Climate Change and Development

Consultation on Key Researchable Issues

Sectoral Issues
Section 2.3. Natural Disasters
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Climate Change and Natural Disasters

The recent tsunami in South Asia was a tragic reminder of how vulnerable human society is to natural disasters. Extreme events such as droughts, floods, heat waves, tropical cyclones, and hurricanes can cause widespread damage and loss of life: devastating communities and destroying decades of development work. As the President of Honduras, Carlos Flores, stated after Hurricane Mitch in 1998, "[w]e lost in 72 hours what we have taken more than 50 years to build." Even industrialised countries with sophisticated prevention and response measures can face billions in recovery and reconstruction, with long-term socio-economic impacts. The development community has worked extensively to tackle the threat of natural disasters, concentrated in the field of disaster risk management. This section will briefly outline the projected changes in climate extremes, based largely on the work of the IPCC. Followed by a review of disaster risk management research and policy; exploring the major areas of progress and some of the obstacles hindering the integration of disaster management with climate change policy.

Climate Change and Natural Disasters

Climate change science has provided strong evidence that the Earth is experiencing a gradual rise in global mean temperature with models projecting an increase in average surface temperature of 1.4ºc to 5.8ºc by 2100. In fact, climate modelling has tended to focus on changes in mean temperature, precipitation, and so forth. However, this is only one aspect of climate change -- changes in climate variability are also expected. Such changes include simple extremes such as heavy rainfall and high/low temperatures, but also extreme weather events such as tropical cyclones, droughts, floods, and ENSO-related events. Catastrophic changes could also occur such as the cessation of thermohaline circulation and the collapse of the ice sheets, which would cause a cascade of dramatic changes in the Earth's climate systems. This section, however, will focus on extreme weather events to explore the linkages between climate change and natural disasters.

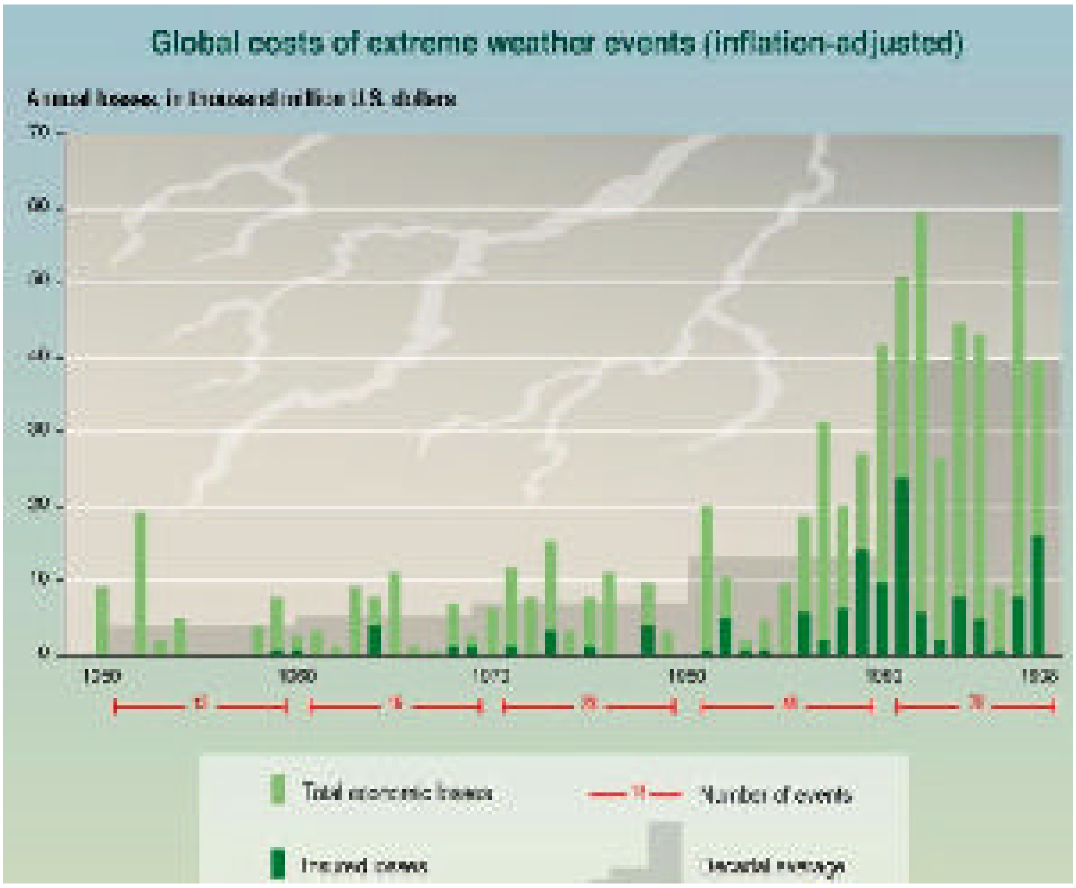
There is strong scientific evidence to show that climate change will increase both the frequency and intensity of extreme weather events. These changes "are likely to be at least as important as changes in mean climate conditions in determining climate change impacts and vulnerability" (IPCC TAR, ch. 1, 2001, p92). In fact, many industries and communities will be able to adapt to gradual changes in climate, but are highly vulnerable to weather extremes such as natural disasters. Unfortunately, modelling climate variability has proved challenging due to inherent uncertainties in the Earth's climate systems. Furthermore, the

IPCC has tended to focus on the physical causes of natural disasters as opposed to the complex social and economic interactions with the physical environment. Current plans for the upcoming fourth assessment report of the IPCC are expected to provide a more comprehensive assessment of disaster issues (Climate and Disaster Risk Reduction, UN/ISDR, Nov 2003). Regardless, great strides have been made in recent years and climate models are becoming more reliable, especially at the regional level where the projections would prove most useful for policy. Future changes in climate variability will depend on the region, but the following are examples of possible climate change impacts published by the IPCC.

- Climate change will likely lead to higher maximum and minimum temperatures causing heat or cold waves which would threaten humans, livestock and wildlife, damage crops, and increase energy demands.
- It is also very likely that certain regions will witness an increase in the frequency and intensity of precipitation, potentially leading to floods, landslides, soil erosion, and pose a risk to humans, animals, and agriculture.
- The frequency of tropical storms (cyclones, hurricanes, etc.) will likely increase in certain regions as well as rain and wind intensity of such storms. These events would threaten human and animal life, but also lead to major infrastructure damages, coastal erosion, water-borne diseases, and harm coastal ecosystems.
- It is also expected that droughts and floods associated with El Niño events will become more intense, having significant impact on agricultural and rangeland productivity in key regions and may also interfere with hydro-power potential.
- Lastly, climate change may also cause a shift in the Asia monsoon which could increase the risk of flooding or droughts in certain areas, and impact agricultural productivity and a host of other sectors dependent on the annual monsoon.

These are but some of the predicted changes in climate variability. Clearly, such changes will have significant socio-economic impacts, creating new opportunities in certain regions and sectors but also increasing vulnerability in others. As seen in other aspects of climate change, poorer communities are the most at risk to these changes in extreme weather. At present, 98% of those affected by natural disasters come from developing countries (Tearfund, 2005, p4) and economic damages from natural disasters are 20 times higher on a per capita GDP basis for developing countries than those of developed countries (Freeman 2001).

Economic Losses from Major Natural Disasters from 1950-2000 (US$)

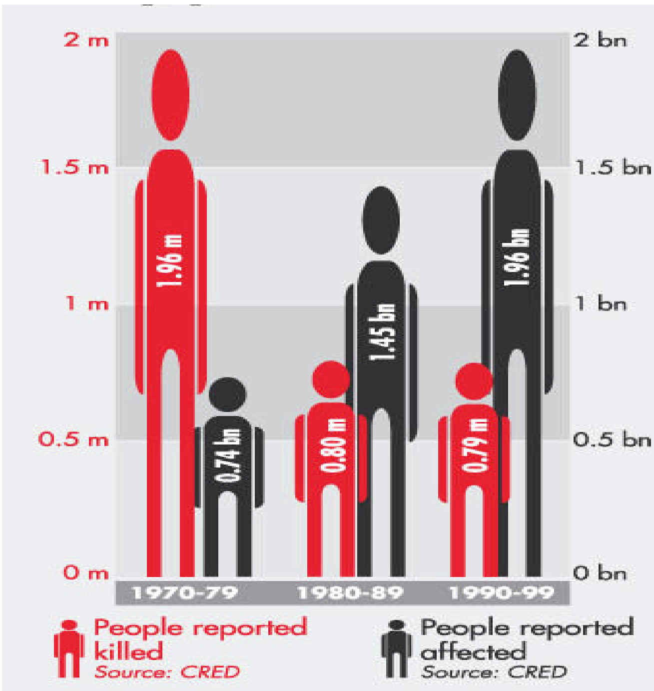


♦ Taken from IPCC TAR 2001 and Munich Re 2000. Inflation adjusted.

Furthermore, the increasing risk of extreme weather events is compounded by the fact that economic damage and human tolls have increased steadily in the last 50 years (Sperling and Szekely, 2005). Many parts of the world are struggling to cope with *current* weather extremes which sabotage development efforts in these countries. From 1950 to 1990, the annual direct losses from natural disasters increased 14 times, from $3.9 billion to US$40 billion per year -- sometimes reaching as high as US$170 billion in a given year. The majority of these economic losses were attributed to weather-related extreme events, which are also becoming more common. Moreover, the UNEP predicts that the global financial cost of natural disasters could exceed US$300 billion by the year 2050, representing 1.5% of world GDP (Berz, 2003). It is not only scientists who warn against the increase risk of extreme weather events -- the insurance industry have also acknowledged the threat and dedicated resources in research and advocacy (Please see Box – on Climate Change and the Insurance Industry).

As mentioned above, human tolls from natural disasters have risen (See Box -). In the past 30 years the number of people affected by natural disasters has increased although, fortunately, actual death rates have decreased. Urbanisation, poor landuse and infrastructure, environmental degradation, climate change, and social and geographical marginalisation are some of the factors which are increasing human vulnerability to extreme events. More communities, especially in LDCs, are at risk to natural disasters, which is a worrying trend considering weather-related extreme events are expected to rise in the coming decades. As Auld and MacIver stated, while debate still continues about the changing nature of climate variability and weather extremes, evidence shows that vulnerabilities to climate events have increased.

Human tolls from Natural Disasters from 1970 to 1999



Adaptation Research Needs: Insurance

Source: Ian Burton

The availability of insurance for climate-related risks such as extreme weather events (floods, droughts, tropical cyclones and others) is very limited and where available tends to be expensive. When climate-related disasters occur in developing countries substantial sums of money are often forthcoming in the form of disaster relief, but when the relief funds are exhausted individuals, communities and nations are forced to borrow money for reconstruction. Reconstruction is often carried out in a hurry (it is important for communities to get back to business as usual as quickly as possible), and fails to take existing climate and future climate change risk sufficiently into account. Such decisions create the probability of a repetition of the disaster which may be made worse due to further population growth in hazardous areas or low quality construction and other forms of maladaptation. This pattern of disaster and response contributes to the rapidly rising curve of disaster losses and the associated rise in impoverishment. The situation is set to get worse with climate change.

In theory insurance could play a powerful role in both risk spreading and risk reduction. Moderately priced and accessible insurance could ensure the availability of funds for reconstruction. Moreover eligibility requirements and rate incentives could be used to promote or require the adoption of adaptation measures to reduce damages, just as fire alarms and extinguishers and car seat belts are used to reduce fire loss and car accident fatalities and injuries. Attractive insurance policies could be made available at a variable price depending upon location and quality of construction, and natural resource and agriculture management practices.

The private insurance and reinsurance industry is generally not responding to this need. Partly this lack of response is linked to a fear of overexposure especially to catastrophic events. Since large scale disasters are increasing in frequency and magnitude insurance companies are increasingly at financial risk themselves and are seeking to reduce their exposure at precisely the time when more insurance availability is needed. In many regions and countries the potential size of the insurance market is too small to attract the private insurance industry. The people at risk are too poor to be able to purchase insurance at commercial rates.

Under the UNFCCC a number of proposals and suggestions have been made to make insurance available for climate-related risks where it is lacking. Little or no progress has been made because it has been assumed that such insurance would have to be supported by substantial public subsidies and governments have been unwilling to contemplate such “bottomless” expense. One reason for this is “adverse selection” meaning that only those people and communities at high risk would be likely to purchase insurance even at subsidized rates. Sufficient risk spreading is therefore hard to achieve. Another reason for lack of government interest is the “moral hazard”. The very availability of insurance might serve to perversely increase risk taking behaviour. Perhaps the most compelling reason however is the uncertainty that prevails because there is no information or understanding about how a public-private partnership for climate-related insurance could be made to work.

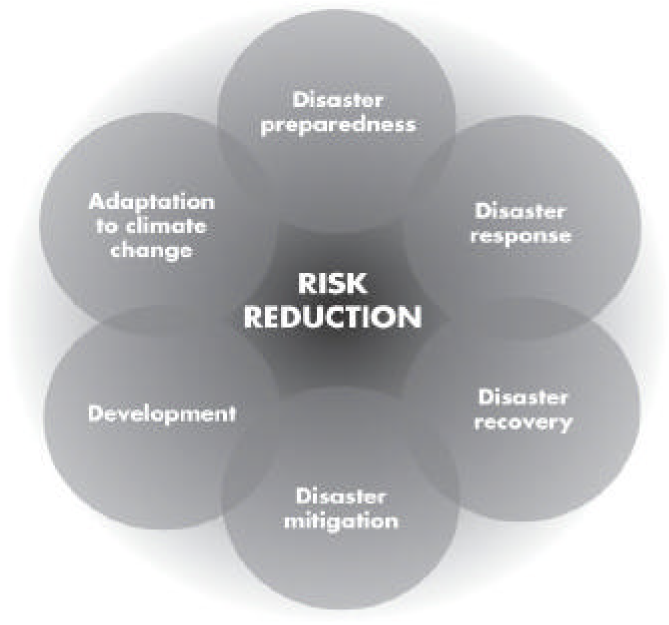
This is therefore a research task. How could a public-private insurance partnership be made to work that would overcome the problems of adverse selection and moral hazard? How could it be financed in such a way that it served its purpose without exposing insurance companies or governments to a permanent regime of subsidies and increasing exposure to catastrophic losses? Would it be possible for a public-private partnership for climate insurance to be or become self-financing? On what actuarial (risk) basis would premiums be calculated? How could related adaptation measures be monitored and regulated? Would there be a role for international financial institutions? How would any such climate insurance programme be related to present disaster relief measures and the costs of adaptation under the Climate Convention?

These are difficult questions and there are many others. Not much is likely to happen until some answers can be found and formulated into reasonable proposals for governments and insurance companies to consider. There is also a need for some vision and leadership to motivate the research community. The opportunities and the needs are clear however. The research does not begin entirely from a clean slate. There are at least a few examples of situations where insurance is being used and is working to spread risk and facilitate adaptation. These examples should be gathered together and examined for ideas and experience that could be used to further the climate insurance initiative. For al these reasons a small informal Working Group is being formed to develop and pursue these ideas.

Disaster Management Research and Policy

The climate change science community has made great progress studying possible changes in climate variability. Nonetheless, the long research tradition on *existing* climate variability belongs to the development community. A range of development fields, including disaster, health and agricultural sectors, have long studied existing climate variability and both human vulnerability and response to natural disasters. In particular, disaster risk management is an interdisciplinary field that seeks to minimise current vulnerability to natural hazards. Disaster risk management develops policies and strategies that both prevent or reduce hazard impacts (mitigation and disaster preparedness) *and* disaster response and recovery efforts (rehabilitation and reconstruction). Research and advocacy in disaster risk management is proactive, emphasising prevention as well as emergency and recovery action. For less developed countries, disaster preparedness is especially important and much more effective than traditional recovery strategies. It is estimated that for every US$1 spent on preparing for disasters, a further US$4-10 is saved in the cost of recovery afterwards (Tearfund, 2005, p4).

Disaster Risk Management Framework



The Hyogo Declaration at the World Conference on Risk Reduction (January, 2005) was the first time climate change was officially included as an underlying risk factor for disasters. This inclusion of climate change was the result of intense negotiations and "provides a number of interesting opportunities for mainstreaming climate change risks in disaster risk reduction strategies and vice versa" (Helmer, 2005, p. 2). The Hyogo declaration raised the profile of climate change within the disaster community and marked an official recognition of the connection between climate change and natural disasters. The Vulnerability and Adaptation Resource Group (Sperling and Szekely, 2005) also presented a paper during the Conference which further illustrated the interlinkages between climate change and disaster management. However, despite these research and policy developments, many observers noted the continued separation of the climate change and disaster fields. The major UN conferences illustrate this separation with few from the disaster community attending the 10th Conference of the Parties to the UNFCCC, and even fewer from the climate change community attending the World Conference of Risk Reduction.

Despite this, many great opportunities exist for collaboration between the disaster and climate change communities. From a conceptual standpoint, the disaster "no regrets" approach for reducing vulnerability and focus on risk reduction follows the same logic behind climate change adaptation. Indeed, the rise of adaptation in the climate change negotiations parallels the shift within the disaster community from disaster management to disaster risk reduction. Furthermore, disaster risk reduction is a promising entry point for climate change adaptation policy by addressing current climate extremes and problems with existing disaster management capabilities. "Strategies to address existing risk scenarios have the advantage of being more feasible for mobilisation of national and international political and financial resources than strategies that address a hypothetical future scenario" (Auld and MacIver, 2004, p203). The climate change community can learn from the long research tradition in the development community in tackling existing vulnerability and coping strategies to extreme climate. For example, risk maps from disaster risk management could aid climate change vulnerability assessments and subsequent adaptation policies. Other disaster risk management strategies such as financial risk management, building codes, flood protection, and coastal ecosystem management can assist adaptation policies.

Of course, adaptation policies cannot loose sight of medium- and long-term scenarios, and it would be a mistake to assume that present climate variability will continue in the future. "Changing baselines of environmental conditions in which disasters occur has to be recognised in its implications for disaster risk management planning efforts" (Sperling and

Szekely, 2005). Both changing climate variability and climate trends will impact disaster risk management; and as such, advances in climate modelling should be shared with the disaster community. That being said, from a political perspective, grounding adaptation in current climate variability is a sound starting point for short-term strategies.

Adaptation Research Needs: The Aggregate Potential of Adaptation

Source: Ian Burton

A frequently repeated mantra in the climate change negotiations is that the benefits of mitigation are global and that the benefits of adaptation are local. It follows that the costs of mitigation should be widely shared in the international community, whereas the costs of adaptation should largely be borne at the local level. This notion is based on the assumption that the causes of climate change can be measured by the global level of greenhouse gas emissions and their concentration in the atmosphere, whereas impacts of climate change and adaptation to them are felt and measured in specific localities. Thus one side of the climate change agenda lends itself to international agreement and action whereas the other depends largely on local or national response. In consequence we have the Kyoto Protocol which specifies the targets and schedule for the reduction of greenhouse gas emissions in the first commitment period, but no equivalent agreement on adaptation.

This social construction of the climate change problem has created a dichotomy between adaptation and mitigation that precludes their quantitative comparison, and obstructs calculation of trade-offs in terms of a common metric. It is clear to all, however, that the more effectively greenhouse gas emissions can be reduced, the less the need for adaptation and vice versa. To put it another way, the more that vulnerable systems can be adapted to the impacts of climate change the more time there is to bring future greenhouse gas concentrations down to a tolerable or not "dangerous" level.

Two innovations are required to correct this misconstruction. One is the recognition that the economic benefits of mitigation are to be measured not in terms of greenhouse gas concentrations and emissions, but in terms of the sum of the benefits of locally reduced impacts. How this might be done is a problem for the "mitigation" and Kyoto community of researchers. The second innovation is the recognition that the economic benefits of adaptation might be measured in global aggregate terms, and that to do so would facilitate understanding of the trade-off between mitigation and adaptation. Such a trade-off does not imply a one-time-only calculation, but a comparison of the stream of benefits and costs from mitigation and adaptation over time. If such a calculation were to be made it would probably show that the aggregate net benefits of adaptation are greater in the short and medium term, whereas the aggregate net benefits of mitigation are greater in the medium and longer term. In other words an optimal policy would provide for more adaptation now in order to buy time for mitigation to be introduced and take effect more gradually.

Many questions have to be answered before such calculations become possible. This is a challenge to the research community in adaptation. It is not sufficient to understand and measure the benefits of adaptation in one locality. Ways must be found of measuring the aggregate net benefits of adaptation. A large number of specific research questions arise. What is the current level of the costs of climate impacts by locality, by sector, and most important, cumulatively or in aggregate? What is the adaptation baseline? In other words what is the cost of climate change now, and how will the costs (damages) of climate change increase over time if nothing is done to increase the level of adaptation? Assuming that adaptation to climate is a normal part of human activity, this refers to the difference between "business as usual" adaptation, and the extra adaptation that is needed to cope with climate change if risk levels are to remain constant.

Why would it be helpful for the adaptation research community to think of the costs and benefits of adaptation in these aggregate terms? Look at it this way. In order to reach international agreement on what is to be considered a tolerable level (that is to say not dangerous) of greenhouse gas concentrations in the atmosphere, it is necessary to know the aggregate costs of the impacts of climate change. This depends not only on the amount of climate change, but also on the level and costs of adaptation.

In recent discussions about the need to reach agreement on what constitutes a dangerous level of anthropogenic interference with the climate system, it has been suggested that an increase in mean global temperature of plus 2 degrees Celsius over pre-industrial levels might mark the threshold of danger. What is not known is by how much such a threshold level could be increased by an effective global programme of adaptation. Would it be possible for example to maintain the same level of risk (avoiding the danger threshold) at plus 3 or 4 degrees Celsius if adaptation measures were fully developed and deployed?

It might be objected that such calculations would do nothing to facilitate locally based adaptation because the bulk of the costs would still have to be borne locally. This is not necessarily the case. The benefits of adaptation consist of the prevention of local losses and the benefits of not having to spend so much so quickly on mitigation.

How could aggregate net benefits of adaptation be measured? Adaptation might be factored into general equilibrium models of the global economy so that total climate impacts with and without adaptation could be estimated. In such an exercise different assumptions about the amount and kind of adaptation could be tested. It might also be possible to measure the costs and benefits of adaptation empirically in specific localities or by sectors up to the global scale. The considerable data and measurement problems involved seem to have largely inhibited this research. It is not about time for the adaptation research community to begin thinking more seriously about the aggregate potential of adaptation?

Disaster risk management and climate change adaptation share the common goal of reducing climate impacts and tackling the underlying socio-economic and political factors which increase vulnerability. Especially in the last three years, organisations like the Red Cross and International Strategy for Disaster Risk Reduction (ISDR) have explored the interlinkages between the two fields. However, it is important to acknowledge a major divide that currently exists between disaster research and disaster policy that will hinder the ability to link climate change adaptation with disaster risk management. Within the policy domain, disaster strategies in most countries still only address emergency and response measures, largely ignoring preventative strategies. There are certain financial and logistical constraints that hinder disaster preparedness, such as deficiencies in early weather warning systems and information dissemination networks, poor infrastructure, and inadequate heath and social services. Least developed countries may find it difficult to find the necessary resources for disaster preparedness strategies. However, the lack of preventative policies can also be traced to an outdated view of disaster management in many government bureaucracies. Many practitioners and policy-makers do not understand disaster risk reduction or its role in the wider development agenda. The PRSPs are a case in point, where little or no mention is made of how disasters impact development and poverty, or the need and logic behind disaster risk reduction (Monirul Qader Mirza, 2003).

International funders also ignore disaster preparedness with aid money being directed towards recovery operations and infrastructure rather than prevention and reducing existing vulnerabilities (Monirul Qader Mirza 2003; Tearfund, 2005). In 2003, the UK Secretary of State for International Development stated, "we are seriously under-investing" in disaster preparedness. The Hyogo Declaration also reiterated the need to shift from traditional disaster management to risk reduction. Even within the development research community, disaster risk reduction is divided between relief and development fields which hinders research and advocacy efforts. Such problems within the disaster community and the slow integration of risk reduction into existing government disaster programmes will seriously undermine the ability to integrate climate change adaptation with disaster policy.

Further Areas for Improvement

Despite sharing many of the same goals, there are practical considerations that hinder the integration of climate change adaptation and disaster risk management. First, disaster management employs a more bottom-up approach, as seen in many other development areas; where as climate change research is exemplified by a top-down research and policy approach. "Disaster management grew from a localised, specific response measures to include also broader preventative measures … [whereas] the response to climate change has been a more top-down process as it became an international issue of importance" (Sperling and Szekely, 2005, p7). Second, the disaster policy operates in a different time frame than climate change policy. Disaster research and policy typically involves 5-10 years plans, as opposed to climate change research which operates with 50-100 year timescales. As Auld and MacIver explain, "[a]ll too often, the disaster management disciplines and the climate change disciplines do not communicate with each other, perhaps because the professionals working in these topic areas operate with different timescales and under different mandates" (2004, p202). Lastly, there are conceptual differences between the two fields. For example, the notion of "vulnerability" is treated differently within climate change and disaster fields.

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