ICIMOD and OFDA implemented the network with relevant adjustments in the early 2000s (Tokar 2005). The main adjustment was in terms of focus: Whereas the AFN-Mekong focuses especially on riverine floods, many activities under the AFN-GBM have a specific focus on the area-specific pertinence of flash flooding. The MRC guides the activities of the AFN in the Mekong river basin, while ICIMOD guides it in the GBM basin.

This report focuses on the application of the AFN in the GBM river basin, which is located in the HKH region of South Asia (Figure 5) and consists of all or portions of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan.

Figure 20 The Ganges-Brahmaputra-Meghna River Basins

Source: http://commons.wikimedia.org/wiki/File:Ganges-Brahmaputra-Meghna_basins.jpg

In the GBM river basin area, the AFN involves ICIMOD's staff and regional partners on flood disaster mitigation. It also involves the eight member countries, which have designated the following NMHS institutions as representatives:

- *Bangladesh*: Water Development Board and Meteorological Department
- *Bhutan*: Department of Energy and Department of Geology and Mines
- *China*: Meteorological Administration and Bureau of Hydrology
- *India*: Central Water Commission and Meteorological Department (observer)
- *Nepal*: Department of Hydrology and Meteorology
- *Pakistan*: Meteorological Department and Federal Flood Commission
- *Afghanistan*: Meteorological Authority
- *Myanmar*: Department of Meteorology and Hydrology.

These institutions are responsible for forecasting and EWSs in their respective jurisdictions.

The Chinese Meteorological Agency (CMA) and the WMO were especially involved in workshops that provided hydrologists and meteorologists with training on the application of satellite-based rainfall estimates (SRE) for flooding and drought; on flash flood guidance; on the application of the GeoSFM rainfall-runoff model; and on the dissemination of information to vulnerable populations in remote areas.

Table 3 depicts the main activities implemented under the AFN initiative between 2001 and 2011. They can be summarized as falling into three primary categories:

- Regional workshops and forums organized by ICIMOD to foster information and data sharing to mitigate flood impacts in the region;
- Training of ICIMOD staff and GBM basin country representatives on applications of SRE, on flash flood guidance, and on dissemination of information to vulnerable populations (see OFDA Fact Sheet FY 2006, 2007). Workshops were conducted at ICIMOD with technical support from NOAA and USGS in 2005 and 2006; and
- Technology transfers from NOAA and USGS to the region (2005 and 2006).

Table 15 AFN HKH Complete Timeline

Project/Initiative	Date/Location	Activity/Meeting	Accomplishments
Regional Cooperation for Flood Disaster Mitigation	May 2001: KTM, Nepal	1st High Level Consultative Meeting: 'Developing a Framework for Regional Cooperation in Flood and Forecasting Information Exchange in the HKH Region'	Identification of Country Nodes, Consensus on regional cooperation in flood disaster management, framework for development of flood information system agreed
Regional Cooperation for Flood Disaster Mitigation	May 2002: KTM, Nepal	1st Consultative Panel Meeting: 'Making Information Travel Faster Than Flood Waters'	Concept note drafted and approved, action plan developed, website: www.southasianfloods.icimod.org was established.
Regional Cooperation for Flood Disaster Mitigation	March 2003: KTM, Nepal	2nd High Level Consultative Meeting: 'Establishment of a Regional Flood Information System'	Technical papers presented, national consultation meetings planned, further partner institutes included, draft project document discussed and revisions agreed upon, resolution and endorsement of project development.
Regional Cooperation for Flood Disaster Mitigation	2003 and 2004	National Consultations: Bhutan, July, 2003; China, Sept, 2003; Bangladesh, Oct. 2003; Pakistan, Feb. 2004; Nepal, March 2004	Needs and priorities identified, pilot basins nominated, national stakeholders' commitments received.
Regional Cooperation for Flood Disaster Mitigation	Nov./Dec. 2004: KTM, Nepal	Technical Meeting on 'Country and Regional Telecommunication Strategies, Data Management, and Dissemination of Regional Flood Information'	Plan for demonstration and testing phase finalized; Draft test plan document prepared, minor upgrades agreed on for select stations.
Flash Flood Guidance (FFG)	May 2005: BKK, Thailand	Flash Flood Guidance (FFG) workshop	(no details)
Regional Cooperation for Flood Disaster Mitigation	May 2005: Bhutan	High Level (Secretary) Meeting	Project document endorsed and recommended to donors for funding; agreement on conducting 'Demonstration and Testing' phase June to Sept. 2005.
SRE	July 2005: Kathmandu	First SRE workshops and applications	Training held upon the request of partners, developed proposals for implementation.
International Flash Flood Management Workshop	Oct. 2005: Lhasa, Tibet	International Workshop on Flash-Floods Management and Sustainable Development in the Himalayas' (Lhasa Workshop)	Member countries presented their respective status on flash flood management ; international hydro-meteorological experts demonstrated systems and technologies for forecasting, early warning, and mitigation of flash floods (USAID/OFDA, ICIMOD, Chinese Meteorological Agency, WMO, Gov't of Norway).
SRE	July 2006: KTM, Nepal	SRE workshop	Launch of cooperative program to validate SRE's in South Asia with ground-truth data
Flash Flood Management Workshop	Dec. 2006: KTM, Nepal	Consultative Workshop on Flash Flood Management and Sustainable Development in the Himalaya Region'	Discussion of specific plans for pilot flash-flood warning systems in China, Nepal, and Pakistan
Satellite rainfall estimation in the Hindu Kush Himalayan Region	2006 - 2009: KTM, Nepal	Number of SRE workshops and applications	Built the capacity of partners, several Masters and PhD studies initiated
Flash flood risk reduction Strengthening Capacity in the HKH	2006 - 2011 KTM, Nepal	Number of Flash flood workshops and applications	Build the technological and Institutional capacity of the national partners; to understand the physical and the socioeconomic dimension of flash flood in the project areas; to build capacity and raise awareness of the selected CBOs, Communities leaders with the national partners; strengthen the capacity of National partners and networking and information knowledge sharing
ICIMOD's Trainer of Trainers Manual	Oct./Nov. 2010: KTM, Nepal	Integrated Approach to Flash Floods and Flood Risk Management in the HKH Region Trainer of Trainers workshop'	Manual tested and revisions incorporated into manual

Project/Initiative	Date/Location	Activity/Meeting	Accomplishments
HIMALA: Climate Impacts on Snow, Glaciers and Hydrology in the Himalayan Region	Aug. 2011	AFN Operational Workshop	For Pakistani meteorologists – on hydromet characteristics of flash floods and flash flood warning system design; curricula on use of satellite, radar, and rain gauge precipitation of flash flood warning systems
Publication on Case studies on Flash flood risk management in the Himalayas	15-17 Feb, 2012, KTM Nepal	Writeshop on Flash Flood Risk Reduction – Strengthening capacity in the Hindu Kush-Himalayas	In support of specific flash flood policies
Working Meeting report on HIMALA	23-27 August, 2012, KTM, Nepal	Working meeting on HIMALA	Implementation Plan and agreement

Table developed by CCB and ICIMOD with input from: Regional Cooperation for Flood Mitigation, Trainer of Trainers Manual, NOAA website on AFN: http://www.nws.noaa.gov/iao/BLT_AFN.php, USAID newsletter, July 2006, on the web.

Compiled by Liz Wiig and Laura Seraydarian, based on OFDA's annual Fact Sheet from 2002 to 2011

It should be noted that the AFN complements other OFDA-funded early warning and flood mitigation activities in the region. For instance, OFDA and NOAA have also worked with national government and NGO partners to pilot the Radio and Internet for the Communication of Hydro-meteorological and Climate-Related Information (RANET) project in countries in Asia. RANET is a complementary activity to the AFN because it provides access to, and its goal is to strengthen the use of, hydro-meteorological information by communities in day-to-day decision-making situations to reduce vulnerability to natural hazards (http://www.drrprojects.net/drrp/drrpp/project/214/read) RANET also operates in Sub-Saharan Africa and in South America.

The AFN has targeted increased regional collaboration for flood and flash flood risks reduction and the use of advanced technologies to better identify and predict risks. Yet, other more societally focused issues remain to be addressed. It is, for instance, important to increase the focus on, and to involve the local communities, zero-order responders, for the eventuality of a flood. A possible approach is community-based (risk) management (CBM), which has received growing attention especially in South and Southeast Asian countries like Bangladesh over the past decade, though it is not yet integrated into the AFN approach.

CBM for risk reduction, emphasized especially by NGOs, is a participatory approach that facilitates the direct involvement of local people in efforts to mitigate risks linked to natural hazards. When it comes to reducing flood impacts, two types of approaches are usually highlighted: Structural and nonstructural. Structural approaches, which are the most common, generally include engineering interventions (e.g. embankments, barrages, etc.) that are intended to prevent hazards from becoming disasters. History has shown that these have a mixed success. Not only are such interventions costly but they have also proven harmful to the environment and have sometimes even amplified the impacts of hazards they were intended to prevent, especially when they are poorly maintained on longer time scales (see Few 2003).

Nonstructural measures, in contrast, are usually more affordable, especially for developing countries that tend to have limited technological and financial resources. These measures are not aimed at preventing disasters but are designed to reduce their impacts on at-risk communities. They include warning systems, evacuation strategies, land use control or risk insurance, among other tools and techniques. At the community level, nonstructural measures also imply adjustments and activities that reduce the vulnerability of individual households (Few 2003). Nonstructural approaches have become quite significant as primary flood mitigation strategies in developing countries due to the limited availability of engineered solutions in those areas.

CBM for flooding implies the recognition that local communities, especially those in flood-prone countries in South and Southeast Asia, have developed various responses and mechanisms to cope with the flood risks with which they have long lived. These communities have significant knowledge of their own flood risks as well as of the range of risk reduction strategies available to them to deal with those risks. Chan and Parker (1996, cited in Few 2003), for instance, describe the strategy of raising houses on stilts in Malaysia to avoid household flooding. Furthermore, community-based organizations tend also to be the first to provide relief when disaster strikes a community, especially in situations of quick onset events like flash floods or avalanches in remote mountain areas, when government assistance can arrive days or even weeks after an event's devastation.

Such "grassroots" or community capacities have been studied for decades, yet they are often neglected in formal flood mitigation planning and response strategies, which tend to rely essentially on costly engineering or technological measures and a top-down approach. These local strategies have been increasingly emphasized by subnational agencies since the early 2000s in order to promote CBM for natural hazard mitigation. They should be further promoted for risk management because they are locally appropriate, flexible and cost-effective (Mallick et al. 2005).

Importantly, CBM can also be fostered through development projects. Interventions that strengthen the assets of local communities in helping them to withstand shocks are increasingly important as risks posed by hydro-meteorological hazards increase with climate change. It is equally necessary, however, to better provide local entities with a certain degree of preparedness through the disseminating of risk information and warnings. Projects to improve CBM are also important when communities at risk are located in remote areas, where national institutions have limited immediate access and influence. In this way, CBM projects must involve interactions with local communities to better understand how decisions about risks are made in those communities, to promote empowerment at the community level and to ensure the resilience of the community in the face of natural hazards.

Though there is a consensus today that traditional and indigenous management systems have often been successful in developing countries, the potential of these approaches is still highly undervalued and underused within DRR projects that are brought into these countries by international organization (see Adeel and Glantz 2002).

Review of a selected DRR project: the AFN

The AFN, achievements and challenges

OFDA's DRR support in the HKH region through the AFN was originally at the core of this evaluation. It was, however, somewhat difficult to maintain that primary focus for at least three reasons. First, it was sometimes difficult to identify the precise role of OFDA in some of the activities under the AFN, because OFDA often partnered with other agencies in addition to the recipient countries. Second, it was difficult to clearly identify what activities were specifically conducted under the auspices of the AFN in the HKH because several overlapping or complementary hydro-meteorological projects were initiated in the region over the past 10 years. Third, interviews conducted with scientists at ICIMOD and within some of the hydro-meteorological services in the region revealed a lack of familiarity within those partner institutions with the name "Asia Flood

Network" or the acronym "AFN". Respondents, however, were more aware of some of the specific programs that took place under this network, such as the multiple workshops on SRE, but not with the network itself.

In fact, it might be appropriate to describe the AFN as an umbrella program under which various hydro-meteorological activities were conducted, some of which were directly related to it, while others were less related though they still contributed to the goal of mitigating flood impacts in the HKH. OFDA was to varying degrees involved in several of these activities, especially in supporting pilot projects, short training sessions and the publication of manuals. Some of these activities are ongoing, while others were designed as short-term projects.

This section describes and highlights results of ICIMOD's main programs aimed at enhancing HKH cooperation for flood and flash flood mitigation from 2001 to 2013. Common features of all of the reviewed programs include a focus on (1) strengthening flood-forecasting skills in the region; (2) encouraging information sharing among ICIMOD member states; (3) fostering technology transfer (and related trainings of counterparts) from the United States; and (4), to some extent, facilitating better dissemination of forecasts and warnings to at-risk populations. In these programs, OFDA provided financial support for and collaborated with various partners including ICIMOD, the WMO, NOAA and the USGS. Though OFDA's specific contributions to these projects is unclear, the agency was clearly a seed provider –a true catalyst – that set the foundation for flood management in the region.

Activities under the AFN can be grouped into three primary phases (described below) in the launching and subsequent enhancing of regional cooperation in the HKH region. The initial Phase Zero involved preparation in terms of the study of the feasibility of a regional information-sharing system, the identification of gaps at national levels, and the setting of the basis for future collaboration on flooding. Phase One essentially revolved around training, tests and validation of SRE in selected pilot river basins. Phase Two, which only recently ended, focused on improving the rainfall prediction models and flood and flash flood forecasts as well as enhancing knowledge on climate change impacts. It should be noted that, although all activities under the AFN share the main broad goal to reduce flood risks in the HKH region, some of them are more specifically aimed at flash flood risk mitigation.

Phase Zero

This preparatory phase essentially consisted of meetings and consultations among states from the HKH region in order to evaluate and endorse terms for a regional collaboration on flood mitigation. It was launched in partnership with ICIMOD and the WMO as a part of OFDA's 5-year "long-term" program, entitled "Regional Cooperation in Flood Forecasting and Information Exchange in the Hindu-Kush Himalayan Region." HYCOS was chosen as a basic framework for the information system.

The purpose of this phase was to strengthen cooperation and information sharing at the regional level. It also established a flood observation network as well as regional and national flood observation systems to improve the transmission of relevant timely data among partner countries, to enhance the national technical capacities in flood forecasting in the region and to better communicate warnings to end-users.

The high-level meeting "Regional Cooperation for Flood Disaster Mitigation," held in Kathmandu, Nepal in May 2001 saw the first discussion on flood mitigation in the region. This discussion led to an agreement among ICIMOD member states that the joint development of a regional flood network was a necessity for the region. A consensus was also reached about the need for information sharing to reduce flash flood risks. Multiple follow-up sessions, also hosted by ICIMOD, followed this initial meeting to further discuss the terms of the regional agreement on collaboration for flood mitigation.

In the latter part of Phase Zero, the sharing of data between hydro-meteorological services in the HKH region was initiated (interview with Dr. M. Shrestha, recorded in October 2012). A "Framework for a system for information exchange and data to support flood forecasting" was also launched under the "Regional Cooperation for Flash Flood and Disaster Mitigation in the HKH," which was directly sponsored by OFDA. The initiative developed a system to test and to share real-time data and set up a website (http://www.southasianfloods.icimod.org) where data and information on floods could be shared among all member countries. The system was first used during the 2004 monsoon, when ICIMOD was able to share rainfall forecasts with all of its members partners across the HKH region. In addition to these programs, a first workshop for SRE capacity building was also conducted.

The meetings and consultations constituting Phase Zero concluded with the endorsement of an action plan in December 2005 and common resolutions for flash flood mitigation in the HKH in the "Lhasa Declaration," which formalized regional cooperation on flash flooding in the GBM basin. Furthermore, gaps, needs and priorities of the member states regarding flash flood mitigation were also identified; a plan for future activities was approved; pilot areas to test the SRE model were selected; and the need to find additional funding was highlighted.

The Lhasa Declaration

The Lhasa Declaration was prepared by participants at the international workshop on Flash Floods and Sustainable Development in the Himalaya Region, held in Lhasa (Tibet) in October 2005. ICIMOD, the Chinese Meteorological Administration and the WMO organized the Lhasa workshop with active contributions from the following: ICIMOD member countries, experts from the WMO, the Asian Disaster Reduction Center (ADRC) and the Asia Disaster Preparedness Center (ADPC). OFDA and other donors such as Denmark's Danida sponsored it. A total of 55 participants representing organizations from the eight ICIMOD member countries and the international community were present (Jianchu et al. 2006). The Lhasa workshop complemented and built on other international conferences and their outcomes, including those of the Hyogo Framework for Action (2005), to address natural disaster and mitigation.

During the workshop, participants examined the situation in each member country regarding their capacity to monitor and mitigate flash flooding. Gaps and needs at the national level were also identified. The eight member countries of ICIMOD gave presentations on flood impacts and management at their levels, the results of which underscored that flash floods are the most frequent and difficult to foresee disaster in the region. Wide differences existed between member countries in their capacities to manage flash flood, however (Jianchu et al. 2006). For instance, some states (e.g. Afghanistan) had only recently built the necessary institutions for disaster management, while others (e.g. Bhutan) had no comprehensive plan for disaster management. On the other hand, some other states (e.g. Bangladesh, India, Nepal and China) had well-established institutions and relatively good coordination among them as well as good communication with local level agencies. In most countries, however, policymaker and community awareness and preparedness appeared weak. Greater involvement and community empowerment were recognized as necessary components of a comprehensive flash flood mitigation strategy.

After the workshop, considerable disparities were identified among regional partners regarding flood forecasting capacities and equipment, levels of implementation, warning systems, etc. In addition, all countries appeared to be in need of increasing involvement of communities. This variability was described optimistically as a chance for regional learning and exchange. Partners agreed (1) to collaborate in order to improve forecasting, warning and hazards control; (2) to better communicate on flash flooding issues; and (3) to create awareness and knowledge on flood risks and the threats they pose to local communities. They recognized that communities at risk have to be involved from the very outset, and they acknowledged the need to improve warning systems and develop policies and strategies to manage floods. The capacity building of relevant institutions (e.g. NGOs, media, local government, the private sector, etc.) at all levels were highlighted as necessary (Jianchu et al. 2006).

Shrestha et al. (2006) summarize the achievements for the period 2001 to 2006:

- A concept paper on the establishment of a regional flood information system was endorsed;
- Action plans with short- to long-term perspectives for project continuation were approved;
- A website (http://www.southasianfloods.icimod.org) where data and information on floods are shared was launched [*NB: the website is not active today*];
- Member countries' needs were identified and their capacities in flood forecasting and management were enhanced;
- Meetings to finalize a regional telecommunication strategy were held;
- Pilot zones for specific studies were selected;
- Possibilities of and utilities to share real-time hydro-meteorological data among member states were proved; and
- Bilateral and regional cooperation was strengthened for flood disaster mitigation.

Despite these significant achievements in connecting actors for basin-wide collaboration, several gaps could also be identified in this phase:

- There were neither connections made with nor inclusions of local levels in the flash flood mitigation planning process;
- There were no socially-based institutions included in the initiative; only high-level government and technical experts were represented during the various meetings and consultations; and
- Plans for the next phases remained unclear with regard to how information on flash floods would be translated down to the local level.

On the whole, the process undertaken during the whole of Phase Zero remained essentially top-down. By the end of the phase flash flooding problems were still perceived as primarily a technical issue as opposed to a societal issue.

Phase One

Phase 1 is essentially based on the following significant project "Application of Satellite Rainfall Estimate in the HKH Region," which was initiated by ICIMOD with funding support from OFDA and technical assistance from NOAA and USGS (ICIMOD 2009). This phase was launched on the basis of both the achievements of the initial phase and the demands that were raised by participating representatives to the regional meetings. Of the eight ICIMOD member nations, only Afghanistan and Myanmar did not participate in the training sessions, although their representatives were present at the regional meetings.

Phase 1 aimed to establish a fully functional data information dissemination system for flood hazards within selected pilot areas of the GBM river basin. Activities toward this goal, which occurred between 2006 and 2009, are described as follows: (1) training for SRE and GeoSFM, (2) application of small projects in selected pilot areas of the basins (selected during the previous phase), and (3) elaboration and publication of a manual for flash flood guidance. Specific objectives of the program included the validation of SREs based on information provided by NOAA (through tests applied in pilot basins) and the improvement of rainfall estimation products. In addition, efforts were also made to improve collaboration and data sharing among ICIMOD member states.

Training on SRE and GeoSFM

Accurate rainfall estimation is essential for timely flood forecasting and warning in the HKH region. In this regard, SRE is an alternative method developed in Asia to provide reliable and rainfall data in real time. The method refines a system developed by NOAA's Climate Prediction Center (CPC). SRE offers a global coverage of satellite data to calculate real rainfall estimates. It is particularly interesting in the context of the HKH region, because a sparse network of hydro-meteorological stations, rain gauges with a limited spatial coverage, unavailability of real-time rainfall data and limited technical and financial resources characterize the GBM river basin. Such a setting presents significant challenges to flood forecasting (Shrestha et al. 2008). In addition, the sharing of real time data across national borders continues to be a challenge in the region. In this difficult context, therefore, the SRE makes it possible to acquire necessary data and offers a means to predict rainfall-induced runoff that may result in flash flooding (ICIMOD 2009).

Geospatial streamflow model (GeoSFM) is a software application that uses RFE data to simulate the dynamics of runoff processes based on datasets and empirical monitoring of wide-area hydrological events (ICIMOD 2009). The GeoSFM enables the manipulation of a large amount of data to characterize the location and magnitude of an event. The software also identifies and maps wide-area streamflow anomalies (for further information regarding the process of RFE and GeoSFM, see Shrestha et al. 2008).

During an inception workshop held by ICIMOD in 2006, representatives from the participating entities raised demands for training and capacity building on SREs. In response, CPC-SRE products were applied in the HKH region in multiple programs and projects implemented between 2006 and 2009; OFDA sponsored some of these projects and served as a bridge for other partner institutions such as NOAA and USGS. As a part of this response, hydro-meteorologists from partner institutions received training on applications of SRE. A primary activity of the project was to develop and test the SRE model (SRFE-2.0) and the geospatial streamflow model that had been developed by the USGS to monitor flood hazards by providing rainfall-runoff models of basins (Shrestha et al. 2008).

Application of projects in pilot areas

The training lessons on SRE and GeoSFM were combined with applications in the pilot basins that had been selected during the preparatory phase. The goal was to validate the results from these models. The application of the USGS CPC-RFE2.0 algorithm to SRE and GeoSFM in the pilot basins indicated that the rainfall estimates generated by SREs were reasonable; yet improvements were deemed necessary if flood forecasting based on the models was to become operational.

Communication to and information dissemination about flood risks to local communities were also tested in selected pilot zones of the HKH region. Results of these pilot projects indicated a need to improve communication and warnings, which was supposed to be done as a result of enhancing the accuracy of satellite RFE.

Publishing the manual

ICIMOD collaborated with climate experts in order to produce three separate modules of the "Resource Manual on Flash Flood Risk Management," which were produced in partnership with USAID. The modules are based on the results from pilot projects and describe preferred methods for planning, stakeholder involvement and implementation of structural measures for flash flood management. They also stress the need for community participation in the flash flood reduction process. The modules were published as guidelines for other institutions to use as training and resource materials.

Phase 1 concluded with a workshop held by ICIMOD in 2008 at which partners pointed out weaknesses they had encountered and planned activities for the next phase. On the whole, this phase essentially focused on capacity building projects located in pilot zones to fill in the gaps identified among member states of ICIMOD (*interview with R. Shrestha October 2012*). The main achievement is related to the booklet, "Application of Satellite Rainfall Estimate in the HKH Region," which summarizes how the program:

- Contributed to building the capacity of ICIMOD's partners;
- Attempted to validate the use of SRE; and
- Looked at potential applications into forecasting (http://www.icimod.org).

The application of SRE and GeoSFM in pilot areas was not conclusive by the end of Phase 1. Tests revealed the necessity to increase the accuracy of rain flow estimates since satellite-based data tends to underestimate heavy precipitation events, such as those seen with monsoon rains (Shrestha et al. 2008). Consequently, the GeoSFM tends to underestimate peak flows when using the RFE data. Results for simulated flows also suggested that the RFEs are not suitable for small-size basins (such as the Bagmati Basin in Nepal, where it was tested). Therefore, preliminary attempts to validate the SRE suggested a need for a more rigorous, spatially-based validation, if flood events were to be realistically predicted (ICIMOD, 2009). Though the GeoSFM proved efficient for large area coverage, results revealed that its use was constrained by a lack of real collaboration among states in terms of data sharing. Local data from ICIMOD's member states needs to be incorporated into the models in order to improve their accuracy, if they are to be useful for prediction.

Phase 1 also highlighted significant challenges regarding the way risks are communicated towards local communities. Except in some pilot areas, little progress was made over the course of the project with regard to involvement of local communities or effective translation of relevant information for use at that level. Even now, effective or reliable flood EWSs have yet to be established for those populations at risk.

Phase Two (ended in 2013)

Because pilot applications in Phase One had revealed serious weaknesses and inaccuracies in the model, partners deemed the improvement of SRE products of vital importance. In response, Phase Two aimed (1) to improve the ability of ICIMOD and its partners to understand the impacts of climate on flooding and to mitigate those impacts as they relate to disasters, and (2) to enhance understanding of climate change on hydrological resources in the HKH region.

During Phase Two, additional validations of the SRE were conducted in pilot basins, and guidance in RFE and GeoSFM were provided to partners in order to solve problems they encountered in using the technologies involved. The GeoSFM was tested in the Naraya basin in Nepal and results indicated a satisfactory calibration and validation. Similar tests were conducted in other countries but results are as yet unavailable (ICIMOD 2009).

In response to some of the problems that have been highlighted concerning satellite rainfall estimates, the HIMALA project was launched by ICIMOD in 2009 in collaboration with NASA and with funding from OFDA (the funds ran out in 2013). The 4-year project focuses on utilizing satellite-based products to better understand hydrological processes in river basins in the HKH region, incorporating snowmelt and glacier melt components into the widely used hydrological model (Brown et al. 2010) to tailor it specifically to the region. The need to better monitor Himalayan glaciers, which comprise one of the world's largest reservoir of freshwater, was underscored at the end of Phase One. Glacial dynamics were not, however, incorporated into the previous rainfall estimate model, which partly explains its inaccuracy and general unreliability for real world applications.

HIMALA uses particular NASA products to fill in gaps identified in the SRE technology. Training sessions and workshops were conducted with technical support from NASA in order to increase capacity throughout the region to manage water resources in the short and long terms as well as to improve understandings of climate change impacts on these resources (Brown et al. 2010). In this regard, the model also integrates the findings of the IPCC 4th Assessment Report (2007) regarding water resource scenarios for the Himalayan region (ICIMOD 2012). Even so, tests of this prototype hydrological model tailored to include snow and glacier melt to assess water availability still have to be conducted in three key selected basins. Data provided by the new model will be incorporated to the GeoSFM. The prototype model is to be applied in more key basins before the end of the project.

In addition to filling in gaps identified in the rainfall estimates model and to integrate climate change impacts, Phase Two further promotes regional cooperation to monitor transboundary hazards and support capacity building in flash flood risk monitoring, as all eight ICIMOD member countries are involved in this phase (ICIMOD 2009).

Phase Two ended only very recently (2013) and complete evaluations have not yet been conducted. However, sources indicate that problems in acquiring and sharing flood-forecasting data among ICIMOD member countries remain *(interviews with representatives of NMHSs*). In addition, the model by itself seems incapable of incorporating local data (i.e. local rain gauge data) to provide more accurate results (from an interview with Dr. Sharma). Finally, despite improvement in the rainfall estimates, the SRE continues to highly underestimate rainfalls on an annual basis as indicated in a recent evaluation of the model through its application in Nepal (Shrestha et a. 2013). The report concludes on the need to improve the rainfall estimates, before they can be used as a model.

Conclusions about the AFN program

Table 16 summarizes the main activities under each phase led by ICIMOD and its collaborating partners to promote flood collaboration and to reduce their impacts in the HKH region.

Table 16 Summary of the AFN-HKH Program Timeline with Main Outcomes

Activities	Outcomes
Phase Zero: Preparatory Phase	
Regional cooperation for flood disaster mitigation	A series of consultative meetings to provide a regional consensus on flood disaster management, to promote regional collaboration, to endorse action plans, to identify gaps and needs for each member country and to select pilot basins for application of rainfall models. Supplied computers to ICIMOD
First SRE workshop	First training held upon request of partner states
Lhasa International Flash Flood Management workshop and Declaration	Workshop during which member countries demonstrated their respective status regarding flash flood management; technologies for forecasting and early warnings were presented by experts. The workshop ended with the Lhasa Declaration, which endorsed a series of commitments for regional cooperation on flash flood mitigation
Phase One: SRE training and model validation	
Flash Flood Management workshop	Consultative meeting to discuss plans for pilot flash flood warning systems in China, Nepal and Pakistan
SRE in the HKH region (+ workshops)	Program led by ICIMOD in collaboration of NOAA and USGS to build capacity of partners, to validate the SREs in selected basins of South Asia and to initiate studies for Masters and PhDs; ICIMOD provided computers to DHM; Research papers on the application of SREs were published at the end of Phase One (see, for instance, Shrestha et al. 2008)
Phase Two: HIMALA	
HIMALA: Climate Impacts on Snow, Glacier and Hydrology in the Himalayan region	Improvements made to the flood prediction model by incorporating snow and glacier melt components.

An overview of what was done for flood collaboration and mitigation between 2001 and 2013 under the leadership of ICIMOD and under the AFN umbrella highlights the following:

- Many high-level governmental meeting were conducted to enhance information and data sharing. In these meetings, national gaps in flood management and clearly defined roles and responsibilities of each national institution involved were identified. Yet, despite a formal agreement among ICIMOD member states, problems in sharing data remain; they were highlighted during Phases One and Two of the AFN, and continue to undermine effective application of SREs;
- Many workshops and capacity building sessions were conducted for national climate centers and technical experts in the HKH region, which contributed to improve overall knowledge about flood and flash flood issues at these levels. At this point, however, the SRE models are neither operational nor accurate;
- A manual with three separate modules on flash flood management was published to improve communication and risk preparedness at the local level. Pilot areas were also selected to train local populations. Results from the pilot cases still need to be upscaled in other zones. Moreover, further activities need to focus on identifying needs and raising risk awareness at community levels. Finally, increased interactions between hydro-meteorologists and policymakers would further contribute to the mitigation of flash flood impacts on societies; and
- Climate change and its role and impacts on floods in the HKH region were until recently unacknowledged in the scientific approach to rainfall estimates and rainfall-runoff models. Only with the launch of HIMALA has this topic been introduced in the field.

Impacts of the AFN on current hydro-meteorological risk management in the HKH

According to NOAA's website (http://www.nws.noaa.gov/iao/BLT_AFN.php), the AFN's primary output in the HKH region has been the enhanced capacity of the regional hydro-meteorological organizations to monitor, forecast and issue flood-related information to at-risk communities. Yet, recent floods in India and Nepal (monsoon floods in June 2013) indicate that the EWS – which includes forecasting techniques as well as dissemination of information to at-risk communities – is not yet completely functional in all areas of the HKH region.

This section presents an overview of the improvements as well as the remaining challenges in the management of flash flood risks in the HKH, as of today. The review is done in light of progress initiated by OFDA through the AFN. Results are based on desktop analyses of relevant documents and research articles. Furthermore, a senior researcher at CCB conducted interviews with relevant personnel at the ICIMOD headquarters in Kathmandu in late September and early October of 2012. Questionnaires were also sent by email to NHMS offices throughout the HKH region in order to gather feedback on perceived achievements of the AFN. Questionnaires queried respondents about ongoing problems they had with flash flooding and its management in their respective countries. However, few responses were received (only from key institutions in Nepal and from one in Afghanistan).

As the following section is essentially based on these interviews as well as on literature that was published after the end of Phase One, the scope of the results is limited.

Using the goals outlined in the AFN initiative, four primary questions were asked to help assess progress made thus far on flash flood mitigation in the HKH region. These questions are:

(1) Have the gaps in flood and river forecasting and early warnings been identified and filled in?

(2) Have the forecasting skills of ICIMOD and of its regional partners improved in the HKH region?
(3) Have information and data sharing content and capacity in transboundary basins been enhanced?
(4) Has the dissemination of forecasts and associated warnings to users and end-users been improved?

Based on the previous analysis of the AFN, the following statements can already be highlighted with regard to OFDA's support to flash flood mitigation in the HKH region:

(1) <u>OFDA succeeded as a catalyst</u>, propelling the AFN initiative forward until very recently (2013). Multiple activities related to this initiative were carried on for years, receiving operational support from other institutions and donors such as the UK government and the WMO (interview with Dr. M. Shrestha).
(2) <u>The AFN would benefit from long-term funding support, rather than short-term grants.</u> So far, most of the support to the AFN was approached as a program variously embedded in or complementary to smaller projects. The funding was primarily dispersed into multiple and relatively small time-scale training activities and pilot projects, which could not provide sustained long-term capacity building or ensure ownership of all projects by ICIMOD.
(3) <u>Support for flood and flash flood mitigation has not yet resulted in any concrete uses of flood forecasts to reduce impacts on local communities</u>. Review of the various programs under the AFN umbrella indicates a focus on quantitative technical and scientific research with little qualitative study of the social, cultural, political and economic differences between individuals and communities that experience such events. Despite the utility of workshops and training sessions on predictive models like the SRE (notably to make it more accurate), operational measures need to be actually developed and applied on the ground in order to enhance a community's resilience to floods, more broadly beyond pilot areas.

Flood forecasts

Gaps in knowledge and technology for predicting floods and flash flooding in the HKH region were found during the preparatory phase of the AFN (2001) and were to be filled in through technology transfer. These transfers aimed at increasing understandings of the role various parameters play in the formation of flood, and especially flash flood, events, which are complex phenomena affected by a range of factors not all of which, it should be emphasized, are of a technical nature. Technology transfers were followed by the application and validation of the forecasting models in the GBM pilot basins, which led to further attempts to improve the prediction models (e.g. by adding more local data and, later, climate change impacts).

Climate experts from the HKH region, interviewed for this particular survey, acknowledged many improvements in the forecasting technology. Yet, significant problems remain in the accuracy of the prediction models, as of today, thereby hindering its real-world application. These problems were pointed out during interviews with hydro-meteorologists from Afghanistan and Nepal as well as through a review of research papers published after completion of Phases One and Two of the AFN. Findings point out that the SRE in itself remains very much a theoretical model and not yet ready to be operational in real-world forecasting contexts for flood management and warning. The SRE's lack of accuracy was highlighted in various research papers, which published findings from the model that were inconsistent with empirical observations measured on the ground in the region (see Shrestha et al. 2008). The main problem with SREs is that their predictions continue to fall far below actual field measurements of rainfall, especially during the summer monsoons. These underestimations were recently observed during applications of the model in Nepal, as pointed out in a report by Shrestha et al. (2013).

Consequently at this time, the SRE/RFE, as well as the GeoSFM, which depends on data from SRE, are only useful from a research standpoint but not yet for real-world application. The GeoSFM rainfall-runoff model requires accurate inputs of rainfall data to be able to provide precise outputs (*interview with Rajbhandari*). But so far, the SRE only provides some indication of the probability of the occurrence of flooding but no true indication of the occurrence of flooding (*interview with R. Shrestha from DHM*). Recent attempts to incorporate more localized data into rainfall estimates in order to improve accuracy have yet to produce conclusive results (*interview with Dr. Sharma*). Improvements are, therefore, recommended before any application of the model (Shrestha et al. 2013). Consequently, further investments in scientific research to improve a prediction model that would definitely be a useful tool for flash flood risk reduction when rendered operational, are necessary.

Lack of accuracy of the SRE is not only a technological problem. The provision of sufficient data to run the streamflow model and to forecast flooding is another obstacle to the production of accurate predictions. As underlined since the outset of the AFN, there is still the need to establish more hydro-meteorological stations across the HKH. For instance, Afghanistan specifically mentioned its lack of data at both national and local levels. Currently, however, increasing hydro-meteorological stations in the HKH region is hindered by the reality of rugged and often inaccessible terrain in some areas of the GBM river basins that makes it difficult to install gauges to collect hydro-meteorological data. In addition, collecting and accessing data at a regional scale is also undermined by problems of regional sharing as discussed later.

Obstacles to the application of rainfall estimates to flood forecasts in individual countries of the HKH region were also found. Results from interviews suggest that the SRE prediction model could be unfit for application in some of the regions located in the HKH because of their particular characteristics or of the nature of floods there (e.g. floods can be caused by snowmelt or monsoon rainfalls, depending on the region). Moreover, in Nepal, discussions with Dr. Sharma and Dr. Gautam from DHM indicated that the data from the SRE in itself had very little use due to time lags between data production and dissemination. Because Nepal has a relatively small river basin with a short temporal scale, data that are collected even on a daily basis but that do not arrive until after a 17-hour time lag, as those delivered from the NOAA CPC, are irrelevant. Due to the small size of the river basin, Nepal needs timely flood information rather than rainfall data if its hydro-meteorologists are to better manage flash flooding.

Consequently, hydro-meteorologists currently working at the DHM have not yet been able to apply the SRE/RFE or GeoSFM in their operational flood forecasting; instead, Dr. Sharma indicated that hydrologists use other models such as HEC_HMS or HEC-RAS. In addition, Dr. R. Shrestha, who is a senior meteorologist at the DHM, pointed to a significant dropout rate among experts at the department, a trend that further compromises the operationalization of the CPC model. That said, Dr. Shrestha also indicated that the DHM is currently using the iteration of the SRE model that is available on NOAA/CPC/FEWS-NET server, which seems to contradict his previous statement!

ICIMOD's Dr. M. Shrestha also added that application of the SREs is a challenge because they require adequate technologies and good internet access, both of which are often unavailable or unreliable in the HKH region. This is especially the case in the poorest countries, such as Afghanistan. Responses from Dr. Rasekhudin (a hydrologist attached to the Foreign Ministry of Afghanistan) indicated significant technological gaps in his country, including poor Internet accessibility that contradict the real-world application of SREs there.

Dr. Rasekhudin revealed further, country-specific problems with the application of the rainfall estimate model, as he noted that floods in the HKH part of Afghanistan are mainly linked to snowmelt, while the SRE model was essentially built for monsoon-affected river basins. As a result, the snowmelt component was not calibrated at first in the flood prediction model, and therefore was not incorporated into training sessions on SREs that were held at ICIMOD. Although the omission of snowmelt (and glacier melt) in the original model, as noted above, was taken care of with the HIMALA project, Dr. Rasekhudin had not been made aware of this update at the time of our interview.

Additional interviews with meteorologists who participated in the SRE workshops indicated that the SRE approach was not suitable for flood forecasting in their countries, mainly because of the time lag (*interview conducted by Dhiraj*). Hence, results suggest that the approach needs to be customized to each country's needs as well as tailored to each country's technological capacities to be applied effectively and to take into account the specific nature of local flash flood hazards.

This survey emphasizes problems in the flood forecasting system in the HKH; it, however, also recognizes the significant advancements in flash flood risk management supported by OFDA through the AFN. Meteorologists and hydrologists working on flash flood forecasting at national and regional levels had several opportunities to enhance their knowledge of various prediction models thanks to workshop participation, trainings and visits abroad. Important technology transfers to ICIMOD and training on the use of these advanced technologies were also sponsored by OFDA. Yet, it is important to highlight weaknesses so that they can serve to guide – and improve – future interventions. Hence, though progress has been made and is still ongoing, efforts have *not* apparently been as effective in as desired developing and upgrading flood-forecasting capacity in the HKH region to date.

Persistent errors and lack of accuracy in prediction models, on the one hand, and disparities between ICIMOD member countries regarding technical abilities to collect data and monitor forecasts on the other, combine to effectively undermine each country's capacity to produce accurate timely forecasts that could be used to disseminate appropriate warnings to the people of the HKH region. Moreover, the model is not specific to each country's needs. These findings indicate that regional initiatives such as this one should not neglect to assess particular needs and capacities at the national level, if models are to be produced that are relevant for each target country and that can be transferred to (absorbed by) the national level. Such current obstacles to real-world application of SREs suggest a lack of informed assessment on the part of ICIMOD of its partners' needs regarding flood and flash flood prediction as well as a lack of sustainable follow-up after workshops and training sessions.

These results also suggest the possible need, in some cases, for country-centered programs (as opposed to regional programs) to initiate and even serve as a basis for larger regional initiatives. Country-centered projects can help identify gaps in technology and specific needs for each state involved, which can lead to more appropriate plans for filling in those gaps. This suggestion does not, however, deny the need for regional cooperation and agreement among countries, especially when it comes to flash flood management in the HKH. To be sure, information and data sharing are crucial to monitor and manage transboundary flood-related issues. For instance, upstream countries should necessarily keep downstream countries informed about their flood forecasting activities and findings. In this sense, specific national assessments could be implemented as a complement to regional programs.

Skills improvements of the NHMSs

One important focus of OFDA's funded activities in terms of the AFN was in capacity building and training for regional and national hydro-meteorological institutions, which included the development of manuals and resource documents. In this context, between 2006 and 2012, ICIMOD conducted several workshops during which its staff and the staff of the NHMS in the HKH region participated in order to improve skills and knowledge for flood forecasting and to learn to use new prediction models (SREs).

Participants to these training sessions from Nepal and Afghanistan were interviewed. They indicated that training sessions, workshops and validation tests on SREs were useful because they enabled the implementation of SREs for flood forecasting, tested their validity and provided an opportunity to improve them. Two interconnected issues were, however, raised by the workshop participants: the complexity of the model they had to learn and the short amount of time allotted for training on it. Consequently, participants asked for longer and more frequent workshops in the future so that they could really focus on building their capacities to use it effectively.

The short-time span of the training sessions can probably be linked to the funds allocated to AFN over the past 10 years. From its inception, the program received funds from several different institutions, including OFDA, but funds were distributed only in relatively small tranches. Dr. A. Shrestha from ICIMOD indicated that this approach to funding really hindered long-term planning because training sessions could only be conducted for short periods but then had to be stopped until the next tranche was secured, thus compromising possibilities of fluid capacity building. For example, because training sessions under AFN were held at different times based on funding tranches, different representatives often attended them. This situation of rotating participants meant that each session had to start at the beginning, a style of training that does not provide for "in depth" assimilation of new techniques. It should be noted that rotating participants can also be linked to "brain drain" and "drop-out rates" from ICIMOD's partner institutions.

Importantly, small tranches that hinder long-term program planning also creates important difficulties in terms of engaging with potential program partners who might provide technical support for trainings.

Training programs on flood forecasting and river hydrology continue to be implemented by ICIMOD from time-to-time. For instance, in November 2012, ICIMOD led a national training workshop on flood information systems (*interview with R. Shrestha from DHM*). Such sessions continue to contribute to the internal capacity building of the member government agencies, and the demand remains high in the HKH for more frequent and longer-term trainings as opposed to the short, irregular sessions that have been offered partially because of the obstacles posed by the noted funding method. A major recommendation would be to consider a longer-term funding approach, which could include internal reporting and output benchmarks that had to be met, that would enable longer-term and more efficient program planning.

Longer-term capacity building, based on sustainable funding, are also required if the capacities of the NHMSs to apply new prediction models into their national context are to be strengthened. It has not been the case so far because of the different technology levels and transfer problems mentioned earlier, as well as the short time-span allotted for training on very complex models (see previous sections). In Nepal, for instance, R. Shrestha from DHM and Pr. Rajbhandari from DoM indicated that the exercises and training applied by ICIMOD and sponsored by OFDA improved knowledge of flood forecasting using the SRE and GeoSFM on an individual level. These trainings did not, however, specifically enhance the skills of their home institution.

One of the hindrances to institutional skills enhancement in Nepal (and elsewhere) is the difficulties encountered in keeping partners engaged in SRE activities once back home. In addition to frequent changes in staff or staff rotation, the DHM has experienced significant brain drain because trained hydrologists are valuable assets for institutions around the globe, so those employed by the government leave for better-paid position once they have been thoroughly trained and have increased their own knowledge.

A similar situation was found in Afghanistan. Though he acknowledged skill enhancement on a personal level, Dr. Rasekhudin indicated that the AFN workshops had not apparently contributed to improving overall capacity within his institution. He specifically mentioned a lack of technologies as well as problems in application of models in Afghanistan as obstacles hindering overall success of the technology transfer at the national level. Moreover, few people from Afghanistan have to date been trained on SREs. The first training sessions conducted through AFN did not apply to either Afghanistan or Myanmar, and even when Afghanistan was later involved as a participant it was only able to send one representative to ICIMOD to be trained. This point is significant, highlighting how participation in trainings and workshops is often very resource-dependent and not only at the front end. In reality, during a project support can often be had through sponsorships by donor organizations, but once a project ends new financial sources have to be found or skills acquired in training can lapse, as they often do, with the state-of-the-art quickly becoming obsolete.

As a conclusion, it appears that the training sessions conducted under the AFN and sponsored by OFDA succeeded in enhancing the personal skills of the participating hydro-meteorologists: this was recognized by all interviewed partners. Yet, further investments in time, resources and staff remain necessary to truly and sustainably improve the capacities of the ICIMOD member's regional institutions to operationalize at the national level the prediction models learned during the trainings. Highlighting this current weakness serves to indicate the necessity of looking for other paths by which to train national institutions. It also underscores the need to deal with the various gaps within institutions that hinder their ability to absorb new skills and apply new products.

Regarding future training sessions, national workshops instead of regional ones should probably be considered. This shift would make trainings more accessible to an increased number of hydro-meteorologists because it would reduce distances covered and lower costs for national institutions. Furthermore, all of the interviewees made it clear that training sessions should be conducted more frequently and with greater detail if institutional capacities are to be truly increased and models successfully operationalized. Trainings should also be conducted in a manner that enables trainees to learn more easily and to be better able to work with data relevant and appropriate to them once they are back at their home institutions. In other word, capacity building needs to be applied more than once, with sustained financial and human resources.

Regarding institutional gaps, some hydro-meteorological institutions seem to be affected by problems of "brain drain" and staff rotation, resulting in a situation wherein individuals rarely remain involved in programs from beginning to end. This situation also challenges institutional capacities to improve and often results in inconsistencies and slower progress in building capacity. Since rotating staff affects institutional capacity, finding incentives to keep trained personnel on staff for longer periods seems necessary. One suggestion is to sign contracts with trainees that ensure that they will work in their home institution for at least two or three years following their training. Monetary or rank bonuses could be used as positive incentives for making such a commitment.

Again, these results highlight existing disparities among national entities that are a part of the same regional initiative, regarding their capacities to send staff abroad for training and to absorb new technologies. They also indicate the need for better follow up by ICIMOD, which should be aware of what, if anything, government hydro-meteorologists are doing with their new knowledge even years after their trainings. ICIMOD should also better incorporate their suggestions in conducting future workshops.

Sharing data and information in transboundary river basins

Data and information sharing is critical for accurate forecasting and early warning, particularly when addressing flash floods in transboundary river basins. Hence, sharing information and collaboration were at the core of the AFN program since its onset. Moreover, as a regional platform, ICIMOD has an important role to play as a primary agent in facilitating regional collaborations on flash flood management. Under the AFN, various consultations for high-level representatives in the HKH region were held with support from OFDA since 2001, and information and experience sharing were promoted. Among them, OFDA sponsored a pilot project for the 2004 monsoon (http://www.icimod.org) that aimed to improve data sharing among ICIMOD member states.

Yet, despite improvements and a few successes, significant problems in terms of a reluctance to engage in data sharing continue to obstruct the success of the AFN program. One of the most significant problems was that collaboration among member states essentially occurred during meetings organized by ICIMOD. Outside of such formal sessions, information sharing was severely limited, as governments of the HKH region tend to perceive and treat climate data as classified information. Hydro-meteorologists from Nepal and Afghanistan, for instance, indicated that they had very limited interactions or collaborations with other NHMSs.

Such exchanges, when they happen, occur at two levels: at regional and national meetings. At the regional level, hydro-meteorologists from the HKH partner institutions meet at ICIMOD for occasional workshops or consultative meetings. Hydro-meteorologists like Dr. Sharma who participated in such meetings indicated that they had only very superficial interactions with regional colleagues, with contact essentially

consisting of the exchange of business cards and references. No further means of or intentions for collaborative work on flood forecasting issues were forthcoming.
Moreover, neither formal nor informal linkages between the regional countries, besides their being ICIMOD partner institutions, are currently active. Dr. Gautam from DHM explained that those regular meetings at ICIMOD have not led to any substantive data or forecast sharing during the time when floods are occurring. An interview with Dr. Karki (Former Deputy Director of ICIMOD) also confirmed that regional members of ICIMOD only share peak flow information but not their river flow data – which are, however, important to share because it could be used to increase the warning time for downstream states (Skype *interview conducted by Glantz, 2013*).

At the national level, meetings are sometimes organized to join hydro-meteorologists and other actors from key institutions to work on national issues and to share experience and knowledge on common matters. In Nepal, for instance, an umbrella organization involving INGOs, NGOs and governmental institutions recently organized consultative workshops about national EWSs in Kathmandu (*interview with R. Shrestha from DHM*). National conferences like this one might be more accessible to a larger audience, as cost and distance are lower compared to regional events that require sending and accommodating staff abroad. We are, however, unaware of whether or not such meetings were held on a regular basis or if they were organized in all countries as a part of the AFN program.

Success stories of information sharing in order to better manage flood risks exist. For instance, the "Framework for a system for information exchange and data to support flood forecasting" sponsored by OFDA has, according to the ICIMOD website, helped manage the 2004 monsoon. Yet, interviews with participants in this initiative from Bhutan, Bangladesh, China, Nepal, and Pakistan (CCB 2013–Dhiraj-personal correspondence) explained that most countries shared only limited hydrological and meteorological data from selected stations during the time of the initiative (2005-2009). Moreover, some countries refused to participate in the initiative. India, for example, participated only as an observer, and Afghanistan and Myanmar were not represented. In addition, the website for data sharing that was launched as part of the initiative, http://www.southasianfloods.icimod.org/index.php (accessed May 7, 2013), though still active, has not been updated in terms of recent flood events since some time in 2009 and in terms of SAF (south Asia floods) "current activities" since 2004.

The lack of both formal and informal collaborations between national hydro-meteorological services in the HKH region, as well as the limited exchange of information during pilot activities to better forecast floods suggest significant barriers to data sharing, despite various efforts to overcome these problems. These obstacles can be attributed to the specific geopolitical context of the HKH region, where lack of trust and confidence between states is prevalent. Several respondents indicated what they have experienced as a low willingness among nations to truly collaborate or to openly provide relevant data for flood forecasting in the region. Nepal is an exception, as its climate data are available on the DHM website.

The complex geopolitical context in the HKH significantly challenges otherwise reasonable ambitions to develop a regional program of flood forecasting based on cooperation and sharing of information. In order to promote regional collaboration, OFDA has funded many high-level conferences and meetings; yet, it appears that many barriers remain to the development of concrete operational linkages between hydro-meteorological services in the HKH region. This is unfortunate since the AFN program was originally launched based on the recognition of countries within the HKH region that cooperation is necessary to manage flash flood risks.

The problems of calibrating prediction models based on the general unwillingness among its members to share data might suggest that ICIMOD should first focus on strengthening links between partner institutions as well as between the partners themselves in order to promote the trust and confidence that needs to be in place if such sharing will ever take place. The current unreliability of the models are also related to such unresolved social issues, which manifest at levels involving people, institutions, and states. Dealing with these issues that underlie the limited technical successes of the models is a necessary step if better flood prediction, which is once again a transboundary issue and ostensibly the primary goal of the entire process, is to be achieved.

Real collaboration has a potential to increase the capacities to forecast floods more accurately and in a timely fashion. Hence, trust among states in this region must be built and enhanced. So far, the particular geopolitical context questions the feasibility or even possibility of a regional program for flash flood reduction. Even if it appears logical in theory due to the nature of flash floods and the geological characteristics of the HKH region, the operationalization of such a regional program is hampered by the complex factors linked to the geopolitical contexts in which such a program—and the science that is central to it—is always embedded.

Finally, additional challenges for countries to share their data are identifiable in the existence of different capabilities among national institutions to collect and monitor relevant data (e.g. due to data resolution and lack of equipment). These disparities lead to enormous differences in the potential contributions each state could realistically make to flash flood mitigation. These challenges—technical, technological and geopolitical--must be identified fully and resolved before a large program with a regional scope can realistically be launched. The possibility of overcoming such socio-political challenges must then be studied fully as the success of the AFN at least partly relies on resolving such trust issues.

Communication about risks at all levels

ICIMOD has adhered to the WMO initiated WHYCOS program framework, which has partially been funded by OFDA since the early 2000s. As such, it has adopted the program's E2E model of information dissemination to local level populations. In this model, at-risk populations are depicted as end-users of forecast products; they are the recipients of flood information. Between these local level end-users and regional level institutions—in this case, ICIMOD—other entities exist at the national and other levels that can support information flow by broadcasting relevant climate information to the local level and by taking appropriate decisions or policies when a warning is released.

The problem is that due to the significant challenges encountered with flood forecasting in the HKH region, most investments in programs have been focused on technology improvements and transfers, and capacity building for the NHMS. Hence, few activities of the program have been directed towards fulfilling the AFN's 4th goal, e.g., better dissemination of flash flood information to at-risk populations. In the same way, neither have interactions between climate scientists and decision-makers been routinely established and strengthened. Yet, interactions between scientists and stakeholders are fundamental to enhance risk awareness among the end-users, and relevant at-risk community. In theory, once a risk of flooding has been recognized, communication should happen quickly to enable response measures to be taken. Communications through EWS must be directed towards decision-makers who have to take appropriate policy decisions and practical measures to mitigate flood and flash flood impacts. Information must also be disseminated at the local level because the communities will be the first affected (i.e., zero-order responders).

ICIMOD and its partner institutions have been generally focused on technology improvements for solving accuracy problems regarding SREs. Although little information about EWSs in member states has apparently been collected, the 2006 report on the SRE workshop did provide some insight into how information is disseminated within individual countries. Additional information was provided in interviews of regional hydro-meteorological services (*interviews conducted by Dhiraj*). These sources indicate that in Bangladesh, for example, risk information and warnings are disseminated through television, telephones and radio; bulletins are released 72, 48 and 24 hours before the anticipated onset of an event. In Pakistan, as of 2006, telephone was the primary tool used for information dissemination. This suggests that one country's effective warning system may not be suitable in another. Another issue to consider is access to warnings: information outreach likely depends on the location of populations, with easier information access available among professionals and people in cities than among the less educated and urban poor, who still have better access than those in rural areas. An evaluation in the region of the effectiveness of national dissemination systems would be useful to better understand and manage such issues.

At the governmental level, preparedness implies having usable strategy plans and policies ready to apply for fast responses when flash flood warnings are issued or when floods strike. This aspect is even more important if risk prediction models are not yet reliable. Governments in at-risk countries must be prepared all the time to face such potential disasters, whether or not the technology for flood forecasting is reliable and usable. These plans are essential at all levels, but especially at the local level, where quick onset disasters strike.

Now that knowledge on floods and flash flooding has improved through various programs and workshops of the AFN, translating it into usable information for policy-makers that supports concrete applications and results on mitigation remains a challenge. This need is recognized by scientists at ICIMOD, which suggest that more attention be given to develop operational measures that can be tested in the field instead of continuing to study hypothetical models. Furthermore, increased interactions among scientists and policy-makers are necessary to help producing climate-products that are relevant in decision-making. Finally, the Nepali NHMS representative R. Shrestha highlighted the need for hydro-meteorological departments to develop and better use communication tools such as mobile phones, radios, televisions as well as local workshops and guidebooks for trainers. Though some of these tools are not routinely available, still hydro-meteorological staff is aware of the critical need to improve interactions with the decision-makers.

Beyond policy-makers, society as a whole should also be prepared for flood – and especially for flash flood – risks: flash floods are quick onset and can happen in remote areas with limited access to government services. Therefore, the role of local communities in mitigation is strong. According to ICIMOD:

> Communities must be involved in the development process if activities are to be successful and sustainable. This is as true for disaster management as it is for other development initiatives (ICIMOD, 2008:7).

ICIMOD, with support from OFDA, has produced and published a series of manuals for flash flood mitigation. Some of these are based on pilot projects conducted at the local level with the purpose of training local communities for flash flood preparedness. These manuals offer real tools and useful methods for trainers to help prepare at-risk populations. Past these manuals, the reality also indicates a need for flash flood mitigation activities. Flash flood responses need to be adapted to reflect local circumstances and contexts and to be flexible because quick onset risks imply the need for a degree of spontaneity in planning and response to events.

In an interview conducted at ICIMOD, a respondent underlined recent progress by the scientific community made in increasing the role of local communities in flash flood management. While local communities were hardly mentioned when flash floods were first discussed, today their significance as flash flood zero-order responders is acknowledged in publications. This recognition was made at the AFN's first regional meeting on flash flooding 2001. Today, ICIMOD is committed to better disseminating forecast and flood information to at-risk populations as reflected in ICIMOD publications (supported by OFDA funding).

The flash flood guidance manuals, published by ICIMOD, are based on field research conducted in pilot areas to assess local conditions. The field study uncovered the need for non-structural measures for flood management at that level and led directly to the preparation of manuals and guidelines containing information on how to train local villagers and enhance flash flood preparedness. Such manuals and training tools may not, however, be completely relevant for many areas in the HKH region, given the local complexity of factors involved in flash flood risks there.

Several problems have been revealed regarding the manuals' general development. The most important of these problems is that the manuals oversee the fact that flash floods in the HKH are determined essentially by specific local variables. However, in these specific publications, ICIMOD tends to support central planning for flash flood mitigation, despite the acknowledged successes of local community managers in mitigating risks. A more open and flexible approach for flash flood management to better reflect local realities and capacities would seem more appropriate than a central planning as reflected in the training materials.

Another problem with the training manuals is that only a small number of villages were selected by ICIMOD to conduct pilot research; hence, they might not be representative. With a small number of case studies on which they were based, the risk exists that the training manuals reflect a few "success story sites." The "one-size-fits-all" approach neglects community differences, which are quite pronounced in the HKH region, as acknowledged by ICIMOD itself. Once again, a flexible approach to flash flood risk management at local levels would be more respectful of local disparities.

Such a central planning approach is common in large regional institutions that dominate a field of activity in a geographical area. Though central planning can be useful for ensuring technocratic efficiency, more clarity, and parsimony in the way risks are identified and managed, it may be disconnected from realities at the local level where different circumstances and contexts call for spontaneous flexibility as opposed to rigid plans.

So far, ICIMOD and the AFN have focused on improving forecasts and skills for climate scientists like those who are the key and senior personnel at that institution. Though necessary, such a focus does not leave much space (or funding) for local communities, except when they are pilot projects. An interview with N. Shrestha from ADAPT-Nepal (NGO) confirms this inference, noting the disconnect between the AFN and the local communities and the serious lack of community outreach by this program. A shift towards a flexible approach of DRR and an increased involvement of various stakeholders in DRR, especially the local communities, would be better achieved, if large regional centers were challenged by new structures and organizations involved in similar activities but with more bottom-up perspectives.

All communities and institutions at all levels should be involved in disaster risk management, and have some degree of preparedness when it comes to quick onset risks. This is especially true as significant reliability and operational problems persist regarding the SREs. Increasing focus on improving communication to as well as risk awareness and preparedness of national and local institutions and local communities is extremely important. Moreover, it is important to develop stronger links between the hydro-meteorological community and their national governance institutions if measures that can be used by decision-makers are to be developed. These policy-makers are in serious need of such concrete timely products that translate the science of mitigating flash flood impacts to the real world.

While ICIMOD in the past has formally acknowledged the necessity to involve local communities as key actors for flash flood management, to date, it has tended to be more focused on improving forecasting science. ICIMOD has the opportunity to develop relevant multidisciplinary research that promotes information dissemination, risk awareness, and preparedness, enabling it to go beyond the publication of training manuals and to develop projects that are directly relevant to the particular contexts of local communities.

It is imperative to build the capacity of communities so that they can take on their key role in flash flood management. Such facilitation can be done through multidisciplinary research that promotes a flexible, localized approach to flash flood mitigation. In this sense, rethinking the current so-called "E2E" model of information dissemination to consider an "E2E2E" model might go a long way in formalizing the role of local communities. The 3rd "E" would close the loop that exists in the old (E2E) model.

Concluding words

The main goal of this survey is not to highlight all the good activities and improvements in the field of DRR to which OFDA has contributed; rather, it aims at identifying lessons learned in OFDA's DRR programs conducted in the HKH region in order to address important challenges to the management of hydro-meteorological disaster risks. OFDA's work in the HKH region has provided successful advances in the field. We have underscored OFDA's key role as a catalyst to ICIMOD and to the AFN. Without its initial support, ICIMOD might not have its current lead position in the field of DRR in the HKH; and the AFN would not have been carried on for more than ten years, through additional funding from new donors.

Nevertheless, its successes aside, it is important to acknowledge problems as a way to improve its future planning activities. By revealing existing constraints impinging on DRR, this review suggests that a key role for OFDA would be to foster an E2E2E model for risk management, giving voice to the local actors and strengthen their resilience.

The AFN and related programs comprise a significant technological effort to improve comprehension of flash flooding in the HKH region. Time was spent to structure an agreement for collaboration among states in a region with a complex, sometimes contentious, geopolitical setting. It was also spent on the facilitation of technology transfers and capacity building for hydro-meteorological institutions. Over all, the focus was essentially on improving the science for flood forecasting and the technical skills of the ICIMOD members; although problems remain in the accuracy of the SRE model, progress is ongoing. Yet, to reach the AFN's ultimate goal—the mitigation of flood and flash flood impacts on vulnerable communities – it is necessary to invest more resources, time and staff to address equally urgent concrete issues that arise with quick onset events. Despite technological advances, people continue to suffer needlessly in flash flood events (see the flash floods that hit India and Nepal in June 2013). Non-structural measures, which often require lower costs than structural and technology-focused measures, are recommended for the local level. These measures should be at the heart of any DRR project in light of the concern that risks from natural hazards are likely to increase in the next few decades due to the impacts of climate change.

Case Survey: Central America and the Caribbean (LAC)

Acronyms

ASCE	American Society of Civil Engineers
CAFFG	Central America Flash Floods Guidance
CAN	Andean Community
CARICOM	Caribbean Community
CDB	Caribbean Development Bank
CDKN	Climate and Development Knowledge Network
CDS	CAFFG Dissemination Server
CEPREDENAC	Centro de Coordinación para la Prevención de los Desastres Naturales en America Central
CPS	CAFFG Processing Server
CRED	Centre for Research on the Epidemiology of Disasters
DDR	Disaster Risk Reduction
ECLA	Economic Commission for Latin America
EIA	Environmental Impact Assessment
EWS	Early Warning Systems
GFFG	Global Flash Floods Guidance
HMDRR	Hydro Meteorological Disaster Risk Reduction
HMH	Hydro Meteorological Hazards
HRC	Hydrologic Research Center
NHIA	Natural Hazard Impact Assessment
IMN	Instituto Meteorológico Nacional de Costa Rica
NMHS	National Meteorological and/or Hydrological Service
NOAA	National Oceanic & Atmospheric Administration
OEA	Organization of American States.
OFDA	Office of Foreign Disaster Assistance
UCAR	University Corporation for Atmospheric Research
UNASUR	Union of South American Nations
USAID	United States Agency for International Development
WMO	World Meteorological Organization

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Introduction

USAID/OFDA has invested considerable effort in recent years to support the development of methodologies and tools that utilize hydro-meteorological DRR strategies, tactics and activities to cope with the risks posed by climate change in the face of an uncertain hydro-meteorological future. The project *Hydro-Meteorological Disaster Risk Reduction: Lessons Learned for Resilient Adaptation to a Changing Climate* was designed to survey selected OFDA hydro-meteorological DRR activities to identify strengths, weaknesses, opportunities and constraints (e.g. SWOC) in order to strategize about bridging, blending, or integrating DRR and CCA programs. Although the geographic scope of this survey is worldwide, the main foci have been on sub-Saharan Africa and South/Southeast Asia. The Latin America and the Caribbean (LAC) region also plays an important role in this study, especially because it has had great influence over and been a center of innovative DRR activities around the world for many years. The region's unique features of stable national political systems, strong regional cooperation and high levels of cultural integration due to historical circumstances have produced a social environment that has enabled OFDA to succeed in developing and implementing several important activities.

The main goal of USAID/OFDA in the LAC region is *to reduce risk by enhancing institutional and community capacities to respond to and mitigate the effects of disasters, to strengthen the resilience of vulnerable communities and to reduce exposure to hazards* (USAID/OFDA 2012). This goal defines a number of priorities to work toward, two of which related to hydro-meteorological hazards were prioritized in this review:

- *Identify, assess, and monitor disaster risks and enhance Early Warning Systems (EWS)*: On this subject, one of the most remarkable projects in Central America regarding the improvement of Flash Floods forecasting systems, "The Central America Flash Floods Guidance" (CAFFG**),** was analyzed**.**

- *Reduce underlying risk factors by supporting "building back better" as a mitigation initiative*: For this initiative, two projects centered in the Caribbean small islands were analyzed, both relating to the introduction of hydro-meteorological hazards into the project's design. These projects were the (1) *Sourcebook on the Integration of Natural Hazards into the Environmental Impact Assessment Process* and the design of (2) *Wind Speed Maps for the Caribbean for Applications with the Wind Load Provision of ASCE-07.*

These initiatives are reviewed in two separate case study sections that comprise this chapter. These sections are further divided into four parts, each of which corresponds to one of the four factors of a SWOC analysis. By analyzing these initiatives in this way, a picture emerges of the lessons that need to be learned for the improvement of future USAID/OFDA actions on hydro-meteorological disaster risk reduction, especially for facing an increasingly uncertain climate future, as suggested in climate change scenarios.

Case I

Identify, assess, and monitor disaster risks and enhance EWSs: *The Central America Flash Floods Guidance (CAFFG).*

Methodology

Data for this survey was gathered through two approaches:

- *A review of 88 key documents*. These documents provided a background on OFDA and the measures that it has taken to strengthen regional DRR capacity in Central America. This review focused particularly on the CAFFG project, for which 36 relevant documents were reviewed. This facilitated an assessment of the project's characteristics and performance as well as of the degree to which these efforts are affecting the practices of disaster reduction at the country-level.

- *Key interviews with informants at WMO, the OFDA Regional Centre and INM Costa Rica*. These interviews provided both context and specific feedback related to CAFFG and other relevant OFDA activities. The interview data were key sources of information, providing data that would otherwise have been unobtainable through the document review.

Project Context

Central America is one of the most disaster-prone areas in the world. It is comprised of a diverse physical geography of high mountains, mountain valleys, rivers, floodplains, volcanoes, and large coastal areas on a narrow landmass bounded by the Pacific Ocean to the west and the Atlantic Ocean to the east. Its unique geological characteristics combined with its subtropical location predisposes it to a large number of natural hydro-meteorological and geological hazards, including hurricanes, floods, flash floods, droughts, landslides, earthquakes and volcanic eruptions (USAID 2012a; VILLAGRÁN DE LEÓN 2002).

Figure 21 Map of Central America

Disasters in Central America have continually increased over the past three decades at an estimated annual growth rate of 5%, from 101 catastrophic events in the decade 1970-80 to 418 events in the following two decades, from 1980-2000. Economic losses from disasters in the region from 1970-2002 exceeded $10 billion dollars, which is to say that in 32 years the region lost an annual average of more than $318 million (http://www.sica.int/cepredenac/contexto_reg.aspx). In light of these numbers, concluding that the Central American region is plagued with numerous and recurrently hazardous events of different scales is not difficult. As a result, the region has endured significant delays in the process of economic and social development (CEPREDENAC 2009). The following point illustrates some of the socio-economic results of these processes:

- A concentration in risk areas of highly vulnerable social groups with poor economic capacity and low resilience;

- Inappropriate land use and human settlements in hazard-prone areas such as along river banks and wetlands, combined with poor infrastructure and social services; and
- The impoverishment of rural areas and the gradual increase in the levels of threat through processes of environmental degradation.

Catastrophic flooding in the aftermath of Hurricane Mitch in 1998 caused one of the worst disasters in modern Central American history. This event caused enormous damage in terms of human, social, economic and environmental losses and significantly increased overall levels of poverty in the region. Estimated losses were equivalent to 30% of regional GDP and highlighted Central America's increasing vulnerability to the occurrence of natural hazards.

Following the impacts of Hurricane Mitch, USAID provided funding for the reconstruction of damaged infrastructure. NOAA and the US NWS also provided technology transfer, training and technical assistance to the meteorological and hydrologic services of the countries hardest hit by the event—Honduras, Nicaragua, El Salvador and Guatemala. USAID/OFDA also initiated a supplemental project in 2000 (known as the Central America Mitigation Initiative, or CAMI) to reduce the impact of natural disasters in the region by financing activities to increase the capability of regional, national and community authorities and organizations to forecast, respond to and prevent future hazards from tipping over into disasters (USAID 2005; 2011; IRG 2003).

Figure 22 From right to left: Satellite picture of Hurricane Mitch, Trajectory over Central America and Damages.

To coordinate the implementation of an early warning system for flash floods in the region, the Hydrological Research Center (HRC), a non-profit corporation located in San Diego, California, developed a concept for the implementation of a Flash Flood Guidance System (CAFFG) for the region. This system would, they proposed, be used as a diagnostic tool by regional NMHSs as well as by disaster management agencies to develop warnings of flash floods. The purpose behind this initiative was to improve government, private sector and public responses to flash floods (Jubach 2011b; Alfaro 2011; Quirós 2007).

For Central American countries, access to flash flood early warning technologies, though such technologies have grown more effective and available in recent years, remain difficult because of human and financial resource limitations. Implementing effective warning systems in the region would, however, provide a significant tool for producing warnings in a timely manner.

Overview:

The CAFFG program is designed to provide seven Central American countries—Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama—with operational meteorological and hydrological services that enable them to provide effective flash flood warnings for small river basins. It is an initiative that addresses the need to provide early warning for potentially devastating flash floods in the Central American Region. The program was funded by USAID/OFDA, and its technical implementer was the HRC, with support from NWS.

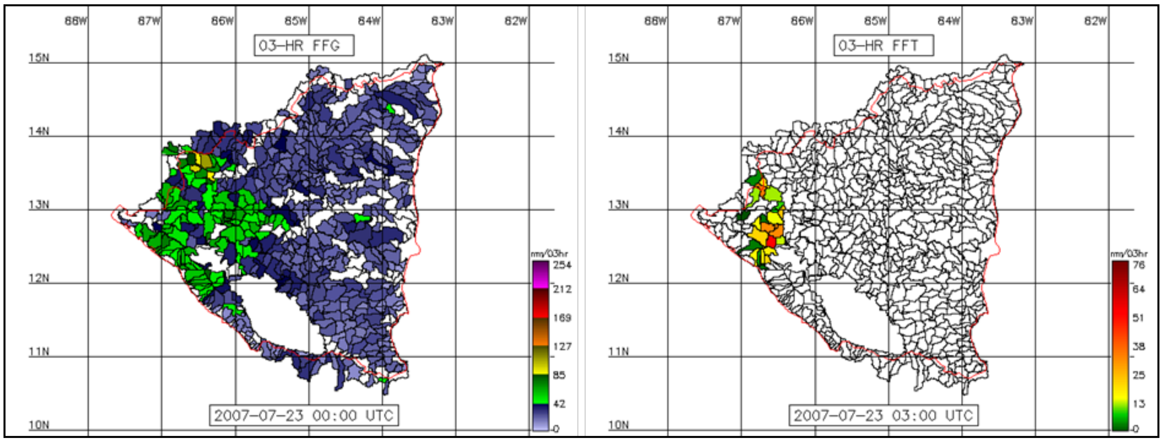
CAFFG estimates Flash Flood Guidance (FFG) based on calculations that estimate the volume of rainfall over a given duration (i.e. 1-6 hours) that would, under certain initial soil moisture conditions, generate bank full flows at the outlets of each basin. If the expected rainfall from an event is forecast to be higher than a predetermined FFG value, then a Flash Flood Threat is generated and the issuance of a warning is considered (Jubach 2011a).

The system is primarily based on data acquisition from satellites, radar and various meteorological station networks (NOAA 2010). Importantly, however, CAFFG also uses local information about precipitation, stream flows and flash flood-prone areas, with FFGs being calculated every six hours for stream basins between 100-300 km^2. A physically-based hydrological model is run every six hours to simulate soil moisture for the region and to determine the nature of the FFG. Graphical and text rainfall, soil moisture, FFG and flash flood threat products are then created and posted to the Internet for access by NMHSs for analysis and dissemination to disaster preparedness response agencies in the seven Central American countries involved in the project.

Real-time rainfall data pass through a quality control model to adjust for biases in the remotely sensed data on the basis of real-time and daily on-site rain gauge information. The result of this model is a merged hourly rainfall product, estimated as a mean areal rainfall value over the small watersheds that cover the Central America region (areas of 100-300 km^2).

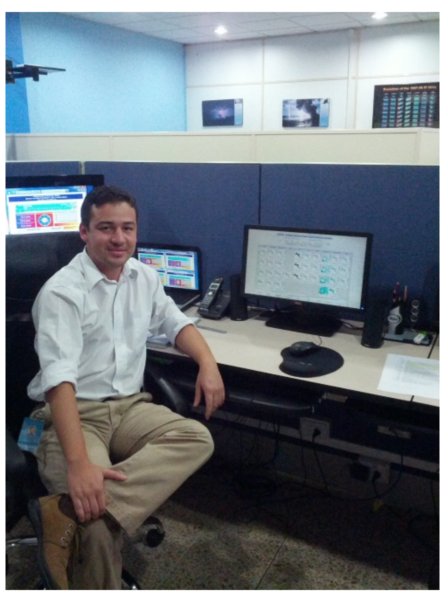
CAFFG uses a soil moisture model that runs on a 6-hourly basis and determines the real-time soil moisture conditions to estimate a threshold runoff. Soil moisture deficits and threshold runoff estimates are used in the flash food guidance model to produce the volume of rainfall of a given duration that is necessary to initiate flooding (i.e. bank full flow) in the small watersheds.

Figure 23 Example of a Flash Flood Guidance (left) and Flash Flood Threat (right) for Nicaragua (July 23, 2007)



The CAFFG Center is located at the IMN (Instituto Nacional de Meteorología) in San José, Costa Rica and charged with the centralized acquisition, standardization and archiving of real-time data products throughout the entire region. All products are disseminated to other national meteorological and hydrological services (NMHSs) and response agencies as appropriate, via the Internet, which basically requires that countries acquire and maintain little more than a PC and an Internet connection.

Figure 24 Using CAFFG at the IMN in San José, Costa Rica



The CAFFG system is composed of two servers installed at IMN in San Jose, Costa Rica. The CAFFG Processing Server (CPS) collects and standardizes numerous real-time data products, evokes various models to produce FFGs and publishes outputs to the dissemination server (CDS). The CAFFG Dissemination Server (CDS) provides login-restricted, secure Internet and SCP (secure and encrypted data transfers) access to various national data products for all CAFFG-participating National Meteorological and Hydrological Services (NMHSs).

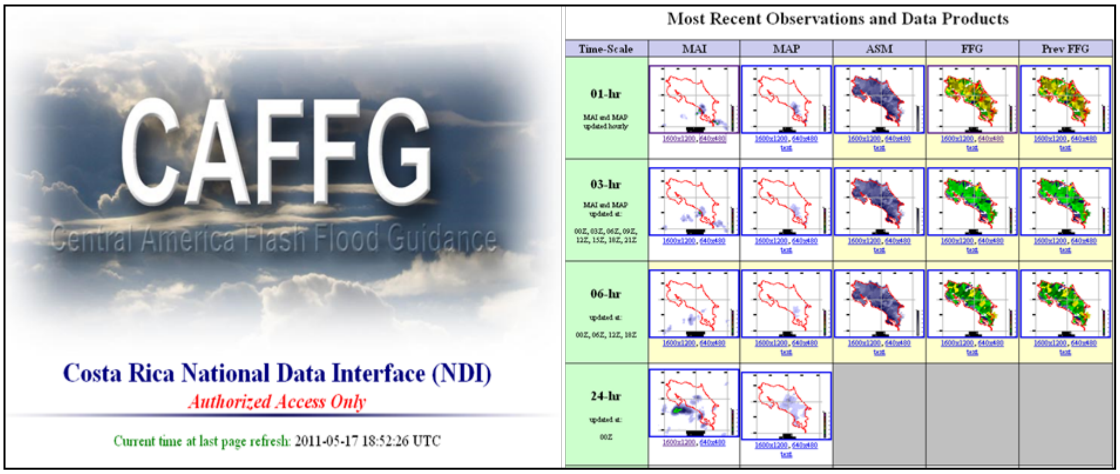
CAFFG is also a mechanism for capacity building for the NMHSs as well as for the national disaster management services. Through the development of technical tools and protocols for implementation, training and capacity building are provided on the use of the data and products. A web-based online training system was also developed together with some workshops and a training course that was held at the HRC headquarters in San Diego, CA.

CAFFG was operationalized in 2004, and since that time several evaluations and upgrades have been made. In 2006, for example, the project was presented at the International Workshop on Flash Flood Forecasting that was organized by WMO and NOAA/NWS. This workshop was intended to help address the strong need for global, remote sensing-based solutions to flash flood problems throughout the world and especially for helping to resolve these issues in developing countries (WMO 2007; 2011). In 2011, CAFFG underwent an important upgrade (OFDA report FY 2011), which included replacement of the existing server at IMN, updating of several models and databases, implementations of new models into CAFFG as the WRF (Weather Research and Forecasting Model) and improvement in training products (Martinez et al. 2012). Since then, CAFFG has been included into a flash flood global initiative (GFFG) that has been developed in partnership with the WMO (Georgakakos et al. 2013).

Although CAFFG was not designed to be a forecast method, the system does enable NMHSs to use other local now-cast/short-term-forecast methods to issue warnings.

Local forecasters can even make slight adjustments based on local circumstances. In fact, the system was originally designed to enable coupling with existing or developing NMHS approaches on national or even local scales.

Figure 25 Some Views of the CAFFG Restricted Operational Website



Overall Assessment of the Project

The CAFFG system aims to enable a close integration of meteorology and hydrology in real time, considering local information and expertise, to increase the potential for reliable warnings of flash floods in small basins. It should serve as a catalyst in the development or improvement of flood warning protocols in the CA region and have a long-term impact on disaster reduction policies.

The main objective of the project was to develop a concept for the implementation of a CAFFG that could be used as a diagnostic tool by NMHSs and disaster management agencies in the region to develop early warnings for flash floods. The primary purpose was to improve regional responses to the occurrence of flash floods. CAFFG was specifically designed to be incorporated into NMHS operations and used along with other available data, systems, tools and local knowledge to aid in determining the near-term risk of flash floods in small streams and basins. At the completion of the project, these objectives were basically met.

The system is currently operational for each of the seven countries in the Central America region. It is available to meteorological and hydrological services and can be used as a tool to analyze weather-related events (e.g. heavy rainfall, rainfall on saturated soils, etc.) that can lead to flash flooding. Rapid evaluations of the potential for flash flooding in specific locations can now be made across the region.

In general, any satellite-based tool to develop warnings is allied to expert analysis. In this sense, CAFFG provides significant amounts of information that can be used, together with experience about local conditions, for creating more complete and timely products in regard to the analysis of flash flood hazards and the issuance of products for early warning.

Effectiveness

In 2007, the Commission for Hydrology of WMO proposed eight criteria that needed to be met for an FFGS to be able to provide advanced warning for situations that are likely to lead to quick-onset flooding. Such warnings, it is thought, can then provide additional lead-time for NMHSs to monitor situations and provide improved flood-forecasting services. According to the WMO's report, FFGS need to be:

- Scientifically sound;
- Technically and operationally robust;
- Current in terms of observational as well as data and information communications;
- Tested and verified according to appropriate standards;
- Inclusive of NMHSs in the process of development and implementation;
- Demonstrably valuable to operational flood forecasting at regional, national and local levels;
- Accompanied by capacity building exercises like trainings; and
- Reviewed on a regular basis.

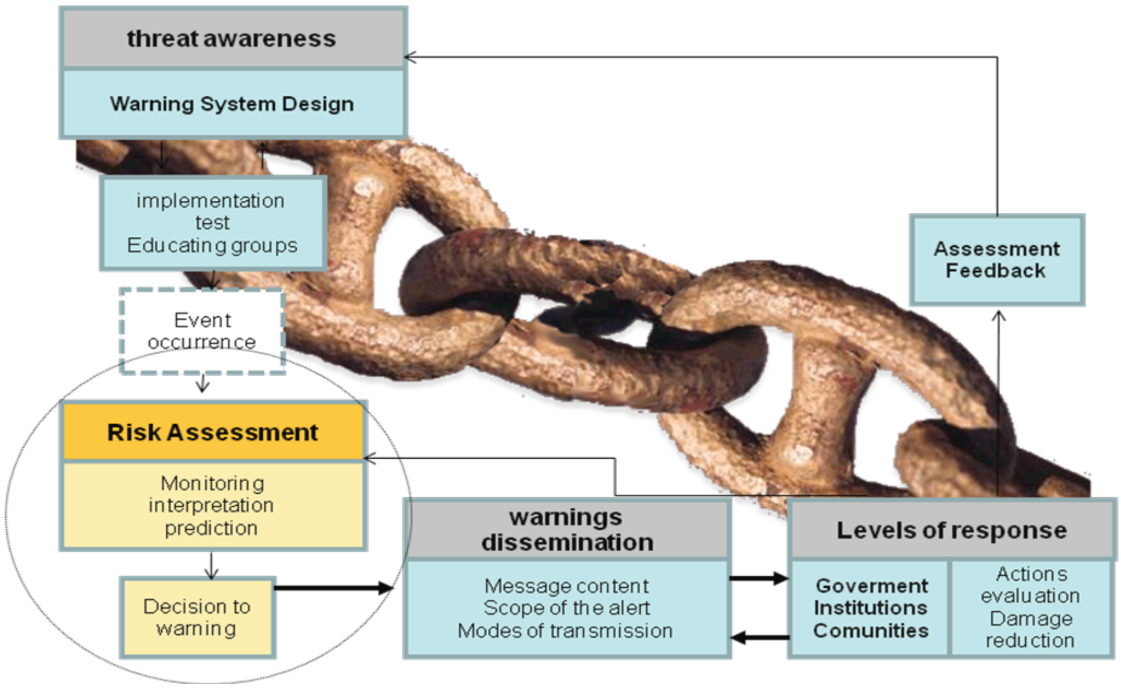
Since its implementation in 2004 and in recognition of its expected long-term goals, the CAFFG project can be assessed as basically successful in fulfilling these criteria. In fact, CAFFG has the unique characteristic of being the world's first regional flash flood guidance system. As such, it now provides operational guidance through the issuance of both regional- and small-scale products to all countries throughout the Central America region. CAFFG also makes use of leading technology with a fully automated real-time operation that disseminates products to member countries via the Internet. Finally, it has maintained a sustainable training program through the years.

Some findings:

- CAFFG is a major scientific undertaking that requires a strong technological transfer mechanism for low-income countries. As such, it sets an important standard for regional cooperation and tends to break down existing barriers in addressing rapidly evolving hydro-meteorological events. Although CAFFG has been operational for nearly a decade, it still has work to do to develop to its full potential and to have a discernible impact on risk reduction policies through the improvement of early warning systems.

- The main goal of implementing an E2E global flash flood warning system is still to be met. For this to happen, better understanding of the application of flash flood guidance for warnings, of local conditions and of how best to work more closely with local and regional disaster agencies through collaborations and joint training programs are necessary next steps to be taken.

Figure 26 Schematic Representation of a EWS Chain Showing the CAFFG Area of Action (encircled). By Lino Naranjo, 2011



- The uses of CAFFG products have been irregular and differential in each country. Only Costa Rica is operating CAFFG close to its full potential as an early warning tool. This disparity is basically due to persistent differences among regional NMHSs in the structures and levels of technical development. Also, important differences exist in their links to disaster prevention agencies. In a workshop in San Jose (2011), for example, the critical role an NMHS should have in the development and improvement of CAFFG was clearly established; differences between each countries NHMS office can, however, lead to significant biases in achieving adequate regional integration. More active participation from WMO in the program could help mitigate, if not eliminate, at least some of these gaps.

- CAFFG is an adaptation of the existing system that is operational in the US. Flash floods are local phenomena that develop rapidly, so reliable warnings for communities depend on strong and fast communication that are networks focused on the local level. Even though regional centers can produce flash flood guidance estimates at high resolutions and disseminate these estimates to NMHSs, appropriate means for communicating to individuals in local areas who will actually use the warnings subsequently issued by NMHSs is crucial if timely steps in emergency management are to be taken. This point constitutes an important difficulty that needs to be overcome in the Central American region, where end users of forecast products and warnings are still often insufficiently linked to what is too often still an end-to-end and not an end-to-end-to-end early warning chain. The point is that end users are vital linkages whose technological deficiencies must be considered along with their feedback about how useful the products they receive actually are to them.

- While until now validation results for the CAFFG system have been promising, these results are but a first step towards solving the flash flood warning problem in Central America. To be sure, fruitful areas for improvement still exist. In general, the CAFFG system produces very satisfactory outcomes; however, because they are the result of a set of models and remote sensing estimates, these final products must be constantly reviewed, further validated and regularly upgraded. Persistent problems include high values of false alarm rates, problems in obtaining adequate climatological data and the need for more reliable hydrological characteristics in some basins. Thus, ensuring that institutional and financial mechanisms are in place to sustain the initiative in the long run is important, especially by trying to increase national capacities and by instilling a sense of ownership in each NHMS to work actively at making these improvements.

- Although CAFFG was operational as early as 2004, it underwent a major upgrade in 2011 when it was first sponsored by WMO. Actually, however, it should be thought of as a project still under development and with much work to be done if it will meet its regional goals.

- Essential to improving CAFFG, apart from improving models and remote sensing estimators, will be the continued development of a reliable, real-time hydro-meteorological observation network, which remains deficient in Central America.

- During the development of CAFFG, a consistent training policy mainly focused on NMHSs technical staff was maintained. Although some further efforts have been made, training "outwardly" to stakeholders and policymakers still needs to be improved. Raising awareness about the real potential of this system in order to avoid false expectations and to ensure strong institutional support in these social sectors is important. CAFFG has significantly increased each country's potential to improve its EWS; this potential does not by itself, however, ensure a better EWS, which is also dependent on social action and government involvement.

- The CAFFG Dissemination Server (CDS) provides login-restricted, secure Internet and SCP (secure and encrypted data transfers) access to various national data products for all participating NMHSs. The use of restricted web access prevents a more participatory system, however, very much diminishing the possibility of open-sharing of information among national stakeholders.

A final point, regarding that final bullet, is that CAFFG was designed to be a "closed" system that does not give NMHSs the chance to make changes or upgrades. This design decision will continue to negatively influence the performance of CAFFG, especially as some of its components become obsolete as the NMHSs make improvements to their own technological capabilities. As an example, Costa Rica is currently developing new techniques and models to make its forecasting more reliable. Although CAFFG could be positively upgraded to include some of these findings, which would likely improve its overall performance in the region, Costa Rican forecasters are not authorized to make changes to the software even though they are quite capable of doing so in terms of level of expertise. As a result, INM currently uses CAFFG only partially, relying more on their own products which, in turn, increasingly enlarges the gap between their own and

CAFFG's products, ironically challenging the very idea that CAFFG is a regional service provider.

SWOC Analysis:

To identify strengths, weaknesses, opportunities and constraints in a selected hydro-meteorological DRR activity is fundamental, if conclusions are to be consistent and lessons that can be used to develop future DRR and CCA programs are to be identified. Information obtained in this review can be usefully summarized in the form of a SWOC analysis:

Strengths

- OFDA support for CAFFG has enhanced collaborations among NHMSs in Central America.
- OFDA support has made possible a strong technological transfer mechanism from American institutions to low-income countries in the CA region.
- Some tools introduced by OFDA during the project provided capacity building elements that improved the skills of expert in NHMSs in Central America.
- Costa Rica, considered the leader in the region in terms of the dissemination of forecasts and warnings to users, works well with supporter institutions (HRC, NOAA, etc.).
- CAFFG has generated a significant increase in the potential of countries in the CA region to improve their EWSs.
- OFDA support has promoted a consistent training policy that is mainly focused on NMHS technical staff and that has been well maintained, including through an online training module.

Weaknesses

- Significant disparities in forecasting and dissemination capacities between nations in the region persist.

- The CAFFG project did not strongly promote interdisciplinary interactions. OFDA actions should work more closely with local and regional disaster agencies through collaborations and joint training programs.

- Project objectives have been focused only on a part of the EWS chain, so a primary goal of implementing a complete EWS is still unmet.

- Levels of responses, public awareness and resilience have not been properly addressed through the program, which is centered only on technical issues and skill development.

- CAFFG is a "closed" system with no chance for NMHS experts to make changes or upgrades. No tools exist to prevent components from becoming obsolete, a weakness that could be addressed by enabling NMHSs to make improvements in the overall technological capabilities of the system based on their own, ongoing research.

Opportunities

- The quality of forecasts should improve significantly in the near future.

- Stability in the regional directive at the LAC-OFDA Regional Center favors development of long-range strategies.

- Mechanisms for regional integration in terms of disaster prevention already exist.

- Demand for weather and climate information by users continues to increase, as awareness of changing climates and disaster risk become more generalized among the general public.

- Local knowledge can be used to improve DDR activities and to foster integration between scientists and local communities. Future projects should reflect a multidisciplinary approach based on a coordinated effort with national agencies and stakeholder.

- Most of the region has stable and functional governance.

Constraints

- Real-time hydro-meteorological observation networks are deficient in the region; yet, it is, along with improving models and remote sensing estimators, essential to improving forecasts.

- Education is not perceived yet is an important component of EWSs, so educational initiatives on DRR are lacking.

- High levels of poverty persist in more vulnerable, flood-prone areas.

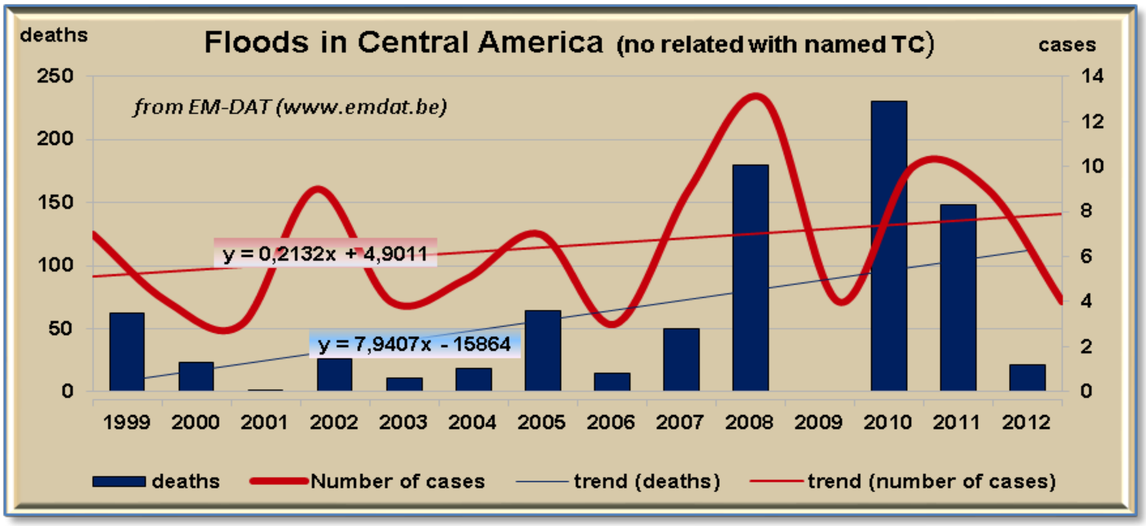
- Some countries in the region are perceived as having high levels of corruption.

- There is a lack of trained personnel, core infrastructure and adequate resources in terms of DRR.

Concluding Remarks

Figure 8 shows trends for both flooding and deaths related to hydro-meteorological events (other than named tropical cyclones) in Central America for the period 1999-2012. This figure was elaborated using information obtained through the International Disaster Data Base, a service of CRED (www.emdat.be). Over the past 15 years, the frequency of flood events in the CA region has increased; even more worrying, however, is that the number of fatalities from floods in that same period also increased sharply. This trend could have many causes depending on a number of multifactorial internal and external issues. The reality is that whatever positive achievements have been made from efforts like CAFFG to improve people-centered EWSs in Central America, the ultimate goal of these efforts seem to remain out of reach.

Figure 27 Flood-related Deaths in Central America



CAFFG represents a huge technological effort to increase the capacity of NMHSs to issue early warnings for hydro-meteorological disasters. This type of project, however, despite its importance, often falls short of fully achieving its ultimate goal (the "what ought to be"), mainly because it is focused only on a part or section of the EWS chain of action that corresponds to the detection, monitoring and prediction of HM hazards. As such, levels of response and public awareness and resilience are not adequately or often even appropriately addressed because they are not considered technical issues and are therefore usually nominally dealt with or even excluded from project planning. In this way, an important gap is created and consistently enlarged, which, paradoxically, puts the ultimate goal of systems like CAFFG at risk of being unachievable. This gap must be filled post-haste. Working on capacity building within risk management institutions is important, among policy makers and in the general public to help understand the information available in forecasts and warnings, their strengths and weaknesses and their role in decision making processes.

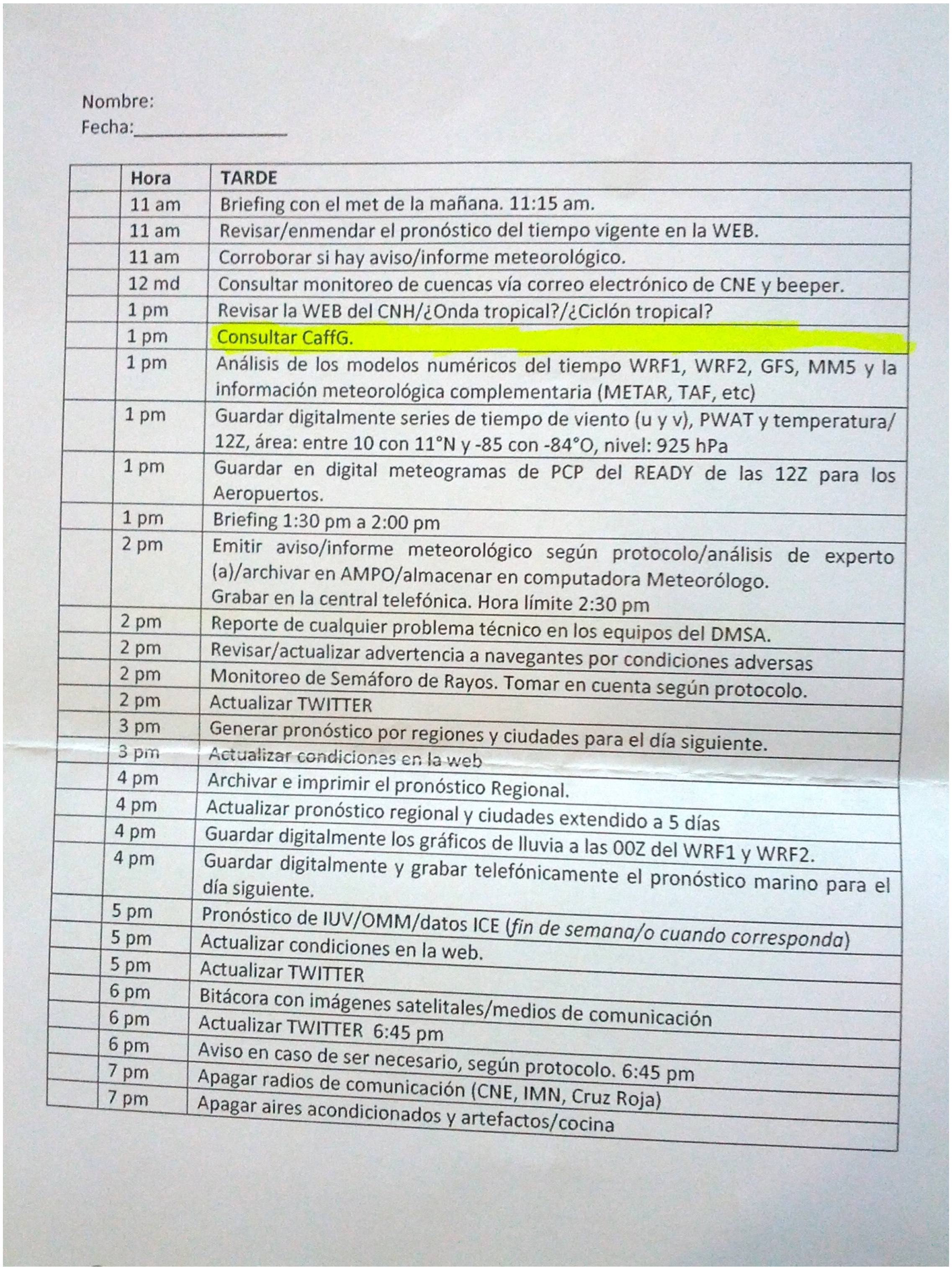
Also highly desirable is that future OFDA funded projects be established not only according to the interests and expectations of the great scientific and technological centers in the United States. Such projects, importantly, must better reflect the multidisciplinary nature of issues and approach them based on a coordinated effort between national agencies and stakeholders to use and improve national technical and scientific potential and to consider the social background of each country involved in its regional projects.

OFDA disaster assistance is to varying degrees also directed at the creation of capacities in each country to reduce its vulnerability, increase its resilience and enable the development of adequate response levels that require progressively less foreign support. Thus systems like CAFFG that clearly reflect this concept must be completely open to collaborative interactions with national and local experts, the goal being that those experts would ultimately take control of the development and maintenance of the system. In this way, assistance becomes a key but ephemeral part of an actual technological transfer process that ends with national or regional self-sufficiency and ownership of the activity well after OFDA's support has ended.

CAFFG's operational website was designed both in Spanish and English. From the seven countries involved, only Belize is English speaking; the other six are Spanish speaking. Language management of the system could also be improved by giving the primary languages of the primary users (Spanish in this case) a more extensive role. Most of the documents, presentations, etc. for CAFFG still use English as the first language, as do the more relevant training activities, which require national specialists to travel to the United States and to be trained in English.

Language is much more than a way to communicate, however. It is a way to really understand how people are and how they think. Projects in the future should take much more care to utilize national languages and cultures and try to involve as many elements of national realities as possible. In this sense, the LAC-OFDA regional office has enacted a very appropriate policy concerning language and culture with respect to its operational task forces, a philosophy that should be extended in the implementation of future projects in the region and perhaps elsewhere as well. Obviously, Central America, with a strong cultural integration due to historical circumstances, represents a unique case in the world; however, projects will likely have a better chance of success, the more aligned they are to the national culture in which they are being implemented.

Figure 28 Facsimile of the IMN Protocol for its Daily Operational Activity Showing CAFFG (highlighted) as one of the tools.



Nombre:
Fecha:________________

	Hora	TARDE
	11 am	Briefing con el met de la mañana. 11:15 am.
	11 am	Revisar/enmendar el pronóstico del tiempo vigente en la WEB.
	11 am	Corroborar si hay aviso/informe meteorológico.
	12 md	Consultar monitoreo de cuencas vía correo electrónico de CNE y beeper.
	1 pm	Revisar la WEB del CNH/¿Onda tropical?/¿Ciclón tropical?
	1 pm	Consultar CaffG.
	1 pm	Análisis de los modelos numéricos del tiempo WRF1, WRF2, GFS, MM5 y la información meteorológica complementaria (METAR, TAF, etc)
	1 pm	Guardar digitalmente series de tiempo de viento (u y v), PWAT y temperatura/ 12Z, área: entre 10 con 11°N y -85 con -84°O, nivel: 925 hPa
	1 pm	Guardar en digital meteogramas de PCP del READY de las 12Z para los Aeropuertos.
	1 pm	Briefing 1:30 pm a 2:00 pm
	2 pm	Emitir aviso/informe meteorológico según protocolo/análisis de experto (a)/archivar en AMPO/almacenar en computadora Meteorólogo. Grabar en la central telefónica. Hora límite 2:30 pm
	2 pm	Reporte de cualquier problema técnico en los equipos del DMSA.
	2 pm	Revisar/actualizar advertencia a navegantes por condiciones adversas
	2 pm	Monitoreo de Semáforo de Rayos. Tomar en cuenta según protocolo.
	2 pm	Actualizar TWITTER
	3 pm	Generar pronóstico por regiones y ciudades para el día siguiente.
	3 pm	Actualizar condiciones en la web
	4 pm	Archivar e imprimir el pronóstico Regional.
	4 pm	Actualizar pronóstico regional y ciudades extendido a 5 días
	4 pm	Guardar digitalmente los gráficos de lluvia a las 00Z del WRF1 y WRF2.
	4 pm	Guardar digitalmente y grabar telefónicamente el pronóstico marino para el día siguiente.
	5 pm	Pronóstico de IUV/OMM/datos ICE (*fin de semana/o cuando corresponda*)
	5 pm	Actualizar condiciones en la web.
	5 pm	Actualizar TWITTER
	6 pm	Bitácora con imágenes satelitales/medios de comunicación
	6 pm	Actualizar TWITTER 6:45 pm
	6 pm	Aviso en caso de ser necesario, según protocolo. 6:45 pm
	7 pm	Apagar radios de comunicación (CNE, IMN, Cruz Roja)
	7 pm	Apagar aires acondicionados y artefactos/cocina

Figure 29 Example of an Operational Flash Flood Warning Disseminated on April 22, 2013 by the IMN

Aviso Meteorológico

Aguaceros intensos con tormenta eléctrica en el Valle Central esta tarde

22 de abril de 2013
11:30 a.m.

Esta mañana se presentaron temperaturas altas en el Valle Central, lo cual sumado al ingreso de brisa marina desde el Océano Pacífico, son condiciones propicias para que se generen aguaceros intensos acompañados por tormentas eléctricas y fuertes vientos.

Inicialmente las zonas con mayor probabilidad de afectación por dicha actividad lluviosa serán las cercanías de las montañas de Heredia y Alajuela, así como en los alrededores de Escazú, Santa Ana y en general las zonas al oeste del GAM.

Por otra parte, se prevén aguaceros de variable intensidad en la Península de Nicoya y el Pacífico Central y Sur. EN lo que respecta al Caribe y la Zona Norte, estarán con nubosidad de parcial a total y lluvias aisladas en las montañas.

El IMN recomienda precaución por posibles inundaciones repentinas en el Valle Central y algunos puntos del Pacífico. En caso de tormenta eléctrica cercana evite mantenerse en sectores abiertos, incluso si no está lloviendo. Precaución por reducción de visibilidad debido a la formación de bancos de neblina. Además recomienda extremar la vigilancia en lugares cercanos a ríos y quebradas ante el posible incremento en los caudales de los mismos.

Eladio Solano León/Diego Garro Molina
Meteorólogos
DMSA-IMN

Case II

Reduce the underlying risk factors supporting "building back better" as a mitigation initiative: *Sourcebook on the Integration of Natural Hazards into the Environmental Impact Assessment Process and A Design Wind Speed Maps for the Caribbean for Applications with the Wind Load Provision of ASCE-07.*

[NB: Because of considerable delays in delivery from the OFDA office of relevant literature regarding Caribbean projects (received only after the editing stage of the surveys was in progress and close to the deadline), the following report is necessarily based only on documents and reports gathered in an extensive Internet search. No interviews were conducted and no direct interactions with involved institutions were possible, given time constraints.]

Overview

National governments and development agencies in partnership with USAID/OFDA have invested considerable effort in recent years to develop methodologies and tools that utilize hydro-meteorological disaster risk reduction design strategies, tactics and activities to screen development projects from the risks posed by climate change in the face of an uncertain hydro-meteorological future. These tools and their applications within actual, real-world settings remain quite limited, however. As such, a relevant approach to reviewing them is to examine the feasibility of incorporating consideration of Natural Hazard Impact Assessments (NHIA) within existing modalities for project design, approval and implementation. Environmental Impact Assessments (EIA) can be particularly relevant in this context by illustrating how natural hazard risk components can be enhanced and how useful mechanisms that enable the development review process to better encourage and promote designs that limit or reduce vulnerability to natural hazards, can be provided.

Among developing countries, Caribbean Island States have shown particular interest in the use of EIA as a tool to incorporate considerations of NHIA in projects. A key motivation for this interest has been their high exposure to extreme climatic events like floods and hurricanes, and the possibility that many of these hazards could be exacerbated by projected climate change (Agrawala et al. 2011). Social, political and institutional systems now face these hydro-meteorologically hazardous events so often that livelihoods and social, economic and physical infrastructure suffer physical damage, economic loss, dislocation and mortality as a result. As economic and population growth continue in the Caribbean, new developments exacerbate existing hazardous conditions and vulnerabilities. In fact, some institutions and governments already recognize the value and need to use EIA as a tool to adapt to climate change.

At a regional level, the Caribbean Development Bank (CDB) and CARICOM (2004) have moved forward and proposed that member countries of the CARICOM should consider the impacts of environmental change on projects in the EIA process. These institutions have provided, in partnership with USAID and the Canadian International Development Agency, guidelines related to how CARICOM member countries could proceed to integrate NHIA, developing the *Sourcebook on the Integration of Natural Hazards into the Environmental Impact Assessment (EIA) Process*.

This sourcebook is a compilation of mechanisms for assessing, within EIA, potential interactions between a proposed project and natural hazards. The combined process is referred to as Natural Hazard Impact Assessment–Environmental Impact Assessment (NHIA-EIA). The sourcebook presents a generic approach to the NHIA-EIA process that can be adapted to existing EIA processes at national and regional levels. Furthermore, it addresses all natural hazards, including those associated with climate change. An NHIA is defined as:

> “A study undertaken to identify, predict and evaluate natural hazard impacts (from existing hazards as well as those which may result from the project) associated with a new development or the extension of an existing facility. This

is achieved through an assessment of the natural hazards that are likely to affect or result from the project as well as an assessment of the project's vulnerability and risk of loss from hazards. An NHIA is an integral component of and extension to the environmental review process and EIA in that it encourages explicit consideration and mitigation of natural hazard risk" (ProVention Consortium and Caribbean Development Bank, 2007).

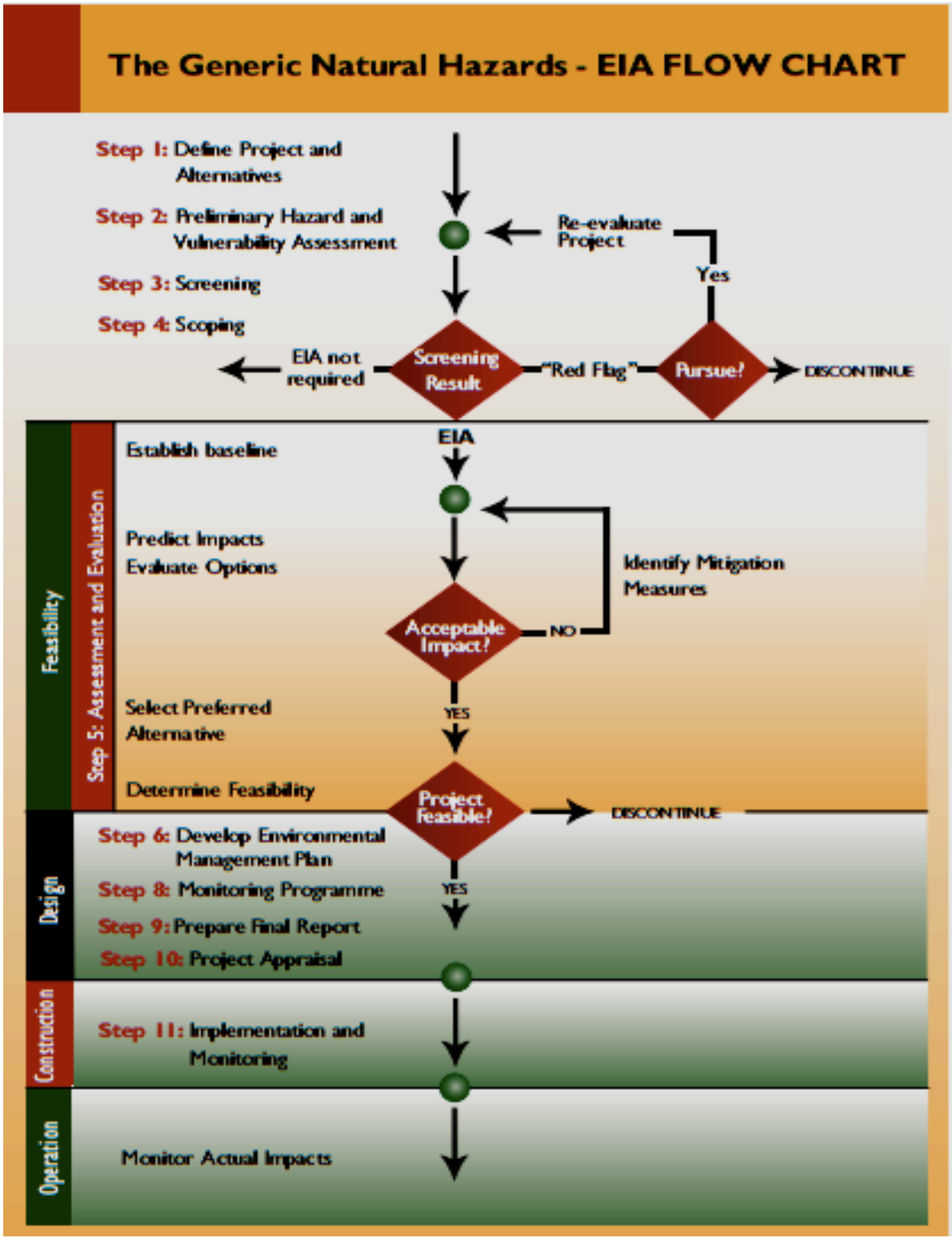
The target audience for the Sourcebook includes EIA practitioners and reviewers at the national and regional levels in the Caribbean. Importantly, it is not meant to be a guide to the full EIA process. Rather, it focuses exclusively on interventions into the EIA process that are necessary to ensure that natural hazard risk considerations are appropriately addressed (CDB/CARICOM, 2004).

The main body of the sourcebook is divided into four sections:

- Section 1: Overview of the NHIA-EIA process as well as brief descriptions of prevalent natural hazards in the Caribbean.
- Section 2: Generic EIA process identifying how natural hazard risk considerations should be addressed in each step of the generic process.
- Section 3: Cumulative impacts from multiple natural hazards or from inter-hazard exacerbations.
- Section 4: Special considerations for the incorporation of natural hazards into existing EIA process at the national level within the Caribbean.

Additionally, the Sourcebook is complemented with 12 Annexes containing information relevant to HMIA.

Figure 30 Generic Natural Hazard-EIA Flow Chart

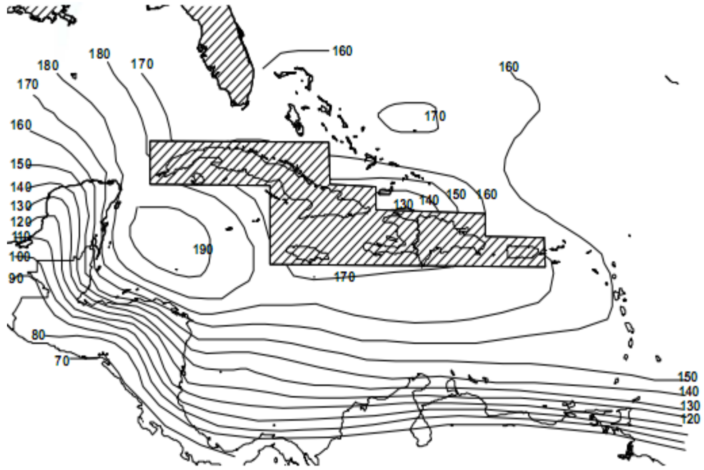


Source: CDB & CARICOM (2004)

A critical factor for the success of an NHIA-EIA is the availability of sufficient information to permit full and accurate assessment of natural hazard-related factors. In this regard, particular attention needs to be paid to hurricane winds, which are one of the main hazards that do damage to structures in the Caribbean. Engineers in all Caribbean countries work on project designs to resist winds, and therefore, confidence in wind hazard information is important to designers. Clients sometimes also wish to specify levels of safety for their facilities, a capacity that is critically dependent on the quality of hazard information. Many Caribbean countries also use the codes of the American Society of Civil Engineers (ASCE 7-05) when dealing with wind loading standards; however, ASCE-7 was written for the U.S., which of course has both hurricane and non-hurricane prone regions.

In 2008, the Pan-American Health Organization, under a special grant from USAID/OFDA, developed the *Wind Speed Maps for the Caribbean for Applications with the Wind Load Provision of ASCE-07* (Vickery and Wadhera, 2008). This paper uses a hurricane simulation method to estimate design wind speeds for the Caribbean region and resulted in the development of wind speed maps for return periods of 50, 100, 700 and 1700 year. The model was validated through comparisons to historical observations of central pressure differences, storm headings, translation speeds and minimum distances of approach. The 700 and 1700 year return period wind speeds were given as design wind speeds for Category 2 and Category 3 & 4 structures, respectively. This study was intended to fill in the existing gap in the wind hazard guidance in NHIA-EIA for structural design purposes.

Figure 31 Contour for 700-year Return Period Peak Gust Wind Speed(mph) at 10 m height



Source: Vickery and Wadhera (2008)

Main Findings

- Projections of various aspects of hydro-meteorological hazards, mainly in the context of climate change scenarios, have different degrees of associated uncertainties. Larger scale spatial projections typically have lower uncertainty than those specific to a particular location. Quite often, the variables that matter most for project design, such as rainfall, wind and other extremes, are also associated with greater uncertainty. There may, therefore, be a risk of unnecessary or even counterproductive investments in altering project designs, if these uncertainties are not adequately considered.

Figure 32

Country	Formal EIA Mechanisms For Assessing Impacts of Climate Change?
Antigua and Barbuda	No
Bahamas	No
Barbados	No
Belize	No
British Virgin Islands	No
Cayman Islands	No
Dominica	No
Grenada	Yes
Guyana	No
Jamaica	No
St. Kitts	No
St. Lucia	No
St. Vincent	No
Trinidad and Tobago	Yes

- There is ample scope for enhancing the resilience of projects by employing NHIA-EIA procedures; however, the goal of incorporating NHIA into environmental assessments remains more an aspiration than an operational fact. Actually, in 2004 only two Caribbean countries had considered climate change as part of the EIA and even now the situation is a little different. Some bottleneck elements are the lack of availability of detailed information on historical records and the risk of unnecessary or counterproductive investments in project design.

- Some experts have questioned the suitability of EIA for promoting climate risk management. Klein et al. (2007) and Scott-Brown (2010) both argue that challenges persist in ensuring the quality, relevance and independence of EIA, especially in implementing their recommendations. In addition, the authors separately argue that EIA may fail to consider local perspectives, which are relevant for any climate risk assessments where local experiences could be a key asset for identifying relevant indicators and adaptation options.
- Modeling can be an important tool for overcoming the lack of climate information in NHIA. However, the need exists to make substantial and long-term investments in the provision of climate modeling as well as in establishing good communication

mechanisms between the scientific community and practitioners so that climate change information can be appropriately incorporated in EIA.

- A clear political commitment, strong institutions and appropriate governance are essential for integrating NHIA issues in development processes and for reducing environmental risks. Typically, these efforts face a lack of political and institutional support as some people see the NHIA-EIA as an impediment to development rather than a need.
- Awareness of the benefits of NHIA as part of the EIA processes is crucial. Environmental assessment is a costly exercise and disaster risk assessment can easily be ignored. Strong understanding and awareness of the potential importance of addressing disaster risk is therefore required to make appropriate judgments on its likely significance. At this point, a strong need exists for capacity building programs in NHIA-EIA directed toward policymakers and stakeholder.
- Persons conducting NHIA-EIA should possess qualifications, skills, knowledge and experience on natural hazards, hazard mitigation, climate change and climate change adaptation policies and measures. The same standard should be applied to government experts who review and assess EIA. In this case, capacity building programs remain crucial.
- Although the evaluation of environmental and social impacts is closely related in theory, their impacts are usually assessed separately with little or no integration through analytical evaluation processes. Moreover, it appears there are no clear environmental goals.
- Undoubtedly, NHIA-EIA procedures offer a vehicle for enhancing the resilience of projects to the impacts of HMH and climate change consequences, importantly improving hydro-meteorological DRR strategies; however, these actions typically fall under the auspices of financial entities, governments and institutions or companies linked to strong economic sectors such as tourism, which is an important industry in the Caribbean. Thus, whether USAID/OFDA’s future economic aid policies should continue to flow funds towards sectors with high economic power is questionable; in contrast, increasingly greater funding should be directed towards increasing resilience in the poorest and most vulnerable sectors of society.

SWOC

Identifying strengths, weaknesses, opportunities and constraints in a selected HMDRR activity is fundamental, if conclusions are to be consistent and lessons about DRR and Climate Change Adaptation program development are to be identified. The information collected can be summarized in the form of a SWOC analysis as follows:

Strengths

- OFDA support of NHIA projects has been directed to enhancing resilience of projects to the impacts of HMH and climate change consequences as an important vehicle for improving strategies on hydro-meteorological DRR.
- OFDA support of this kind of project makes possible the transfer of state-of-the-art technologies and modeling from American Institutions to the region to fill the lack of reliable climate information in Caribbean countries.
- Some tools introduced by OFDA during the project contained capacity building elements that improved the skills of experts in relation to EIA in the Caribbean.
- OFDA support on NHIA projects are directed towards improving intraregional cooperation between Caribbean countries and enhancing the role of regional integration entities such as CARICOM and the CDB.

Weaknesses

- Significant disparities between nations in the region exist in the development of NHIA-EIA tools and regulations.
- Limited integration of environmental and social impacts also means that projects do not strongly promote interdisciplinary interactions.

- Mechanisms are lacking to incorporate public opinion and concern regarding projects; although public consultation processes have usually been established within the EIA, in many cases the process continues to be focused on a one-way, E2E model of risk reduction as opposed to a model with a feedback loop from civil society to the forecasting community, i.e., E2E2E.
- Varying levels of response and public awareness and resilience in the region are not adequately addressed in this kind of project, which is mainly focused on technical issues.
- Usually, the variables that matter most for project design, such as rainfall, wind and other extremes, are also associated with greater uncertainty. A risk of unnecessary or even counterproductive investments in project design may, therefore, exist if these uncertainties are not adequately considered.
- EIAs are seen by some as an impediment to “development” rather than a necessary step for “appropriate development,” leading to some antagonism between stakeholders.

Opportunities

- Climate and other related models will likely improve significantly in the near future.
- NHIA -EIA procedures are being integrated into CDB instruments.
- Strong mechanisms of regional integration exist in the area and are focused on disaster prevention and on building resilience.
- Awareness is increasing about climate change and disasters in governments and across society.
- Awareness is increasing in terms of application of this methodology as a tool for routine incorporation of DRR into project cycles.
- There is an increase in demand for hazard maps and vulnerability assessments.

- There is stable and functioning governance in most of the region.

Constraints

- Reliable climate information is deficient in the region, which has been identified as the essential aspect of improving NHIA-EIA activities.
- Models do not always adequately compensate for the lack of empirical observations.
- Education is not yet perceived as an important component; there continues to be a lack of educational initiatives on DRR.
- Some countries in the region are perceived as having high levels of corruption.
- There is a lack of trained personnel, core infrastructure and adequate resources in terms of DRR.
- Bureaucracy has focused more on the approval of projects than on their long-term environmental management.
- There is a lack of clear, long-term environmental goals and objectives.

Concluding Remarks

USAID/OFDA financial support to HMDRR projects in Caribbean Small Islands has been directed to the mainstream of enhancing resilience to the impacts of hydro-meteorological hazards and disaster avoidance and climate change in terms of expected climate change scenarios of more intense hurricanes being generated in the area. With the strong tourist industry being the basis of small island economy, a great interest has been shown in incorporating hydro-meteorological DRR issues into future projects. At this point, much of the effort has been focused on supporting initiatives from regional institutions such as CARICOM, CDB and PAHO, which are working to include NHIA into the EIA of future projects and to improve standards for engineering design in the Caribbean. This line of action is challenging, however, because although these activities have an intrinsic strategic relevance for the Caribbean economies, the goal of incorporating NHIA into environmental assessments remains more an aspiration than an operational fact.

EIAs themselves have been very irregularly developed in the countries of the region, with significant disparities in the development of NHIA-EIA tools and regulations among nations persisting. Furthermore, an ethics issue arises from this analysis. Although the study of winds speed maps attempts to fulfill the interest of PAHO to improve the health infrastructure of the region, the overall project on NHIA-EIA was developed by the CDB, a financial entity which until 2012 was rated by Standard & Poor's (S&P) as 'AAA', a testament to the bank's high-performing loan portfolio and capital investment strength. In truth, the direct beneficiaries of such efforts as have been observed thus far in the region are all institutions or enterprises with strong ties to economic sectors such as tourism. As such, whether future economic aid policies from USAID/OFDA should continue to flow toward sectors already possessing such great economic power is questionable. Redirecting increasingly greater amounts of funds towards increasing resilience in the poorest and most vulnerable sectors of Caribbean island societies should become a priority.

General Comments

Obviously, analyzing strengths, weaknesses, opportunities and constraints from a sample of projects in one region is only a first step in the more involved task of identifying lessons and providing recommendations about DRR and CCA program development in the face of an uncertain hydro-meteorological future. This report should be seen as part of a wider study, which means that the results should be analyzed in a deeper way within a more comprehensive context, taking into account other projects and activities in different geographical regions and other social realities.

In this light, review of these projects did lead to several general insights that, although they are basically included directly or indirectly into LAC USAID/OFDA priorities for the next years, should be highlighted and developed in a more consistent way to assist and improve future strategies. These insights can be summarized as follows:

Encourage projects that foster international and regional cooperation: The LAC region has a strong vocation for regional integration and cooperation both in political and economic fields. Institutions and/or organizations such as OEA, UNASUR, MERCOSUR, CAN, ECLA, etc. promote collaborations and joint actions between countries in the region. Furthermore, other international organizations such as WMO, UNEP and EU, etc. are developing important actions in the region for increased prevention and mitigation of hydro-meteorological disasters. Many of the LAC OFDA efforts have been directed at broadening frameworks of international cooperation in support of joint initiatives with many of these institutions. Continuing this policy for hydro-meteorological DRR activities in the future is crucial, especially in the face of climate uncertainty in the region. Coping mechanisms have to be designed taking into account that projected impacts of climate change will have supranational, regional and even continental dimensions, which means that many isolated efforts may have low expectations for long-term success.

Institutionalize Higher Education in Hydro-meteorological DRR: USAID/OFDA, into its capacity building program for the LAC Disaster Risk Reduction Plan, 2012-2014, included the clear intention of supporting activities to assist universities in developing the DRR capacities of future professionals and leaders. This project is particularly needed in Hydro-meteorological DRR and CCA programs, where required long-term strategies can only be supported, if strong awareness and acceptance from policymakers and national leaders is achieved. Some accomplishments to this effect have been made in recent years both with funding from OFDA, including the DRR program at Florida International University (FIU), as well without OFDA support, such as the El Niño Affairs program ("Assunto de El Niño") developed by Guadalajara University. OFDA should continue to act as a catalyst by explicitly promoting such actions. Higher education in hydro-meteorological DRR should be centered in universities in the region and programs should be multidisciplinary focused. In this way, an educational concept called "Climate

Affairs" (Glantz 2003), which considers not only technical and scientific issues but also social and ethical ones, could provide a guide for continued development of such activities.

Encourage projects with more comprehensive vision: As is the case in many regions in the underdeveloped world, Latin American society shows a significant gap between the rich, the middle class and the poor (frequently composed largely of indigenous populations). Lack of adequate social welfare measures and inequity in the use of land and resources make poor people the most vulnerable to hydro-meteorological hazards. Every project in hydro-meteorological DRR should consider this reality: even the best "good technical project" that plans to design an EWS or increase resilience can fail to reach its goals, if it does not take into account social contexts. USAID/OFDA should encourage American Institutions to make proposals that are multidisciplinary, bringing together technological expertise with social reality to provide more security to the most vulnerable populations in the region.

Case Study: RANET

Context and Problems

Technology propels the science of meteorology forward and becomes the basis for operational services. The domain of Information and Communications Technologies (ICTs) or more generally communications technology is, however, quite broad, involving core infrastructure for data exchange, dissemination platforms, routine IT management, software development, and protocol and standards development. Of course, specific technologies can range from radio to satellite to internet to telephony. But technology is also rapidly evolving. Systems and skills provided today can be easily irrelevant in just a few years. The domain is always changing.

All the more challenging is that there are significant regional differences in how the public can and does interact in the "information age," which may not directly affect operational services but certainly does affect how the public receives and accesses the information produced by national services. The world of social media, mobile devices, and the like are challenging the technological community in still new ways. While new technologies, or more specifically the implementation of new technologies, certainly offer advantages, these advantages do not come without an often disruptive price in terms of operations and policy in the public provision of weather services.

At the core of regional and national meteorological, hydrological and climate services are, quite simply, communications and computing technologies. Capacity development of these technologies necessitates both development of ICT capacity in support of operations as well public dissemination and outreach.

The Project

RANET is an initiative of national meteorological services to improve rural and remote community access to basic forecasts, observations and warning information. Initial and continuing funding of the program has been provided by the OFDA through an interagency agreement with the NWS International Activities Office (IAO), though participant and other donor countries have and continue to provide funding as well as significant in-kind resources.

The RANET program grew out of the Regional Climate Outlook Forum (RCOF) of Africa, participants of which noted that the full potential of seasonal forecasts could not be realized unless there was an effort parallel to the RCOF that improved the information access of the rural poor. As a result, the RANET program's approach to the challenge of communication has been largely infrastructure based, focused on examining how best to move information from urban centers of production to remote areas that typically have limited information access due to their remoteness, lack of resources or both. Since its initial installation in Africa, the program has undertaken projects in various parts of the Americas, Asia and the Pacific region to provide training, establish pilot demonstrations and build various systems through such technologies as HF radios, mobile phones and community radios. Of course, web-based systems, satellite broadcasts and even satellite telephony have been included as these technologies have been introduced.

While the initial mission of RANET was to address rural and remote community access to information, the program has also worked on improving communication capacities that benefit the operation of meteorological services. Often this component of the system has been adopted out of necessity, as an NMHS cannot attempt to support rural and remote communities if it cannot reliably access the information it needs to generate products for the public. Additionally, regional warning centers for cyclones and tsunamis often also provide basic information to the system that is then further contextualized for sub-national dissemination.

Despite a technology and infrastructure focus, the RANET program traditionally values, and often relies on, efforts that address the social science aspects of communication, which stress use, understanding and application of information products within existing decision-making processes. Not only are there often-structural challenges involved in delivering information to individuals in difficult-to-reach areas, but such users must often also be actively engaged to really understand their own information needs and then learn to accept what they might initially see as being useful climate observations. In other words, moving information from point A to point B is not enough.

RANET has often also found that public warnings and alerts are actually not supported by many developing countries. The reality is that the very idea of a warning as framed in current DRR is in many ways a very Western notion that may not have the same sense of urgency in developing countries due to various factors. Such factors include: populations having more critical demands and needs (e.g. chronic hunger, disease, etc.); unclear national regulatory frameworks or ill-defined authorities and responsibilities for warnings; a lack of respect among communities for national or provincial governments, which typically host warning authorities; or simply the reality that slow-onset, complex hazards are often perceived as being less threatening than are quick-onset events such as floods, tsunamis or violent storms.

At its core, RANET is a small technology transfer program. Only in specialized cases, such as management of satellite broadcast capacities, does it operate entire systems. RANET began its activities at the time when the development community initially began addressing the 'digital divide' in the mid-to-late 1990s. Since then, the development and humanitarian communities have become more concerned with information access and knowledge management, having undergone several changes in focus (e.g. access for the sake of access, creation of information communities, and later development of specialized applications) along the way. In each phase, RANET has participated and learned from its own successes and failures. One of the program's advantages today is its longevity, considering that it has survived various changes in policy, approach and policy fads. In recent years, it has even been able to utilize some of the lessons of its earlier attempts at technology transfer to direct its future policies and iterations.

Main Lessons

- Capacity development in communications, and indeed most NMHS functions, is in essence a technology transfer initiative. RANET's approach, which emphasizes user driven perspective, small investments, and a high degree of decentralization, has enabled the project to explore solutions and identify NMHSs that are ready for assistance, all at relatively low costs. In short, it promotes community driven innovations that are evolutionary in nature. While capacity development through this approach has been slow, in general it is often less disruptive to operations, current policies and fiduciary capacities than other approaches might prove to be.

- Capacity development of NMHSs, and specifically services provided to the public, often assumes that improvements in products such as forecasts will somehow automatically benefit users. Users must, however, be engaged in order to determine if provided information is actionable and understandable.

- Lay users of meteorological information are innovative, and they often informally incorporate forecast information as well as ordinary knowledge into their decisions. Although community dialog is critical, the ability to conduct research and speak with numerous communities is impossible with inadequate funding.

- Remote training material is necessary if programs are to be scaled-up.

- Broadcast communications are still critically important, as telephony and point-to-point communications are still comparatively expensive for most national operations;

- Regardless of the reason, while the meteorological community emphasizes visually intensive products, the rest of the world seems to be moving towards short message platforms. Public adoption of short messages may therefore be forced by form factors, such as through mobile phones, or it may result from organically developed norms on social media platforms such as Facebook or Twitter. Even when images are utilized, they are often iconographic, quickly imparting a short message but not containing detailed information;

- Any general move to short form materials will require an increase in public outreach and education to ensure understandings of message meanings, of forecast jargon and of how further details can be accessed; and

- Multipurpose systems, while hard to coordinate and manage, are inherently more sustainable and often lead to growth without donor support.

About Lessons (Insights) from Existing Disaster Risk Reduction and Humanitarian Evaluations

Each year billions of dollars of humanitarian and development aid are distributed around the globe for projects ranging from immediate disaster assistance and getting life back to "normal" to diversifying livelihoods and promoting economic development. Given the number of humanitarian and development organizations at work and the vast resources they dispense, it is not surprising that many have conducted investigations of the degree to which their programs have achieved their goals. These studies are commonly called evaluations, assessments or compilations of lessons learned.

As a preliminary step in reviewing the lessons USAID/OFDA might learn from its own projects, looking to how other organizations structure and conduct their assessments makes sense. Three of the six evaluations presented here were not specific to DRR programs but were related to humanitarian or development aid more broadly. Nevertheless, better understanding the best-practices and insights of different sectors can still help OFDA take steps towards developing more comprehensive and effective systems for monitoring and evaluating its own projects. This review compiles information from six reviews of multi- and unilateral aid programs performed by both NGOs and government actors. These six reviews were selected to represent different organizations and sectors within development and humanitarian aid, as well as different approaches to evaluation.

In reviewing these documents, we address the following questions:

- Why do governments or agencies engaged in humanitarian assistance decide to conduct these reviews? What are their goals?
- What methods were used to conduct these evaluations?
- What evaluation criteria were used?

- What reporting requirements and procedures were used to facilitate evaluation?
- What did the reports discover?
- What important common themes are identifiable in these evaluations?

Overview of the Reports Consulted

This part of the report is based on information drawn and compiled from the following six studies that were carried out by other international agencies or NGOs. It provides a brief summary of each of the sources and links to other relevant documents to provide context to the discussion that follows.

- Catholic Organisation for Relief and Development Aid (2010). Programme Evaluation of Disaster Risk Reduction. Retrieved from https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CDAQFjAA&url=http%3A%2F%2Fwww.cordaidbondzondernaam.nl%2Fnl%2FProgramme-evaluation-Disaster-Risk Reduction.pdf&ei=QwwlUdTyEIPSqQGPkYGYBg&usg=AFQjCNG9qxLUvKKxiGNDsu VNkWAhqGwEjw

- UK Department for International Development (2011). Multilateral Aid Review. Retrieved from https://www.google.com/search?q=dfid+multilateral+aid+review&rlz=1C5CHFA_enUS503US503&aq=0&oq=DFID+mul&aqs=chrome.1.57j0l3.2841&sourceid=chrome&ie=UTF-8

- Federal Ministry for Economic Cooperation and Development (2011). German Humanitarian Assistance Abroad. Retrieved from http://www.auswaertiges-amt.de/cae/servlet/contentblob/610766/publicationFile/165378/Evaluierung_HH.pdf

- Swiss Agency for Development and Cooperation (2011). Disaster Risk Reduction in International Cooperation: Switzerland's Contribution to the Protection of Lives and Livelihoods. Retrieved from http://www.preventionweb.net/english/professional/publications/v.php?id=17901

- Swedish International Development Cooperation Agency (2008). Are Sida Evaluations Good Enough? Retrieved from http://www.oecd.org/derec/sweden/41390724.pdf

- Global Facility for Disaster Reduction and Recovery (2010). Evaluation of the World Bank Global Facility for Disaster Reduction and Recovery. Retrieved from https://gfdrr.org/docs/GFDRR_EvaluationReportVol-I.pdf

Catholic Organisation for Relief and Development Aid (Cordaid): Programme Evaluation of Disaster Risk Reduction

Cordaid is a Dutch relief agency that operates around the globe. The overarching goal of its programs is to "reduce the potential impact of disasters on communities" (Cosgrave, 2010, p.28). The Cordaid evaluation assessed programs in order to "gain greater insight into and understanding of the efficiency, relevance, and effectiveness of the Cordaid DRR programme and the best strategies for any future DRR programme" (Cosgrave, 2010, p.3).

Cordaid uses a community approach, in which the community is engaged in an analysis of the hazards they face and the identification of priorities for action. An action plan is then developed, and Cordaid may fund parts of the plan. Cordaid considers DRR a factor of institutions and EWSs, public awareness, disaster knowledge, physical risk reduction, and preparedness. Despite the bottom-up, community-driven approach to development, funding is allocated from a centralized, top-down agency. In practice, programs are more focused on risk-aware development and helping to build community organizations that could advocate for change.

UK Department for International Development (DFID): Multilateral Aid Review (MAR)

DFID conducted its multilateral aid review to help the organization make future funding decisions. In keeping with its economic focus, it evaluated the strengths and weaknesses of grantees, with particular attention to "value for money." Value for money is defined as achieving "the best possible results at the lowest possible cost in support of their mandated development of humanitarian objectives" (Cosgrave, 2010, p.5). The report states that, given variations in performance across organizations, reform of multilateral aid is a high priority for DFID.

Data for the MAR were collected through 2-4 day country visits in 10 countries. Staff from each aid agency, governments, partners, and civil society was interviewed. Data gathered for 10 different criteria were condensed to form two scales: contribution to UK objectives and organizational strengths. These scales were then combined to provide an overall assessment of value for money. Each organization was then rated on a four-point scale from poor to very good value for money. Those contributing to UK goals and demonstrating organizational strengths were assigned very good value, whereas others were labeled good, adequate or poor. Organizations were assessed individually but categorized according to their status as humanitarian organizations, multilateral development banks, organizations connected to the European Commission, private sector development organizations or UN organizations. This allowed for general conclusions to be drawn about the effectiveness of different kinds of organizations according to different criteria. Future funding decisions were made based upon the rating of each organization according to the two scales.

The explicit recognition of limited funding and the procedure for determining future funding allocations might be of interest to USAID. Interestingly, only those organizations that were deemed to be performing poorly according to DFID's criteria (and only half of those) were defunded. This tendency suggests that the evaluation may have been a means for DFID to compel greater accountability among grantees and to demonstrate that funding was not guaranteed.

An explanation of how the government made funding decisions can be found here: http://www.dfid.gov.uk/Documents/publications1/mar/Taking-forward.pdf.

Other documents, including the government's response can be found here: http://www.dfid.gov.uk/what-we-do/how-uk-aid-is-spent/a-new-direction-for-uk-aid/multilateral-aid-review/

Responses from the organizations that were reviewed can be found here: http://www.dfid.gov.uk/What-we-do/Who-we-work-with/Multilateral-agencies/Multilateral-organisations-responses-to-the-Multilateral-Aid-Review-/

Federal Ministry for Economic Cooperation and Development (BMZ): German Humanitarian Assistance Abroad

This report was the first exhaustive study of German humanitarian assistance. Its purpose was to improve governance in the specific fields of emergency and transitional aid abroad, which received 804.1 million euros between 2005 and 2009. The assessment meant to provide recommendations in five focus areas: 1) relevance and results of programs; 2) quality of management and interactions between the two German agencies related to development: the Federal Foreign Office (FFO) and the Federal Ministry for Economic Cooperation and Development (FMECD); 3) coordination with other donors; 4) suitability of funding channels; and 5) linking relief aid to development [Linking Relief, Rehabilitation, and Development (LRRD)]. The report consists of six country studies and was conducted by a team of independent evaluators who constructed an evaluation matrix and reconstructed the program logic for German humanitarian assistance on the whole. Only the executive summary is available online. For full report visit: www.bmz.de/en/publications/type_of_publication/evaluation/index.html#n2anker12681317.

Swiss Agency for Development and Cooperation (SDC):
Disaster Risk Reduction in International Cooperation:
Switzerland's Contribution to the Protection of Lives and Livelihoods

The SDC assessment focused specifically on DRR efforts funded to "[enable] countries to attain a higher level of safety" (SDC 2011, p.3). DRR is one of four strategic priorities of Swiss humanitarian aid, which, guided by the Swiss cultural focus on prevention, promotes preparedness through its programs. According to SDC, the goal of DRR is "less damage in terms of human and economic losses and less endangered livelihoods from future natural events" (SDC 2011, p.6). Like the HFA Framework, the SDC takes the position that DRR should be mainstreamed into all development and humanitarian projects; it therefore evaluated two separate kinds of programs: targeted DRR and efforts to mainstream DRR into other kinds of humanitarian and development assistance.

The evaluation assessed five targeted DRR programs and eight mainstreaming efforts in Nicaragua, Peru, Mali, Tanzania, Mongolia, Bangladesh, Tajikistan, and Georgia. Targeted programs were assessed based upon awareness building, capacity development, policy development, and actual reduction of risks. For each of these areas, assessments were made based on outputs, outcomes, and impacts. Reduction of risk was measured after a new event occurred by assessing whether damage was averted. In the absence of a new event, proxies (unspecified) were used. Mainstreaming efforts were assessed based upon six key areas: policy, strategy, country planning, project cycle management, external relations, and institutional capacities. These were developed to align with the goals in the HFA. Countries were scored on a scale of 1-4 in each category, though criteria for the scores were not provided. Overall, mainstreaming efforts were found to have developed differently in each of the eight countries.

Swedish International Development Cooperation Agency (Sida): Are Sida Evaluations Good Enough?

Sida conducts approximately 40 evaluations per year of its individually funded development and humanitarian initiatives. These are made publicly available on the Sida website. Information for this analysis was drawn from a meta-evaluation of 34 of those individual evaluation studies and was commissioned in order to improve the quality of Sida evaluations. The study is also part of Sida's general efforts to improve the quality of its programs through evaluation. This information was supplemented with criteria from Sida's extensive evaluation protocols, which are also available on their website (http://www.sida.se/English/how-we-work/evaluations1/What-is-evaluation/). Sida's evaluation guidelines can be found at http://www.alnap.org/pool/files/evaluation_manual_sida.pdf.

Evaluation of the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR)

In 2010, Universalia, an independent consultant, was commissioned to evaluate the first three years of GFDRR programming. The purpose of the evaluation was to assess performance, identify lessons and provide recommendations for improvement of the "business model." As an entity associated with the World Bank, the GFDRR represents a different kind of development actor in being more closely linked to the private sector than most NGOs. The GFDRR's strategic mission is to support implementation of the HFA and achievement of the Millennium Development Goals (MGDs). Given the HFA's emphasis on mainstreaming DRR into other areas of national policy and development, linking DRR to other sectors is a primary objective. The organization supports both preventive measures and disaster recovery.

The GFDRR requires that all programs receiving over $300,000 conduct independent evaluations within 3-5 years of implementation. It also requires regular evaluation of its overall activities, a requirement fulfilled by this report. Regular evaluations are meant to be formative, meaning that they are meant to assist in learning and development of the organization.

Other Evaluation Reports

In searching for relevant evaluations, several other reviews were encountered that have not been included in the detailed review for the sake of expediency and because of overlaps with existing reviews. Links to these reports can be found in the additional reports section below.

Review Goals

As indicated in the paragraphs above, most reviews were conducted with the intent of providing insight into program effectiveness so that they may be made more efficient in the future. The common interest in program improvement is logical given limited funding and widespread anticipation of greater need for disaster and humanitarian aid in the future especially in the face of a changing climate. In a variation on this theme, the DFID study was conducted in order to determine where to allocate future funding. It also explicitly describes which programs received more or less funding because of the evaluation. Similarly, the GFDRR sought recommendations to "optimize its use of resources" (GFDRR, 2010, p.1). As noted in several of the recommendations, making the evaluation criteria explicit and clearly linking performance to funding should help organizations better understand the metrics by which they are being evaluated and foster greater accountability in the future.

All organizations specifically mention the evaluation of outcomes and improvement as goals. Nevertheless, descriptions of precise outcomes are lacking because of difficulties in tracing changes to specific funding sources, a problem discussed in greater detail below. Consequently, most programs are forced to make general statements about the success of their programs.

Lessons From Methods

Apparent in the review of these reports is that despite having similar goals agencies take drastically different approaches to the evaluations of their programs. The following Table provides a summary of the methods used as outlined in the reports.

The diversity of methods used in each of these reports in some ways complicates comparative analysis; however, given the similarity of goals, evaluating which methods best addressed the common goals of providing insight and improving future programming was appropriate. The primary lesson to be learned through comparison of these reviews is that consistent, systematic and transparent methods are important to overall credibility. Consistent standards and the availability of individual program assessments also greatly enhance the credibility of results. The degree of rigor perceived across these studies varied considerably. Whether one agrees with the evaluation criteria used, both the Sida and DFID reviews stood out in their clear delineation of criteria and methods. In contrast, the conclusions reached by SDC and Cordaid would have been better supported by more explicit and systematic methods.

Table 17 Summary of Study Methods

Agency	Data Sources and Methods
Cordaid	• Interviews at the Dutch headquarters • Four country case studies (including observations, focus groups, community meetings and workshops) • Information collected at a Cordaid conference • A survey of Cordaid's partners.
DFID	• 2-4 day country visits (10 countries) in which staff from the aid agency, government, partners and civil society were interviewed.
BMZ	• Six country studies conducted by a team of independent evaluators. • The evaluators also constructed an evaluation matrix and reconstructed the program logic for German humanitarian assistance on the whole.
SDC	• The evaluation was made on five specific DRR programs and eight mainstreaming efforts. • It was unclear how data was collected.

Sida	• Meta-evaluation of studies conducted by independent evaluators as part of an overarching evaluation protocol. • Methods for individual studies varied, but all used the criteria set forth by Sida in policy guidance documents.
GFDRR	• The report used pre-specified sampling, standard interview questions, and triangulation of findings from interviews, small-groups sessions, project documents, and both in person and virtual site visits. • The report acknowledged limitations, including the immaturity of many projects, low survey response rates and the rapid rate of change in the organization, making some findings obsolete.

The Cordaid report gave the impression that the reviewers resorted to the collection of whatever data was most readily available. It was generated based on interviews at its Dutch headquarters, four country case studies (including observations, focus groups, community meetings, and workshops), attendance at a Cordaid conferences and a survey of Cordaid's partners. The study appears to have collected rich information from each site; however, the methods of analysis are unclear and somewhat anecdotal. For instance, the study repeatedly states, "When well implemented, Cordaid's approach works" (GFDRR, 2010, p.32). Because of little systematic discussion of methods or sampling or of how data was analyzed, however, understanding how conclusions like this were drawn was all but impossible. Such conclusions seem to be based primarily on partner organization and community satisfaction with the interactions rather than on data related to the evaluation criteria. Consequently, the report has a more informal tone and lacks significant reliability.

The conclusions drawn in the SDC report also lack rigor because the conclusions drawn do not appear supported by the evidence provided. Highlights from individual projects were used as examples of success in each of the HFA priority areas, but the interpretation of results was dependent upon assumptions about utility and loss reduction that were not sufficiently justified. For example, earthquake awareness programs in schools were measured in terms of overall number of participating students and schools, but no evidence is provided that knowledge gains through such programs is retained or even used in emergency situations. Although such measurements are difficult to obtain, doing so is important considering SDC's goal of "Less damage in terms of human and economic losses and less endangered livelihoods from future natural events" (GFDRR, 2010, p.6). In another instance, the report touts the ability of technicians in Nicaragua to map hazard zones for incorporation into planning. These maps are said to have a positive impact, as the assessments are considered "whenever possible." Examples of planning based upon these maps, a rather simple outcome to measure compared to others in DRR, were lacking. Overall, failure to provide specifics or support for claims to success gave the impression that those responsible for the release of the report were uncritically declaring their programs a success.

In comparison to these studies, DFID's methods were much more transparent. Although "value for money" is a controversial metric, especially for humanitarian assistance, the detailed explanation and application of the criteria provided credibility. Its methods and criteria were also appropriately aligned with the goal of determining future funding allocations. Although more detailed explanations of interview and data collection procedures would have further supported their conclusions, that all agencies receiving funding were evaluated and that efforts were made to collect the same data for each case was nevertheless clear.

Sida's evaluations stood out positively not only because of their comprehensive methods sections but also because of the transparency of their protocol and their obvious commitment to regular monitoring and evaluation. Their evaluation of evaluations also explained sampling procedures and the relevance of the evaluation criteria. In recognition that they are key to accountability and promote confidence in findings, Sida generally uses independent consultants for its reviews. Furthermore, in the name of transparency, all Sida funded evaluations are also posted on the Sida website. According to their documents, they use utilization-focused evaluation, and a participatory, empowering approach to evaluation. Part of this entails developing monitoring and evaluation capacity within developing countries, as these skills and resources are often lacking. Whether these practices improve the credibility of results, transparency in criteria and procedures used, coupled with an obvious commitment to regular evaluation, significantly enhance credibility.

GFDRR's methods were also among the most transparent and rigorous. Their sampling and data collection methods were meticulously reported, adding significant credibility to their findings. They were also careful to evaluate programs from each of their three key development tracks. Unlike any of the other studies, the report also specifically addressed the limitations of their data collection methods. Although they had intended to use survey data, low response-rates required them to disregard the data. Another difficulty arose in evaluating programs that had not yet been completed. Rather than detracting from their findings, explicit recognition of these limitations and explanations of how they were handled inspires confidence.

These reviews point to the importance of transparency in sampling, methods and the drawing of conclusions. Well-executed studies with valid conclusions may be questioned if methodological information is incomplete. Although agencies have an obvious incentive to emphasize favorable results, claims of success should be linked to program goals and supported by specific evidence.

Evaluation Criteria

In any evaluation, determining the criteria against which programs are being evaluated is necessary. Criteria are reflective of the organizations' general goals as well as of the purpose of evaluation. Review of these reports shows that despite similarity in goals such criteria vary widely across organizations; however, because of the different methods used, the criteria were operationalized, and likely defined, differently. As discussed in the previous section, clear delineation of measurement and data collection procedures is an essential aspect of the credibility of indicators. Likewise, having clear and precise definitions of what terms mean and what constitutes success or failure is important. None of the studies provided details of the survey or interview questions that were administered to gauge performance on these criteria. Because of the limited information available and of such variation across contexts, making definitive statements about the relative worth of these metrics in all circumstances is difficult. Nevertheless, some metrics appear to be widely used and applicable to a variety of programs. These include effectiveness, efficiency, sustainability, relevance and impact. The following Table provides a summary of the evaluation criteria used by each organization.

Because of the variety of programs that are administered under the banner of DRR, criteria applicable to a wide variety of programs can help streamline overall monitoring and evaluation processes. Among these six organizations, Sida stands out for having consistent procedures and criteria in place. Sida's guidance document on evaluations provides a good summary of key goals and terms as related to their mission. The five general criteria—effectiveness, impact, efficiency, sustainability and relevance—could be applied across a range of programs [NB: Impact is also notoriously difficult to measure, as tracing and attributing causality in complicated systems is nearly impossible. Likely, therefore, is that evaluators are actually assessing outputs or outcomes as a proxy for impact]. Cordaid, the BMZ and GFDRR had nearly identical evaluation criteria, with each adding a few additional criteria to reflect its specific goals.

While having set criteria may appear rigid, as mentioned in Sida's aggregate evaluation, most evaluation criteria can be operationalized differently by different evaluators. This is both a strength and weakness. Flexibility enables the development of specific indicators (i.e. measures of criteria) that are relevant and appropriate in a particular context. Nevertheless, consistency is important for ensuring comparability across programs, which might be desirable for funds allocation. The GFDRR report specifically recommended the development of "standardized, results-based reporting templates so as to regularize, streamline, and focus cyclical reporting" and project management (iv).

Table 18 Agency Goals and Evaluation Metrics

Agency	Organization's Goal(s)	Criteria/Metrics
Cordaid	"Reduce the potential impact of disasters on communities" (28).	• Efficiency • Effectiveness • Relevance • Sustainability • Coherence • Impact
DFID	Poverty reduction	The following two scales were combined to measure value for money. **Relevance to UK Priorities:** • Critical role in meeting development objectives • Attention to crosscutting issues • Focus on poor countries • Contribution to results **Organizational Strengths:** • Cost and value consciousness • Partnership behavior • Strategic/performance management • Financial resources management • Transparency and accountability • Likelihood of positive change
BMZ	"Enabling people to live in dignity and security" (7).	• Relevance & Appropriateness • Effectiveness & Coverage • Efficiency • Impact • Sustainability/connectedness • Crosscutting issues • LRRD • Interface between agencies • Appropriateness of funding channels
SDC	"Less damage in terms of human and economic losses and less endangered livelihoods from future natural events" (6)	**Criteria for specific DRR programs (in-line with HFA):** • Outputs • Outcomes • Impacts **Criteria for mainstreaming DRR with other forms of Aid (in-line with HFA):** • Policy • Strategy • Country programing • Project cycle management • External relations • Institutional capacity

Table 18 Agency Goals and Evaluation Metrics (Continued)

Sida	Poverty reduction. To "contribute to an environment supportive of poor people's own efforts to improve their quality of life."	• Effectiveness • Impact • Efficiency • Sustainability • Relevance *Actual indicators used in individual evaluations may vary.
GFDRR	Reducing vulnerability to natural hazards and climate variability in support of Millennium Development Goals (MDGs) and HFA	• Relevance • Efficiency • Effectiveness • Governance and Accountability • Sustainability

Such standardization also helps with a comparison of results across programs. Consistent overarching criteria were what enabled Sida to conduct a meta-evaluation of its evaluation scheme, which concluded that more uniformity in specific indicators was necessary to ensure meaningful results. Ultimately, how to balance flexibility against consistency is at the discretion of the organization, but such decisions should be made carefully only after weighing the benefits and drawbacks.

Although DFID included relevance and effectiveness among its criteria, its approach also stood out. The metric of "value for money" fits with DFID's desire to use the evaluation as a basis for future funding decisions. Value for money was defined as a combination of contribution to UK objectives and organizational strengths. Through the inclusion of objectives and organizational strengths into its analysis, DFID was able to focus on efficiency without reducing evaluation solely to economic concerns. These two indices seem to gloss over actual outcomes and sustainability, however. While evaluating organizations with different goals according to the same criteria may be difficult, the actual impact of these organizations on people's livelihoods and opportunity remains vague. Given DFID's overall focus on poverty reduction, the connection between value for money and long-term poverty reduction could be made clearer.

DFID's approach was successful in condensing information from 10 criteria into two overall scales. It was transparent about expectations for each criterion, though it was not clear how those were linked to data collection tools. The strength of this technique is that it allowed for large amounts of information covering vastly different areas of performance to be incorporated into a single, overall rating. Because DFID was evaluating organizations and not projects, it was unable to assess overall impact or sustainability of individual projects. DFID found that monitoring and evaluation of projects funding by these organizations was lacking, again highlighting the importance of regular monitoring and evaluation.

SDC's evaluation criteria stand out as being significantly different from those of the other studies. SDC decided to link its criteria to HFA, which was both a strength and weakness. In theory, alignment with international goals is a good thing; however, several of the Hyogo priorities are difficult to associate with on-the-ground DRR activities, which are the primary focus of funding and evaluation. For agencies funding specific projects, it seems more logical for activities to be linked to the HFA, while evaluation criteria can determine whether those goals are being met. Outputs, outcomes and impact are common measures, but they do not account for key features, such as sustainability of outcomes or impacts, efficiency in delivery or relevance of an intervention to a particular context. Reducing outputs, outcomes and impacts to a single category and adding additional criteria that address the relevance and sustainability of an intervention might, therefore, make sense.

These reports highlight the importance of clearly identified criteria that are related to an agency's mission but can also be measured. In fact, delineation of clear goals that relate to organizational mission should be a prerequisite to evaluation. Greater degree of specification of evaluation criteria before funding is dispersed (as in the case of Sida's standard criteria) can help set expectations, facilitate monitoring and evaluation, and foster overall accountability and effectiveness. It also helps ensure that programs with similar goals are evaluated according to the same, predetermined metrics and methods. Although similar goals can be measured in a variety of ways, several criteria were common to most of the studies: effectiveness, efficiency, sustainability, relevance and impact. The few studies that did not incorporate all of these elements often missed out on important dimensions of project longevity or relevance to a particular context. Because they are broadly applicable, they also serve as a good foundation for overarching evaluation policies.

Findings & Common Themes

Because of differences among programs and goals and the variety of indicators used, the reports framed their findings in a variety of ways; in examining these findings, however, some common themes emerged. The following Table (3) presents a summary of each report's findings for each indicator used, and the succeeding Table (4) lists key recommendations emerging from the reports. The sections that follow describe key trends and insights that might be drawn from a cross-case analysis.

Table 19 Summary of Key Findings

Agency	Criteria	Findings
Cordaid	**Efficiency**	• In some projects, community and NGO investment were unbalanced • The survival of resource-intensive projects was not guaranteed after initial funding ended • Tension existed between bottom-up organizing and top-down funding of projects • Staff turnover is a problem at Cordaid • Project timeframes were often not long enough to accommodate the community-development model
	Effectiveness	• Openness and commitment of the community to DRR • Previous history of disasters • Linkages between partners and communities • Congruency with other goals • Technical ability of partner organizations • Ability of partners to incite action in a community
	Relevance	• DRR was found to be congruent with Cordaid's mission to alleviate poverty • Selection of partners and programs were found to be appropriate given a program's goals

	Sustainability	• Projects focused on diversifying income-sources and building resilience were found to be more sustainable than those that did not • Sustainability was threatened by potential maintenance costs • The most sustainable interventions engaged both communities and governments in the projects
	Coherence	• Neither Cordaid nor in-country partner organizations were found to incorporate DRR considerations into their other programs
	Impact	• Projects with the most impact were those in which the community was mobilized to lobby the government for support
DFID	**Critical role in meeting UK development objectives**	• Only 5of 43 were deemed weak related to UK development priorities • Weak agencies had relevant mandates but lacked the focus or the resources to be key agents of change
	Attention to cross-cutting issues (fragile contexts, gender, environmental/ climate change)	• Humanitarian organizations fared better than other multilateral organizations • Private sector organizations were least equipped for conflict zones • Only half of humanitarian organizations were satisfactory in their attention to the environment and to gender issues
	Focus on poor countries	• 25 of 43 place satisfactory emphasis on the poor • The most effective organizations were those that provided services based upon contextual factors • On the whole, UN agencies performed poorly, likely because of their global mandate
	Contribution to results	• Organizations have difficulty demonstrating results, even if positive contributions are likely • Monitoring and reporting is often lacking
	Cost and value consciousness	• Only 3 of 43 organizations were “strong,” 20 were satisfactory • Most that failed were UN and NGO organizations, with development banks performing better
	Partnership behavior	• Of 43, 5 were strong, 23 were satisfactory, and none were unsatisfactory • There was some evidence of competition among organizations • In some cases rigid policies can make true cooperation difficult

	Strategic/performance management	• Only 14 of 43 organizations performed adequately on this metric • It is difficult to measure the impact of "soft" issues, like policy guidance • Hiring, promotion, and staff policies are not transparent and consistent
	Financial resources management	• 23 of 43 organizations performed satisfactorily • UN allocations are often not based on systematic need • Monitoring of deliverables is lacking
	Transparency and accountability	• Most organizations make information about their policies and programs available to the public.
BMZ	**Relevance & Appropriateness**	• German humanitarian aid seldom conducts needs analyses or specifies the purpose of funding • Capacity to assess results is lacking and should be improved
	Effectiveness & Coverage	• Evaluations and accountability are rare; however, the report concludes that case studies suggest that interventions are successful in improving quality of life (although no evidence or reference to indicators was provided in the executive summary)
	Efficiency	• There have been no studies of efficiency and program managers know little about their efficiency. There is likely room for improvement
	Impact	• Little is known about project impacts but the benefits are assumed to be positive • Contributing toward the goal of "enabling people to live in dignity and security" was too far-reaching a goal given the timeframe of assistance and the complicated nature of humanitarian crises
	Sustainability & Connectedness	• Long-term planning is an area of weakness
	Crosscutting issues	• Human rights, gender, conflict sensitivity, environmental soundness, HIV/AIDS are not systematically taken into account in humanitarian responses
	Linking Relief, Rehabilitation, and Development (LRRD)	• The importance of LRRD is recognized, but it is not successfully realized in practice. More effort needs to be made to link emergency response to long-term development goals
	Interface between agencies	• Interface between offices is weak
	Appropriateness of funding channels	• Appropriateness of financing channels, which is essential for LRRD, is lacking. Germany funds too many actors, and selection criteria are unclear. More systematic understanding of the organizational strengths of grantees is needed
SDC	**Mainstreaming**	• Mainstreaming efforts varied greatly across countries, but was largely positive (with the exception of Mali)

	Targeted DRR Projects	• Targeted DRR should follow an integrated approach of assessing risks, including stakeholders and considering sustainability
Sida	**Effectiveness**	• Most studies sufficiently addressed effectiveness but failed to sufficiently address attribution of effects to specific projects. • Most reports did not adequately address unintended consequences
	Impact	• Difficult to establish impacts, as casual analyses are lacking and require significant investments
	Efficiency	• Only 21% of the analyses adequately addressed efficiency
	Sustainability	• Reports addressed sustainability, but the projects evaluated were often ongoing. Consequently, only projections of sustainability were possible. Assessing true sustainability requires examination after project completion
	Relevance	• Assessment of relevance of programs in relation to Sida's policies and country partners was satisfactory, but most evaluations made little mention of the relevance of interventions from the perspective of project beneficiaries
GFDRR	**Relevance**	• GFDRR was found to be a valuable player in DRR • It has leveraged its knowledge and policy expertise to mainstream DRR considerations into other areas of government and development
	Efficiency	• Partnerships help facilitate efficient mainstreaming of DRR
	Effectiveness	• Although young (18 months old) many projects are showing positive results • DFDRR has been effective at promoting knowledge sharing and learning between nations
	Governance and Accountability	• A Results Management Council (RMC) and Consultative Group (CG) were designated to provide guidance to GFDRR from its inception • These were found to be flexible and strategic entities for managing GFDRR priorities
	Sustainability	• GFDRR's funding was found to be stable • Sustainability of the mainstreaming efforts funded by GFDRR will depend on collaboration between GFDRR, governments and project partners • Because the program is new, it is impossible to assess sustainability

Table 20 Summary of Recommendations

Agency	Recommendations
Cordaid	• Cordaid should foster development of strong community organizations that are capable of advocating community needs
DFID	Funding decisions made considering 'value for money': • Increase funding to organizations providing very good value for money • Continue steady funding for organizations receiving a good rating • Those in the adequate category that are contributing to UK objectives but show poor results will generally continue to get funding if they agree to reforms. They will then be reevaluated in two years • Of the eight that performed poorly, four would be defunded because their missions overlap with other, more effective (by the terms of this study) organizations. Problems include lack of transparency, poor reporting of results and poor financial management • Savings from these programs will be channeled into high-performing programs • Four organizations will be given provisional funding because they perform essential services, however poorly. DFID will work with them to improve performance
BMZ	• Ministries should conduct needs assessments and be more selective in their choice of partners • Ministries should develop results-oriented goals • Implementation should include/empower local people to a greater extent • Integration of crosscutting issues should be a requirement • A reoccurring theme across all levels is the need for more attention to results, reporting and lessons learned • Reporting should be consistent to enable statistical developments
SDC	• Need to consider DRR in other areas of SDC programming and review to divide labor between humanitarian, development, and climate aid • Need to provide adequate resources for mainstreaming and other activities • Need to share DRR knowledge with other organizations and sectors
Sida	• More rigorous design and data collection are still needed • Evaluation criteria and terms of reference need to be clearly outlined at the beginning of projects to set expectations • Evaluations should be timed so that they can collect and provide information that is of use to future projects

GFDRR	Most recommendations focus on building stronger platforms for future growth and success: • The GFDRR "should develop standardized, results-based reporting templates so as to regularize, streamline and focus cyclical reporting" and project management (iv) • Need to develop formal project selection criteria • Need a rigorous strategic plan that includes results and performance indicators • Need to develop a multi-year evaluation plan • Need for dialogue between GFDRR and the UNISDR to clarify individual functions

Tendency to Focus on the Positive

Unsurprisingly, most reports emphasize positive outcomes and downplay or rationalize shortcomings. This is particularly true in summaries and public versions of reports. Sida's and GFDRR reports are notable exceptions, however, emphasizing as they do areas in which improvements need to be made. While focusing on successes is understandable, doing so can lead to conclusions and continued support for programs that seem unwarranted or unreliable. As discussed above, SDC seemed to conclude programs that had been successful, without providing convincing evidence. Similarly, Germany also painted its efforts in a positive light, indicating that despite a lack of evidence their programs were likely to have a positive impact. Failure to support conclusions with adequate evidence erodes credibility and reliability.

Challenges of Measuring DRR Impacts

These reports highlight the challenges in determining the impacts of programs. Few of these evaluations dealt specifically with DRR; however, the challenge of developing or identifying an analogous situation is common to many fields. Sida found that the design of most of its individual evaluations were non-experimental in nature and failed to specify rigorous methods, resulting in a lack of transparency. Sampling appeared to be unsystematic and data collection was often limited to the easiest available information. Likewise, the evaluations generally contained little discussion of management or implementation. Although most reports provided recommendations, given the quality of the evidence upon which they were based, the authors themselves deemed them suspect.

None of the reports considered here suggest any particularly compelling ways of untangling impacts (e.g. risks reduced, lives saved, program sustainability, country ownership, etc.) from the multitude of factors and uncertainties surrounding a particular intervention. The SDC report elaborated on the inherent difficulties in measuring increases in safety or losses averted. In particular, connecting specific programs to outcomes is difficult, as is taking measurements until an event has occurred and then concluding that it appears that damages have been reduced. Even then, a drought in one place at a different point in time may have different consequences, as societies, like climate, are also dynamic and change in unexpected ways. Assessing the validity of an analogy is difficult and requires great care, as no two situations are exactly alike. In order to measure impacts, the SDC study relied on reporting after a disaster had occurred or on estimates using proxy indicators.

There are obvious limitations to these methods but sometimes alternatives are lacking. For this reason, although reports often use impact as a criterion, they often resort to using output (items produced such as policies, workshops or reports) or outcome (sustained changes in behavior resulting from program) measures as a proxy.[6] Such use of proxies is not necessarily problematic as long as the reports are transparent in how they measure and draw conclusions.[7] What is clear, however, is that outlining goals, variables to be measured and planning for monitoring and evaluation are essential to credibility of results.

[6] These definitions of output, outcome, impact were adapted from Oxfam (2009). Measuring the Impact of Disaster Risk Reduction: A Learning Companion *Oxfam Disaster Risk Reduction and Climate Change Adaptation Resources*, 1–16.
[7] Some logframe frameworks conflate outcome and impact.

The Importance of Regular Monitoring and Evaluation

Regardless of the challenges, predetermination of variables to be monitored and transparent monitoring techniques lead to more valid assessments. Collecting baseline data, whether from a previous or recent disaster or an estimate based upon initial development and capacity patterns, is essential to monitoring progress. Upon evaluation, both Germany and DFID lamented the lack of consistent monitoring by organizations it funded. In contrast, GFDRR recognized the need to develop standardized measures relatively early. Having clear goals and measurement criteria before program implementation is necessary for consistent monitoring; attempting to determine results after a project has ended is difficult, if not impossible, without uniform data and regular reporting. Of the six organizations, only Sida and GFDRR appeared to have consistently considered evaluation prior to project implementation. Sida's assessment guidelines and "Terms of Reference" are a step in the right direction, providing uniform standards and pointing project managers towards essential goals to be considered.

In addition to monitoring programs for intended outcomes, remaining alert in order to identify new and emerging phenomena is important. With the exception of Sida, little attention is usually paid to the potential unintended consequences of aid, such as mal-adaptation[8] and dependency[9]. Yet, even the Sida evaluation acknowledges that most project-level evaluations conducted gloss over or neglect these concerns. Consideration of unintended consequences is an important step in learning from the past; along with increased monitoring end evaluation, therefore, further attention should be given not just to project successes and failures but to unintended or unforeseen events.

Finally, more thought needs to be given to the timing of evaluations, as assessments of impacts and sustainability cannot be fully assessed, except by conjecture, as well as,

[8] IPCC TAR, 2001 a. Climate Change 2001: Impacts, Adaptation and Vulnerability. IPCC Third Assessment Report, Cambridge University Press.

[9] Moss, Todd J., Pettersson, Gunilla and Van de Walle, Nicolas, An Aid-Institutions Paradox? A Review Essay on Aid Dependency and State Building in Sub-Saharan Africa (January 2006). Center for Global Development Working Paper No. 74; Mario Einaudi Center for International Studies Working Paper No. 11-05. Available at SSRN: http://ssrn.com/abstract=860826

perhaps, by the passage of time. Both the Sida and the GFDRR evaluations noted that evaluations conducted before projects have been fully completed cannot measure sustainability, a key determinant of long-term impact. Some time should, therefore, be allowed to elapse in order to assess how and whether projects persist after the immediate implementation phase. Nevertheless, not too much time should elapse, as institutional and participant memories of program implementation will fade and lessons may be lost. Again, balance is necessary.

Integration of Humanitarian, Development and Other Forms of Aid

Humanitarian and development agencies commonly recognize the need to link various forms of international funding. This need for "layering, integration, and sequencing" was repeated in USAID (2012) in its *Building Resilience to Recurrent Crisis* document. Similar concerns were echoed throughout the reports reviewed here. SDC and the German Bureau of Economic Cooperation specifically examined the extent to which DRR and humanitarian aid were being linked, integrated or "mainstreamed" into other kinds of aid. SDC believes that integrating DRR into all (sustainable) development efforts will improve outcomes across the board. Likewise, because of its connection to the HFA, the GFDRR believes integration of DRR with national economic and development policies should be a primary focus for meeting broader development goals. DFID reflected on the need for integration by evaluating attention to crosscutting issues, including gender, climate change and the environment, and conflict. The Cordaid report confirmed DRR as a relevant component of its overall focus on poverty reduction, and its findings support the importance of integrating various levels of government as well including local people in decisions. These examples demonstrate that development actors around the world are struggling with the challenge of synchronizing various kinds of aid and ensuring that humanitarian, development and climate variability and change adaptation programs are synergistic rather than redundant or counteractive. Rather than struggling independently to address these challenges, agencies and NGOs around the world would do well to share experiences and learn from successes and challenges abroad in a more formal and structured manner.

Conclusions

Examination of these reports confirms that great variation in approaches exist to what could be viewed as lessons learned assessments. Nevertheless, most evaluations are developed for the purpose of improving programs and discovering what is and is not working. In the most extreme cases, information on effectiveness is used to allocate future funding and defund ineffective organizations. Examination of the methods of these studies shows that a lack of clear protocols for assessment undermines the reliability as well as credibility of the findings. Transparency in assumptions, data collection and analysis provide legitimacy, even when disagreement with assessment criteria being used arises. Likewise, determination of consistent evaluation criteria prior to project implementation facilitates monitoring, reporting and later evaluation. Based on the criteria used by these studies, effectiveness, efficiency, sustainability, relevance and impact appear to be applicable to a wide range of programs.

The findings of these studies suggest that most aid agencies face similar challenges in monitoring and evaluation as well as in implementation. Determination of impact is difficult in any real-world, dynamic system. This should not, however, be an excuse for lax reporting; evaluation is even more difficult in the absence of reliable data. Drawing on the conclusions from the methods and criteria sections above, greater attention needs to be paid to routine monitoring and periodic evaluation. Sida's policy guidance documents could serve as a model for USAID. Setting clear expectations for funding recipients is more likely to lead to robust reporting.

Finally, aid agencies around the world are struggling with how to define the relationship between humanitarian, development and climate change aid. Monitoring and evaluation of different approaches, along with information sharing among organizations, could be a valuable way forward for identifying the most successful ways (e.g., best practices) to integrate different kinds of humanitarian and development assistance.

Other Evaluations and Further Reading

Development Assistance Committee Peer Reviews (2012). http://www.oecd.org/dac/peer-reviews/

Evaluation of Finnish Humanitarian Assistance 1996-2004 (2005). http://www.oecd.org/derec/finland/37220875.pdf

Finnish Evaluation Guidelines (2007). http://formin.finland.fi/public/default.aspx?contentid=105901&nodeid=34606&contentlan=2&culture=en-US

Humanitarian Emergency Response Review (2011). http://www.dfid.gov.uk/what-we-do/key-issues/humanitarian-disasters-and-emergencies/how-we-respond/humanitarian-emergency-response-review/

Oxfam International (). Measuring the Impact of Disaster Risk Reduction: A Learning Companion http://community.eldis.org/?233@@.59cdc973/8!enclosure=.59cf3b92&ad=1

UK Government Office of Science (2012). Reducing Risks of Future Disasters Priorities for Decision Makers. http://reliefweb.int/report/world/reducing-risks-future-disasters-priorities-decision-makers

Usable Concepts for Disaster Risk Reduction (DRR)

1. **The ‘Rs’ of Disaster Risk Reduction (DRR)**
2. **Satisfice**
3. **Foreseeability**
4. **Re-function**
5. **“Social Inventions”**
6. **Zero-order Responders**
7. **IMPROVISatory**
8. **Lessons identified ≠ Lessons learned**
9. **Creeping environmental problems (CEPs)**
10. **Drought follows the plow (DFP)**
11. **Re-educate**
12. **Resilient Adaptation**
13. **Grain storage improvements**
14. **Climate Change Risk Disclosure (CCRD)**
15. **CCR(+B)D development**
16. **Late Warning Systems**
17. **Sunsetting DRR assistance programs**
18. **Reversed Triage: Help the bottom group first**
19. **Hotspots Pyramid**
20. **“The 3 ‘O’s”**
21. **Disaster Risk Reduction (DRR) Bank**
22. **Forecasting By Analogy (FBA) and the search for “lessons”**
23. **Mitigating the impacts of Climate Change Adaptation (CCA)**
24. **Assigning a “Project Scribe”**
25. **“End-to-end-to-end” (E2E) forecast system**
26. **DRR RANN**
27. **“Ordinary knowledge” as a concept**
28. **Working *with* a changing climate, not against it**
29. **“Partnership vs. Ownership (of projects that seek to bridge DRR and CCA)”**
30. **Climate Proofing**
31. **Risk taking, risk aversion … and risk making**
32. **Decision Making Under Uncertainty (DMUU)**
33. **Decision Making Under Foreseeability (DMUF)**

Usable Concepts for Disaster Risk Reduction and Climate Change Adaptation

Concepts or notions can arguably be viewed as "social inventions" in that they are not only attempts to describe and inform but are also often designed to influence individual, group and/or societal behavior. Specific ideologies (often in the form of 'isms') and sometimes even slogans that appear on placards held by protesters in the streets can be categorized as social inventions, if they become rallying points. As far as we can tell the roots of the phrase "social invention" go back to the mid-1960s and early 1970s and can be linked to the notion that humanity had entered the "Space Age" (Mazlish 1965), a slogan that one could effectively argue inspired people to look differently at earth's place in the universe and people's relationship to the earth. A key understanding about social inventions is that they often have as great an impact on individual, group and societal behavior as does the development of new technologies. Concepts, however, have to compete for the attention of the public and policymakers alike in a way similar to how corporations invest in developing popular slogans for their products to capture attention and encourage brand loyalty. In completing this survey and especially in searching for lessons learned from climate-, water- and weather-related hazards and disasters, many concepts were identified that might be of use in decision-making processes for coping with—as well as planning for—the adverse impacts on societies and ecosystems of hydro-meteorological events.

In the following section, examples are provided of thirty-three thought-provoking concepts and ideas that could be viewed as social inventions through which to inform the public and policymakers about hazard and disaster situations. The following examples are meant to be illustrative of a larger set of usable concepts in the full report and are not presented in any specific order of priority. Notably, these inventions might also provide opportunities for disaster-related decision makers to more effectively ground their ongoing debates and pronouncements in hazard realities as they are and not as what is believed "ought to be" reality. As such, these concepts merit serious consideration.

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1. The 'Rs' of Disaster Risk Reduction (DRR)

Notable in a review of disaster literature are the many concepts used in disaster risk reduction or, more broadly, in disaster risk management that begin with the letter "R": reduce risk, request, respond, relief, restore, re-position, review, re-think, rehabilitate, reconstruct, resources, responders, resilience, re-declare, repatriate, re-kindle, reuse, re-visioning, and more. The frequency of the use of disaster-related "R" words is not really an accident. In a way, that many activities begin with the prefix "re" should be expected, since in the past, when disasters were considered little more than 'acts of god' events occurred and societies dealt with them almost exclusively in terms of "response and recovery." The problem is that even though the socio-political causes of disaster are well known, these two R-word actions continue to dominate planning and response throughout the emergency management and humanitarian communities. Furthermore, even today many government ministries have divided jurisdictions that limit what one agency can do to prepare for and respond to the consequences of disaster. With what has been referred to as "mission creep" in terms of the expansion of these ministries' roles into areas of prevention and preparedness, such jurisdictional lines have, however, increasingly become blurred. Like this, traditional approaches to disaster risk reduction (DRR) have more and more often taken on preventative activities to prepare for recurrent disasters. Today, much more emphasis and attention is paid to and more resources are allocated for preparedness and prevention-oriented DRR programs.

2. Satisfice

To *satisfice* is to "decide on and pursue a course of action satisfying the minimum requirements to achieve a goal;" "optimization requires processes that are more complex than those needed to merely satisfice" (www.thefreedictionary.com). The word satisfice was given its current meaning by Herbert Simon (1956).

To optimize: we usually do not know the relevant probabilities of outcomes, we can rarely evaluate all outcomes with sufficient precision, and our memories are weak and unreliable. A more realistic approach to rationality takes into account these limitations: This is called “bounded rationality.”
< http://en.wikipedia.org/wiki/Satisficing >

Satisfice is in fact an interesting and thought-provoking combination of two concepts, ‘satisfy’ and ‘suffice,’ that also has ethical as well as social economic implications. “Satisficers,” those who are satisfied to meet at least minimal requirements to achieve their goals through their actions, are usually viewed in opposition to ‘maximizers’ who seek the best result possible from their actions toward their goals. Perhaps the notion of ‘satisfice’ has a useful role to play in disaster preparedness and in response and recovery, as well as in DRR and CCA bridging or blending activities.

3. Foreseeability

The notion of foreseeability is used in the theory of law and in essence can be viewed as a qualitative expression of probability in order to determine accountability or fault when someone has been injured or killed (or when property has been damaged). This expression clearly applies to disasters as well (Glantz 2008), which means that foreseeability is uniquely relevant for dealing with the potential hazards of climate variability, extremes, and change. By its application, that is, we can foresee which adaptation measures should be implemented and when.

The following description of foreseeability taken from a Law dictionary (Gifis 1991) illustrates the point:

- "FORESEEABLE RISK, i.e. risks whose consequences a person of ordinary prudence would reasonably expect might occur…
- In tort law… a party's actions may be deemed negligent only where the injurious consequences of those actions were foreseeable."

- For example, "established by proof that the actor or person of reasonable intelligence and prudence, should reasonably have anticipated danger to others created by his or her negligent act."
- "Foreseeability encompasses not only that which the defendant foresaw, but that which the defendant ought to have foreseen."

While the data and time series necessary to determine the statistical probability for the occurrence of a hazard may not be known or available, awareness of the possibility of recurrence of that hazard (or likelihood of a disaster) based on the timing, frequency, and magnitude of past occurrences, and on the known level of societal awareness and preparedness, is possible. Hence, in known at-risk locations around the world the need to prepare remains ever-present, and now more than ever under conditions of a warming, changing climate, and the yet-to-be-determined regional and local changes in hydro-meteorological event variability and extremes that is all but certain to accompany this warming.

That there are likely to be adverse consequences from people's vulnerability to the hazard of climate and its changes on various time scales is reasonable to expect, especially if steps are not taken to reduce that vulnerability. For instance, do those with the power to act beforehand have a legal, if not moral or political, responsibility for the resulting climate impacts? The case study by Holloway (2000) of the impending drought in southern Africa from 1991–93 is instructive here. The famine consequences of the drought were foreseeable and those with the power to act took heed and led a massive food import and distribution effort, which is credited with averting catastrophe.

A similar level of foreseeability was not, however, acted upon in mid-2002 when officials in Zimbabwe were warned about the strong possibility of an El Niño-related drought and the potential for subsequent food shortages (Glantz and Cullen 2003). After years of politically-instituted changes in land ownership and land use, linked to the dictatorial and corrupt governance of President Robert Mugabe, food production after a shock like an El Niño-related drought was expected to decline across the country. Yet, Mugabe continued to break up the large productive farms (owned by Europeans) into smaller subsistence plots given to his political supporters. Once a forecast for the onset of El Niño was made in 2002, which was accompanied by the prediction of potential drought across southern Africa, a person of ordinary prudence would have foreseen the strong possibility of severe food shortages in Zimbabwe as well as in other countries across the region that depend on Zimbabwe's "bread basket" for food imports. Despite this foreseeability, Mugabe and his government did little to avert the crisis (Howard-Hassmann 2010). By October 2003, 50 percent of Zimbabwe's population was unable to meet its food needs, shortages that continued for several years, especially since Mugabe continued to interfere with farming, food distribution and humanitarian aid. The leaders in power in Zimbabwe chose not to avert the foreseeable and preventable disaster. This was clearly a case of political "ignore-ance" at the highest levels of government (They had information available but chose to ignore it). We know what the impacts of climate variability and extremes are and what those of climate change could be. They are foreseeable; yet all too often needed action is not taken. As with the Zimbabwe case, "ignore-ance" is clear (Glantz and Kelman 2014).

4. Re-function

Much as global to local climate regimes vary and change at all time scales, so, too, do societies. Societies must, therefore, re-visit what they at one time—such as in the present—may have considered to be "best practices" because it is highly likely that new and different 'best practices' will be needed for the new, different and emerging circumstances that societies face.

Given contemporary concerns about climate change and its likelihood of increasing the number as well as the frequency and intensity of extreme climate-, water- and weather-related events, humanitarian aid agencies have to re-function, that is, re-think, not only how they provide emergency assistance or approach DRR programs but also what tools they keep, discard or add to their disaster avoidance "toolbox." This is especially true considering the likelihood that national budgets for humanitarian aid agencies will be increasingly limited even as the need for such aid increases as the impacts of climate change becomes more and more apparent in the coming years and decades. DFID, for instance, now uses the rule of "value for money" as one hurdle in a set of criteria for providing assistance; it no longer feigns altruism in its humanitarian DRR-related aid distributions; it requires that such distributions have some demonstrable value. Such a rule might be appropriate for the preparedness and prevention aspects of DRR and perhaps for longer-term development programs but are quite inappropriate for providing emergency assistance to disaster-affected populations. Nevertheless, "value for money" will likely continue to be a key metric of foreign assistance in the future of numerous global north governments.

Evidently, a third of the way through the second decade of the 21st century, the concept of "resilience" has surpassed and overshadowed previous development buzzwords such as "adaptation," "vulnerability" and even "sustainable development" to become a primary development goal for many humanitarian assistance programs (including USAID).

5. "Social Inventions"

There are notions and concepts and even words alone that can change the way people do things. The outcomes of many "business as usual scenarios" have forced us to rethink how society interacts with its environments, from local to global levels. Technological inventions change human behavior towards the environment as well as the way people view their regional and local hydro-meteorological hazards. But concepts and even slogans on placards at popular demonstrations are also known to inform and change the behavior of populations. Grassroots-level notions can energize and enhance DRR education and training activities. While we might know this at some level in the back of our minds, social inventions, that is, ideas that have a major impact on what we do, are as and often more important and influential than the technologies that we develop. In this way, social inventions such as the notion of "the space age" can lead to new technologies, and new technologies can generate new social inventions. In retrospect, one could effectively argue that social inventions have had as much influence on the course of history as have several of our technological inventions.

6. Improvisation

im·pro·vise
v. im·pro·vised, im·pro·vis·ing, im·pro·vis·es
v.tr.
1. To invent, compose, or perform with little or no preparation.
2. To make or provide from available materials.
(http://www.thefreedictionary.com/improvise)

By definition, "first responders" are representatives of the formal structures of governance who are the first from outside a disaster-affected area to come to the aid of those in that area. When a disaster occurs, these men and women arrive first to assist victims and contend with and manage responses to remaining hazards. First responders include the police, firefighters, search-and-rescue teams, the national guard, emergency medical providers, the Red Cross and the like. They are often courageous and most always laudable for their skill and actions in situations of extreme duress.

The reality, however, is that the "victims" of disaster events are the true first responders, even as the violence and shock of such events unfold around them, which is why we propose that those individuals should be represented not just as victims but as the "Zero-Order Responders" (ZORs) that they are. We propose this shift in framing to acknowledge the fact that individuals swept up (sometimes literally) in a disaster zone do not and have never just sat on their hands waiting for help from the formal structures of government or of civil society to arrive, which is the implication of their being labeled as "victims". Even though they are forced into survival mode, individuals take action, often courageously and always to the best of their after-event abilities, to help themselves, their families, their friends and their neighbors to overcome the devastation that might otherwise overwhelm them, not letting down until the so-called first responders arrive hours, days or weeks away to relieve them and deliver them even further out of disaster-related harm's way.

In such situations, ZORs are forced by necessity to *improvise* in order to survive, remaining out of harm's way for hours or days—sometimes even weeks—after a disaster event. Such *innovative* thinking can be taught, as the following quotation about what is known as the MacGyver Effect, named after the inventive character of a 1980s TV action show, suggests: "Innovation (often) comes from constraint (If you've got very few resources, you're forced to be very creative in using and reusing them.)." The MacGyver Effect is often referenced in terms of crisis survival, as the educational website *Evoke* notes:

> In a world where we're running out of water to drink and fuel for our cars, inventors are being forced to be resourceful to solve these problems - not just the several big issues, but multitudes of smaller ones.
>
> This sounds like an American TV show called *MacGyver* from the 1980s featuring a detective called Angus MacGyver (they usually just call him Mac). In each episode, he uses ordinary, everyday items to build things that he needs - for instance, he combines a hairpin and wine to make a magnifying glass, and a muffler, some gas, a steering wheel and some seat cushion stuffing to build a mortar shell.
>
> Just like MacGyver, in our modern world, we need to be resourceful. It could be as small and simple as recycling water that we use, or it could be as big as a new type of desalination plant to turn salt water into drinkable water.
>
> From the people who are researching and inventing new kinds of biofuel, right down to the person making toy cars from scrap metal in Kenyan slums, show us that anyone, anywhere, can be innovative and resourceful.
> (http://www.urgentevoke.com/profiles/blogs/the-macgyver-effect?xg_source=activity)

The point is that improvisation, learned from ZORs, can be taught to at-risk communities on how to prepare for and improve the possibility to survive the aftermath of hydro-meteorological disasters. In truth, these communities already do improvise as ZORs in times of crisis, but their responses could be enhanced with more awareness and preparedness.

7. IMPROVISatory

An "improvisatory" is analogous to a laboratory or "collaboratory." It is a place where improvisation stories can be collected and catalogued based on interviews and observations. This can be done via electronic media and social networks. It can also be a place where people are taught to act out in-situ innovative, hydro-meteorological disaster-related scenarios.

8. Lessons Identified ≠ Lessons Learned

"Lessons learned," in the wake of hydro-meteorological disasters, are educational opportunities about societal impacts and responses to climate, water, and weather-related extremes and changes. Potentially, they can serve as "teachable moments" that inform governments, communities, and individuals to prevent and mitigate impacts and losses from climate-related disasters (Glantz 2008). Often, however, lessons are not heeded, and thus, there is a growing need to distinguish between a "lesson learned" and "lesson identified" ("lesson drawn") from an experience. If a lesson has only been identified (a recommendation, for example) but that recommendation has not been tested, acted upon or evaluated, it should not be considered a lesson learned. This is a serious issue with usually negative implications. It is why similar disasters in the same location can yield the very same lessons time after time, with nothing ever really being learned because those identified lessons remained unlearned. Perhaps a more accurate phrase would be that a lesson has been drawn (e.g., identified) from an experience rather than that a lesson has been learned from that situation.

9. Creeping environmental problems (CEPs)

Quick-onset hazards receive most of the attention of governments, media and aid organizations, while slow-onset, incremental but cumulative hazards tend to be put on the proverbial back-burner, seldom demanding the immediate response called forth in times of abrupt crisis. Such slow-onset, creeping environmental changes do, however, eventually swell into crisis.

Just about every human interaction with the environment verges on becoming a creeping environmental problem (CEP), such as deforestation, soil erosion, desertification, CO2 emissions, water quality issues, etc. In many locations around the world, CEPs are reaching the brink when hazards become disasters (Glantz 1999).

The point is that rates of change are as important as types and directions of change, particularly because societies tend to respond more quickly and comprehensively to quick-onset changes than to slow-onset ones. Yet those slowly developing changes can and often do as much if not more damage over the long term than the former. Importantly, however, the creeping evolution of such incrementally changing hazards into a disaster is often preventable, since there is time to act as the consequences of CEPs manifest and become identifiable when monitored effectively (Glantz 2003). Glantz (1994a; 1994b) refers to “creeping environmental changes,” “creeping environmental problems,” and “creeping environmental phenomena”. CEPs as small, incremental but cumulative changes to environmental conditions which, over time, amount to create major problems, are often seen as a crisis (or disaster) only after an undefined threshold has unwittingly been crossed (see case study about the Aral Sea Basin in Glantz [1999]).

10. Drought follows the plow

As populations increase or shift for a variety of natural, demographic, socio-economic, or conflict reasons, people tend to move onto marginal land, as the best agricultural or pasture land in a given area is most likely occupied. The ‘margin’ typically refers to poor soil quality or low rainfall in an area. It can also refer to the more culturally-motivated desire of settlers to pursue their old livelihoods in new locations where soil or rainfall conditions are marginal, especially in comparison to the location from which they migrated. As such, people on the margins tend to cope with lower yields, more crops failures, less vegetation on rangelands, etc. Nature is usually blamed but in this way people tend to put themselves, whether wittingly or not, into hydro-meteorological harm's way. In other words, "Nature pleads not-guilty" (Garcia et al. 1981)—and drought follows the proverbial plow into marginal areas (Glantz 1994a).

11. Re-educate

Once is not enough. Approaches must be devised to continuously educate at-risk populations about hazards they are likely to face and about DRR practices that might help them prepare for and mitigate hazard impacts. This is particularly important as new knowledge is identified, drawn, and potentially learned from current and past experiences, including those from ZORs. Thus, refresher activities are necessary to remind communities to stay vigilant as well as introduce~~s~~ them to newly identified best practices.

12. Resilient Adaptation

Borrowed from the field of social psychology, this concept represents a flexible decision making approach in the face of an uncertain hydro-meteorological future (Glantz et al. 2009, 43). It can be applied to coping with climate-related changes in regional and local hazards as well as to the potential for disaster. Resilient adaptation is NOT a simple merging of the two climate change concepts of 'adaptation' and 'resilience' but represents a flexible approach to societal and individual adjustments to the potential but still uncertain impacts of climate change. When monitoring adaptive practices, for example, the concept of resilient adaptation would become, by analogy, the traffic signal of adaptive responses to climate change impacts, alerting society to "slow down, notice this, take a detour, and stop" (Truss 2006). A cautious approach to adjust to the changing climate is not just a social desire; it is a necessity. The truth is that climate characteristics are changing in ever more surprising ways with extremes resulting from the drivers of such changes likely to become more frequent, more intense and more spatially random in the near and distant future (SREX 2012). It is very important, however, to keep in mind that societies are also changing. As Truss wrote in her book on the importance of punctuation marks in language, “Every language expert … has accepted that it’s a mistake to attempt to ‘embalm the language’. Of course it must change and adapt”. The same sentiment must be applied by analogy to societal attempts at adaptation (more correctly, adjustment) to an uncertain changing climate throughout the rest of the 21st century. Hence, there is a need for flexibility in adaptation to climate change and its impacts on climate-related variability and extremes. Pursuing the concept of Resilient Adaptation in response to the uncertainties to come in the years ahead merits serious consideration by humanitarian and development assistance agencies.

13. Grain storage improvements

Considerable attention is focused on increasing agricultural production in developing areas. Increasingly marginal areas are being exploited under mounting pressure for food production purposes, even though those areas might be considered marginal for rain-fed agricultural activities in the first place. Grains are being modified to provide higher yields and genetically modified (GMOs) industrial food production is on the rise. Satellites are monitoring grain production from space throughout the growing season to provide estimates of trade and humanitarian assistance needs, and so forth. Despite all of these techniques trying to increase agricultural outputs, it has widely been acknowledged that in various locations around the globe a significant portion of annual harvests are lost in storage to pests, mildew and rodents. By simple logic, a focus on improving storage facilities in rural areas of developing regions would immediately and greatly improve food availability in the household as well as in the marketplace.

14. Climate Change Risk Disclosure (CCRD)

The Securities and Exchange Commission (SEC) in the USA presently has a voluntary program calling on corporations to be transparent and explicit about their CO_2 emissions (http://www.sec.gov/rules/interp/2010/33-9106.pdf). Conceivably, at some time in the not-too-distant future, the SEC will begin to mandate that corporations account for their greenhouse gas emissions (mainly CO_2) for the purpose of providing potential investors environmental ratings for publically traded companies according to their "risk to climate change" factor. That risk is presently defined narrowly in terms of carbon emissions, and risks would include the carbon accounting for the operations of the company as well as for its individually produced products. It would also include the risks of foreseeable climate change-related impacts of the various assets of the company. In its broadest definition, CCRD could be re-defined to require even greater accountability, taking into account other relevant factors that might put a corporation at-risk to changes in high-impact climate, water or weather impacts, whether climate change-related or not. For example, while Toyota, a car manufacturer headquartered in Japan, was not directly affected by the 2011 flooding in Thailand, some of its production plants in Thailand were adversely affected (Yang 2011).

A CCRD would provide both a qualitative as well as a quantitative way of explicitly identifying first- and second-order risks a society might face from hydro-meteorological hazards. Thus, a CCRD would potentially be of value to communities and governments by providing a useful way to identify risks in urban and rural settings as well as for early warning of potential hazards and disasters. It would be useful for DRR as well as for CCA.

15. CCR(+B)D development

This is nearly the same as CCRD except that it includes a search for the potential benefits of a changing climate that might be taken into account and made explicit. For longer-term strategic development purposes a systematic assessment of climate change risks

AND BENEFITS disclosed to donors, their partners and their funding recipients might enhance the sustainability of humanitarian and development responses.

16. Late Warning Systems (LWSs)

This idea of a late warning system that is separate from an early warning system is based on observations as well as the belief that most people do not respond to early warnings but only respond as the seriousness of subsequent warnings increases. A need exists for considering the potential value of late warning systems because those who wait to be sure that they must respond to an impending forecasted disaster usually require different information, perhaps in different formats, than information that is typically provided by a succession of early warnings.

In a recent UNISDR newsletter, there was yet another comment about the recipients of early warnings of hydro-meteorological hazards, in this instance drought:

> The 2010/2011 drought, which affected the Horn of Africa, was not unexpected. Indications of the drought conditions were received as early as September 2010. *The question posed over and over again is: Why was there no early action following the early warning?* There are many conflicting professional opinions circling around answering this question. (May 2012 Issue, p.1; emphasis added).

Certain segments of any population will tend more towards being "risk takers" than other segments and delay taking action even when reliable information is in hand. Such individuals put off taking action on information about threats for many psychological, social, cultural, economic and political reasons, including because they tend not believe the information, because they hope that the threats will not play out or will not be as severe as predicted or because they have a false sense of security or personal capacity to cope with impending threats. EWSs are in general not designed to take into account human characteristics that can cause delayed responses to early warnings.

Time and time again, when those individuals charged with monitoring hazards and issuing warnings realize that people are not heeding early warnings, they tend to focus on refining the existing early warning system or message. They do so by various means: making the messages clearer or shorter; delivering it through a range of media types and perhaps in different languages and dialects; and giving even earlier warnings, etc. What is missing and needed is a pragmatic recognition of the fact that "risk takers" will not move so readily even as a real threat becomes imminent. Risk takers are not so eager to move or to deviate from their daily routines or leave their possessions open to looting in their absence. In response to this social reality the concept of late warning systems (LWS) requires serious consideration.

The utility of for a late warning system (LWS) may well find support based on actions taken in communities immediately before the onset of floods, bush and forest fires, or hurricanes. In such "eleventh hour" moments, those in civil defense can often be seen going door to door to try to convince individuals who fall into that "risk-taker" segment of the at-risk population to err on the side of caution and evacuate. But this is not the only way the concept of an LWS could be operationalized. In fact, successful LWSs would require a range of different approaches to spark timely responses from those who tend to linger in the face of foreseeable if not imminent disaster. The differences between and the complementarity of early and late warning systems merit serious exploration.

17. Sunsetting DRR assistance programs

Sunsetting a program or project refers to bringing it to an end by ending future funding support after a certain date. Doing so is not without adverse consequences, however. This concept encourages thinking that is concerned with the future but that is also keenly aware of the present in terms of DRR programs. It can be an important way of thinking especially given that budgets may foreseeably be flat-lined for the near- to mid-term, at a time when global requests for disaster assistance are expected to increase as global warming intensifies both hydro-meteorological extremes and uncertainties. A question arises, however, when a pilot projects proves successful. Is there an obligation on the part of the funding organization to continue funding a follow-up activity?

18. Reverse Triaging: Helping the bottom group first

Triage was introduced by French doctors on the bloody fields during WWI when a shortage of medical supplies and personnel prompted leaders to call for triaging, or dividing the battlefield wounded into three groups: those with wounds not considered life threatening (the walking wounded), those with serious wounds but who had a good chance of surviving if quickly attended to by doctors or nurses, and those who had been gravely wounded and despite considerable medical attention would not be expected to survive.

For disaster-related emergency response, a reversal of this selective response should seriously be considered. What reverse triaging suggests is that the worst disaster-affected individuals and groups should be attended to first. Given the medical, operational and response technologies and techniques that have been developed (primarily still for military use) over the past few decades, this possibility is becoming more realistic. With such tools, emergency humanitarian planners will be increasingly able to provide real to poor and marginalized disaster victims whose lives in previous disaster (and conflict)s situations~~)~~ would likely have been lost in the last century.

19. Hotspots Pyramid

'Hotspots' in the context of hydro-meteorological extreme events, can be defined as relatively localized areas that are at an elevated risk to climate-, water- and weather-related environmental and societal changes. Such areas can be qualitatively or quantitatively determined.

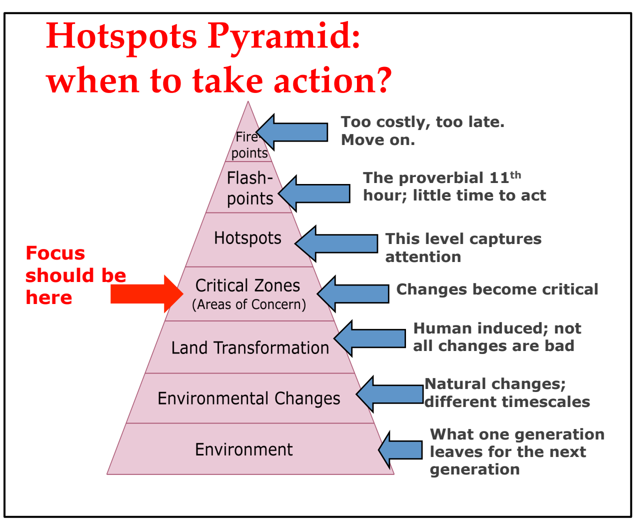
For example, one of the truly global aspects of climate change is sea level rise. All island nations as well as low-lying coastal areas are at high risk to this aspect of climate change.

The difference in comparison to other predicted changes like shifts in rainfall patterns or changes in seasonal characteristics is that sea level rise yields only losers. Few favorable options are available to individuals or governments, whether local or national, to adapt to this particular impact of climate change. In truth, only costly—economically, politically, socially and culturally—measures can be taken, such as general population retreat from low-lying coastal areas and re-enforcement of coastal barriers to attempt to hold back the rising sea and its storm surges.

Another foreseeable change to expect in mid-latitude regions around the globe is the emergence of tropical vector-borne diseases. Mosquitoes, for example, do not respect political borders and can easily spread poleward from the equator into regions where the various parasites they carry had never before been present or had been previously eradicated. In this way, diseases that are now viewed as problems of the "tropics" or of developing countries will increasingly become problems for industrialized, countries as atmospheric temperatures continue to rise steadily.

A pyramid of changes hotspot environments—and especially in hazard-prone areas—highlights the need for and possibility of earlier intervention than may previously have been recognized. The following diagram (Fig. 1), based on Glantz (2003), represents an idealized continuum of change using agriculture as an example.

Figure33 Hotspots Pyramid (Adapted from Glantz 2003)



Description of the Hotspots Pyramid. *Environmental changes* brought about by human activities, particularly those associated with agriculture, can gradually lead to land transformation (e.g. from forest to various farming systems, from swamp to drained areas or from dry areas to irrigated rice production systems). Such changes are usually *neutral* and, to some extent, reversible. This means that, if the land is abandoned again, it will spontaneously revert to a system similar to the original *natural* system. At the next level (*land transformation*) the land (and related resources) is transformed by human activities for a purpose: for reasons of shelter, food, energy, safety, etc. Too much land transformation in a given area can lead to environmental changes that move progressively toward irreversible degradation of the environment. When severe transformation and extreme degradation continues (becoming areas of concern, *AOC*s), such change becomes increasingly visible to more than local people. If such creeping changes continue unabated, AOCs become *"hotspots"* that demand attention and intervention from political leaders. *Flashpoints* represent the level where future degradation becomes irreversible change but resources can still be protected and restored, though only with the input of considerable human effort and financial resources. It represents the proverbial 11th hour or last chance to take action. *Firepoint* is the level of degradation from which there is no practical way to return to earlier conditions. At firepoint the land is typically abandoned as unusable.

In such a hotspots pyramid scenario, if response is mobilized when an AOC has been recognized, which is the stage before the emergence of a disaster 'hotspot', then fewer resources will be needed in order to respond adequately to that situation than if the area of concern had not been addressed until it actually became a 'hotspot'.

20. "The 3 'O's"

The 3 "O's" represent a way to measure response activities in a research or applications organization. The 3 "O's" refer to Outreach, Outputs, and Outcomes. Outreach encompasses discussions, lectures, social networking, mentoring, training and educating, and the like, and it can be said that just about everyone in an organization engages in outreach, either in person or electronically. Outputs are activities or "things" that can be counted, such as the number of training workshops held, the number of papers published, the number and plans of action developed and modified or the number of people assisted. Organizations tend to like outputs because they can easily be counted and are often viewed as signs of the success of an activity. Outcomes are what are left in place once the "outsiders"—in this case, emergency responders or development workers—leave at the end of the risk reduction response or recovery related to a disaster.

Outcomes are the most desired of these three objectives, but they are also the most difficult to verify, especially in the short term. Many organizations tend to confuse outreach and outputs with outcomes. The problem is that organizations often favor short-term objectives over longer-term ones, and outcomes may not be visible in the short-term or if visible may not be attributable to any specific DRR activity. The tendency for organizations is to focus on outputs (e.g. workshops, reports, conference papers presented, etc.) as a measure of success because they are easier to quantify and are visible in the short term. But OUTPUTS are not OUTCOMES! Only patience and the passage of time can validate potentially positive outcomes of a pilot project or other development activity. The problem is that most government agencies or especially donors do not have or devote the time or the patience to wait for the real outcomes of an activity to emerge; instead, they tend to count the proverbial "beans" of outputs as an inappropriate surrogate to those hard-won successes.

21. Disaster Risk Reduction (DRR) Bank

This idea for a DRR Bank was proposed by a Bangladeshi student named Raiyan who was a participant at the first *International Graduate Conference on Climate Change and People*, which was held in Kathmandu, Nepal in November, 2010 (http://gradconference.wordpress.com/). The conference was specifically for advanced undergraduate and graduate students from Greater South Asia. As a grassroots, bottom-up idea based on the concept of the Grameen Bank, it merits serious discussion.

Obviously, this idea is a variation on banking lessons identified and learned from hydro-meteorological hazards and disasters from around the globe.

22. Forecasting by Analogy (FBA): the search for "lessons"

The concept of "forecasting by analogy" (FBA) comes from engineering. It has, however, long been adapted for use in climate, water and weather impacts studies based on the view that, unless societies change their behavior in response to a forecast of a hydro-meteorological or geo-hazard, they are likely to again suffer from similar or worse consequences than those that occurred during a previous hazard episode of the same type. The reason is that—barring changes in behavior—the "business as usual" approach will likely prevail. Not only is it necessary, however, but it is imperative to "draw lessons" about what worked and didn't work, that is, what was learned, from previous societal experiences in order to better prepare for and cope with the impacts of future hydro-meteorological hazards, to generate forecasts about them, and to prepare for and respond more efficiently to both those future forecasts and hazards. In other words, looking back is as important as looking ahead. To do so requires a "hindcasting" exercise that examines societal reactions to a recent forecast as well as the real impacts that resulted from the hazard that was characterized by that forecast. As Glantz (1989, p.4) once suggested:

> Forecasting the future by analogy can be a fruitful approach to improve our understanding of how well society is prepared to cope with the presently unknown regional characteristics of a potential climate change some decades in the future. However, we must not expect analogues to tell us what that future will be…. Analogues can, however, help us to identify societal strengths and weaknesses in coping with extreme meteorological events so that we can reinforce the strengths and reduce the weaknesses.

23. Mitigating the impacts of CCA (climate change adaptation)

Adaptation is an on-going process, not just a one-time adjustment to an anticipated but still uncertain future. It is also an all-encompassing concept, which means that any discussion of adaptation must include an answer to the question, "adaptation to what?". Adapting to a faltering economy, for example, may be successful, but doing so may prompt adverse conditions, perhaps unintended, in other sectors of society. Likewise, those discussing adaptation should distinguish between adaptation actions that are focused on ~~the~~ short-, mid- and long-term time frames. What might work in the short-term may not be sustainable in the face of a changing climate; indeed, it may even exacerbate long-term climate change. Similarly, adaptation for the long-term may not receive interest or attention because it is focused on proposed or anticipated but uncertain impacts too far away from the present to merit concern.

Another consideration to take into account is that each adaptation activity will foreseeably generate its own set of downstream impacts. Therefore, whenever tactical or strategic adaptation activities are proposed in response to climate change, climate variability or hydro-meteorological extremes, cascading impacts (i.e. secondary, tertiary) must be identified and responses to them must be proposed and prepared as well. Thus, no recommendations for adaptation should be stated without potential ramifications.

24. Assigning a "Project Scribe"

Several approaches to seeking lessons can be identified in a DRR or CCA activity and can be applied to similar activities in the future. One problem with identifying lessons relates to how, when and where those lessons should be noted. Some have suggested that significant lessons that have been learned while a project is still being carried out could be identified by convening a mid-course project workshop. Others suggest that lessons should be identified only sometime after the project has ended. Both of these approaches have merit but they can also be critiqued. For example, the latter approach can (and often does) lead to situations in which people have some difficulty remembering all of the lessons that had been identified during the course of the project, especially a multi-year project or if people involved in one phase have since moved on to other unrelated projects. Another question asks, how far after a project ends should the search be undertaken for lessons that have been learned? Even the most vivid memories can fade, even in the short term.

One suggestion to counter this problem of when to identify lessons is to assign a scribe or record keeper who is tasked with regularly recording (i.e. daily, weekly, bi-weekly, monthly) lessons that have been identified by project participants. Such lessons can be sought from individuals or during occasional group meetings, through observations or interviews or focus groups. Near the end of the project, the lessons identified can be reviewed as being useful or not, with the useful ones being passed on to agencies, donors and aid recipients for their consideration in generating future projects.

25. "End-to-End+ Feedback" forecast system (E2E + Feedback or E2E2E)

The model of an "end-to-end" (E2E) forecast system is prominent in hydro-meteorological communities. In it, a forecast of climate, water or weather conditions in the near term is generated and disseminated to prospective users in various socio-economic sectors, including decision makers in government ministries. Hence, the direction of flow of information is from forecaster to user. The E2E model became well established in the early 1990s, when attempts were being made to emphasize the importance to societies of hydro-meteorological forecasts. What has not, however, been made explicit in the model, even today when better understanding has become available, is the calling for the feedback that "the users" can provide to corroborate and fine-tune the user-friendliness of the forecasts. This is especially true as the wide range of users who have often vastly different, though sometimes overlapping, needs from the forecasting community is increasing acknowledged as in no way resembling the homogenized "user" that was originally modeled as being the final end of that "end-to-end" linear reduction. To be sure, much of the criticism coming from communities about forecasts and early warnings is that those possibly useful tools often do not meet the needs of the communities they are meant for. In this way, forecasters continue even now to provide information that the forecasts *think* the users want or need, which is a significant problem. Adding an explicit third "end" --- feedback from users --- to early warning forecasters to the "end-to-end" model addresses if not resolves this particular communications issue, with feedback from civil society being not only legitimized as possible but also increasingly sought after by those responsible for hazard- and disaster-related forecasts and warnings to improve their models for more reliable forecasts, e.g. an E2E+feedback forecast system.

26. DRR & Research Applied to National Needs (RANN)

In the mid-1970s the US NSF developed a program called RANN, or Research Applied to National Needs (http://www.nsf.gov/about/history/nsf50/nsf8816.jsp). During its brief existence, it provided a national focus of research attention and funding for the nation. Why it was ended is not clear; the notion of such a program focused on national needs is, however, a useful one by analogy for capacity building and for building the resilience of developing societies in the face of climate change. In a century of likely increases in greenhouse gas emissions, more hazards that generate more disasters are foreseeable. In response, many humanitarian assistance agencies may become overwhelmed with requests for assistance, some significant portion of which will likely be left unmet. Because outsiders cannot truly know a region at risk to hydro-meteorological hazards—or especially the people who live there—each at-risk developing country or each region within each country should develop a "Disaster Risk Reduction Research Applied to its National Needs" (DRR RANN) Program to educate, train and prepare those who are foreseeably at risk of hydro-meteorological disasters—including those we consider "zero-order responders" (ZORs) and first responders.

27. "Ordinary knowledge" as a concept

Lindblom and Cohen (1979, p.12) defined ordinary knowledge as "knowledge that does not owe its origin, testing, degree of verification, truth, status, or currency to distinctive

… professional techniques, but rather to common sense, casual empiricism, or thoughtful speculation and analysis." Local, indigenous, and traditional knowledge are subsets of ordinary knowledge that draw on "knowledge of things beyond the local setting."

Decision makers are drawn from civil society and, like most people, are likely to rely heavily on their own accumulated ordinary knowledge. For their part, they also have a responsibility to listen to the public and its views as reliable input based on ordinary knowledge for decisions about DRR and CCA issues. Scientists too have a further responsibility that goes beyond their research to make clear to non-scientists the results of their research, correct misinterpretations of environmental cues and media reports and foster proper use of scientific indicators in ways that reinforce, assist or calibrate "ordinary" knowledge. Yet, communication between scientists and the public has apparently been less than adequate for a very long time. For example, H.G. Wells (1904) wrote, "many of those scientific people understand the meaning of their own papers quite well. It is simply a defect of expression that raises the obstacle between us." Today, given the relatively rapid changes underway in the climate system, ordinary knowledge will need to be supplemented by scientific knowledge in ways that laypeople understand if they are to adapt well to the changes that are coming if not already here.

Fortunately, innovation like wireless communication technologies are constantly being developed and becoming economically feasible for large segments of society. These technologies must be more effectively exploited to enhance, for example, communications between climate scientists, policymakers and civil society. Doing so will facilitate the development of social interactions that surpass the top-down (vertical) capacity strategies of the past in favor of more equitable possibilities for action and understanding that can emerge when voices from stakeholders are heard. Increased communications will also enable meaningful lateral interactions between, for instance, illiterate successful farmers and herders who through greater access to such communication possibilities are empowered to mentor and teach other illiterate farmers and herders who may be less successful, and thus fosters a type of climate capacity building that is horizontal (Shrimpton 2002) and community empowering.

28. Working *with* a changing climate, not against it

The phrase "climate change" raises eyebrows and interest now as never before. Obviously the word "change" is responsible for this expectable human reaction. Most people, institutions and governments fear change that they do not control, a psychology that should be remembered in discussions about climate change.

Eric Hoffer, an American migratory worker and self-taught social philosopher, wrote a book entitled *The Ordeal of Change* in which he discussed how people fear even the smallest changes to their routines or ways of life (Hoffer 2006). He wrote about the fear he faced as a migrant worker in California during the Great Depression in the 1930s that was a period of severe, multi-year droughts, unemployment and large scale regional migrations in the United States. He had finished picking peas on one farm and was about to move to pick string beans on a different farm, but he was afraid that he would not be up to the task of picking string beans. In Hoffer's own words "Even the change from peas to string beans had in it elements of fear." Most people today might not see this shift in work as an insurmountable change, but it was to him. In this time of changing global climates, fear is mounting in civil society and among its representatives, fear of new kinds of unprecedented changes that will have more serious implications for societies and their citizens. How will members of society respond when their activities are forced to change, individually and collectively, because of a warming climate?

Change can take place in many ways: it can be abrupt and step-like, or it can be a long, drawn-out affair. Abrupt change can clearly lead to socio-economic and political crises for a society. Some scientific reports now warn of abrupt climate changes occurring in relatively short time periods (on a scale of decades), if one or another yet to be identified tipping point in the global atmospheric temperature regime is reached. Unfortunately, scientists and decision makers do not have adequate local to national information that is reliable and detailed enough about the possible impacts of such changes encouraging them to take immediate actions to minimize potential damage.

For slow-onset changes, on the other hand, different problems arise. First of all, they are preventable and reversible up to a specific irreversible level of degradation that can occur months, years or decades in the future. Second, incremental changes could eventually accumulate leading to abrupt environmental changes, if not full-blown crises that demand attention and require a large amount of funds to address. The urgency to arrest slow-onset (creeping) incremental changes seems difficult for policymakers to accept. Third, governments do not have a favorable track record of dealing with creeping, incremental but cumulative changes in the environment. Rates of change in greenhouse gas emissions, in local temperature and precipitation, in ecosystem functioning, and in demographic shifts are extremely important to monitor in order to identify impacts and response strategies to such changes in a timely and effective way.

The point is that climate-related change will not directly affect all people in a given region or country at the same time or in the same way. In the near future, policy makers will have to convey this idea to local people and their leaders, but first researchers from various fields will have to determine effective ways to convey this understanding to policy makers whose tendency is to "kick the can down the road" leaving difficult issues for their political successors to resolve.

29. "Partnership in vs. Ownership of (projects that seek to bridge DRR and CCA)"

Partnership in and ownership of projects that seek to bridge DRR and CCA do not necessarily lead to similar results, yet definitions of these concepts tend to be quite similar, as noted in a cursory review. A review suggests that the term "partnership" is not being used in strict accordance with its definition. In standard usage, the concept of partnership denotes "a *cooperative* relationship between people or groups who agree to share responsibility for achieving some specific goal". Different arrangements can be agreed to in forming a partnership, and some partnerships are more equitable than others. Partners, though, are not necessarily equal in power, resources or influence. Having more power, influence, or money, one partner can dominate the others. In such a case, the subordinated partner in many ways must follow the wishes of the dominant partner.

Definitions of ownership tend to be brief and to the point: "The act, state, or right of possessing something (e.g. the ownership of land)" own·er·ship [oh-ner-ship]

1. the state or fact of being an owner.

2. legal right of possession; proprietorship,

(http://dictionary.reference.com/browse/ownership?s=t)

In a book about foreign assistance entitled *The Samaritan's Dilemma* by Gibson *(2005)*, ownership is defined in the following way:

> Ownership of an asset refers to participation in the provision, production, consumption, and decision making related to its continued use. In the field, these attributes are often dispersed among the donor, the consultant, and the formal owner or recipient. The actual beneficiaries, who have an enormous stake in the outcome of the project, however, are often excluded from the prerogatives and privileges of ownership. Poorly defined and improperly vested ownership can hamper success and sustainability of an aid project" (171).

Elsewhere in the book (p. 16), the authors identify four dimensions of ownership:

1) Enunciating demand (for the project)
2) Making a tangible contribution
3) Obtaining benefits
4) Sharing responsibility for long-term continuation or non-continuation of a project

The point is that having ownership of an activity is different than being partner in an activity. The difference relates in large measure to possession and responsibility. Once a partnership in a specific activity ends, neither party is obligated to continue to work with the other party on that activity. In this case, we are talking about projects or programs related to DRR and/or CCA. Related to this is that the goal of the partnership may itself be time constrained (2 or 3 years is common), which means that whether the objective has been reached to the satisfaction of the partners or not, the project ends. A partnership can be time limited without any commitment to continuance by partner, donor or recipient.

The problem is that the partnerships may not require a strong commitment, which means that once a project comes to an end motivation to continue pursuing its goals, especially if doing so would require a partner (the recipient) to use its own funds. This might be so even if other partners (and funders) had expectations that the pilot project would continue even after initial funding ended. Another problem is that donors sometimes come to realize that there is a lack of commitment on the part of a partner, even though the donor might be very committed to the activity's goals (DRR or CCA or both). At the end of the project, the donor might then choose to "re-partner" but with a new partner.

The objectives of ownership differ from those of partnership because taking ownership to address a longer-term issue requires a commitment to the project that may not hold for partnerships. Ownership suggests that each actor must be committed to use its own resources to continue the activity until it succeeds. It means that the recipient of donor funding did place a high priority on the activity.

30. Climate Proofing

The idea of "climate proofing" appears every now and again in climate change literature. It is a nice, feel-good concept that proposes that science and engineering can devise ways to protect societies from the vagaries of the climate system. It is a nice goal, but is also really a stretch in that it is a goal known to be impossible to reach. Yet some considered it to be worth the effort and risk associated with not attaining it. While specialists use the phrase, knowing its limitations, civil society may not recognize those limitations and think that such proofing would be 100 % effective, like a raincoat that is 100% waterproof. No one goes to a store to buy a raincoat and asks an attendant if they have a raincoat that is 70% waterproof! The use of the phrase "climate proofing" is misleading to the public, providing a false sense of security to those who take the expression literally.

It is difficult to envision that society could be completely protected from climate variability, change and extremes.

Over the years, various governments have proposed programs and technologies designed to weatherproof, or climate-proof, their countries or the vulnerable regions within them. The objectives of such programs can be interpreted in either of two ways (Glantz 2006):

> (1) To insulate human activities from the influence of climate and weather conditions, most likely extremes of precipitation (rain or snow) and temperature.
>
> (2) To reduce the exposure of weather- and climate-sensitive activities to climate-related hazards.

Objective 1 is quite idealistic and misleading to the public because such a goal is all but unattainable. To date, no society has been able to fully insulate its people and activities from climate- and weather-related anomalies. Yet a phrase such as "climate proofing" suggests that there are programs in place that can now or will be in the near future to achieve such an objective.

Objective 2 is more realistic. It suggests that climate proofing is a process as well as an end state. While the objective may be unattainable, effective operational steps towards achieving an increasingly protected society is attainable. This objective is most likely the one that governments have in mind when they propose such "proofing" activities either for society as a whole, for specific climate-sensitive social and economic sectors, or for their regions known to be vulnerable to hydro-meteorological hazards and disasters.

Both objectives are designed to minimize, if not eliminate, the chance of surprises and to mitigate, if not prevent, the unwanted consequences of anomalous weather or climate. For example, the history of successful agriculture in the Canadian Prairie Provinces has been punctuated by drought episodes. The Prairie Provinces suffered as much as the U.S. Midwest during the Dust Bowl days in the 1930s (but of course they receive no attention in U.S. history books). In the 1970s, following the recurrence of severe drought in the Prairies, the Canadian Government launched a program to "drought-proof" their Prairie Provinces. Drought-proofing measures included changes in land-use practices such as leaving stubble and crop residue in the ground after harvest. This was done to retain snow and to protect the topsoil from being eroded by winds. Expectations for successfully drought-proofing this region, however, were soon undermined by nature, as droughts and crop losses continued to reappear in the region. Today, Canadians in the region are more specific in their activities by, for example, calling for specific drought-proofing actions to protect farm water supplies (Glantz 1979).

Despite the confusion that surrounds the concept of drought proofing, it is still proposed by U.N. agencies as well as by various national governments. Two recent examples come to mind, Australia and India. During the 2002 drought in New South Wales, the government pursued a drought-proofing strategy, calling on farmers to review the way that they manage their land and water resources for drought. Drought-proofing in this situation meant mitigating the potentially adverse impacts of very dry conditions by devising ways to keep moisture in the soil by resorting to no-till practices and by upgrading irrigation facilities (eg, www.abc.net/stories).

The U.N. development program has partnered with Britain, Australia, and development agencies in creating drought-proofing activities in India on an experimental basis (e.g. Orissa and Rajastan) (www.undp.org.in/news/press/press207.htm). The plan of these activities is to encourage the use of technologies for the purpose of rainwater harvesting and groundwater recharging in order to make water supplies in rural areas more reliable and available than they are at present, especially when meteorological drought conditions occur. But not everyone has bought into the notion of climate proofing. For example, Indian policy analyst Devinder Sharma has argued that drought proofing measures should not be imported from other countries but should be home-grown. In September 2002 he suggested the following:

> It comes as a rude shock. The American agriculture that we studied in the universities and appreciated has crumbled with one year of severe drought. It is well known that Indian agriculture falters because of its complete dependence on monsoons. But with the kind of industrialization that took place in the United States, and with the amount of investments made, we were told that US agriculture is not dependent upon rains. Now, though, the drought-proofing that we heard so much about appears to be a big farce (www.indiatogether.org/agriculture/opinions/dsharma/uslessons.htm).

Labeling a program as intending to climate proof or weather proof may represent the hopes of the climate and weather research and forecast communities. However, it is a poor way to capture the attention of the public for the long-term, as there are unanticipated hydro-meteorological episodes in store for most if not all parts of the globe. First of all, the notion can be interpreted to mean that such a goal is attainable, especially with the availability of new forecasting tools and techniques and improved understandings of the workings of the climate system. Second, it raises false hopes that are only to be dashed by the next surprising climate or weather anomaly.

Perhaps a better way to introduce the concept of "proofing" is to talk about it in terms of working "towards climate proofing." This presents the idea of proofing as a process and as a laudable societal goal towards which to strive, but one that comes without an assurance or guarantee that it can eventually be a goal that can be reached, though progress *towards* the goal can be made.

31. Risk Taking, Risk Aversion … and Risk Making

Risk taking and risk aversion are prominent concepts in finance and psychology. *Risk-taking* refers to the tendency to engage in behaviors that have the potential to be harmful or dangerous but that provide the opportunity for some kind of outcome that can be perceived as positive. (http://ptsd.about.com/od/glossary/g/risktaking.htm). Note that although the second part of the definition may be valid for gambling, for example, it is not an effective option when it comes to decide whether or when to respond to an early warning about an impending hydro-meteorological hazard or disaster.

Risk aversion is defined as “a manifestation of people's general preference for certainty over uncertainty, and for minimizing the magnitude of the worst possible outcomes to which they are exposed” (http://financecareers.about.com/od/rz/g/Risk_Aversion.htm). Another term for this tendency is “risk avoidance.” This concept directly relates to the expected effective response to hydro-meteorological early warnings about a hazard or possible disaster.

The ways that people deal with risk can fall into yet another category, however, that of “risk making.” *Risk making* refers to situations wherein decisions that are made by group A have potentially adverse consequences for group B but not for group A. Risk makers bring ideas, projects and programs to benefit other regions, if all goes well. But if such a project ends up having adverse consequences, such as when people re-settled in an area of high risk are exposed to a deadly and destructive flooding event, the planners merely go back to the proverbial (sustainable development) drawing board, while those who were adversely affected are forced to live with the negative impacts of the risk makers' failed project.

Humanitarian and emergency assistance planners must be sure to consider with every project that they avoid becoming risk makers for the communities they seek to help. Risk-making decisions relate to situations in which decision makers mean to help people and communities through humanitarian aid and development, but their activities actually create new and different risks. This is similar to the notion of “mitigating the impacts of adaptation to climate change,” which illustrates the reality that adaptation measures in response to climate change will have their own ripple effects on society, some positive and some negative.

32. Decision Making Under Uncertainty (DMUU) and Foreseeability (DMUF)

Over a decade ago, the US NSF developed a program to solicit proposals to research the notion of "decision making under uncertainty" (DMUU). DMUU has value for applying science to societal decision-making processes. The scientific community's "job" focuses on what we do not know and on reducing uncertainty. Libraries are filled with books, articles and reports about uncertainty in decision-making and attempts to reduce it. DMUU focuses on and highlights what we do not know, as opposed to what we do know. This brings to mind the adage about whether a glass is half empty or half full. With regard to scientific inquiry we can ask if a glass is 1/4th empty or 3/4th full. Scientists by nature tend to focus on the uncertainties, and on the part of the glass that is 1/4th empty. The reality is that most decisions are made with less than perfect information in hand. It is important to keep in mind that, even with perfect information in hand, there is no assurance that the best possible decisions will be made. Perhaps it is useful to consider a positive and perhaps more realistic perspective for most decision-making situations, such as "decision making under foreseeability."

Decision makers always have some information in hand and are often forced to make on-the-spot decisions. Scientific curiosity may have the luxury of time to focus on reducing any remaining scientific uncertainty. However, decisions need to be made and decision-makers cannot often wait for additional scientific discoveries. A key concept for decision makers, then, is "foreseeability," we discussed earlier. People can relate to the foreseeability of the occurrence of an extreme event that had occurred in previous times, even though they do not know about the science-based probability of its recurrence at a specific place or point in time. It is uniquely relevant for dealing with the uncertainties surrounding potential hazards spawned by climate, water and weather variability, extremes, and change. By its application we can foresee not only which adaptation measures should be considered for implementation and when, but can also identify in advance the first or second order ripple effects in the environment of adaptation to a changing climate.

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WMO (World Meteorological Organization) (2011). *Strengthening of Risk Assessment and Multi-hazard Early Warning Systems for Meteorological, Hydrological and Climate Hazards in the Caribbean*. Chair, Publications Board World Meteorological Organization Geneva, Switzerland.

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NB: The study team reviewed all USAID/OFDA Annual Reports from 1992 through 2013.

INTERNET RESOURCES:

www.abc.net.au/nws/stories/s604472.htm

http://www.adb.org/Documents/Reports/Urban-Air-Quality-Management/cambodia.pdf, Country Synthesis Report on Urban Air Quality Management, Cambodia

http://www.agrhymet.ne

Sida's evaluation guidelines can be found at http://www.alnap.org/pool/files/evaluation_manual_sida.pdf

http://www.business-in-asia.com/cambodia/cambodia_constructions.html

http://www.delkhm.ec.europa.eu/en/events/dec-22-09/005%20-%20Climate%20Change%20in%20Cambodia%20by%20Dr%20Tin%20Ponlok.pdf

"USAID New way of doing business" on http://www.devex.com

An explanation of how the government made funding decisions can be found here: http://www.dfid.gov.uk/Documents/publications1/mar/Taking-forward.pdf.

Other documents, including the government's response can be found here: http://www.dfid.gov.uk/what-we-do/how-uk-aid-is-spent/a-new-direction-for-uk-aid/multilateral-aid-review/

Responses from the organizations that were reviewed can be found here: http://www.dfid.gov.uk/What-we-do/Who-we-work-with/Multilateral-agencies/Multilateral-organisations-responses-to-the-Multilateral-Aid-Review-/

http://www.drrprojects.net/drrp/drrpp/project/214/read

http://www.eoearth.org/article/Water_profile_of_Cambodia

http://financecareers.about.com/od/rz/g/Risk_Aversion.htm

http://www.icimod.org

ICPAC website: http://www.icpac.net

www.indiatogether.org/agriculture/opinions/dsharma/uslessons.htm

http://www.meteo.go.ke/ranet/Info/ranet.html

http://www.mot.gov.kh/GeneralInformation.aspx?sm=63&Ads=1

http://www.mrcmekong.org/.../InterSWAT_IQQMOutput20-21May06modi_2.pdf

NECJOTHE GHA website page: http://www.necjothe GHA.org/

NOAA website: http://www.noaa.gov

http://www.nws.noaa.gov/iao/BLT_AFN.php

http://www.oed.com/view/Entry/163619?redirectedFrom=resilience#eid

http://ptsd.about.com/od/glossary/g/risktaking.htm

OFDA/CRED International Disaster Database: www.em-dat.net

www.recambodia.org/biomass.htm

http://www.state.gov/r/pa/ei/bgn/2732.htm#profile

www.thefreedictionary.com

www.undp.org.in/news/press/press207.htm (link doesn't work)

http://www.unisdr.org

www.urgentevoke.com

http://www.usaid.gov

http://www.water.nsw.gov.au/Water-Management/Modelling/River-systems/River-systems/default.aspx

http://www.whycos.org

http://en.wikipedia.org/wiki/Royal_Gendarmerie_of_Cambodia

http://en.wikipedia.org/wiki/Satisficing

http://en.wikipedia.org/wiki/SWAT_model

http://www.wmo.int/disasters/surveys/country/surveyCountry.htm

http://www.worldresourcesreport.org/responses/ranet-project-climate-information-collection-zambia

http://www.zi-online.info/en/artikel/zi_CamBuild_2010_Cambodia_ InternationalBuilding_ Construction_Industry_Show_816447.htmlf

Only the executive summary is available online. A full report can be ordered from the BMZ at http://www.bmz.de/en/publications/type_of_publication/evaluation/index.html#n2anker12681317

Website (http://www.sida.se/English/About-us/Evaluations/).

INTERVIEWS:

Interviews were conducted with the following persons/ institutions:

At ICPAC: Zachary Atheru, who was the Program Officer; Chris Oludhe, who was in charge of the Tana River Reservoir Pilot Project; Joseph Mutemi, who was in charge of the Rift Valley Pilot Project;

At University of Nairobi: Pr. Robinson Kinuthia Ngugi, who was in charge of the pilot project in the Machakos;

With the NHMS: Kassa Fekadu, meteorologist from Ethiopia; Mujuni Godfrey, meteorologist from Uganda; Ruben Barakiza, climate scientist from Burundi; Nshimirimana Godefroy, chief of forecasting service from Burundi; Mohamed Ahmed Elkhais, senior meteorologist from Sudan; Edwar Andrew Ashiek, meteorologist forecaster from South-Sudan; Shamin Nusit, meteorologist from Tanzania; Mary Kilavi, chief meteorologist from Kenya; another meteorologist from Kenya; and Ngirimana Aimable, forecaster from Rwanda (we did not get responses from representatives of Eritrea, Somalia, and Djibouti);

At the Ministry of Arid Land: M. James Odure;

At the CCB: Tsegay Wolde-Georgis

At NOAA: Kelly Sponberg

With a representative of the civil society: M. Ravi Nayak, from the One Acre Fund NGO;

With a representative of the media sector: Patrick Luganda, Director of NECJOGHA, Uganda (email exchange: 01/23/2013).

Finally, the information collected on the RANET program mostly comes from Internet resources, and email exchanges with Kelly Sponberg.

Furthermore, an associate, Peter Usher, conducted interviews with small-scale farmers in Kenya highlands in March 2013.

Rajendra Shrestha, senior meteorologist in the Meteorological Forecasting Division of DHM

Dr. Rishi R. Sharma, Director General of DHM and Permanent Representative of Nepal with WMO, Department of hydrology and Meteorology (DHM) (email interview received on January 10, 2013)

Bajracharya S. R., Satellite Hydrology Officer, Integrated Water and Hazard Management, ICIMOD

Dr. Mandira Shrestha, water resource specialist at ICIMOD, Nepal

Dr. Dilip Kumar Gautam, Senior Hydrologist, Former Chief of Flood Forecasting section, DHM. Regional Integrated Multi-Hazard Early Warning System for Africa and Asia

(RIMES), Asian Institute of Tehcnology, Thailand (email interview received on January 1, 2013)

Dr. Arun B. Shrestha, program manager at ICIMOD, Nepal

Dr. Sayed Rasekhudin, hydrology engineer from the Foreign Ministry of Afghanistan

Pr. Rupak Rajbhandari, Head of the Department of Meteorology (DoM) at Tribhuvan University, Nepal (email interview on Jan. 11 2013)

Nitesh Shrestha, Program Manager at ADAPT-Nepal (email interview on Feb. 10 2013)

Dr. Mahdav Karki, [Former] Deputy Director of ICIMOD. Skype interview conducted by M. Glantz on October 26, 2012