A Climate Risk Management Approach to Disaster Reduction and Adaptation to Climate Change

UNDP Expert Group Meeting.
Integrating Disaster Reduction with Adaptation to Climate Change

Havana, June 17-19, 2002

United Nations Development Programme

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Executive Summary

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Disaster Losses and Unsustainable Development

Disaster occurrence and losses associated with extreme and increasingly not so extreme climate events have increased dramatically in recent years. While many of the emerging patterns of disaster risk are associated with natural hazards that show no tendency to increases in magnitude and recurrence, human interventions in the natural environment are generating new socio-natural hazards, mainly associated with climate events. In many incidences of new flooding, landslide, drought, forest fire and coastal erosion, environmental degradation has transformed natural resources into new hazards. At the same time, the social, economic, territorial, physical and political vulnerability of populations in many developing countries continues to worsen, weakening their capacity to absorb the impact of and recover from extreme climate events.

Rapidly increasing levels of disaster losses are beginning to outweigh development gains in a number of countries. This is particularly the case in the Small Island Developing States (SIDS). It is now very clear that flawed development and environmental practices are at the root of much of the new disaster risk. The achievement of the UN Millennium Goals, in areas such as poverty reduction, health and education will be impossible unless concerted efforts are made to manage and reduce the disaster risks associated with potentially damaging climatic events.

Global Change, Complexity and Uncertainty

Processes of global change are adding new and even more intractable dimensions to the problems of risk accumulation and disaster occurrence and loss associated with climatic events. Due to global change, rapid and turbulent changes in risk patterns in a given region are rarely autonomously generated and may, in numerous cases, be caused by economic decisions taken on the other side of the globe. This territorial complexity of causal factors extends down to include the impacts of national, sectoral and territorial development policies on regions and localities.

The scientific evidence that climate is changing due to greenhouse gas emissions is now incontestable. It is equally well accepted that climate change will

alter the severity, frequency and spatial distribution of climate-related hazards. However, even while modelling of the linkages between global climate change and particular extreme climate events becomes increasingly sophisticated, it is still not possible to predict with any degree of confidence how particular climate events in specific locations will behave in the future. Even with regular and much better understood climate phenomenon like ENSO, considerable regional and temporal variations in impacts are observed from event to event.

Humans have gradually and spontaneously been adapting to the variations in climate but the rapid accumulation of climate-related risk in recent decades and the resulting patterns of loss point to a loss of effectiveness and even breakdown in spontaneous adaptation. As the range of hazards and vulnerabilities faced by any given community increases, it often becomes possible only to play one kind of risk scenario off against another in search of a "less worse" scenario. The processes of global change have stacked the odds even higher against successful adaptation. As the causal processes of risk become increasingly global, the options available to local communities and other local stakeholders to influence risk generation processes becomes restricted, if not non-existent.

Risk Management Strategies

Different approaches to manage and reduce climate related risks have been attempted by the humanitarian, development, environmental and climate change communities.

Since the 1970s, the discourse within the broader disaster risk management community has undergone a gradual paradigm shift from response to improved response preparedness to hazard mitigation to vulnerability reduction to integrated disaster risk management. The risk conscious development community has also attempted to promote more integrated schemes where risk considerations are factored into development programmes. And the environmental community has increasingly seen the relevance of environmental management and good resources use for hazard control and reduction.

However, despite the awareness raised by the UN International Decade of Natural Disaster Reduction (IDNDR) in the 1990s, disaster risk has continued to accumulate. Most national and international efforts continue to be fundamentally preparedness and response focused. However, a large number of successful experiences in Asia, Latin America, the Caribbean and Africa, in which different risk management approaches were piloted, have built up a substantial body of knowledge on the theory and practice of risk management.

In parallel, the scientists and organisations examining the problem of global climate change have gradually expanded their approach from an initial concern with the causes of climate change to a concern with modelling its potential effects. In programme terms, on the one hand, this has led international efforts, via the United Nations Framework Convention on Climate Change (UNFCCC), to mitigate climate change through reduction of greenhouse gas emissions and, on the other hand, to the assessment of countries' vulnerabilities to climate change and the design of adaptation strategies. In recent years, there has been an increasing commitment to and emphasis on adaptation rather than just mitigation.

In the same way, however, as the disaster risk management community has failed in practice to substantially move beyond response and preparedness, the climate change community has not yet been able to move beyond fairly theoretical formulations of vulnerability and adaptation towards concrete plans and programmes of action.

In many developing countries totally separate institutional systems exist for promoting adaptation to climate change, on the one hand, and disaster risk management, on the other. The efforts to design strategies to adapt societies to the effects of climate

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Strengthening national and local capacities to manage climate-related risks, as they can be understood now, is the best strategy to be able to manage more complex climate risk in the future

change and national and international efforts to manage the disaster risks associated with extreme climate events remain fundamentally divorced. At the international level, it is only recently that a search for synergy between objectives and institutional frameworks has been sought with regard to the UN Environmental Conventions on wetlands, biodiversity, global climatic change and desertification.

The lack of capacity to manage and adapt to climate-related risks is already a central development issue in many developing countries, particularly in SIDS. And the lack of capacity to manage the risks associated with current climate variability (on a season to season and year to year basis) is the same that will inhibit countries from addressing the future increases in the complexity and uncertainty of risk due to global climate change. In a way, the entire potential of the future already exists like a seed in the present moment. Strengthening national and local capacities to manage climate-related risks, as they can be understood now, is the best strategy to be able to manage more complex climate risk in the future. It is also more feasible to mobilise national and international political and financial resources to manage an existing risk scenario than to address a hypothetical future scenario. Medium and long-term adaptation must begin today with efforts to improve current risk management and adaptation. Lessons from current practices along with the notion that learning comes from doing are of critical importance.

Integrated Climate Risk Management

Integrated climate risk management, as a concept, would address both the hazards and vulnerabilities which configure particular risk scenarios and would range in scale from actions to manage the local manifestations of global climate risk, through to global measures to reduce hazard (for example, by reducing greenhouse gas emissions) and to reduce vulnerability (by increasing the social and economic resilience of vulnerable countries such as SIDS, for example). Integrated climate risk management would need to include elements of anticipatory risk management (ensuring that future development reduces rather than increases risk), compensatory risk management (actions to mitigate the losses associated with existing risk) and reactive risk management (ensuring that risk is not reconstructed after disaster events). Moreover, it will have to take into account both potential impacts on socio-economic and environmental systems.

Integrated climate risk management could provide a framework to allow the disaster community to move beyond the still dominant focus on preparedness and response and for the adaptation to climate change community to move beyond the design of hypothetical future adaptation strategies. In some regions, such as the Caribbean and the South Pacific, synergy such as this is already being achieved. However, urgent actions must be taken at the international, national and local levels if integrated climate risk management is to move from a concept to practice and serve to reduce risks and protect development.

At the international level, if it were recognised that most disaster risk is now climate related and that adaptation must refer to the management of existing climate-related risks, the United Nations should promote an integrated international framework and partnership for risk management, which incorporates elements of and builds on existing frameworks for addressing climate change, disaster reduction, desertification and others. Such a framework needs to start from a clear concept that climate-related risk is one of the central development issues of our time and the achievement of the UN Millennium Goals will not be possible unless climate-related risks are significantly managed and reduced. The current proliferation of parallel international frameworks and programming mechanisms for addressing what is a holistic development issue is counterproductive if the objective is to strengthen national capacities to manage and reduce climate-related risks.

At the national level, integrated climate risk management strategies, plans and programmes need to be built on the dispersed institutional and administrative mechanisms, projects, human and financial resources currently applied to disaster risk management as well as adaptation to climate change and other related areas such as desertification. The United Nations should develop new programming mechanisms and tools to promote integrated national climate risk management programmes as well as resource mobilisation strategies to ensure that such programmes can be adequately funded.

Ultimately, integrated climate risk management needs to take root at the local level. Most climate-related disaster events are small to medium scale and have spatially delimited local impacts. Ultimately, risk is manifested and losses occur at the local level and it is at this level that national and international support to integrated climate risk management has to be realised and capacities strengthened. However, given the diverse territorial base of risk causation, scaling up has also necessarily to take place.

Conclusion

Climate-related risk, aggravated by processes of global economic and climatic change, poses a central unresolved development issue for many countries, particularly but not exclusively for SIDS. Unless such risks can be managed and reduced the achievement of the UN Millennium Goals will be a mirage.

Current approaches towards managing disaster risk and adaptation to climate change fail to address the issue for different reasons. The first is still predominantly focused on response to disaster events and fails to address the configuration of hazards, vulnerabilities and risks. Moreover, mono hazard approaches still prevail in contexts more and more typified by concatenation, synergy and complexity and there is still a great deal to do in order to bring risk management and sustainable development concerns and practices together. The second focuses on the impact of future climate change on risk but fails to make the connection with currently existing climate-related risk events and patterns. At the same time, both approaches are divorced, in concept and in terms of the institutional arrangements and programming mechanisms at the national and international levels.

If development is to be protected and advanced in countries affected by climate risks, an integrated approach to climate risk management needs to be promoted, building on successful approaches piloted by the disaster risk management community but mainstreamed into national strategies and programmes. Addressing and managing climate risk as it is manifested in extreme events and impacts in the here and now is the most appropriate way of strengthening capacities to deal with changing climate in the future.

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A Climate Risk Management Approach to Disaster Reduction and Adaptation to Climate Change

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1.0 Risk Management and Adaptation to Climate Change

In 2000, the United Nations convened the Millennium Summit, where the heads of state of more than 100 countries agreed on the Millennium Development Goals (MDGs) for the next 15 years. These define eight major objectives that the world community should strive to attain by 2015. The MDGs have a direct relationship with improving overall human welfare, health, education and promoting environmental sustainability in the world's poorest countries. Achievement of these goals becomes difficult, if not impossible, if integral human security and sustainability are not enhanced and guaranteed.

Disaster risk levels and disaster-related losses in society have shown such progressive growth over the last 40 years that they nowadays constitute a serious threat to sustainability and development. Furthermore, current trends and the constant rise of new risk factors suggest that there will be ever-increasing losses in the future if deliberate, co-ordinated and conscientious action is not taken in the short and medium terms.

Determined levels of risk associated with extreme physical phenomena are inherent to human existence on planet Earth. The history of human endeavour and societal advance is, in many ways, the history of adaptation to our physical environment. Positive utilisation of natural resources has always been accompanied by periodic losses over times of adjustment to new extreme conditions. Resources and hazards, in fact, are part of the same equation and continuum. Managing this continuum has guaranteed, during long periods of time, that the balance of gains and losses has essentially been positive.

However, over time and especially during the last 200 years, this "natural" equilibrium has been rapidly lost or eroded by the creation or generation of new socially induced and spurious risk factors, whether on the hazard or vulnerability side of the equation. Many of these new factors derive from inadequate development practices, the inadequate location of

human endeavour, the accelerating processes of environmental degradation, the introduction of potentially dangerous new technologies and the impacts and consequences of poverty and destitution.

Environmental insecurity and the threat of extreme disaster losses or damages increasingly add to the human insecurity associated with the disadvantaged social condition and position of billions of people, particularly in the developing world. The rapid increase in risk factors that followed the advent of the industrial revolution now promises to enter into a new progressive, if not, abrupt phase. Global Climatic Change (GCC) associated with the emission of greenhouse gases (GHG) promises to introduce new risk factors that build on existing risks associated with normal climatic variability and extremes.

Hence, managing risk will inevitably become a major societal concern going way beyond past and existing preoccupations associated with inherent and excess risk. Current trends and forecasts would suggest that the social distribution of risk and losses could become one of the dominating concerns of humanity in the future. Now is the time to begin to redress the current situation in which insufficient attention is paid to such matters and existing management and societal schemes are extremely unarticulated, dispersed and inefficient when faced with the magnitude and importance of the problem of risk and disasters. Short-term attention to existing and recurrent problems must be complemented with and seen in the light of medium- and long-term changes and impacts.

Risk and risk management must be placed squarely in the centre of the equation, and notions of disaster displaced from the still dominant concern and action in favour of preparedness and response in favour of proactive and prospective risk reduction and control. This must be achieved guaranteeing a close, synergic and interactive relationship between existing risk management, climate adaptation and sustainable development practitioners.

2.0 Climate-related Disaster Loss and Unsustainable Development

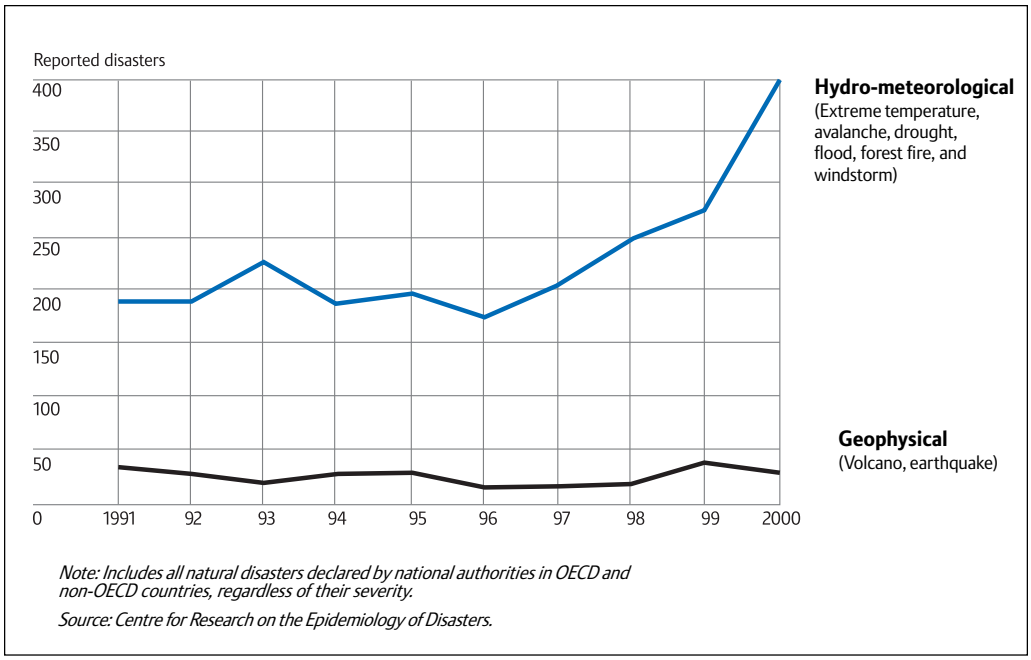
Although disasters are associated with a wide range of hazard types, hydro-meteorological phenomena account for a very significant part of disaster losses each year both in terms of human and economic losses. It is, in fact, estimated that half of humanity (3 billion) now lives in coastal areas or near rivers (for instance, natural hazards such as floods account for 40 per cent of all deaths in disasters) and that hurricanes, floods, drought, hail storms and storm driven wave action account for over 70 per cent of economic losses, again with a far higher relative incidence in the developing countries. These figures are worrying especially considering that the number of reported hydro-meteorological disasters in 2001 was approximately double the figure reported in 1996.

With regard to climate change, it is estimated that 14 of the 20 hottest years recorded over the 20th century occurred between 1980 and 2000, and that the hottest year to date was 1998. This same year also broke records in the cost of destruction and disruption caused by disasters, with some US$ 98 billion in damages and 32,000 casualties due to climatic phenomena, a 50 per cent difference as compared to the previous year.

Overall, disaster occurrences and losses associated with extreme and increasingly not so extreme climatic events have increased dramatically in recent years and particularly since 1996. While the number of reported disasters associated with geophysical events such as volcanic eruptions and earthquakes remained remarkably constant, those associated with hydro-meteorological events such as floods, drought, forest fires and storms have demonstrated a curve of exponential growth. Hypothesis and speculation are inevitable with regards to the possible links between increased disaster losses, temperature rises and climate change.

Overall, disaster occurrences and losses associated with extreme and increasingly not so extreme climatic events have increased dramatically in recent years and particularly since 1996

Seen from the perspective of economic impact, in constant monetary terms, the losses during disasters throughout the world during the 1990s were *nine times* superior to those sustained during the 1960s and *six times* superior to those during the 1970s



Note: Includes all natural disasters declared by national authorities in OECD and non-OECD countries, regardless of their severity.

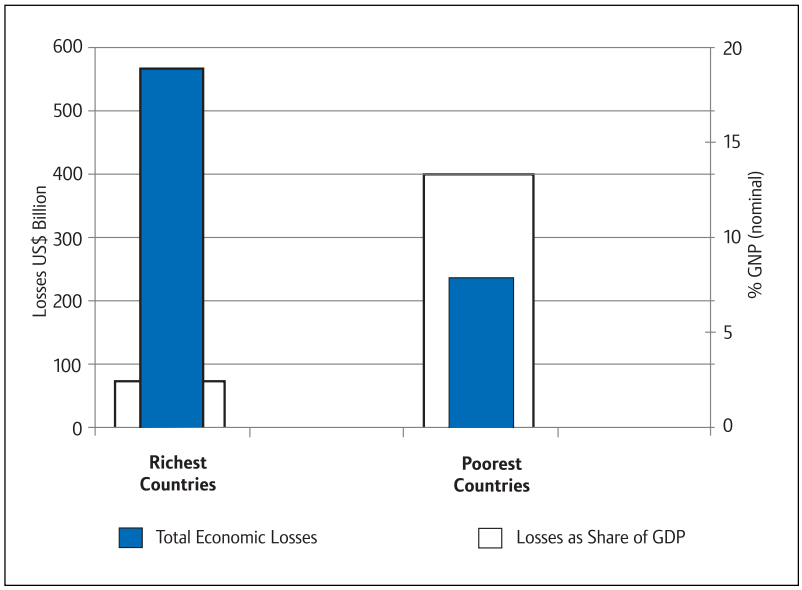
Source: Centre for Research on the Epidemiology of Disasters.

Seen from the perspective of economic impact, in constant monetary terms, the losses during disasters throughout the world during the 1990s were *nine times* superior to those sustained during the 1960s and *six times* superior to those during the 1970s. This can be explained in terms of the increased exposure of population, infrastructure and production, increases in the value of assets and increases in human vulnerability to hazardous events.

Although economic losses tend to be higher in absolute terms in the developed countries, overall developing countries are particularly hard hit due to the highly vulnerable nature of their economic base and, in some cases, due to the very small size of their economies. However, over the last decade, even developed countries have increasingly suffered from disasters, with enormous losses to national economies and the insurance and reinsurance business. Conjectures now exist on the correlation between changing patterns of risk and greater threats to these countries in the future.

The levels of losses are now so great that some see the development process as a "loss factory" where gains are constantly drained off at the bottom. The burgeoning levels of losses are beginning to outweigh development gains in a number of countries and as such are fast becoming unsustainable. This is particularly the case in the Small Island Developing States (SIDS). It is now very clear that flawed development and environmental practices are at the root of much new disaster risks.

Disaster Losses, Total and as Share of GDP, 1985-99



3.0 Risk and Disaster: the Basic Causes

Hazards serve as detonators of pre-existing risk conditions revealing errors in the location of human activities and existing levels of social, economic and ecological vulnerability. Today, faced with the inevitability of many natural phenomena, the major bent in terms of explaining disasters and disaster losses favours the analysis of social vulnerability.

Disaster risk, or the probability of future losses and damages associated with the impact of external physical events, is socially constructed in contexts where hazards interact with exposed and vulnerable communities or societies. The very notion of hazard remits to the socially induced transformation of physical elements and resources into dangerous or potentially dangerous phenomena. This transformation occurs when population, infrastructure and production are located in hazard prone areas and live or exist under vulnerable conditions. Vulnerability is a socially constructed condition that generates lack of resilience and fortitude when facing environmental extremes. This lack of resilience may manifest at the structural, physical, economic, social and political, and institutional levels. Thus, it is human vulnerability, location and lack of resilience that are at the centre of the explanation of many large-scale disasters. And, it is these factors that must be considered and modified in order to decrease disaster risk and incidence in the future.

Much has been written and is known with regards to what are called technological, social or anthropogenic hazards. Conflagrations, explosions, oil spills, nuclear accidents and even terrorist activities are some of the many expressions of inadequately managed technology, human activity and social dissent. Natural hazards interfacing or interacting with technological or anthropogenic hazards many times lead to concatenation, synergy and new types, forms and extent of disaster losses.

Between the natural and anthropogenic hazards there exists a third major category of hazard type which as yet has received little attention, but which effectively establishes one point of convergence between the risk and disaster and the adaptation to climate problematic. Here we refer to what have been called socio or pseudo natural hazards. This notion refers to hazards that are created at the interface between human activity and natural or modified ecosystems. Examples may be found in the increased threat and potential for flooding, drought and landslides associated with river basin degradation and deforestation, the potential for coastal erosion associated with the wide-scale destruction of mangrove swamps and with urban flooding patterns that relate to the lack of adequate pluvial drainage systems in cities. Many other examples may be found including the threats for down stream populations and economic activity associated with large dams and reservoirs. This type of human intervention is also increasing the hazardous character of truly natural hazards and extending their impact to new areas.

Socio-natural hazards are steadily increasing and associating with much small- and medium-scale losses and damages that are rarely registered in the disaster loss data bases maintained by international organisations. Increasing evidence exists to suggest that the accumulated impact of small- and medium-scale disasters is equivalent to or exceeds large-scale disaster impacts. These types of event are recurrent and their impacts are mostly felt at the local or community levels. With the scaling up of their multiple and diverse effects, the sum of many local impacts may be transformed into regional or even national impacts.

Whatever the types of hazards that help to explain disasters, mainstream thought now places the risk and disaster problematic firmly in the development debate and concern. Sustainability of development in developing countries, in particular, is increasingly seen to be impossible without increased and sustained

Today, faced with the inevitability of many natural phenomena, the major bent in terms of explaining disasters and disaster losses favours the analysis of social vulnerability

Due to global change rapid and turbulent changes in risk, patterns in a given region are rarely autonomously generated and may, in numerous cases, be caused by economic decisions taken on the other side of the globe

levels of security for humans and their endeavours and natural ecosystems.

Risk is seen as a product of differing processes of social and economic transformation that many times are euphemistically referred to as "development". Therefore, any major move in favour of risk reduction and control must be conceived within the framework of the development and project planning processes. Risk and disaster do not exist as separate and autonomous conditions but are intimately related to ongoing social processes and must be dealt with in this context if any major advances are to be achieved. Skewed processes of social and territorial development are generating increasingly complex and intractable patterns of disaster risk, particularly in developing countries.

Although vulnerability, lack of social resilience and reduced levels of adaptation to environment are not defining characteristics of poverty per se, there can be no doubt that poverty is a major factor in explaining these and their particular social and territorial distribution. Disaster risk is but one component of the risk faced by society. But, disaster risk is many times constructed on the basis of every-day or life-style risk typified by conditions of malnutrition, ill health, unemployment, lack of income, social and family violence, drug addiction and alcoholism, lack of education and opportunity, etc. Dealing with existing disaster risk inevitably requires dealing with every-day risk. Social, community and human resilience in general are indispensable for reduction and control of disaster risk in the future. Reducing vulnerability means enhancing resilience and adaptation. Reduction of vulnerability requires development and increased resilience and sustainability cannot be achieved without this.

4.0 Global Change, Complexity and Uncertainty

Processes of global change are adding new and even more intractable dimensions to the problems of risk accumulation and disaster occurrences and losses, associated with climatic events. Global change encompasses both socio-economic and environmental processes, and the links between them.

The globalisation of local, national, sub-regional and regional economies over recent decades has increased the complexity of risk in spatial, temporal and semantic terms, continuously forging and reproducing new and as yet unpredictable patterns of risk at the social and territorial levels.

Due to global change rapid and turbulent changes in risk, patterns in a given region are rarely autonomously generated and may, in numerous cases, be caused by economic decisions taken on the other side of the globe. This territorial complexity and concatenation of causal factors extends down to include the impacts of national sectorial and territorial development policies on regions and localities.

The impacts of globalisation are being felt in both rural and urban areas. Urban areas often concentrate a complex interplay of multiple hazards and vulnerabilities with synergic effects and a very heterogeneous social and locational distribution. Rural areas in the developing world suffer diverse processes of incorporation and exclusion with differential impacts in terms of vulnerability and risk.

The accumulation of greenhouse gases in the atmosphere and resulting changes in the world's climate is a second global process that is increasing the complexity of risk. The scientific evidence that climate is changing due to greenhouse gas emissions is now incontestable. It is equally well accepted that climate change will alter the severity, frequency and spatial distribution of climate-related hazards. However, even while the modelling of the linkages between global climate change and particular climate events becomes increasingly sophisticated, it is still not possible to predict with any degree of confidence how particular climate events, in specific locations, will behave in the future.

The notion of socio-natural hazards discussed

above has generally been limited to the consideration of lower scale phenomena and local impacts. However, the notion establishes a natural bridge between current day disaster concerns and the problem of Global Climatic Change. The hazards now being experienced, or to be expected in the future with GCC, are essentially socio-natural in origin, product of the relationship between human activities and the natural atmospheric system. Scale determinations and considerations may differ between the normal range of socio-natural hazards and those associated with GCC, ranging from local to global, but the two types of concern have more in common than differences. Reversion or control of the hazard construction process is possible in both cases. And, despite the global nature of climate change, its impacts will in the end be felt locally or regionally, and interaction will occur with existing hazard patterns, the product of more localised socio-natural processes.

The rapid accumulation of climate-related risk in recent decades and the resulting patterns of losses, point to a loss of effectiveness and even breakdown in spontaneous adaptation and coping. As the range of hazards and vulnerabilities faced by any given community increases, it often becomes possible only to play one kind of risk off against another in search of a "less bad" scenario. Many highly vulnerable communities may deliberately choose to inhabit a hazard prone environment if this reduces other risks, related to income generation, for example. Or, should they find themselves in hazard prone zones due to exclusion from formal land markets or for other reasons, they will many times opt to stay in order to maintain those conditions that provide them with the means to reduce daily life risk and vulnerability. On the other hand, factors such as poverty, limits to migration, land tenure systems, migration between ecologically distinct areas and a continuous reduction in terms of knowledge of ecosystems, inevitably place barriers to spontaneous adaptation.

As the causal processes of risk become increasingly global, the options available to local communities and other local stakeholders to influence risk generation processes becomes restricted, or non-existent. At the same time, the growing complexity of risk, due to both economic globalisation as well as to global climate change, greatly reduces the predictability and increases the uncertainty surrounding the occurrence of particular climate-related disasters: be they the rapid impact of floods, landslides, forest fires or hurricanes in given locations or the obsolescence of productive systems through changing climatic or market conditions.

In other words, the evidence from patterns of disaster occurrence and loss shows that climate-related risks are rapidly increasing, which in turn indicates the growing failure of and breakdown of adaptation at all levels. The growing complexity and globalisation of climate-related risk, translates at the national and local levels into impotence to affect the causal processes of risk and increasing uncertainty regarding the nature of risk itself and what could be viable strategies to manage and reduce it. Moreover, disaster risk becomes for the poor an unheeded notion when faced with more pervasive every-day risk conditions associated with ill health, malnutrition, illiteracy, unemployment, drug addiction and family and social violence.

5.0 Risk Management – Differing Entrances, the Same Problem

Faced with the bleak scenario of increasing disaster risk and losses, different approaches to manage and reduce climate related risks have been sought or attempted by the humanitarian or disaster response, development, environmental and climate change communities.

The rapid accumulation of climate-related risk in recent decades and the resulting patterns of loss point to a loss of effectiveness and even breakdown in spontaneous adaptation and coping

Since the 1970s the national and international organisations responsible for responding to disaster events and providing humanitarian assistance, have been gradually expanding their approach to address first hazards, then vulnerabilities, and eventually risks

5.1 Disaster Response, Development and Environmental Institutional Approaches

Since the 1970s the national and international organisations in charge of responding to disasters and providing humanitarian assistance, have been gradually expanding their approach to address first hazards, then vulnerabilities, and eventually risks themselves. From their beginnings in response, many disaster-related organisations have moved on to: strengthen capacities in preparedness and early warning (enabling the conjunctural mitigation of losses associated with extreme climate events); reduce hazard levels, through structural measures such as flood control embankments, soil conservation measures and others; reduce vulnerabilities through strengthening community and national level capacities and resilience and eventually to address integrated disaster risk management, in which a range of measures are designed to address the full range of hazards and vulnerabilities present in a given location.

However, despite the UN International Decade of Natural Disaster Reduction (IDNDR) in the 1990s, in which member states with the support of international organisations were supposed to make a concerted effort to reduce disaster risk, risks have continued to accumulate and increase, while most national and international efforts directed by humanitarian and response oriented institutions continue to be fundamentally preparedness and response focused. A large number of successful experiences, however, in Asia, Latin America, the Caribbean and Africa, in which different risk management approaches were piloted, have built up a substantial body of knowledge on the theory and practice of risk management. These successful pilot approaches provide a glimpse into the future of risk management, if they were to be mainstreamed and applied as part of a concerted and integrated programme.

For its part, the risk conscious development community has attempted to promote more integrated schemes where risk considerations are factored into development planning and projects. Despite the fundamental importance of such approaches, they are not as yet a common or regular practice. At the same time few deny the fact that it is with a greater involvement of development based institutions that risk reduction can become more effective. Attempts to add risk reduction concerns to existing traditional response oriented organisations face enormous difficulties and limitations and a need exists to break out of traditional schemes and construct risk reduction endeavours on the basis of development oriented organisations and institutions.

The environmental community has increasingly seen the relevance of environmental management and good resources use for hazards control and reduction. It has been recognised that equilibrium and resilience of ecosystems offer natural protection from natural hazards and reduce the likelihood of new hazards generated by processes of environmental degradation. This has been particularly apparent over the last five years and has been stimulated by the impacts of large-scale events during this period, which clearly revealed the relationship between environmental degradation and hazard occurrence as it has been the case of large scale disasters in Central America, the Caribbean, Venezuela, Mozambique, China and Indonesia between 1998, and the present, particularly associated with flooding and landslides.

5.2 The Climate Change Adaptation Approach

Scientists and organisations examining the problem of global climate change have gradually expanded their approach from an initial concern with the causes of climate change, through a concern with modelling its potential effects (for example, in terms of sea level rise and desertification) towards a concern with how societies and economies can adapt to changing climatic conditions.

Greenhouse gas emissions and their potential effects on world climate has been the subject of research and debate for over 20 years. Major movements forward in the search to limit this phenomenon date primarily from the Earth Summit in Rio in 1992, with the signing of the UN Framework Convention on Climate Change (UNFCCC). In programme terms, this led to international efforts, through the UNFCCC, to mitigate climate change through international agreements to reduce greenhouse gas emissions. The Kyoto Protocol in 1997 and the establishment of stipulated reduction levels over the next decade was the most important of these agreements and recent negotiations have centred essentially on the debate of common but differentiated responsibilities for climate change, and intractable discussions surrounding the Clean Development Mechanism.

The climate change arena – broadly speaking, the UNFCCC and the Intergovernmental Panel on Climate Change (IPCC) frameworks, and the array of research and advocacy entities that interact with these – has tended to identify increased human vulnerability to climate extremes as a likely outcome of climate change. As such, it has advised and undertaken research on vulnerability, produced an array of vulnerability assessments and, to a lesser extent, advised and undertaken assessments of climate change adaptation.

Despite the search to limit the rate of climatic change and, in consequence, the hazards it will pose for different regions and population groups, the inevitability of change has increasingly been recognised. Already accumulated emissions will guarantee this change and this is now unavoidable. Reductions in emissions over the next years cannot be achieved at a rate that is sufficient to greatly ameliorate change. In recognition of this fact, increasing attention has been given over the last five years, in particular, to the need to foment and support initiatives that promote or enhance the adaptation capacities of the population in affected regions and areas. By and large, however, actors in this arena have yet to make concrete and specific recommendations on *how* adaptation ought to be undertaken, nor to engage in actual responses to the specific instances of human vulnerability.

The issue of adaptation to the effects of climate change was first contemplated by the first conference of the parties (COP1) in 1995 in the following three stage process:

Stage I: Inventory and planning, including studies on the possible impact of climate change, the identification of countries or regions particularly vulnerable and defining the policy options to guide adaptation measures and increase capacity building.

Stage II: Measures, which include continuing capacity building to lead the adaptation process in those countries most vulnerable to climate change, as defined in Article 4.1 (e) of the Framework Convention.

Stage III: Measures to facilitate the adequate adaptation of other countries, including insurance and other measures contemplated in Articles 4.1 (b) and 4.4 of the Framework Convention.

In its last COP7 in Marrakesh, the Climate Change

Vulnerability and Climate Change

"Adaptations to current climate and climate-related risks (e.g., recurring droughts, storms, floods and other extremes) generally are consistent with adaptation to changing and changed climatic conditions. Adaptation measures are likely to be implemented only if they are consistent with or integrated with decisions or programmes that address non-climatic stresses. Vulnerabilities associated with climate change are rarely experienced independently of non-climatic conditions."

IPCC Working Group II (2001)
Third Assessment Report

Increasing attention has been given over the last five years, in particular, to the need to foment and support initiatives that promote or enhance the adaptation capacities of the population in affected regions and areas

How to live with and adapt to climatic extremes and how to promote more resilient and secure communities are questions that are in the centre of concerns

Convention parties agreed on guidelines to orient adaptation strategies to climate change in those regions and countries most likely to be affected. This movement was consolidated with the results of the meeting where commitment to expanded funding for the development of adaptation strategies was agreed through the GEF and other financial sources.

With this gradual turn to adaptation considerations and an increase in its salience, the climate change adaptation community has clearly commenced to take up a topic that is very close and complementary to the traditional preoccupations of the risk and disaster community. How to live with and adapt to climatic extremes and how to promote more resilient and secure communities are questions that are in the centre of concerns for both communities.

However, in the same way as the risk and disaster community has failed in practice to substantially move beyond response to extreme disaster events, the climate change community has not yet been able to move beyond fairly theoretical formulations of vulnerability and adaptation, towards concrete plans and programmes of action. Such notions as planned and spontaneous adaptation, and even the concepts of vulnerability and risk, are far more easily used and talked about than understood in practical and applied terms. The problems of uncertainty surrounding the modelling of the impact of climate change in particular locations, together with the difficulties of mobilising political will and support to adapt to uncertain future events are factors which conspire against the development and implementation of adaptation strategies.

5.3 The Challenge of Integrating the Concerns of Different Practitioner Communities

The clear coincidence between climate risk management and adaptation to climate change has not as yet been reflected in wide scale collaboration, consensus and integration within the respective scientific and practitioner communities. This is even truer when it comes to civil society and government in general where, in addition to misunderstandings with regards to the problematic and the relationships that exist, consciousness levels on the seriousness of the problem and commitment to action are as yet ephemeral. Furthermore, despite the changes that have occurred over the last decade, the disaster problematic is still essentially seen as almost inevitable, and preparedness and response planning considered the only way to deal with it. The global climatic change scenario is mostly seen as distant in the future, unspecified in terms of possible impacts and so unpredictable that planned action is not seen to be really feasible. Laissez-faire notions exist and short-term responses are still the predominant answer given.

Important discrepancies exist as regards fundamental notions and concepts and common misunderstandings exist as regards the approach and subject matter considered under these two non-discrete subject areas. Many of the differences in understanding, concepts and approaches probably derive from the different scientific origins of the two problems: the far more recent development of the climate change and adaptation problematic and a lack of communication between the different communities, which is reflected in the lack of a common literature and the different institutional and organisational structures for the promotion of advances and change.

Despite this there can be little doubt that the two problems are essentially linked and represent a continuum where risk, human security and sustainable development are in the centre of analysis and concern.

Unlike the patterns of hazard occurrence and disaster incidence related to normal climatic variability where certainty exists, Global Climatic Change is plagued with the problem of uncertainty. When and how climate changes will impact on populations and ecosystems and the attendant risks are as yet very obscure. Modelling procedures as to date do not permit a sufficient degree of spatial and social

accuracy. Moreover, how these changes will interact with current hazard patterns and risk scenarios is also unknown. The difficulties of projection and prediction can be, for example, appreciated when examining the tentative nature with which current science can predict impacts from a recurrent phenomenon such as El Nino. Evidence shows that different Ninos have different spatial and social impacts.

Uncertainty as to trends and patterns, concatenation and synergy, are paralleled however with the certainty that new macro- and micro-scale hazards will be created with major impacts on population and environment. Given that climate is an integral part of the global environment, climate changes will not only affect socio-economic systems but also ecosystems, water resources and biodiversity, disrupting the natural resource base and threatening long-term sustainability. Traditional disaster-related problems associated with hurricanes, flooding, drought, landslides and coastal erosion will be compounded with the impacts of climate change, with the risk of ever increasing damage and loss to society, particularly in the more vulnerable countries and population groups where resilience is lower and adaptation more difficult. This will be particularly apparent in rural areas where to date a still dominant portion of the world's poor population lives, and natural resources are the basis of sustenance and livelihoods. However, this will also be a severe problem for the urban poor and other population groups. This is particularly true in the short- and medium-term in Latin America where today over 75 per cent of the population is urban and the trend is pointing upwards.

Any possible long-term benefits of climate change notwithstanding, dis-synchronisation of climatic and terrestrial systems will likely involve numerous incidences of loss, both large and small, including disasters, impoverishment stemming from losses of assets and opportunities for the poor, disease outbreaks, water resource shortages, loss of viability of particular agricultural systems and ecosystem decline.

In effect, the potential changes associated with global climatic change and the new patterns of risk and disaster that will develop, constitute a "natural" follow-on to and outcome of the current risk and disaster problematic. Risk is constantly evolving as new or modified risk factors are introduced by societal action. Historically, the risk scenario has been moulded and modified with all major societal advances, changes and innovations. The industrial revolution led to the introduction of technological hazards and rapid changes in land use and environmental practices that have had severe consequences as regards the generation of risk. The advent of nuclear energy added new risk factors. And, the present trend with Global Climatic Change, incited by human intervention in the environment, comprehends a further step in the constant evolution of risk in society, with the additional problem of the rapid speed of change, the probable magnitude of the possible effects and the new challenges this signifies in terms of human adaptation.

With regards to the different understandings that exist, there is a tendency for external viewers to see disasters and risk management practice as being dominated by preparedness and response concerns when faced with current and repetitive problems. And, to see practice as being directed essentially to already existing and more or less predictable risk contexts related to normal climatic variability. Moreover, risk management specialists and practitioners have done very little to date to incorporate climate change variables and contexts in their action frameworks. These still show a tendency in favour of short-term actions and solutions based on historical patterns of hazard incidence. This is compounded by the still dominant approach oriented in favour of single hazard approaches as opposed to the use of multi-hazard analysis and action frameworks.

Despite this general context, reality shows that the risk and disaster management communities are not

Given that climate is an integral part of the global environment, climate changes will not only affect socio-economic systems but also ecosystems, water resources and biodiversity, disrupting the natural resource base and threatening long-term sustainability

Nowadays, risk management tends to be progressively seen as a cross cutting, integrative and cross-sectoral practice covering concerns that go from disaster prevention and mitigation through response to reconstruction

monolithic blocks. Efforts and movements that attempt to change the status quo, promoting more integral visions with regards to risk management, and pushing practice more in favour of risk reduction and risk control areas (as opposed to traditional and dominant response concerns) have been prevalent over the last decade. Nowadays, risk management tends to be progressively seen as a cross cutting, integrative and cross-sectoral practice covering concerns that go from disaster prevention and mitigation through response to reconstruction. Decentralisation and community and local participation are seen as essential components of this practice. Moreover, the dominant tendency to see disaster prevention and mitigation as something that attempts to reduce existing risk levels in society and thus "prevent disasters" has been gradually eroded giving way to a vision that also incorporates prospective considerations. Corrective or compensatory risk reduction operating on existing levels of risk has been complimented with a move in favour of prospective risk management that attempts to foresee and control future risk. This can be seen with the insistence that risk management should be an integral component of development and project planning cycles. New developments must be analysed and considered in the light of potential new risk factors.

For its part, the adaptation to climate change community is also not a monolithic block as regards thought and practice, despite the relatively youthful nature of these concerns. This community may have commenced development of ideas thinking in terms of adaptation under conditions of uncertainty and in long time periods using the complimentary notions of "spontaneous" and "planned" or "independent" or "formally planned" adaptation to climate change. And, this may have been done basically ignoring present hazard scenarios associated with normal climatic variability. However, today, this is not always the case, and some current thought favours more incremental approaches, building on current patterns of risk, introducing incentives to increased resilience and adaptation under current conditions as a basis for longer term adaptation.

The notions of *no regret* and *win-win* policies and practices reflect this current train of thought. That is to say, many adaptation strategies are consistent with sound environmental practice and wise resource use today, and are appropriate responses to natural hazards and climate variability and to the threat of creation of new socio-natural hazards. No regret adaptation strategies are seen to be beneficial and cost-effective even in the absence of climate change. Win-win strategies have their rationale in ecosystem maintenance, improved resilience and enhanced livelihoods. Finally, current thought also tends to support the idea that long-term planned adaptation will not really be feasible in many instances, although government incentives and support for adaptation must exist. Spontaneous or independent adaptation is already happening in many hundreds of diffused, incremental actions by many stakeholders.

In sum, it is clear that despite the still de-linked nature of the two scientific and practitioner communities the points of convergence between them far outweigh the differences in emphasis and approach. A common problem related to risk in society and uncertainty as to future impacts and the social and territorial distribution of these, a concern for the relations between society and environment, and a flux between short- and long-term considerations typifies both. Moreover, it is also very clear that the basic point of departure for both communities is the notion of sustainable development and livelihoods.

Despite the similarities in the climate risk management and adaptation problematic, the evidence shows that present national and international efforts to design strategies to adapt societies and their economies to the effects of climate change and national and international efforts to manage the disaster risks associated with extreme climate events

remain fundamentally divorced. In many, if not most, developing countries totally separate and parallel institutional systems and programming mechanisms exist for promoting adaptation to climate change, on the one hand, and disaster risk management, on the other. On another related front, it is only recently that a search for synergy between objectives and institutional frameworks has been sought with regard to the UN Environmental Conventions on wetlands, biodiversity, global climatic change and desertification. These are all clearly related one to the other but have been dealt with until recently as if they were separate and discrete problems.

Retrospective analysis will show that an important problem during the International Decade for Natural Disaster Reduction was that insufficient efforts were made in integrating diverse specialist groups and caucuses important for risk reduction and related to sectoral and territorial development, environmental management, poverty reduction, etc. The tendency was still for these groups to work apart and not as an articulated whole. We now face a similar problem on the expanded basis given by current concerns for climate change adaptation.

This divorce between the adaptation to global climate change and the disaster risk management communities is unproductive, and even absurd, if it is accepted that both are addressing the same issue of climate-related risks, but from apparently different viewpoints. This includes supposed differences related to the time period under consideration. Risk managers are seen to deal with current and short-term risk and climate adaptation specialists with longer-term changes and risk. But this is essentially a false separation. Risk, by definition, refers to the probability of certain events occurring in the future. The uncertainty surrounding the specific impacts of future climate change, in particular, space-time coordinates is therefore an intrinsic characteristic of existing risk and which has to be dealt with by risk management in the here and now.

The lack of capacity to manage and adapt to climate-related risks is already a central development issue in many developing countries, particularly in SIDS. From this perspective, the lack of capacity to manage the risks associated with current climate variability and with already occurring extreme climate events is the same lack of capacity that will inhibit countries from addressing the future increases in the complexity and uncertainty of risk due to global climate change. In the sense that the entire potential of the future already exists like a seed in the present moment, strengthening national and local capacities to manage climate-related risks, as they can currently be assessed, is the best strategy to be able to manage more complex climate risk in the future. At the same time, it is more feasible to mobilise national and international political and financial resources to manage an existing risk scenario than to address a hypothetical future scenario. Medium- and long-term adaptation must begin today with efforts to improve current risk management and adaptation initiatives and contexts. And, lessons from current practices along with the notion that learning comes from doing are of critical importance.

Despite the prevalent divergence between the two communities, some convergence can now be witnessed, however, in various areas where risk management and climate change adaptation communities have come together, and these with the development community. This is the case in the Caribbean, Central American and South Pacific areas, for example, where attempts at methodological and strategy integration are occurring. However, this is still not the case in general and a relatively deep divide still exists in conceptual, methodological and practical terms. This must be overcome and integration achieved in the interest of promoting more coherent and efficient approaches. Each community has much to learn from the others as regards concepts, methods, strategies and instruments of common use in the promotion of short-, medium- and long-term risk

Medium- and long-term adaptation must begin today with efforts to improve current risk management and adaptation initiatives and contexts. And, lessons from current practices along with the notion that learning comes from doing are of critical importance

It is imperative that we develop an integrated risk management focus that brings together current risk and disaster and adaptation to climate change concerns and communities, relating these closely to sectoral and territorial sustainable development caucuses and agencies

reduction, control and management in general.

There is an urgent need, therefore, to build on the successful approaches piloted by the disaster risk management community over recent decades, while using increasingly accurate modelling of the impact of global climate change in specific locations, to develop integrated or total climate risk management plans and programmes.

6.0 Integrated Climate Risk Management

Whether dealing with actual potential disaster contexts, or future impacts associated with climate variability and change, the essential challenge is risk reduction, risk control, the increase in human resilience and increased capacities to adapt continually and prospectively to possible environmental extremes and conditions. In view of this, it is imperative that we develop an integrated risk management focus that brings together current risk and disaster and adaptation to climate change concerns and communities, relating these closely to sectoral and territorial sustainable development caucuses and agencies. This synthesis should be articulated and operationalised into one of total risk management for a wide range of elements at risk, ranging from communities to ecosystems, at long and short time scales and across spatial scales.

Integrated climate risk management, as a concept, would address both the hazards and vulnerabilities which configure particular risk scenarios and would range in scale from actions to manage the local manifestations of global climate risk, through to global measures to reduce hazard (for example, by reducing greenhouse gas emissions) and to reduce vulnerability (by increasing the social and economic resilience of vulnerable countries such as SIDS, for example). Integrated climate risk management would need to include elements of anticipatory risk management (ensuring that future development reduces rather than increases risk), compensatory risk management (actions to mitigate the losses associated with existing risk) and reactive risk management (ensuring that risk is not reconstructed after disaster events). Moreover, it will have to take into account both potential impacts on socio-economic and environmental systems.

Integrated climate risk management could provide a framework to allow the disaster community to move beyond the still dominant focus on preparedness and response and for the adaptation to climate change community to move beyond the design of hypothetical future adaptation strategies. In some regions, such as the Caribbean and the South Pacific, synergy such as this is already being achieved. However, urgent actions must be taken at the international, national and local levels if integrated climate risk management is to move from concept to practice and serve to reduce risks and protect development.

At the international level, if it were recognised that most disaster risk is now climate-related and that adaptation must refer to the management of existing climate-related risks, the United Nations should promote an integrated international framework and partnership for risk management, which incorporates elements of and builds on existing frameworks for addressing climate change, disaster reduction, desertification and others. Such a framework needs to start from a clear concept that climate-related risk is one of the central development issues of our time and that, as stated in the first part of this summary, the achievement of the UN Millennium Goals will not be possible unless climate-related risks are significantly managed and reduced. The current proliferation of parallel international frameworks and programming mechanisms for addressing what is a holistic development issue is counterproductive if the objective is to strengthen national capacities to manage and reduce climate-related risks.

At the national level, integrated climate risk management strategies, plans and programmes need to be built on the dispersed institutional and

administrative mechanisms, projects, human and financial resources currently applied to disaster risk management as well as adaptation to climate change and other related areas such as desertification. The United Nations should develop new programming mechanisms and tools to promote integrated national climate risk management programmes as well as resource mobilisation strategies to ensure that such programmes can be adequately funded.

Ultimately, integrated climate risk management needs to take root at the local level. Most climate-related disaster events are small to medium scale and have spatially delimited local impacts. Even large-scale events can really be interpreted as the sum of a large number of local impacts. Ultimately, risk is manifested and losses occur at the local level and it is at this level that national and international support to integrated climate risk management has to be realised and capacities strengthened. Differential levels of loss at the local levels, when faced with similar hazard conditions, can only be explained by the differential levels of vulnerability that exist.

7.0 Some Parameters and Indicators for Integrated Climate Risk Management

The raising consciousness among critical political decision makers and the public in general of the need for and the challenges associated with integrated risk management may be achieved concentrating first on the present disaster problematic and more adequately dimensioning its real impacts on development, and then linking in climate change considerations. Short-term, existing problems are probably more convincing elements for decision makers than long-term uncertainty. On the other hand, seeking to manage impacts associated with such phenomena as El Nino and other sources of inter-annual time-scale climatic variability gets political actors, sectoral experts and the public involved in managing climatic risks. Therefore, learning to prevent negative impacts from such phenomena presents a strategic opportunity for building resilience to climate change and for increasing social consciousness as regards the need for increased attention to future possible climate impacts.

Applications of an integrated risk management framework in decision making should take into consideration that:

- The current development situation and needs in a particular location is the most appropriate starting point for additional risk reduction and control efforts of an adaptive nature.
- Adaptation strategies currently being pursued in local, regional and national settings are often extensions of on-going efforts to reduce climate-related disaster risks.
- While past climate is not a good guide as to the future climate, past experiences and lessons learned from efforts to improve management of climate variability are valuable for adapting to climate change. In addition, spatial and temporal trends in past disaster events reveal current vulnerabilities and risks.
- Adaptive learning comes from doing, and lessons must be learnt from successful and best practices already implemented. It is highly unlikely that adaptation will come from a *priori* planning.
- Adaptation will require continual adjustment of risk management practices to account for changing climate hazard and vulnerability conditions.

Out of their resourcefulness or out of necessity, people will adapt to climate change. This constitutes independent or autonomous adaptation. This contrasts with formally planned adaptation that involves deliberate policy decisions, plans and implementation by external parties. In many cases, independent adaptations will be adequate, satisfactory and effective. However, under some circumstances independent adaptation may not be satisfactory or successful due to erroneous or limited understanding of climate change, limited knowledge of possible adaptation options, the negative impact of group adaptation on others, the ignoring of the needs of

Ultimately, risk is manifested and losses occur at the local level and it is at this level that national and international support to integrated climate risk management has to be realised and capacities strengthened

The integrated climate risk management approach should draw on frameworks that have been developed to date for disaster risk identification, reduction and transfer, as well as others developed in such contexts as farming systems research and commodity, food security and financial risk management

future generations, cultural constraints to adaptation, lack of resources, or the greater cost-effectiveness and efficiency of collective responses, as opposed to individual or community schemes. In such cases, the role of external agents should be to facilitate the adaptation process in order to ensure that the stated obstacles, barriers and inefficiencies are addressed in an appropriate manner. This will require provision of reliable information, financial, technical, legal and other assistance, and the direct implementation of adaptation options where the scale of response is most appropriately at the national level, provisions to guarantee that adaptation options do not have adverse environmental, social, economic or cultural effects and the ensuring of equity in the adaptation process.

Information and access to reliable data will be a critical factor in adequate decision making from the government through the community levels, and in the reduction of uncertainty associated with medium- and long-term climate change. In addition to the generation of more temporally and spatially specific information, more will need to be done to translate climate information into decision support tools for sector and region specific applications. Information on both climate variability and long-term trends needs to be translated into risk information for decision making. Reduction of uncertainty will be facilitated through the exchange of information up and down spatial and social scales, from scientists to policy makers and between specialists. But, uncertainty about risks and impacts of disasters and climate change needs to be explicitly recognised in the decision making process for all development decisions. This could be achieved by creating "headroom" for environmental considerations in all development planning decisions.

Uncertainty is a major factor as regards future changes. New information will, in many cases, change the nature and appropriateness of decisions that have been made. Flexible institutional arrangements should be promoted that have the capacity to incorporate new information on environmental risk into development planning, as it becomes available. Flexibility within the institutions to adapt to the new information is necessary to avoid inappropriate path dependency and mal-adaptation.

The integrated climate risk management approach should draw on frameworks that have been developed to date for disaster risk identification, reduction and transfer, as well as others developed in such contexts as farming systems research and commodity, food security and financial risk management. And, in order to assess and address risks across a wide spectrum, and develop improved management decisions relating to short- and long-term risks, there is a need for cross cutting coherence in such areas as assessment methodologies, assessment studies, recommendations based on sound analysis and risk/related terms and concepts. A more coherent approach to risk assessment and reduction will assist in identifying risk management alternatives in both the structural and non-structural domains such that both the short-term objectives of disaster risk reduction and the longer term objectives of adaptation to climate change will be more fully achieved.

Any approach to risk management and adaptation should be essentially prospective or anticipatory, and promoted in the very short-term. This will:

- Widen the range of possible response options, decrease costs in the medium- and long-terms, limit the possible levels of social disruption and prove to be more environmentally sustainable than with reactive approaches.
- Gain immediate advantages through the promotion of *win-win* and *no regret* policies, that is, build on current conditions, strengthening ecosystems and providing immediate and future benefits as regards social protection for vulnerable communities, sectors and critical systems.
- Provide increased levels of protection for many development plans and projects now under

consideration, which are likely to be subject to impacts by future climate change and sea level rises.

- Provide for the immediate enhancement of institutional capacity, developing expertise and building knowledge. These are factors of critical importance for adaptation and take time to develop. On the other hand, the complexity of risk generating processes, the range of socio-economic and environmental considerations that come into play and the diverse and complex nature of the social intervention required, needs the search for coherence and coordination across:
- Geographical scales – community, local, regional, national and global.
- Time scales – seasonal, inter-annual, decadal and centennial.
- Climate-affected sectors – water resources, health, agriculture, food security, ecosystems, etc.
- Development concerns – poverty reduction, coastal zone management, rural development, urbanisation, economic growth, etc.
- Stakeholder groups – scientists, experts, politicians, nation states, non-governmental organisations, regional and international organisations, financial institutions and civil society, in general.

The primordial emphasis in risk reduction, risk control and adaptation schemes should be on increases in the resilience of the poor, in particular, favouring the most vulnerable. To date there has been an over-emphasis on adaptation and mitigation and insufficient attention paid to resilience, livelihood strengthening and risk management in general.

The integration of the risk and disaster, and adaptation approaches in a single risk management approach must be supported with a strengthening of the ongoing process favouring synergies between existing UN Environmental Conventions relating to global climatic change, biodiversity, wetlands and drought. The complexity of risk contexts demands increased integration, harmonisation and cooperation between until now separate concerns, caucuses and interest groups. This will also require institutional reform and reorganisation permitting more flexible and agile relationships between complimentary areas of concern. The modification of inter-governmental frameworks and policies will be required in order to dissolve barriers separating the issues of climate change adaptation, disaster risk management and sustainable development. And, concrete actions must be taken to support local, national, and regional efforts to manage climate-related risks, beginning in the present and building on current initiatives.

A starting point for more committed and integrated action relates to the UN System as such where even greater efforts must be made to assure that risk considerations are incorporated in existing planning and programming mechanisms such as the CCA and UNDAF. The UN should serve as a promoter, advocate, and stimulation to innovative behaviour and change.

8.0 Conclusion

To conclude, climate-related risk, aggravated by processes of global economic and climatic change poses a central unresolved development issue for many countries, particularly but not exclusively for SIDS. Unless such risks can be managed and reduced the achievement of the UN Millennium Goals will be a mirage.

Current approaches towards managing disaster risk and adaptation to climate change fail for different reasons to address the issue. The first is still predominantly focused on preparedness and response to disasters event and fails to address the configuration of hazards, vulnerabilities and risks. Moreover, mono hazard approaches still prevail in contexts more and more typified by concatenation, synergy and complexity and there is still a great deal to do in order to bring risk management and sustainable development concerns and practices together. The second focuses on the impact of future climate change on risk but fails to make the connection with currently

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existing climate-related risk events and patterns. At the same time, both approaches are divorced both in concept and in terms of the institutional arrangements and programming mechanisms at the national and international levels.

If development is to be protected and advanced in countries affected by climate risks, an integrated approach to climate risk management needs to be promoted, building on successful approaches piloted by the disaster risk management community but mainstreamed into national strategies and programmes. Addressing and managing climate risk as it is manifested in extreme events and impacts in the here and now is the most appropriate way of strengthening capacities to deal with changing climate in the future.

Seminar Papers

SEMINAR PAPER 1

Adapt and Thrive: Combining Adaptation to Climate Change, Disaster Mitigation, and Natural Resources Management in a New Approach to the Reduction of Vulnerability and Poverty

Dr. John Soussan, Professor, University of Leeds, School of Geography, United Kingdom and Dr. Ian Burton, Consultant, Canada

Abstract

This paper describes and explains the enthusiasm for adaptation and uses it as a foundation to develop a new non-governmental initiative entitled "Adapt and Thrive Now". The paper, which serves as an introduction to the programme, is structured as follows. In Section II some of the key concepts are elaborated. Section III briefly outlines the current climate regime; the institutions, programmes and agreements currently in place and being developed especially at national and international levels. It is shown that agreements hammered out at the international level and supported both financially and technically have often fallen short of expectations, and threaten to continue to undermine the best intentions. This paper does not attempt a full analysis of the praxis of development, but focuses upon two major shortcomings. These are the wide gulf between high level and top-down development work and needs and actions at the local and community level, and the lack of integration across socio-economic sectors. These deficiencies have been identified many times, and attempts to resolve them are being advanced slowly. It is the mission of the Adapt and Thrive programme being launched by IUCN and its partners to accelerate progress by linking climate change adaptation to the closely related issues of natural resource management, disaster mitigation, and the decisions and choices of people at the local level, especially the livelihoods of the poor and the most vulnerable. Section IV takes up the question of livelihoods and explains how it can be linked with adaptation to help create empowerment,

capacity and motivation for development. Section V characterises the main elements in the creation of vulnerability and provides a provisional diagnosis of the issues and the obstacles from the local to the global scale. This lays a basis for the broad strategy of the Adapt and Thrive programme, which is a climate risk management approach to disaster reduction and adaptation to climate change outlined in Section VI.

Adaptation is not proposed as a panacea for the world's ills. We are convinced that it does offer a new opening to revisit some long-standing problems of environment and development in an innovative way. The consortium of organisations involved in this initiative is committed to the vigorous pursuit of this opportunity, and invites others to engage in the common efforts.

What Can Adaptation Really Achieve?

The debate over climate change has now reached a stage where all but the most resistant accept that, whatever happens to future greenhouse gas emissions, we are now locked into inevitable changes to climate patterns in the near future. Many believe that these changes have already started. The emergence of this consensus has led to increasing attention being paid to the issue of how to respond to these changes. In the early years of the new millennium, the idea of adaptation has emerged to catch the attention of scientists, environment and development specialists, diplomats and negotiators, and increasingly many civil society organisations. The use of adaptation promises to bring a fresh and more successful approach to the problems of the global environment. The opportunity must be seized and promoted if any significant part of this promise is to be realised.

The idea of adaptation itself is not new. The concept has a long pedigree in the natural sciences going back at least to Charles Darwin's *The Origin of Species*. It has also been used extensively in the social sciences as a synonym for response to social, economic and technical as well as environmental change. There is therefore a considerable body of established knowledge as well as ongoing research into adaptation, although it is not always identified by that name. This knowledge can provide a basis for a new vision of development in which adaptation is seen not as an unfortunate necessity in the face of adversity but as a positive embracing of opportunity for beneficial change.

What is new today is the understanding that adaptation can be used as a key and a lever to help open and drive a new effort with renewed motivation. It also captures the idea that adaptation for development and poverty reduction is everybody's business. There is a role for international development assistance in adaptation, but the fundamental drive must come from those who do the adapting. The appeal of adaptation is that it puts the responsibility in the hands of those who stand most to gain, whether that be individuals, families, communities or nations. The role of development assistance, and of global environmental agreements must be to facilitate adaptation, to help build capacity and to share in the removal of obstacles. Adaptation therefore requires partnerships; capacity building; the involvement of a wide range of stakeholders; motivation at all levels, and above all, political will.

Of course, adaptation itself is a term given different meaning by different people. This is discussed below, but the focus of our approach is that adaptation must start today, through actions to target and reduce the vulnerabilities that poor people face. These take many forms, including climate-induced hazards such as the

threat of floods, droughts, cyclones and mudslides as well as the impacts on livelihoods of variable and unpredictable rainfall, declining access to resources from aquatic ecosystems and others. These vulnerabilities are widespread and pernicious in their impacts and would pose formidable challenges even if they were not likely to become even more prevalent as the climate changes. This sets the context within which adaptation to climate change must be considered: the foundation of this process must be to assist poor people to adapt to existing vulnerabilities.

The current growth of interest in adaptation began with the use of the term in the UN Framework Convention on Climate Change (UNFCCC) signed at Rio de Janeiro in 1992. For most of the 1990s, the negotiations under the Convention focused upon the need to reduce greenhouse gas emissions and the stabilisation of greenhouse gas concentrations in the atmosphere, leading to the signing of the Kyoto Protocol. During these negotiations it became increasingly clear that some climate change cannot be avoided and that the target of stabilisation will be difficult to achieve in the short or medium term even if the targets of the first commitment period of Kyoto Protocol are implemented in full and on time. At the same time the Intergovernmental Panel on Climate Change (IPCC) reports have confirmed that climate change is now being detected. The view of adaptation has now therefore changed. It is no longer a secondary and long-term option to be used only as a last resort. Adaptation is now everywhere an imperative, and, in some places, an urgent imperative.

From the beginning of the climate negotiations it has been accepted that adaptation has some role to play in reducing vulnerability to climate change. Initially this was thought to be quite small and limited, but as understanding of the implications of climate change has grown, the role of adaptation has correspondingly increased. Adaptation is not a substitute for mitigation (the stabilisation of greenhouse gas concentrations), but it is now understood to include adaptation to climate variability and extremes as well as long-term change in climate means. It is also recognised that to be effective adaptation to climate change should be integrated into national economic and social development, and that it should be harmonised at both policy and practical levels with other environmental management activities especially in the areas of land and water management, health, the conservation of biodiversity and the protection and development of the earth's dry lands.

Such objectives are easy to state but difficult to achieve in practice. The applied research and development activity now being formulated by the IUCN Task Force is in direct response to this need and proposes a "learn by doing" approach in which policy analysis and the identification and assessment of climate change adaptation measures are associated with practical and ongoing development activities. This implies a programme that includes case studies, as well as the preparation of policy papers and the engagement of the policy community and stakeholders at all levels in a mutually helpful and creative dialogue.

The Task Force itself has four main objectives:

- To offer convincing demonstrations of how policy processes can link with on-the-ground actions to reduce the existing and future climate-related vulnerabilities that poor people face in different parts of the world.

- To identify multi-stakeholder, participatory processes that form the basis for the selection, implementation and appraisal of adaptation strategies.

- To make the case for using natural resource-based approaches for the reduction of vulnerabilities. These approaches should provide multiple benefits: they should generate immediate economic returns to poor people, sustain and diversify their livelihoods, conserve ecosystems and sequester carbon.

- To critique the emerging policy framework for addressing adaptation and make a compelling, strategic case for alternative approaches.

The Keystone Concepts

In this section we define the core concepts needed to understand how poor and vulnerable communities are able to adapt to variable and changing climate patterns. Indeed, even this first sentence contains several concepts that need to be explained very clearly if we are to see more light and less heat in this debate. Clarity is needed in part because the issues we discuss here have traditionally been discussed by four distinct communities:

- **Disaster Management**: people and institutions that are primarily responsible for forecasting and immediate relief efforts for major disasters such as floods, cyclones and, in some cases, pollution events.

- **Climate and Climate Change**: the world's meteorological community and, more recently, people involved with the IPCC process. This community includes both people concerned with current weather and with long-term climate patterns.

- **Environmental Management**: a wide-ranging set of people and institutions that deal with both overall environmental issues and specific aspects of environmental management such as water resources, conservation or forests. One characteristic of this set of stakeholders is that it is itself extremely disparate and fragmented: forest managers rarely communicate with water managers, and even a sector such as water can contain many institutions (within and out of government) that often have little contact with each other.

- **Poverty Reduction**: is again an extremely broad set of issues, but recently the greater focus on poverty in national and donor policy agendas has led to specific initiatives such as the Poverty Reduction Strategy Papers that are led primarily by economic agencies and that are instrumental in defining the context in which many other aspects of policies aimed at the needs and vulnerabilities of poor people are set.

All four are communities that are central to the issues we are discussing here. And all are communities that have their own perspectives, their own processes and even their own usages of many of the key concepts involved in any discussion of adaptation by poor communities to climate change. We need a common conceptual framework to bring them together, and in particular, to meet the key goal of ensuring that adaptation is mainstreamed into their respective sets of activities. This framework is premised on the belief that addressing existing vulnerabilities is the most effective way to address the impacts on poor people that climate change is likely to bring. The starting point is a common vocabulary for the keystone concepts of adaptation, vulnerability, resilience, poverty, livelihoods and security.

Adaptation is the ability to respond and adjust to actual or potential impacts of changing climate conditions in ways that moderate harm or take advantage of positive opportunities. It reflects positive actions to change

the frequency and/or intensity of impacts, as opposed to coping strategies that are responses to impacts once they occur. The adaptation can be anticipatory, where systems adjust before the initial impacts take place, or it can be reactive, where change is introduced in response to the onset of impacts that will re-occur and reflect a structural change of the state of the system: in climate terms where new temperature and rainfall patterns emerge.

Adaptation takes place at all levels, from changes to global systems through changes at national or regional levels to adaptations made by individuals and local communities. The development of adaptation strategies needs to recognise this and define the appropriate mix of actions at these different levels. It can be planned, where pre-meditated decisions that reflect an awareness of impacts is made, or it can be autonomous, where people or natural systems adjust to climate impacts without conscious planning decisions. Understanding these autonomous responses is particularly important in defining the best approach to adaptation, as in many cases they will significantly change our expectations of what will happen in the future. They also represent major policy opportunities that must not be neglected, as policies such as stimuli to markets or the dissemination of technology opportunities can be more effective, less expensive and far less demanding on limited institutional capabilities than approaches that solely rely upon planned interventions.

For poor and vulnerable communities, the basis of adaptation strategies often needs to be a combination of these different forms of adaptation. They should include actions taken by the poor themselves in response to changing market or environmental conditions supported by larger scale, planned responses by government or other institutions that provided adaptation measures that are beyond the control or capabilities of local communities.

The need for and scale of adaptation reflects the **vulnerability** of people and natural systems to disruption from changes that reflect the impacts of climate conditions. Vulnerability is a term that is used in many different ways. For poor people, vulnerability is both a condition and a determinant of poverty, and refers to the ability of people to avoid, withstand or recover from the harmful impacts of factors that disrupt their lives and that are beyond their immediate control. This includes both shocks (sudden changes such as natural disasters, war or collapsing market prices) and trends (for example, gradual environmental degradation, oppressive political systems or deteriorating terms of trade).

In relation to climate change, vulnerability relates to both direct effects such as more storms, lower rainfall or sea level rises that lead to displacement and indirect effects such as lower productivity from changing ecosystems or disruption to economic systems. Any consideration of the need for adaptation to help poor communities to adjust to the effects of climate change must take account of all of these different forms of vulnerability. Of course, exactly how these phenomena will affect different people in different places is largely unknown: one of the many uncertainties that surround the climate change debate. This is both because of the uncertainties inherent in specifying these impacts and that the vulnerability of people will be affected by many things beyond climate change.

This does not mean that nothing can be done until certainty replaces uncertainty, for by then it is generally too late. Assessments of the likelihood of some impacts can be made, with these useful in guiding decisions on

adaptation measures, but in many cases this will not be adequate. Rather than trying to ameliorate specific impacts, the general principle should be to reduce the overall vulnerability of poor people to the shocks and trends that are the consequence of variability in climate conditions.

The **resilience** of poor people is their ability to withstand the impact of these trends and shocks. Resilience varies greatly from household to household, even in one locality. It is determined by two characteristics of people's livelihoods: the assets they possess and the services provided by external infrastructure and institutions. Both the assets and the services are extremely broad in their scope. Assets include the amount and quality of knowledge and labour available to the household, the physical and financial capital they possess, their social relations and their access to natural resources. External services include those provided by flood control, coastal protection and other infrastructure, transport and communications, access to credit and financial systems, access to markets, emergency relief systems and others.

For many poor people in developing countries, access to these external services is extremely limited, so that their resilience is in large part a reflection of the local asset base. Strategies to strengthen the resilience of communities, and especially poor communities, should be based on the most effective combination of measures to secure and enhance the community's asset base and measures to provide improved external services. What is the best balance in any one place needs to be determined through effective assessments of local needs and capabilities.

Taken together, the reduction of vulnerabilities faced by and the improvement to the resilience of poor people to withstand the impacts of climate change will improve their **security**: that is, the extent to which they can live their lives and conduct their livelihoods free from risks. These threats have many forms. They can be to the very lives of people, with the incidence of more climate-related disasters likely to increase in many parts of the world and particularly an issue in tropical regions where most of the world's poor live. Changing climate conditions and rising sea levels are also likely to make many places uninhabitable unless concerted and effective adaptation measures are taken, which could displace many vulnerable people with devastating consequences for their livelihoods and social relations.

Climate change and associated ecological changes also pose threats to the viability of many economic and social structures even where people are not displaced or in serious physical risk. This is particularly true where they will lead to decline in the availability or quality of natural resources such as water or land on which the livelihoods of many poor people are based. This is the ultimate goal of adaptation processes: to provide security to people who face greater threats because of changes to the climate conditions in which they live.

These four concepts: adaptation, vulnerability, resilience and security, are the core ideas developed in the rest of this paper. They are discussed below in relation to the dynamics of the livelihoods of the poor, with clear definitions given for both livelihoods and poverty. All of these concepts are open to many interpretations. It is hoped that the explanations given here will provide a basis for the identification of the most effective processes through which actions to assist the poor and vulnerable to adapt to climate change can be developed.

Before moving on to this discussion, one further concept needs clarification: **poverty**. Traditional approaches to poverty as simply an economic condition (often expressed in relation to living on less than $1 or $2 a day

for individuals, or as per capita GNP for nations) have been replaced by approaches that see poverty as something that is complex, variable, multidimensional and dynamic. The UNDP's "Human Poverty Index" sees poverty as a lack of basic human capabilities, with the index consisting of five key indicators: life expectancy, access to safe water and to health services, literacy and the proportion of children underweight aged five and under. A similar vision is reflected in the UN's Millennium Development Targets, which stress health, education, gender and environmental sustainability.

The World Bank's approach since 2000 stresses the multi-dimensional character of poverty, with both the material and non-material as important. Key elements of poverty are given as the inability to satisfy basic needs, lack of control over resources, lack of education and skills, poor health, malnutrition, lack of shelter and access to water supply and sanitation, vulnerability to shocks and a lack of political freedom and voice. The OECD DAC argue that "poverty, gender and environment are mutually reinforcing, complementary and crosscutting facets of sustainable development" (Poverty Guidelines 2001), so that any poverty reduction strategy must focus on gender and environmental issues. Poverty itself is defined as being rooted in the lack of economic, human, political, socio-cultural and protective capabilities.

In a joint contribution to the World Summit on Sustainable Development preparatory process the European Commission, DIFD, UNDP and the World Bank also emphasise the material and non-material aspects of poverty including the lack of income and material means, poor access to services, poor physical security and the lack of empowerment to engage in political processes and decisions that affect one's life. They focus on livelihoods, health and vulnerability as three dimensions of poverty reduction.

The new thinking on poverty reflected in the approach of these and many other international agencies and national governments have also placed poverty reduction at the top of the policy agenda. In almost all cases, actions (including those such as adaptation to climate change) are expected to show in direct and material ways how they contribute to poverty reduction. This is as it should be, for the poor are both the hardest hit and the least able to cope with processes such as climate change and other forms of environmental jeopardy (just as they are most vulnerable to negative impacts from changing economic and political systems). For the purposes of this paper, these approaches to poverty are consequently important in both the centrality of concepts such as vulnerability and in the expectation that any approach to adaptation should demonstrate how it is able to target the needs and potentials of poor people as a first priority.

The Current Regime

Under the UNFCCC a new regime for the promotion of adaptation has slowly been emerging. It is important to situate the Adapt and Thrive initiative in this context since its concerns are central to the issue of adaptation and development. Getting a clearer picture of these trends is a considerable task that will be undertaken in the future, and although the final form of this model is far from set, to date it is tending towards a classic top-down approach in which adaptation measures are equated with large-scale infrastructure based interventions in which adaptation is largely equated with physical protection. There will without doubt be many circumstances where large investments in infrastructure are an essential part of the adaptation process, but what is emerging to date appears to give little space to non-concrete alternatives. In particular, 'bottom-up' approaches that are rooted in existing community-based patterns of resource management and that aim at sustaining and enhancing

the livelihoods of vulnerable people have largely been ignored. We would argue here that these need to be integral to, indeed need to be the point of departure for, adaptation strategies, as they are cheaper, more sustainable and in many cases more effective in achieving the core goal of assisting poor communities to adapt to the impacts of climate change.

At the first meeting of the Conference of the Parties to the Framework Convention (COP 1, Berlin, 1995), a decision was taken (Decision 11/CP.1) to approach adaptation in three stages, defined as follows:

- Stage I: Planning, which includes studies of possible impacts of climate change, to identify particularly vulnerable countries or regions and policy options for adaptation and appropriate capacity building.

- Stage II: Measures, including further capacity building, which may be taken to prepare for adaptation as envisaged by Article 4.1(e).

- Stage III: Measures to facilitate adequate adaptation, including insurance and other adaptation measures as envisaged by Articles 4.1(b) and 4.4.

Under these provisions the Global Environment Facility (GEF), which is the financial mechanism for the Convention, has met the agreed full costs for the preparation of First National Communications under the Convention. In addition a number of impacts, vulnerability, and adaptation studies have been carried out including studies in Bangladesh, the Caribbean and the Pacific Islands supported by the World Bank. Studies of impacts have also been carried out in many countries as part of the United Nations Environment Programme's country studies, and in the country study programmes sponsored by the Netherlands and the United States. In addition, many independent research institutions and NGOs have begun their own programmes on vulnerability and adaptation. Bilateral development assistance agencies are also becoming interested in adaptation.

Most of the early work has focused heavily on the potential impacts of future climates, described in climate scenarios derived from General Circulation Models (GCMs). A new generation of research is now in the formative stage which provides for much greater attention to adaptation, and which addresses adaptation and vulnerability to current climate change and variability and extremes as well as longer-term climate change. The proposed new round of studies will also be focused on the role of adaptation in development. Although this change in perspective is now generally accepted as an appropriate step forward, the methods to be employed and the scope of the studies has not yet been established. The UNDP has developed an Adaptation Policy Framework, which is now being elaborated and tested in Central America and Cuba. The conference of the Parties has adopted guidelines for the conduct of National Adaptation Plans of Action (NAPAs) for the Least Developed Countries, and the World Bank has taken the initiative in establishing an inter-agency cooperation group known as the Vulnerability and Adaptation Resource Group (VARG). The World Bank is also proposing to develop a methodology for rapid assessments, and to launch its own National Adaptation Strategy Studies (NASS).

All of these initiatives are attempting to define their own approaches and methodology. In this context the Adapt and Thrive initiative of the IUCN and partners has a unique role to play. Building on its comparative

advantage in the field of natural resources management and conservation the, IUCN is well placed to develop (in co-operation with selected partners) a unique approach in which adaptation to climate change can be linked with disaster mitigation, natural resources management and conservation and sustainable livelihoods.

In response to the evolving nature of the climate issues and the way in which it is perceived, the Conference of the Parties has moved to establish two new funds, which can provide support for adaptation. The first is the Special Climate Fund, a multipurpose fund open for voluntary contributions from donors. This fund is not expected to have significant monies before 2005. The second is the Least Developed Countries Fund which is currently resourced by voluntary contributions and is supporting the preparation of NAPAs as its first activity. A third fund is also in prospect, but this is a fund dependant upon the ratification of the Kyoto Protocol. It will be created under the Clean Development Mechanism (CDM) of the Protocol and involves a levy on activities undertaken under the CDM.

The IUCN Adapt and Thrive initiative can help in the development and formulation of activities under these three funds by testing out and demonstrating a new integrative approach in the form of case studies and related policy papers.

Vulnerability, Livelihoods and Climate

The key goals of adaptation strategies are to reduce vulnerability to climate-induced change and to sustain and enhance the livelihoods of poor people. These strategies consequently need to be rooted in an understanding of how the poor and vulnerable sustain their livelihoods, the role of natural resources in this and the scope for adaptation actions that reduce vulnerabilities and increase the resilience of poor people. This is not as straightforward as it sounds, for the effects of climate change are just one of the many factors that influence people's livelihoods. This section develops these ideas further, relating the dynamics of livelihoods to the vulnerabilities that climate changes are likely to bring.

What do we mean by **livelihoods**? This is an increasingly widely used concept that, as with the concepts discussed earlier, can be open to different interpretations. One of the most widely accepted definitions of livelihoods is: *"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base"* (Carney 1998, p.4).

Central to both this definition and determining the resilience of households to vulnerabilities is the idea of **livelihood assets**. These are the means of production available to a given individual, household or group that can be used in their livelihood activities. These assets are the basis on which livelihoods are built and, in general, the greater and more varied the asset base the higher and more durable the level of sustainability and security on their livelihoods. There are generally five forms of livelihood assets identified in most approaches:

Natural capital: The natural resource stock from which resource flows useful to livelihoods are derived. The actual resources available to an individual household reflects the characteristics of the local resource base and the extent to which the household is able to gain access to these resources, which in turn reflects issues of

ownership and entitlements as well as the availability of technologies that make it possible to use the resource potentials.

Social-political capital: The set of social relationships upon which people draw in pursuit of their livelihood. This includes the range of contact networks, membership of groups and organisations, relationships of trust and access to wider institutions of society that are important in the actual operation of livelihood activities and that can be determining in terms of access to markets, credit, government services and many other factors of production.

Human capital: The skills, knowledge, ability to labour and good health important to the ability to pursue livelihood activities. For individual households, this includes both the quantity (number of productive individuals) and the quality (what these individuals know and how hard they are able to work) of human resources. It includes knowledge and skills learnt from both formal education and through experience and non-formal learning routes.

Physical capital: The basic infrastructure for transport, buildings, water management, energy, and communications and productive capital (tools, machines, etc) which enable people to pursue the livelihoods. It includes both those that people own and those that they have access to (roads, irrigation systems, telephone networks, etc) whether provided by government or the private sector (and whether free or paid for).

Financial capital: The financial resources which are available to people (whether savings, supplies of credit, regular remittances and pensions, social security payments or insurance) and which provide them with different livelihood options. This includes finances (including credit) for investments in new productive assets, for inputs into production and (importantly for our purposes) for responding to the effects of different vulnerabilities, including recovering and reconstructing livelihoods after disasters.

Taken together, these livelihood assets determine much about how livelihoods work, and in particular are the basis for understanding how people will respond to climate-induced vulnerabilities. This, in turn, means they are (or at least should be) the basis for the development of adaptation strategies. All of these assets are important, but for the poorest and most vulnerable of the world (especially the rural poor), natural resources are of particular significance. This has been recognised for some time: *"Predominantly the poor of the world depend directly on natural resources, through cultivation, herding, collecting or hunting for their livelihoods. Therefore, for the livelihoods to be sustainable, the natural resources must be sustained"* (Rennie and Singh, 1996, p. 16).

This recognition is now reflected in international processes such as the joint submission to the World Summit on Sustainable Development prepared by the World Bank, European Union, UNDP and DFID: *"Poor people tend to be most dependent upon the environment and the direct use of natural resources, and therefore most severely affected when the environment is degraded or their access to natural resources is otherwise limited or denied" (p.3).* It is even reflected in a number of Poverty Reduction Strategy Papers (PRSPs): *"The poor in Tanzania are heavily dependent on the environment"* (Tanzania PRSP). *"Climate conditions....degradation of soil and water resources are major constraints on economic growth and contribute massively to poverty and*

severe food insecurity" (Burkina Faso PRSP). *"There is a strong correlation between sound natural resource management and poverty reduction"* (Cambodia PRSP). *"Environmental protection is of significant relevance to poverty reduction....the poor are disproportionately exposed to the impact of deteriorating environmental conditions"* (Armenia RSP).

These quotes reflect the situation today in many parts of the world. All the evidence suggests that these vulnerabilities are going to significantly increase in the future, in part due to climate change but also because of other forms of resource and livelihoods pressures, *unless* effective and substantial measures are taken to ameliorate them through adaptation and other strategies.

How do livelihoods relate to climate change-induced vulnerabilities? The range of vulnerabilities that poor people face in different parts of the world encompasses all aspects of life, with most not directly related to climate change (though many are affected in some way by it). There are many ways to approach the relationship between climate change and vulnerability, but the 2001 IPCC Working Group II Report on Impacts, Adaptation and Vulnerability gives insights that are as good a starting point as any. Here we relate the likely changes to vulnerabilities identified in the report to the dynamics of the livelihoods of poor people in different major types of agro-ecological zones of the developing world. In doing so, we strongly agree with the Working Group II statement that:

"Populations are highly variable in their endowments [of different capitals] and the developing countries, particularly the least developed countries.... have lesser capacity to adapt and are more vulnerable to climate change damages, just as they are more vulnerable to other stresses. This condition is most extreme among the poorest people" (IPPC 2001, p. 8).

Sea level rises will displace millions of the poor, with the areas least likely to be protected those where people are poorest. Small island states and low coastal areas and deltas, such as southern Bangladesh, are most at risk. In many cases, those displaced will have few opportunities to re-establish their lives except in urban areas, where livelihood opportunities are limited without the skills, capital and contacts needed to cope with urban life. Even where people are not physically displaced, rising seas will reduce the natural capital in ecosystems such as coastal fisheries, mangroves and wetlands that are essential to the current livelihood patterns of many poor communities, whilst the dangers of salination of water supplies will affect both these and other coastal communities.

Changes in **temperature and rainfall patterns** (both to averages and to the variability of rainfall) are widely predicted, with many semi-arid parts of the developing world likely to become even hotter and dryer and have even less predictable rainfall, in particular. These changes will both directly affect crop yields and will produce changes to ecosystem distributions and species ranges. This will dramatically affect the livelihoods of many poor people, with in particular declining food security and problems with the viability of many livelihood activities, including livestock, fishing and the use of forest products as well as agriculture. Secondary impacts will be likely to include increases in urban food prices and greater problems with services such as water supply and sanitation (exacerbating pressures that rapid urbanisation will bring) that affect the urban poor.

The changing climate patterns, and especially more **extreme events**, will increase vulnerability to natural disasters, both slower onset ones such as droughts and rapid onset disasters such as floods and cyclones. These will affect many areas, but semi-arid areas (droughts) and coastal and deltaic regions (floods and storms) are particularly vulnerable. Dangers of erosions, landslides and flash floods will also increase in, in particular, many hilly and mountainous areas. Changing climate patterns and more extreme events will have impacts on new livelihood activities such as from tourism, that will limit diversification opportunities which, combined with damage to infrastructure and other types of physical capital, will affect the wider range of vulnerabilities (such as limited access to markets) the poor face. The poor social and political capital, along with extremely limited access to financial capital, mean that these communities are least likely to be protected by investments in infrastructure or disaster mitigation and relief systems.

Predicted adverse **health** risks will affect the poor, in particular, throughout the developing world. These risks are in particular those associated with water-borne (such as dysentery or cholera) and vector-borne (such as malaria) diseases as well as heat, stress, morbidity and mortality. These health impacts pose a double jeopardy for poor people's livelihoods: the contribution of key productive members of the household is lost and the cost of health care is expensive and time consuming. Such risks will be widespread, but the dearth of medical care systems in many more remote, poorer areas of Africa and Asia, in particular, mean that the poor in these areas are the most vulnerable to these risks. The deterioration of the availability or quality of water supplies in many areas (again due to wider resource stresses that climate change will exacerbate) will significantly increase many of these health risks, whilst poorer nutritional states caused by declining food security will make many poor people more vulnerable to the effects of diseases when they do strike.

The increased danger of damage to crops, livestock and gathered plants and animals from **pests** will be similar in distribution and impact to those of increased health risks, but will be exacerbated by the risks of physical damage caused by floods, droughts and storms. Although the development of more crop resistant or drought tolerant crop strains may limit these risks, many poor rural communities are far less able to gain access to such new varieties (which in any case make them more dependent upon external inputs that can be unreliable in their availability), placing them at an even greater disadvantage in agricultural markets.

Finally, the IPCC report stresses the likely impact of climate change on **financial and insurance systems**. These will indeed be dramatic on a global scale, but very few poor people are able to gain access to these systems so that the direct effects upon them may be limited. This does not mean that they will be unaffected, however, as the strains these systems will experience, along with the declining value of many of their assets, mean that poor people are even less likely to be able to gain access to the capital and credit systems that they so vitally need. Innovative financial solutions are essential in any programme to assist the world's poor to adapt to the impacts of climate change.

Adaptation as a Process

The discussion so far has shown the people's livelihoods are dynamic, complex and variable in character, with poor people in particular responding with the means they have available to the vulnerabilities they face. The development of adaptation strategies to mitigate the impacts of climate change on these people should

reflect these dynamics of people's livelihoods, working in particular to reduce the vulnerabilities they face and to strengthen their resilience to these vulnerabilities. This can only be achieved where adaptation is seen as a process that is itself adaptive and flexible to address the locally specific and changing circumstances that are the reality of the lives of the poor.

What does this mean? The first point is that adaptation is not something that is 'done' to or for people: it is something that they do that may (or may not) be supported by external agencies. This is the heart of the logic presented here. Whether or not this is 'autonomous' or 'planned' adaptation is hard to say, as it is not centrally orchestrated, but individuals and communities often take very conscious and planned steps to adapt the patterns of their lives and livelihoods to reflect immediate or anticipated changes to climate conditions (including increases to variability and extreme events that add significantly to the vulnerabilities that they face).

The extent and significance of this varies according to how vulnerable people are and how significant climate, and natural resources affected by climate, is in their livelihoods. As such, whilst the IPCC (2001) statement that *"those with the least resources have the least capacity to adapt and are the most vulnerable"* (p. 8) may be true, it fails to recognise that **those with the least are the most likely to take conscious adaptation actions precisely because they are the most vulnerable**. Moreover, the actions that they take will be constrained by their limited assets and capabilities, but they will also be the most appropriate given the specific local manifestations of climate change impacts and potentials to respond to them. The point of departure for any adaptation process must consequently be what is already happening (or is likely to happen) amongst the people who are the target of the process: the poor and vulnerable.

Their actions can and should be supported by external agencies, aiming to either increase their resilience or reduce the vulnerabilities that they face. This may include major projects, including large-scale infrastructure such as dams or coastal defences, which are largely financed by others and in which poor people are but one of many stakeholders. It may also include changes to the framework of laws and policies that govern different aspects of natural resource management, investment incentives, access to technologies, services or markets, disaster management and relief and many (perhaps all) spheres of government. It may include changes to institutions and to governance conditions that affect the lives of the poor and dictate the channels through which they interact with external agencies. It almost certainly will include actions to build up the asset base of the poor, to sustain existing and open up new livelihood opportunities and to help forge stronger and more cohesive community-level institutions that are the basis for future adaptation measures.

Adaptation should also not be seen in isolation. One of the keys to catalysing adaptation will be to mainstream it into wider development and other processes, rather than separating it out into special measures funded separately and executed by separate agencies. The key to adaptation is to ask what is being adapted (and why of course), then to see how much and in what direction changes to existing development trajectories need to move. This needs a careful analysis of patterns of development and natural resource management with, in particular, a focus on how sensitive these are to existing and potential future changes to the climate. For larger countries in particular, this needs to be spatially disaggregated so that it can be linked effectively to ecological variety. It also needs to be targeted for equity: that is, linked to the distinctive needs and potentials of poor communities. Understanding what these are should reflect the livelihoods approach set out above

with, in particular, a focus on sustaining and improving the asset base of poor people and strengthening their resilience to external vulnerabilities.

In developing this approach to adaptation, particular attention needs to be paid to the disconnections: the gaps between local and national processes, between formal and informal patterns of economic activity and management of resources. These gaps are characteristic of much of life in many parts of the world, and are particularly found in many poor communities where wider institutional weaknesses are found. It necessitates a very strong focus on institutional capacity development in adaptation processes, with in particular activities to ensure the effective participation and empowerment of poor communities in key decisions in these processes. Three particular challenges exist in developing institutions to support adaptation processes:

- Changes to laws and policies must enable place-specific actions, something that their generic character makes particularly challenging. These changes must both direct the actions of government institutions and create packages of incentives and regulations that catalyse actions within society as a whole.

- How can successful local-level actions, often developed under controlled conditions and with intensive external inputs, be scaled up to a level where they can make an impact at national and global levels?

- How can we ensure that they are effectively targeted at the needs and interests of the poor, and in particular that the emerging institutions represent marginalised peoples and enhance equity in the development of adaptation processes? The history of the impact of many major infrastructure projects on the poor gives salutary lessons here.

This institutional focus should not be at the expense of effective action where needed, however. There is always a fear that nebulous and long-term processes such as 'institutional development' can delay action or be an excuse for inaction. This must not be the case, so the approach to adaptation advocated here is based on the idea of looking for 'win-win' solutions: actions that both serve immediate needs and bring immediate benefits and that also contribute to the longer term process of capacity-building and structural change. This may sound optimistic, even unrealistic, but if adaptation processes are rooted in the reduction of existing vulnerabilities and increasing the resilience of poor people to these vulnerabilities, then this will bring immediate rewards and will also strengthen their capability to deal with future, even greater threats from climate change.

There are many such win-win approaches, with different ones appropriate for different places. The conservation, through community-based sustainable management, of mangrove belts, coral reefs, wetlands and forests are examples of where immediate benefits and long-term capacity development go hand in hand, as are sustainable improvements to water management and availability, improvements to infrastructure such as roads and even improvements to environmental health conditions that will mitigate potential climate change impacts. There is a need to document models of good practice of such approaches, along with the processes through which they can be disseminated on a scale sufficiently large to make an impact. Doing so is beyond the scope of this paper, but it is hoped that the approach set out here will catalyse wider thinking on this relationship between contemporary development, based on sustaining and enhancing the livelihoods of the poor, and the process of adaptation to climate change.

A Strategic Framework for Adaptation

The approach set out here is that adaptation should be rooted in addressing the climate-induced vulnerabilities that poor people face. This can be achieved by a combination of structural and non-structural measures that reduce the force of vulnerabilities and/or increase the resilience of poor people to resist them. A key is that action is needed now: the poor of the world are already vulnerable. We cannot afford to wait.

But at the same time we recognise the problems associated with the precautionary principle, where future threats are mitigated by present investments, but at a price that is the opportunity cost of these investments. For poor people and poor countries, there are many urgent needs, many immediate problems that demand attention and investment. Adaptation approaches should consequently seek out 'win-win' options whereby actions today will meet immediate needs and will also create the basis for reducing future vulnerabilities and the capacity for more effective adaptation as the impacts of climate change bite.

How can these measures be identified? What is the process through which the world's poor can be assisted to adapt to the threats of climate change? A three-stage process, each with several steps, can form the basis for developing adaptation strategies:

Understanding Vulnerability-Livelihood Interactions

- Identify the main climate-induced vulnerabilities that affect poor communities in different places and relate these to the wider vulnerabilities they face and to the dynamics of their livelihoods and their assets base.

- Assess the adaptation measures that poor people already take and relate this to their resilience to withstand climate-induced vulnerabilities.

- Determine, through participatory processes, the needs, priorities and capabilities of different stakeholder groups in relation to adaptation to climate-induced vulnerabilities

Establishing the Legal, Policy and Institutional Framework

- Diagnose existing laws, policies and regulatory systems in relation to their effects on climate-induced vulnerabilities, including agriculture, forestry, disaster management, water and all other relevant sectors.

- Define the institutional processes through which adaptation measures are implemented, including where decision-making authority lies at national, local and intermediary levels and the links between these levels.

Develop a Climate Change Adaptation Strategy

- Identify potential reform measures and investment options to enhance the resilience and reduce the vulnerability of poor people to climate variability and change and enhance their access to ecosystem services. This should include both structural and non-structural measures, and the financial means and the institutional changes necessary to implement successful adaptation processes.

- Based on participatory processes, prioritise the potential reforms and investments taking into account the financial, knowledge, institutional and other resources available to implement them.

Seizing the Opportunity

We have argued the case that there is a new window of opportunity to utilise the concept of adaptation as a means to bring together, harmonise, and reinvigorate the experts, the programmes, and the stakeholders in the diverse fields of disaster management, climate and climate change, environment and natural resources management, and poverty reduction. If a strong convergence of these interests can be brought together and marshalled into a new initiative there is a prospect of significant payoff, and an important contribution to the intractable problems of sustainable development.

This paper has succinctly elaborated upon some of the main concepts and processes involved, and seeks to provide a conceptual basis for action. The next steps include the development of more specific proposals for such action. This requires further discussions among the partners in this initiative, and consultations with many other groups and organisations which might wish to become parties in the activity in diverse ways and places.

The purpose of this concluding section is to raise a number of further practical questions that need to be addressed as the initiative moves into its design phase.

More Dialogue?

Some of the concepts developed in this paper are relatively new and untried. Others have a longer lineage, but are still not widely in use. The integration of the concepts into this Adapt and Thrive initiative is a new and untested idea. It may be therefore that more discussion and dialogue is required before moving into a practical, empirically based research and outreach activity. Hastily plunging into fieldwork before the ideas are more widely discussed and tempered by experience could be ineffective or counter productive. How much more dialogue is needed and how broadly should the net be cast to draw in other parties?

What Forms of Dialogue?

Consideration might be given to different levels and ways in which a dialogue might be developed and expanded. This paper could be used as a document to help stimulate debate, either in face-to-face meetings or in electronic means of communication. Meetings could be either in small groups or could extend to the organisation of large regional or international conferences. The ideas advanced in this paper could be used to generate a self-sustaining epidemic, in which a widening circle of people become infected, and spread the message.

Is the Germ Potent Enough?

To continue the epidemiological metaphor for a moment, we could ask if the formulation of the concepts and message of this paper is yet powerful and contagious enough? More dialogue could no doubt help to sharpen the ideas at the same time as engaging other players. But is dialogue by itself enough?

Pilot or Demonstration Studies?

This concepts paper might be further strengthened by the more systematic incorporation of field studies or practical experiments. Our assertion is that the fields of disaster management, climate change, natural resource and environmental management, and poverty reduction have not been addressed in an integrated way anywhere. One step would be to design and begin some work along these lines on a modest scale. While such an initiative would have some original features, we should not pretend that it is entirely novel. We are confident that the fields we have identified have not been addressed in an integrated way before. On the other hand, similar ideas of a more integrated approach have been proposed and tried before in other domains and other contexts. Perhaps a more systematic effort is needed to draw upon these experiences.

A Survey of Previous Integration Efforts?

Another parallel activity might be a systematic survey of the literature, and case studies, and the experience of development specialists and practitioners in the development of integrated approaches. Such an exercise could have value in its own right, but would also contribute to the sharpening of the concepts and the design of case studies or pilot projects. If this is enough relevant case material, the literature might be brought together in the form of a book, which distils previous experiences, identifying obstacles as well as success stories.

Specific Policy Papers?

As this initiative gets underway some more specific policy questions are certain to arise. Indeed many intractable policy questions in development have long been identified that could be revisited from the perspective proposed in this concept paper. Such an exercise could also be in initiated in parallel with other activities proposed.

Begin the Dialogue Now?

The first question in this list relates to the need for dialogue. The dialogue could begin immediately and could start by addressing the first six questions, before moving on to implement the answers that they generate.

Vulnerability and Adaptation Assessments to Climate Change: An Evolution of Conceptual Thinking

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Abstract

This paper presents the historical development of the conceptual ideas underpinning vulnerability assessments to climate change. Different generations of assessments are described by means of a framework based on cause and effect relationships and the formulation of response strategies.

The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol have encouraged the development and use of assessment results mainly to make the case for greenhouse gas emission reduction, rather than to consider strategies to adapt to the impacts of climate change. However, recognition of the fact that climate is already changing and that benefits of emission reduction are limited in the short-term have considerably increased the attention given to adaptation by the climate change community. Planned adaptation is now seen as a necessary strategy to complement mitigation measures in reducing the vulnerability of societies to both present and future climate hazards. In the conceptual framework for vulnerability assessment, this development is rejected in the progressive inclusion of non-climatic determinants of vulnerability to climate change, including adaptive capacity. The ongoing evolution of conceptual thinking about vulnerability assessments can provide a basis for the climate change and risk management communities to join forces in reducing climate related risks both now and in the future, even though legal and financial frameworks for action are still largely separate.

Policy Responses to Global Climate Change

The risks of anthropogenic climate change call for a wide range of policy responses to reduce the vulnerability of important climate-sensitive systems. Mitigation and adaptation are the two fundamental response strategies that are distinguished in the climate change community. Whereas mitigation refers to limiting global climate change through the reduction of greenhouse gas (GHG) emissions, adaptation aims at moderating its adverse effects through a wide range of system-specific actions.

Mitigation has traditionally received much greater attention than adaptation from the climate change community, both from a scientific and from a policy perspective. The unequal weights given to the two fundamental response options to climate change are largely due to the international policy framework within which they are negotiated. The 'ultimate objective' of the UNFCCC, as stated in Article 2, is the "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". Facilitating adaptation to the adverse effects of climate change is mentioned at a less prominent position, although one could argue that the level at which human interference is dangerous is in part determined by adaptation activities (SP01). The same holds for the Kyoto Protocol (KP), where quantitative limits for greenhouse gas emissions are complemented by far less specific provisions to evaluate and facilitate adaptation measures.

The focus on mitigation is also reflected in the work of the Intergovernmental Panel on Climate Change (IPCC), an organisation jointly established by the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) in 1988. The objective of the IPCC is to assess all available peer-reviewed literature on climate change and present it in a form accessible to policymakers. To this end the IPCC is organised in three Working Groups (WGs).

- WG I assesses the scientific aspects of the climate system;
- WG II assesses the impacts of climate change and options for adapting to these impacts; whilst
- WG III assesses options for limiting GHG concentrations. Thus, adaptation to climate change is supposed to be addressed by WG II, but its reports to date have emphasised the assessment of impacts.

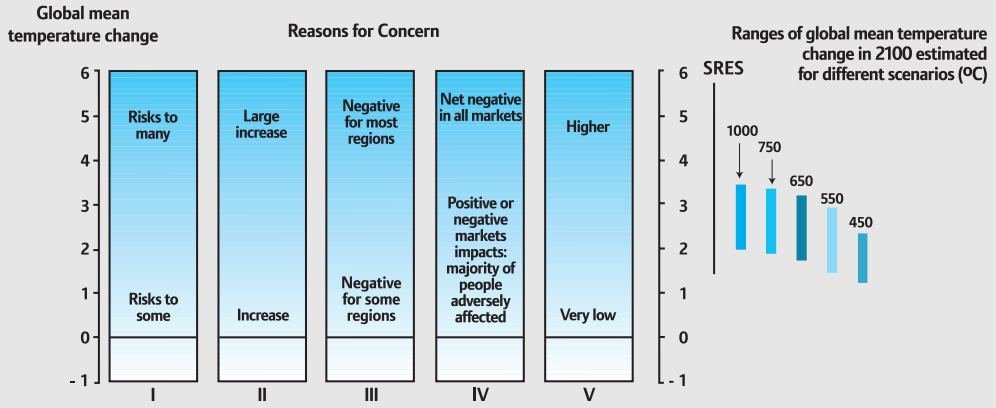
There are important reasons for the focus on mitigation in the UNFCCC and KP. First of all, mitigating climate change helps to reduce impacts on all climate-sensitive systems whereas the potential of adaptation measures is limited for many systems. It is, for instance, hardly conceivable how Pacific coral atolls could 'successfully' adapt to substantial levels of sea level rise. Secondly, reducing GHG emissions applies the polluter-pays principle whereas the need for adaptation measures is likely to be greatest in developing countries, which have contributed little to climate change. Thirdly, GHG emission reductions are relatively easy to monitor quantitatively, both in terms of their absolute amount and as deviation from an established baseline. It is much more difficult to ensure that international assistance to facilitate adaptation would be fully additional to existing development aid budgets.

In spite of the need for mitigation there are also convincing causes for a more comprehensive consideration of

adaptation as a response measure to climate change. First of all, adaptation measures typically require less time to become effective than emission reductions, the effect of which is only felt after several decades. Given the amount of past GHG emissions and the inertia of the climate system, the Earth is already bound to some degree of climate change, which can no longer be prevented even by the most ambitious emission reductions.

Secondly, most adaptation measures can be implemented locally or regionally, and their efficacy does not rely on the actions of others. Thirdly, adaptation to climate change typically also reduces the risks associated with current climate variability, which constitute a considerable threat in many regions. For a more in-depth discussion of the 'preventionists' versus 'adaptationists' debate, see Figure 1.

Figure 1: Risks of climate change damages for several emission scenarios



I. Unique and Threatened Systems

Extinction of species.

Loss of unique habitats, coastal wetlands.

Bleaching and death of coral.

II. Extreme Climate Events

Health, property, and environmental impacts from increased frequency and intensity of some climate extremes.

III. Distribution of Impacts

Cereal crop yield changes that vary from increases to decreases across regions but which are estimated to decrease in most tropical and subtropical regions.

Decrease in water availability in some water-stressed countries, increase in others.

Greater risks to health in developing countries than in developed countries.

Net market sector losses estimated for many developing countries; mixed effects estimated for developed countries up to a few degrees warming and negative effects for greater warming.

IV. Global Aggregate Impacts

Estimates of globally aggregated net market sector impacts are positive and negative up to a few degrees warming and negative for greater warming.

More people adversely affected than beneficially affected even from warming less than a few degrees.

V. Large Scale, High Impact Events

Significant slowing of thermohaline circulation possible by 2100.

Melting and collapse of ice sheets adding substantially to sea level rise (very low likelihood before 2100: likelihood higher on multi-century time scale).

Source: (IPC01, Fig 6{3).

Figure 1 presents an aggregated synthesis of the WG II contribution to the Third Assessment Report (TAR) of the IPCC (MCL+01). It relates changes in global mean temperature simulated for a set of IPCC emission scenarios to the risks of climate damages, categorised by different 'reasons for concern'. This categorisation also helps to explain differences in the potential of adaptation measures.

Whereas improved building codes, early warning systems and disaster preparedness schemes can substantially reduce the risks of 'extreme climate events' (category II), their efficacy will be very limited for many 'unique and threatened systems' (category I). Often-cited examples of the latter type of systems are biological communities that cannot cope with substantial amounts of climate change because of limited migration potential, such as many coral reefs, alpine ecosystems or the Cape coral kingdom.

Evolution of Vulnerability Assessments

We distinguish four different stages of vulnerability and adaptation assessments. Their evolution is characterised by a purpose shift: from science-driven assessments that estimate (long-term) climate impacts to policy-driven assessments that recommend specific adaptation measures. This focus shift has important consequences for the degree to which non-climatic factors are considered, for the consideration of vulnerability to current climate variability and extremes, for the characteristic temporal and geographical scales, for the treatment of uncertainty considering future developments, for the integration with other policy goals, and for the involvement of stakeholders. For a more detailed discussion of these issues, the reader is referred to the references.

Each stage of vulnerability assessments is illustrated by a corresponding conceptual framework. These frameworks take the form of a causal map that depicts the main elements considered in the determination of the results, and their cause-and-effect relationships. However, they do not represent operational guidelines for vulnerability assessments, which are presented, for instance, in the references. The frameworks are widely applicable whereby some generalisations have to be made in applying the same concepts and terminology to vastly different impact domains. Most examples in this paper refer to climate impacts on human health. The climate change community, in large part because of its intensive co-operation within the IPCC, is developing a common terminology, although definitions are still being debated. Since some of the important terms are used differently in other scientific communities, when discussing key terms of the conceptual framework we present definitions from the latest IPCC glossary.

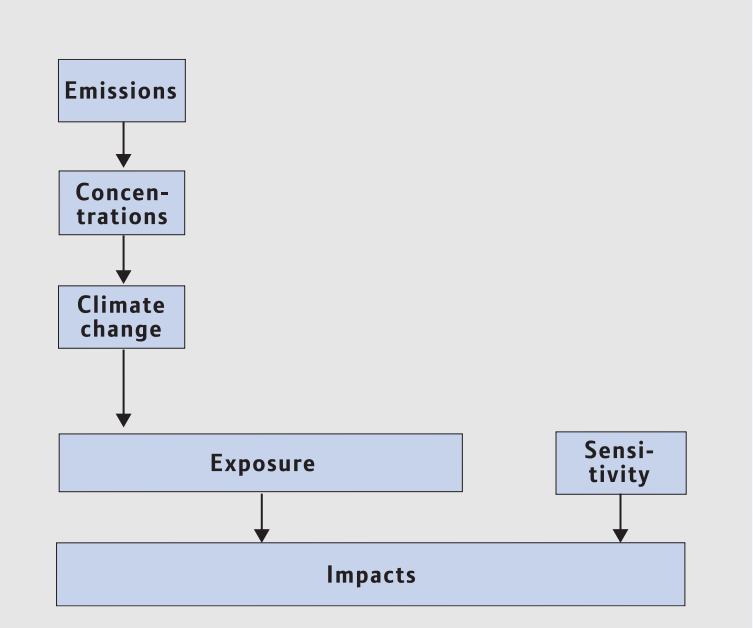
Impact Assessment

> *(Climate) impact assessment: The practice of identifying and evaluating the detrimental and beneficial consequences of climate change on natural and human systems.*

Impact assessments evaluate the potential effects of one or more climate change scenarios (compared to a hypothetical constant climate scenario) on one or more impact domains. In that way, they contribute to the identification of 'levels of greenhouse gas concentrations' that would lead to (or avoid) 'dangerous anthropogenic interference with the climate system' as called for by Article 2 of the UNFCCC.

Figure 2 depicts the main elements considered in a climate impact assessment and their relationships. The assessment starts from scenarios of either greenhouse gas emissions or atmospheric concentrations, such as the often-assumed 2-_CO_2 case. A climate model is then applied to determine the corresponding level of climate change.

Figure 2: Conceptual framework for a climate impact assessment



Climate change: A statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. . . .

Exposure: The nature and degree to which a system is exposed to significant climatic variations.

The exposure of a system to climatic variations depends both on the level of global climate change and on the location of that system (which is coined exposure unit by the IPCC). Climate is a multi-dimensional phenomenon, which exhibits variations on different time scales. However, most impact assessments tend to focus on long-term changes in average climate conditions (such as annual mean temperature or precipitation) because these results are most readily available from climate models.

Sensitivity: The degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. [. . .] The effect may be direct [. . .] or indirect [. . .].

The sensitivity of a system denotes the dose-response relationship between the exposure to climatic stimuli and the resulting effects. Sensitivity is often assumed to remain constant over time. However, whilst this assumption may be correct for unmanaged natural systems, its appropriateness can be questioned for most human systems, which evolve continuously, even in the absence of climate change.

(Climate) Impacts: Consequences of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential and residual impacts. [. . .]

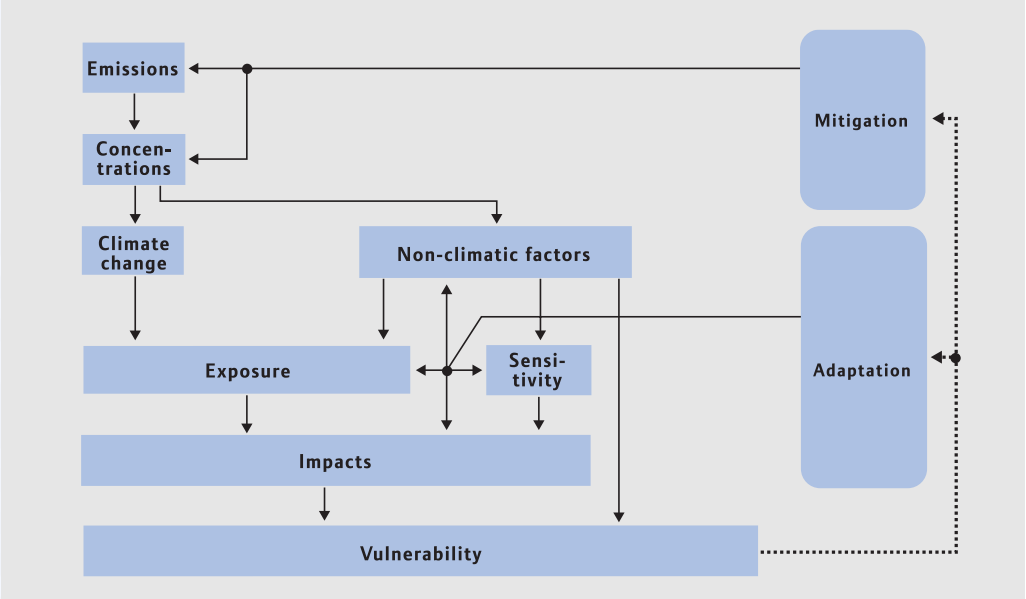
Climate impacts are determined by the exposure of a system to climatic stimuli and by its sensitivity to these stimuli. Potential impacts refer to assessments where the sensitivity is assumed to be constant or follows a reference path independent of climate change whereas residual impacts refer to the impacts that remain after the consideration of adaptation measures. It is interesting to note that the IPCC definitions for 'exposure' and 'impacts' are not fully consistent. Whereas the former includes all climatic variations, the latter only considers those aspects, which are due to climate change. This distinction has major policy consequences even though climate science does not provide tools that could sharply separate climate variability according to natural and anthropogenic causes. It is also relevant for different conceptualisations of 'vulnerability' in the climate change and the risk management communities that will be discussed later.

Climate impact assessments, as understood here and conducted in the early half of the 1990s, do not explicitly address adaptation. Examples include many integrated assessment models of climate change, for instance IMAGE, ICLIPS, CLIMPACTS, and MIASMA. These models present spatially referenced projections for (mainly geobiophysical) impacts of different emission scenarios on various climate-sensitive systems. Their use for policy formulation is limited to longer-term climate impacts.

First-generation Vulnerability Assessment

Interestingly, the glossary of the IPCC TAR does not define the term 'vulnerability assessment', thereby contributing to some confusion about its meaning. In our conceptualisation, vulnerability assessments are distinguished from impact assessments mainly by their embedding in a broader context. The focus thus shifts from the multiple downstream effects of a single driver to the multiple upstream stressors that threaten a system.

Figure 3: Conceptual framework for a first-generation vulnerability assessment



We distinguish two 'generations' of vulnerability assessments. Figure 3 depicts the framework for a first-generation vulnerability assessment. Compared to Figure 2, a couple of components have been added.

Non-climatic factors denote a wide range of external influences that affect the vulnerability of a system to climate change. These factors include ecological, economic, social, demographic, technological and political parameters. Some non-climatic factors are linked to the concentrations of greenhouse gases.

Well-known examples include the direct effect of carbon dioxide on plant physiology that moderates the effect of climate changes, and the interaction of local air pollution with high temperatures in the causation of certain respiratory diseases in humans. Non-climatic factors may not only affect the sensitivity of a target system to climatic stimuli, as exemplified above, but also its exposure. Obviously, this is only relevant for target systems that can avoid stressful climatic conditions by relocation or some other way of protection.

> *Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.*

Vulnerability (to climate change) is a broader concept than (climate) impacts even though the two are closely related. The main distinctions are the increasing attention paid to non-climatic factors (see above), the explicit consideration of uncertainty in climatic and non-climatic scenarios, and the normative evaluation of impacts as to their desirability ('adverse effects') and importance. In the conceptual framework, these differences are reflected in the inclusion of non-climatic factors both on the 'upstream' side and on the 'downstream' side of impacts. It should be noted that the IPCC definition does not restrict the concept of 'vulnerability' to social systems.

The importance of non-climatic factors for the downstream evaluation of impacts is illustrated with an example from the field of food security. The significance of a simulated decrease in crop productivity (the 'impact') for a region largely depends on factors such as the proportion of the agricultural labour force, the degree of integration into global food markets, and demographic projections.

The normative evaluation of impacts is less relevant for human health because the most prevalent indicators for health impacts, such as mortality, morbidity, and disability-adjusted life years, already have a quasi-normative character.

Figure 4 helps to explain different concepts of climate-related vulnerability that are important in the context of this paper. The diagram depicts four stylised trajectories for the impacts of climatic stimuli on a climate-sensitive system. The current level of impacts (or risk) is shown on the left where all trajectories start. The lowest trajectory denotes the reference case of an undisturbed climate. Due to non-climatic developments, the impacts of climate variations may nevertheless change over time. The other trajectories present the higher impacts (or risks) associated with a specific climate change scenario assuming different degrees of adaptation. We will later come back to these trajectories because they are related to specific stages of vulnerability assessments.

Figure 4: Different concepts for impacts and vulnerability (see text).

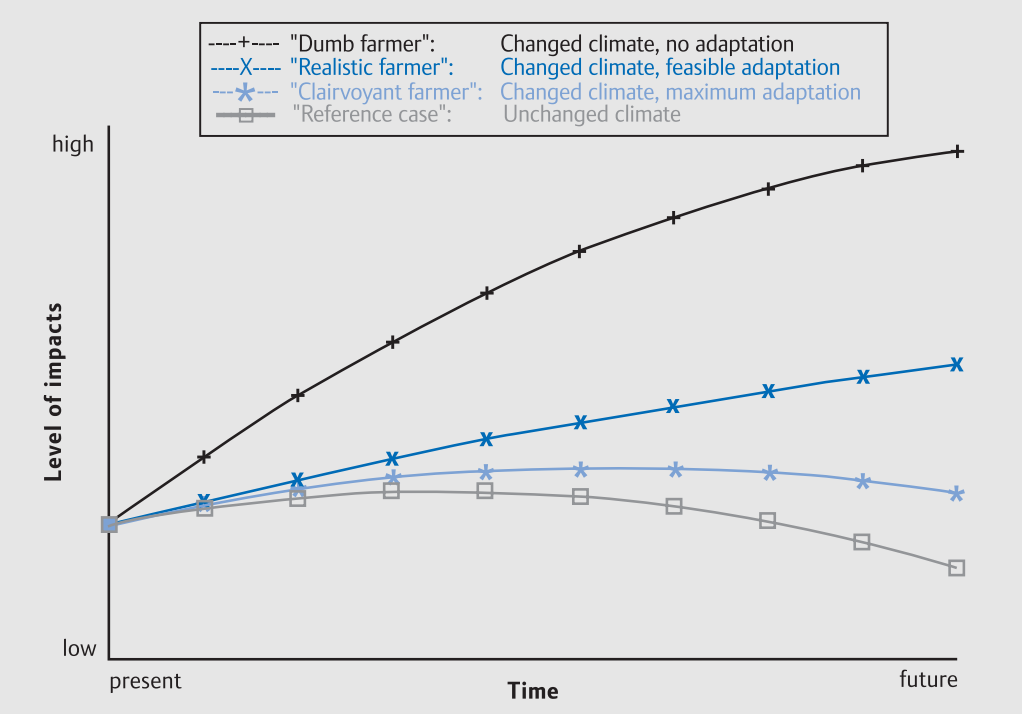


Figure 4 can be used to explain a major difference in the understanding of '(climate) vulnerability' between the risk management and climate change communities. Whereas the former refers to it as the absolute risk associated with climate variations (represented, for instance, by the 'dumb farmer' trajectory), the latter defines it as the increase in risk due to climate change (that is, the difference between the 'dumb farmer' and the 'reference case' trajectories). Different focuses of the two communities can be partly explained by the fact that both of them tend to concentrate their efforts where the vulnerability (according to their definition) is highest. In spite of this difference, the two communities agree in regarding vulnerability as the endpoint of a sequence of analyses. Contrasting views that consider vulnerability an overarching concept, or even a starting point for an impact analysis, are discussed in the references.

Recognition of the fact that many systems are vulnerable to climate change is likely to trigger a bundle of policy responses at different levels. This 'potential for human agency' is indicated by the dashed lines in the framework diagram.

> *Mitigation: An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.*

Mitigation refers to actions that limit the rate and amount of climate change. The two basic mitigation options are the reduction of (gross) GHG emissions, for example, through fuel switching in the energy sector, and the reduction of their concentrations through enhancing the sink capacity of biological and other systems.

> *Adaptation: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. [. . .]*

Adaptation denotes all changes in a system, compared to a reference case that reduces the adverse effects of climate change. In the conceptual framework, we distinguish adjustments within the vulnerable system or sector from adjustments that affect external factors. We illustrate the various links from adaptation to other components of the conceptual framework by examples referring to climate impacts on human health. The exposure of humans to hazardous climatic conditions (for example, heat waves, floods and droughts) can be reduced directly by measures within the realm of public health, and indirectly through modifying non-climatic stressors. Implementing early warning systems for heat waves and storms is an example of the former type whereas enhancing the observance to evacuation orders during natural disasters by ensuring insurance coverage for lost or damaged property belongs to the latter type. The sensitivity of humans to climate-related health hazards may also be reduced directly, for example, by vaccination against climate-sensitive vector-borne diseases, and indirectly through actions that affect external stressors, for example, by improving the nutritional conditions of children to enhance their immune status. Adaptation can also reduce impacts without affecting the exposure to climate stimuli or the sensitivity to them (in a narrow sense). Examples from the public health sector include so called 'secondary interventions' that limit the spread of communicable diseases after a local outbreak, for example, through promoting appropriate hygiene precautions. This link may be less important for other impact domains.

First-generation vulnerability assessments acknowledge the potential of mitigation and (much more so) adaptation measures to reduce the adverse effects of climate change. However, merely listing potential response options and their expected benefits does not provide a full picture of the vulnerability of a climate-sensitive system. Depending on the level of adaptation assumed, the results can lie anywhere between the 'dumb farmer' and the 'clairvoyant farmer' cases in Figure 4.

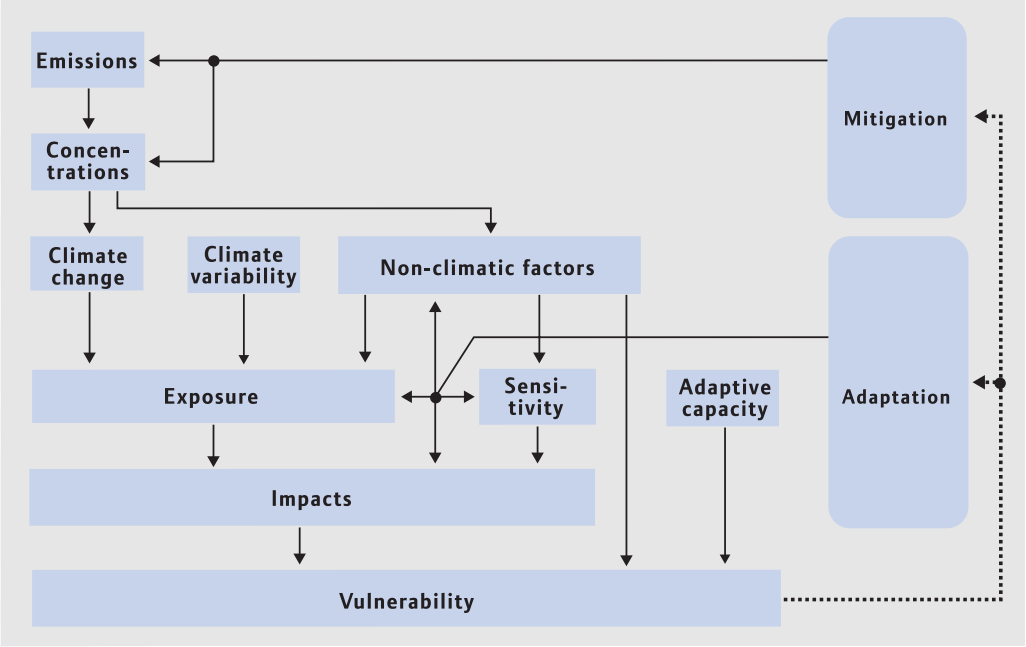
Similar to impact assessments, vulnerability assessments raise awareness of the vulnerability to climate change, and of the potential of response options to reduce it. First-generation vulnerability assessments allow to evaluate the significance of climate change relative to other stressors to a system on the 'upstream' side. On the 'downstream' side, climate impacts can be evaluated as to their relevance for a particular system, sector, or society. Both applications help to prioritise further research, and to determine the need for adaptations to moderate adverse effects of climate change. An important contribution to determining 'critical levels' of climate change consists in the identification of 'limits of adaptation' for vulnerable systems.

Second-generation Vulnerability Assessment

The step from climate impact assessments to first-generation vulnerability assessments was characterised by the inclusion of non-climatic determinants of vulnerability, and by the normative evaluation of climate impacts. The resulting broader view on the potential consequences of future climate change helps to assess adaptation needs. The requirements for and limitations to implementing adaptation measures are more thoroughly assessed in second-generation vulnerability assessments, which are conceptualised in Figure 5.

> *Climate variability: Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).*

Figure 5: Conceptual framework for a second-generation vulnerability assessment



Climate variability is likely to be affected by climate change, in this case understood as changes in the mean climate. For instance, the majority of climate simulations suggest that the intensity of precipitation events will increase in a warming world. Since most systems are affected by climate variability, it constitutes an important component of their exposure.

> *Adaptive capacity (or adaptability): The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.*

Adaptive capacity, as defined above, can refer to both social and natural systems. Determinants of adaptive capacity in social systems comprise economic resources, technology, information and skills, infrastructure, institutions, and equity. The higher the adaptive capacity of a system or society, the greater is its potential to moderate adverse effects of climate change, and the lower is its vulnerability. Since the ability of a system to cope with current climate variability is an important indicator for its capacity to adapt to future climate change, analyses of current vulnerability across systems or regions can provide important lessons for adaptation science.

Figure 5 shows that the vulnerability of a system to climate change is determined by its exposure to climate variations, by its sensitivity to them, and by its adaptive capacity to moderate adverse effects. The first determinant represents the external side of vulnerability whereas the second and third represent its internal side.

The consideration of adaptive capacity in second-generation vulnerability assessments results in more realistic estimates of the potential of adaptation to reduce adverse impacts of climate change. This corresponds to the 'realistic farmer' trajectory in Figure 4. Their main applications are thus comparative vulnerability assessments across regions or sectors that help to better target further research, and to prioritise resources for the implementation of adaptation measures.

Adaptation Policy Assessment

The purpose of vulnerability assessments, as defined here, is to estimate the vulnerability of a system, sector or region to climate change and variability. They identify adaptation options, estimate their potential to reduce adverse effects, and assess the capacity of a society to actually implement them. Such assessments are an important intermediate step on the long way from primarily science-driven assessments of potential impacts to policy-driven assessments that provide specific recommendations to planners and policymakers. Achieving the latter objective requires a closer look at the response options available, including considerations as to their implementation and to their integration with existing policies and practices on resource management, disaster reduction, economic development, public health, etc.

Due to major differences in the characteristic temporal and spatial scales of mitigation and adaptation measures, the respective assessments are conducted largely independent of each other. The focus here is on adaptation policy assessments. We prefer that term to 'adaptation assessment' to emphasise that its main purpose is to contribute to policymaking by recommending specific anticipatory adaptation measures.

The conceptual framework for adaptation policy assessments (that also includes mitigation actions) is shown in Figure 6. In the adaptation box, two types of actions are now distinguished. Facilitation refers to activities that enhance adaptive capacity, thus creating or improving the conditions for the implementation of adaptation measures. Such activities include awareness raising, capacity building, and the establishment of institutions, information networks and legal frameworks for action. Implementation refers to activities that actually lessen adverse climate impacts on a system by reducing its exposure or sensitivity to climatic hazards, or by moderating non-climatic factors.

Figure 6: Conceptual framework for an adaptation policy assessment

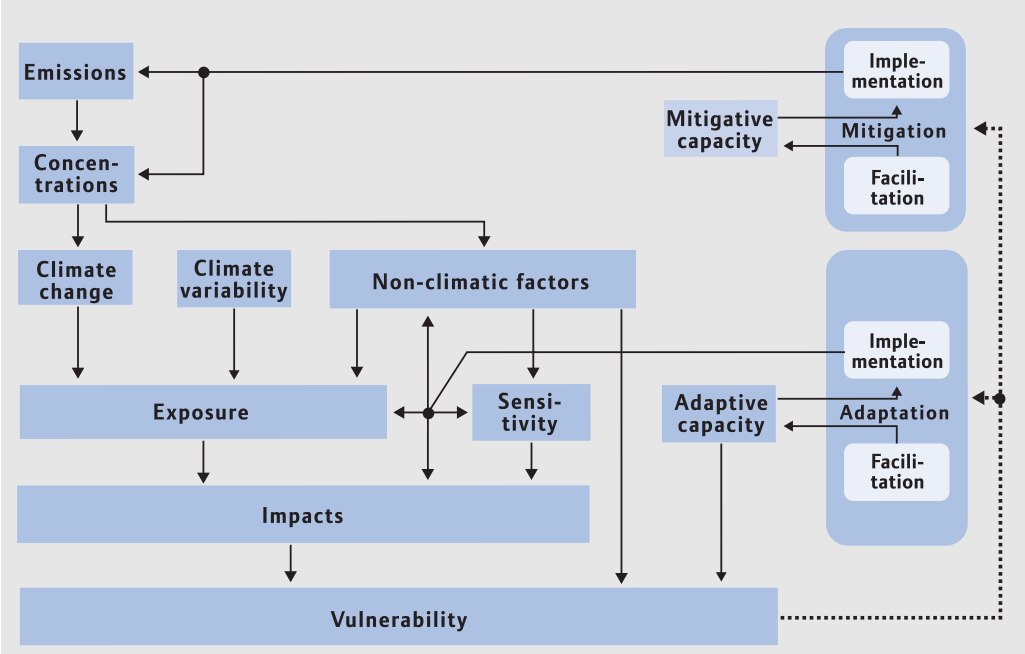


Figure 6 also shows the two-way relationship between adaptive capacity and adaptation.

Adaptive capacity determines the feasibility of adaptation measures (of the implementation type) but it is also affected by adaptation measures (of the facilitation type). The same distinction applies to mitigation. For instance, the establishment of a carbon trading scheme is a facilitation measure that enhances the mitigative capacity of a region whereas the replacement of a carbon-intensive power plant by a less carbon-intensive one (that becomes economically viable due to the possibility for trading carbon permits) constitutes an implementation measure. The concept of 'mitigative capacity' has been introduced into the literature only very recently.

The development of robust adaptation strategies requires the uncertainty of future climate change to be addressed. For a more detailed discussion of this topic, see references. Adaptation measures also need to be embedded in the existing policy context. Ideally, adaptation to climate change and variability will facilitate the achievement of other policy goals, such as sustainable development, economic diversification, and biodiversity conservation. The identification of such win-win strategies substantially enhances the relevance of the assessment results to policy-makers. The embedding of adaptation (and mitigation) measures in a broader policy context cannot be adequately represented in the causal web for adaptation policy assessments shown in Figure 6. It is nevertheless an indispensable component of any assessment that aims at providing specific advice to policy-makers on measures to reduce climate-related vulnerability.

Summary and Conclusions

We have presented four stages of vulnerability and adaptation assessments to climate change. Their evolution reflects an increasing vertical and horizontal integration, and a shift in the main purpose from mainly science-driven to policy-driven assessments. Each stage was illustrated by a conceptual framework depicting the main elements considered, and their causal relationships.

The first stage is represented by impact assessments that take the results of climate models for specific emission scenarios and superimpose the simulated climate changes on an otherwise constant world to estimate their potential impacts on various climate-sensitive systems. First-generation vulnerability assessments account for important non-climatic factors and acknowledge the potential for adaptation (and mitigation) measures. Second-generation vulnerability assessments pay particular attention to the capacity of a system to adapt to future climate change and, as a proxy, to its ability to cope with current climate variability. Even though second-generation vulnerability assessments consider climate change and the potential response options in a wider context, their main purpose is still a scientific one, namely to estimate the vulnerability of a system to climate variability and change. A fundamental shift occurs in the fourth stage, represented by adaptation policy assessments. They contribute to policymaking by recommending specific anticipatory adaptation measures. This requires a more detailed look at the process and the actors of adaptation, and at the potential for the integration of adaptation measures with existing policies. Characteristic features of such decision-oriented assessments are an intensive involvement of stakeholders, a strong emphasis on the vulnerability to current climate variability, and the formulation of response strategies that are robust against uncertain future developments.

Compared to climate impact assessments that primarily address the problem of determining critical levels of climate change, adaptation policy assessments tend to have a shorter time horizon and a more restricted geographical scope.

Adaptation is not a panacea, and neither are adaptation policy assessments. Many adverse effects of global climate change cannot be avoided even by the most thoughtful adaptation measures. Mitigating climate change will thus remain high on the scientific and policy agenda. However, the recent evolution of vulnerability assessments provides a promising basis for the climate change and risk management communities to join forces in reducing the vulnerability of societies to climate-related risks both now and in the future. Although the conceptual thinking about vulnerability in the two communities converges, legal and financial frameworks for action, and even underlying ethical principles, are still largely separate.

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3

SEMINAR PAPER

Managing Risks of Climate-related Losses on Decadal Time Scales

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Abstract

The majority of natural disaster events worldwide involve hydro-climatic hazards – primarily droughts, floods and cyclones. Assessing disaster risks involves identifying:

- *Probabilities over space and time of natural hazard events;*
- *The collection of elements that could potentially be exposed (people, infrastructure, economic activities and assets); and*
- *The vulnerabilities of the exposed elements that would cause them to be damaged.*

In this way the likelihood of future human and economic losses can be estimated. In this framework, a portion of the risk is contributed by exogenous factors, that is, hydro-climatic hazards, while a portion is contributed by the endogenous characteristics of the exposed elements that make them susceptible to being damaged (for example, their vulnerabilities). Risk assessments seek to reduce losses by informing decisions that will either limit socio-economic exposure to natural hazards or reduce vulnerability. The prospect of climate change associated with global warming, however, along with other anthropogenic environmental changes, implies

potentially rapid changes in the spatial and temporal distributions of hydro-climatic hazards, the specific character of which cannot currently be predicted. Furthermore, rapidly changing social and economic conditions make the future interactions between nature and society even more difficult to anticipate. Thus the task of assessing risks of losses over decadal time scales is complicated by rapidly changing circumstances on all fronts – hazards, exposure and vulnerability. Lack of predictability at these time scales argues for the creation of resilient systems as an ongoing process, systematically informed by whatever information is available at the time. This paper examines integration of disaster risk management and climate change adaptation from that perspective.

Despite seeming similarities in the perspectives of disaster risk management and climate change adaptation, the two discourses differ in some respects. The basic conceptual frameworks are not identical and key terms have different meanings in the different contexts. The time frames of interest overlap but are not identical. Risk management and adaptation may also have at least somewhat different objectives, something to be explored further. Disaster risk management is becoming a mature discipline, with modern origins dating to the 1960s and '70s, with theory and methods emerging in the 1980s and '90s. The idea of climate change adaptation is a slightly more recent development, with terminology, theory and methods that are still being defined. Refining common issues and identifying common ground between these two discourses is a key task towards identifying win-win strategies for managing climate variability in the short-term and climate change over the 21st century. Strategies are built on analyses, analyses on methods, methods on theory and theory on concepts and data. This paper examines some of the similarities and differences between disaster risk management and climate change adaptation in these and other areas. In this way points of departure as well as areas of commonality can be identified.

How did the existing division and separation between the different groups and approaches come about? What is the conceptual and practical significance of this?

One difference between the perspectives of climate change adaptation and disaster risk management originates in the way the potential future climate impacts are assessed. In the climate change context, the concern is with the climate system's behaviour in the future when greenhouse gases that trap heat in the atmosphere are expected to double. More trapped heat means higher global temperatures, new patterns of atmospheric and oceanic circulation and altered regional climate distributions. In this context, assessed impacts are driven by future climate states predicted by computer models of the climate system. The models are run until they reach "equilibrium" at the higher greenhouse gas concentrations, and potential impacts of the new average climate state are examined.

Impacts assessment in the context of climate change expected to arise due to global warming originated in this modelling exercise, using Global Climate Models (GCMs), the main tool for predicting future climate conditions, as a starting point. Climate change researchers "force" the GCMs with simulated increased amounts of greenhouse gases, which altered the radiation and heat fluxes within the models. This in turn alters the simulated average distributions of temperature and rainfall under conditions of higher greenhouse gas concentrations. In the modelling/systems analysis framework, these altered climate states, or scenarios, become

the inputs for other models – agriculture, international trade, food security and so on. Other types of approaches for developing scenarios use historical climate conditions as analogues for future climates.

As with any type of modelling, this approach requires making simplifying assumptions. One of the simplifying assumptions here is that climate is a primary driving force for social, economic and environmental change. That is, it is not just the climate system that is "forced" with increased levels of greenhouse gases but in fact the entire system, including a societal response.

Another widely acknowledged attribute of the approach is that GCM predictions of future climates at regional scales are unreliable. Thus the use of the term "scenarios" as opposed to "predictions". Ranges of climate scenarios may be used as the basis for a discussion for a range of potential societal responses in a particular region of interest.

While this approach has been useful for experimenting with the hypothetical impacts of a range of potential future climates, it quickly reaches limits as a tool for informing policy. Ranges of scenarios and their impacts may seem highly speculative when compared to real and pressing environmental, social and economic problems, particularly in developing countries.

A complementary alternative is to employ vulnerability analyses that examine the characteristics of socio-economic systems. Vulnerability analyses seek to determine where climate exerts its greatest influences on socio-economic systems, and how those systems could be made more resistant to climate shocks. Such an approach relies less on prediction and on climate as a driving force, focusing instead on the characteristics of society and the economy. As reducing the rate of increase of greenhouse gases is proving difficult to achieve, some degree of human-induced climate change may be inevitable. Perhaps focusing on societal vulnerability to climate impacts will result in alternative options for reducing negative impacts, through risk reduction and adaptation strategies. Moreover, vulnerability potentially provides an area of common ground for integrating the disaster risk management and climate change adaptation perspectives.

As the majority of natural disasters involve hydro-meteorological hazards, as in the case of climate change impact assessment, disaster risk assessment often includes a climate related component. In this framework, the climate system generates natural hazards – droughts, floods and windstorms. Socio-economic systems are variously vulnerable to these different hazards. The characteristics of these systems determine the degree to which they will be damaged when exposed to a climate-related hazard event of a particular magnitude, duration and timing. Risks of a specified degree of losses among the exposed elements are calculated for specified time periods based on hazard exposure and vulnerability factors.

So there are differences between disaster risk assessment and the way climate change impacts are studied. In disaster risk management, the period for which risks are being assessed typically begins in the present. Although the assessment is future-oriented, assessed risks are largely a function of historical and present-day patterns, natural hazard and socio-economic patterns. In this context it is the extreme ends of the spectrum of climate variability in a given location that are considered significant, rather than the average climate state. Livelihood systems, even in regions that experience a high degree of climate variability and frequent disasters, typically are adapted to the normal seasonality of the region, although economic, social and environmental pressures

may force social groups into "maladapted" livelihood strategies.

Techniques for assessing the risks of losses are well developed, serving among other things as the basis for setting insurance premiums. Accelerating changes in both society and the climate system, however, are beginning to make assessing future risks based on historical patterns and current conditions problematic.

Conceptual precision and the semantic and terminological consequences for risk and adaptation issues. Risk, hazard, vulnerability, prevention, mitigation, risk reduction, resilience, adaptation?

In disaster risk management three terms are fundamental: vulnerability, hazards and risk. In the risk equation for a particular set of elements at risk for a particular time period, *risk = f (hazards, vulnerability)*. In this equation, hazards are exogenous causal factors of disaster while vulnerability factors are endogenous causal factors. Both are required to create a disaster.

Notwithstanding their importance, and the ready availability of authoritative descriptions of their precise meanings as applied to disaster risk assessment, the terms "risk" and particularly "vulnerability" are often carelessly used. For example, the phrase "vulnerable to disaster" is frequently seen in disaster literature, even though this phrase technically makes no sense in light of the fact that disasters are in fact caused by vulnerability to natural hazards. Hazards, on the other hand, may be referred to as disasters, as in "droughts, floods and other disasters", even though in and of themselves they no more cause disasters than a hurricane that fails to make landfall and dissipates at sea. To contribute to disaster, hazard events must affect vulnerable people or assets and be associated with losses. Thus to create a disaster, exposed elements and vulnerability are also required.

In particular, uneven understanding of the technical definition of "vulnerability" and inconsistent use of this term in the literature has perhaps contributed to a tendency of new authors that take an interest in anything relating to losses to redefine vulnerability in any way that suits them, even though the term was recognised as a technical one and therefore one requiring precise definition over 20 years ago. In disaster risk management contexts, "vulnerability" refers to the propensity of the elements exposed to a natural hazard event to suffer damage, as in "vulnerable to drought," or "vulnerable to flooding".

In the climate change adaptation context, vulnerability often appears in the phrase, "vulnerability to climate change". When compared to the already difficult task of assessing vulnerability to droughts, floods or other specific hazards – a challenge that at least can be addressed by an appeal to the biophysical properties of exposed elements and their behaviour under climatic stress – the idea of being vulnerable to *change* is exceedingly subtle.

Take a simple example of two objects, a billiard ball and an egg. It is readily understandable that the egg is more vulnerable to a wooden mallet than the billiard ball and therefore more at risk of breaking when struck. How would one devise a similarly simple example to convey the sense of vulnerability to change? Since it is the climate that is changing, in this analogy one presumes that it is the mallet that would change into something else. Suppose the mallet was replaced with a feather. Now both objects are less vulnerable to the new "hazard".

Is this a reduction in vulnerability to change? Or merely a reduction in vulnerability?

While the above point may seem like hair-splitting, in fact such a clarification is crucial. Reducing societal vulnerability to climate shocks will require difficult, expensive choices. It is preferable to base difficult and expensive choices on sound analyses. Analyses require methods and methods require clear and consistently understood underpinning concepts. The concept of vulnerability is common to both the climate change and disaster management discourses. It even appears to mean similar things, but this surface appearance may mask a fundamental dissimilarity. On the other hand, occasional confusion in the disaster management context stemming from ignorance notwithstanding, the concept of vulnerability is well defined, operational and fundamental to disaster risk assessment.

In the future, as in the past, extreme climate events will continue to be experienced by people and other exposed elements as droughts, floods, cold spells and so on. Vulnerability to these types of specific hazard events can be readily assessed. It remains to be seen whether the concept of vulnerability to climate change is similarly operable within the adaptation context. Another relatively well known but purely circumstantial point of semantic confusion is over the term "mitigation". In the climate change context mitigation refers to reduction of greenhouse gas emissions, whereas in disaster management it refers to risk reduction. Although it is widely used in both circles, in disaster risk management it is not strictly necessary and can easily be avoided altogether as a way of reducing potential confusion.

Mitigation means "to soften" and is often used instead of "prevention" in disaster management discourse because prevention of damages is interpreted by some in an absolute sense and therefore felt to be unattainable in the face of powerful natural hazard events. When one reflects, however, on the fact that preventive health care does not insist on people never getting sick, nor accident prevention to mean that accidents never happen, prevention of losses during disasters is a more precise concept than mitigation. It is more specific in terms of the timing (*pre-* implying that action is taken before a disaster occurs) and also in the sense that the specific strategy involved is one of avoiding losses. Its complement is preparedness, or being ready beforehand to deal with losses that cannot be avoided. Replacing the less specific term "mitigation" with "prevention" and "preparedness" provides more precision within the disaster management discourse and clarifies communication with members of the climate change community.

What disasters managers refer to as "mitigation", the climate change community refers to as "adaptation." The evolutionary origins of this term might seem to give a smaller role to intentional social change than one would hope for when faced with a possible climate crisis, something to be further clarified.

Development as the principal issue and starting point for ordering and integrating the two perspectives. Increases in human security, resilience and sustainability as final goals of risk management and adaptation.

Developing countries, particularly in the semi-arid tropics, regularly experience disasters due to climate shocks and persistent vulnerability. Worldwide, most disasters have a hydro-meteorological trigger. Worldwide, disaster events are increasing in frequency and economic losses are growing, disproportionately affecting the well-

being and economic prospects of the poor.

Developing countries that routinely experience these types of losses do so, in particular, when they have a high degree of reliance on primary sector activities that are vulnerable to climate shocks, a lack of resources to buffer their economic assets and activities against such shocks, as well as geographic situations that make continuing climate shocks inevitable.

When the prospect of radical climatic shifts is added into the equation, it seems self evident that developing countries in such conditions should be assisted to adopt measures to better anticipate and manage climate variability that is already contributing to mounting losses and impeding socio-economic development. The frequency of disasters is an indicator of mal-adaptation to prevailing climate variability, and adapting to the current range of extremes would be a valuable exercise for learning to adapt to future shifts in climatic distributions.

Unfortunately, the mechanisms that were set up to assist with preventing – and increasingly, adapting to – climate change appear to have been devised specifically to preclude their use for addressing anything other than the marginal difference between current climate and future climate. That is, mechanisms such as the Global Environment Facility are designed specifically to limit their applicability towards managing the floods and droughts of today. Rather, they are intended to be used to address only the incremental portion of droughts and flooding contributed by climate change brought on by anthropogenic global warming.

Consequently a certain amount of effort is being devoted to establishing what this incremental difference is, or will be. How difficult is this? First of all, climate is constantly varying for many reasons (seasonality, El Nino, Milankovich cycles, etc) and over all time scales – diurnal to millennial to geological. Establishing the incremental difference between the current climate and an altered one requires establishing whether the distribution of variation for any given point on the earth's surface is significantly different than for some historical period, something that cannot be established definitively until after the fact. Secondly, human and natural systems do not respond to the incremental portion of climate variability that may be brought about by climate change. Rather they respond to the totality of the climate to which they are exposed. Thus it is a conceptual impossibility in terms of impacts assessment to distinguish between the portion of the impacts caused by climate change as opposed to the portion caused by the "baseline" climate or "baseline" vulnerability for that matter.

Therefore, the implication of climate change for development strategies would seem to be one of added emphasis on building institutional and economic resilience in the face of climate variability to reduce vulnerability to climate shocks in the near term, emphasising those that at the same time offer protection against future climate changes. Examples include strengthened regional cooperation on climate-related issues, improved climate monitoring and prediction capabilities, climate outreach services to assist communities and countries in understanding, anticipating and managing climate conditions and integration of climate issues into development planning. Such efforts will have the twin benefits of reducing disaster losses and at the same time building capacity to deal with climate variability and change in the future.

Vulnerability in the risk equation. Does climate change affect both hazard and vulnerability conditions? Problems with definitional imprecision as regards vulnerability and exposure. May we talk of vulnerable ecosystems in the same breath as we talk of vulnerable communities and society?

The specific effects of global warming and climate change on regional climates are unknown, and may continue to be until they materialise. Average global temperature is rising, and with that increase sea levels may reasonably be expected to rise due to melting of ice and thermal expansion of the oceans, which would contribute to an increase in flooding in coastal areas. Higher temperatures are also likely to increase the volumes of water moving through the global hydrologic cycle, which would result in more frequent extreme events. Similarly, changes in regional climate averages would bring formerly infrequent conditions from the tails of historical climate distributions nearer the altered-climate average, also resulting in more frequent extreme events compared with historical conditions. There is also some evidence from coral reef studies that warmer temperatures may be associated with more frequent Ël Niño events.

Thus, whatever beneficial effects climate change may have, there are reasons to believe that it could result in a higher frequency and severity of hydro-climatic hazard events. If this is the case, and the development process does not include an increasing emphasis on vulnerability reduction, losses would be expected to increase. Increasing losses would imply a further increase in societal vulnerability, raising the spectre of a downward spiral of hazards, disasters and vulnerability.

This conjecture, however, greatly oversimplifies the process of social change in the manner of the GCM scenario-driven model of climate impact assessment. While climatic factors have historically been very important in the process of socio-economic change, other factors such as technology, politics, environmental degradation, economic growth (or decline), conflict, cultural change, etc, are also processes of continual transformation. Their exceedingly complex interaction makes the future of both society and the environment highly difficult to predict. Thus it is highly speculative to ascribe a pre-eminent role to climate as a driving force.

This reinforces the conclusion that development strategies should begin to take more account of the need to prepare for and prevent negative climate impacts under current conditions. This approach will have immediate benefits in terms of loss reduction. At the same time, the possible consequences of potentially mounting climate-related losses in the future due to climate change may serve to make climate-related risk reduction more competitive in the immediate term in relation to the full suite of other development priorities, all of which are admittedly pressing.

Risk management as a reactive practice as opposed to the prospective nature of adaptation. Is this an adequate distinction between the two fields? Is the idea of planned adaptation the same as prospective risk reduction and management? Is planned adaptation possible or is it a contradiction in terms and a deviation from the origins of the idea in evolutionary theory?

In his book, *Against the Gods: The Remarkable History of Risk*, author Peter L. Bernstein traces the historical development since ancient times of societies' attitudes about the future. This transition involves a shift from

fatalistic beliefs in destiny to more proactive approaches of anticipating and planning for possible adverse outcomes while seeking to maximise opportunities and gains. In the context of disasters, risk management has emerged as an alternative to the reactive strategy of over-reliance on post-disaster relief and reconstruction, emphasising instead prevention of losses and preparedness to stem additional losses in the emergency phase and speed recovery. This transition parallels a modern shift in thinking about disasters as "acts of God" to disasters as social phenomena in which historical processes conditioning exposure and vulnerability are highly important causal factors. Risk reduction relies on calculations of probable future losses, as it is necessary to have a basis for prioritising which investments in prevention and preparedness will have the greatest returns in terms of avoided losses.

While the term "adaptation" implies passive evolution rather than internationality, for the concept to inform intentional efforts to cope with climate change it surely must be in the sense of avoiding losses and other adverse consequences and maximising social benefits to the extent possible. If so, in this respect the two concepts, risk reduction and adaptation, appear nearly identical.

The major differences would seem to be twofold. First, in terms of timeframe, disaster risk management is undertaken over the lifespan of the assets/elements for which risks are being estimated, typically starting in the present and continuing for up to several decades into the future. Adaptation, however, while presumably it can be undertaken at any time and in the evolutionary sense is constantly ongoing, is concerned in the context of climate change with a period in the future when the climate will have been "changed" due to human activity. Thus its concern is not with the here-and-now but rather with a time in the future when conditions will be different, although neither the temporal window when this will occur nor the specific character of these differences can currently be accurately predicted.

The second difference is that due to this farther-future orientation, uncertainty, the central problem in risk management, is exacerbated in the case of adaptation to the point at which neither future-climate scenarios nor socio-economic forecasts can reasonably be expected to provide much more specific guidance to policy makers other than to suggest that climate change is a serious problem requiring sustained attention. For example, in the U., uncertainty even as to the effects on global climate of rising greenhouse gas emissions is cited by the Bush administration as grounds for failing to take substantive action on any aspect of the climate change issue other than further research. If action on climate change is dependent on greater certainty with respect to the specific changes in the behaviour of the climate system, such action could be stalled indefinitely. Therefore it is important to have other arguments for responding to climate change other than increasing the certainty of predictions from computer models.

Is planned adaptation or prospective risk management the real problem for the future? Or is providing communities, societies, families or individuals with the means, capabilities and resources to autonomously adapt or adjust to changing environments the problem?

Managing short-term risks associated with climate variability is a process that takes place at many levels, from the household to the community, and from the national and regional levels to international and global scales.

Sophisticated household- and farm-level risk management strategies in agricultural areas of the developing world are well documented. At the national and regional level, with the advent of seasonal climate forecasting, information on the likely quality of upcoming rainfall seasons is routinely provided to the public and national governments by national meteorological services and regional climate centres in a dozen regions around the globe. Internationally, institutions such as multilateral development banks, bilateral donors and the United Nations have undergone a discernible shift towards more emphasis on risk management over emergency management, although the latter continues to dominate. So the process of risk management is being pursued simultaneously at multiple levels.

In the case of adaptation it is more difficult to provide specific information as to what to expect from climate change, but clearly in recent decades the issue has gone from a scientific issue to a political one, of concern to national governments, international bodies and individuals. In both cases these trends suggest that risk management and adaptation are not single strategies but rather comprise multiple strategies including institutional strengthening, capacity building, shifts in resource allocations, international coalition building, public education and information, appropriate national policies, and the like.

Managing uncertainty in the disaster and climate change problematic

Rapid environmental and social change pose distinct challenges for disaster risk management. Future risks are calculated based on historical patterns. If the 100-year drought or flood becomes a 10-year return-frequency event, losses are likely to significantly exceed expectations. Adaptation, with its even more futuristic orientation, faces even greater uncertainty with respect to the interaction of climate and society at whatever point in the future climate is determined to have "changed".

Rising uncertainty about specific risk factors, coupled with rising certainty about escalating risks, promotes convergence between disaster risk management and adaptation schools of thinking. These trends suggest that measures that promote both disaster reduction and adaptation will yield higher returns on investment than ones that address climate-related problems from either of these perspectives alone. Combining the two perspectives has the potential to inform immediate decisions over both short- and longer-term planning horizons. Long-term processes, such as infrastructure development, land use planning and economic development, will do especially well to take into account climate change potential and vulnerability. In the short-term, measures to promote flexible responses and resilience to climate shocks such as those generated by Ël Niño and other sources of inter-annual climate variability offer society the opportunity to strengthen the understanding, institutions and capacity to manage climate to reduce losses and capitalise on opportunities.

One final note: There is a tendency to ascribe the current steep upward trend in disaster losses to climate change. This is a variation on the old "acts of God" perspective, in which climate change rather than fate is the source of calamity. While this paper has argued that climate change is an important consideration in disaster management (and vice versa), the steep increase in losses has not been accompanied by a steep increase in hazard frequency and severity. Severe droughts and floods are regular features of many disaster prone regions in the past, and will continue to be so in the future. Scientific studies are beginning to establish trends such as rising global temperatures, particularly night time temperatures, but significantly different patterns of drought

and flood or storm frequency and severity outside historical ranges have so far not been detected. Therefore, by process of elimination, rising losses must be a function of increased exposure – that is, more people and economic assets subjected to natural hazard events – combined with vulnerability of those people and assets to the hazards to which they are being subjected. For both disaster reduction and adaptation it is important to keep the focus on the social processes that result in exposure and create vulnerability. In the absence of rapid and stringent measures to control greenhouse gas emissions, climate change and the need for adaptation may well be inevitable. In such case both disaster reduction and adaptation will depend on policies and measures that acknowledge and address the exposure- and vulnerability-related risk factors contributed by the development process itself.

4

SEMINAR PAPER

Scaling-up: Resilience to Hazards and the Importance of Cross-scale Linkages

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Abstract

This paper explores the common thread and identifies some of the conceptual overlaps and gaps between the climate change and disaster risk management approaches. The issue of scale is central to ongoing discussions concerning climate change and disaster prevention and mitigation. In particular, this paper spells out some of the major challenges in terms of our understanding of cross-scale linkages, both in space and time, and how these affect the impacts of climate and environmental change on the global, regional and local scale. Specifically this paper suggests that increased resilience to environmental change will depend greatly on our capacity to integrate cross-scale approaches. Several examples drawn from the author's experience in Central America, will seek to illustrate the cumulative impact of small-scale, low magnitude events, and how these sum up, both in time and space, to produce major disasters. A conceptual framework is finally proposed to improve our understanding of cross-scale interaction, and harness these approaches for a more effective adaptation to climate change and resilience to natural hazards.

Introduction

Central to the current debates concerning climate change, environmental degradation and recurrent disasters is the capacity of human social and economic systems to prevent, mitigate and adapt to the impacts of

hazards. Adaptation to heightened risk, in a context of increased uncertainty and rapid change, requires new concepts and tools to face unprecedented challenges ahead.

However, the fragmented nature of knowledge systems and the different lenses through which natural phenomena and social responses are analysed limit our capacity to understand complex issues such as climate change and disasters, further hampering our capacity to act upon these future impacts. The growing bodies of literature on climate change, environmental change and disasters are an illustration of how knowledge systems overlap and using similar words and concepts to describe vastly different processes and issues. New perspectives enable more effective integration between natural and social science, in order to better understand change and adapt better to rapidly evolving environmental and social systems. This paper explores one of the facets of this challenge linked to addressing cross-scale and cross disciplinary approaches which may pave the way for a comprehensive approach to adaptation and mitigation of climate change and disasters.

Global vs Local Environmental Change Scale

Specific Issues

Environmental change occurs at different scales, both in time and space, and has cross-scale implications which are only beginning to be fathomed. Global climate change is caused by an intricate chain of micro- and macro-processes, which forces us to distinguish truly global transformations in atmospheric, biospheric and human systems with what are pervasive world-wide environmental problems and hazards. Meshed with the problems of scale (what to include) are the problems of complexity (how to account for it), which pose formidable challenges for modelling, predicting and monitoring environmental change (Smil, 1994).

Scientific inquiry has lent to our understanding of physical processes a bent for order, hierarchical organisation and harmony. We still perceive nature as a fabric of life in balance with itself, ecosystems as communities in harmonious co-existence, and mankind's transformation of nature as a threat to stability. This explains the growing unease and concern over global climatic change. Change is seen as unnatural. Yet, as Vaclav Smil (1994:32) aptly reminds us: "*The preservation of the biospheric status quo is fundamentally anti-evolutionary and maintaining that any anthropogenic changes are at best undesirable and, more likely, disastrous triumphs of disorder above order is to misread the evolutionary record*".

Evolutionary biology shows us that life on Earth has undergone over the past millions years dramatic episodes of global change. These changes were of both cosmic origins due to orbital shifts, magnetic inversions, solar activity and meteorites and of geogenic (plate tectonics and associated seismic and volcanic activity) and biogenic origin (mass extinctions, interspecies competition and adaptation). All points to the fact that any equilibrium is temporary, and that adaptation and diversity has evolved as a mechanism of biotic communities to buffer change.

The only life forms known on Earth are carbon-based and driven by photosynthesis. These complex organic compounds derive from CO_2 and H_2O with different combinations of the three macronutrients (nitrogen, phosphorus, and potassium) and a dozen micronutrients (ranging from calcium and sulphur to cobalt and zinc). Life on Earth is also maintained through major cycles which redistribute solar energy and nutrients

through atmospheric circulation. These include the biogeochemical cycles of water, carbon (involving tropospheric CO_2, organic matter and sedimentary carbonates), nitrogen (between atmospheric N_2, NO_2 and N_2O and nitrates and ammonia in soils and proteins in biomass) and sulphur (mainly as SO_2, H_2S and sulphates). The transformation of nutrients by microbial metabolism, soil weathering and erosion, have assured global abundance of these indispensable inputs during life's evolution. (Smil, V., 1994).

Holling, Gunderson and Ludwig, (2001) ask themselves why has the world not collapsed and the life-supporting systems on earth continue to function. Their answer is in understanding the system resiliences as the capacity to experience wide change and still maintaining ecosystem functions. The other part of their argument is that human behaviour and creativity have so far proved capable of adapting to historical climate and environmental changes. How then do we distinguish what is predictable (yet uncertain) from that which is emergent, incremental and inherently unpredictable?

At the dawn of the 21st century, the scale of human induced changes in atmospheric and biospheric processes over the last century has had discernible impacts of patterns on climate and life forms on the planet. There are fundamental underpinnings to the current global change that we must keep in mind. All terrestrial civilisations have been and will continue to be solar energy driven. Solar radiation is indeed needed to maintain Earth's troposphere inhabitable and to drive photosynthesis, the basis for most biospheric processes. Shifts over the past 150 years from direct conversion from solar power, to the massive use of fossil fuels has transformed human societies' capacities in terms of the energy use intensity, production of agricultural surpluses, unprecedented material affluence, and high personal mobility. As Smil (1994:60) forcefully suggests: "*If we are to remain and prosper on this planet, we must reconcile our needs with biospheric limits. Our actions will continue changing the environment, but we must, not before too long, arrive at levels of interference which are compatible with long-term preservation of critical biospheric functions*".

Smil (1994) distinguishes three major environmental changes at the end of the 20th century:

- The changing composition of the atmosphere;
- The loss of biodiversity and onset of a global extinction crisis; and
- The declining availability of critical natural resources and services.

Scale shifts become a crucial aspect of any analysis on global environmental change. There is a need to distinguish truly global phenomena occurring at a planetary scale, such as shifts in the Earth's radiation balance and a relatively rapid decline of stratospheric ozone. Other processes occur as pervasive and world-wide phenomena, but at a regional, national and local scale. Regional environmental problems range from accelerated soil erosion, depletion and pollution of aquifers, deforestation and biodiversity loss, and soil salinisation on irrigated land, to increased atmospheric emissions of greenhouse gases due to fossil fuel burning, agriculture and forest fires. These suppose shifts in orders of magnitude. Local effects are usually limited to areas of 100 km^2, small national and regional impacts to101 km^2-102 km^2. Extensive regional changes can be measured in areas between 104 km^2-105 km^2, while semi continental impact can extend to ranges of 106 km^2, as in the case of many acid rain impacts. Most of these scale shifts are not discrete and are enmeshed in

complex processes such as those typical of atmospheric and climate related circulation patterns.

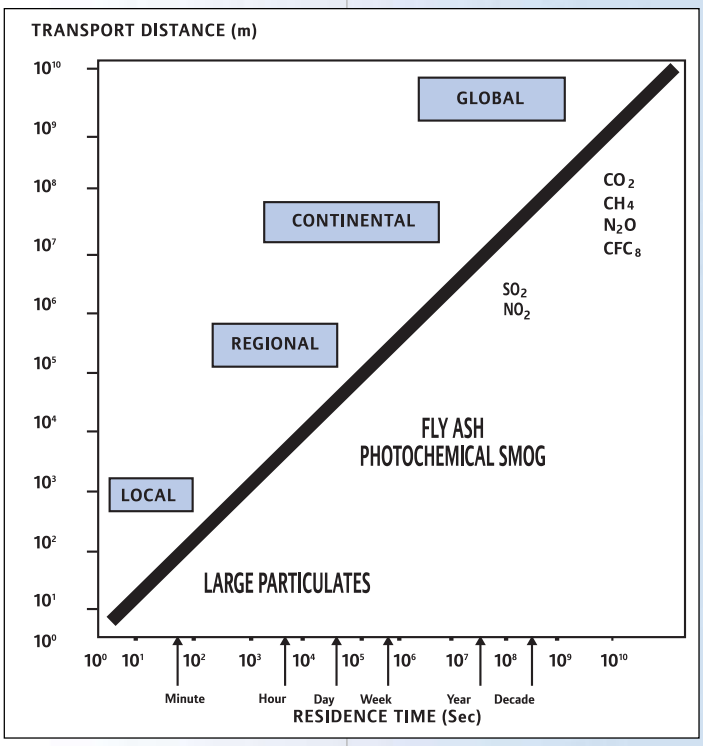
Many analysts are forced to resort to the "Precautionary Principle", which urges to take action on environmental issues and hazards before complete scientific evidence for their causality is established. In many cases, firm scientific evidence may arrive too late for effective action to take place.

Cross-Scale Issues

In what could be considered a major watershed in our understanding of complex systems and human/environment relations, Holling, Gunderson and Ludwig (2001) among others have provided an innovative look at the interface between natural and social science. Their proposed theory of adaptive cycles provides us with key tools to better understand planetary change and improve our resilience to climate change, environmental change and disasters.

Looking carefully at cross-scale interactions between ecosystems, social organisations and resource use regimes, they developed a coherent theory on how these systems behave over different scales of time and space – by integrating the dynamics of change over space from local arenas to regional and global arenas over time, from months to millenia. Imbedded systems and organisations tend to link scaled processes, so fast and slow processes, local and distant one cannot be treated separately. In a word, Holling *et al* suggest that we have so far tried to understand these complex phenomena through partial constructs, and discrete bodies of knowledge such as economics, ecology, biology, geography, sociology. This is obviously inadequate to understand such complex phenomena such as climate change.

Figure 1: Special temporal scales of environmental change. Local to global effects of atmospheric pollution as related to distance and time



Soure: Vachav Soil 1993:62

Time scale has been worked by historians and climate specialists such as Le Roy, Ladurie and Lamb, and Holling *et al* (2001) parts from an evolutionary perspective. He suggests as a good reminder of the usefulness of cross-scale analysis is that the current world system is increasingly reliant on fossil fuels, and in essence, the global, petroleum dependent civilisation is being subsidised by processes of photosynthesis that took place in the Jurassic Era. Many regions rely on fossil water sources from aquifers in arid and semi arid climates. We inherit many benefits from past evolution, including the extraordinary biodiversity and registers of history, language and tradition. Time has also a forward looking quality. And risk is at the heart of any analysis on the future, as Giddens (2001:42) suggests: "*Risk is the mobilising dynamic of a society bent on change, that wants to determine its own future rather than leaving it to religion, tradition, or the vagaries of nature.*"

For Holling *et al* (2001:5) suggest that "*the emergence of novelty that creates unpredictable opportunity is at the heart of sustainable development*". In this sense the challenge of climate change requires a world view that better integrates ecological with economic with institutional with evolutionary theory, that enables to overcome limitations of single scientific disciplines. They propose five world-views that summarise the distinct way to apprehend Nature.

Figure 2: Caricatures of Nature

	Stability	Processes	Policies	Consequences
Flat Nature	None	Stochastic	Random	Trial and Error
Balanced Nature	Globally stable	Negative Feedback	Optimize or Return to equilibrium	Pathology of Surprise
Anarchic Nature	Globally unstable	Positive Feedback	Precautionary Principle	Status Quo
Resilient Nature	Multiple stable	Exogenous input and internal feedback	Maintain variability	Recovery at local scales or Adaptation; Structural surprise
Evolving Nature	Shifting stability and scape	Multiples scales amd Discontinuous structures	Flexible and actively adaptive, probing	Active Learning and new institutions

Source: Holling, Gunderson and Ludwig, 2001

Understanding the human ecology of natural hazards in most regions requires an assessment of natural processes, resource stocks and flows in terms of their relations with and significance for human society. The separation of society and environment in the hazards paradigm creates geographical and ecological fiction (Hewitt, K., 1997).

A Conceptual Framework: Hazards, Vulnerability and Resilience

Hazards and their Mitigation

Disasters have a way of captivating the human imagination. They become part of the worldwide spectacle of a globalised media. Famine in Ethiopia, floods in Mozambique, cyclone damage in Orissa, flash floods and landslides in Venezuela, just to mention the latest human tragedies which have made the news. For the most part, they are perceived as major disruptions of urban settlements, livelihoods and economic processes. Be these hazards teluric, such as in earthquakes or volcanic eruptions, or meteorological events (severe storms, tidal surges, windstorms, hail, snowstorms, hurricanes and drought) and their hydrological and geomorphological responses in the form of floods, mudflows, landslides, mass wasting, wildfires and groundwater depletion, all have a territorial impact. Much of disaster related research has centred on the study of hazards, geared essentially to a better understanding of these recurrent energy flows and releases. Practical applications of hazard research have also enabled the improvement of early warning systems, the definition of the probability of recurrence of major events, thus improving prevention and devise means to mitigate their impact on society.

The hazards paradigm has also contributed to reinforcing the notion that disasters are induced essentially by natural forces. The awe which these events inspire is also the key to understanding this passive vision of human agency on earth. The perennial recurrence of physical events in Central America has also nurtured a

vision of geographical fatality. However, the disruptions caused by damaging events in the form of floods, quakes, winds and volcanic eruptions are also natural processes from which most geomorphological, hydrological and biological processes are built. An important feature of disasters is they act at varying scales, both in space and in time. The spatial dimension of a hazard is directly related to the degree of energy transformation and the extent of dangerous forces and damaging agents. The temporal scale helps to distinguish the rate of onset of the phenomenon, its duration and frequency. Most of these parameters tend to be compounded in the sense that they create synergies in time and space. For instance, episodes of drought and catastrophic forest fires were a prelude to the impact of Hurricane Mitch which tore through Honduras and Nicaragua in October 1998.

Several authors also attribute the region's high biodiversity to the intrinsic geological and geomorphic instability of many of these mountain landscapes (Myers, N., 1984). These are high energy areas by virtue of terrain and gravity, and therefore are marked by recurrent floods, mudflows and landslides Diversity as a response to hazards has constituted a clear mechanism for ecosystems to distribute risk. Many ecosystems, particularly floodplain forests and wetlands, play an important buffering function for major hydro-meteorological events, through flood storage and flow regulation (Godschalk, D., 1999; Cuny, F., 1983). A key feature of current research in ecology is the concept of resilience, by which an ecosystems' sturdiness is measured by its ability to withstand, recover from and evolve from major disturbances (Holling, C.S., 1986; Gunderson, Holling and Light, 1995). The thresholds which enable certain geomorphological or biological systems to prevail in the face of adversity help us understand the needs for structural and non-structural hazards mitigation.

Another aspect of hazards research emphasises the paradoxical nature of resources, both natural and man-made, which can be both beneficial and hazardous (Burton and Kates, 1972). For instance, throughout the world human populations have settled on floodplains, volcanic soils or constructed dams and nuclear power plants which provide benefit flows through goods and services. These resources can also pose threats to human livelihoods when they become hazards in the form of floods, volcanic eruptions or through structural failure of power plants.

Non-structural Mitigation and Environmental Processes

Traditionally, the response by many societies to natural hazards has centred on the construction of civil defence or engineering works (such as levies, reinforced structures, earthquake proof buildings, etc). This is commonly known as structural mitigation. These measures are often extremely costly, and of limited effectiveness during particularly high magnitude events (Blaikie, P., 1997: Maskrey, A., 1993). Other authors suggest that an alternative to these protective measures and civil defence works should rely more systematically on the buffering capacity of natural ecosystems (Tobin, G.A. and B.E., Montz,1997; Smith, K., 1996). There has been a growing tendency to resort to environmental management practices to favour hazards mitigation, particular in floodplains, coastal lagoons and mangrove swamps.

The rediscovery of the role of natural systems in buffering the impact of hazards has been most clearly documented following the catastrophic 1993 Mississippi valley floods in the United States, which affected an estimated 6.6 million acres of land, produced between $12 and $16 billion in damage and cost 38 lives (Godschalk, D., 1999:193). The scale of these spring floods and the limited effectiveness of existing structural

mitigation work dramatically changed the way that floodplain planning has been conceived in the United States. A Federal Government report following the disaster, called the Galloway Report , "*endorsed the gradual move away from structural measures, embraces land use and relocation strategies, and emphasises protecting and restoring the natural functioning of river systems*" (Godschalk, D. 1999:33). The final conclusions of the report advocate the wise use of floodplains, echoing the calls since the 1971 Ramsar Convention for the wise use of wetlands. As Godschalk (1999:53) suggests "*Wise use* of floodplains means enjoying the benefits of floodplain lands and waters *while still* minimising the loss of life and damage from flooding and *at the same time* preserving and restoring the natural resources of floodplains as much as possible. Wise use thus is any activity or set of activities that is compatible with both the risks to the natural resources of floodplains and the risks to human resources (life and property)." This is hardly a groundbreaking revelation. As early as 1936 Gilbert White was already writing on the benefits of sound floodplain land use planning, emphasising the role of wetlands in flood storage and flood mitigation (White, G., 1936,1945).

Thus in many cases the best forms of hazard mitigation can be found through restoration and enhancement of natural hydrological and biological processes. This may include the conservation of forest cover in upper tributaries of major watersheds, the enhancement of the buffering role of wetlands in flood control or the role of mangrove forests in protection against coastal storms and tidal surges. Thus a healthy ecosystem can provide real protection to human settlements by suffering damaging agents and providing key livelihood resource (Godschalk, D., *et al*, 1999). This fact reinforces the linkages between sound environmental stewardship and hazard mitigation. In the following sections, this paper explores these linkages in the Central American region, and in particular the role of *in situ* conservation and wetlands conservation in mitigating risk.

Definitions of Vulnerability

Hazards are necessary but not exclusive ingredients in a disaster. What really defines a disaster is the combination of physical, biological or technological hazards and population growth and migration as well as the resulting configuration of human settlement, distribution of wealth and opportunities which create patterns of vulnerability. The combination of hazards and conditions of vulnerability are the major building blocks of risk (see Table 1 and Figure 2). According to Hewitt, exposure to dangerous agents and environment is the basis of all disasters. But the key differentiating factors are found in the conditions of exclusion and structural social and economic disadvantage for the majority of populations in both urban and rural setting which create the human conditions of weakness, lack of protection and of resilience. The powerlessness of these vulnerable populations to guarantee safety conditions explain the continuous high toll paid by marginal and structurally disadvantaged population in the human and economic impact of disaster.

Contrary to the prevalent notion, the severity of a disaster cannot be measured by the extent or duration of a physical event, but rather by the degree of damage and harm inflicted on human societies. And in most societies there are varying social, economic, ethnic and political conditions which will determine the degree of weakness of particular age, gender or social groups. There are also public policies which provide protection for some more than others. Increasing globalisation and historical legacies of exclusion and indigence also create conditions of structural disadvantages for a large proportion of the population. But there is also a mutual relationship between society and environment which makes impossible a separation of "natural hazards" from society.

Table 1: Vulnerability: Some of the Basic Forms in which it Arises
1. *Exposure to dangerous agents and environments*
2. *Weaknesses:* predisposition of persons, buildings, communities or activities to greater harm.
3. *Lack of protection* against dangerous agents and for weaker persons and items.
4. *Disadvantage:* lack of the resources and attributes to affect risks or respond to danger
5. *Lack of resilience:* limited or no capability to avoid, withstand or offset and recover from disaster.
6. *Powerlessness*: inability to influence safety conditions, or acquire means of protection and relief.

Source: Hewitt, K. 1997: p.27

As Kenneth Hewitt (1997:27) suggests, "the problem of vulnerability is rooted in *impaired adaptive capabilities* (in addition to defencelessness and structural disadvantage)". An important consideration here is at which stage a social group or an individual loses its ability to adapt to its immediate surroundings. This is often the case of incoming migrants from rural areas to cities, or the case of pioneer settlers on the agricultural frontier. Thus conceived, impaired adaptation leads to faulty practices and in many cases to the social construction of risk. This is also intimately linked to the livelihood security of these migrant populations. This has a direct impact on these populations' capacity to prevent, cope and recover from harm. As such, risk is no longer defined by threat external to society, but is attributed to "the human allocation of endangerment through these aspects of communal existence. Vulnerability is maintained by economic and other conditions. It is reproduced by the activities that sustain unsafe living conditions for some, or disempower them, and changes only if these conditions are transformed" (Hewitt, 1997:153).

In this sense the model of development of Central America has also been a major factor in creating vulnerable social and economic conditions. Centuries of exclusion, concentration of land and wealth, and over the past decades a runaway urban sprawl into high risk areas. As Lavell (1999) puts it: "Disasters become the necessary and inevitable result of "development". They are built into the process, and are the price to pay for the "gains" achieved by following a model that guarantees growth and development for some and poverty and vulnerability for the majority". The wholesale modification of landscapes and the growing degradation of forest ecosystems can have a direct impact on increased vulnerability. Periods of rapid change in population distribution, and periods of violence and instability, there is a rapid accumulation of vulnerabilities. Again, varying scales in time and in space are at play, produce complex scenarios of risk, which tend to be more heterogeneous and disperse. As Maskrey puts it: "*No hay vulnerabilidad sino muchas vulnerabilidades, no un desastre sino muchos desastres*. (There is not a single vulnerability, but rather many vulnerabilities, not a disaster, rather many disasters)" (Maskrey, A., 1994:37). This was recently demonstrated in Central America during the recent bout of disasters, in which many stricken communities of rural Guatemala or el Salvador, admitted that the past two decades have been an 'ongoing disaster'.

The deadly combination of land degradation in mountainous regions and crowded cities downstream provided the perfect setting for Hurricane Mitch. In referring to the environmental factors at play in creating disasters, Blaikie (1997:42) affirms "*...the extinction of wild genes (sometimes called genetic erosion) can significantly increase future vulnerability to plant pests and diseases. Deforestation and wetland destruction are major factors in such genetic erosion, leading to the loss of many species, known and unknown".* The past 50 years

have been marked by a significant transformation of natural ecosystems in Central America. Many authors have pointed to the dangers of genetic erosion of many of these tropical ecosystems (Myers, N., 1984). In particular, the causal relation between deforestation and increased flood risk has been underlined by Blaikie (1997:41). "*The connection between land degradation and unsafe conditions can be quite significant"* (Cuny 1983). Deforestation and soil erosion can increase hazard intensity or frequency in the long run. This again reinforces the notion that sound environmental management may contribute to reduce the intensity of hazards and their recurrence.

Environmental Resilience: Diversity as Stability

A key aspect of environmental management is the concept of resilience. Initially understood as the capacity for an ecosystem to withstand and recover the effects of harvesting, culling or extraction by human use, it can be extended to mean the capacity of systems to undergo and resist major damaging events such as landslides, volcanic eruptions or floods. Although early ecosystem research tended to portray ecosystems as predictable and stable, recent research has reviewed these premises to underline that many ecosystem dynamics defy attempts to predict and model them. Disasters conceived as violent intrusions of chaos into human settlements and territory, do not provide the holistic vision necessary to truly apprehend the two-way relationship between societies and ecosystems. As Berkes and Folke (1997:10) remind us that "*stressed ecosystems, as in resource overexploitation, tend to change not gradually but in lurches, through threshold effects and in surprises, whereby outcomes differ from predictive models not only quantitatively, but* ***qualitatively***."

We are dealing therefore with a moving target, as the concept of resilience suggests, since most natural systems are increasingly difficult to predict and model. This is clearly the case of much of the research concerning climate change, ozone layer depletion and the impacts of biodiversity loss on ecosystems. C.S. Holling (1986) has reached the conclusion that most ecosystem dynamics contain an element of surprise. Since resilience is based on "*the diversity and complexity of ecosystems (which) can be traced to a relatively small number of biotic and abiotic variables and physical processes, thereby contributing to the functional performance of the ecosystem*." (Berkes and Folke, 1997:13). This is of compelling importance for the *in-situ,* and *ex-situ,* conservation of biological diversity, since both species focused and ecosystem based approaches to conservation are intimately linked. In many ways, the future and genetic stability of domesticated systems depends to a significant degree on the existence of wild species in their original habitat.

Table 2: Resilience as Applied to Integrated Systems of People and Nature

1. "The amount of disturbance a system can absorb and still remain within the same state of domain of attraction
2. The degree to which the system is capable of self organisation (versus lack of organisation, or organisation forced by external factors)
3. The degree to which the system can build and increase the capacity for learning and adaptation

Source: (Folke, C., et al *2002: 4, citing Carpenter* et al *2001)*

Thus species diversity in an ecosystem may not be as important as the specific function of individual species and organisms and their relationship to the system as a whole. Another major contribution to our understanding

of ecosystem resilience is that these relationships occur at varying scales both in time and space. Holling makes the compelling argument that the degree of resilience is determined by an intricate play between rhythms and scales. As he puts it "*periods of gradual change and periods of rapid transformation coexist and complement one another*" (Berkes and Folke, 1997:355).

Most disasters involving natural hazards are born of these relationships across scales, and compounded by the interaction of hazards of progressive onset (such as ENOS or the El Niño effect) and the high energy events such as earthquakes or volcanic eruptions. Thus, an episode of drought can increase the likeliness of forest fires, which in turn tend to contribute to increased runoff, flash floods and mudslides. A parallel can be drawn between the intricacies of ecosystem evolution and the human ecology of disasters. As ecosystems rely on complex functional interrelations between species, a disaster will also hinge on the social construction of risk, which both occur over different scales and at different time. As Berkes and Folke (1997:35) have shown: "*problems of cross scale in nested systems are increasingly caused by slow changes reflecting decadal accumulations of human influences on air and oceans, and decadal to centuries-long transformations of landscapes. Those slow changes cause sudden changes in fast environmental variables that directly affect the health of people, productivity of ecosystems and vitality of societies*." (Berkes and Folke, 1997:355). Vulnerability is therefore the flip side of resilience; when a social or ecological system loses its resilience it becomes vulnerable to change that previously could be absorbed (Kasperson and Kasperson, 2001a). Even small amounts of change in a vulnerable system can be disastrous.

Risk Management and Environmental Security

Finally, the linkages between risk, security and resilience are important to illustrate some of the major challenges facing Central American societies today. Blaikie *et al* (1994) have striven to provide us with the Disaster Pressure and Release Model that takes into account a combination of global factors, dynamic national pressures and local conditions which lead to disasters. The PAR model traces the causes of disasters to a series of factors which generate vulnerability (see Figure 1). The range from root causes which are often linked to global forces over which local communities have little or no influence, which determine to greater or lesser degree the restriction of access to power, land and resources. These root causes are linked to the economic and political spheres which create policies and structures which promote social exclusion, concentration of wealth and define the use of force through military or police structure. The root causes also determine to a large degree the tenure over land and resources. Blaikie *et al* (1994) also distinguish dynamic pressures which are seen as linkages between larger structural causes and local conditions. They "*translate the effects of root causes into the vulnerability of unsafe conditions*" (Blaikie, P., 1994:24).

These dynamic pressures are those which determine the basic health and nutritional status as well as the access to education and job opportunities of a population, its tenure security and the state of its surrounding environment. It is also the locus of macro forces such as population growth, rapid urbanisation, deforestation and loss of biodiversity, decline in soil fertility and the relative scarcity of key resources such as water. All these contribute to create unsafe conditions in terms of fragile physical environment, in which natural hazards can announce major damaging agents such as floods, drought or earthquakes. It also fosters an increase in vulnerable social conditions and livelihoods at risk, because of low income, limited access to resources and weak local

institutions. The combination of these factors of environmental scarcity, resource capture and collapsing institutions have laid the groundwork for the disasters of the late 20th century in Central America.

Adaptation, Mitigation and Increasing Resilience

Blaikie *et al* (1994) also provide us with an analytical model to understand that disasters occur when these pressures, both global and dynamic, compounded by unsafe conditions, are released in the form of disasters. The Pressure and Release Model they suggested described how structural constraints and dynamic pressures conditioned the creation of unsafe conditions. However, while communities throughout the world have developed coping mechanisms and local institutions which enable them to improve their co-existence amidst natural hazards, there are processes root causes which can only be addressed at broader scales.

Adaptability is the key, but hinges often on the capacity of the local population to understand and interpret through cultural systems their habitat and associated hazards and risks. For this to be achieved, it is necessary not only to understand the range and intensity of natural hazards and their probable occurrence, but also and more importantly to develop policies which effectively attack those dynamic forces which produce vulnerability. As Hewitt (1997: 153) suggests: *"Empowerment may be much more critical to reducing the vulnerability of such people than any particular tools, information or regulations to combat a hazard"*.

Twelve Steps to Mitigate Risks
1. Manage mitigation
2. Integrate the elements of mitigation
3. Capitalise on a disaster to initiate or to develop mitigation
4. Monitor and modify to suit new conditions
5. Focus attention on protection of the most vulnerable
6. Focus on the protection of lives and livelihoods of the vulnerable
7. Focus on active rather than passive approaches
8. Focus on protecting priority sectors
9. Measures must be sustainable over time
10. Assimilate mitigation into normal practices
11. Incorporate mitigation into specific development projects
12. Maintain political commitment

Source: Blaikie, P., et al *1994*

Holling (2001) introduces the concept of the adaptive cycle which consists in analysing scale relationships, called Panarchies, which linked spatial and time scale into a coherent conceptual whole. The adaptive cycle allows to model and understand the role of change in both ecosystems and social (institutional and organisational) systems. The Holling Adaptive Cycle consists of:

- ***The inherent potential*** *of a system that is available for change, since that potential determines the range*

of future options possible. This property can be thought of, loosely, as the "wealth" of the system.

- ***The internal controllability*** *of a system; that is, the degree of connectedness between internal controlling variables and processes; a measure that reflects the degree of flexibility or rigidity of such controls, such as their sensitivity or not to perturbation.*

- ***The adaptive capacity****; that is the resilience of the system, a measure of its vulnerability to unexpected or unpredictable shocks. This property can be thought of as the opposite of the vulnerability of the system. (Holling, 2001:394).*

These properties are those that shape the responses of ecosystems, agencies and people to crisis. This also helps us explain why, for instance, larger economies in Latin America, with larger populations and material and organisational wealth, better withstand the impact of major disasters. A measure of vulnerability has to do with both pre-existing potential and adaptive capacities. Connectedness determines the degree to which a system can control its own destiny and resists to external perturbations and variability. Resilience, as such, is achieved by increasing adaptive capacities to overcome disturbances and thrive in the face of adversity.

Hardware and Software Approaches to Mitigation

Two major approaches to mitigation can be distinguished: the hardware and the software. The first emphasises structural solutions to shifts in climate, discharge, flow and impact of weather related change. This is a typical mechanical response, as through the design of levies and dams to control flooding, building sea defences to stop sea level rises, responding to traffic increase through wider highways, broader bridges and more cables. Most civil defence infrastructure is often rigid and inflexible. They can have negative impacts on ecosystem services and local livelihoods. Such infrastructure maintenance can be hugely expensive to build and maintain. They also create the illusion of security in areas that are prone to coastal surges, flash floods and avalanches. The use of risk transfer through insurance has obvious enabled to develop areas previously unsettled due to high risks.

Over the past few years, the physical hazards centred and structural mitigation approaches have proven that they have serious shortcomings, and in the face of growing risk it is necessary to broaden the debate beyond infrastructure and rehabilitation post disaster, and assess societal choices. How then can we develop instruments and institutions of global environmental governance that can supersede, complement and enhance national and regional agendas? Conversely, can we adequately extrapolate from local experiences in sustainable livelihoods and resilience-building initiatives, to the regional/landscape/ecosystem approach without losing sight of essential institutional linkages? We need to focus on these cross-scale issues which enable to link the macro with the micro, the highlands with the lowlands and the rural and urban communities in many societies. In Central America, the emergence of regional initiatives geared around biological corridors, bioregional, landscape and ecosystem approaches to conservation, such as the Mesoamerican Biological Corridor, have contributed to creating tools and institutional arrangements at the meso-scale.

The software approach is different in the sense that it also looks at how adaptive measures can be taken to mitigate risk through sound land use planning, restoration of key ecosystem functions and capacity building

for resilient livelihoods and institutions. This implies the identification and promotion of a wide range of adaptive responses (for example, demand side management, end use management, change cropping patterns, livelihoods, diversification). They also include community-based empowerment and local land-use planning to reduce risk to lives and livelihood. Faced with climate change impacts, there are areas where a planned retreat from risk-prone or affected areas may be necessary. But in others there are options for maintaining ecosystem functions and services, enhancing resilience and adaptative capacities. This obviously implies to manage risk, increase preparedness, and above all move away from certainties.

These software approaches to mitigation could prove to be some of the most important steps in building institutional arrangements which enable urban populations and regional economies to adapt to change, while retributing the custodians and stewards of renewable environmental services such as the provision of potable water, the mitigation of floods and related disasters, and the protection of biodiversity and the production of biomass for energy use. Interesting experiences in community based early warning systems in Guatemala and Honduras have borne promising, albeit isolated, results in the prevention of floods. Environmental services payments are currently being used by municipal utilities companies in Costa Rica to support the conservation of upper watersheds which supply water and energy to urban communities. These institutional arrangements could enable those communities adjacent to protected areas to benefit from national/regional/local linkages through integrated institutional arrangement. These regional institutional constructs would enable to link local natural resource management (community forestry, wetlands restoration) to the mitigation of natural hazards and the adaptation to climate change, through environmental service payments and other bioregional transfers of resources.

Conclusions: How to Build Cross-Scale Linkages and Increase Resilience through Adaptation

Folke, C., *et al* 2002 explore new elements to sustain the adaptive capacities of social-ecological systems in a world that is in constant change. They identify four critical factors that interact across temporal and spatial scales and that are key to consider when dealing with natural resource dynamics during periods of change and reorganisation. These are:

- Learning to live with change and uncertainty;
- Nurturing diversity for resilience;
- Combining different types of knowledge for learning; and
- Creating opportunity for self-organisation towards social-ecological sustainability.

Faced with change and uncertainty, sustainability in the face of adversity is certainly something that inhabitants of the 21st century will have to learn to do. This requires a keen understanding of scale relations, and if the fact that nature and humanity are inexorably coupled in co-evolution over time, for good or ill. Today, human actions are indeed a major structuring factor in the dynamics of ecological systems. The resilience of ecosystems will also define their degree of vulnerability. The concept of resilience forces us to think differently about

change. Instead of trying to control and suppress change in a system assumed to be stable, Folke, C., *et al* 2002 suggest that we need to manage the capacity of social-ecological systems to cope with, adapt to and shape change. In a sense, managing for resilience increases the likelihood of sustainable development, by reducing vulnerability of human settlements and natural resource regimes to environmental change in a context of heightened uncertainty and surprise.

For this there is a need for combining different types of knowledge, at different scales. No one discipline has the monopoly over understanding and adapting to global change. In a resilient system, change has the potential to create opportunity for development, novelty and innovation. Interesting new perspectives are emerging from cross-scale and trans-disciplinary approaches which can provide us with key insights for facing the unprecedented challenge of climate change.

A fundamental challenge, identified by Folke, *et al* (2002) is how to raise awareness over the long term, several generations ahead. They insist on "*building knowledge, incentives and learning capabilities into institutions and organisations for managing capacity of local, regional and global ecosystems to sustain human well-being in the face of complexity and change*" (2002:6). These management approaches involve diverse interest groups, stakeholders and knowledge brokers in new and imaginative roles, through upland-lowland linkages, environmental service payments and collaborative management for mitigation. The resilience-building approach may provide the opportunity to test in many of UNDP's and related GEF projects in local and national environmental management, capacity building and risk management initiatives. There are ample opportunities to field test resilience building and risk management approaches in the LAC Region, and to innovate in the field of adaptation to climate change. Several interesting regional strategies and the only GEF funded project in adaptation to climate change in Central America, Cuba and Mexico can provide a timely opportunity to apply these new ideas and create opportunities for reducing vulnerability to disaster and climate change through increasing adaptive capacity.

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Integrating Disaster Risk Management and Adaptation to Climate Variability and Change: Needs, Benefits and Approaches, from a South Pacific Perspective

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Abstract

Conceptually, risk management is one of several fundamentally important strategies that facilitate a fully integrated approach to poverty reduction, social mobilisation, sustainable economic growth, environmental protection and resource conservation. It has a central role to play when addressing threats and barriers to sustainable development, including disasters (be they natural or man-induced) and climate change and variability.

Clarity in conceptual thinking across the spectrum of relevant policy and management constructs and tools, and practical application of the resulting understanding, are well advanced in the South Pacific. This is an outcome of frequent disasters, the high natural variability in both atmospheric and marine conditions and the extreme vulnerability and degraded resilience of many small island ecosystems, in tandem with the attendant serious consequences that have been experienced in the past or are anticipated for the future. Another contributing factor is the close relationship between the small island countries and the metropolitan countries that surround the Pacific Islands Region, resulting in cooperative approaches that facilitate research, greater understanding and improved policy outcomes.

The paper will draw on the experience gained in the South Pacific in order to provide an integrated conceptual

framework, and practical policy and management strategies, to address the major environmental and related challenges facing humankind. These will combine the strengths and address the weaknesses of disaster risk management, adaptation and other approaches that facilitate sustainable development.

The key conclusions reported in this paper are:

- *Climate change will increase the likelihood of extreme events, and hence disaster risk.*
- *Even today, extreme events are a major impediment to sustainable development.*
- *Sustainable development planning already addresses some risks, including those associated with financial shocks, national security, human health, transport services and food, water and fuel supplies.*
- *Development planning must reflect both recurrent historical risks and new risks, including those associated with climate change.*
- *Effective risk management prevents precious resources from being squandered on disaster recovery and rehabilitation.*
- *Many risks and losses are manifest locally, but measures to alleviate them have important national and international dimensions.*
- *There is urgent need to adopt and implement an integrated approach that exploits the synergies to be gained from harmonising responses to extreme events, variability and long-term change.*

The comprehensive, integrated programme of Climate Change Adaptation through Integrated Risk Reduction (CCAIRR, pronounced care) addresses this need by using risk management approaches to help prioritise and implement the following risk reduction measures:

- *Mitigation of greenhouse gas emissions;*
- *Disaster reduction; and*
- *Adaptation to extreme events, variability and change.*

Currently CCAIRR focuses on integrated, risk-based approaches to disaster risk management and adaptation to climate variability and change, through local assessments and responses, with national and international facilitation.

Introduction

Significantly, most small island countries of the Pacific are already experiencing disruptive changes consistent with many of the anticipated consequences of global climate change, including extensive coastal erosion, droughts, coral bleaching, more widespread and frequent occurrence of mosquito borne diseases and higher

sea levels making some soils too saline for cultivation of traditional crops (Hay and Sem, 2000; Hay *et al*, in prep). These, and other precursors of global climate change impacts now being experienced by Pacific Island Countries, provide some of the more compelling and tangible indications of the seriousness of global warming, certainly more than the often quoted projections of increased global temperature and sea level. The adverse consequences of climate change are already an unfortunate reality for many small island inhabitants. They highlight the serious and wide-reaching consequences future climate changes will have on Pacific Island Countries, likely exacerbating the existing adverse impacts of the extreme events and high variability that are inherent characteristics of their climate and related systems.

The combination of current and anticipated impacts of disasters, and of climate variability and change, for small island states in the Pacific is thus of great and urgent concern, given the extensive and growing evidence of the vulnerability of these countries and given the acknowledged limitations these countries have for coping with, and adapting to, such events and changes (Hay *et al*, in prep). Small island states are likely to be among the countries most seriously impacted by climate change, including sea level rise, despite being the smallest contributors to human-induced climate change. Typically, they also have seriously limited capacity to adapt to the adverse consequences of these pressures.

A major challenge is to equip people, communities and societies to develop and modernise in less wasteful ways than is the current development paradigm, but without losing the sound social and cultural values and practices that underpin their traditional way of life. Only through such measures can the current inequity in the use of environmental services and resources be addressed in ways that produce sustainable outcomes. By their very nature, environmental capacity building and enhancement require a multi-pronged approach that addresses the objective of enhancing the ability to undertake integrated policy formulation, planning and management related to environmental protection, poverty reduction, social mobilisation and sustainable economic development. Included in such initiatives will be legislative, institutional and human resources development designed to improve economic efficiency, enhance environmental protection, sustain natural resource use, mobilise society and reduce poverty.

Substantial progress along these lines has already been made in the South Pacific, in part as a result of relatively frequent disasters, the high natural variability in both atmospheric and marine conditions and the extreme vulnerability and degraded resilience of many island ecosystems. Another motivation has been the associated serious consequences for both biophysical and human systems, as experienced in the past, or anticipated for the future. A further contributing factor is the close relationship between the small island countries and the metropolitan countries that surround the Pacific Islands Region, resulting in cooperative approaches that facilitate research, greater understanding and improved policy outcomes. The progression from problem recognition, through conceptual and empirical understanding and the development of policies and plans, to their implementation, is comparatively rapid in the South Pacific. This is due, in part to the inability of countries, and the region at large, to support a multiplicity of specialised agencies, to the resulting close links between the few technical- and policy-focussed agencies, at both regional and national levels, and to the relatively open and pragmatic approach taken by policy- and decision-making bodies.

The Economic, Social and Environmental Consequences of Disasters and Climate Variability and Change – Actual and Anticipated

Table 1: Major Disasters in Pacific Islands during the 1990s

Year	Country	Event Type	Population Affected	Number of Details	Houses Destroyed	Losses (million US$)
1990	Samoa	Cyclone Ofa				140
1991	PNG	Mudslide		200		NA
1991	Samoa	Cyclone Val	170,000			300
1992	Guam	Typhoon	Omar			
1993	PNG	Earthquake		48		NA
1993	Solomon Is	Cyclone Nina	88,500		11,992	NA
1993	Vanuatu	Cyclone Prema	9,000		1,200	NA
1993	Fiji	Cyclone Kina	150,000	21	2,000	140
1994	PNG	Volcanic Eruption	100,000	4		220
1997	Cook Is	Cyclone Martin	1,649	19		7.5
1997	Tonga	Cyclone Hima			648	14.5
1997	Fiji	Drought				160
1997	PNG	Drought & Frosts	1,200,000	"many"		50
1997	Marshall Is	Drought				6
1997	FSM	Drought				9
1997	Regional[a]	Drought				>275
1998	PNG	Tsunami	11,854	2,182		NA
1998	Tonga	Cyclone Cora				56
1998	French Polynesia			10	NA	
1999	Fiji	Cyclone Dani	20,000	12		3.5

Sources: Campbell and World Bank (2000)

Note: Losses are not adjusted for inflation; NA indicates loss estimates are not available.

Table includes only those events with significant losses.

[a] Regional drought estimates include those listed for Fiji, PNG, Marshall Is and FSM in 1997; most other Pacific Island Countries also experienced drought conditions in 1997/98, but loss estimates are not available.

Only one drought is recorded in the above Table. As noted by Campbell (1999), this reflects a strong tendency towards the under-reporting of drought events in Pacific disaster statistics – unlike other extreme events they tend to occur without fanfare, being insidious and pervasive in nature.

Table 1 lists the major disasters experienced in the Pacific Islands Region during the 1990s. This listing of events and their consequences is incomplete, but it does provide insight into the types of events, and their significance. Of the16 events listed in Table 1, 13 have atmospheric origins, and of these, the majority (11) are tropical cyclones.

Disasters incur significant financial and non-monetary costs for the Region. Total losses associated with the 10 events for which data are provided in Table 1 exceed $US 1.4 billion. Consistent with trends observed internationally, disaster costs are almost certainly increasing in the Pacific Islands Region. As evidence, Campbell

Table 2: Losses Associated with Four Similar Tropical Cyclones Affecting Fiji, 1952-93

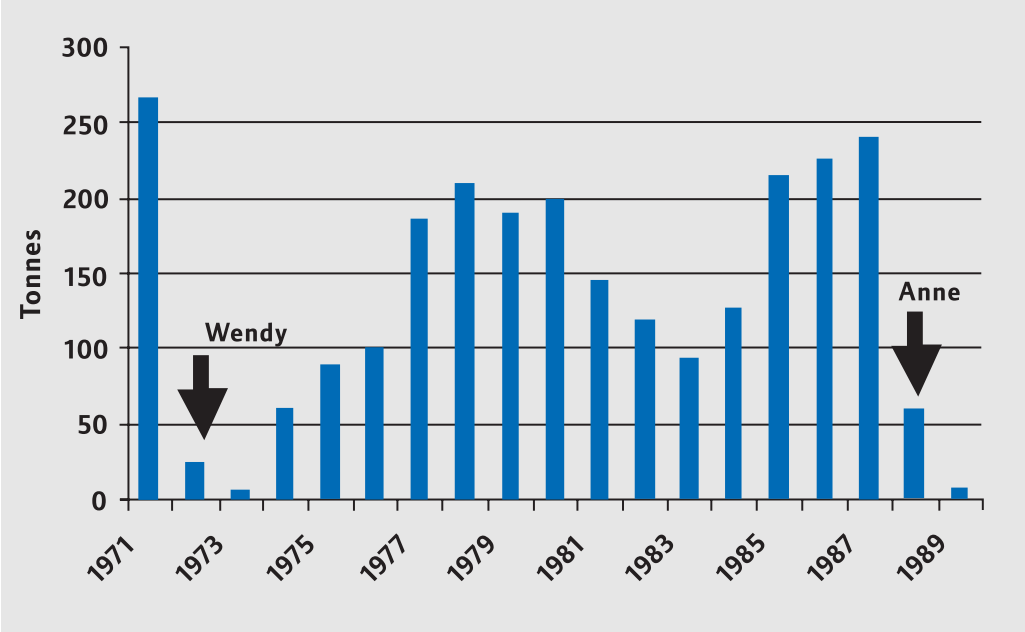
Year	Name of Cyclone	Estimated Loss (million F$)
1952		0.5
1972	Bebe	6.0
1983	Oscar	30.0
1993	Kina	150 (approx)

Source: Campbell (1999)

(1999) presented the estimated losses associated with four similar tropical cyclones that affected western Fiji in the latter half of the last century (Table 2).

Monetary and other losses are exacerbated through the cumulative effects of disasters. Cyclones Ofa and Val, which hit Samoa in 1990-91, caused losses of $US 440 million. This is in excess of the country's gross domestic product for the two years combined (Campbell, 1999). As a result of Cyclone Val alone, around 90 per cent of all indigenous and plantation trees on the second largest island (Savai'i) were defoliated, 40 per cent of indigenous trees were snapped or uprooted and 47per cent of plantation trees were snapped or uprooted. In cases where trees are not destroyed, production still takes several years to recover. This is illustrated in Figure 1. Mota Lava in northern Vanuatu was affected by two severe tropical cyclones in 1972 (Wendy) and 1988 (Anne). Due to damage to coconut trees, it took some seven years before copra production peaked again after Cyclone Wendy. Production never did reach pre-cyclone heights due, at least in part, to some trees being totally destroyed in the event (Campbell, 1999).

Figure 1: Copra production in Mota Lava, Vanuatu, 1971 to 1989 (from Campbell, 1999)



Between 1992 and 1998 Fiji experienced four cyclones, two droughts and severe flooding. Last century Tokelau experienced five major cyclones (1914, 1966, 1987, 1990, 1991), with the time between successive events decreasing markedly.

Table 3 shows the losses of dwellings caused by tropical cyclones in the Pacific Islands Region during the latter part of last century. As Campbell (1999) notes, no clear trend is visible, but it is possible that on a per capita basis housing losses are decreasing due to post-disaster rehabilitation programmes incorporating construction

Table 3: Housing Losses in Tropical Cyclones in Pacific Island Countries

Year	Name of Cyclone	Country	Houses Destroyed
1972	Bebe	Fiji	11,770
1973	Juliette	Tonga	1,250
1975	Val	Fiji	758
1976	Pamela	Guam	
1979	Meli	Fiji	1,322
1980	Tia/Wally	Fiji	874
1981	Arthur	Fiji	569
1982	Issac	Tonga	2,000
1982-83	Scyclones	French Polynesia	1,218
1983	Oscar	Fiji	4,733
1986	Eric/Nigel	Fiji	10,000
1987	Sally	Cook Is	200
1991-92	Zelda/Axel Gay	Marshall Is	1,500
1992	Omar	Guam	2,000
1993	Kina	Fiji	5,544
1993	Kina	Solomon Is	1,200

Source: Campbell (1999)

of wind resistant homes. However, material losses may be increasing as the extent and cost of household contents increase over time. He also comments that fatalities from disasters may also be decreasing, especially for tropical cyclones, where improved forecasting, warning and preparedness systems are now in operation in most countries.

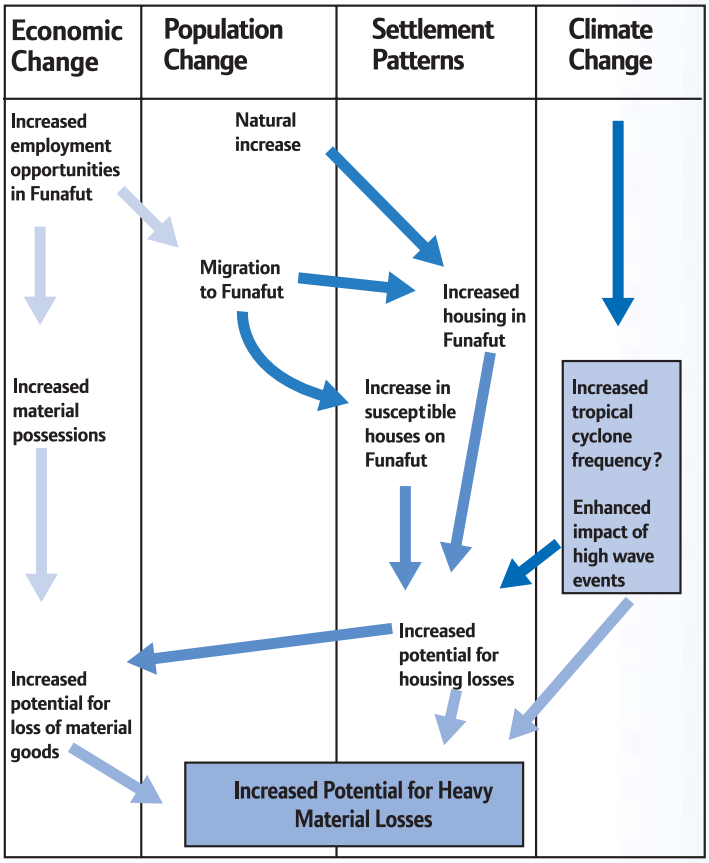
It is also likely that many other changes taking place simultaneously will in some way exacerbate the adverse consequences of extreme events. Changes that may need to be integrated into assessments of the socio-economic consequences include:

- Population growth (although outer islands may experience population decline);
- Urbanisation;
- Increasing material possessions;
- Increasing poverty;

- Growth in tourism; and
- Changes in international aid regimes (including disaster relief aid).

Figure 2 provides an example by indicating some of the pathways through which changing population density in Funafuti (the capital atoll of Tuvalu) will contribute to greater losses from tropical cyclone events. This is a result of the population on Funafuti increasing due to people moving to seek work opportunities through government services and tourism development, and due to increased property exposure through increasing

Figure 2: Integrated assessment of impacts and vulnerability in Funafuti, Tuvalu. Sem *et al*, 1996



material possessions and a greater number of non-permanent dwellings. If either the intensity or frequency of tropical cyclones affecting Funafuti increases, or indeed if both were to occur, the losses would be even greater.

A recent study (World Bank, 2000) used new information and understanding gained through two detailed case studies to determine the integrated economic and non-monetary costs of the collective impacts of climate change. The aim of the study was to demonstrate the extent and specific nature of the adaptation policies and measures required if Pacific Island Countries are to choose a development path that decreases their vulnerability to climate change, including current and future extreme events. Such responses must be integrated with

other actions designed to maintain or enhance the quality of the human and physical environment, in order to safeguard the future well being of the people and the life supporting systems on which they depend, as well as ensuring the continued ability to attract foreign investment in an increasingly competitive global economy.

As shown in Table 4, by the 2050s the annual cost of climate change will equate to a substantial portion of GDP. When these costs are combined with those of even a single extreme event the implications for the national economy , and the society at large, are clearly far reaching. Current trends suggest a continuing rise in the vulnerability of Pacific Island Countries to climate events, independently of, but likely to be exacerbated by, climate change. Even in the near-term some effects of climate change may be irreversible. For example, coral reefs are extremely vulnerable to degradation caused by local human activity and to climate variability (including extreme events) and change. For just the Fijian island of Viti Levu, by 2050 the annual average

Table 4: Economic Costs of Extreme Climate Change in the 2050s, and Gross Domestic Product (GDP) (expressed in 1998 $US million)

	Event and Cost	Annual Cost of Climate Change	GDP
Tarawa atoll	Storm surge: 430	8 to 16	47
Viti Levu	Cyclone: 40	23 to 52	2,452
Viti Levu	Drought: 70	23 to 52	2,452

Source: World Bank (2000)

economic costs arising from the loss of coral reefs and related services may be as high as $US14 million. If there was no recovery in the longer term, the cumulative costs would be much higher, even when expressed as an annual average.

While falling far short of irreversible changes, even severe impacts may well preclude opportunities to act in the future, in part because rehabilitation costs may be prohibitive. Indeed, researchers have noted that, when the full range of possible driving forces is applied to impact models, the range of possible impacts becomes too large for decision makers to identify practical applications of adaptation options. The detailed data on economic costs presented in the World Bank report support another important conclusion, that the costs of climate change and variability will be spread relatively uniformly across all sectors studied. This finding appears to contradict both popular perceptions and earlier technical assessments. Given the study's findings, and for other reasons, climate change is not an issue that should occupy only one or two branches of government. Nor should government be the sole player.

The effects of extreme events, along with those of climate change and variability, will be pervasive in Pacific Island economies, making it imperative to implement an enabling policy and legal framework that includes assigning disaster risk management and adaptation an appropriate priority in national development planning, harmonising conflicting sectoral policies, strengthening institutions and supporting co-management approaches, especially those that facilitate community participation in planning and budgetary decisions and in assisting with implementing adaptation and disaster reduction.

A Comprehensive Approach to Integrating Disaster Risk Management and Adaptation to Climate Variability and Change

Until recently, failure to grasp the real and pervasive costs of disasters made it difficult to convince most policy and decision makers to divert scarce resources from one part of the national, enterprise or community budget in order to support disaster reduction programmes. On top of this, certainties in climate change impact estimates, and even more so in the likely success of adaptive responses, were simply too large for adaptation to be incorporated into national development planning in a meaningful way.

The studies reported here, and other recent investigations, have been instrumental in three important regards:

- Highlighting the high costs of climate related events, variability and trends;
- Documenting how costs have increased with time, and that this trend is likely to continue into the future;
- Showing that confidence in the latter projection is improving.

While the range given for anticipated costs is typically still large, the implications are clear – even in the near future climate variability and change (including extreme events) are likely to impose major incremental social, environmental and economic costs on Pacific Island Countries. Importantly, such costs are inherently distributed inequitably, preferentially affecting the poor and other vulnerable groups. These findings justify calls to mainstream both disaster risk management and adaptation to climate variability and change, in a mutually consistent and supportive manner. The key to this is to ensure disaster reduction and adaptation are integral components of the national risk management strategy and, in turn, of the national development planning process. Most countries already have policies and plans to manage financial risks, human health risks, biosecurity risks, agricultural risks, risks in the transport sector and energy supply risks. Disasters and climate change and variability should be included and addressed in the same portfolio of national risks.

This can best be achieved by having key players recognise that both disasters and climate change are significant impediments to successful economic development – that is, they represent risks to the regional, national and local economies. Countries are already experiencing the manifestations of these risks, in the form of recent disasters, but also via climate variability. The most efficient and effective approach is to manage the risks in an integrated manner – through disaster risk management, and planned and proactive adaptation that involves "no regrets" strategies. Many disaster and climate change response strategies are the same as those which contribute in a positive manner to sustainable development, sound environmental management, and wise resource use. They are also appropriate responses to climatic variability and other present-day and emerging stresses on social, cultural, economic and environmental systems. Therefore, "no regrets" strategies, plans and actions are beneficial even in the absence of climate change. Risks associated with the full spectrum of hazards, from extreme events to the consequences of long-term climate change, should be managed in a holistic manner as an integral part of national development planning (Figures 3 and 4).

It is important that national development plans, and sectoral plans, include disaster risk management strategies and climate change adaptation measures that will ensure risks are reduced to acceptable levels. These measures, and related strategies, will help strengthen decision making processes by requiring that specific programmes and projects include strategies and measures to manage risks associated with extreme events and with climate

change and variability. Such mainstreaming can also be facilitated by undertaking institutional strengthening and reforms that result in economic ministries having a mandate and responsibility for ensuring that disaster reduction and climate change are reflected in national policies, plans, legislation, regulations and programmes.

Figure 3: The "optimal response" to climate change for Pacific Island Countries (adapted from Kay and Hay (1993), Hay and McGregor (1994) and Campbell and de Wet (1999)

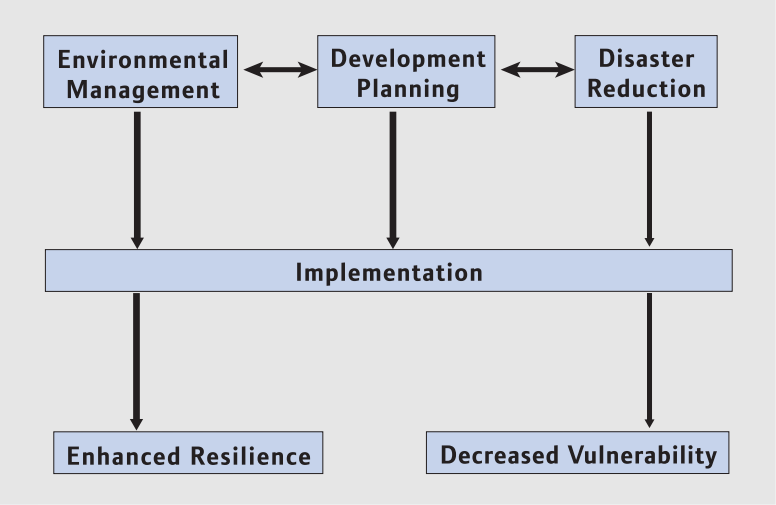
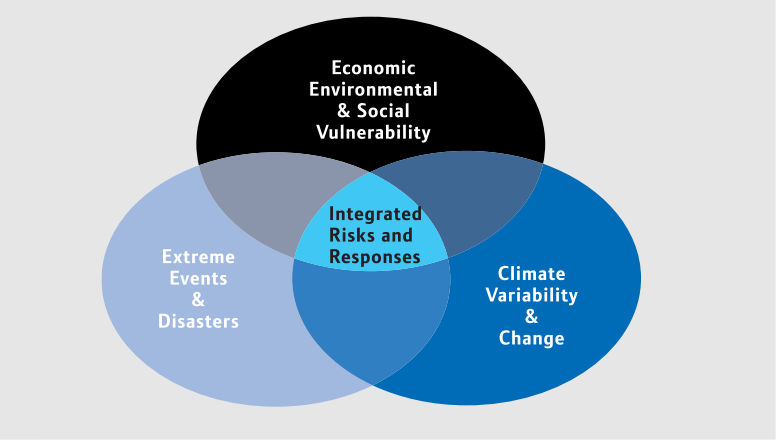


Figure 4: Risk-based assessments of, and responses to, extreme events, disasters and climate variability and change play an integral role in reducing economic, environmental and social vulnerability



Climate Change Adaptation through Integrated Risk Reduction

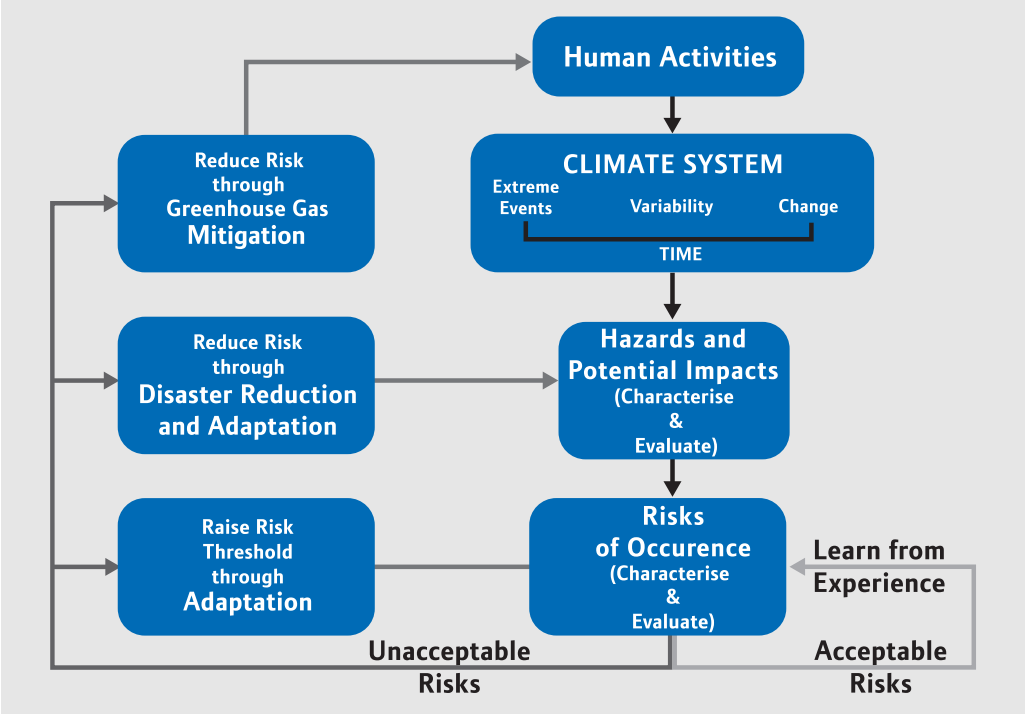
CCAIRR is a recently launched initiative, being driven by the International Global Change Institute (IGCI) of the University of Waikato. CCAIRR builds on the extensive experience and broad expertise of IGCI in such areas as natural hazard assessment, coastal hazard assessment for management and planning, integrated

assessments and modelling at a range of spatial and temporal scales, environmental and health risk assessments, environmental planning and governance evaluations, building sustainable development capacity at community level and identification and evaluation of adaptation options.

Under CCAIRR this collective experience, and that of IGCI's national, regional and international partners, is being harnessed and focussed in order to address the three priority needs identified above. An overview of the broader regional initiatives and capabilities which underpin CCAIRR is provided in Annex 1.

Figure 5 illustrates the key elements of the conceptual understanding and resulting practical actions that facilitate an integrated, comprehensive approach to risk management related to disasters and climate variability and change, including sea level rise. The key concept is the existence of a continuum of potential events that may all be classed as hazards, ranging from extreme events of short duration (example a tropical cyclone), through events associated with variations in atmospheric and marine conditions (example ENSO-induced drought), to events resulting from long-term changes, such as accelerated coastal erosion as a consequence of sea level rise. These hazards originate in response to the mix of external (example, rising temperatures as a consequence of the enhanced greenhouse effect) and internal (example, growing demand for food as a result of population increases) pressures on both biophysical and socio-economic systems.

Figure 5: Key elements of the conceptual understanding and resulting practical actions that facilitate an integrated, comprehensive approach to risk management related to disasters and climate variability and change, including sea level rise

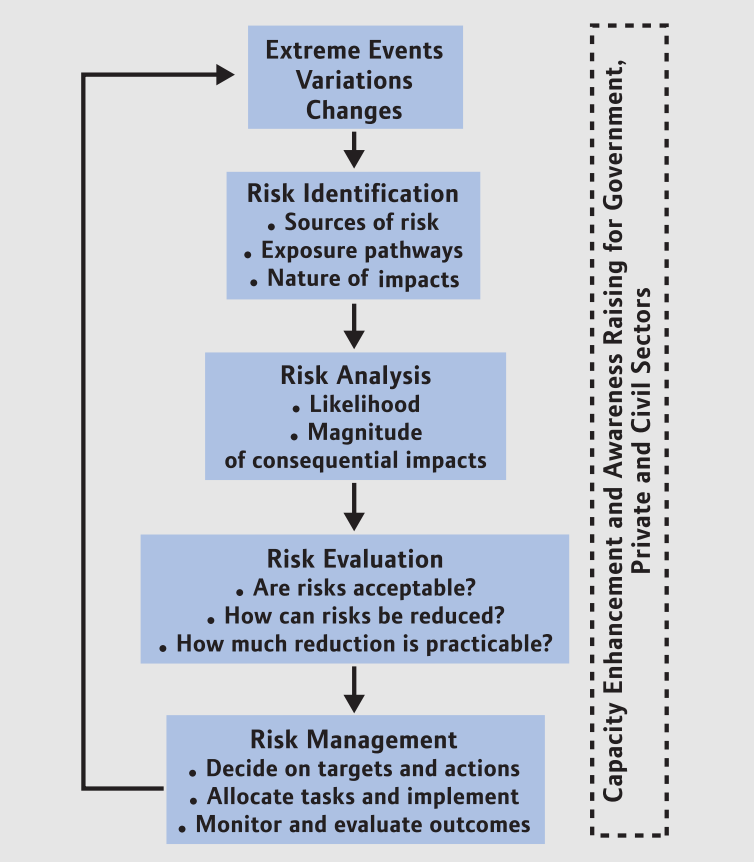


Regardless of their magnitude, frequency or duration, the potential significance of these hazards can be determined using a conventional risk assessment methodology, involving exposure assessment (risk analysis)

and risk characterisation (risk evaluation) (Figure 6). If the resulting risk is deemed to require an intervention, it can be reduced through specific actions that are undertaken in concert with the mix of other risk reduction strategies that are a normal part of national development planning and operations. These include management of financial and human health risks.

The methodology therefore allows for an integrated risk-based approach to determining the need for actions to reduce the potential for, and impacts of, disasters and for adaptive measures that will lessen the adverse consequences of climate variability and change. The approach is an elaboration of that advocated initially by Jones *et al* (1999). Pressures on biophysical and socio-economic systems will generate dynamic responses that may range between a high magnitude event occurring over a short duration (a disaster) to slow but persistent changes. Regardless, the future environmental outcomes are best characterised by scenarios, given the complex interactions involved and the typically large uncertainties in both the pressures and the responses. By comparing a relevant impact threshold with event and change scenarios it is possible to determine the probability of that threshold being exceeded at any time in the future. The probabilities can be used as a basis for evaluating the risks. If they are found acceptable, there is still a need to evaluate and revise, or confirm, the impact thresholds as new information comes to hand and human values and perceptions change.

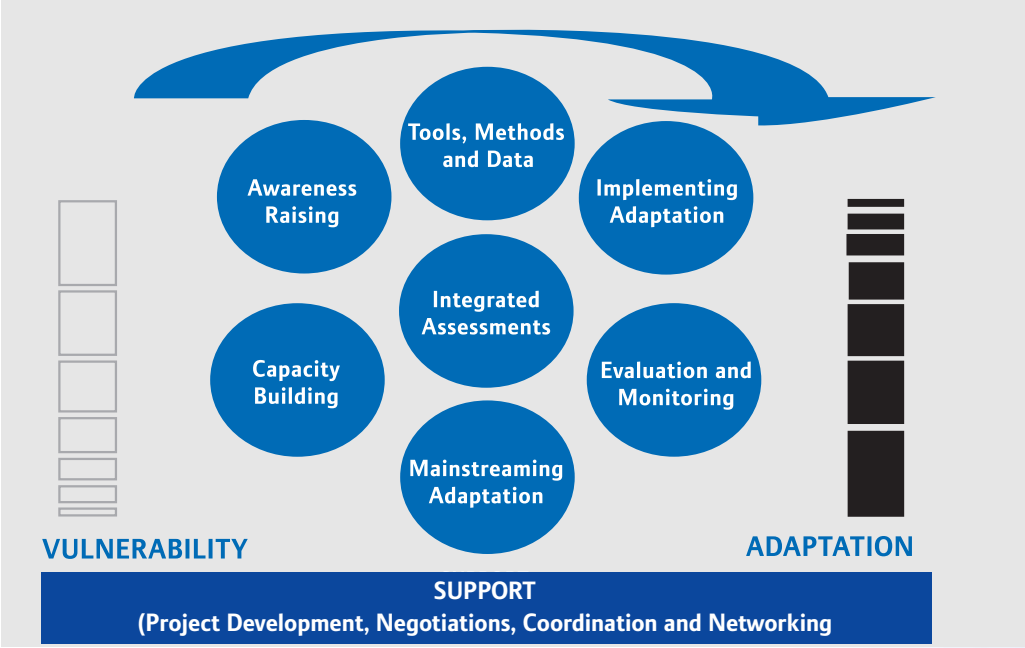
Figure 6: The integrated risk reduction methodology that underpins CCAIRR, addressing both response to disasters and adaptation to climate variability and change



On the other hand, if the risks are deemed to be unacceptable, actions can be taken to raise the impact thresholds and/or reduce the pressures on the relevant biophysical and socio-economic systems. The former can be achieved through disaster reduction measures in the case of anticipated extreme events and through adaptation measures that reduce the adverse impacts of variability and longer-term changes. The range of actions to reduce pressures includes not only adaptation and disaster reduction, but also mitigation of climate change through greenhouse gas emission reduction strategies or activities that remove carbon from the atmosphere or store it elsewhere, such as in growing trees.

CCAIRR is an integrated package that can be customised to meet the specific needs and capacity of a given end user. The key elements of the CCAIRR package are shown in Figure 7.

Figure 7: The key elements of the CCAIRR package



The ultimate goal of CCAIRR is to mainstream both disaster risk management and adaptation to climate variability and change, in a mutually consistent and supportive manner. The key to this is to ensure disaster risk management and adaptation are integral components of the national risk management strategy and, in turn, of the national development planning process. As noted above, most countries already have policies and plans to manage financial risks, human health risks, biosecurity risks, agricultural risks, risks in the transport sector and energy supply risks. CCAIRR assists countries and communities to include management of disaster risk and risks associated with climate change and variability in the portfolio of risks that are addressed at community level, with national support.

This can best be achieved by having key players recognise that both disasters and climate variability and change are significant impediments to successful economic development – that is, they represent risks to the community and to the national economy. Countries are already experiencing the manifestations of these risks, in the form of recent disasters, and also via climate variability.

The most efficient and effective approach is to manage the risks in an integrated manner – through disaster risk management and planned and proactive adaptation that involves "no regrets" strategies. Many disaster and climate change response strategies are the same as those which contribute in a positive manner to sustainable development, sound environmental management, and wise resource use. They are also appropriate responses to climatic variability and other current and emerging stresses on social, cultural, economic and environmental systems . Therefore, no regrets strategies, plans and actions are beneficial even in the absence of climate change. CCAIRR views adaptation as the means by which risks associated with the full spectrum of hazards, from extreme events to the consequences of long-term climate change, can be managed in a holistic manner as an integral part of community and national development planning and monitoring.

It is important that community and national development plans, and sectoral plans, include disaster risk management and climate change adaptation measures that will ensure risks are held at, or reduced to, acceptable levels. These measures, and related strategies, will help strengthen decision making processes by requiring that specific programmes and projects include strategies and measures to manage risks associated with extreme events and with climate change and variability. Such mainstreaming can also be facilitated by undertaking institutional strengthening and reforms that result in economic ministries having a mandate and responsibility for ensuring that disaster reduction and climate change are reflected in national policies, plans and programmes.

Summary and Conclusions

Risk management is one of several fundamentally important strategies that facilitate a fully integrated approach to sustainable development. In most economies it already plays a central role in addressing threats and barriers to sustainable development, including management of financial risks, human health risks, biosecurity risks, agricultural risks, risks in the transport sector and energy supply risks. The economic, social and environmental risks associated with disasters (be they natural or human-induced) and climate change and variability should be added to this risk portfolio, and managed as an integral part of national and community development planning. This is the key to successful mainstreaming of an integrated approach to disaster risk management and adaptation to climate change.

Countries of the Pacific Islands Region have made substantial progress towards achieving this goal, having developed clarity in conceptual thinking across the spectrum of relevant policy and management constructs, and proficiency in the practical application of these concepts and the supporting methodologies and tools. This is in part a response to the frequent disasters, the high natural variability in both atmospheric and marine conditions and the extreme vulnerability and degraded resilience of many small island ecosystems . The serious consequences that have been experienced in the past, or are anticipated for the future, also provide substantial motivation.

As a result of this experience and understanding it has been possible to develop an integrated conceptual framework, and practical policy and management strategies, methods and tools, to address the major environmental and related challenges facing the Pacific Islands Region. Climate Change Adaptation through Integrated Risk Reduction (CCAIRR) is an integrated package that can be customized to meet the specific needs and capacity of a given end user. CCAIRR views adaptation as the means by which risks associated with the full spectrum of hazards, from extreme events to the consequences of long-term climate change, can be

managed in a holistic manner as an integral part of community and national development planning. The ultimate goal of CCAIRR is to mainstream both disaster risk management and adaptation to climate variability and change, in a mutually consistent and supportive manner. The key is ensuring that both disaster reduction and adaptation are integral components of community and national risk management strategies and, in turn, of community and national development planning processes.

Annex 1

Evolution of Integrated Conceptual Frameworks, Methods and Tools

Integration and Mainstreaming of Disaster and Climate Change Response Strategies.

For almost a decade, it has been argued that an "optimal response" to climate change by Pacific Island Countries should be one that will enhance the resilience and decrease the vulnerability of both environmental and socio-economic systems through active and integrated programmes of development planning, environmental management and disaster reduction that reduce vulnerability and enhance resilience to disasters and to undesirable change (see Figure 3). Such an approach has the key advantage of mainstreaming climate change response strategies (Hay, 1997).

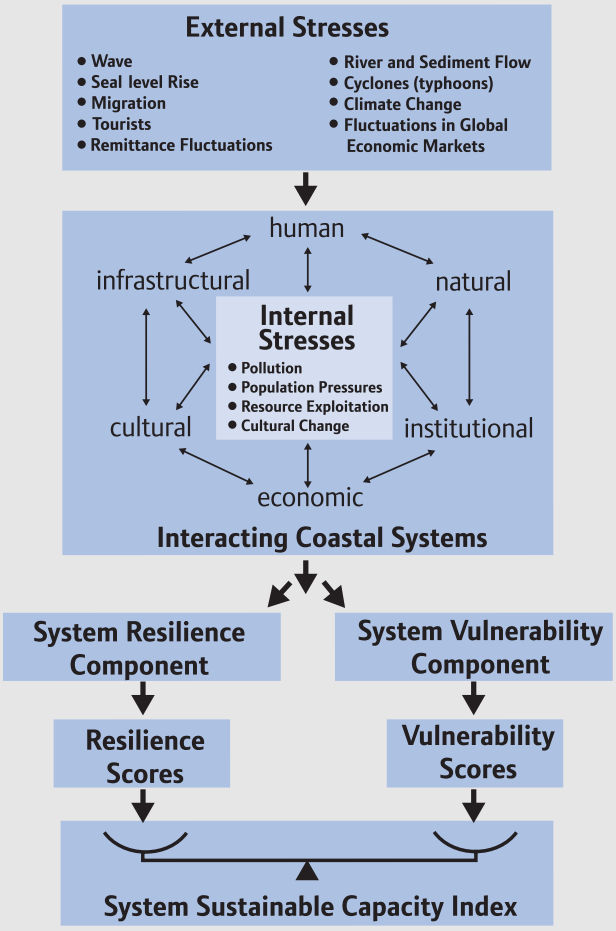
Integrated Assessment of Vulnerability and Resilience

These concepts, plus difficulties experienced in applying the IPCC Common Methodology (IPCC, 1991; IPCC 1992) to Pacific Island countries (Kaluwin, 1993; Kay and Hay, 1993), resulted in development of a broader assessment and decision-making support framework appropriate to the South Pacific, and even more widely applicable. The resulting Stress-Response Methodology for the Assessment of Vulnerability and Resilience to Sea Level Rise and Climate Change (Kay and Hay, 1993; Kay *et al*, 1993) is illustrated in Figure A1.

The assessment is conducted in terms of both external and internal stresses on biophysical and socioeconomic systems. In addition to climate and sea level changes, the external stresses typically evaluated include waves, tropical cyclones, fluctuations in global economic markets and foreign tourist activities. Internal system stresses, such as those resulting from population growth, natural resource depletion, pollution and cultural changes are implicitly considered in the decision support framework.

The approach is similar in concept to the interacting systems approach for the decisions to mitigate potential climate change impacts on Caribbean islands (Engelen *et al*, 1992). The methodology thus views a study area as a set of separate, but interacting systems (example natural, institutional, economic, cultural, infrastructural). This facilitates a flexible, non-prescriptive method for analysing the diverse systems of the Pacific region, recognising the distinctive attributes described above (Kaluwin, 1993). The vulnerabilities and resilience of the study area are analysed separately in the Stress-Response Methodology. This is an artificial separation undertaken in order to clarify the range of management responses available to reduce further impacts relating to climate change and sea level rise.

Figure A1: Framework of the stress-reponse methodology for assessing the vulnerability and resilience. Example is application to coastal systems (from Kay and Hay, 1993)



As a result, impact reduction responses are divided into measures for vulnerability reduction and resilience enhancement. The term "vulnerability" is used in the methodology to describe the attributes of a system which will react adversely to the occurrence of external or internal stresses. Such attribute responses will generally produce a negative outcome. The term "resilience" is used in the opposite sense to vulnerability – resilient attributes of a system will typically reduce the impact of internal and external stresses. Resilient system attributes can be intrinsic characteristics which allow adaptation to stress, or be conscious adjustment decisions and actions taken by people in order to reduce adverse impacts.

Qualitative scores are assigned to the vulnerable and resilient components of each coastal system, collectively for both internal and external stresses. Separate scores are assigned for present day and for the assumed future conditions. The net impact on the system as a result of external and internal stresses is the net difference between the system's vulnerability and resilience scores. This net system impact for either present day or future conditions is interpreted to be a measure of the system's ability to cope sustainably with stress. Accordingly, a net value is termed the "sustainable capacity index". The concept of sustainability was introduced to highlight the need for long term viability of systems, as shown by the difference between the vulnerability and resilience scores.

Future conditions include the additional stresses associated with climate change and sea level rise, cumulative consequences of ongoing internal and external stresses, and assumed intrinsic changes to the system being assessed. Thus the assessment framework considers realistic and evolving conditions in the study area.

Future condition vulnerability and resilience scores are assigned for two alternate management intervention scenarios. The "no incremental management" scenario assumes no action will be taken by decision makers and managers to reduce the impact of stresses in addition to those exerted on the present coastal system. In contrast, the "optimal management response" scenario assumes a suite of management interventions will be undertaken in order to optimise the reduction of stress-induced impacts on coastal systems. These may include national coastal management and disaster management policies and plans, and education and training of community level decision makers.

A number of shortcomings in the prototype Stress-Response Methodology were identified and addressed in subsequent applications (example Nunn *et al*,1993; 1994a; 1994b; Yamada *et al* 1995). These included the subjectivity in assigning the vulnerability and resilience scores to individual system components, the penalties of working with only six levels of system components as opposed to aggregating the scores for sub-system elements, the failure to acknowledge explicitly the non-linear interactions between system components and the ongoing difficulty of quantifying intrinsic values and valuing elements of subsistence societies.

Vulnerability Indices

Pernetta (1988) developed a relative index of susceptibility to climate change and sea level rise. The index was based on an approximate equal weighting for altitude, island numbers, total land area and island type. It was applied to Pacific Island Countries, allowing them to be grouped into four susceptibility categories. Based on the classification, states such as the Marshall Islands, Tuvalu and Kiribati would suffer "profound" impacts from global warming, including disappearance in the worst-case scenario; "severe impacts" resulting in major population displacement would be experienced by the Federated States of Micronesia, Nauru and Tonga; "moderate to severe impacts" would be felt by Fiji and the Solomon Islands; and "locally severe to catastrophic" effects would be experienced by Vanuatu and Samoa.

A more complex index, the Environmental Vulnerability Index (EVI), has been developed by Kaly *et al* (1999). It is designed for small island states, and particularly those for which data availability is limited. The index incorporates climatic, non-climatic and human-induced stresses on the environment and seeks to reflect relative vulnerability as a function of these combined factors. The EVI utilises a large number of variables (49 in all). It is argued that a large number of indicators is required because of the complex ecological systems. Each indicator is measured along a seven-point scale, with seven representing the highest incidence and one the lowest. A sub-set of indicators is used to measure the level of risks (or pressures) which act on the environment, forming the risk exposure sub-index (REI). Another sub-set of indicators is used to measure the intrinsic resilience of the environment to risks (IRI). A third sub-set is used to measure extrinsic vulnerability, forming the environmental degradation sub-index (EDI) which describes the ecological integrity.

Hazard Mapping

Coastal hazard mapping is used to provide a rational basis for assessing the relative risk to life and property posed by coastal hazards, including landward migration of the shoreline due to relative sea level rise (Gibb, 1983).

Risk Assessment

Jones *et al* (1999) describe and apply a risk assessment methodology that aims to maximise benefit and minimise loss by assessing the likelihood of possible future outcomes and by using this information to influence changes in behaviour involving both adaptation and mitigation of climate change. The method is an explicitly iterative rather than linear assessment that determines how to achieve or avoid transgressing given thresholds. Impacts that are sensitive to climate are identified and thresholds in the form of limits or benchmarks are established. Impact thresholds can be grouped into two main categories:

- Biophysical thresholds that mark a physical discontinuity on a spatial or temporal scale; and
- Behavioural thresholds where reaching a particular environmental, economic or other state triggers a change in behaviour.

Thresholds can be either an absolute value or a rate of change over time. By comparing a threshold with climate change scenarios it is possible to determine the probability of that threshold being exceeded at any time in the future. Stakeholders not only have a role in identifying thresholds and determining whether the

risk posed by exceeding a threshold warrants intervention, but also in identifying the key climatic variables that cause the impacts being considered and also suggesting interventions that can be the subject of further analysis. These interventions can be designed either to reduce the likelihood that a threshold will be reached or to raise the threshold itself.

Jones *et al* illustrate application of their risk assessment methodology using two hypothetical impact thresholds relating to sea level rise and coral reefs and for global scenarios with and without implementation of the Kyoto Protocol. They identify two related hazards that may combine to place the hypothetical coastline under a greater threat than that posed by each risk on its own, and two given thresholds based on an assessment of the potential impacts. The thresholds are an atmospheric concentration of CO_2 of 560 ppm (based on evidence that an atmospheric content of CO_2 of 560 ppm, twice the pre-industrial level, leads to a reduction in the calcification of reefs and benthic calcifying communities of 17-35 per cent; this may reduce the ability of a reef to grow fast enough to protect the coastline under sea-level rise and/or to produce sufficient sediment to achieve the necessary rate of island accretion) and a sea-level rise of 50 cm (identified in consultation with planners, engineers and other stakeholders as a critical threshold for the hypothetical coastline).

Ranges for both thresholds at given times in the future are established, using the uncertainty estimates in the global scenarios. The ranges are assumed to have uniform probability, that is, the probability of the extremes of the range are just as likely to occur as the median value. Monte Carlo sampling is then carried out within these ranges to determine the probability of both thresholds being exceeded at the same time.

The results are shown in Table A1. They show that the thresholds are largely unmet by 2050, but by 2075 the sea level rise threshold is exceeded in over 20 per cent of cases and atmospheric CO_2 in over 60 per cent of cases, for a combined risk of 16 per cent of cases. By 2100 the combined thresholds are exceeded in over 40 per cent of cases. When the Kyoto Protocol modified scenarios are applied, the decreased risk ranges between 0 and 15 per cent for individual thresholds. The risk of both thresholds being exceeded simultaneously drops by 9 per cent and 6 per cent in 2075 and 2100, respectively.

Table A1: Risk of Threshold Excedence for a Sea Level Rise of 50 cm, an Atmospheric CO_2 Content of 560 ppm, and their Combined Risk, in Percentage, for 2050, 2075 and 2100, according to the IS92a-f and IS92a-f Kyoto Protocol Modified Scenarios

	50 cm Sea Level Rise	Atmospheric CO_2 of 560 ppm	Combined
IS92a-F			
2050	0	3	0
2075	22	63	16
2100	52	81	44
IS92a-f Kyoto Protocol			
2050	0	0	0
2075	15	48	7
2100	47	81	38
Difference			
2050	0	-3	0
2075	-7	-15	-9
2100	-5	0	-6

Source: Jones et al 1999

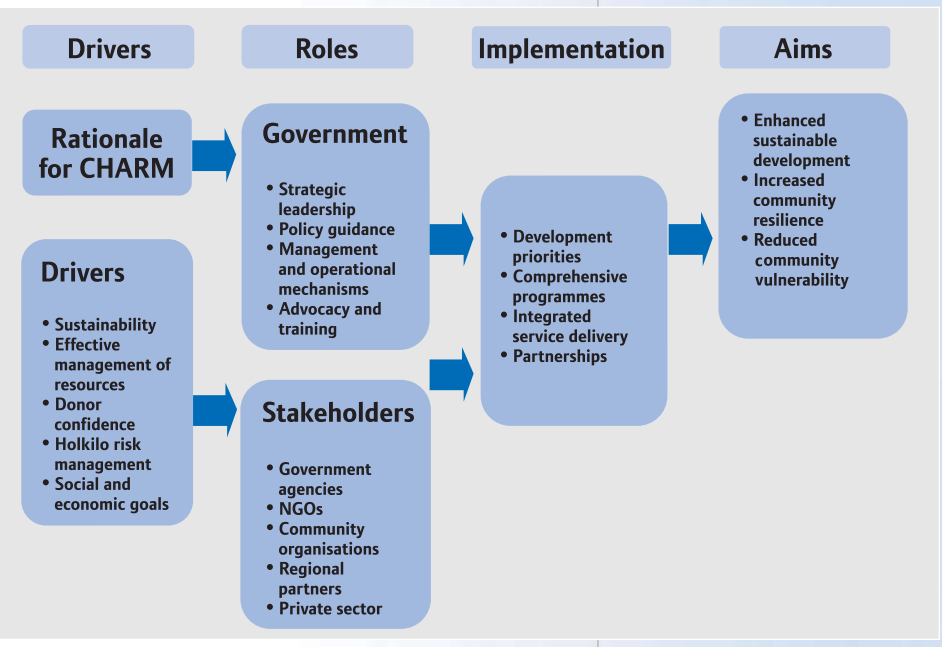
The findings demonstrate that where the upper limit of possible climate change is reduced through mitigation, as is the aim of the Kyoto Protocol, risks will tend to be reduced. However, the effect of the Kyoto Protocol on risk, as suggested in Table 4, is minimal. Therefore a substantial investment in adaptation is required if identified risks are to be addressed. Table 4 indicates that the two thresholds may be exceeded some time between 2050 and 2075, with adverse impacts being highly probable by 2100. Implementing the Kyoto Protocol reduces the risk by less than 10 per cent or, alternatively, delays exceeding the threshold by less than a decade. The time period between the current situation and when the critical threshold is exceeded becomes the "window for adaptation", providing an insight to the scale and timing required to adapt.

Comprehensive Hazard and Risk Management

At the 1995 Pacific Islands Forum Meeting, national leaders developed a regional vision – overcoming vulnerability to the effects of natural hazards, environmental damage and other threats. Achievement of the vision requires integration of effective risk and vulnerability reduction strategies within regional and national development plans. To facilitate a regional response to this challenge, the three year South Pacific Disaster Reduction Project was assimilated within a new regional Disaster Management Unit. The Unit coordinates regional activities in order to add value to national disaster management programmes directed at reducing vulnerability. It also liaises with regional response agencies in order to ensure that key lessons learned from emergency responses become well known within the region and are incorporated in the disaster management strategies of all countries.

As part of its efforts to assist Pacific Island Countries, the Disaster Management Unit, located in the South Pacific Applied Geosciences Commission (SOPAC), developed guidelines for comprehensive hazard and risk management (CHARM). The CHARM Guidelines are designed to move the hazard and risk management approach away from solely being response and relief toward a more holistic risk management containment strategy that is linked intrinsically to national development planning. Although effective response and recovery mechanisms are important, there needs to be a balance whereby risk is minimised through deliberate, proactive and planned sustainable mitigation efforts. The critical ingredients of CHARM are that it has a holistic programming focus, it seeks to involve national and regional partners in collaborative efforts and it is modelled on the Australian and New Zealand joint standard 4360:1999 to ensure it meets accredited standards and is thus recognised regionally and internationally (Figure A2).

Figure A2: The rationale for CHARM, and its integration with national development planning

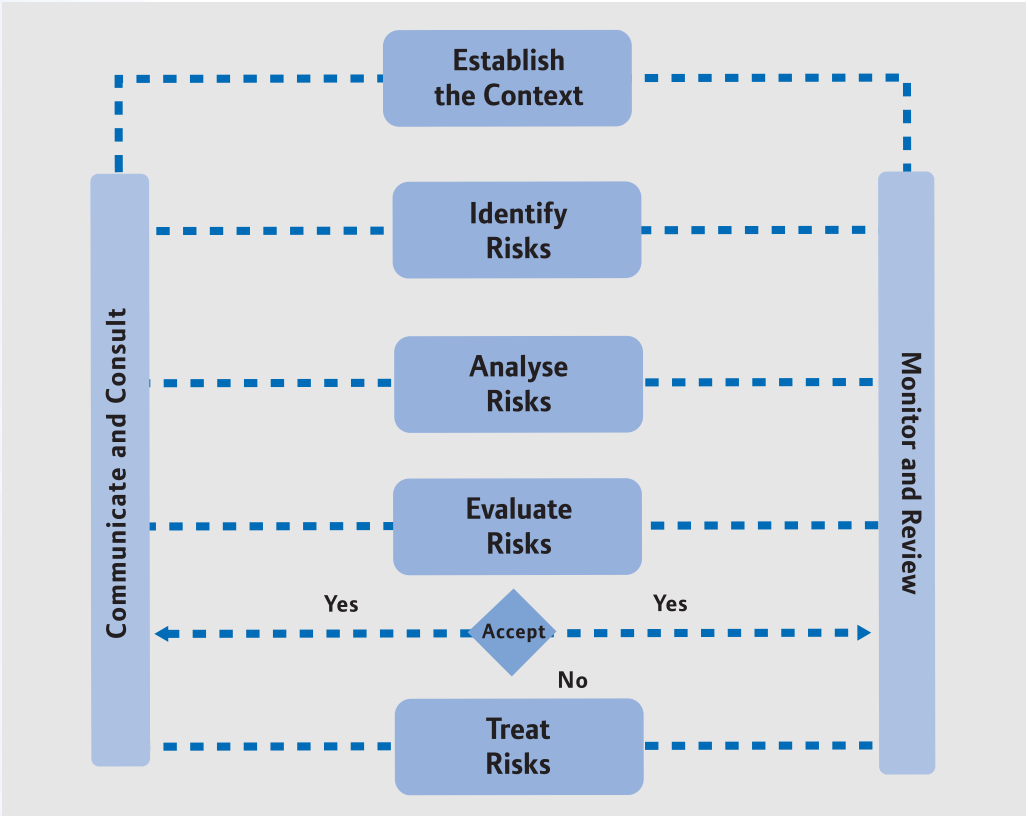


The major goal of the Pacific CHARM model is to develop a national risk and treatment option matrix that incorporates the activities of all agencies (Figure A3). CHARM targets the identified gaps in the matrix. The key steps of the CHARM process are shown in Figure A4.

Figure A3: Example of CHARM national risk and treatment option matrix, from SOPAC (undated)

Primary Hazard	Secondary Hazard	Vulnerable Sector	Scope of Impact	Potential Risks	Treatment Options	Develop Programme (Gap Analysis)	Links to Regional Partners	New Projects (Fill the Gaps)

Figure A4: Key steps in the CHARM process, from SOPAC (undated)



Integrated Assessment and Modelling

The numerous and well-developed interactions between the natural and human systems of island countries means that integrated assessments, and the tools to support them, are of particular relevance (Hay *et al*, 1995). One such tool that has proved particularly beneficial is VandaClim, an integrated assessment model based on the imaginary island country of Vanda (Warrick *et al*, 999). The model was developed by the International Global Change Institute (University of Waikato, New Zealand), in collaboration with the South Pacific Regional Environment Programme (SPREP) and United Nations Institute for Training and Research (UNITAR), as a tool to support training and other capacity enhancement activities related to the Pacific Islands Climate Change Assistance Programme (PICCAP) and other regional and international initiatives. Development of VandaClim involved linking a regional climate change scenario generator with selected impact models for four key sectors.

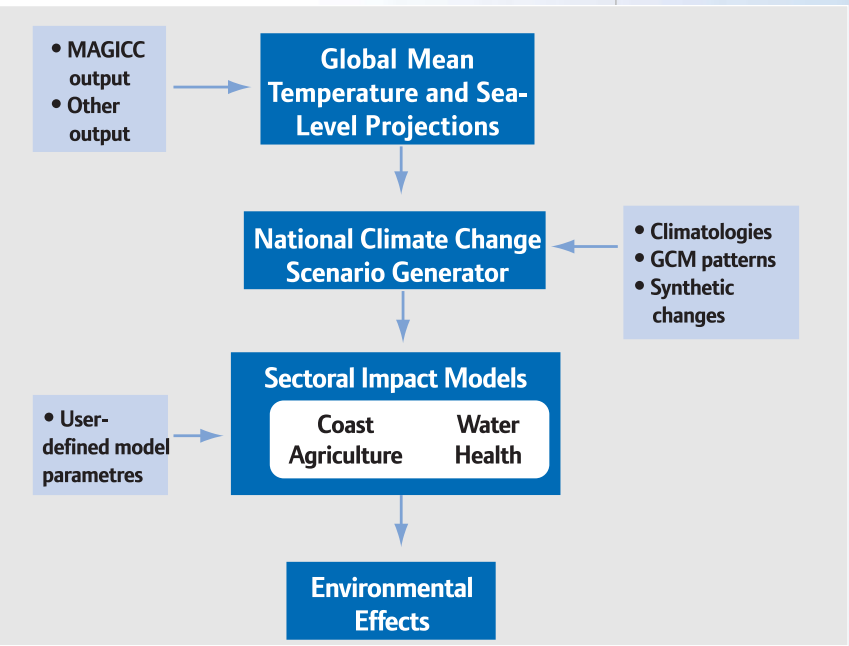
The main components of VandaClim are:

- Time-dependent (1990-2100) projections of global mean temperature and sea level change;
- A regional climate change scenario generator; and
- Sectoral impact models, including impact models for agriculture, coastal zone, human health and water resources (Figure A5).

The user thus has considerable flexibility in generating scenarios, being able to choose among a large range of projections from greenhouse gas emission scenarios; the low, mid or high cases from each projection (which encompasses the range of uncertainty in model parameter values); several global climate model patterns; and the year of interest (in five-year increments from 1990-2100). A wide range of models is available for use in vulnerability and adaptation assessments of agriculture. These range from relatively simple biophysical indices to complex process-based models. Two methods for assessing impacts of climate change and sea level rise on the Vanda coast have been incorporated into VandaClim:

- A variant of the 'Bruun Rule', suitable for assessing time-dependent erosion of beach and dune systems; and
- A simple inundation model ('drowning' concept) suitable for the flat, low-lying deltaic coastal plains.

Figure A5: Structure of VandaClim



Health impacts can be examined using a biophysical index which estimates potential incidence of malaria as influenced by temperature and rainfall and a simple threshold index for estimating change in risk of cholera outbreaks as a result of extreme flooding. For water resources three models are included: an atmospheric water balance model for assessing the water resource situation for the country as a whole; a water balance river discharge model that is used for estimating monthly mean discharge for evaluation of wet and dry season river flow, and a discharge-flood area model that is used for the areal extent of flooding.

VandaClim is one component of model system with a nested capacity for multi-scale spatial and temporal analyses – regionally, nationally, sub-nationally and at individual sites (Kenny *et al*, 2001, Warrick, 2002). For example, PacClim was created as a regional climate change scenario generator for the Pacific Islands Region, as part of PICCAP. PacClim was designed to meet the need for generating consistent, comparable scenarios for the many island countries scattered across the Pacific. Individual island models, such as FijiClim, were developed to examine in detail the implications of climate change for individual islands.

The integrated assessment models have proven their use across the spectrum of impact assessment and adaptation evaluation studies, including:

- Characterising and examining baseline climates and marine conditions, including variability and extremes;
- Creating climate change and sea level rise scenarios;
- Evaluating impact models;
- Conducting sensitivity analyses;
- Projecting sectoral impacts of climate and sea level variability and change;
- Examining uncertainties; and
- Facilitating integrated impact analyses and adaptation evaluations (Warrick, 2002).

The model system is currently being extended to include:

- Human dimension elements – spatially-related demographic, land use and infrastructure data linked to biophysical impacts arising from climate and sea level variability and change;
- Non-climatic scenario generator – vulnerability of islands is also affected by changes in land use and by socio-economic development; it is important to understand the relative importance and roles of climatic and non-climatic factors when considering adaptation, especially in the wider context of sustainable development;
- Adaptation options – a more explicit, systematic treatment of adaptation will give the user the opportunity to examine and evaluate a range of options;
- Economic tools – recent work in the Pacific has shown promise in applying relatively simple economic

tools to climate change problems (World Bank, 2000); incorporation of such tools into the integrated model system will facilitate integration across sectors, by expressing a range of impacts (but not all) in monetary terms.

- Transient mode – current models allow time slice comparisons (example 1990 versus 2050) only; an alternative approach is to run the models year-by-year; running models in transient mode provides the potential for superimposing the variability (including extremes) of climate (and/or sea level) on the change in mean conditions over time, allowing improved quantification of impacts and assessment of adaptation options.

- Open architecture – these features are designed to enable users to, for example, define their own geographical boundaries and spatial resolution, enter spatial climatologies and add down-scaled results from global climate models (Warrick, 2002).

Only three examples of the benefit of using this capability for integrated assessment modelling will be presented here.

In Fiji, the yield of dalo (that is, taro, an important commercial and subsistence root crop) is highly sensitive to weather and climate conditions, especially accumulated rainfall (Figure A6). This and other environment-crop relationships are incorporated in FijiClim, allowing the assessment of crop productivity under current and projected climatic conditions, including those associated with specific stages of the ENSO cycle. Figure A7 shows the areas where there is a high risk of the dalo crop failing under present day (1990) normal and El Nino (drought) conditions, as well as under El Nino conditions in 2050.

Figure A6: Yield of dalo (taro) for given seasonal rainfall amounts

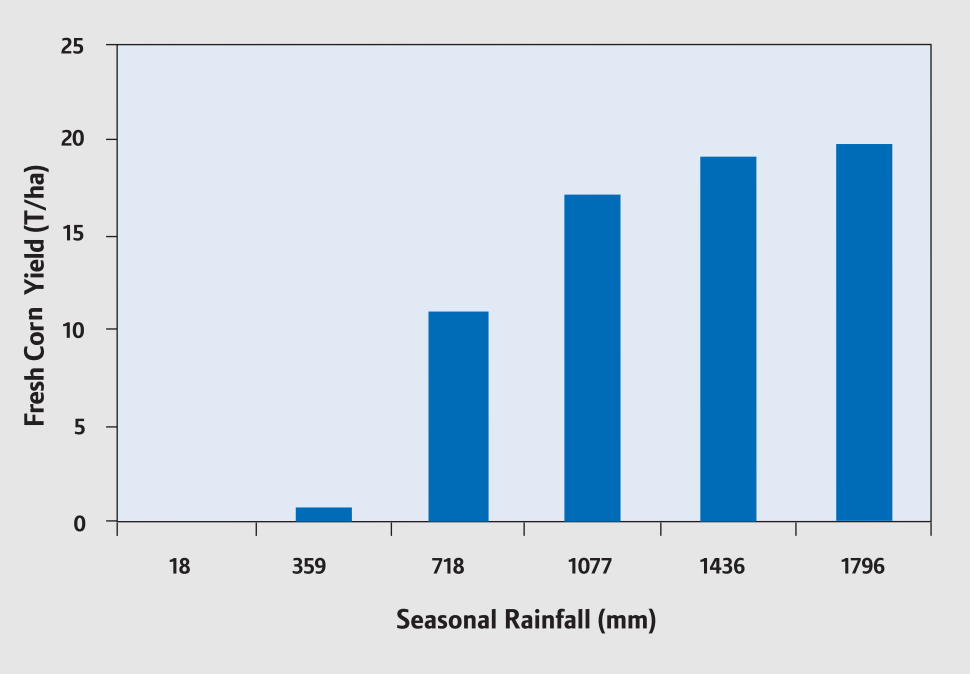
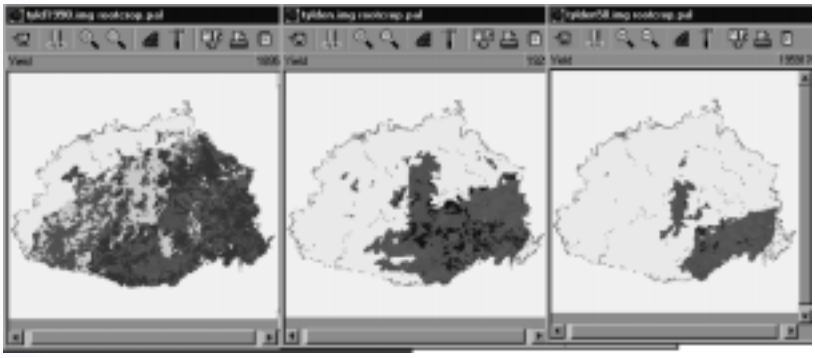


Figure A7: Areas with high risk of the dalo crop failure under present-day (1990) normal and El Nino (drought) conditions, as well as under El Nino conditions in 2050

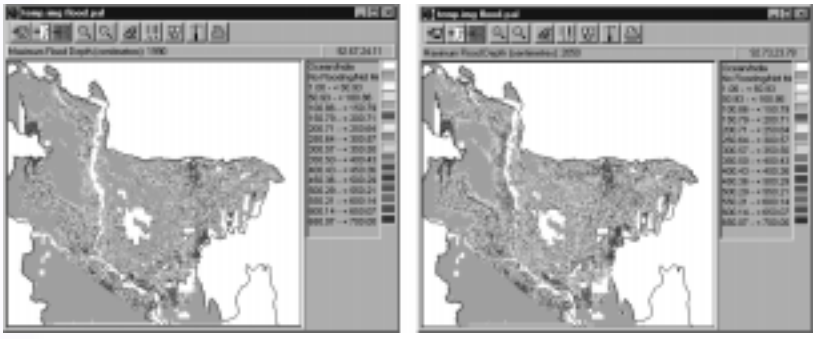


1990 Current El Nino 2050 El Nino

In Bangladesh, a recurrent environmental problem is widespread – over-bank flooding from the Ganges, Brahmaputra and Meghna river systems. The integrated assessment model BDClim was developed collaboratively with the Bangladesh Unnayan Parishad, providing the capability to investigate the possible effects of climate change on the depth and areal extent of flooding within the country, taking into account changes in climate and runoff over the vast river basins that feed into Bangladesh (Figure A8).

Figure A8: Depth of a one-in-20 year flood event in Bangladesh, under current and projected (2050) conditions

Current situation 2050



The model has been used, for example, by the World Bank in examining how climate change could impinge on development projects in Bangladesh, over the long term (Smith *et al*, 1998).

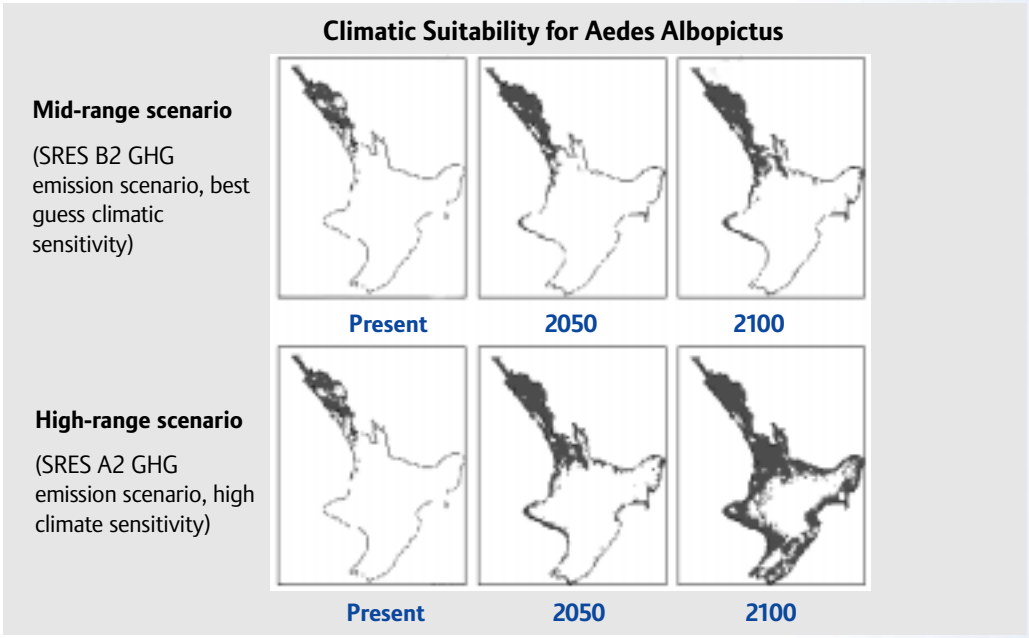
Finally, Figure A9 shows an example of the output from HOTSPOTS, an impact sub-model designed to characterise and examine the potential risk of dengue, a vector-borne disease, not yet occurring in New Zealand. Currently dengue does not occur in New Zealand, but the recent appearance of a number of invasive species suggest that it may well occur in the future, with continued global warming. In order to address this issue spatially, and help identify where preventive bio-security strategies might focus, the model overlays components dealing with the mosquito vector population, human population and virus introduction. The results indicate that climate change could increase substantially the risks of survival and persistence of an

effective vector (especially *Aedes albopictus*) in the North Island of New Zealand. (Figure A9) (de Wet *et al*, 2001).

Adaptation

Two factors make adaptation unavoidable. Even if global greenhouse gas *emissions* were to be stabilised near their current levels, *atmospheric concentrations* would increase throughout the 21st century, and would continue to increase slowly for several hundred years afterwards. Substantial cuts in emissions, estimated to be at least 60 per cent, are necessary to stabilise greenhouse gas concentrations in the atmosphere. But in reality, reductions in ongoing emissions will be small – implementation of the Kyoto Protocol will lead to a 5.2 per cent reduction, at best, with little reduction in risk to key biophysical and human systems, as was demonstrated in the example provided above.

Figure A9: Impact of changed climatic conditions in the North Island, New Zealand, on the survival of *Aedes Albopictus*, a mosquito vector for dengue fever. Use of mid- and high-range climate change scenarios provides an indication of both sensitivity and uncertainty (from de Wet *et al*, 2001)



The second factor is the serious consequences of climate change for Pacific Island Countries, as summarised in the previous section. While there are significant uncertainties as to how the climate will change, both globally and in the Pacific Islands Region, and what the precise consequences might be, it is wise to develop and implement policies and plans that will ensure timely adaptations that reduce or even prevent the adverse effects of climate change.

Therefore an anticipatory approach that is initiated as soon as possible is prudent, for five principal reasons:

- If adaptation is reactive, as opposed to anticipatory (Figure A10), the range of response options is likely to be fewer; adaptation may also prove more expensive, socially disruptive and environmentally unsustainable;

- Many adaptation strategies are consistent with sound environmental management, wise resource use, and are appropriate responses to natural hazards and climate variability, including extreme events – such "no regrets" adaptation strategies are beneficial and cost effective, even in the absence of climate change;

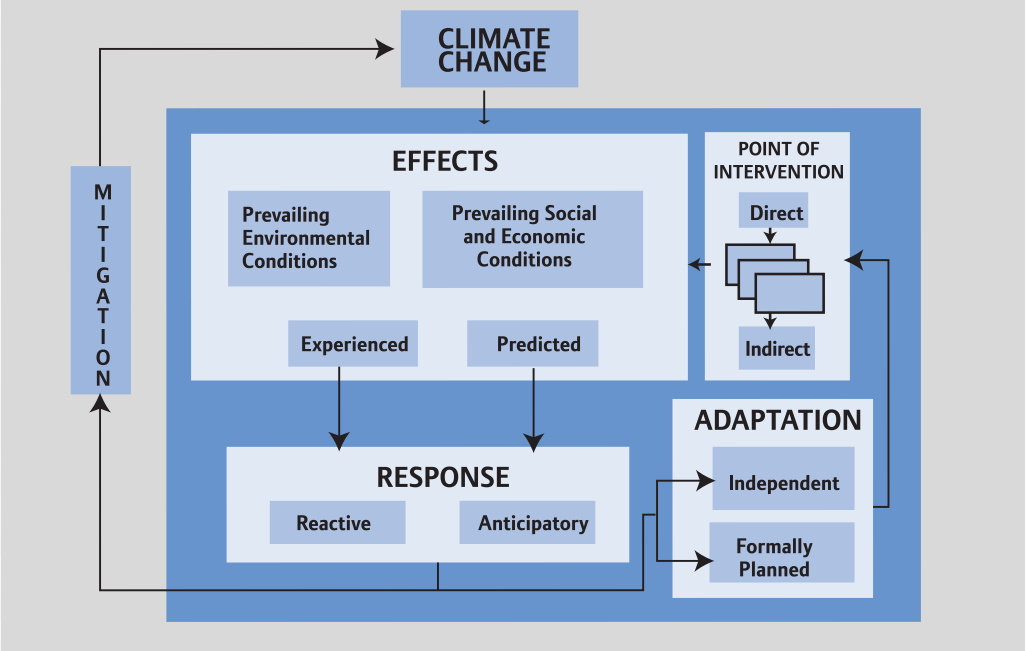
- Many development plans and projects that are currently under consideration have a life expectancy that requires future climate conditions and sea levels to be given due consideration;

- Climatic suitability for *Aedes Albopictus*;

- Pacific Island Countries depend heavily on valuable and important ecosystems that are sensitive and hence vulnerable to climate change – it is easier to enhance the ability of ecosystems to cope with climate change if they are healthy and not already stressed and degraded; and

- Adaptation requires enhancement of institutional capacity, developing expertise and building knowledge – all these take time.

Figure A10: A generalised model of adaptation as a response to climate change effects.



This model shows that adaptation can be reactive or anticipatory, independent or official, and can be implemented at a variety of points of intervention in relation to the effects of climate change.

Whether adaptation is anticipatory or not will depend on decision makers being aware of the likely effects of climate change and of the options that are available to enable an adaptive response to be planned (from Hay *et al*, in prep). People will, as a result of their own resourcefulness or out of necessity, adapt to climate change, based on their understanding and assessment of the anticipated or observed effects, and on the perceived

options and benefits for response. This may be considered to be *independent adaptation*.

The entities who adapt in this way may be individuals, or members of groups such as households, extended families, clans, village or island councils, businesses, or in some cases, governments. This contrasts with *formally planned adaptation* that involves deliberate policy decisions, plans and implementation by *external* parties.

In many cases independent adaptations will be adequate, effective and satisfactory. However, under some circumstances independent adaptation may not be satisfactory or successful, often for one or more of the following reasons:

- Understanding of climate change effects may be limited or even erroneous;
- Understanding of the possible adaptation options may be limited or defective;
- Adaptation responses undertaken by one group may impact adversely on another group;
- The needs of future generations may not be taken into account;
- There may be cultural constraints to certain adaptation responses;
- Individuals or communities (or other groups or institutions) may not have adequate resources to implement the most desirable adaptation measures; and
- It may be more cost effective, and in other ways more efficient and effective, to implement certain adaptation responses on a more collective basis, rather than at the level of the individual or community.

In *formally planned* adaptation, the role of an external entity, such as central or local government, can be to facilitate the adaptation process to ensure that the above mentioned obstacles, barriers and inefficiencies are addressed in an appropriate manner. In the context of Pacific Island Countries this would include:

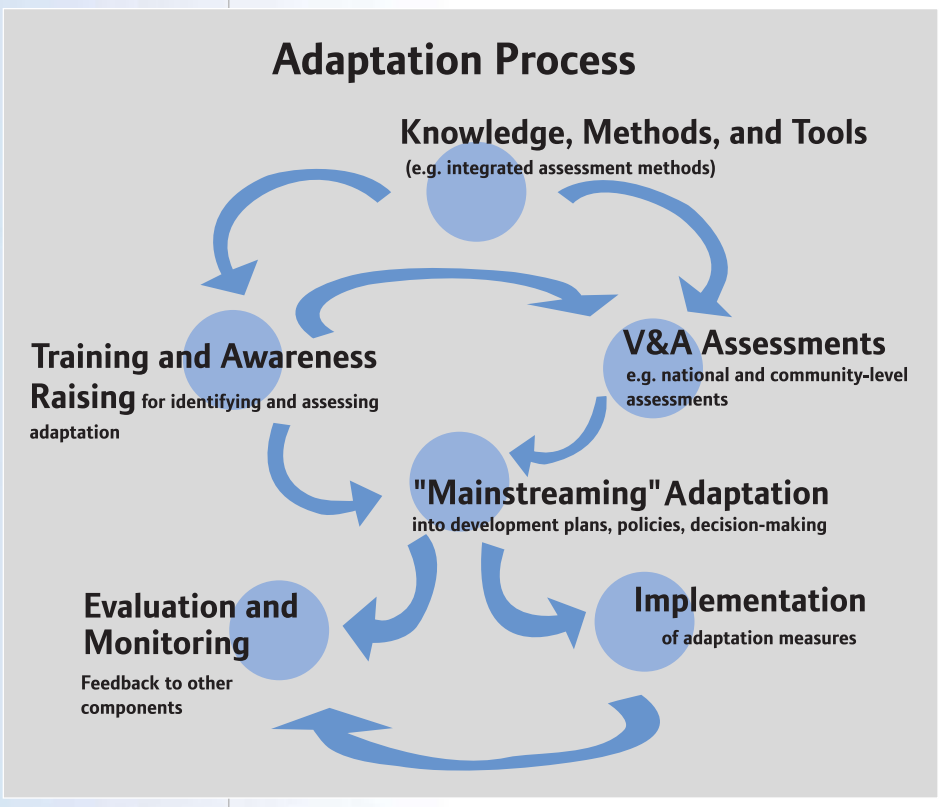
- Facilitating adaptation through the provision of information about climate change processes, effects and adaptation options;
- Through the provision of financial, technical, legal and other assistance, facilitating the implementation of adaptation options where those affected, such as communities or other organisations, do not have the resources to adapt effectively;
- Implementing adaptation options directly where the scale of response is most appropriately at a national level;
- Ensuring that adaptation options implemented do not have adverse environmental, social, economic or cultural outcomes; and,
- Ensuring that there is equity in the adaptation process and that some individuals are not unfairly affected

either by the effects of climate change or as a result of adaptive actions.

Of course, governments must also take adaptive actions where their own property, resources and services are likely to be adversely affected by climate change.

Clearly, adaptation is considerably more than a discrete measure or action and is best seen as a multi-dimensional, evolving and dynamic process (Figure A11). This means that the definition of adaptation should be extended to include all the components that are involved in this wider process that would allow Pacific Island Countries to become more resilient to the effects of climate change.

Figure A11: Adaptation as a process. From Hay *et al*, in prep, courtesy of R.A. Warrick.



Firstly, for adaptation initiatives to be successful they must be founded on a solid knowledge base provided by comprehensive assessments of both the vulnerability to climate change, and of potential adaptation options. This requires professional training leading to development of in-country professional capacity to undertake climate change impact assessments and assessment of vulnerabilities. Building knowledge and capacity requires the development and application of a range of methods and tools that help further the understanding of climate change impacts, vulnerability and adaptation. In addition to this, increasing public awareness and knowledge is an essential component that empowers individuals, communities and governments to develop and implement appropriate adaptation measures and facilitate the mainstreaming of adaptation measures. To ensure the sustainability, appropriateness and effectiveness of adaptation measures there is also a need for ongoing evaluation and monitoring following implementation.

Finally, such *formally planned* adaptation initiatives and processes should not occur as isolated activities. Instead they should be "mainstreamed" and implemented as an integral part of national and community development planning, environmental management and disaster management (see Figure 3).

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Establishing a Common Ground to Bring Together Disaster Reduction and Climate Change Communities – Challenges and Opportunities

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Abstract

The essential difference between present and future climate is expected to be in terms of intensity and frequency of occurrences of climate extremes. The planned adaptation is now recognised as a necessary strategy to reduce societal vulnerability to present and future climatic hazards. This shift in emphasis provides opportunities for both climate change and disaster reduction communities to join together to anticipate and manage present and future climatic hazards. Disaster reduction specialists have been acquiring valuable insights and experiences to reduce societal vulnerability to existing climate variability and associated risks. This could benefit the climate change community to draw appropriate lessons to design and implement planned adaptation strategies to respond to anticipated climate risks. This paper suggests a strategic framework to enable both communities to move forward to formulate and implement locally relevant adaptation plans.

Climate Change Debate – Evolutionary Trends

For most of 1990s the climate change debate centred around stabilisation of greenhouse gases (GHG) concentration into the atmosphere. Hence climate change mitigation has been advocated as a major policy intervention. However, in the late 1990s, the climate change debate recognised the inevitable consequences of human induced impacts on climate, regardless of achieving the target of stabilisation of GHG emission.

Hence adaptation has been recognised as a necessary strategy to complement climate change mitigation efforts. However, operationalising of adaptation strategies into national policy and programme instruments proved to be difficult in view of uncertainties associated with climate change impact scenarios.

In this context, the recommendations of Third Assessment Report (TAR) of the IPCC assume significance. The TAR notes that *enhancement of adaptive capacity should serve to reduce the vulnerability of regions and sectors to climate change, including climate variability and extremes and can therefore be seen as supportive of ongoing attempts at sustainable development. The TAR also recognises that experience with adaptation to climate variability and extremes can be drawn upon to develop appropriate strategies for adapting to anticipated climate change.*

These recommendations reveal the following:

- Enhancement of adaptive capacity to reduce vulnerability to climate change as well as to current climate variability and extremes;

- To draw lessons from the experiences of adaptations to climate variability and extremes to design adaptation strategies to anticipated climate changes; and

- Mainstreaming of climate change adaptation strategies into sustainable development process.

The latest shift in conceptual thinking on climate change adaptation issues as brought out by TAR broadens the scope for dialogue among climate change, disaster reduction, and sustainable development communities. This shift encourages all the communities to come together to evolve a pragmatic approach to convert a global concept into a locally actionable practice.

Natural Disaster Reduction – Evolutionary Trends

An exercise has been undertaken to trace the evolutionary trends with regard to natural disaster management policies and practices in Asia with reference to Bangladesh, India, Indonesia, the Philippines, and Vietnam. These countries are selected for the following reasons:

- These countries are subjected to periodic occurrences of severe climatic hazards;

- The livelihood opportunities of the majority of the population are dependent on agriculture;

- These countries also benefited from Green Revolution technologies in the mid 1970s; and

- These countries have attained independence from colonial rule in the late 1940s and initiated national building process around that time.

These exercises reveal the following general trends. Up to the 1960s, natural disasters were perceived as characteristics of natural hazards and beyond human control. Accordingly, major interventions were in the form of *disaster of response,* that is, action just prior to, during and after the occurrence of natural hazard events.

In the 1970s and 1980s, a shift in perception was evident. Governments perceived that recurrence of climatic hazards in specified locations as normal climatic feature. Hence the relevance of societal vulnerability has been recognised as a necessary pre-condition for natural hazards to precipitate disasters. Since then reduction of societal vulnerability to climatic hazards has been recognised as one of the major policy interventions. Efforts have been made since the 1990s to incorporate *disaster reduction* (disaster mitigation) into development planning processes to anticipate and reduce climatic hazard impacts. However, it must be emphasised that the national policy and institutional frameworks for disaster reduction are still far from perfect to anticipate and manage observed climate risks.

Convergence of Interests of Climate Change and Disaster Reduction Communities

These evolutionary trends indicate the emerging convergence of interests between climate change and disaster reduction communities. Disaster reduction communities have accumulated vast experience in evolving and implementing disaster reduction programmes. They are not only responding to disasters but also geared to evolve and implement anticipatory disaster reduction measures in a significant way. The climate change community is also concerned with anticipatory and planned adaptation strategies to address risks associated with climate change as well as current climate variability. Hence, there is a distinct possibility of joining together of these two communities to anticipate and manage natural hazards associated with the current and future climate variabilities and extremes.

The concept of adaptation is not new. However, the current emphasis on adaptation in the context of climate change does provide an opportunity to revisit some of the unresolved disaster reduction and sustainable development issues with urgency and renewed vigour.

Climate change poses a major threat to sustainable development. The extreme vulnerability of certain societies to present and future climate risks necessitates that climate change is treated not just as an environmental concern but as a developmental problem. This means that climate change, as an issue, must come out of the label of an environmental problem, to take the centrestage as a major development problem. As disaster reduction has already been recognised as a developmental issue, the coming together of climate change and disaster reduction communities is inevitable.

A Strategic Framework for Collaboration between Disaster Reduction and Climate Change Communities

Time has come to evolve a strategic framework to move forward to formulate actionable programmes. While this framework could be an evolving process, we suggest the following areas to initiate action:

Addressing Present Day Societal Vulnerability to Climate Variability and Extremes

The policy makers in most developing countries, at least in principle, recognised the desirability of incorporation of disaster reduction strategies into the development planning process to anticipate and manage known and

observed climate risks. Till reliable climate models provide area-specific climate change scenarios, it may not be possible to convince the policy makers in developing countries to adopt climate change focussed adaptation strategies to deal with unknown climate risks of an unknown future. Till such time the climate science provides region-specific climate change impacts, it would be desirable to initiate actions to address the present day climate variability and extremes. The implementation of planned adaptation strategies to reduce the present day societal vulnerability to climate variability and extremes would enhance the capacity of the vulnerable communities to withstand future climate change impacts. This approach also could contribute to a sustainable development agenda and have the chance of receiving acceptance at all levels.

The occurrence of extreme climate events and their impacts on society in certain locations due to climate variability could be easily identified. By way of illustration, the impact of ENSO on agriculture with respect to Indonesia and the Philippines are discussed in the succeeding paragraphs.

The cropped areas of the Philippines and Indonesia are subjected to climate variability, associated droughts and floods almost every year (Tables 1- 2). However, in Indonesia, a La Nina associated climate variability could amplify flood impacts at least twice more than that of most normal years, and drought impacts could be amplified around five times more than that of most normal years due to El Nino. Similarly in the Philippines while El Nino associated impacts amplify drought impacts around five times more than that of most normal years and La Nina could enhance typhoon impacts significantly.

These extreme climate events proved to be a serious set back to socio-economic developments of these countries. The climate change impact is expected to mimic El Nino and La Nina type impacts.

Table 1: Drought and Flood Impacts in the Last 10 years (1989-1998) in Indonesia

	Flood (ha)		Drought (ha)		Remarks
Year	Affected	Total damage	Affected	Total damage	
1988	130,375	28,934	87,373	15,115	La Nina
1989	96,540	13,174	36,143	2,116	
1990	66,901	9,642	54,125	9,521	
1991	38,006	5,707	867,997	192,347	El Nino
1992	50,360	9,615	42,409	7,267	
1993	78,480	26.844	66,992	20,415	
1994	132,973	32,881	544,422	161,144	El Nino
1995	218,144	46,957	28,580	4,614	La Nina
1996	107,385	38,167	59,560	12,482	
1997	58,974	13,787	504,021	88,467	El Nino

Table 2: The Impact of Typhoon/Floods and Drought on Rice and Corn Production in the Philippines – 1980-1999

(in Metric Tonnes)

	Typhoon/Flood		Drought	
Year	Rice	Corn	Rice	Corn
1980	77440	4000	13580	11710
1981	427770	69515	20550	3285
1982	237105	24875	52705	6775
1983	127035	555	590000	10005
1984	37140	10770	42675	69700
1985	196920	23730	21105	22075
1986	313635	25165	43105	36435
1987	123644	72219	170432	76733
1988	380501	43747	48552	4889
1989	245809	41461	3649	2154
1990	108234	40359	123131	171782
1991	152215	4029	15841	43480
1992	11425	650	78572	58165
1993	245929	2423	-	-
1994	112266	51846	85606	77009
1995	328136	21768	44686	22480
1996	72901	18170	1163	153705
1997	75109	1185	14879	14475
1998	1048327	115714	462443	505168
1999	318042	30509	1203	49

Source : Bureau of Agricultural Statistics, Department of Agriculture, Government of the Philippines

Likewise in most countries, low frequency but high magnitude extreme climate events could wipe out years of development progress. These events also deepen the poverty of already marginalised communities who have no choice but to live in these high risk areas. Climate change and the disaster reduction communities could join hands to evolve and implement adaptation strategies to enhance the resilience of these vulnerable communities to present day observed and known climatic risks. This approach could enable these communities to withstand future climate risks.

Sharing of Experiences

Disaster reduction communities have accumulated rich experiences over a period of many years in mainstreaming disaster mitigation into national development policies. Climate change communities could benefit from these experiences. The sharing of experiences could help prevent the new wheel-inventing process. By way of illustration, the following examples are given:

- Evolution of drought management and drought mitigation policies and programmes in India for managing periodic droughts and cropping pattern changes in Bangladesh to mitigate the impact of floods (successful adaptation practices);

- Evolutionary trends of institutional adaptation to manage water related disasters in Vietnam (so far partially successful and ongoing adaptation process); and

- Development induced maladaptation and increased vulnerability to droughts in semi-arid regions of India and flood-prone regions of Mekong delta in Vietnam (inappropriate adaptation practices).

Illustration 1: Evolution of Drought Mitigation Strategies in India

India is one of the most drought prone countries in the world. Out of 174 million ha of cropped area, 131 million ha falls in the semi-arid tropics in the country. Around 265 million people in rural areas are subjected to periodic droughts. Drought management has been one of the major development issue in India. After independence (1947), numerous strategies have been evolved to cope with droughts, a summary of the evolution of drought management and mitigation strategies since the 19th century is shown in Table 3.

Table 3: Major Elements of Drought Management in India: a Historical Perspective

Approach	Famine Relief	Scarcity Relief	Drought Relief	Drought Management	Monsoon Management
Time Period	Pre-independence era (pre-1940s)	Post-Independence and up to mid-1960s	From late 1960s to mid-1970s	Late 1970s to 1980s	1990s to present
Objectives	Minimise starvation deaths	Prevent starvation deaths	Ensure economic access to food	Preserve quality of life	Promote sustainable development
Intervention	Very late	End of harvest season	End of monsoon season	Within the monsoon season	Before, during and after monsoon session
Preparedness	Absent	Administrative arrangements	Food distribution network	Contingency crop /fodder/drinking water plans	Mitigation plans
Key Management Programs	Limited intervention to minimise deaths	Free kitchens, gratuitous relief	Employment generation programs	Crop stabilization	Watershed development programs
Administrative Approach	Famine Codes	Scarcity relief manuals	Drought relief manuals	Drought handbooks	Community based natural resource management practice
Episodes	Pre-Independence famine management	1965 to 1967 drought	1972 drought	1979 and 1987 droughts	Non-episode driven

Source: Subbiah 1992

The information provided in the table indicates that there is a gradual emergence of disaster reduction strategies since the 1980s to reduce societal vulnerability to droughts. It may be seen that all the responses before the 1980s were driven by major drought events. The monsoon management approach, evolved during the 1990s recognises that drought is a normal part of the climatic feature. Community based micro-watershed development programmes have been adopted as national drought mitigation practices and incorporated into national development planning. The gradual adoption of watershed programme as a drought mitigation strategy is shown in Table 4.

Table 4 : Progressive Adoption of Watershed Development Programmes for Drought Mitigation in India

Year	Number of Watersheds	Area Covered in hectares	Financial allocation (in million Rs)
1975	1	450	2
1980	47	2500	104
1985	99	90000	560
1990	3000	3000000	20000
1995	10000	10000000	50000
2000	20000	20000000	70000

Illustration 2: Changing Cropping Pattern in Bangladesh

Bangladesh, being a flood prone country, has evolved a crop diversification strategy to grow less and less crops during the flood period (June to September) and more crops during the flood-free winter season (October to March). The area under aus cropping which is a high flood risk crop has decreased and the area under boro cropping which is grown during flood free season increased.

The cropping system changes (Table 5) in the last three decades, aided by technology and development programmes, have helped the Bangladesh community to withstand one of the worst floods in 1998.

Table 5 : Changes in Cropping Pattern in Bangladesh

Cropping Pattern	1987-88	1999-2000
Aman-Fallow	19.1	17.2
Aus-Aman	14.5	3.2
Aus-Aman-Non-rice	13.9	1.1
Aman-Non-rice	13.0	11.7
Boro-Fallow	12.6	29.0
Aman-MV Boro	7.7	18.7
Non-rice-Fallow	4.8	10.0
Others	14.4	9.3

Source: Department of Agriculture and Extension, Ministry of Agriculture, Government of Bangladesh

Illustration 3: Vietnam: Strategy and Action Plan for Mitigating Water Disasters

Vietnam's Strategy and Action Plan for Mitigating Water Disasters was drawn up in response to the increasing frequency and severity of natural disasters; the threat of global warming; and recent social and economic changes, which were felt to have brought the need for a concerted effort to address the problems of water disasters. The Plan outlines a three-pronged approach to water disaster mitigation:

- Forecasting and warning systems;
- Preparedness and mitigation; and
- Emergency relief and response (Table 6).

The Plan seeks an integrated approach, encompassing social, economic and environmental objectives as part of its broader aim of fostering the sustainable development of areas prone to water disasters. It also aims to ensure that all aspects of water disasters are addressed; that duplication is avoided; that activities are coordinated; and that activities combine a range of structural and non-structural measures.

The strategic approach indicated by the Plan is an important advance in itself. Moreover, progress has already been made under many of the Plan's 18 tasks. However, the implementation of non-structural mitigation measures appears to have been less successful, with little headway being made to date in the design and introduction of new schemes to provide self-financed mitigation and disaster insurance schemes or in the introduction of land-use planning and building codes. Periodic appraisals are being undertaken by the Government of Vietnam to address implementation bottle-necks and refine the institutional process to meet emerging needs.

Table 6 : Vietnam – Water-disaster Mitigation

Forecasting and Warning Systems		Mitigation		Emergency Relief and Response	
Non-physical	Physical	Non-physical	Physical	Non-physical	Physical
1. Public Awareness Training and Education • School programmes • Radio Programmes • TV programmes • Print programmes	2. Warning and Communi-cation Systems • National level • Provincial level • Local level	6. Water Laws and Regulations • Land use planning • Dikes • Flood and typhoon • Building codes • Watershed management and forest law	12. Watershed Management and Deforestation • Remedial construction • Modelling and monitoring	17. Institution Building for Relief • Establish disaster relief management unit	18. Emergency Repair • Equipment • Technology • Materials
	3. River Flood Forecasting • Weather radar • Hydro-meteorologi-cal stations	7. Flood Insurance: and Self Financing • Flood insurance • Revolving fund	13. Emergency Communication System • Disaster communication		

Forecasting and Warning Systems		Mitigation		Emergency Relief and Response	
Non-physical	Physical	Non-physical	Physical	Non-physical	Physical
	• Data transmission • Data base • River models				
	4. Flash Flood Forecasting • Weather radar • Hydromet stations • Data transmission • Data base • River models	8. Institution Building for Water-Disaster Preparedness (at the Provincial Level) • Mammals • Procedures • Training • Facilities (Computer, communications, etc)	14. Sustainable Management of River Dikes • Under - seepage • Overtopping design (includes changing conditions and rehabilitation)		
	5. Typhoon Forecasting • satellite ground station • Sea buoy system • Weather radar • Meteorological stations • Data transmission • Typhoon models	9. Area Specific Studies (Master Plans and Watershed Studies) • Basins • Geographic features • Flash flood prone areas • Reservoirs • Wetlands	15. Sustainable Management of the Sea and Estuary Dikes • Overtopping design • New materials • New designs		
		10. Sea-water intrusion and Greenhouse Effect • Sea level rise (Greenhouse Effect) • Sea-water intrusion	16. Sustainable control of the rivers • Training • Sediment minimization and control • Siting control • Erosion		
		11. Dike and Dambreak Studies • Emergency action plans			

Source: Benson, 1997

Illustration 4 : Cropping Pattern Changes in the Mekong Delta of Vietnam

Vietnam, since the 1930s, reveals that farmers had a cropping system which was well adapted to flooding conditions up to the 1960s. The intensification of cropping patterns by adopting green revolution technologies in the 1970s and 1980s, led to farmers establishing a flood escape cropping system. Since the 1990s, a large-scale diversified cropping pattern was established. Though the diversified cropping pattern provided higher income, the high floods caused serious crop losses periodically. The current cropping system is not well adapted to flood-prone environment. This maladaptation is basically due to non-incorporation of climate as one of the decisive factors in sustaining the cropping system (Tanaka 1995).

Illustration 5: Cropping Pattern Changes in Anantapur, Andhra Pradesh, India

Anantapur district in the Indian state of Andhra Pradesh receives rainfall around 500 mm annually. The distribution of rainfall varies considerably from year to year and season to season. Prior to the 1960s, rainfed farming in this region was primarily for meeting home consumption requirements of the farmer and demands of the local market for food and fodder. Minor millets was grown as the main crop in most areas. In small patches either pigeonpea, castor, sorghum or groundnut were grown as the main crops; whereas groundnut was used primarily as a condiment, oil was also produced using traditional bullock powered mills.

This complex cropping system had evolved over a long period and hence was presumably tailored to the climate variability of the region The last three decades witnessed major changes in the cropping pattern as well as in the technological options. The variety of groundnut cultivated in the 1960s and early 1970s was a traditional runner variety, which required about 150 days for maturity. The variety TMV-2 was introduced in the region during the early 1970s. This new variety had several advantages over the traditional runner type. Initially, farmers cultivated both varieties for some years. Gradually by the late 1970s, the bunch type had replaced the runner type completely.

At present, groundnut (variety TMV -2) is the major crop cultivated in the rain-fed regions of the Anantapur District. Such extensive monocropping of groundnut has emerged only in the last two decades. Hence farmers do not as yet have adequate experience of the impact of climate variability on different facets of crop growth, development and yield (Gadgil, S., 1999).

The frequent droughts cause drastic fall in the groundnut yield. During these times, the income level of farmers, particularly resource poor farmers, goes down and the debt levels due to high investment causes severe distress. Crop specialisation of this type in a low and variable rainfall region increases vulnerability of the farmers to droughts in the long run.

The Indian experiences of incorporation of watershed-based development programmes into national development planning and change of cropping patterns in Bangladesh could be considered as successful

disaster reduction strategies. The institutional strategies to manage water related disasters in Vietnam could be treated as evolving disaster reduction strategy. Cropping pattern changes in the Mekong delta of Vietnam and the semi-arid regions of India could be treated as inappropriate mitigation strategies. Climate change communities could draw appropriate lessons from these types of experiences to design planned adaptation strategies to climate change and variability.

Summary and Conclusions

We have presented evolutionary trends in climate change debate as well as policies and practices relating to natural disaster management with reference to selected disaster prone countries in Asia. Climate change and adaptation strategies are now oriented to meet the goals of sustainable development concerns. As disaster reduction has already been recognised as a development issue, the coming together of climate change and disaster reduction communities is inevitable. We presented a strategic framework for collaboration between disaster reduction and climate change communities to move forward to formulate actionable programmes. The planned adaptation strategies of climate change could be oriented to address natural hazards associated with present and future climate variability and extremes. This approach provides an opportunity for both communities to evolve joint programmes. Disaster reduction communities have accumulated rich experiences over a period of many years in mainstreaming disaster mitigation into national development policies. By way of illustration, successful mitigation practices, partially successful and ongoing mitigation practices and inappropriate maladaptation practices have been provided. Climate change communities could benefit from these experiences to design adaptation strategies.

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Risk Management and Burden Sharing in Climate Change Adaptation and Natural Disaster Mitigation

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Abstract

The connections between natural disasters and climate change are being increasingly recognised. However, the two communities – the "disaster community" and the "climate community" – have yet to work closely at the scientific/technical level or in the policy and negotiation process.

This paper addresses the possibility of developing a global system of insurance as one possible way in which the common interests of the climate and disaster community might find some useful synergy.

Climate Change and Natural Disasters

Throughout the last decade of the 20th century, both climate change and natural disasters received more attention than ever before in international meetings at the UN, in the media, by governments and civil society, and in the private sector. The International Decade for Natural Disaster Reduction (IDNDR) helped to focus attention on the need for greater efforts to reduce the impact of extreme events in nature on human life and livelihood. The Decade culminated in a forum at which many useful lessons were presented and encapsulated in a declaration. Provision for the continuation of its work was made by the establishment of the International

Strategy for Disaster Reduction, led by an inter-agency Task Force and secretariat based in Geneva.

During the same decade the UN Framework Convention on Climate Change went from negotiations, to signature, and ratification in rapid succession. The Kyoto Protocol to the Convention has also been agreed, and signed, and is close to ratification.

These two important initiatives are both directed towards improved management of the relationship between human beings and their environment, and as such can both be seen as part of the sustainable development agenda described in the Brundtland Report (Our Common Future) and formulated in more detail in Agenda 21.

There are some important connections between natural disasters and climate change. When viewed from the perspective of the "disaster community", climate change is an additional threat that will cause increased variability and more extreme events. Climate change adds to the problem of natural disasters. From the perspective of the "climate community" an increased frequency of extremes is an indicator of climate change, and helps to dramatise what might otherwise be thought of as a slow incremental process not requiring immediate action.

Despite this obvious commonality of interests, the two communities have not worked as closely together as they might have done, either at the scientific/technical level or in the policy and negotiation process.

One reason for this is probably that both communities have been preoccupied with other aspects of their domains or areas of concern. For the climate change community the preponderance of attention and efforts has been directed at "mitigation" by which is meant the reduction of greenhouse gas emissions and the sequestration of carbon in biomass, with the aim of eventually stabilising the concentration of greenhouse gases in the atmosphere and thus reducing the threat. The disaster community has long focussed its attention on emergency preparedness and disaster relief and rehabilitation. Seen in this light the two communities have much less in common.

The situation has now been dramatically changed by a shift in priorities in both communities. One of the major conclusions of the IDNDR was that more attention should be given to actions that can reduce the vulnerability of people and places to extreme events in nature. In some circles this is referred to as disaster mitigation, and includes longer run measures such as land use planning, building design, and insurance as well as short-term disaster planning. This broadening of the strategy for dealing with disasters has in fact been happening for some time, but the IDNDR confirmed and reinforced this direction.

Change has come more slowly in the climate community and the idea of adaptation encountered strong resistance for some time. In the past two years the prevailing views have changed dramatically and now adaptation is receiving a lot of attention. Three new sources of money or "windows" are being created to help meet the costs of adaptation in the most vulnerable countries and regions, and the 46 Least Developed Countries are being assisted to prepare NAPAs or National Adaptation Plans of Action.

This shift in priorities is in fact a new convergence of interests. There is now a clear opportunity for the

disaster and climate communities to work more closely together.

Attribution, Risk and Burden Sharing

In order to make best use of this new opportunity it is appropriate to ask how we might best draw upon the relative strengths of the two communities. I have one suggestion to make in this direction, and perhaps there are many others.

Climate change is seen as a global environmental problem in a way that disasters are not, at least not so far. Climate change has been brought into the funding mechanisms of the Global Environment Facility (GEF) precisely because it is seen as an issue involving the common property of the global atmosphere. All nations are at risk (although by no means equally) from climate change. Moreover the reason why this is so can be attributed in large part to the historical emissions of carbon dioxide from the more developed or industrialised countries. In the case of climate change the fault or attribution of blame has been placed on the shoulders of the developed countries and in the United Nations Framework Convention on Climate Change (UNFCCC) the developed countries accept this interpretation in principle. How much blame they share, and how this will change in future as the developing countries continue to increase their own emissions are now being vigorously debated and negotiated. In the case of natural disasters no such attribution of blame has been accepted and few even suggest it. Natural disasters are still largely perceived as just that – natural – and hence the attribution of blame is rarely proposed at the international level. At the national and local levels there often is a search for the perpetrators. Governments, private sector entrepreneurs, and God are often indicted. Now climate change is being added to the list of usual suspects.

Because there is an obvious source of blame in the case of climate change attention has focused on the idea of compensation. The developing countries have determined that the industrialised nations are to blame and therefore that they should provide compensation. Since there is no obvious attribution of blame in the case of natural disasters (although some are now beginning to challenge this), the attention has focused much more on risk and risk assessment, risk management and risk reduction.

Insurance to the Rescue?

One way in which the common interests of the climate and disaster communities might find some useful synergy is in the area of insurance. If a way could be found at the international/global level to create a system of insurance against the perils of natural disasters and the impacts of climate change a number of objectives might be simultaneously addressed, and a way out may be found from the present impasse over compensation and liability.

Since the impacts of natural disasters caused by natural forces and natural disasters exacerbated by climate change cannot be distinguished in practice, a global system of insurance could be created which would draw upon the risk assessment models and skills used in disaster work, and the concern for appropriate compensation which so troubles the climate community.

A fundamentally moral case can be made for such action. Since the days of Jean-Jacques Rousseau and his

work on the social contract it has been understood that an essential part of the glue that holds societies together is the idea that "we are all in this together" and that there is a responsibility on the part of the better off and more fortunate members of a community to share their wealth with other less fortunate than themselves. This does not mean that a utopian equality should prevail, but rather that the distribution of wealth, safety, and risk in a society should be "reasonable". What is reasonable in any given circumstances is open to debate, but the principle is widely accepted.

At the global level such a sense of the social contract does not yet exist, although there are many signs that it is struggling to be born. The rapid progress of globalisation in matters of economy, finance, and trade is making the need for comparable advances in the social and environmental sphere daily more evident. The creation of some sort of global insurance scheme to provide protection against the worst impacts of natural disasters and climate change is a daunting but not impossible ambition. There are many obstacles that need to be carefully considered, not the least of which is the problem of moral hazard. By trying to do good one can in fact encourage and promote actions that make things worse. In addition there is the obvious fact that for most of the world insurance is a private industry that would strenuously oppose more "government interference". My suggestion therefore is only to take a modest first step. Let there be established at a global level a commission or a task force or some similar body, that could make a careful study of all the options and report back to the UN.

I think that UNDP is in a good position to initiate such a study in association with others such as the World Bank. It would carry even more weight if it could be conducted under the authority of the United Nations and if some governments also actively supported the idea. The specification of the terms of reference and modus operandi of such a commission or task force requires some careful thought and probably negotiations. In the meantime however there are a number of things that might be done to facilitate the work of a commission once established. For example it would be helpful to have a survey of the present availability and status of insurance. Where and in what ways has recent experience been positive, and where and what are the deficiencies? UNDP is in a good position to begin gathering data of this kind and making an assessment of the present situation.

Among the questions that need to be formulated are the appropriate roles of public and private insurance, and also the extent and types of risk to be examined. The idea of insurance is very broad concept and might be designed to include anything from small-scale farmers, up to the nation state itself. At one end of the scale the concern is with the viability of very small enterprises and the flow of resources in small communities. At the other end of the scale the financial viability of nations is at stake.

In view of the growing threats of natural disasters and climate change it is time to examine the idea of collective security and our common future in a globalising world.

8

SEMINAR PAPER

Ethical Bases of Risk Management

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Abstract

The human being can be considered "the masterpiece" of the known Universe, taking into account that each one of the more than six billion human beings inhabiting this planet have in our brains an amount of approximately 100 billion neurons (the same number of stars in our galaxy and the same number of galaxies in the Universe), that as recognised by science, form the most complex structure existing, at least in this known Universe. Each human body is the result of the interaction of trillions of cells; each one specialised in fulfilling a specific function. During the process of pregnancy, the human body repeats in "fast motion" (generally in nine months) the process of the emergence and evolution of life on Earth, four billion years ago, until the time in which the first human beings started to walk on the surface of our planet. After birth, we human beings begin to cover, also in "fast motion", the history of culture (the set of different expressions of the impact of our species on the cosmos, including the knowledge we have on this same cosmos and on ourselves). We human beings are, on the other hand, the creators of the structure that may get to be more complicated than the human brain: the "noosphere", mentioned by Theilard de Chardin, formed by the interconnected human brains in true time and of which the first "version" we know today is the world wide web.

But while each one of us, the men and women that inhabit this planet, are an expression of this prodigy of the

cosmos, we must recognise that in the four billion years in which there has been life on Earth, our species has become the worst plague that has ever hit this planet.

Some of the reasons on which we base this statement are the following:

- *Our species has eliminated almost all its "natural enemies", considering as such, the species that through homeostasis or self-regulation mechanisms control the size and behaviour of a population. Our few, still existing "natural enemies" are found in viruses (HIV, Hepatitis B, etc), but our species is taking firm steps towards their elimination or control.*

- *There is no ecosystem where the human species cannot thrive: we human beings live within the inter-tropical strip, the temperate region, the poles, on the coasts, in cities, at great heights above sea levels, etc. We do not live permanently in the bottom of the seas or in outer space, but the impact of our species is ever growing in each one.*

- *We have been able to avoid the action of natural selection on the individuals of our species (including the author of these lines) that would have surely not reached an adult age without the aid of "cultural measures". Science and technology have allowed the survival of individuals that would have otherwise not endured, and has increasingly prolonged the lifespan of human beings.*

- *No other species has had the ability of the human species to impact the biosphere, up to the point that today, the human being is able to manipulate the essential software of life through genetic engineering, with medium- and short-term consequences that we are not completely able to foresee. At the same time, we have tried, although without success, to manipulate the software of the climate that, after being achieved, can bring about disastrous consequences.*

- *Today more than six billion human beings inhabit this planet "and if the duplication remains constant, within 40 years (towards 2040) there will be 12 billion; within 80 years 24 billion; within 120 years, 48 billion... However, few people believe that there may be room on Earth for so many persons". Of course, not all the inhabitants of the Earth exert the same impact on the planet: those calling themselves "developed countries" produce a much greater impact than the countries belonging to the so-called Third World, while at the same time, the strata of the population having the greatest consumption capacity within each country exerts a much greater impact than those with lower incomes. In other words, it is not only the number of persons inhabiting this planet that determines the fact that we are a plague, but the way in which we interrelate with ourselves and our surroundings.*

- *Culture, that in the so-called "primitive communities" was a mechanism for "ecological regulation" that successfully substituted the natural mechanisms that controlled the other species in the different ecosystems, has today become one of the main reasons for our condition as a plague. Just to give an example, we may say that according to the predominant culture in the world, for an animal or plant species to have the right to exist, it must demonstrate its usefulness to the human being, especially in relation to its contribution to competitiveness in the market. This is extended in practice to human cultures and communities and to men and women as individuals: those not "competing" in the market, or not being successful in this competition,*

lose their right to exist.

Phenomena such as global heating and its effects on natural phenomena such as hurricanes or the El-Niño and La Niña phenomena, that seem to have become much more destructive than before (and having always in mind the fact that vulnerability is increasing in an even larger and poorer population) can be interpreted in two ways:

This is given by the results of the impact of human activity on the self-regulation mechanisms of the biosphere, and specifically, as effects of the deterioration of these self-regulation mechanisms through the action of man. In more simple words, we may say that the human beings are "ruining" the self-regulation ability of the biosphere.

But, on the other hand, we may consider that far from having been deteriorated, the self-regulation mechanisms, acting like the immune system of the biosphere, are found in a perfect state of health and, through phenomena such as global heating and its impact on the natural phenomena described, they are working to rid themselves of the plague (a thesis that I personally endorse at this moment).

Our work as (theoretical and operative) actors in risk management, is to prevent the natural, social-natural and anthropical phenomena from becoming a threat to humankind. And, as a consequence, we prevent them from producing risks and disasters. Will we then be preventing the self-regulation mechanisms – the immune system – of the biosphere, from fulfilling its objective? Will we then be favouring the plague?

I personally consider that the only acceptable ethic is that of having human happiness as its ultimate goal. Our challenge then is to work for the benefit of human happiness: human safety in the face of the dynamics of Earth and before our own dynamics. But also, we must guarantee that our species will not become a hazard for our ecosystems.

For this we must start from an ethical position that, among other things, will demand the need to acknowledge the right of nature to participate in the decisions affecting it. The wrongly called "natural disasters" are expressions of the voice of nature complaining harshly, since it was not kindly heard or attended when human decisions were made.

Introduction

This text was written in Colombia, and is therefore marked throughout by the painful reality of the war the country is now living through, and that, in the words of the French researcher Daniel Pecault, more than a *civil war*, it is a *war against the civil society*.

The violence in Colombia produces 40 thousand homicides each year, of which nearly 30 thousand are attributed to common delinquents. The others are due to confrontations between legal and out-of-law armed actors (military and police forces, guerilla groups and paramilitary groups), affecting the unarmed civil population that, as in Bojayá (Chocó) a few days ago, tends to be caught between two fires; and the massacres that the guerilla and paramilitary groups carry out indiscriminately against the communities that are suspected to be

collaborators or sympathisers of the other troop, or whose territory is of strategic interest to any of these groups, motivating their forced displacement. The number of internally displaced persons in Colombia at the moment (June, 2002) is nearly three million people.

But also while this paper is being written, a high percentage of Colombian territory and of the communities inhabiting its cities and rural areas are found literally under water due to the strong rainfalls recorded during the months of May and June of this year and the consequent growth of rivers and other water reservoirs in the country, with densely populated banks. It would not be surprising – since this has occurred many times – that, within a few months, many of these same communities will be affected by drought, water and energy rationing due to the depletion of the reservoirs and to forest fires.

The Colombian population, as well as other communities in the world, is losing its ability to adapt itself to changes in its surroundings, that, although being considered apparently *natural*, are increasingly harsh and, as we will see later on, is interpreted by the author as an expression of the desire of the biosphere to recover from the aggressions of the human species, of which it has been the victim.

If the ecosystems have the ability of *resilience*, allowing them to "heal" or recover from the crisis affecting them, the biosphere, formed by all the ecosystems in the planet and by the strong interrelations and interdependence between each other, also has the global ability of *resilience* (an expression of the ability of self-regulation or homeostasis of living creatures), that is expressed at a planetary level or through local processes. We are dealing with an immune system characteristic of living creatures that is also shown by the Earth, and that, as in the immune system in the human body, it produces *fever* when an attack of a certain virus is recorded. In this case, the viruses are possibly ourselves, human beings, and the immune system of the planet is trying to rid itself of us. Paradoxically, from this viewpoint, our function as *promoters of risk management* may be then interpreted as trying to prevent the success of the immune system of the planet in its purpose to rid itself of the *plague.* This is so unless, as part of the risk management, we may find a way to keep working to benefit the human species, but without holding – and much less increasing – our condition as a *plague*. Ethics constitute a prime tool for this purpose.

We Colombians are starting to understand that simultaneously at the local and Earth levels, and both in our condition as Colombians as well as of members of the human species, ethics are for us, at this moment, a requisite for survival. The starting point to constructively solve the crises affecting us is the acknowledgement of the *sacred condition of all forms of life* (including, of course, that of humankind), the acknowledgement of the *unity of the vital phenomenon* (that is expressed as the interdependence between all living creatures forming the biosphere and between the ecosystems of which we are a part) and the acknowledgement of our *responsibility, as human beings, in the face of life on Earth*.

The following pages are the result of many years of work with vulnerable communities both to natural and anthropical threats, the latter being the most severe, with violence in all its expressions (and that in itself as a threat, it is also vulnerability and disaster).

In other words, these are theoretical considerations emerging from our daily practical work, and that through

workshops, lectures, field days, pedagogical materials and other means, are returned to the communities as new working tools.

We are a Masterpiece of Universal Transformation

"When I think of the relation between the Universe and the human brain, one of the images that comes to my mind is that of a tree, but not only of its splendid treetop, formed by branches and leaves, but also of the equally extensive rooting system that may get to be as deep under the earth as the branches toward the sky. For me, the branches symbolise the observed Universe, while the roots symbolise the brain. Both systems are constantly growing and evolving and they depend on each other".

Timothy Ferris

"*El Firmamento de la Mente*" *(The Firmament of the Mind)*

Our sun, the star from which all the energy used on Earth is derived, is found at the edge of a galaxy – the Milky Way – which is formed, according to the most sensible calculations, by another 100 billion stars (100,000,000,000). Astronomers state that in space there are some 100 billion (100,000,000,000) other galaxies, some having two, three or four times more stars than our Milky Way.

Supposing that all galaxies had an average of some 100 billion stars, there would then be, in the Universe, the square of 100 billion stars (100,000,000,000 x 100,000,000,000), that is, 100 billion trillion stars ($10,000^{3}000,000^{2}000,000^{1}000,000$), a one followed by 22 zeros, a number that is impossible for us to conceive.

Not all these stars have planets revolving around them (in fact, it is believed that, for example in the Milky Way, only 5 per cent of the stars have planets), nor are there the conditions for the emergence of life in all planets, at least in a form similar to that we know on Earth, in which it is essential to have water in a liquid state.

Astronomers take into account other factors to calculate the probability that life may exist somewhere else in the universe, and especially some form of life that is aware of its own existence and of the existence of the cosmos, such as we the human beings: that is, what we proudly call "intelligent life", or at least "conscious life".

Among these factors is the probability that, in fact, this may not emerge even in a planet with conditions for life. There is also the probability that in that planet, life would have evolved into an "intelligent" form of civilisation and that it may have been able to survive through its own technological development without falling into a self-destructive phenomenon such as a nuclear catastrophe.

The truth is that no matter how low these probabilities may be, considering any number, in one out of every 10 billion stars in a universe of 100 million trillion stars, there would be one trillion (1000 billion) stars having at least one planet revolving around it that would be inhabited by a civilisation.

In other words, from the viewpoint of probabilities, it is not only possible, but most probable that somewhere

else in the Universe there are living creatures, and even other beings like us that are aware of their own existence.

Our existence on this planet is due to the conjunction of multiple factors, some as strange as that of the presence of the gigantic Jupiter in its orbit around the sun, with an enormous gravitational influence that determines that collisions as that of 65 billion years ago when a comet hit the Earth, are not observed more frequently (which would have not allowed life to evolve to this point).

But even in this case, as we said, no matter how complex the confluence of factors needed for the emergence and persistence of life on a planet, and no matter how small the probability may be that all these factors may appear, it is unconceivable that in such a gigantic universe (10^{33} cubic light years of space, according to Timothy Ferris), this consciousness would have only been developed in a small planet that revolves around a non-significant star located at the external edge of a medium-size galaxy.

Furthermore, where forms of life and forms of consciousness may exist, they may not necessarily be linked to biological processes that are similar to those on Earth, but materialised in other forms of energy or in other types of processes that we are not even able to suspect.

Hence, there has to be life – and also a conscious type of life – somewhere else in the universe, of which we have no doubt, at least from the viewpoint of probabilities, even under the most conservative calculations.

Nonetheless, in this universe of 100 billion trillion stars, we are only absolutely sure of the true existence of life in only one planet: Earth.

And we are only completely sure of the true existence of one sole form of life that is aware of its own existence and aware of the existence of the cosmos: the human species, our own species.

I should anticipate in saying that I share the criticisms formulated to my last statement in regard to the possibility that other forms of life such as animals, and even plants (or mountains and clouds), may also be conscious – in their own way – of their own existence. It is also possible that some animal species (perhaps elephants, whales, dolphins?) may be aware – also in their own way – of the existence of the cosmos.

Furthermore, I would dare to say that I believe that they truly are (the mere act of being what one is, that *"dignity without words of the wild animals"* stated by Timothy Ferris could be understood and realised as another form of cosmic consciousness). But we are entering the field of subjectiveness, in which (although I do not reject its validity), the view of the cosmos of each person and his or her personal values play an important role.

Yet, it seems objectively confirmed that, possibly with a few exceptions, all human beings are aware of their own existence, although we cannot be so sure that all human beings are equally aware of the existence of the Universe and that they form part of it. But the latter is due to cultural reasons, and not because there are brain differences that may prevent some persons from acquiring that awareness of belonging and of totality.

8

SEMINAR PAPER

The Universe is aware of its own existence through us. It knows itself by means of the human brain and it feels it exists and that it is alive through our senses and our *synesthesia*. We could state that human beings constitute the "*self-perception"* of the universe, the feeling of its own existence (or at least one of its organs of *self-perception*), that is, its kinesthesia (with a k)*,* but at the same time we are our own synesthesia (with an s) of the cosmos: this sense through which the cosmos captures the sensation of its existence and perceives (or questions itself on) the significance and the direction of this existence.

Each human being, each one of the six billion human beings that now inhabits this planet, is a unique, unrepeatable and particular universe. Each one of us has covered, in nine months within our mother's womb, the history of life on Earth, since it began nearly four billion years ago in an aqueous medium like the amniotic fluid within which our pregnancy develops, until the first human beings appeared on the Earth's surface. Timothy Ferris states that no structure in the universe is as complex as the human brain, perhaps with the exception of what the Russian, Vladimir Ivanovich Vernadsky, and the French, Edouard Le Roy and Theilard de Chardin, called the *noosphere*, that is, the linking of all our brains through the biosphere.

Even in the case in which there would effectively be other conscious beings, through which the cosmos would perceive itself and would question itself on its *raison d'être,* we, as human beings will not stop being, perhaps not the "masterpiece" (as anthropocentric as it sounds), but at least one of the masterpieces of universal development.

To recognise this character in ourselves does not contrast with our awareness of our smallness both in terms of space as of time.

What is a human being in a Universe of the size of 10^{33} cubic light years?

What is a human being in the midst of 10^{22} stars that exist in the Universe?

What does the human lifespan mean (30 thousand days at most if one lives 82 years), in a Universe 12 billion years old?

In terms of dimensions or duration, we could say that it is nothing. But in terms of significance, we could consider that it is everything.

Thomas Berry stated that "human is that being in which the Universe is reflected and praises itself and its numinous origin by its unique means of conscientious self-perception. All living beings do this in their own way, but in humans this becomes a dominant mode of functioning. We do not think of the Universe, it thinks in itself in us and through us".

Our ability for love, for discovery, for creativeness and for poetry in all their expressions (including our ability to scrutinise the Universe through academic and "popular" sciences and many of the applications of technology), make me feel proud of belonging to the human species.

We are the Worst Plague that Exists or has ever Existed on the Surface of the Earth

"*Many large corporations promote crime and live on crime. There was never such a large concentration of financial resources and scientific and technical knowledge devoted to the production of death. The countries that sell more arms to the world are the same ones that are in charge of world peace. Fortunately for them, the threat of peace is weakening, the dark clouds are floating away, while the market of war is recovering and offering promising perspectives of cost-efficient butcheries. The armament factories work as much as the factories that manufacture enemies according to their needs.*"

Eduardo Galeano
"*Patas Arriba*" (*Feet Up*)

No species constitutes a plague in itself, but an animal or plant species may become a plague if the mechanisms regulating its impact on the ecosystems of which it forms a part, disappear; the impact may come from either the size of the population or the ecological behaviour of the species, or, of course, from the explosive combination of both factors mentioned.

In natural ecosystems these regulation mechanisms are materialised and are carried out through the many interactions connecting one species with another and through the connection of living creatures (animals, plants, microorganisms) with the so-called *abiotic* components or supposedly non-alive entities of the ecosystems (minerals, humidity, luminosity, temperature, etc).

The growth of one species is controlled, among other factors, by the conditions that guarantee a habitat for its protection, to feed itself, to reproduce itself and to raise its young; by the amount of food available and by its "natural enemies" or predators that feed on that particular species. This live spider web of interactions determines that, for example, if the pressure of a species on its source of food is too large, the food decreases, and with it the possibility of the species to reproduce itself and consequently the species will decline, thereby reducing the pressure on the animal or plant species that it uses as food.

In contrast, if the size of the population of a species increases, there will be more food for its predators (the species that feed on it) and as a consequence there will be more predators, which will lead to a decline of the prey species. Hence, through permanent self-regulation mechanisms (based on a dynamic combination of positive and negative feedback) the natural ecosystems, as well as the so-called agro-ecosystems (productive systems managed by human beings based on the principles of natural ecosystems), remain at the *steady state* condition, that is translated into a harmonic relationship (although not necessarily "in equilibrium") of the living species among themselves and of these with their surroundings.

If within an ecosystem, the trees that nest birds that feed on certain butterflies, are cut down, for which reason the birds must migrate, the butterflies might well become a plague. And if this felling is carried out to replace the trees by a monoculture of a plant that serves as food for the butterflies, this condition will be even more reinforced.

We human beings have been slowly eliminating all the natural mechanisms that at one time regulated our impact on the ecosystems we live in, with which our species has acquired not only the condition of a plague, but of the most destructive of plagues that have ever existed or that exist today on this planet.

In the first place, we have ended with practically all the "natural enemies" threatening our existence (although, as we just saw, in the natural ecosystems, even when certain species are a threat for individuals from other species, in more global terms, they contribute to the survival of the species that is their prey). The few living creatures that we may consider our "natural enemies" are found at a microscopic level (viruses and bacteria). Scientists keep working to eliminate, or at least control, these "natural enemies", for example through the search for a vaccine against malaria or against AIDS, or by fighting staphylococci and other microorganisms that harass our species.

In the second place, because of our effort, there are no ecosystems or environmental conditions that are completely intolerable for our species: we human beings have conquered the poles, the tropics, the coastal areas at different latitudes, the deserts, and we started our adventure in outer space and in the bottom of the oceans. Although outer space and the bottom of the oceans are not yet inhabited permanently by human beings, the activity of our species does have a notorious impact on them. At this moment, rotating around the Earth are several hundreds of tonnes of space scrap.

In the third place, we have been able to free ourselves from the mechanisms through which natural selection limits the possibility of survival of the "least fit" individuals from the strictly biological point of view, as well as the fact that we have been able to overcome – and we continue to overcome – the "life expectancy" of human beings. And although it is true that a very large proportion of the human population lives under the limits of poverty, which means that it is under conditions of hunger, it is also true that this hunger it not due to the fact that our species is not able to produce all the food we need, but that neither the resources are distributed with equity, nor at the global level, is there a priority to cover human needs, but to protect the economical interests of a few producers and intermediaries. Therefore we see that frequently in "developed countries" – and sometimes in our own country – "excess" food is destroyed to keep prices high. In theoretical terms, humanity may produce the food for twice or three times the number of inhabitants it has today. Another thing is the impact on the planet that that production would imply and the true possibilities of sustaining it on the long-run, that is, to carry it out in a sustainable way.

In the fourth place, the population of our species is increasing faster each day. "At present the world population is of some six billion human beings. If the duplication period remains constant, within 40 years (towards the year 2040) there will be 12 billion people; within 80 years, 24 billion; after 120 years, 48 billion.... However, few people believe that the Earth can sustain so many people."

In the fifth place, no species has had the impact ability (not only at the local level but also at a global level) reached by human technology in its direct and intentional effects, as well as its indirect or accidental effects. Just to give a few examples, in a few decades we will have deteriorated the ozone layer that filters the ultraviolet rays coming from the sun, and that it took life nearly two billion years to form. The global heating phenomenon, produced by human contamination on the Earth's atmosphere, has enhanced the destructive

capacity of hurricanes and tornados, as well as other natural phenomena as El Niño and La Niña.

Today the possibility of manipulating the genetic code in living creatures and even human beings is a fact, with consequences that are still unpredictable for the future of the planet and the species. We have the technological ability to transfer water from one basin to another, to create new chemical elements, to extract the energy enclosed in the atoms, to dry up coastal areas and swamps, to extract any mineral or substance enclosed in the Earth's crust, whether it is at the surface or at the bottom of the sea.

We do not know, however, what to do with a large amount of the garbage that all these processes considered as "development" produce, that more harshly invade the soils and sub-soils, the atmosphere and the reservoirs, as well as outer space that was uncontaminated a few decades ago. Referring to the loss of reciprocity in the relation between the human community and the ecosystems we occupy, Thomas Berry states that "what is happening now and the origin of our (ecological) tragedy, is our refusal to return what has been given to us; the industrial system is an effort to avoid this return, the price of our present comforts. We take from the Earth without giving back to it. It is that simple. We take the resources and return poisonous products".

In the sixth place, culture, that used to substitute the mechanisms of self-regulation existing in natural ecosystems in human society, through beliefs and conducts such as myths and rites that enforced them, or the *animism* of the so-called "primitive religions" (that recognised the sacred character of all beings that share the planet with us), are today ever more at the service of our condition as a plague. From the very fact that we lack a totalising view of the cosmos that would allow us to apprehend the Universe as a whole and to discover the role and the position of mankind within that complex trap that is the cosmos, to the disregard of the rights of other animal and plant species, rights that are inborn in their condition as living creatures, regardless of whether they are "useful" or not to the interests (especially economical interests) of mankind.

Our culture reinforces, through most of its expressions, the conviction that we human beings constitute the raison d'être, and the ultimate goal of this planet we live in and exploit. We have lost the awareness of the interactions and mutual dependencies between one species and another and between living creatures and the other elements forming the environment. As was already indicated, the scientists suspect, and with a high probability of being true, that life has been able to evolve to forms as complex as the human society, given the presence of the planet Jupiter in its orbit. They know, for example, that the existence of aerobic life on Earth depends on the cleanliness of the phytoplankton (microscopic plants in suspension) that live in the seas and whose photosynthesis generates most of the oxygen we breathe. Science also knows that the stability of the temperature in our planet depends on the ability of the tropical forests to regulate, also through photosynthesis, the amount of carbon dioxide present within the Earth's atmosphere. At the same time, it is known that in the biodiversity of tropical forests there are active principals that can cure many of the diseases known today, as well as diseases that are still unknown or that are still non-existent, but that, if today's rate continues, when the diseases do appear, we will have destroyed all the natural medicine that contains the substances able to cure them.

Since we have been overcrowded in cities that are apparently independent of the conditioning of nature, we have forgotten our dependence to seasonal cycles and even to the need of night and day. The availability of

artificial light has made us forget that darkness fulfills a function as essential for the daily revitalisation of life, as the function fulfilled by the sun as a source of light and heat energy.

Instead of marvelling before the most tangible prodigies of the cosmos – of a cosmos that starts with our own bodies and of whose wondrous will of life, we, the human beings, are a tangible, concrete and immediate expression – instead of recognising the most evident interdependence that links us with other species and with other beings that share with us our most immediate habitat or that "*sacred community*" of the biosphere, we are delighted before the possibility of improbable dependencies, dictated by "occult" and dubious "sciences". We are so bewildered by the possibilities of supernatural powers that we have lost the ability to recognise the daily miracles offered to us by nature, including the miracle of existence. As stated by the Colombian writer Arturo Guerrero, "we usually yearn for the stars at noon without realising that the sun is one of them".

All this determines that we not only act, but also think as a plague.

We confer to ourselves the rights of life and death, of extinction and existence, over other living species and over the other elements of the environment, and we consider ourselves the only raison d'être of this planet, up to the point of rejecting anything that may become a hindrance to our predominance and of elaborating multiple philosophical and apparently "ethical" discourses to justify our right to exploit other forms of life or to destroy their habitats.

But at the same time we forget the sacred character of all human life, the value of each individual as a materialisation of the Universe, as an expression of the "sacred community". This statement is not just mere rhetoric, in a country like Colombia where 40,000 persons are murdered in one year, where abduction is a lucrative industry and where there are one and a half million displaced persons, human beings that are violently torn from their customs, from their roots, from their territory, from their symbolic universe and from their history. We can only understand the profound human drama of the displaced persons if we imagine that from one day to the next someone decides to uproot us from our habitat, and we are forced to move to an unknown and hostile territory.

No other species reaches comparative levels of cruelty against itself and against other species as mankind. No other species is capable of performing the horrors of abduction and torture in any of its physical or spiritual forms. No other species enjoys or is enriched with the planned pain of other human beings, or are they amused with cruelty as in the human species. No other species promotes, as a form of amusement, the fights to death between other species, and even between human beings.

Our potential for cruelty and our destructive power in all its expressions (including so many perverse expressions of science, religion and politics and many ominous applications of technology), make me feel ashamed of belonging to the human species.

The Dimension of Our Dilemma: How can we Act in Favour of the Human Being without Stressing its Condition as a Plague?

"*We need new ethical principles that can recognise the absolute evil of biocide (the destruction of the vital systems) and of geocide (the destruction of the planet). It is incredible that we should be so sensitive to suicide, homicide and genocide, and we have absolutely no moral principle to face biocide and geocide (...). What is human, considered at one time as the glory of creation, is now seen as a destructive force. What is human has become the terrestrial disaster. The doubt has even been stated, on the viability of the human species. The question is not if Christianity or other traditions are viable or not, the question is the viability of what is human, or, more precisely, the viability of the Earth in its basic vital systems, during the existence of humanity. This requires an extensive review of our thoughts on all human institutions, especially on religious traditions."*

Thomas Berry

"*Reconciliación con la Tierra*" *(Reconciliation with the Earth)*

If on the one hand, at the species level, we acknowledge ourselves as one of the masterpieces of universal transformation and we interpret human reasoning as one of the forms through which the Universe is aware of its own existence and questions itself on its raison d'être, and if at the individual level we learn to recognise in each human being a unique, particular and unrepeatable expression of that "*sacred community*" that is the cosmos, but, at the same time we become aware of our condition as a plague, we will be faced with an ethical dilemma, since all we do in favour of the human species, of its quality of life and of its happiness, we will be doing it in favour of the plague.

Personally, I do not conceive an ethic that does not have as its ultimate goal to improve the conditions of existence – either material or spiritual – of human beings. I believe, together with the priest Camilo Torres, that "*love is effective or it is not love*", and that at the same time ethics, that is a tool of love, becomes an effective action through the multiple materialised expressions of human activity: the production of more and better quality food to cover the growing needs of the population; the development of vaccines and of treatments to avoid and cure diseases such as cancer and AIDS; the reduction of infant mortality; the prolonging of life with quality and material and spiritual dignity; the cure for inborn diseases; the risk management for the prevention of disasters or to reduce the losses and suffering they produce; the search for pacific solutions to conflicts; the disarmament of nations; the abolition of chemical, biological, informational and nuclear weapons... It would be impossible to list all forms through which several hundreds of thousands of human beings are devoted and have been devoted throughout history, to work in favour of our species.

Nevertheless, I repeat, unless we radically change the form in which we interrelate between ourselves and with our planet, everything we are to continue doing in favour of human beings we will be doing against the Earth.

Although at a punctual level it is valid that the progress we make, for example, with a view towards the reduction of poverty and increasing the opportunity of marginal communities, will contribute to the preservation

of the ecosystems with which they interact, and of the non-human species that inhabit them, at a global level this will only be able to produce real effects in favour of the biosphere if we are able to globally revert the course of our species as a plague.

As Thomas Berry once said, "we need a profound cultural therapy", an ethical revolution that may redirect the sense of all we will do for the benefit of the human species so that it may, at the same time, benefit the Earth.

Surely, everything stated in this text has already been said before. Therefore, far from trying to be original, our intention in writing this is to gather and stress the validity of multiple contributions of human thought that may help us solve the dilemma, especially for those, as myself, who will not renounce our commitment with the human species, even knowing that we may be contributing to the survival of the plague. Hence, I do not include myself in the line of what Umberto Eco calls "mystic ecologism" according to which "the suicide of all humanity is essential, it would have to perish to save a species that it has almost destroyed, mother Earth, which has been denaturalised and suffocated."

It would be unconceivable that we should renounce the search for the cure of diseases that affect our species, that we would welcome the massacres and the wars as ways to reduce human population, that we would hinder – if it were in our hands – the possibility of saving the life of a sick child or of prolonging the dignified existence of an elderly person, or that we would stop working to avoid the transformation of phenomena, typical of the dynamics of nature, into disasters for human communities.

But I do believe in the need for a "mystic environmentalism", that would allow us to feel as one with the cosmos – with that cosmos that starts and has its expressions in our own bodies – and that allows us to recognise and admire in each one of the beings and the phenomena surrounding us (also starting with ourselves), that "sacred community of subjects", which Thomas Berry refers to.

Although it may sometimes seem to be exactly the opposite, this text is based on an attitude of hope for the future of the human species and of our ability to live in harmony with the Earth and with the other species that, together with us, form the biosphere.

In his epistolary dialogues with Carlo María Martini, Bishop of Milan, Umberto Eco asks himself if "there is a notion of hope (and of self-responsibility in relation to tomorrow) that may be common both to believers and non-believers. What can it still be based on? What critical function may a reflection on the end have, that would not imply a disinterest towards the future, but a constant judgment of the errors of the past?"

That hope may possibly be materialised in an ethical and pledged attitude in will as well as in reason, based on the understanding of the unity and interdependence between all forms of life that inhabit the Earth and with the Earth itself, and in our ability to know and feel as one with the cosmos.

We have in ourselves the possibility of compassion, not in the restricted sense appearing in the dictionary ("feeling of sorrow for someone else's pain or grief"), but, returning to the etymology of the word, as the ability of sharing someone else's passion without that someone else having to be necessarily a human being. To be able to feel in our own guts the feeling of all the other beings that are part of the cosmos, in other

words, the synesthesia or sense of being, of which we previously referred to above.

It is possible that the importance of having children live together with creatures of other species from their early infancy (as long as they create affective bonds with them and they are not treated as mere disposable toys), lies in that animals have an infinite ability to become our teachers in compassion. Our affective contact with another animal teaches us to understand languages that are not enclosed in words, and to communicate with other living forms through our skin, corporal language, intuition and love.

In the following paragraphs belonging to a classical but hardly disseminated text titled *Culture and Ethics*, Albert Schweitzer defines the way in which ethics should have as its essential goal a respect for life, and how this respect cannot start from anything else but the experience of unity between human beings with all the other expressions of life in the cosmos and how this life should be reflected in the giving of oneself "to the vital affirmation of the universe and of life".

"All true knowledge becomes an experience. I know the essence of the phenomenon, but I get to understand it by an analogy of the will of life that exists in me. This is how knowledge of the world is transformed in me in the experience of the world. The necessary knowledge of this experience fills me with respect before the mysterious desire of life that encourages all. It urges me to think, and fills me with amazement, it makes me rise more and more towards the height of the respect for life.

"The true philosophy should emerge from concrete data of the awareness of existence, the most direct and understanding data of the consciousness of existence. This consciousness tells us: I am a life with the eagerness to live, in the middle of life that is eager to live. We are not dealing here with a sophisticated phrase. At each moment, its sense is renewed in my spirit. As in my will to live there is a desire toward a transcendent life, and toward that mysterious altitude of the urge to live called pleasure, and at the same time a fear of annihilation through that mysterious enemy of the will of life called pain; in the same way in which I recognise these tendencies in the will of life surrounding me, whether they express themselves in an understandable way or they remain silent. Ethics consists, therefore in this: in living according to the obligation of having the concurrence, within the respect for life, of all the will of life with life itself. Thus, we reach the fundamental and essential principle of moral: good is to sustain life and help it; evil is to annihilate it and place barriers. But this main principle that is essential of the moral not only means an order and a deeper study of the current concepts of evil and good, but also an extension of these concepts. True moral is the person (and only the person) that obeys the obligation of helping all life with which it is in contact, and rejects to do anything harmful to any living being. That person does not ask himself the point to which this or that life really deserves his compassion, or up to what point it is able to feel. Life, as such, is sacred to him. He has no fear that they will laugh at him and consider it sentimentalism. The fate of all truth is just that of producing a general laughter before being recognised as the truth. At other times it was considered a stupidity to hold that coloured persons were true human beings, and should be treated as such. This stupidity has today become an accepted truth. Today it seems exaggerated to extend the same consideration to all living objects, even to the most elementary expressions of life, as the existence of an ethic based on reason. But the moment will come in which we will be amazed that humanity would have taken so long to consider incompatible with ethics the

damage that we produce today without a reflection on the life that surrounds us. Ethics consists of an unlimited responsibility toward everything alive.

"If the expression of respect for life as a generalised feeling seems hardly alive among us, we have to recognise that the feeling thus expressed is something that, after having been presented to a person's reflection, will never leave him. Compassion, love and all praiseful enthusiastic expressions are given within it. With an incessant vivacity the respect for life works according to the principles determining it, and is devoted to the permanent, untiring activity of a responsibility that is not detained for any moment and at any time.

"For me, the fact of living is still a painful problem. Imbued with the respect for life in a world where the will of creation works at the same time as the will of destruction, and the will of destruction works at the same time as the will of creation. I can do nothing more than to abide by the solid fact that the will of life is presented within me as a will of life that would like to be one with the other wills of life.

"Ethics for the respect for life knows no relative ethics. Only the conservation and promotion of life can be considered as good. All annihilation and all damage to life, no matter what the circumstances originating them may be, should be considered as evil. It is not through a trend, imposed from outside, toward an equalisation of what is ethical and what is necessary, that man progresses through the path of ethics, but listening to the ever clearer voice of ethics in itself; letting himself be dominated ever more by the desire to maintain and promote life, and opposing with an ever growing decision, the need of annihilation of life, of damage to life. In ethical conflicts, man can only recur to a subjective decision. No one may tell him, in each case, up to what point the extreme limits of perseverance may extend in keeping and promoting life. He must decide for himself, on his own, letting himself be guided by the highest imaginable responsibility toward the life of other beings. We cannot allow ourselves, at any moment, to succumb to indifference. We can only find ourselves in reality when we live the conflicts more profoundly. A clear conscience is an invention of the demon.

"Only when in modern man the desire to again become a true man is aroused, can this emerge from the maze in which it is now forced to wander, blinded by the shadows of knowledge and the pride of power. Only then will he be in a position to effectively oppose the pressure of the relations with society that now threaten his humanity....

"With a responsible feeling toward culture we raise our sight above the peoples and states, directly toward humanity. To he who has ethically given himself in to the vital affirmation of the Universe and of life, to the future of man and of humanity, it is a cause of concern and of hope at the same time. To free himself, to rid himself of that concern and of that hope is poverty; giving himself in to it, is richness. This is our faith in these hard times: without knowing if we will get to see the dawn of a better future and only with the trust in the power of the spirit that may open the path to a humanity based on culture."

As of Our Duties with the Biosphere (I)

"*Considered in its greatest physiological extension, life is the planet's surface. Saying that the Earth is a piece of rock of a planetary size inhabited by forms of life, is like saying that our body is a skeleton infested with cells.*"

Lynn Margulis and Dorion Sagan
"*¿Qué es la Vida?*" (*What is Life?*)

Our main duty with the biosphere is to understand it not as something static, but as a dynamic, complex, non-linear process endowed with its own "order" (which, because it does not necessarily correspond to the human concept of order, is given the name "chaos") and of its own "rationality", that does not necessarily agree with human logic either. It is known that the biosphere is the complex spider web of living: biotic – beings and conventionally non-living ; abiotic – beings, and of interrelations between them that enable the whole Earth to be considered, not only as a rock bearing life that turns around the sun, but that the Earth itself is a living being.

In other words, that our main duty in relation to the biosphere is to acknowledge its own *entity* (to acknowledge its existence), its own *identity* (to acknowledge that it exists as a subject and not as an object) and its own *personality* (to acknowledge that it exists in its way, according to its own dynamics and its own "order", and that it cannot be submitted by force to human order, that is, at the same time, an order that varies from time to time, according to the predominant ideology).

Later (or before: it does not matter), comes the duty of acknowledging ourselves as a part of the biosphere, which is expressed not only in that we *know* and *feel* as part of this spider web of interactions that connect some beings with others, but that we are aware of the direct and indirect consequences of our acts or omissions, and that we may assume the corresponding commitment and the corresponding responsibility, not only at an immediate level, but with the generations to come.

One of the greatest problems of cities, in terms of acquiring that awareness and of taking that responsibility, is that the harmful effect of the actions and omissions of "urban beings", are often produced very far from the place where they are committed. If, for example, we leave the water faucet needlessly open, we do not have before us the ecosystem that is fed from the outlet of the aqueduct, neither do we generally have in mind nor in our imagination, the amount of interactions needed for the sun, clouds, plants and soil together to spout from the earth one sole drop of that water we are wasting. At the same time, if we throw into the garbage can a plastic, non-biodegradable, container, we do not have before us the effects that it will produce in the soil for several years, unless we live near a rubbish dump or a sanitary disposal area, which is quite unlikely when we belong to a social sector of the middle or upper classes.

As absurd as it would be to ask the liver not to feel as part of our body, or to allow the pancreas, the brain or the lungs to act independently, one from the other, as if the other organs and functions of the body did not exist, it is equally absurd to continue considering that the human species is able to continue acting behind

nature's back.

Thomas Berry states that "we do not speak to the river, we do not listen to it. We have broken the conversation. On doing this, we have destroyed the universe. If we do not listen to the voice of the trees, birds, animals, fish, mountains and rivers, we are in trouble."

One of the principles of the "guidelines for a policy for the citizen's participation in environmental management" adopted by the Environment Ministry in Colombia in 1998, is the need to guarantee the participation of nature in the decisions that affect it. This document states the following to support this principle:

"*Although sustainability does not constitute an exclusively ecological objective but mainly a human one (economical, political, social-organisational, cultural, educational, institutional), both the so-called civil society, as well as the State tend to leave out the participation of nature in the decisions affecting it, forgetting that this constitutes the basic substrate of the relations and environmental conditions that are the basis of existence and of the viability of the human species on the planet Earth. Although in most communities forming the present society, nature is normally not listened to, it always makes itself heard, sometimes in a dramatic way, through the wrongly called "natural disasters", which are rooted from the reaction of the ecosystems to the aggressions of the human community of which they have been the victims. As impossible as it is to speak about sustainable development without the active participation of the communities, it is also impossible without the active participation of nature. The problem lies in that today we have limited knowledge on how to guarantee that participation in practice, or even how to identify, listen and interpret the indications and warning messages sent by nature.*

"The inclusion of this "principle" within the guidelines to develop a participation policy has been a permanent reason for controversy.

"The implications of doing this may vary from the most pragmatic ones, that interpret the participation of nature as the realisation of a permanent monitoring of the changes in the ecosystems and of the dynamics of the Earth, with the aim of reaching an adequate risk management (with the objective of managing threats and reducing the vulnerability of the community to face them), to the most philosophical ones (in terms of the so-called "deep ecology") that search nature's acknowledged personality and personification, not only as a scenario, but also as a subject and star actor in environmental management for sustainable development.

"The reading of the ecosystems, through western science as well as through traditional knowledge, is a task that has already been undertaken by many institutional actors and the civil society forming part of the National Environmental System (SINA, acronym in Spanish), of Colombia, and it constitutes one of the raisons d'être of the research institutes belonging to the system. Risk management is, or should be, one of the aims of all the components of the National System for the Prevention and Attention to Disasters, closely interrelated with SINA.

"The fact that, under any name, nature's right to participate in the decisions affecting it has started to be recognised, does not invalidate the inclusion of this principle in politics, moreover when there has been the

insistence in that the participation should constitute a variable that crosses horizontally all the integrants of SINA and all the fields and topics of environmental management."

Derived from the above mentioned duties, is our obligation to allow the biosphere to "flow" according to its own rhythm and according to its own "logic", which, as has been said, does not necessarily always agree with logic or with human priorities. When we try to alter the rhythms of nature to adjust them to human needs, we are generally building the conditions for future disasters. We do not have to submit nature to our own desires that are ever greater.

Fortunately our technology has not yet reached the ability to "control" the climate, which, since we are dealing with one of the most complex sub-systems within this whole system that is the biosphere, may produce more catastrophic consequences than beneficial ones, both for our species and for the planet of which we form part. If a minimum increase in the Pacific ocean water temperature is able to produce global disturbances such as the phenomenon called El Niño and its associate La Niña; or if, as was demonstrated by hurricane George that passed through the Caribbean and hurricane Mitch, through Central America, an average planetary temperature a few degrees higher could produce an increase in the destruction capacity of these phenomena, we can imagine what would it mean for the earth's atmosphere if we could shorten or prolong the summer, transfer clouds from one region of the Earth to another, or provoke and manipulate the hurricanes, the storms or the tornados according to our will, as war weapons.

Through genetic engineering we have been able to intervene in other complex and chaotic systems, such as plant and animals, including human beings, to produce alterations, of which we do not yet know the long-term consequences or, if we can essentially control them, but as someone said, after the genie is out of the bottle, it is impossible to again imprison it. Therefore, it is urgent for ethics to progress faster than technology, with the aim of having those tools and possibilities used for the benefit of life and not to increase the potential damage of the plague.

That same human intelligence that makes me personally feel so proud of belonging to our species, is constructing "intelligent" genetic weapons, capable of identifying its victims and of acting only on those that have certain characteristics in their chromosomes: uses of technology that express the worse of the human plague, of which I am so ashamed to form part.

In our interest to discover our duties with the biosphere, let us call again on Thomas Berry when he stated that we should be aware that "*there should be equal opportunities for things to be as they are. Everything is on the top of the hierarchy in its way. When we talk about swimming, the fish are at the summit; when we try to fly, it is the birds; if we want to harvest peaches, it is the trees; if we are dealing with the specific being of each person, that person is at the summit; if it is the reflective thought, the best are the human beings. But it is not because we are the best in one field that we may be the best in absolute terms. The best in absolute terms is the planetary community, the community of species.*"

But at the same time we should be able to recognise in each individual and in each process, the complexity of the whole planetary community. Each individual, including each human being, is a *fractal* or qualitative summary of the complexity of the universe.

Lynn Margulis and Dorion Sagan, referring to Arthur Koestler, explain this phenomenon in the following terms:

"The philosopher and novelist Arthur Koestler (1905-1983) used the term "holarchy" as the coexistence of lesser beings forming part of larger sets. Contrastingly, most of the people think that life on Earth is a hierarchy, a long chain of beings that ends in the human species. Koestler's denomination is free from the connotation of "superiority" or of the control of the set by any of its elements. For the individuals constituting Koestler's holarchy, he used the name "holons" that are not simple parts, but wholes that also work as parts. In his metaphysic formulation and terminology... life on Earth is not a created hierarchy, but an emergent holarchy that rose from the self-induced synergy of combination, coupling and recombination.

"In fact, all the existing species are equally evolved. All living beings, from a bacterial cell to a representative of the Congress, evolved from one same autopoietic ancestor that became the primeval live cell. The fact in itself of surviving is already a test of "superiority". The paused explosion of life that has covered a winding course of four billion years until the present moment has made us all. The Veda intuition that the individual conscience is an illusion and that each one of us belongs to a sole prime substrate – Brahma – may perhaps be right in a certain sense: we share a common inheritance, not only in relation to chemistry but in relation to consciousness, one same need to survive in a cosmos whose matter we share, but that in itself is indifferent to our life and to our concerns."

Finally, let us express something that is already implicit in the previous paragraphs: when we approach the biosphere as a whole that is complex, indivisible and alive, from the ethical viewpoint the division between biotic and abiotic is senseless. When an abiotic element, having no life, is integrated to the processes of life, its abiotic condition is relative. Even those fearing to fall into "animism" should recognise that for practical purposes that are so vital for the health of the biosphere and for that of the human body, its biotic and abiotic components are both equally important.

As of Our Duties with the Biosphere (II) Are Sustainable Development and Neoliberal Globalisation Compatible?

"The triumph of the free market economy over the state-owned system has not led to munificence for the poor, and unemployment has become a permanent wound for developed countries. I have said it many times and I will repeat it again: the market is an effective mechanism, but as all mechanisms, it is blind: with the same indifference it creates abundance and misery. On its own movement, it threatens the ecological balance of the planet; it corrupts the air, poisons the water, turns forests into deserts, and finally, damages many living species, among them man himself. Finally, and above all: it is not, nor can it ever be a model of life. It is not an ethic, but just a method to produce and consume. It ignores fraternity, destroys social bonds, imposes uniformity of consciousness and has made art and literature a business. The State is not the creator of richness. Many of us ask ourselves, has this situation no solution? And if it does, what is it? I would lie if I say that I know the answer."

Octavio Paz

One of the greatest issues of humanity in this end of the millennium is the compatibility (or possibility of coexistence or existence at the same time) of the so-called "sustainable development" through which, according to its most well-known definition, it is expected that the present generations may cover their needs without affecting the right of the future generations to cover their own needs, and the neoliberal economic model that today rules the world, based on the globalisation of economy, far beyond any type of ecological, political or cultural frontier, and above any other consideration is ruled by "market laws".

Globalisation starts from the basis that the economy constitutes a complex and dynamic system, a network of interrelations that connect all the inhabitants of the planet, and the inhabitants with their natural and cultural surroundings, and as a consequence, it states that no human groups or countries can be isolated from this global spider web.

The neoliberal character of globalisation determines that these interrelations must take place at the scenario of an open market, and that the ability of all and each one of the actors participating in this scenario to survive depends on its "competitiveness", that is, of its ability to compete and "survive" in the market. The neoliberal economical model then adopts, in its most crude interpretation, the principles of "natural selection" described by Darwin, according to which only the "most fit" are able to survive. Here "fitness" becomes a synonym for "competitiveness".

Neoliberalism and globalisation are apparently based on "natural laws", which are transferred to the field of economy, both in the theory of evolution and in the postulates of ecology.

If we agree with Thomas Berry that "*human technologies should be coherent with the technologies of the natural world*" we could consider that neoliberal globalisation is a way of harmonising human activities with "the thought" of the Earth, and no one would dare to raise the question expressed on the title of this chapter, on the compatibility between neoliberalism and sustainable development.

However, as stated by a well known ex-president of Colombia, "one thing is one thing and another is another".

Of course, ecology has shown us not only that all and each one of the biotic and abiotic components forming part of the planet are interconnected, but also that the Earth as a whole, because it is surrounded by a biosphere or spider web of living creatures that permanently interact in order to maintain life, may be considered in itself as a living creature with the ability for self-regulation and with an awareness of its own existence, and not only as an inert rock holding life.

Ecology has taught us also that the "administration" or "environmental management" of the planet should be carried out as a function of that globalism, given the fact that the biosphere constitutes the indivisible result of the dialectic interactions between all the ecosystems of the Earth, and in which the political frontiers between each country (properly called by someone the "scars of history"), or the ideological or cultural frontiers between human groups, are senseless.

It would seem logical, since economy ("home administration") and the word ecology ("study of the relation between living beings and their environment") that share in their root the concept of *oikos* or home, are

based on the same consciousness of globalism.

At the same time, it would seem logical that the economy, that is a human construction, would adopt for itself the same evolution criteria that, according to Darwin, has operated on and by life throughout almost four billion years in which living creatures have covered the surface of the Earth, and that the survival of one and the disappearance of the other is determined by "organic" mechanisms of selection.

Why is it then that the incompatibility between sustainable development and neoliberal globalisation has been not only stated theoretically, but is increasingly evident in practice? Why is there in the world a growing number of environmentalists – as well as of thinkers and leaders that are not necessarily environmentalists – that are against the neoliberal globalisation of the economy, when ecology shows and demonstrates the globalised character of all the interactions found in our planet? To try to answer these questions we should keep in mind the origin of economy.

Our species has invented this "science", economy, that theoretically studies the way in which human beings and our communities are related with the resources that are offered to us by nature and man's own activity, but that in practice, more than explaining, it determines, orders, regulates the way in which there relations should work. The concept "resource" is created by the economy, and it refers to those goods or procedures to which we turn to obtain a certain objective, indicating that our resources are means and not ends in themselves.

In other words, a creature, an object, a "living" or "abiotic" process, including a person or a group of persons acquires the character of a "resource" (we frequently hear the words "human resources" and "human capital") according to whether it is or may be useful, directly or indirectly for the aim of human beings. A resource is something *useful* at one moment and for a certain objective. That usefulness of the resource for human interests is what is conceded for a good or a service that Marx calls its *"use value",* while the possibility of exchanging that good or service for another is given the name *"exchange value".*

Each good has to a certain point a *"use value"* and an *"exchange value".* Coffee, for example, serves to prepare a stimulating beverage, besides a host of treats (*"use value")* and it can also be exchanged for cars, heavy machinery, and other manufactured products ("*exchange value").*

Before the Spanish conquerors arrived, the cultures that lived on what today is known as Mexico and Guatemala, used the cacao not only as food and for rituals (the word chocolate means beverage for gods), but it was also used as money, that is, as a means of exchange.

Gold, that for the pre-Columbian cultures had a symbolic-religious character, a ritual and sacred "use value" (although it could also be exchanged for other products), had for the Spanish conquerors above all an "exchange value". The yearning for gold was not for the gold itself, but for the power of the person possessing it, not in the newly "discovered" continent, where it was relatively abundant, but in the European society where it was a sign of power and richness.

From its origin, humanity has exchanged some products for others, initially through that elementary form

that is *bartering* (that has again appeared in Colombia as a consequence of the economic crisis). The communities in the mountains used to exchange – and now exchange – agricultural product of temperate and cold areas, for products from the coastal area and warm areas, and vice-versa.

Later, money was invented, having as its main value that of exchanging (although sometimes it may also have a "use value": a coin, for example may be used to buy something, but it may also be used to "flip a coin", or to loosen or tighten a wide slotted screw).

The truth is that, from the viewpoint of economy, every being, object or process in existence in this planet, should justify that existence either through the function of its "exchange value " or its "use value", and these values are determined, as mentioned above, as a direct or indirect function of human needs and interests. According to the predominating form of thought, the mere existence of a being does not concede it its right to exist. The plant species of which we ignore their use for human interest, we call "weeds", and in consequence we do not only feel authorised, but also forced to destroy them.

The ever greater knowledge of nature and of the interactions and mutual dependence between the beings that form it, has been demonstrating the "usefulness" of everything that exists, and has been creating an awareness of the responsibility we human beings have in relation to other forms of life, but always as a function of considering that if we allow them to disappear, in some way, either directly or indirectly, it will be detrimental to us. We keep on being tremendously anthropocentric in our valuation of other species.

In practical terms, it is important and necessary to be able to demonstrate that all that exists in nature is useful to us as human beings, or that our survival depends, either directly or indirectly on the existence of other creatures and of many processes that are not "controlled" by us. That is, we find ourselves in the obligation of discovering and demonstrating the "use value", or the "exchange value" of everything in existence.

If we lose the ability to establish ethical and "compassionate" relations with that "sacred community of subjects" that is the universe, we should turn to the utilitarianism of our species to defend the right of existence of other beings.

In other words, we should demonstrate that everything in existence, including human beings, offer us comparative advantages for survival in the world market. Everything can compete as merchandise or serves to increase the competitiveness of goods and processes of merchandise.

We base our need of respecting and conserving the integrity of tropical rain forests, not on the rain forests themselves, or because they are the expression of the exuberance of the will of life that animates the universe, but because without their function as a regulator of the composition of the atmosphere, the survival of the human species would be impossible, as has been demonstrated by global heating that is intimately linked to deforestation and the later burning of forests in the planet. And we feel committed with its biodiversity, not because it constitutes an expression of the "sacred community", but because we know or we presume that in it there are multiple resources to cover the present or future needs of the human species.

This, of course, is ethically valid. We noted above that it would be unconceivable to have an ethic without

considering in its ultimate goal, man's quality of life and happiness.

At the same time it is valid from the pragmatic point of view, that if we are dealing with survival in a world ruled by neoliberal principles, we turn to concepts such as that of *"environmental services",* or the concept of *"ecotourism"*, that allow to sustain in terms of economical competitiveness, the respect and conservation of certain ecosystems and of the species and landscape forming them, as well as the features of the human cultures that form part of them.

Or, we argue on the importance of not contaminating a river, the atmosphere, or the soil, demonstrating that contamination is a sample of the "inefficiency" of productive processes, that lead to a lower competitiveness of the products in the national and international markets, especially now that these markets require the compliance of certain requirements of "environmental management" in their elaboration process. It should be acknowledged that in enterprise management the concept of *"eco-efficiency"* or *"ecological efficiency"* has been introduced, and forms an integral part of the sustainability of an enterprise.

That is, in many cases, it can be demonstrated that the respect for life (basis of ethics) is cost-efficient in economical terms, but it is a very serious question that if this cost-efficiency cannot be demonstrated, the "laws of the market" will determine the extinction of certain living creatures or the processes in which they participate, while determining the disappearance of certain "good manners" or ethical expressions, because they are not "competitive" in the market world.

If, for example, we only sustain the conservation of biodiversity as long as it offers competitive advantages, what will happen to it when through biotechnology the most advanced countries are able to synthesise the active principles of plants that form part of the biodiversity of the tropical ecosystems?

On the other hand, in Colombia, it is simple to demonstrate that the present levels of disintegration that have led the country to the verge of a collapse as an organised society – and that consequently make us a totally unsustainable community – are caused by the combination **inequity - corruption - violence** (all of which are, in one way or another, expressions of the absence of ethics in the respect for life). It is also possible to demonstrate that in a community like ours, dominated by corruption, in the short-term, ethics and solidarity become ballast, and not an advantage.

From this point of view, this reasoning that is expressed in terms of *"why can't I rob if all others do?"* seems difficult to refute, unless we can climb a few steps in the point of view of the ethical discussion and invoke a more elevated sense to human existence.

At the risk of falling into apparently dogmatic sentences, I dare to state that the only way out for the Colombian crisis is the general adoption of an ethic in the respect for life in all its expressions (that is able to counteract the combination mentioned above), but I know that the main obstacle for this to happen is in that, as already stated, in our situation ethics is a ballast and not an advantage for immediate economic survival. We need formulas to construct an economical and cultural situation in which ethics (and its different expressions of compassion and solidarity) may not only be desirable, but also possible in practice, or at least where the daily practice will not hamper them.

We must touch the pockets of Colombians demonstrating that ethics is cost-efficient (hence, the importance of concepts such as *"eco-efficiency"* that was already mentioned), but, more than considering cost-efficiency, we must be able to waken compassion (the ability to "share passion": to feel in our own guts the feeling of others and the feeling of the cosmos), the feeling of belonging to the universe and its processes, and the reverence towards that "sacred community" of which we human beings are expression and part.

For this, as I already mentioned, it is essential to create the proper climate, a culture broth, a fertile matrix for ethics to enroot and prosper, and to demonstrate its advantages as a formula for survival and for daily coexistence.

In a world that supposedly rejects slavery as an aberrant form of violation of human rights, we human beings (just not to mention other living creatures), have become merchandise and objects with "exchange value". Under the rules of the neoliberal globalisation game, not only the economical activities that for some reason stop being competitive are "extinguished", but so are the local customs and even the cultures having values and attitudes that are considered ballasts in the market scenario, and of course, the human beings that lose their condition of being cost-efficient. The enterprises fire those who are about to reach ten years of service to avoid non-payable service loads. The governments are forced to eliminate all types of expenses and subsidies that apparently or actually "distortion" the market. The international economical bodies impose on the countries the obligation to reduce the size of their state structures, which means the unemployment of several thousand workers and employees and the decrease, in practice, of the services lent by the State to the most needy but "less cost-efficient" economical sectors.

In Colombia, even the armed groups that justify their existence and their procedures in the struggle against inequity, have turned the human beings into merchandise, in negotiable objects, and they have made suffering a source of political dividends and of economical resources. On turning to terrorism, murder, forced displacement and torture as forms of struggle (extortion and abduction are the forms of torture that are equivalent to forced disappearances), far from combating a system that degrades human condition, it legitimises the conception according to which human beings do not have dignity inherent to their own existence. Instead, they constitute usable "resources" according to the needs of the market, whether it be a financial market, a market for goods and services, or a market for political and social proposals – or for the absence of proposals. Whoever turns to homicide, torture, to displacement and to terrorism as a means for their struggle, is legitimising them and the right of his adversaries to use the same methods. But they are also legitimising – because they legitimise each other – inequity, corruption and violence.

When we hear in the news that a person is murdered, missing or abducted; or that there are a number of victims of a massacre or displaced families (and even that another enterprise is bankrupt or that the unemployment index has increased another point), we forget that we are not talking about abstract figures, but human beings, and that behind each one of those numbers there is not just one but many lives that are cut short, mutilated, inevitably traumatised. Today we are living in Colombia the consequences of the unhealed wounds of 40 to 50 years of violence, and very probably, the next two generations will have to suffer the consequences of the violence of the 1980s and the '90s.

We need to have a "close shave" – and it is getting closer and closer to each and every Colombian – so that we may recognise, behind each abstract number, a tragedy, a face and a story.

On the other hand, we should ask ourselves: What does the concept "market" mean in cosmic terms, in the way that we conceive it and apply it today?

If globalisation has imposed its rules and conditions, we expressed this, it is all right that as individuals and as communities we develop strategies of "competitiveness" that may allow us to survive and progress in the scenario of a "market economy", but only when these strategies do not imply the deterioration or disappearance of beings and processes that do have significance in cosmic terms, which, unfortunately, is what is happening to us today.

For the sake of survival in this fiction known as the market, in a few decades we will be deteriorating systems and processes that have taken several billion years for the "will of life" of the Universe to develop.

It is usually argued that throughout the history of life on Earth there have been a large number of mass extinctions of animal and plant species. However, this does not authorise human beings to provoke or accelerate new extinction processes through their desire for profit, because of ignorance or because of carelessness. This is equivalent to saying that a person has the right to kill another person because that person was going to die some day.

The impact of living creatures – and of course, of human activity – on their surroundings is inevitable. From precisely these transformations that the living creatures produce on the environment and of the changes that they, or other living creatures, are forced to make as a consequence of these transformations, emerges the concept of co-evolution.

But when this impact leads to the loss of the ability for the self-regulation of the eco-system, these, or the biosphere as a whole, are in charge of paying us back. When we act like a plague, the biosphere activates its self-regulation mechanisms to try to get rid of us. This has a cosmic sense, in contrast to the fiction of the "market" that does not have or will ever have sense beyond a few centuries of human history. After a few dozen generations, if our species has been able to survive, the tyranny of the "market" as we know it today and as it affects most of the human beings, will be overcome.

The "Emergent Behaviour" as a Source of Hope and of Vitality

In the world of "artificial life" (also known as AL or "A Life"), there is the concept of the *emergent* behaviour to refer to those complex forms of "conduct" of systems that are equivalent in nature to the flight of flocks of swallows or to the swimming standards of schools of anchovies, that do not emerge from such a complex and "intentional" programme (in the sense that the elements that form the system are programmed to execute certain manoeuvers), but from the repeated interaction in the virtual time and space of several thousands of objects (called "boids", a contraction of "bird objects") having a behaviour that is ruled by three simple instructions:

- Don't get too close or too far from the other objects existing in the virtual space, including the other "boids";

- Try to equal the speed and direction of the other "boids"; and

- Try to "fly" always towards the centre of the "boids" that are found in the immediate vicinity.

Craig Reynolds (a researcher in complex systems of the Los Angeles Symbolics Corp), who "discovered" the behaviour of the "boids", also found that without having a specific instruction for the population of the "boids" as a whole, and without considering the starting point of the different flying objects, these are reorganised by themselves in a spontaneous manner in the form of a school or a flock (that is, in a coherent unit) after evading an obstacle, which constitutes a surprise for the researchers after running the programme for several hours with the three primary instructions.

As in the flock of birds or schools of fish, hundreds of "boids" are detained at the same time, they reduce or increase their speed, they suddenly change their direction and they carry out flight patterns that, on intentionally searching through other means, would require complex computers and hundreds of thousands of hours of programming.

"The simulation starts with the "boids" distributed at random on the screen and they spontaneously get together to form a flock. The first instruction allows for the necessary separation between the "boids". The other two determine the cohesion and the direction of the flock".

The main conclusion derived from Reynolds' experiments is that in the virtual world as well as in nature and in society, behaviours of enormous complexity may emerge from iteration and reiteration of very simple individual components, allowing to concretise the hope that the large separation between the human species and nature, that has led us to become a plague, may begin its transformation through the consequent and coherent interaction of small and simple changes of our individual conduct.

"It seems easy to understand in what way an emergent order is produced from the basic rules that later rise to give place to more and more increasing levels of complexity. From intuition it can be seen how a correct selection of local norms may get to be transformed into global behaviour. The difficult thing to understand is how, starting from global behaviour, it may be possible to modify local behaviour.

Therefore, at a strictly environmental management level, it has been understood that the solution to the large ecological problems of the planet have to be sustained by a coherent sum of local solutions inspired by the same goal. In Colombia, for example, there are hundreds, and even thousands of concrete local experiences of environmental management, true "factories of hope", many of which have been verified and validated – and may be perfectly replicated by adjusting them to the specificities of each region and community – but that in most cases are still marginal and therefore insufficient to definitely and radically impact the predominant conception of development and the deterioration processes affecting the ecosystems of the country.

At this moment we do not clearly see the "global" solutions to the problems dealing with violence that, as stated above, produce the displacement of 1.5 million Colombians and the almost always unpunished murder of 40,000 persons each year, without considering all the other disastrous consequences.

However, we are aware that at a planetary, as well as a national and regional scale we can purge our condition as a plague if we can become the protagonist of a deep cultural change – and we can say it clearly, a spiritual change – that may lead us to even redefine the concepts of religion and of humanity. The start of this cultural and spiritual change may possibly be the catalyser allowing that successful local experiences in environmental and social management may be able to modify the direction of development and the relations between nature and the human community.

How did Jesus Christ, with 12 barefooted fishermen, provoke the defeat of the Roman Empire, if not through the power of commitment, of the metaphor come true, of conviction?

Based on the idea of the gene, the British biologist Richard Dawkins has created the concept of the *"meme"* to refer to the *"unit of idea"* that, in the same way as the virus are carriers of genetic information, the meme has the ability to disseminate through a population and to infest a crowd.

The first time I found the *meme* concept in the media, was in *Time* magazine at the time of the mass suicide of the followers of the spiritual leader of the sect called "Heaven's Gate" that led a group of Americans, first to castration, and later to a mass suicide, with the conviction that they would supposedly leave this planet in a space ship.

It seemed to me that if a *meme* of death was able to infest a community, the *memes* of life could surely provoke an *emergent behaviour* in the benefit of life on Earth and in favour of human happiness.

What elementary instructions could be followed by each one of us (persons, communities, organisations, countries) in the assurance that an *emergent behaviour* would evolve from the summing up of individual changes, which would be translated into a planetary transformation?

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Building Resilience to Climate Change through Adaptive Management of Natural Resources

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Abstract

The risks associated with climate change impacts are real but highly uncertain. Emerging insights from adaptive ecosystem management and new institutional economics argue that building resilience into both human and ecological systems is the optimal way to deal with future surprises, or unknowable risks. But do these emerging insights have implications for policy and strategy for climate change adaptation? And how does such management affect the vulnerability of particular social groups or stakeholders in resource dependent societies and vulnerable places? This paper outlines these issues with respect to management of critical resources in the context of Caribbean island states. We review emerging perspectives on collective action for natural resource management and use insights from these areas to inform the nature of future adaptive capacity and direction. A case study is presented of present day collective action for community-based coastal management in Trinidad and Tobago to demonstrate the importance of social acceptance of strategies which build coastal resilience. Yet all societies need to enhance their adaptive capacity to face both present and future climate change outside their experienced coping range.

The challenge, posed at both the scale of local natural resource management and at the scale of international agreements and actions, is to promote adaptive capacity in the context of competing sustainable development objectives.

Introduction

Climate change is happening now. An increasing body of scientific evidence suggests that not only will current human activities change the global climate of the future, but our own and our ancestors' actions have influenced the climate we currently experience (IPCC, 2001b). At present it is thought that the impacts could include a change in the incidence of diseases such as malaria (Martens *et al*, 1999), an increase in the percentage of the world's population experiencing water stress from changes in rainfall (Arnell, 1999), increases in the risk of hunger due to changes in food production possibilities (Parry *et al*, 1999), and increases in flood risk and wetland losses among other problems.

While we are sure that the climate is changing and that human activities are exacerbating any natural changes, we are not sure about the range of changes, the magnitude of future climate change impacts, nor about the global distribution of the impacts. What is clear is that there will be winners and losers from climate change. The question is therefore how do we minimise the short- and long-term costs of climate change? Decision makers will often take the path of least resistance which can include avoiding decision-making where conflict exists over the proposed policy path (Clark, 1996). Engaging stakeholders in developing policy and management strategies succeeds in building a constituency for the problem, raises awareness of the issues and often leads to support for decision-making (Olsen, 1993). This last factor is important where decision-making takes place under uncertainty as is the case of climate change. Inclusionary processes that allow stakeholders to engage in the decision-making process are becoming recognised as important steps that can contribute to more supported decision-making (O'Riordan and Ward, 1997). However forced consensus is not the same as finding a balance among competing objectives of different stakeholders (Kothari, 2001).

Responses to the climate change threat can be considered from two different starting points: either impacts first or vulnerability first. The latter approach requires us to consider who are the most vulnerable in society now and how we can direct development to improve the resilience of both the people and the environment. Studies in the area of vulnerability have proposed measuring national level vulnerability through the development of indicators and indices, such as (Crowards, 2000), and (Kaly and Pratt, 2000). Such indicators are useful in understanding which sectors and regions are most economically, socially and ecologically vulnerable. However, this knowledge needs to be translated into actions to reduce vulnerability. (Abramovitz *et al*, 2001) use the elements of the disaster cycle to categorise the main elements in reducing vulnerability, namely: mitigation, preparedness, response and recovery. This cycle implies that we need to change human behaviour, anticipate disaster, prepare for the worst and plan for recovery. Using the disaster cycle concept is almost akin to using the precautionary principle in environmental planning. It enables us to consider vulnerability reduction in a holistic manner, tackling it as an inter-disciplinary, cross-sectoral, inter-temporal, multi-species management challenge.

Some form of integrated response is clearly needed. Integrated management approaches are being promoted in complex natural systems management, especially where there are different ecosystems interacting and where there are linkages between human activity and ecosystem health, see for example (Cicin-Sain, 1993; Olsen, 1993; Turner *et al*, 1999). Adaptive management is an approach that involves implementing policies as experiments (Holling, 1978). It involves a continual learning process that cannot be separated into 'research'

and 'ongoing regulatory activities' (Walters, 1986). Walters further suggests that adaptive management is necessary because, in most cases, full knowledge about a system does not exist, and optimum productivity is an unobtainable goal, hence an iterative management process that is fed by an ongoing learning process is about the best that can be achieved. Ecosystem management, on the other hand, is an approach that "integrates scientific knowledge of ecological relationships within a complex socio-political and values framework towards the general goal of protecting native ecosystem integrity over the long term." (Grumbine, 1994:31).

Adaptive ecosystem management offers one means of undertaking management in the face of uncertainty and risk. The adaptive approach requires that there is flexibility within the management framework to adapt and change as new information and understandings become available. The ecosystem concept requires that the complexity of the ecosystem is accepted, that planning takes place over the appropriate spatial and temporal scales in line with ecosystem changes and that the interactions of human behaviour with the environment are considered. We assume that such an approach can improve the resilience of people and the environment and hence reduce vulnerability. All four elements of the disaster cycle: mitigation, preparedness, response and recovery are tackled by encouraging a move away from mismanagement of resources through the implementation of an evolving management process that develops through an iterative process.

Learning-based, iterative, and inclusive management approaches have been developed within the larger area of integrated conservation and development approaches. For a summary of recent innovations in integrated conservation and development see (Brown, 2002). Such approaches offer pathways for vulnerable climate change, stakeholders to become involved in developing adaptation policy and ensuring that there is 'headroom for change' in the adaptation strategy, often through participatory methods. Using the case study of the adaptive capacity of a community in Trinidad and Tobago to environmental change, this paper explores the impacts of collective action on adaptive capacity and its scope to enable policy to be adapted more rapidly to changing environmental conditions.

In conclusion, we find that it is important that resilience can be built through the extension and consolidation of social networks, both at the local scale and at the national, regional or international scale. Social acceptance of any adaptation strategy is critical and such strategies need to be responsive to the changes that occur in both the environment and society. Hence management approaches need to be iterative and flexible enough to include and manage new information and knowledge as it becomes available.

Environmental Change and Community Response

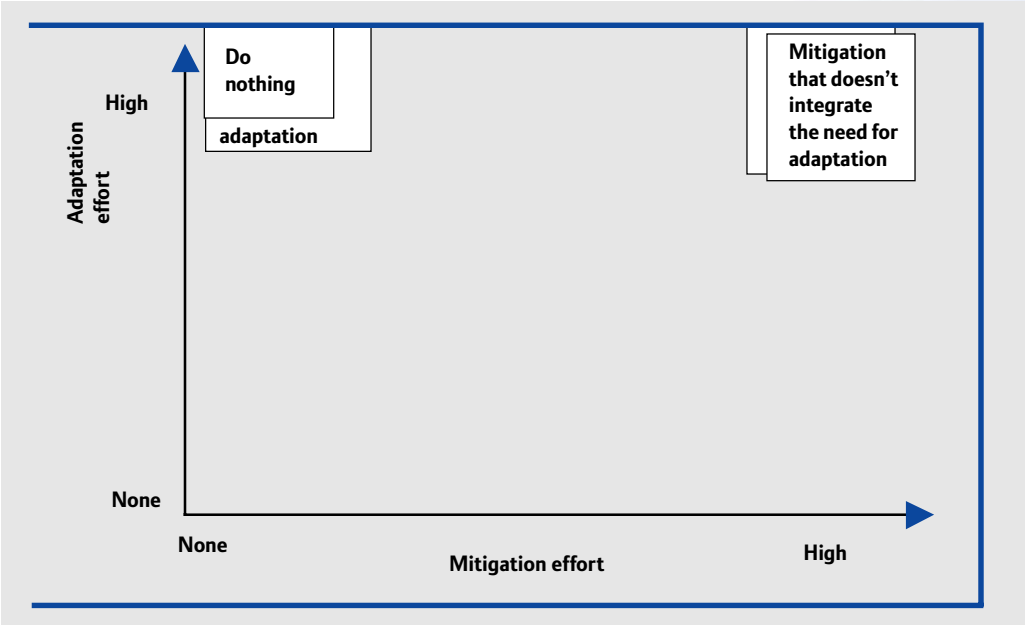
Climate change and its impacts are already starting to be observed and experienced across the globe in a myriad of ways. The most immediately obvious examples of climate change come from increasing incidence of coral damage from bleaching associated with the frequency of ENSO events and the deposition of African dust in the Caribbean, see for example (Shinn *et al*, 2000). These simple examples are merely indicators of the larger changes that are happening, see (IPCC, 2001a).

An increasing body of knowledge reveals that low lying small island states are likely to be uniquely vulnerable to climate change impacts, especially changes in hydrologic cycles (notably increases in both droughts and floods), temperature increases and sea level fluctuations, which could threaten coastal populations, rare coastal

ecosystems such as mangroves and coral reefs, and freshwater lenses through saltwater intrusion, (Carter *et al*, 2001; Nurse *et al*, 2001). In their assessment of the potential consequences of climate variability and change for the south-eastern United States, (Burkett *et al*, 2001) note that there is likely to be an increase in summer heat; agriculture could benefit from moderate warming (2 - 4°C) as long as rainfall does not decline; forest productivity will likely be affected, possibly through a decline in pine species, but an increase in hardwood productivity; sea level rise "will likely accelerate with dramatic effects on population centres, infrastructure and natural ecosystems in the low lying Gulf and South Atlantic coastal zone" (Burkett, *et al*, 2001:139); changes in minimum temperature and rainfall will likely alter ecosystem structure, as will changes in fresh water and tidal inflows. The impacts of these changes on the populations living in coastal areas or on small islands are likely to be immense.

The question then arises, what can be done now? Clearly there is still much uncertainty about the risks and the impacts. The scientific literature splits the options available to decision makers into adaptation and mitigation responses. Adaptation refers to the actions that people take in response to, or in anticipation of projected or actual changes in climate. These actions are designed to reduce adverse impacts or take advantage of the opportunities posed by climate change. Mitigation, on the other hand, refers to actions taken to prevent, reduce or slow climate change. It involves slowing or stopping the build up of greenhouse gases in the atmosphere (Hulme, 2002). However, there are clearly adaptive responses that are also mitigating responses, such as changing crop mixes to include more carbon-sequestering plants that are more resilient to the changing climate. It is in some ways more useful to think of the possible set of responses in terms of the effort and resources that can be spent on mitigating and adaptation activities. The response space that such a conceptualisation creates contains the full set of options available to decision makers, given their resources and desires to implement change, see Figure 1.

Figure 1: Response space to climate change



Options range from no effort to high levels of effort to adapt and mitigate. The possible outcomes include both the do-nothing option, the win-win option that describes a situation of adaptation that offers mitigating benefits, as well as a host of other options. However, the considerations of what can be done to mitigate and adapt are in many ways another version of the larger sustainable development question. How can we develop now to allow the future generations to enjoy a lifestyle no worse than our own? How can more sustainable development be promoted in areas that are liable to be suffering the effects of climate change caused by the actions of those outside their control?

In this paper we propose that sustainable development can be enhanced through building community and institutional resilience. Resilience traditionally referred to the single state equilibrium of an ecosystem, where emphasis was placed on resistance to disturbance and speed of return to the equilibrium state (Pimm 1984). It was thought that environmental perturbations, such as groundwater reduction, habitat fragmentation, and inputs of nutrients or toxic chemicals into ecosystems, occurs gradually over time and ecosystems respond in a smooth and continuous manner to these stresses (Vitousek *et al,* 1997). More recent studies have shown that many different types of environmental change can trigger sudden shifts in ecosystems to alternative states; these events can be part of a continuous trend or a one off event (Scheffer *et al*, 2001). The natural sciences are not yet able to precisely predict threshold levels or carrying capacity for complex ecosystems or when such events might occur. Hence preventing environmental perturbations from surpassing threshold levels is not possible, given the state of scientific understanding; however, nor is it desirable, given the importance of ecosystem disturbance to promote system renewal and diversity change (Paine *et al*, 1998).

As it has become clearer that ecosystems have multiple equilibrium, that non-linear changes occur and that there are threshold effects whereby rapid transformation occurs, the definition of resilience has altered accordingly (Nystrom *et al*, 2000). Building on this knowledge, more recent definitions of resilience refer to the magnitude of disturbance that can be absorbed by a system before it moves from one state to another (Holling, 1995). Resilience therefore now considers stability as a central concept. Ecosystem management approaches that increase ecosystem stability rather than control the environmental disturbances are thus being promoted (Nystrom *et al*, 2000; Scheffer *et al*, 2001). In the field of coastal zone management, increasingly it is being proposed that ecosystem resilience may be enhanced through some traditional resource management practices; see for example (Berkes and Jolly, 2002; Trosper, 2002).

Drawing on the concept of ecological resilience, social resilience is used to refer to positive adaptation despite adversity (Luthar and Cicchetti, 2000). Social resilience has also been defined as the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change (Adger, 2000). Three general characteristics of social systems may need to be present to enable societies to be resilient, notably: the ability to buffer disturbance, the capability to self-organise and the capacity for learning and adaptation (Trosper, 2002).

Research is revealing that individuals and communities have recently been adapting to climate change in the same way that they have coped with climate variability throughout history (Adger and Brooks, 2002). Adaptive capacity exists within communities to different degrees as shown in studies from coping with natural hazards. In New Zealand, after the eruption of Mt Ruapehu, it was found that self-efficacy, a sense of community and problem-focused responses were good predictors of community resilience (Paton *et al*, 2001). Most importantly,

Paton *et al*, recognise the importance of the nature of social relationships as a factor that can enhance resilience. In another example, in the Canadian arctic, the Inuvialuit people of Sachs Harbour have been making short term adjustments in the face of climate change over the past 10 years (Berkes and Jolly, 2002). Their adaptations include switching hunted species and changing the timing and methods of hunting. Flexibility within cultural traditions and networks make other forms of adaptation possible for this community, such as food sharing networks and intercommunity trade. The Berkes and Jolly study also found that newly evolving co-management institutions are creating linkages across scales, local, regional, national and international and hence transmitting local concerns to a wider audience and also being able to draw on the same wider community for assistance and advice.

The lessons from these studies are site-specific but they do establish some broad criteria by which to assess the adaptive capacity of communities. The nature of relationships between community members is critical, as is the access to and participation in the wider decision-making process.

In communities where there is less cohesion, for example one where there is more central planning of community life, it may be that another important factor is the structure of the governance institutions. In other areas, such as coastal zone management, the expansion of social networks has been noted as an important element in developing more robust management institutions (Tompkins *et al*, 2002). More specifically, drawing on (Cox, 1998) networks can be explored in terms of the access to power and representation that they provide to participants (networks of engagement) and the support they offer to participants in vulnerable positions (networks of dependence). The expansion of spaces of engagement appears to be critical to enhancement of resilience in communities being affected by, or likely to be affected by climate change.

The question is then, how can communities enhance their networks of association, most importantly, their spaces of engagement? Local groups and individuals often feel their powerlessness in many ways, although none so much as in the lack of access to decision makers (Brown *et al*, 2001). In this paper we propose that building successful collective actions, possibly in the form of co-management arrangements for natural resources can enhance the resilience of communities, as can maintaining ecosystem services and ecosystem resilience. The latter can retain or even expand the possibilities for adapting to climate change.

Ecological resilience at first thought does not seem compatible with social resilience; one concept focuses on environmental conservation, the other on social development. The means of enhancing both social and ecological resilience may be found in supporting communities in traditional management approaches where there has been identified and continued success in resource management in the face of environmental change. The way to achieve this may be through the application of adaptive ecosystem management that evolves through learning-based integrated resource management. Building community resilience through the expansion of the networks of dependence and engagement could facilitate this type of learning based management.

Underwriting Risk in Communities and in Government

Collective action is the co-ordination of efforts among groups of individuals to achieve a common goal, when individual self-interest would be inadequate to achieve the desired outcome (Olson, 1965). Co-management

is one form of collective action whereby resource stakeholders work together with a government management agency to undertake some aspect of resource management. Many examples exist where forms of collective action have been attempted with varying degrees of success, for example in fisheries management (Lim *et al*, 1995), coastal zone management (Sandersen and Koester, 2000), and watershed management (Ravnborg and Guerrero, 1999).

In principle the concept of collective action seems to offer one solution to resource management. However, by working together, by consolidating their spaces of dependence, and by working with the government, to expand their spaces of engagement, stakeholders may in fact be building community resilience to better cope with climate change impacts. In practice there are several threats to successful implementation of collective action, notably the 'tragedy of the commons' (Hardin, 1968), and the 'prisoner's dilemma' (see, for example, Nicholson, 1985). These theories suggest that self-interest will generally drive individual behaviour and the outcome will be free riding behaviour or overuse of the resources. However, recent research suggests that 'free riding' behaviour is not the logical outcome of collectively managed resources (White and Runge, 1995).

Empirical evidence of successful collective actions for natural resource management, such as (White and Runge, 1995) and (Berkes *et al*, 1989), has contributed to the development of a set of general pre-conditions for successful collective action, see for example (Olson, 1965; Sandler, 1992; Steins and Edwards, 1999). Assuming that there is a link between the functioning of stakeholder networks and adaptive capacity, then these pre-conditions could also be the pre-conditions for more resilient communities. There are three principles for collective action on which there is broad agreement: smaller groups tend to be more successful than larger groups; the more equitable the distribution of endowments among members the more chance of success; failures of collective action can be overcome by the introduction of selective benefits and alternative institutional design. Underpinning these principles are the concepts of social discourse and the need for integration of diverse stakeholders' interests into collective decisions (Davos, 1998). Further evidence on these design principles for coastal resources is found in (Baland and Platteau, 1996) who demonstrate that the more unequal the distribution of benefits from collective resources, the greater the possibility of conflict and hence of collective action failure. The literature on deliberative and inclusionary processes for resource management supports these lessons, see for example (Owens, 2000), recognising that the barriers to community or individual action do not lie primarily in a lack of information or understanding alone, but in social, cultural and institutional factors.

At the institutional level, making decisions about what to do about climate change is complicated due to the existence of uncertainty about the size and distribution of the possible impacts, and the risks attached to making maladaptive decisions. However, complexity and uncertainty characterise environmental decision-making in all areas. Fisheries managers, pollution control regulators, coastal zone managers, flood control managers and others have to take decisions about the resource without full knowledge about the complexities of the resource they manage or the impacts of their decisions.

The reality of resource management in these and other areas is that much of it takes place in the face of risk and uncertainty. How to handle that risk and uncertainty has driven research in several areas. The different fields have each taken their own approaches to this challenge. However, in recent years consistent themes

have arisen from them, notably 'integration' and 'adaptation'.

Recognising the importance of learning from errors within past management process may generate new responses based on stakeholders' needs. Such learning-based or adaptive management systems are widely supported (see, for example, Kay and Alder, 1999; Turner *et al*, 1999; and Sorensen, 1997). Similarly integrated approaches are increasingly being promoted. The concept of 'integrated' policy is a recurrent theme in a wide range of resource management literature, including animal pest control, coastal zone management, rural development, forest management, health policy and planning, land use planning and climate change, see for example (Lawrence, 1997; Sorensen, 1997; Pinkerton, 1998; Wainwright and Wehrmeyer, 1998; Allen *et al*, 2001; Jones, 2001; Peattie *et al*, 2001). Initial work on the concept of integrated approaches in the area of coastal zone management suggests that three main issues require consideration, these are: comprehensiveness over time, space, actors and issues; aggregation of policy perspectives into one overall perspective; and, consistency among and between policy levels and management issues for the various sectors and at all levels of management (Underdahl, 1980). More recently emphasis is placed on the need for five areas of integration:

- Horizontal integration;
- Vertical integration;
- Planning, management, education and applied research;
- Planning should recognise the joint functioning of adjacent ecosystems and their inherently interactive processes; and
- Analysis of impacts should be trans-disciplinary.

Horizontal integration refers to cross-sectoral harmonisation of policy and practice relating to resource management, and vertical integration refers to the different scales of governance, from local to international, involved in management. Equally important are the management structures that exist and the potential for change within those structures, whether they are institutions, property rights or communities.

Integrated policy and decision-making can be developed by one of, or a combination of, four main approaches that relate to the process of decision making (Kay and Alder, 1999). Decision-making and planning can be 'rational', whereby problems are identified, goals and objectives are defined, alternatives considered, decisions made, plans implemented and then evaluated. This is the usual structure of natural resource management decision-making that has become entrenched largely due to the use of logframes and project cycles (Adger *et al*, 1999b). Alternative approaches include incremental planning theory, which has also been described as 'the science of muddling through' (Kay and Alder, 1999). Adaptive planning, based on the ideas of (Holling, 1978) and (Walters, 1986), both cited in (Lee, 1999), promotes setting management policies as experiments that can be scientifically tested. Despite significant interest in this approach in the academic arena there has been little success in applying it to management issues (Lee, 1999). The fourth approach, termed 'consensual planning' by (Kay and Alder, 1999) relies on deliberation of management issues by key stakeholders with the objective of building consensus.

An adaptive ecosystem approach may be the answer needed to bring together the lessons learned at the community level through collective actions and understanding networks, and at the government level through developing integrated ecosystem approaches. Ecosystem-based management approaches should recognise the complexity, interconnectedness and dynamic character of ecological systems; be suited to local conditions; incorporate people who are affected by or who affect the ecosystem; work across administrative boundaries; emphasise interagency cooperation and the need for organisational change (Imperial, 1999). The bringing together of the natural and social sciences within an integrated policy framework, coupled with a learning-based management system, may enable gains to be made in reducing vulnerability.

Adaptive Ecosystem Management for Natural Resource Management in Trinidad and Tobago

The apparently incompatible governance structures necessary for promoting social and ecological resilience are clear from experience. Autonomy, inclusive institutions and sharing responsibility for natural resources flies in the face of the dominant hierarchical institutional forms of government throughout the world. Similarly, adaptive ecosystem management overturns some major tenets of traditional management styles. This section outlines an experience in promoting new forms of governance to promote resilience in Trinidad and Tobago. It has to be noted that the resilience objectives (either social or ecosystem) are not explicit in the laws and institutional changes nor in the evolving community-based initiatives. Nevertheless, the need to promote sustainability in the present day resonates with the concepts of resilience and adaptation to climate change.

There have been management dilemmas associated with the Buccoo Reef Marine Park in Tobago for over 30 years, where the struggle to find balance between the drive for development and the need for conservation has left decision makers in a difficult position (Brown *et al*, 2001). Pushed from one side by the population demanding job opportunities and improvements in the quality of life the government has the option of developing a tourism industry. However, it is pulled on the other side as it has to deal with the issues of managing fish stocks; conserving the national 'natural' heritage for future generations of Trinbagonians; maintaining the quality of the environment for both residents and tourists; and maintaining the natural coastal defences provided by the coral reefs and mangroves to protect the island from storm and wave damage, see for example (Goreau, 1967; Laydoo *et al*, 1987; IMA 1995; THA 1999).

The contested objectives for the Buccoo Reef have not been resolved, and hence the area has become one of the many 'paper parks' that exist in name only. Paper parks are global phenomena whereby a protected area has been designated but effective management has not been implemented (Ticco, 1995). In response to many years of under-funding by the government, it was proposed that management could be enhanced by including the Buccoo Reef stakeholders in a participatory decision-making process for the area. This participatory decision-making process, termed the trade-off analysis framework involved identifying and engaging key stakeholders; identifying their interests and objectives for the resource; engaging them in a process of information dissemination and dialogue to explore their preferences for managing the area; collecting and analysing economic, social and ecological data to understand the impacts of different future scenarios on important criteria; data analysis; resolving conflicts that existed and finding areas of agreement among them, see (Brown *et al*, 2001).

The process brought together a mix of community stakeholders from different spatial areas, different socio-economic backgrounds and areas of employment with government stakeholders from different sectors, including tourism, fisheries, land use planning, town and country planning, economic planning and education. The intersect oral, multi-scale, integrated nature of the stakeholder engagement ensured that the diverse actors who influence or who are affected by the complex ecosystems in the coastal zone were all included. The decision-making process was dynamic and the multi-criteria model used to describe the human and ecological system interactions was flexible enough to be able to include new information about coastal processes.

The bringing together of the physical and biological systems through a multi-criteria analysis model and human-behavioural 'soft' systems through stakeholder engagement and conflict resolution was an important part of the integrated adaptive management strategy. It is the soft systems that both Berkes and Jolly (2002) and Paton *et al*, (2001) suggest are critical elements of community resilience. In the Tobago context it was found that social learning, which refers to the process of behavioural and knowledge learning by individuals in social environments through interaction and deliberation brought about a consolidation of the local spaces of dependence and an expansion of spaces of engagement (Tompkins *et al*, 2002). It may be the case that reducing the barriers to communication among institutions and communities promotes social learning (Glasbergen, 1996). Reducing communication barriers may be best achieved through engagement of stakeholders and through openness, sharing information and positively reinforcing feedback. One of the outcomes of this process was the creation of a cohesive multi-stakeholder group, which reached the conclusion that better solutions could be found by working with each other and with the government.

The application of this deliberative and adaptive trade-off analysis process brought about two critical changes at the community level and in the government level. First the various groups of previously conflicting stakeholders were mobilised to take action together, as they recognised that they had more power as a group than as individuals. The groups' cohesion introduced the potential for more flexible localised adaptive responses to environmental change. Open lines of communication meant that small modifications in behaviour at the community level could be instigated through group processes rather than through more formalised institutional change, which was required prior to the establishment of the group as few of the group members communicated with each other. One example of this was in the decision of boat users in the area to be more careful in their use of oil and gas in the marine area to reduce spillage in response to a discussion within the group that oil and gas spills in the marine area were a problem (Adger *et al*, 1999a). The creation of the multi stakeholder group immediately solidified the group's space of dependence and on this base grew the possibility of developing a more formalised co-management arrangement with the government decision makers.

The second critical change arose as the multi-stakeholder group also realised that by jointly speaking with a single coherent message increased their chances of being heard by the decision makers. Conversely, the decision makers found that the active support by the multi-stakeholder group for the decisions to be made enabled them to initiate changes in the management process without fear of making unsupported and hence unsuccessful resource management decisions. The integration of the stakeholders into the decision-making process expanded the stakeholders' space of engagement, which in itself provided them with the incentive to continue to work together.

Community participation in decision-making about natural resources can be beset by a myriad of problems, and may not always be in the best interests of either the targeted community or the natural resource being managed (Cooke and Kothari, 2001). Indeed, the creation of strong spaces of dependence, empowered communities and high self reliance will not necessarily lead to environmental health improvements (Tacconi and Tisdell, 1992). This may be particularly relevant in the case of climate change where those experiencing the impacts will not necessarily be causing the impacts, although the work of (Berkes and Jolly, 2002) adds credence to the idea that it is important to build resilient communities so that they are able to adapt to the coming changes.

In addition to community level adaptation through resilience is the importance of flexible decision-making processes that can accept new information and be modified on the basis of this information. Such learning based processes are anathema to the usual forms of governance which tend to follow a more rigid decision-making process. However, perhaps institutional flexibility is an area that requires developing further.

The Way Forward

The way forward in building resilience to climate threats requires a three-pronged approach:

- Cement localised spaces of dependence;
- Expand spaces of engagement; and
- Avoid being tied to specific response paths through the implementation of flexible learning-based management.

Climate change stakeholders may need to find ways to strengthen their spaces of dependence to support them in the face of change, but also to expand their spaces of engagement to enable them to find a wider support network, in the form of interaction with regional or national government, or international agencies. Social resilience in this context is promoted through at least two distinct networks:

- Networks and community relations of individuals and groups operating to cope with variability and change in everyday decision-making; and
- Wider networks of individuals or groups who may be able to influence the decisions that are being made at the local scale.

The use of integrated and adaptive ecosystem approaches may promote the expansion of these networks, and hence enhance social resilience. Similarly there must be sustained enhancements to ecological resilience, although again this may be achievable through the application of either traditional community-based adaptive responses that have proved successful in supporting ecosystem stability in the face of past environmental change, or through learning-based management, both of which require adaptive systems and governance structures that can change and develop as new information and understanding are introduced.

In the area of adaptation to climate change, the lessons that can be drawn from the fields of new institutional economics and ecosystem-based management offer new direction. Clearly, the nature of the relationships between stakeholders at the community level will determine their immediate response to climate change risks. However it is their networks that enable individuals to engage in the wider decision environment that will affect their longer-term resilience. The existence and the usefulness of these networks is determined by institutional as well as social factors.

At the community level, reducing the barriers to communication through sharing information and positively reinforcing feedback are important elements in consolidating networks of dependence. This could be achieved through collective action, whereby stakeholders work together to find areas of commonality on which they can work to provide support to the wider group. At the institutional level, integrated institutional structures may be better able to support the inclusion of climate stakeholders in decision-making processes, and to ensure that their needs can be addressed by as wide an audience as possible. Providing spaces for deliberation within decision-making processes can facilitate this as can opening up channels of communication and ensuring that all-important stakeholders are engaged.

In both spaces of exchange we need to be sure that we clearly identify who are the vulnerable stakeholders and ensure that any adaptive management processes are directed towards them. This might mean encouraging the evolution of new institutions that are sensitive to the resilience of the ecosystems which they are managing, and that are specific to climate change issues.

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SEMINAR PAPER 10

Adaptation Responses from the Central American Energy Sector with Unintended Consequences to Global Climate Change

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Abstract

Traditionally in the Latin American and Caribbean (LAC) region, a majority of finance and technology institutions, governments, and energy producers have been mandated to promote the least expensive sources of energy, which in most cases result in higher sources of greenhouse gas (GHG) emissions. During the last 10 years, in addition to development challenges, the region has also faced changes in rainfall patterns due to climate change. As a consequence, a shift from hydropower to electricity produced from fossil fuels as well as an increase in CO_2 emissions have occurred. For example, data from the Central American interconnection project show that those countries have increased generation of electricity using fossil fuels from 9 per cent in 1990 to 35 per cent in 2001, with expectations to steadily increase thereafter.

Taking into account the Central American stated objectives [1], in previous publications we stated that providing energy for all – the poor and the rich – constitutes a win-win situation. Enthusiastically we proposed that looking at clean energy through the global public good lens increases our awareness of the interconnections between local/national interests to reduce poverty and regional/global interests to preserve biodiversity and

[1] ALIDES, the Central American Alliance for Sustainable Development signed in 1994, introduced an environmentally friendly common development agenda.

stabilise the climate. Why then is the Central American region doing the opposite and increasing both GHG emissions and the consumption of fossil fuel energy?

In this paper we discuss briefly that the atmosphere – one of global public goods – is being harmed by CO_2 and other gases resulting from the human production of goods and services. Our analysis centres on electricity production and exploring the possibility of avoiding the development path initiated by the 1850s industrial revolution and the use of CO_2 intense power sources. Hence, we focus on identifying some of the reasons that impede the use of alternative options in Central America, which would succeed in reducing the use of CO_2 intense fuels, such as charcoal and oil.

Policy makers should make adaptation decisions to solve climate change and economic development problems based on various forms of information: available, processed, and that with numerous limitations (for example, economical and environmental information). This situation has resulted in Central American countries abandoning their indigenous sources of energy – with great potential but affected by the climate (less rain) and the economy. The new sources are not only imported – increased demand of foreign exchange – but also CO_2 intense. Nonetheless, they are climatically reliable and require smaller initial investments than other alternatives.

We use the following definitions for mitigation and adaptive capacity from the IPCC. Mitigation is defined as an anthropogenic intervention to reduce the sources of greenhouse gases or enhance their sinks. Adaptive capacity is defined as the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

This paper is divided in three sections. The first describes the structure of energy supply and demand in Central America and explores possible alternatives to fossil fuels. The second includes some anecdotic as well as factual, first-time evidence about the policymaking process that takes into account climate change scientific data and occasionally makes the wrong adaptation decisions[2]. The final reflects on worrisome repercussions to other parts of the world of the applicability of Central America's policy approaches discussed here, and suggests some possible changes.

The Energy Context in Central America

Since the early 1990s the demand for energy has been growing in Central America. The local endowments in fossil energy, however, are negligible to supply the increasing needs while the potential of renewable sources is colossal. The climate phenomenon known as El Niño, itself associated with climate change, has been modifying the availability of non-fossil forms of energy, such as hydroelectricity. As a consequence, Central American governments, with the exception of Costa Rica, are prioritising the provision of reliable and affordable electricity rather than persisting in the use of renewables in the face of first evidence of changes in rainfall patterns and

[2] Mitigation is defined as an anthropogenic intervention to reduce the sources of greenhouse gases or enhance their sinks (www.ipcc.ch/pub/wg3spm.pdf, 6 June 2002 at 5:05 p.m.). Adaptive capacity is defined as the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (www.ipcc.ch/pub/wg2TARtechsum.pdf, 6 June 2002 at 5:00 p.m.).

other climatic events. The language of the scientific community and growing evidence of adverse climate effects is somehow not reaching the policy makers to allow them to make better-informed choices.

Fossil Fuel Resources and the Growing Demand of Energy

Historically, Central America refers to five countries: Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica. However, Panama is often included and we will follow that tradition. With the exception of Costa Rica, one of the most stable democracies in Latin America, the region has suffered from the civil wars or unrest in recent decades. Latest peace agreements in Guatemala and El Salvador, followed by the election of democratic governments in all countries and acceptable economic growth makes this region a stable one within the Latin American context.

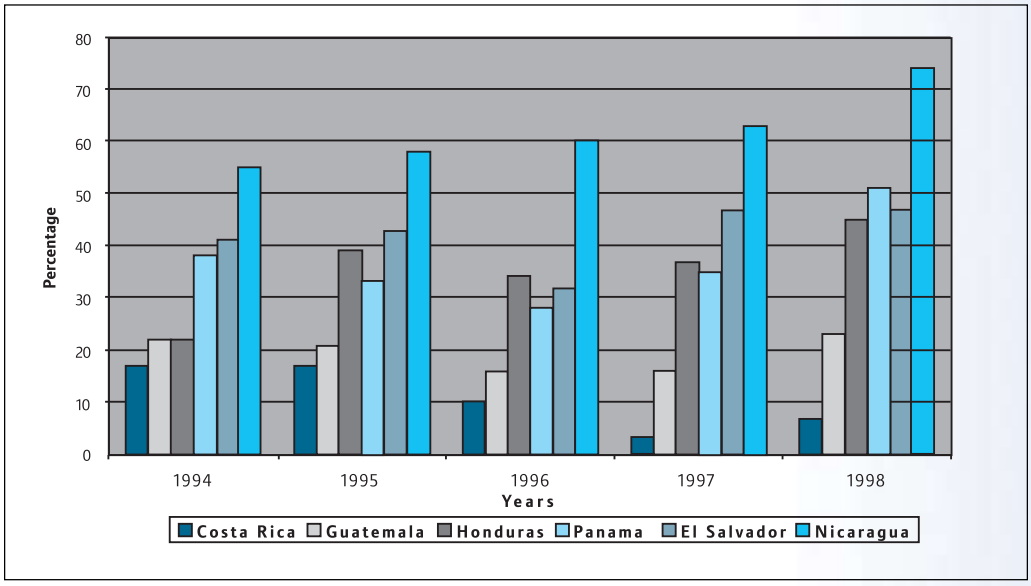
The most rapid growth in energy consumption over the past five years occurred in developing countries. As they seek to industrialise, raise standards of living, and accommodate population growth, they inevitably use more energy. For example, between 1996 and 1998 Central America's population grew an average of 2.43 per cent; while commercial energy use and electric power consumption grew an average of 3.24 per cent and 4.50 per cent, respectively (World Development Indicators Database).

The present structure of electricity production in each country of Central America depends on two major sources: hydropower (61.3 per cent) and fossil fuels. Hydropower is well developed in Central America and has been made possible thanks to the richness of the rainfall and easy accessibility to sizeable hydro resources in the region. Fossil fuels (gas, charcoal, and oil) are becoming more important sources of electricity production.

Figure 1 shows the percentage of electricity production in Central America based on fossil fuels. The figure clearly shows between 1994 and 1998 a significant growth in fossil fuel dependence, particularly in Nicaragua, Panama, El Salvador, and Honduras. Most of the oil used in Central America is imported. For example, net oil imports as a percentage of commercial energy use has increased in Panama from 69 to 73 per cent, in Nicaragua from 35 to 45 per cent, and in Honduras from 38 to 43 per cent. Only Costa Rica and, on occasion, Guatemala represent the reverse situation, with net oil imports for electricity use diminishing. Costa Rican policy is based on favouring of renewables under the assumption that increasing dependence on oil for the supply of electricity and other uses of energy is not the best economic bet for Central America considering international oil price volatility and the uncertainty associated with the cost of final electricity. Nevertheless, Costa Rican Chambers of Industry and Commerce are complaining that electricity prices are too high and make them less competitive in a global economy – some even argue that this situation is due to self-imposed policies favouring renewables[3].

[3] In 1998, the use of renewables represented approximately 2.2 per cent of the world's energy consumption. In May 2002, it was proposed that the WSSD adopt a global goal of 10 per cent renewables of total energy – similar to the European Union goal of 12 per cent – by 2010. This proposal is likely to encounter high opposition with the same arguments used by the Costa Rican companies.

Figure 1: Electricity production from fossil fuels in Central America (% of total)



Source: World Bank, World Development Indicators Database

The Impact of El Niño: Rain Makers or Fuel Switchers?

After the global energy crisis of the 1980s, most countries of the region reduced their dependency on fossil fuels for electricity generation (imported mainly from Mexico and Venezuela) due to planned efforts to increase the use of domestic sources of energy – in an effort to develop self-sustained policy and decrease the need for foreign exchange payments leaving the region. For instance, between 1975 and 1980 fossil fuel imports increased by 55 per cent, between 1980 and 1985 the increase was a mere 15 per cent. Between 1985 and 1990, however, imports increased again by 44 per cent. During the 1990s, all countries used more fossil fuels to produce electricity – varying from a minimum range of 16 to 39 per cent in Panama to a maximum of 49 to 75 per cent in Nicaragua. Costa Rica did not follow the same path[4]. It was the only country in Central America to maintain its fossil fuel dependency below 10 per cent. This corresponds to the country's political choice for renewable sources of energy, as discussed earlier.

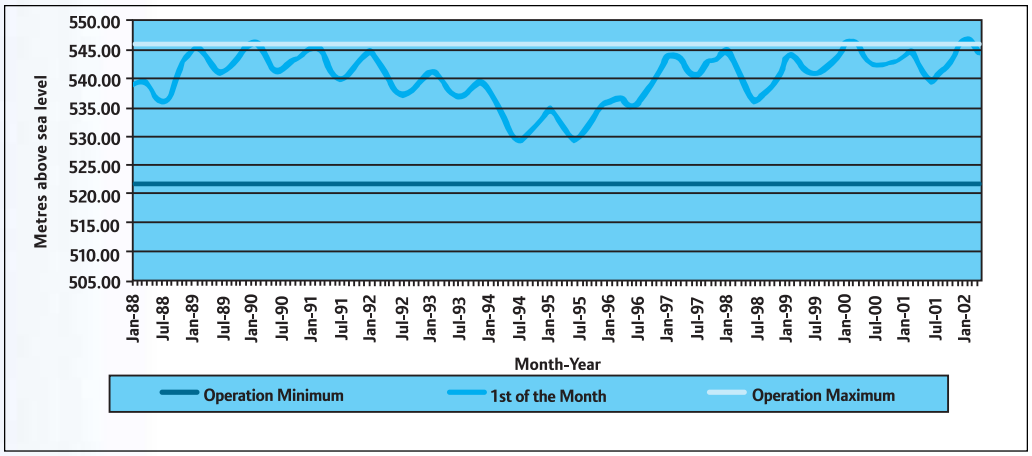
Two reasons contributed to the increased dependence on fossil fuels. First, El Niño was too long (1992-1995) and associated with dry conditions on the Pacific coast of Central America where most of the human settlements (IPCC, 2001) and historically all the electric infrastructures are located. Second, newly privatised utilities wanted to reduce capital investments and respond quickly to the demand for energy.

In 1994, as a result of climate changes, the authors witnessed Central American hydroelectric dams and reservoirs either stopping production or reaching their design capacity. For example, Cajon, the main hydroelectric dam in Honduras, stopped producing. Guatemala was suffering from black-outs and even rented

[4] Transportation is excluded from the analysis. This sector uses mainly fossil fuels (liquid and gas) and the fossil fuel demand of this sector is growing sharply due to a reduction of import tariffs on vehicles, a growing population, and longer commuting distances.

a boat for power generation. In Costa Rica, Arenal Reservoir, which feeds electric plants representing approximately 22 per cent of installed capacity in the country, was operating only a few hours a day and close to its designed minimum level of water (see Figure 2). The fluctuations in the graph follow the seasonal changes (wet and dry) that occur in Costa Rica.

Figure 2: Monthly level of Arenal Reservoir in Costa Rica during period: January 1998-April 2002



Source: DSE, BFAK-C SIEN with information from ICELEC_CENCE_ TECNOLOGIAS DE INFORMATION

The dry season occurs generally from December through April while the wet season is from May through November. The dry regions of the country become drier, longer as a result of El Niño and other climate changes. Therefore, the Arenal Reservoir is taking much longer to replenish and refill to normal working levels. As a result, in July 1994, the reservoir reached its lowest level of 529 meters above sea level, whereas at other times it was at a level consistently between 535 metres[5] and the maximum of 546 metres. In 1995, the government of Costa Rica had to hire an airplane to coat rain clouds with silver in order to induce rainfall into the Arenal Reservoir. On other occasions, the excess rainfall on the Caribbean side drove the reservoir to its designed maximum causing water spills, increased erosion and other problems. Between 1991 and 1997, additional costs were added to electric bills – denoted as a thermal factor. Essentially, during this period the initial thermal factor of nearly one increased steadily to a high of nearly four.

Currently the new El Niño and other extreme weather events are disturbing the economic and social stability of Central America once again. During the summer of 2001, Nicaragua and Honduras suffered severe droughts in the Pacific areas that forced the United Nations and other agencies to supply food to rural areas' residents usually dependent on self-sustaining agriculture. In severe contrast, by the end of October, the Atlantic coast had suffered floods and heavy rains as well as hurricanes and storms.

Recent findings of an IPCC working group reported that "there is ample evidence of climate variability at a wide range of time scales all over Latin America, from intra seasonal to long term" and El Niño "the Southern

[5] One of the authors (Castro) was present on several occasions when President Reina from Honduras called his Costa Rican colleague, President Figueres, to compel the Costa Rican utility company (ICE) to export electricity to Honduras. On one of those occasions in 1995, President Figueres politely refused arguing that the general public would condemn him for putting Costa Rica at risk of suffering blackouts.

Oscillation, is responsible for a large part of the climate variability at inter-annual scales in Latin America" (IPCC, 2001).

Making Energy Investment Decisions under Increased Uncertainty: Why then is Fossil Fuel Generation Increasing?

Historically, the uncertainties in Central America were based on political and social unrest followed by economic shortfalls. Currently, all countries are facing high debt levels. In fact, two countries are considered highly indebted poor countries (under the HIPC initiative). These instabilities limit the ability of the governments to develop infrastructure that requires high initial investments.

During the first half of the 1990s, therefore, the region experienced the worst crisis of electricity shortages in its history. This situation led the way for the introduction of private investments in electricity generation – especially renewable sources, such as hydropower, the dominant source of energy in the region. According to the Latin American Energy Organisation, the region's hydropower potential is approximately 594,000 megawatts but installed capacity totals a mere 124,000 megawatts (roughly 21 per cent)[6].

Presently, added to the economic uncertainty, is the environmental instability. For example, El Niño is putting stress on water supply[7] as the combination of higher evaporation (from warmer temperatures) and lower precipitation reduces soil moisture, water levels and flows. Global warming is thus threatening the production of hydroelectricity in Central America by changing the potential for natural evaporation and rainfall patterns including frequency, magnitude and location – all keys to designing a hydroelectric project. Not surprisingly, for Central American policy makers[8], El Niño has become the symbol of increased uncertainty for electricity based on renewable sources as well as other consequences such as stress on agriculture, increase in forest fires, hunger threats, and immigration flows within the region (*La Nacion*, June 6, 2002).

During the last decade, Central America has suffered an increasingly growing demand of water and energy but not always sufficiently covered by the increase in supply. This has led to all countries in the region suffering from low quality electricity (for example, voltage problems, brownouts) and even blackouts in Honduras. At the same time, similar problems have occurred in Quito, Ecuador, Sao Pablo, Brazil, and Santiago, Chile. Most recently, these problems even reached the United States during the California energy crisis. The energy sector of the region is in a permanent flux: continuous changes in the heads of the energy ministries,

[6] In the last 10 years there have been no new hydropower projects financed by development banks or the governments and climate change was not in the scope of the analysis of the existing projects. However, assessment of future projects includes an increase in the variability of water levels for hydro projects. Personal communication with Gonzalo Aroyo of the Inter-American Development Bank, June 13, 2002.

[7] "During an ENSO event, drought can occur virtually anywhere in the world, though researchers have found the strongest connections between ENSO and intense drought in Australia, India, Indonesia, the Philippines, Brazil, parts of east and south Africa, the Western Pacific Basin Islands (including Hawaii), Central America, and various parts of the United States. Drought occurs in each of the above regions at different times (seasons) during an event and in varying degrees of magnitude." (http://enso.unl.edu/ndmc/enigma/elnino.htm).

[8] Personal communication with Ministers and policy makers of Mexico and Central America between May 2001 and May 2002. Also stated by the Commission of Central American Utilities at http://www.ceac-ca.org.sv.

high pressures for privatising when state-owned or for intervention and regulation when private, the devastating economic costs of the lack of energy is well documented (for example, job losses, export decreases), and reliability problems reduce the attractiveness to international companies[9].

As a result of these increasing uncertainties it is difficult for environmental policy makers to promote the use of renewables based only on the old benefits: to reduce oil dependence and money transfer outside the region. To mainstream the promotion of energy, the Central American policy makers require new financial mechanisms and support to provide cleaner energy, such as hydro, biomass, and solar. It is important to discuss the following three possibilities.

- **Global interest rates:** One possibility is for international financial institutions to provide loans using interest rates taking into account global benefits. For example, currently in Central America, 12 per cent is the norm for long-term loans in US$ whereas in developed countries 5 per cent is the norm. The main difference is due to country risk. Obviously this works against high initial investment projects such as hydro and other renewables. Unless the rate is reduced, it is a pervasive incentive against the use renewables.

- **New markets and partnerships:** Renewable energy is more competitive when environmental costs are considered. For example, wind energy projects in Costa Rica are competitive with fossil fuel alternatives because the Dutch government bought the CO_2 reduction certificates at US$10 per tonne. Finland is exploring bio-energy in El Salvador and Nicaragua while Norway has supported other pilot projects in the region to develop the CO_2 market.

- **Technology transfer:** Many researchers believe that the costs and performance of renewable energy technologies have reached the stage where the number of economical applications in developing countries will be feasible (WEA, 2000). Accelerating access to new technology markets is a must. For example, the Dutch government is financing the use of efficient Compact Fluorescent Lighting in Honduras.

- **Reduce environmental uncertainty:** There are very few climate models showing the impacts in the Central American region, and in general in developing countries. There is a need for more and better modelling to facilitate the process of decision-making for hydroelectric projects. The national forecasts do not have enough credibility or data to help project designers.

To make matters worse there is the pending concern of the more than 10 million people in Central America alone that are without electricity. The Economic Commission for Latin America and the Caribbean[9] estimates that the Central American population is composed of 5.9 million families, of which two million are off-grid (a 33 per cent non-electrification index). In Costa Rica, about 50,000 families do not have access to electricity (6 per cent of the population). In El Salvador, 350,000 families (27 per cent of the population) are excluded from the electricity grid and in Honduras 430,000 families (44 per cent). Moreover, the minimal data available from the World Bank that combines income and electricity services shows that the amount of people in

[9] Between 1996 and 1998, one of the authors (Castro) participated in the negotiations with INTEL. Costa Rica was in final competition with Mexico, Chile and Brazil. Energy reliability, quality and pricing were major concerns of the company's location manager.

Nicaragua without electricity service is 272,000 families (31.9 per cent) and in Guatemala 749,000 families (41.3 per cent) – illustrating that less than 3 per cent of the poor have access to electricity in these two countries (World Bank, 2001). The established Millennium Development Goals of the United Nations Development Programme to halve the population excluded from electricity service will require an investment between US$300 and US$500 million[10].

Conclusion

The demand for fossil fuels in electricity production has been rising significantly in the last decade in Central America. In parallel, the need to provide the poor with electricity and cleaner sources of energy will add to the development challenges of the countries. The small initial endowments in fossil fuels as well as growing concern for the risk of global warming have been incentives for governments to consider using clean energy. However, most countries of the region are paying more attention to reliability than prices and placing environmental concerns at an even lower priority. Policy makers will need clearer signals from two important sources: the scientific communities in the regions and reducing the uncertainty of the local impacts of El Niño and climate change; and developed countries willing to fulfil their responsibilities to the global environment. The former will require time and effort to translate scientific uncertainties into less complicated reporting for long-term decision-making and the latter will require more financial resources promoting sustainable energy including financial incentives for those developing countries willing to increase investments in renewable energy sources.

Villages that still remain without electricity often have low energy needs, are isolated and dispersed geographically. Connecting these villages to the conventional grid system can impose a financial burden on the public at large. Choosing to use renewable energy sources as a source of electricity for homes and businesses that generates less pollution is a great way to act locally to solve a global problem. However, financing for a renewable energy project is a crucial issue. In most of the developing countries, those who are potential customers of renewable energy systems live below the poverty line and do not have purchasing power to afford this technology.

The appropriate choice of clean energy systems depends on the context of each specific country, the local availability of the appropriate technology, and the emergence of innovative financing options. It has been a real challenge to expand and improve well-established energy markets beyond the major industrial countries. The international community is still struggling with making markets, those for goods and services as well as those for financial assets, work both efficiently and equitably.

Creating new markets, such as carbon emissions trading which internalises environmental costs to make renewables more competitive, will not be an easy task to accomplish. Yet, it would be a worthwhile challenge to tackle. As described here, we know that developing countries have available most of the positive assets/commodities in terms of clean energy and carbon sequestration potential. The task at hand is to provide them with the appropriate tools and instruments to value and trade those assets.

[10] This calculation is made using 5 people per family and between $1500-2500 per household solution.

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Disaster Reduction and Adaptation to Climate Change – A CARICOM Experience

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Abstract

Historically disaster reduction efforts in the Caribbean have focused on response to regional disasters most of which were climate-related – hurricanes, tropical storms, landslides, floods, drought. Not much effort was focused on disaster reduction (mitigation)[1] through instituting proactive interventions aimed at reducing the vulnerability of natural and human systems to climate-related disasters.

However with the emergence of a new paradigm in the disaster management arena, with more attention being paid to disaster reduction/prevention, there is an opportunity to develop strategic linkages between the climate change and disaster management communities in the region.

This paper explores opportunities for developing these linkages and examines ways in which efforts at disaster management and climate change adaptation can be mutually reinforcing and beneficial.

[1] The terms 'mitigation' and 'reduction' are used interchangeably, and it has been used here as it appears in the reference documents. However 'mitigation' in the context of disasters must be differentiated from its use in the context of a response to climate change.

Introduction

In the Caribbean, disasters caused by climate-related natural hazards such as floods, landslides, droughts, wildfires, hurricanes and associated storm surges have exacted a heavy toll in terms of the loss of human lives, destruction of economic and social infrastructure and degradation of already fragile ecosystems. Global climate change is predicted to exacerbate this situation. The period between 1960 and 2000 witnessed an exponential increase in the occurrence, severity and intensity of disasters, especially during the last decade (Table 1).

Table 1: Main Natural Disasters in the Caribbean (1979–2001)

Year	Country (Hazard Type)	Persons Affected	Damage US (000´s) *
1979	Dominica (David and Frederick)	72,100	$44,650
1980	St. Lucia (Allen)	80,000	$87,990
1988	Dominican Republic (Flood)	1,191,150	
1988	Haïti (Gilbert)	870,000	$ 91,286
1988	Jamaica (Gilbert)	810,000	$ 1,000,000
1989	Montserrat (Hugo)	12,040	$ 240,000
1989	Antigua, St. Kitts/Nevis, Tortolla, Montserrat (Hugo)	33,790	$ 3,579,000
1991	Jamaica (Flood)	551,340	$ 30,000
1992	Bahamas (Andrew)	1,700	$ 250,000
1993	Cuba (Storm)	149,775	$ 1,000,000
1993	Cuba (Flood)	532,000	$ 140,000
1994	Haiti (Storm)	1,587,000	
1995	St Kitts & Nevis (Luis)	1,800	$ 197,000
1995	US Virgin Islands (Marilyn)	10,000	$ 1,500,000
1998	Dominican Republic (Georges)	975,595	$ 2,193,400
2000	Antigua/Barbuda, Dominica, Grenada, St. Lucia (Lenny)		$ 268,000#
2001	Cuba (Michelle)	5,900,012	$ 87,000

** valued at the year of the event.*

Source: OFDA/CRED International Disaster Database (EM-DAT) 2002. #USAID/Jamaica 2000, Hurricane Lenny Recovery in the Eastern Caribbean.

Within the region, losses incurred from a single hurricane event in some countries have exceeded their annual GDP. This trend poses a major threat to the sustainable development goals of the region and is being treated with some urgency by governments.

Global climate models predict that extreme weather events may occur more frequently and sea level rise would magnify the impact of storm surge and waves on coastal areas, while elevated sea-surface temperatures

and changes in sea water salinity would decrease the resilience and hence the protective capacity of natural ecosystems such as coral reefs and mangroves (IPCC TAR[2]).

Global concern about natural disasters led the international community to launch the International Decade for Natural Disaster Reduction (IDNDR 1990-1999) in order to increase awareness of the importance of disaster reduction. The experience of the decade has prompted a major conceptual shift from disaster response to disaster reduction underscoring the crucial role of human action.

Disaster Management in the Caribbean

In the Caribbean the emphasis in dealing with natural disasters was in the area of disaster response. With increasing frequency, countries in the region are facing situations in which scarce resources that were earmarked for development projects have had to be diverted to repair damage inflicted by disasters (Vermeiren). Recent experiences in some countries in the region confirm that economic growth only recovers slowly from a major natural disaster. If this trend were to persist, coping capacities of societies in the region are likely to be overwhelmed.

In these circumstances, if sustainable development is to be achieved in the Caribbean, countries will have to take effective measures to manage natural hazard[3] risks and become more resilient to the negative impact of natural hazards and related environmental disasters.

The International Strategy for Disaster Reduction (ISDR), as the successor arrangement to the IDNDR was designed to respond to this need by proceeding from protection against hazards to the management of risk through the integration of risk reduction into sustainable development. The ISDR vision is "to enable all societies to become resilient to natural hazards and related technological and environmental disasters, in order to reduce environmental, human, economic and social losses." This vision will find its realisation by focusing on the following four objectives:

- Increasing public awareness.
- Obtaining commitment from public authorities.
- Stimulating interdisciplinary and intersectoral partnerships and expanding risk reduction networking at all levels.
- Improving further the scientific knowledge of the causes of disasters and the effects of natural hazards and related technological and environmental disasters on societies.

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[2] *Third Assessment Report of the Intergovernmental Panel on Climate Change*

[3] *A 'hazard' has potential to cause significant negative impacts on community elements and can be natural, human-induced or technological in nature. It is not in itself a disaster, but the potential cause of one. (Comprehensive Hazard and Risk Management (CHARM): Guidelines for South Pacific Islands, 2001*

In addition, the ISDR was mandated to:

- Continue international cooperation to reduce the impacts of El Nino and other climate variability.
- Strengthen disaster reduction capacities through early warning.

Countries in the region were involved in implementing the Caribbean Disaster Mitigation Project (CDMP) funded by the Offices of Foreign Disaster Assistance (OFDA) (1993 – 1999). The broad purpose of the CDMP was to establish sustainable public/private sector mechanisms which invariably reduce loss of life, reduce the potential of physical and economic damage and shorten the disaster recovery period in the project area. The project sought to make development more sustainable by strengthening the linkage between development and disaster reduction.

To support this objective, CDMP sought to achieve three programme results;

- Promotion of the acquisition and application of disaster mitigation skills, techniques and methodologies;
- An increased pool of professionals in the region with disaster mitigation skills;
- Incorporation of mitigation activities in post disaster reconstruction and recovery programmes.

Six project outcomes were posited:

- Reduced vulnerability of basic infrastructure and critical public facilities.
- Improved building standards and practices to reduce natural hazard vulnerability.
- Increased availability and access to natural hazard/disaster risk information for use by stakeholders.
- Increased community awareness of and involvement in disaster preparedness and mitigation measures.
- Improved ability of public sector and private property insurers to link premium structure to risk.
- Incorporation of mitigation activities in post-disaster reconstruction/recovery.

This project facilitated the shift of the disaster management paradigm from that of disaster response to one of disaster reduction as embodied in the ISDR. In the disaster community, the terms disaster prevention and disaster reduction have been used interchangeably. In the strict sense of the term, disaster prevention may be understood to allude to the adoption of measures aimed at avoiding disasters, which is not always possible. Disaster reduction narrowly interpreted implies that measures would be adopted to reduce or limit the severity of disasters. In a broader sense, disaster reduction involves all measures designed to avoid or limit the adverse impacts of natural hazards and related environmental disasters. Viewed in these terms, disaster reduction includes disaster prevention and has emerged as the all-encompassing concept.

Developing a Regional Risk Management Strategy

In recent years the traditional disaster management approach, which focused nearly exclusively on actions that can be taken immediately prior to, during or shortly after a disaster event to reduce damage, injuries and death has evolved and expanded to include natural hazards risk management. Hazard risk management focuses more on anticipating problems by ensuring that growth and development addresses the likelihood of hazards and their interaction with environmental systems. Traditional preparedness and response mechanisms often focus on individual hazard events, but risk management views hazard exposure as an ongoing process and aims at reducing vulnerability to those hazards across all sectors of society and the economy.

In 2001, a working group representing regional and national disaster management organisations, the private sector, regional technical institutions and multi and bi-lateral donors and lending institutions developed a proposed Strategy and Results Framework for Comprehensive Disaster Management (CDM) in the Caribbean (CDERA, 2001). This strategy was undertaken with the objective of integrated comprehensive disaster management into the development process within the region and emphasises hazard risk reduction. Supporting this development is the establishment of the Disaster Mitigation Facility (DMF) for the Caribbean, at the Caribbean Development Bank (CDB). The DMFC will focus on the incorporation of hazard risk management into development decision-making within the internal operating of the CDB, its borrowing member countries and partner regional institutions.

Hazard Risk Management

Hazards translate into risks and consequently disasters only when juxtaposed with vulnerable elements of human, natural and built systems. Given that little can be done to reduce the occurrence and intensity of most natural hazards (climate change being an exception), hazard risk arrangement activities and programmes focus on reducing existing and future vulnerability to damage and loss. The process of hazard risk management involves three primary, interrelated categories of risk management actions (" Natural Hazard Risk Management in the Caribbean – Revisiting the Challenge" – discussion draft prepared for the Caribbean Group for Cooperation in Economic Development (CGCED) meeting 2002):

- Risk identification;
- Risk reduction; and
- Risk transfer.

Risk Identification

This involves developing an understanding of the particular hazard and the vulnerability of the human, natural and built systems exposed to this hazard. This is accomplished by carrying out the following activities:

Hazard Data Collection and Mapping: Involves identification of locations subject to hazards and expected severity of hazard effects and recording these through hazard mapping and development of GIS databases possibly constructed to reflect multiple hazards.

Vulnerability Assessment: These are carried out to determine which elements of the human, physical (built) and natural environments are susceptible to damage from the effects of natural hazards. Such information is considered critical in determining the scope of action which may be required in the risk reduction phase of the process.

Risk Assessment: This involves determination of the likelihood and consequences of each hazardous event and assigning levels to the risks based on the likelihood of an event occurring and the potential consequences that may emerge. The process provides critical information on the potential economic impact and costs associated with hazard related risks.

Post-disaster Assessment: This provides an opportunity to identify residual risks not identified in the preceding steps as a result of failure in identifying some existing vulnerabilities.

Risk Reduction

These activities are designed to minimise or eliminate damage from hazard events, can address existing and future vulnerability and be directed towards physical, social and environmental vulnerability. Risk reduction may involve the following measures:

Physical Measures: These may be structural or non-structural. Structural measures involve engineering interventions and non-structural measures are policy interventions that guide future development and investment towards reduced hazard vulnerability.

Socio-economic Measures: These refer to activities that help build individual and community hazard resilience through addressing underlying social and economic problems which expose communities to hazard risks, for example, settle in vulnerable areas.

Environmental Measures: These seek to increase that resilience of natural ecosystems such as coral reefs, mangroves and watersheds so as to enable them to continue performing their natural functions which in turn contribute to the protection of the natural and built environment, for example, beaches, coastal infrastructure.

Post-disaster Measures: This involves the implementation of necessary risk reduction measures during the recovery period following a disaster.

Risk Transfer and Financing

This is designed to reduce financial risk through risk transfer mechanisms provided that all efforts are taken to reduce the vulnerability of the assets to be covered. Mechanisms suggested for exploration are:

- Budget self-insurance;
- Market-insurance and reinsurance;
- Public asset coverage;

- Risk pooling and diversification; and
- Risk financing.

Climate Change in the CARICOM Region

During the last decade the Climate Change problematique emerged as a major area of concern for the small island and low-lying coastal developing states of the Caribbean region. Indeed at the SIDS conference in Barbados in 1994, climate change was identified as a major environmental issue which was to be addressed under the Barbados Programme of Action (BPOA). Although in its initial stages the climate change debate was mainly concerned with greenhouse gas (GHG) mitigation, it was realised that due to the inertia in the earth's climate system, regardless of global efforts to significantly reduce GHG emissions, projected changes in global climate would continue to be observed with dire consequences for SIDS and low-lying coastal countries. As a result it is now generally accepted that for these countries their immediate priority in terms of responding to global climate change is adaptation.

The Intergovernmental Negotiating Committee of the Climate Change Convention (INC/FCCC) agreed at its 10th Session that adaptation to the adverse effects of climate change would require short, medium- and long-term strategies which should be cost effective, should take into account important socio-economic implications, and should be implemented on a stage-by-stage basis in developing countries that are Parties to the Convention. The following sequence of activities was envisaged:

Stage I: Planning, including studies of possible impacts of climate change to identify particularly vulnerable countries or regions and policy options for adaptation and appropriate capacity building. In the medium- and long-term, two additional stages were envisaged for countries or regions identified in Stage 1 as being particularly vulnerable.

Stage II: Measures, including further capacity building, which may be taken to prepare for adaptation.

Stage III: Measures to facilitate adaptation (for example, insurance).

The Caribbean Planning for Adaptation to Global Climate Change (CPACC) Project was a project developed for 12 CARICOM countries and funded by the GEF. The project (1997-2001) was implemented by the World Bank, executed by the Organisation of American States (OAS) and everyday implementation carried out by a Regional Project Implementation Unit based in Barbados. This project was in fact a Stage 1 Adaptation activity as defined by the INC/FCCC. The project's overall objective was to support Caribbean countries in preparing to cope with the adverse effects of global climate change (GCC) particularly sea level rise in coastal and marine areas through vulnerability assessment, adaptation planning and capacity building linked to adaptation planning (CPACC Project Document, 1997). More specifically, the project sought to assist national governments to:

(i) Strengthen the regional capability for monitoring and analyzing climate and sea level dynamics and trends, seeking to determine the immediate and potential impacts of GCC;

(ii) Identify areas particularly vulnerable to the adverse effects of climate change and sea level rise;

(iii) Develop an integrated management and planning framework for cost-effective response and adaptation to the impacts of GCC on coastal and marine areas;

(iv) Enhance regional and national capabilities for preparing for the advent of GCC through institutional strengthening and human resource development; and

(v) Identify and assess policy options and instruments that may help initiate the implementation of a long-term programme of adaptation to GCC in vulnerable coastal areas.

Project activities focussed on planning for adaptation to GCC in vulnerable areas, including regional sea/climate data collection and management, impact and vulnerability studies, and the assessment of policy options.

It is quite evident that the activities carried out under the CPACC project parallel those undertaken in the disaster management community. In fact objectives (i) and (ii) correspond to the risk identification stage of the Hazard Risk Management (HRM) process now being adopted by the disaster management community in the region, and objectives (iii), (iv) and (v) fall neatly under the risk reduction phase of the HRM process. This is not surprising in that climate change adaptation seeks to achieve the same goals as the Comprehensive Disaster Management (CDM) strategy now being implemented in the region. Previously when disaster management efforts were focussed on actions that can be taken immediately, prior, during or shortly after a disaster event to reduce damage, injuries and death, that is, were reactive, there was no room for synergy between the climate change and disaster management communities. Now that the latter's approach to disaster management has a greater focus on "disaster reduction", that is, proactive and anticipatory action, there are excellent opportunities for closing the gap which now exists between the two communities and for closer collaboration in the execution of regional activities under the sustainable development agenda.

Adaptation to Climate Change in the CARICOM Region

The IPCC defines adaptation as adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation and autonomous and planned adaptation.

- Anticipatory adaptation is adaptation that takes place before impacts of climate change are observed and is also referred to as *proactive* adaptation.

- Autonomous adaptation is adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems and is also referred to as spontaneous adaptation.

- Planned adaptation is adaptation that is a result of a deliberate policy decision, based on awareness that

conditions have changed or are about to change and that action is required to return to, maintain or achieve a desired state.

- Reactive adaptation is adaptation that takes place after impacts of climate change have been observed.

- Private adaptation is usually pursued by individuals, households or private companies and is usually done in the actor's rational self interest whereas public adaptation is usually directed at collective needs and is implemented by governments at all levels.

Given those definitions there is a compelling nexus between disaster reduction and anticipatory and planned adaptation when dealing with climate change hazards. Unfortunately there are no close links between the disaster management and climate change communities, although recently steps are being taken to rectify this discrepancy. Further the disaster community is seldom concerned with increasing the resilience of natural ecosystems hence facilitating the role of the latter in autonomous adaptation.

The CPACC Project which considered impacts of sea level rise on coastal infrastructure identified distinct physical impacts that are expected to occur with climate change (CPACC Report on Coastal Vulnerability and Risk Assessment[4]; CPACC Issues Papers 6). The most significant of these were:

- Submergence of low-lying wetland and dryland areas;

- Erosion of soft shores by increasing offshore loss of sediment;

- Increased salinity of estuaries and aquifers;

- Rising coastal water tables; and

- Increased and more severe coastal flooding and storm damage.

It is anticipated that because a significant amount of coastal infrastructure and population centers are situated within two kilometres of the coast in most Caribbean countries, these impacts will affect many aspects of coastal economic development – tourism, agriculture, and water supplies.

A study prepared by the National Oceanic and Atmospheric Administration's National Ocean Service (NOS) (Lewsey *et al)* as an input to the follow-up project to CPACC identified the following trends that are increasing the Vulnerability of Caribbean Coastal Infrastructure and Land Uses to Climate Variability and Change:

- Increasing population density and growth rates;

- Growth of the tourism industry: a paradigm shift from agriculture to uncontrolled coastal development;

[4]Under Component 6 of the CPACC Project studies on coastal vulnerability and risk assessment were carried out for three pilot countries.

- Lack of land-use planning and development controls;
- Location of coastal infrastructure in hazardous areas;
- Inadequate waste disposal systems – compromise resilience of natural ecosystems;
- Quality of building construction and insurance incentives;
- Destruction of ecological buffer systems;
- Continued reliance on top-down approaches to land-use planning;
- Destructive agriculture and forestry practices.

The study further observed that some of the specific effects of climate change on coastal infrastructure and settlements, natural resources and habitats will likely include:

- Destruction and loss of infrastructure in low-lying coastal areas arising from sea level rise;
- Greater property damage and loss from increased hurricane activity;
- Flooding of low-lying areas from storm run off and storm surge;
- Increased costs of sea defence mechanisms;
- Increased costs and reduced availability of insurance coverage for property;
- Dislocation of coastal populations, particularly squatter communities;
- Destruction of hotels and other beach front properties due to the effects of sea level rise, storm surge and hurricanes;
- Increased demand and competition for coastal lands as a result of land lost to sea level rise;
- Reduced demand for tourism and subsequent changes in islands employment structure;
- Changing patterns of port development and infrastructure as a result of sea level rise that include higher maintenance costs and increased dredging;
- Salt water intrusion into coastal wells and other freshwater resources;
- Destruction of coral reefs as a result of bleaching from elevated sea surface temperatures;
- Loss of mangroves to sea level rise in areas where coastal topography, mangrove systems and coastal infrastructure do not allow sedimentation to keep pace with rising sea levels; and

- Increased coastal erosion.

The vulnerability assessment study undertaken by CPACC for Barbados revealed that much of the coastal infrastructure is located in vulnerable areas and is likely to be inundated under projected rising sea levels. This infrastructure includes utilities, fire stations, police stations, designated hurricane shelters, desalination plant, fuel storage and processing facilities, hospitals, major coastal highways, Government Headquarters and the Coastal Zone Management Unit (CPACC Report on Coastal Vulnerability and Risk Assessment for Barbados).

The NOS study also identified a suite of generic responses which are designed to reverse the human impacts on environmental degradation in the Caribbean:

- Strengthen regulations to protect ecological buffers;
- Strengthen building codes;
- Develop regulations to phase out development in high hazard areas;
- Develop comprehensive land use plans;
- Institute land protection tools for ecological buffers and vulnerable coastal lands;
- Implement market based incentives to promote sustainable tourism;
- Develop reforms to link property insurance with construction quality;
- Preserve and restore ecological buffers;
- Develop an ongoing communications plan for improving public awareness and environmental education; and
- Map hazard areas in the coastal region and undertake risk analysis related to climate change.

Several of these responses which are being considered as adequate for addressing climate change adaptation in the region parallel those which are being identified as suitable responses to facilitate disaster reduction. Some of the tools used, information and skills requirements are similar – hazard maps, vulnerability assessments, valuation of natural resources, public awareness, risk analysis and early warning systems. However, as climate change science improves so that reliable regional climate models and region-specific climate change scenarios become available, greater precision will be injected into regional projections of climate change impacts on critical physical and socio-economic systems in the region. This in turn will better inform policy and other interventions necessary as part of a country's adaptation strategy. Until such time as these tools become available the strategy being adopted in the region is based on the assumption that in strengthening the region's resilience to the impacts of present day climate variability countries would have embarked on the road to decrease the region's vulnerability to long term climate change. It is this assumption that informed the process of developing National Climate Change Adaptation Policies and Implementation Plans for Caribbean

countries under the CPACC project. Hence through an extensive process of stakeholder consultations, use of expert knowledge and the experience of coping with present day climate variability, countries were able to articulate policy interventions and other actions which would contribute to reducing their present day vulnerability to impacts arising from climate variability. To the extent that these interventions and actions also contribute to the sustainable development agenda of the country, there will be a greater chance that they will be implemented. Response to present day climate variability therefore offers an excellent strategic vehicle to start insinuating climate change adaptation into National Development Plans.

Risk Management

Under another project, Adaptation to Climate Change in the Caribbean (ACCC) funded through the Climate Change Development Fund (CCDF) of the Canadian International Development Agency (CIDA), the region has been implementing a project which seeks to build capacity for integrating adaptation to climate change into the physical planning process, in the private sector and governments, using a risk management approach. Risk management has been regarded as providing an excellent framework for facilitating decision-making in an environment of uncertainty. Given the uncertain nature of climate change science at this juncture it is therefore not surprising that the risk management approach is being adapted to facilitate the choice of appropriate policy options for dealing with climate change adaptation.

Under the ACCC project use is being made of the Canadian Standards Association (CSA), "Risk Management Guidelines for Decision Makers", an approved National Standard of Canada. These guidelines are being adapted to assess climate change risks in the Caribbean. The project is designed to:

- Identify how a risk management approach can address climate change risks in the Caribbean;
- Review appropriate sectoral approaches for integrating risk management into climate change adaptation planning and management;
- Identify mechanisms whereby risk management processes can be integrated into existing legal, institutional and policy frameworks;
- Identify an appropriate process to initiate the integration and consideration of risk management processes between the various sectors; and
- Integrate sectoral adaptation measures into National Development Planning.

CAN/CSA-Q850-97, Risk Management: Guidelines for Decision Makers

The decision making process described in the CSA Risk Management Guideline (CAN/CSA-Q850-97) consists of six steps that follow a standardised management or systems analysis approach (Figure 1).

The process is iterative and allows for the return to previous steps at any time throughout the process. The features of the Q850 approach are that it:

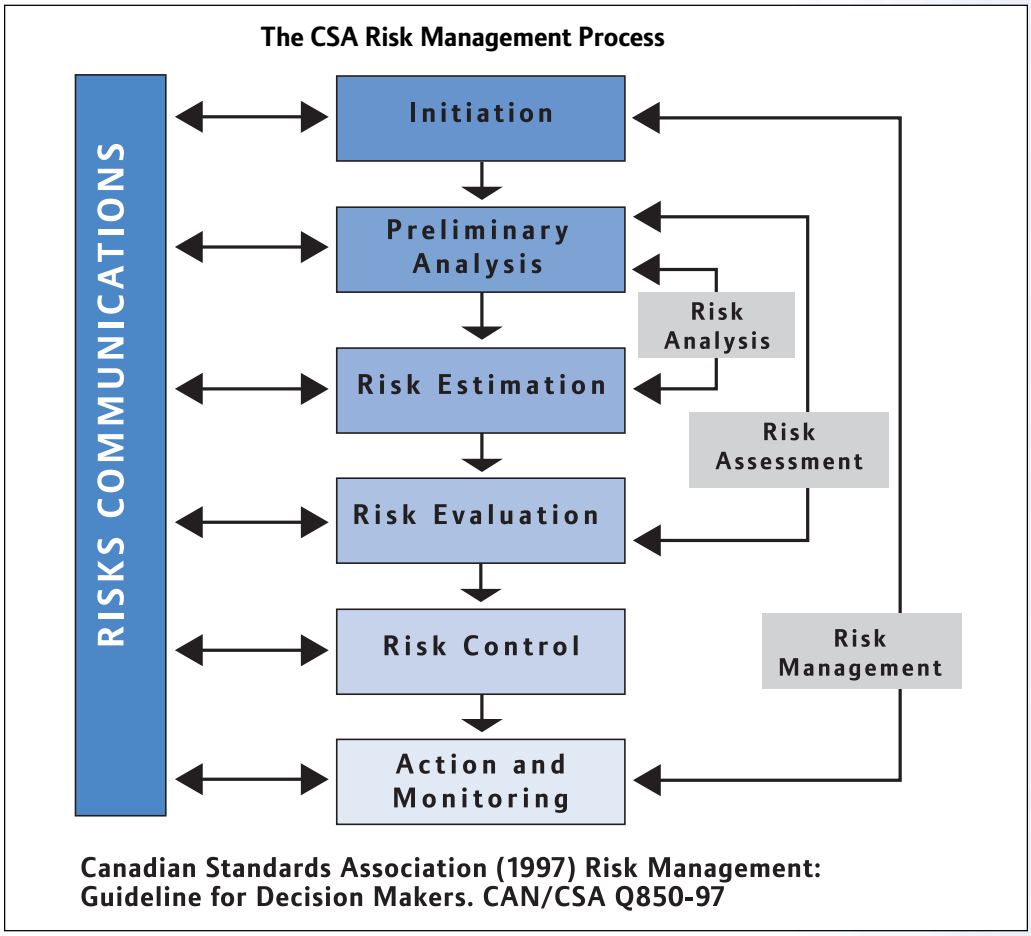
- Incorporates stakeholder perceptions of the acceptability of the risk into the decision process, providing for more informed decision-making and ensuring that the legitimate interests of all affected stakeholders are considered;

- Incorporates a risk communication framework into the decision process, ensuring reasonable and effective communication among stakeholders;

- Provides a standardised set of terminology used to describe risk issues, thus contributing to better communication about risk issues; and

- Provides for an explicit treatment of uncertainty.

Figure 1: Steps in the Canadian Standards Association risk management decision-making process



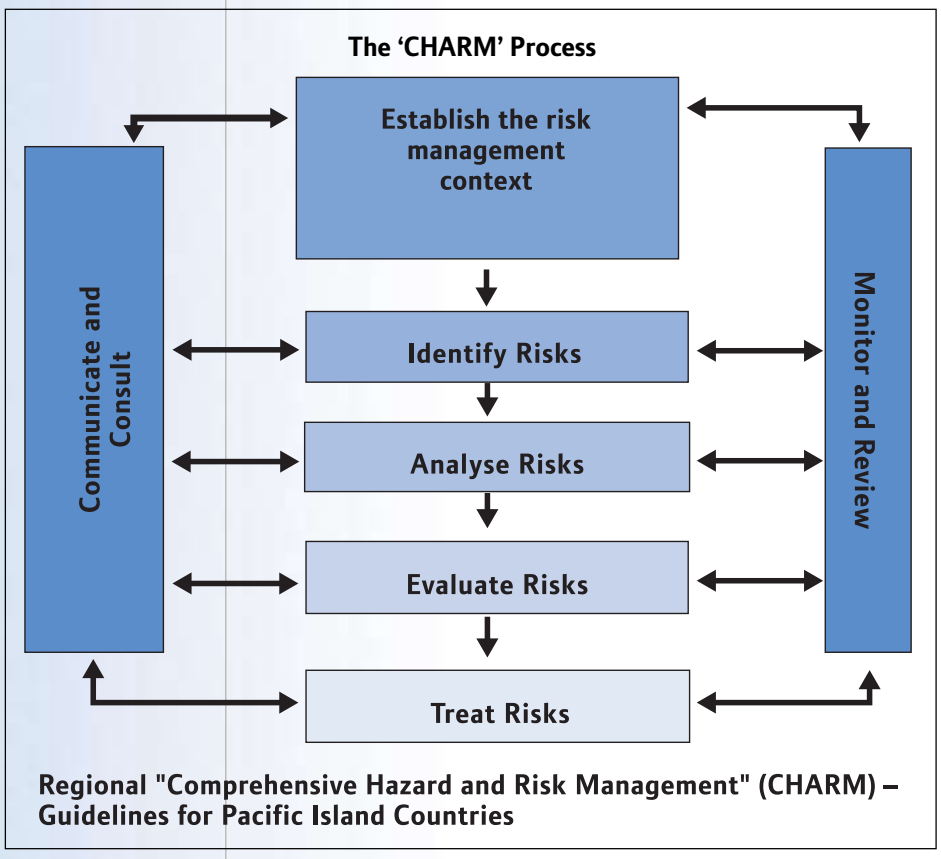
Source: CAN/CSA Q850-97 Risk Management: Guideline for Decision Makers

Comprehensive Hazard and Risk Management (CHARM): Guidelines for South Pacific Island Countries

As part of our efforts to explore the use of the risk management approach to deal with climate change risks we are also examining the utility of the Comprehensive Hazard and Risk Management (CHARM) process developed and applied in the South Pacific Island Countries. CHARM is modelled on the AS/NZS 4360:1999 standard to ensure it meets accredited standards and thus recognised regionally and internationally. It is defined as "a comprehensive hazard and risk management tool and/or process within the context of an integrated national development planning process".

By aligning the CHARM process with National Strategic Development Plans, Pacific countries seek to move from a disaggregated sectoral approach towards a broader integrated programming approach that will promote the achievement of sustainable outcomes. The major goal of the CHARM model is to develop a national risk and treatment option matrix that has considered the activities of all agencies and targets the gaps in the matrix. The major steps associated with this goal are contained within the five main steps of the AUS/NZS 4360:1999 Standard (Figure 2) and the process is underpinned by a continuous requirement for:

Figure 2: Steps in the 'CHARM' risk management process



Source: Comprehensive Hazard and Risk Management (CHARM): Guidelines for Pacific Island Countries

- Communication and consultation;
- Monitoring and review; and
- Effective documentation.

Given the similarity of conditions existing between the South Pacific and Caribbean SIDS, an exercise is being conducted to determine which aspects of both the Canadian and the CHARM processes can be utilised to develop a risk management methodology best suited to Caribbean circumstances.

Conclusion

Recent developments in the region leading to the greater focus of disaster management on reduction efforts afford an excellent opportunity for a closer liaison between the disaster management and climate change adaptation communities. Such a liaison will be beneficial and mutually

supportive. Skills developed in the disaster management community over years of dealing with the aftermath of climate-related hazards are easily transferable to support activities required for the identification of and implementation of climate change adaptation options. Similarly information and experience generated by dealing with disaster management is relevant for use in climate change studies in the region. As more precise tools for the latter are developed (climate change scenarios, regional models) by the climate change community, greater confidence will be imparted into the process of identifying feasible options for climate change adaptation and disaster reduction. There will be a need to close the existing gap between the disaster reduction and climate change communities to rationalise terminology utilised by both, methodologies adopted (risk management, vulnerability assessments, hazard mapping, damage assessment), and the use of already scarce human and financial resources. Finally, most disaster reduction efforts seem to be focussed on dealing with impacts on human, natural and built systems and the protection of these from damage, while ignoring the functions which natural ecosystems play in the entire spectrum of disaster reduction. Strengthening the resilience of natural ecosystems to climate impacts is an essential part of the climate change adaptation strategies which are now evolving. Collaboration between these two communities will ensure the insinuation of this consideration into disaster reduction strategies.

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Linking Adaptation to Climate Change and Disaster Mitigation in the Eastern Caribbean: Experiences and Opportunities

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Abstract

The Third Assessment Report (TAR) of the IPCC highlights the increasing threats to sustainable development presented by projections for global climate change. The TAR also recognises the peculiar circumstances of Small Island Developing States (SIDS) and identifies them as among the categories of countries most vulnerable to climate change.

Much of the vulnerability of these island countries to projected anthropogenic climate change derives from their existing high levels of weather/climate related disaster risk particularly hurricanes and droughts. In most instances such climate-related disasters can be expected to worsen with climate change.

The increasing scientific knowledge of climate change therefore presents formidable challenges for development planners and policy makers in public and private sectors to ensure that climate change considerations are factored into present and future development plans. In the case of disaster and risk management programmes this is particularly important from at least two perspectives:

- *Ensuring that present disaster mitigation efforts incorporate knowledge of projections for climate change, and*

- *Ensuring that existing, and future development activity, does not increase risk levels taking into account projections for climate change.*

The paper first provides an overview of the eastern Caribbean region including identifying some of the existing challenges and threats to sustainable development. This is followed by an indication as to some of the likely impacts of climate change in the region based on IPCC estimates and scenarios. An attempt is then made to give an overview of some of the structural and other factors that have minimised the opportunities for integration of risk management and climate change portfolios. Finally an attempt is made to identify opportunities for strengthening the integration of climate change concerns into disaster mitigation and risk reduction efforts as part of wider attempts to achieve sustainable development.

Overview of the Eastern Caribbean

Physical Features

Four eastern Caribbean Countries –Antigua and Barbuda, Dominica, St Kitts and Nevis, and St Lucia – constitute the collective "case study" for the assessment. Geographically, the countries occupy part of the eastern boundary of the Caribbean archipelago and consist primarily of the top of ancient submerged volcanoes, the principal exception being the island of Barbuda which is a low lying coral island. The region's volcanic origin has resulted in a generally rugged topographic profile, particularly in inland areas, forcing human settlements and activities onto often narrow coastal belts. Volcanic and seismic activities continues in most islands, most notably in Dominica and in the island of Montserrat where an active volcano since 1995 has forced the evacuation of two-thirds of the population.

The climatic features of the islands are characterised as tropical maritime and are influenced primarily by the presence of the Atlantic Ocean and Caribbean Sea. Average temperatures range from a high of 31°C in August to a low of 27°C in January. Climatic conditions, particularly micro-climates, vary quite substantially throughout the islands being influenced by altitude and position in relation to the prevailing winds. Rainfall amounts vary widely, from a high of 10,000mm (400 inches) for interior regions of Dominica to 900mm in Antigua and Barbuda during low rainfall years. Variability in rainfall is, however, a feature of the climate and periodic drought conditions affect the islands. All of the islands are also affected by the annual Atlantic hurricane season lasting from May to November. After an extended period of relative dormancy the years since1995 have seen intensified hurricane activity with many of these systems directly impacting these islands. There is general consensus that since 1995 the region has entered a more active period of hurricane formation, possibly linked to multi-decadal changes in global weather and climate.

The islands display a range of terrestrial and marine biodiversity, with biodiversity being particularly rich in coastal and marine environments where coral reef, mangroves, and sea-grasses provide habitats for various species. Notwithstanding their small size, a number of endemic species exist in terrestrial and marine environments. The natural resources of the region – its climate, soils, fisheries, and beaches – provide the basis for the principal economic sectors of tourism and agriculture.

Socio-economic Characteristics

The modern history of the islands can be dated to the period of European settlement in the 16th and 17th centuries resulting in the extermination of the indigenous population[1] and the introduction of slave labour from Africa. Population figures vary from 160,000 in St Lucia to 40,000 in St Kitts and Nevis. As with most other developing countries, a youthful base heavily dominates the population pyramid. Traditional intra-island and external migration continues to be an important feature of social and labour mobility although rates of migration to North America and Europe have slowed as immigration policies have tightened in those countries.

The agricultural sector continues to be a primary source of employment and foreign exchange, particularly the important banana industry in St Lucia and Dominica, and sugar cane in St Kitts and Nevis. In all countries small farmers, including producers of livestock, vegetables and poultry, provide the core of agricultural production and make important contributions to nutrition and food security. The fisheries sub-sector consisting of migratory pelagics, near-shore pelagics, demersals, lobster and other fisheries also provides an important element of the agricultural sector contributing to exports, employment and nutritional inputs. Overall the sectoral contributions of agriculture vary from 15 per cent in Dominica to 3 per cent in Antigua and Barbuda.

Table 1: Sectoral Contribution of GDP in Constant Prices: 2000

	Agriculture	Hotel & restaurant	Government services	Construction	Manufacturing
Antigua and Barbuda	3%	15%	16%	13%	2%
Dominica	15%	2%	15%	8%	5%
St Kitts and Nevis	5%	5%	15%	19%	12%
St Lucia	8%	15%	12%	9%	12%

Eastern Caribbean Central Bank, 2001

Tourism presently constitutes the most dynamic element of the regional economy in terms of employment, foreign exchange receipts, and inter linkages with other sectors of the economy. The tourism product is based on the region's natural assets, primarily coastal but also terrestrial and increasingly cultural resources. Beach dominated tourism is the principal form except in Dominica where the country's rich forestry, mountainous terrain, and volcanic geology provide world class eco-tourism attractions. In addition to stay-over visitor arrivals, cruise tourism constitutes a major and growing component of the tourism market. Tourism demand is generally greatest during the winter seasons from December to April as cold conditions in Europe and North America prompt vacation travel to the Caribbean.

As in most small states, governments are forced to adopt a vigorous role in promoting economic activity so as to overcome the natural limitations imposed by small size and lack of economies of scale.

[1] One remaining community of indigenous Carib people remains in Dominica.

A number of environmental stresses already confront attempts to achieve sustainable development. These include coastal erosion, deforestation and attendant impacts on watersheds, marine pollution, solid and liquid waste management, and loss of biodiversity. Additionally the close linkage between the natural resource base and the principal economic sectors of tourism and agriculture means that impacts from present climate variability, particularly droughts and hurricanes, have significant socio-economic impacts. As micro-economies, lacking economies of scale even in their dominant sectors, the development options open to these countries are likely to be extensively impacted by climate change.

Climate Change Projections for the Caribbean

The TAR points out that an analysis of observational data for the Caribbean indicates that the region has experienced increases in surface air temperatures that are in excess of the global average. Empirical evidence suggests an overall drying tendency for the eastern Caribbean that appears to correlate with available meteorological data.

In terms of sea level rise the analysis of sea level trends is complicated by the lack of available historical records. However, coastal areas in all of the islands already experience often severe rates of coastal erosion, in many instances exacerbated by inappropriate construction in coastal areas. Projections for an accelerated future sea level rise are particularly ominous for these countries where all major settlements and most public infrastructure are located within 2 km of the coast. Storm surge and its devastating impacts will also be affected by both sea level rise and intensified storm activity.

While global climate models are presently unable to accurately represent such small land surfaces as those of the eastern Caribbean it is nevertheless possible to arrive at certain conclusions as to some of the likely impacts of certain projected parameters of climate change. In fact a number of the IPCC projections for climate change are particularly relevant to any discussion of the linkage between climate change and disaster risk management in the eastern Caribbean.

Based on an ensemble of several global climate models, the eastern Caribbean can expect to see a continued trend towards drying, with consequent impacts on water supply, agriculture, health etc. Temperature projections of approximately 1.4 to 5.8°C can be expected by 2100 based on IPCC estimates for global temperature rise.

Significantly, increases in the sea surface temperature are expected to drive the formation of stronger, and possibly more frequent, hurricane and tropical storm activity. Temperature increases of the magnitude projected would also have significant adverse impacts in terms of natural resource productivity and effects on human health.

All these scenarios point to a situation where already high risk and vulnerable communities and States will experience heightened levels of risk as a result of climate change. In many instances a combination of vulnerabilities relating to poverty and resource availability make certain communities and groups particularly high risk in terms of the types of adverse impacts that can be anticipated from climate change. This points to the need, where appropriate, to integrate climate change and risk management concerns and activities. Table 2 below provides an indication of IPCC projections for changes in extreme events in the 21st century.

Table 2: Examples of Impacts from Projected Changes in Extreme Climate Events

Projected changes during 21st century in extreme climate phenomena and their likelihood	Representative examples of projected impacts
Simple Extremes	
Higher maximum temperatures; more hot days (very likely)	● Increased incidence of death and illness in high risk groups (elderly, infants etc) ● Increased heat stress in livestock and wildlife
Increasing minimum temperatures (very likely)	● Extended range and improved habitats for some pests and disease vectors ● Increased flood, landslide, and mudslide damage
More intense precipitation events (very likely)	● Increased soil erosion ● Increased pressure on government and private flood insurance systems and disaster relief
Complex Extremes	
Increase in tropical cyclone peak wind intensities, mean and peak precipitation intensities (likely over some areas)	● Increased risks to human life, risk of infectious disease epidemics, and many other risks ● Increased coastal erosion and damage to coastal buildings and infrastructure ● Increased damage to coastal ecosystems such as coral reefs and mangroves
Intensified droughts and floods associated with El Nino events in many different regions (likely)	● Decreased agricultural and rangeland productivity in drought and flood prone areas ● Health impacts associated with droughts and flood events ● Decreased crop yields ● Decreased water resource quality and quantity ● Increased risk of forest and bush fires

Adapted from IPCC, 2001

Opportunities and Constraints to Inter-linkages

Within eastern Caribbean territories the opportunity exists for increased interaction, networking and integration of elements of work between the principal portfolios with direct stakeholder concerns in advancing work relating to integrating climate change into risk management and sustainable development concerns:

- Disaster risk management agencies, and
- Climate change coordinating agencies (generally Ministry of the Environment).

Two inter-related factors have contributed to the levels of coordination, networking, and integration of work programmes within and between the two portfolios in relation to climate change:

- Evolution of the climate change debate, and
- Institutional constraints.

In terms of the evolution of the debate relating to climate change, international attention and focus has been directed through the negotiating process of the UNFCCC. Article 2 of the UNFCCC provides that the ultimate objective of the convention is the stabilisation of emissions of GHG emissions in the atmosphere at levels that would prevent dangerous anthropogenic interference with the climate system. The principal thrust of the negotiating process has therefore been the international attempt to reduce emissions, culminating in the1997 Kyoto Protocol and subsequent efforts to enable its early ratification.

The emphasis of the convention on GHG reduction has meant that adaptation issues have been to a great extent less adequately covered than climate change mitigation efforts.

This is reflected in the protracted negotiations relating to article 4.8 of the UNFCCC and the modest progress made in this regard with the decisions of COP6.5 and COP7 for establishment of an adaptation fund for non-annex 1 countries and a special programme of assistance – so called National Adaptation Plan of Action (NAPA) – for least developed countries.

The result of the process of evolution of the negotiations was initially to sideline adaptation issues vis-à-vis climate change mitigation and therefore to delay the inevitable identification of the need to strengthen the linkages between climate change adaptation and risk management initiatives and programmes. Equally significant is that attempts by developing countries to have disaster management issues incorporated into climate change assistance programmes have met with resistance from annex 1 countries concerned about the lack of adequate scientific evidence to distinguish present day climate variability from future climate change, and about the potential costs involved in including disaster response measures within the framework of the UNFCCC.

The principal advocates for early adoption of stronger adaptation measures within the UNFCCC process have been the AOSIS group of countries comprising island States from the Caribbean, Pacific, Indian Ocean, and Mediterranean regions. Indeed adaptation has always been defined as the primary concern of these countries characterised by their miniscule contributions to global GHG emissions and high levels of vulnerability. A concern of AOSIS countries in relation to the issue of financing for climate change adaptation is the three-phased approach adopted by the Global Environment Facility [2].

[2] GEF Operational guidelines provide that the GEF will provide full cost funding for Stage 1 adaptation activities undertaken within the context of formulation of national communications. Stage 1 is envisaged as "planning, which includes studies of possible impacts of climate change, to identify particularly vulnerable countries or regions and policy options for adaptation and capacity building" UNFCCC decision FCCC/11/CP1. See http://www.gefweb.org/public/opstrat

This three-tiered approach has artificially separated the component elements of the climate change impact assessment and adaptation process, and has probably impeded the progressive development of adaptation tools and methods including the opportunity for developing the intellectual, institutional, and operational base for integration of risk management into climate change methodologies and implementation.

From an administrative perspective the initial focus of the UNFCCC on the highly politicised issues surrounding climate change mitigation concerns (primarily GHG reduction) has meant that the expertise for participating in climate change programmes and activities has largely been the responsibility of ministries of foreign affairs and/or the environment, with disaster risk management and meteorological agencies often not directly involved. This has had the double effect of reducing the effective sensitisation of the risk management communities to climate change issues as well as inhibiting the incorporation of risk management issues into the debate.

The non-participation of the disaster/risk management community however is also reflective of the limited institutional capacities existing within these agencies in such small states. Given the constraints of personnel and resources alongside the strong demands for disaster response services, risk management agencies have been forced to focus their efforts on providing hands on relief and advice to local scale emergencies ranging from hurricanes to industrial accidents. As the responsibilities and capabilities of these agencies have expanded they have encompassed additional advisory and technical roles. However, the agencies have been too small and lacking in the necessary capabilities to get extensively involved in climate change issues at this time.

In all instances some progress has been made in having representatives of the risk management agency participate in the various advisory committees set up to coordinate work relating to climate change and particularly the preparation of the National Communications report [3]. This has facilitated the two-way flow of data and information between the two communities. There has also been training and other activities that have enabled disaster management officials to obtain a better understanding of climate change concerns. Preparation of the various National Communications required under the UNFCCC has also seen the incorporation of data and experiences from various risk management sources into the work on vulnerability and adaptation. There is likely to be increasing recognition of the significance of climate change among senior risk management officials and the need now exists to extend such awareness to other levels and to factor such concerns into risk management programmes.

A principal obstacle in this regard however is the lack of the climate data that is necessary for enabling integration of climate change into risk management. As a recent report on climate observation systems in the Caribbean and Central America has noted there are important gaps in atmospheric, terrestrial, and oceanic information that inhibit a better understanding of current climate variability as well as any changes taking place in the regional climate. Such information will be required for enabling risk managers to better factor climate change concerns into their decision-making. This is especially important in view of the tremendous uncertainties that still surround the likely timing and magnitude of climate change.

[3] Article 12 of the UNFCCC requires Parties to the convention to "communicate" information including "a national inventory of anthropogenic emissions....and sinks, a general description of steps taken or envisaged by the Party to implement the Convention, and any other information that the Party considers relevant".

Integrating Risk Management and Adaptation to Climate Change

The TAR points out that adaptation to climate change has the potential to reduce the adverse effects of climate change although not without costs. The report also indicates that the key elements of adaptation to climate change are likely to relate to climate variability and extremes and not simply to changes in average conditions. The TAR notes that enhancement of adaptive capacity should therefore serve to reduce the vulnerability of regions and sectors to climate change, including climate variability and extremes and can therefore be seen as supportive of ongoing attempts at sustainable development.

This makes even more important the role of risk management as an instrument for climate change adaptation since there will need to be an enhanced capacity at all levels to cope with more intense storms and other extreme events. In the context of the eastern Caribbean this means that already high levels of exposure to weather extremes, particularly hurricanes and droughts, will intensify: this will have policy and planning implications for human settlements, health, and other sectors.

Adaptation measures recommended in the context of eastern Caribbean countries include:

- Strengthened land-use planning and development control;
- Integrated coastal area management;
- Strengthened disaster response capability;
- Watershed management;
- Insurance; and
- Improved health sector monitoring.

In all these areas the need is to be able to factor climate change concerns (rising temperatures, storm activity, sea level rise etc) into these programmes. All reflect a proactive response to climate change adaptation and are consistent with risk management approaches to physical and economic development. The aim is to begin the incorporation of climate change concerns into development guidelines so that sectoral activity can proceed in the context of a changing climate and without undermining the natural resources upon which economic activity is based.

An integral element of climate change is the continuing uncertainty that surrounds, and is likely to continue to surround, the timing and magnitude of climate change. This points to the need to continue the collection of climatological data so that this can feed into climate models and other assessments of the impacts of climate change in the eastern Caribbean.

At the same time it has to be recognised that current tools for climate change adaptation planning are necessarily in their infancy so that adaptation options must be constantly reassessed and revised as the information base

on climate change evolves.

Directions for Programming

Climate change will be virtually all-pervasive and therefore will affect most aspects of life. From this perspective it is important that guiding principles be established for ensuring that programmes developed for economic and social development incorporate concerns for climate change impact and adaptation. These guiding principles should include:

- Country-driven objectives to ensure that activities are congruent with wider development goals;
- Stakeholder involvement and input in project design, implementation, and monitoring; and
- Possible use of indigenous adaptation technologies and methodologies.

A number of initiatives are required to achieve the desired levels of integration of climate change into risk management assessment and policies and then to facilitate the wider adoption of risk management principles into development planning. Notwithstanding the need to further develop the data-base there is sufficient understanding of the likely pathways of climate change to promote active adaptation where this is also consistent with other sustainable development goals.

Notwithstanding the initial actions undertaken by eastern Caribbean countries substantial technical and financial support will be required from the international community in implementing the adaptation priorities indicated above. The following areas are identified for possible programme development and implementation for building climate change risks into national decision-making. They provide a set of outputs and activities that aim at enhancing adaptive capacity as the principal response to the impacts of climate change [4]. They are intended as possible priority areas for facilitating the necessary linkage between climate change and risk management concerns, and for having these concerns integrated into development activity:

- Land use planning as a primary mechanism for minimising the impact of climate change,
- Strategic awareness building activities for key decision makers,
- Media information and sensitisation activities on climate change,
- Development and field testing of climate change adaptation planning frameworks,
- Sharing of best practices and guidelines for risk management and climate change adaptation (for example, in coastal areas),

[4] Many of the proposals are adapted from "Adverse Effects of Climate Change: initial actions relating to the adverse effects of climate change in accordance with article 4.8 and 4.9 of the convention". Tom Downing, Youba Sokona, and Joel Smith. March 2000. Unpublished UNFCCC workshop presentation.

- Consideration of climate change concerns/risks at the planning phase of investment and development projects,

- Implementation of adaptation demonstration projects that enable practical disaster risk management and that meet existing development needs, for example, coastal protection,

- Development of a meaningful international adaptation financing framework for funding of climate change adaptation projects in small island countries that addresses priority areas,

- Strengthening of atmospheric, terrestrial, and oceanic information data-bases including retrieval and storage of historic data,

- Infusing risk management concerns into national communications,

- Modelling of projected climate change impacts on key natural processes and ecosystems in small islands.

At the same time it is critical to realise that adaptive capacity is dependent on a wider range of variables encompassing such aspects as economic development, effective levels of public participation in decision-making, and technological development.

Consequently eastern Caribbean states must continue, and indeed intensify, wider processes of facilitating processes for sustainable development incorporating issues of social equity and empowerment, environmental protection, and economic development.

Conclusion

Projections for global climate change indicate that the small island countries of the eastern Caribbean can expect to experience a number of adverse impacts deriving from changes in such climate parameters as rainfall, temperature, sea levels, and storm/hurricane frequency and intensity. While all these changes can be anticipated to have adverse effects, the projections for more extreme weather events in regions like the Caribbean mean that the roles of risk management agencies are likely to be especially affected by anticipated changes in global climate. This points to the need to strengthen links between climate change and risk management "communities". Specifically, knowledge pertaining to climate change needs to be fed into, and inform, risk management policy and planning.

Climate change represents a cross-cutting set of issues that will require adjustments/adaptations based on best available information and knowledge. The essential challenge is to incorporate that knowledge into sectoral and cross-sectoral activities and to ensure that risk management paradigms are adjusted to reflect the emerging scientific data and observations on climate change at global, regional and local levels. There is the need to establish an enabling environment for the adaptive measures required if the present efforts of these communities to achieve sustainable development are not to be thwarted. This is especially important in that national development programmes and projects planned for the future will be affected by climate change.

Additionally, activities now being undertaken will themselves affect the natural resource base and therefore its potential for responding to any adverse impacts of climate change. It is therefore crucial that policy makers take early actions to begin to integrate climate change considerations into their development planning. The programme priorities identified above should go some way in building adaptive capacities for reducing vulnerability and enabling sustainable development.

For small communities, the costs of adaptation are likely to be considerable from a financial standpoint and will require partnerships at all levels – community, sectoral, national, regional, and international. Assistance will, however, be required from the international community for financial and technical support. During the present period of shrinking resources and increasing demands it becomes even more imperative that there is congruence between agencies and organisations involved in related aspects of sustainable development planning and programme implementation.

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Risk Management and Adaptation: Reflections with Implications for Africa

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Abstract

Africa, like other regions, is prone to disasters, including natural ones. Climate change effects will be devastating, as they will be played on a canvas of weak risk management institutions and practices, and a low level of resilience. The knowledge and information base for decision-making on risk management is also low. Within this context, operationalisation of concepts for risk management and adaptation needs to be built on the principle of common but differentiated needs, strongly integrate local knowledge and practices, and, emphasise on capacity development.

The perspectives in the paper are those coming from the development side of the equation. The focus is on how to facilitate sustainable development through integrating risk management and adaptive management in sustainable development policies and strategies, with an emphasis on the African situation. It covers issues of concepts and policy as well as practical considerations, interventions and guidelines.

The paper first briefly discusses the Africa problematic regarding disasters and climate change, followed by a presentation of some conceptual issues relating to risk and adaptive management from an African angle. It also discusses operationalising risk management and adaptive management through interventions to build resilience in Africa and ntegrates these two approaches in sustainable development strategies. The paper

concludes with some recommended roles for UNDP in the process of facilitating the culture and practice of adaptation in Africa.

The Africa Problematic

Africa is subject to a high degree of climate variability that results in high vulnerability to natural disasters and extreme climate events, particularly droughts, floods, and epidemics, the most common hazard events, as seen from Table 1. In contrast, volcanoes, earthquakes and cyclones/hurricanes occur less frequently. In general, Table 2 shows that there has been an increase in the annual frequency of large-scale disaster events in Africa since 1985, compared to the frequency since 1970. The Africa Environment Outlook confirms this trend of increasing occurrence and severity of natural disasters, particularly in the Sahel (UNEP, 2002 A). In terms of country incidence, Ethiopia, Mozambique, Tanzania and Sudan experienced the highest number of disaster events. In terms of population affected, these countries, in addition to Malawi, were the worst affected.

Africa contributes least to the problem of climate change. The region accounts for only 7 per cent of global emissions of greenhouse gases, 3.5 per cent of global total carbon dioxide and 7 per cent of methane (UNEP, 2002 B). The average per capita annual GHG emissions from Africa is 0.3 tonnes of carbon while in cumulative terms, Africa accounted for only 4 per cent of cumulative GHG emissions from 1900 to 1999 (World Resources Institute, 2001). Furthermore, Africa's forests act as a significant global carbon dioxide sink. Ironically, Africa is most vulnerable to adverse climate change effects due to the high dependence on agriculture for livelihoods, and the low financial resource base and capacity to adapt to or mitigate these effects.

The continent's high vulnerability to climate change is expected to result in increased average temperatures and worsened variability of rainfall with its attendant deleterious effects on already stressed livelihoods in several areas of sub-Saharan Africa. According to the Africa Environment Outlook, average annual rainfall in Africa has been on a declining trend since 1968, while the incidence and severity of drought in Africa is expected to increase due to global warming (UNEP, 2002 A, B). Crop yields in Southern Africa could decline by 20 per cent. Many parts of the continent, including the Gulf of Guinea, the eastern Africa coast and the Western Indian islands are at risk from rising sea levels and malaria-carrying mosquitoes would likely spread to the southern end of the continent during the next decades (UNEP, 2002 A).

The regional situation is an aggregation of adverse effects at the national level. For example, in Ghana the Environmental Protection Agency's climate change vulnerability assessment (1990 - 2050) showed that the effects of long-term decline in natural resource productivity will be exacerbated by climatic change effects due to increasing temperature, and falling precipitation resulting in decreased availability of both surface and ground water resources. There would also be shifts in agro-climatic zones: the northern savannah zone will become drier, shortening the transition zone whilst the coastal savannah will also tend to move northwards. Furthermore, vulnerability assessment of climate change affect on agriculture showed that by 2050, the yield of maize will decrease by 7 per cent compared to the 1990 levels while millet will be least affected due to its higher drought tolerance (Republic of Ghana, 2000).

These negative expected outcomes of extreme weather events, climate change and climate variability on the socio-ecological systems in Africa need to be addressed through the application of appropriate risk and adaptive

management concepts and practices.

Some Conceptual Issues (Relating to Risk Management and Adaptive Management with African Angles)

Vulnerability Relations in Socio-ecological Systems

The relationship between human security, ecological resilience and development sustainability depends on the interactions between factors determining social, biological and physical aspects of global change in an inter-linked manner. As we know, human livelihoods, well-being and security depend on ecological services, such as air, food, fuel and medicines. In Africa, this dependence is more marked for some services, particularly those relating to basic needs, due to the lower level of socio-economic development, than in other regions. For example, in Ghana a 1998 survey showed that 38 per cent of the national population earned some income from forest product activities (Arnold and Townson, 1998). In addition, forests and other natural resources contribute to the natural, physical, financial, human, and, socio-cultural and spiritual capital profile of the poor that determine their livelihoods strategies and outcomes in several ways (Vordzorgbe, 2001). Due to poverty in Africa, the net deleterious impact of human activity on ecosystems is heightened, thereby compromising the goal of achieving sustainable development.

Vulnerable ecosystems are directly related to vulnerable communities and societies, but not in a linear or one-to-one relationship. These communities adapt and can survive, even after vulnerable ecosystems die away, due to human adaptation, including utilising other ecosystems to meet human livelihood needs and migrating. A community living in a vulnerable ecosystem need not necessarily experience the same degree of vulnerability as the ecological system supporting it; how the community fares depends on the nature and extent of the relationship between the two entities of that physical space. If the ecosystem has little direct impact on the livelihood of the community, the relationship is weaker and more tenuous. However, in Africa the relationship is quite strong, and directly proportional, since livelihoods are more dependent on ecosystem health.

Effects of Climatic Change on Hazards and Vulnerability

Climatic change affects both vulnerability and hazards; the link is through human actions and interface. For example, in the Sahelian zone of Africa, reduced rainfall due partly to worsening desertification, arising partly from autonomous climate change and human action or inaction, results in increased land degradation and crop failure (hazard) and susceptibility to famine (a vulnerability). Once more, the level of development determines the relative impacts; in situations of low development (and greater reliance on ecosystem benevolence), climate change affects both, but impacts vulnerability more. In developed regions, climate change affects hazards more than vulnerability. Hence, the key to developing or strengthening adaptive capacity in Africa to address climate change and its effects is to focus on reducing vulnerability. This viewpoint is supported by the observation that, given Africa's poverty status, we cannot afford to concentrate solely on classical mitigation efforts; we need to prioritise our risk management requirements by focusing on developing adaptive management systems and initiatives.

Table1: Number of Large-Scale Disaster Events and Number Affected in Selected African Countries 1970-1985

Country	Floods	Drought, Famine, Food Shortage	Epidemics	Forest Scrub Fire	Tropical Cyclone/ Hurricane/ Typhoon	Volcanoes Infestation	Insect	Landslides	Earthquakes
Angola	1 (100,000)	5 (3,186,000)	4 (47,311)						
Benin	10 (1,868,727)	7 (2,125,000)	8 (4,119)	2 (7,200)					
Burkina Faso	5 (102,796)	17 (7,038,290)	14 (90,463)						
Burundi	1 (3,600)		3 (30,598)						
Cape Verde	1 (112,000)	12 (10,000)	1 (2,996)		2 (7,722)	1 (6,306)			
Central Afr. Republic	4 (43,614)	3 (NA)	1 (418)		1 (1,850)				
Chad	5 (88,355)	20 (8,091,000)	5 (27,644)		2 (1,300)		2 (NA)		
Comoros		3 (300,000)	1 (450)		4 (115,052)	2 (25,000)			
Dem. Rep. of Congo	3 (63,056)	2 (800,000)	14 (10,453)		1 (NA)	1 (8,010)		1 (148)	9 (61)
Djibouti	6 (489,000)	4 (355,000)	3 (3,241)		4 (775)				
Ethiopia	16 (858,951)	25 (60,880,64)	6 (103,688)		4 (775)				
Ethiopia	16 (858,951)	25 (60,880,064)	6 (103,688)			2 (2)	2 (NA)	2 (29)	
Gambia	16 (858,951)	13 (651,000)	3 (1,769)		1 (5,000)				
Guinea	2 (13,066)	3 (NA)	2 (24,030)						1 (21,436)
Guinea Bissau		8 (NA)	4 (40,656)	8 (1,500)			3 (NA) incl. tsunami		
Lesotho	3 (180,000)	5 (1,001,500)	1 (500)		3 (250) storms				
Liberia	1 (5,000)	1 (NA)	3 (1,887)		1 (2,000)		1 (1,00,000)	1 (200)	
Madagascar	2 (68,443)	5 (2,316,500)	1 (NA)		20 (5,348,830)		1 (NA)		
Malawi	10 (1,013,226)	6 (16,507,267)	4 (736)						1 (145,391)
Mali	4 (49,195)	13 (5,202,000)	8 (5,202,000)				5 (NA)		
Mauritania	3 (10,500)	17 (6,769,156)	5 (1,065)				4 (240,000)		
Mozambique	11 (4,281,300)	16 (26,490,000)	9 (272,119)		6 (4,008,251)			1 (2,500)	
Nigeria	4 (257,992)	14 (7,734,199)	10 (110,037)				3 (NA)		
Rwanda	2 (1,921,678	4 (2,262,000)	3 (5,1120)						
Sao Thome & Principe		3 (93,000)	2 (1,063)						
Senegal	7 (340,500)	13 (7,264,998)	3 (3,797)				4 (NA)		
Sierra Leone	1 (200,000)		8 (910,781)		2 (12,000)				
Somalia	9 (1,190,500)	6 (783,500)	9 (41,093)		1 (NA)				

Country	Floods	Drought, Famine, Food shortage	Epidemics	Forest Scrub Fire	Tropical Cyclone/ Hurricane/ Typhoon	Volcanoes Infestation	Insect	Landslides	Earthquakes
Sudan	11 (3.347.165)	12 (25,350,000)	10 (27,408)	1 (NA)			4 (NA)		2 (10,015)
Tanzania	17 (769,879)	10 (9,430,000)	12 (54,246)	1 (NA)	1 (2,500)				
Togo	3 (176,905)	5 (600,000)	5 (8,264)						
Uganda	3 (183,280)	7 (1,559,000)	8 (103,031)					1 (NA)	4 (52,000)
Zambia	3	5 (2,996,201)	5 (24,521)				2 (NA)		

Table 2: Analysis of Large-Scale Disaster Events in Selected Countries 1970-1998

Country	Total Events	Total Killed	Total Affected	Annual Frequency since 1970	Annual Frequency since 1985
Angola	10	3,108	3,333,311	0.36	0.69
Benin	27	646	4,005,046	0.96	1.07
Burkina Faso	38	9,731	7,038,290	1.25	1.15
Burundi	5	286	34,198	0.17	0.23
Cape Verde	17	141	139,024	0.61	0.46
Central Africa Rep.	9	63	45,882	0.32	0.30
Chad	34	7,243	8,208,299	1.21	NA
Comoros	10	36	440,016	0.36	0.38
Dem. Rep. of Congo	23	2,795	881,728	0.82	1.38
Djibouti	17	245	848,016	0.53	0.69
Eritrea	3	NA	21,979	0.6 (1993)	–
Ethiopia	56	1,211,263	66,738,870	2.0	2.8
Gambia	22	439	661,769	0.76	0.69
Guinea	8	616	58,532	0.29	0.30
Guinea-Bissau	18	1,083	47,581	0.64	0.77
Lesotho	12	40	1,182,250	0.43	0.69
Liberia	8	593	1,009,087	0.28	0.38
Malawi	21	1,244	17,666,620	0.75	1.46
Mali	30	6,866	10,453,195	1.07	1.77
Mauritania	29	2,373	7,020,721	1.03	1.23
Mozambique	43	115,015	35,054,170	1.57	1.67
Nigeria	31	6,179	8,102,228	1.11	1.46
Rwanda	9	257	4,188,790	0.32	0.39
Sao Thome & Principe	8	181	94,063	0.17	0.15
Senegal	27	367	7,609,295	1	1
Sierra Leone	11	729	222,781	0.39	0.69
Somalia	25	25,658	2,015,093	0.92	1.31
Sudan	40	156,126	28,734,588	1.48	2.15
Tanzania	42	4,516	10,256,625	1.5	2.23
Togo	13	948	785,169	0.46	0.85
Uganda	23	728	1,897,311	0.82	1.62
Zambia	15	2,549	5,171,625	0.54	0.87

Resilience or Adaptation

Resilience is a higher-order goal than adaptation and should be the target of risk management development. Resilience depends on the ability to absorb shocks without altering the state of the system, to self-organise, and, to learn and adapt. Hence, adaptation, although preferred to mitigation in Africa's circumstances, is necessary but is not a sufficient condition for enhancing resilience. Inordinate focus on adaptation, without adequate attention to building the strength of the human and ecological systems to withstand shocks, to reorganise when buffeted by stresses, and to maintain previous states would not achieve resilience. There is the need to adopt a positivist approach of using adaptive management to facilitate resilience.

In the African context, given our weak institutions and structures for risk management, the first order of business should be to strengthen the shock absorbers in any given socio-ecological system and develop the capacity for reorganisation. The difficulty with the mitigation route in Africa lies in the challenge of pursuing sustainability within the context of risk and uncertainty, that is achieving manageable risk that leads to resilience within the constraint of low financial and technological resource availability in the region.

Panarchy and African Socio-ecological Systems

There is an aspect of African philosophies that is of critical importance to building resilience to climate, and other sources of change. This is about how the African perceives and relates to nature. The lives of most Africans are not decoupled from nature. Instead, the two are intricately linked and bound by close physical, biological, spiritual and cultural ties. This approach to the humanity-nature relationship implies that the African does not feel that society can control nature or be placed in an adversarial relation with nature. This orientation of inter-dependence between man and nature permits and promotes long-term adaptation and resilience. We do not take nature for granted, but instead adopt a flexible attitude to harnessing its bounty while anticipating its surprises.

This traditional way of life of Africans is both a facilitator of and a hindrance to resilience. The positive aspect is the underlying concept of dynamic symbiotic man-nature relationship. The negative side is that traditional life inhibits or retards change required for resilience. The challenge is how to balance these two aspects in building adaptive capacity for resilience in Africa.

To a large extent, this tension between constancy and change, and, permanence and renewal within African socio-ecological systems, mirrors the basic paradox that exists in the interactions between nature and people captured by Holling (2000): the paradox of the importance of change in the face of the necessity for stability in social-ecological systems. As the saying goes, change is the only constant in the universe. Within the context of evolving complex adaptive systems, panrachy ensures that adaptive cycles of growth, accumulation, restructuring and renewal perpetuate in transformational cycles nested at various scales of time, depending on the system. Thus, through panarchy, sustainable development ensues via the engendering of adaptive capability (Holling, 2000). This simultaneity of slowly adapting traditional life systems, more rapidly changing modern systems, and, physical systems that transform according to their own cycles offers a conducive setting for the development of resilience in socio-ecological systems in Africa.

Risk Management or Adaptive Management

Adaptive management and risk management are complements in creating and maintaining resilience of socio-ecological systems. Risk management is part of human adaptation while adaptive management is also part of risk management. Both adaptive management and risk management are concerned with achieving resilience in human-ecological systems in Africa, as in other regions. Further, the constituent processes of both approaches are phased and recursive. However, both approaches address issues of resilience from opposite sides of the equation: risk management focuses on the object or source while adaptive management deals with the subject. However, this distinction becomes blurred when one considers that risk management, including disaster mitigation, also deals with the impacts of risk on the subject while adaptive management, in turn, also involves disaster risk reduction.

Some other characteristics of the two strategies are as noted in Table 3.

Table 3: Some Features of Disaster Risk Management and Adaptive Management

Disaster risk management	Adaptive management
● Reactive, but has proactive elements	● Proactive, but contains reactive elements
● Deals with extreme and frequent as well as slow-onset events	● More suitable for slow-changing phenomena and processes
● Risk measurement is largely based on expost probability of occurence and magnitude of impacts of hazards	● Risk management is mainly based on probability information derived from subject's attitudes to risk
● Seeks to reduce risks as much as possible	● Seeks to increase the survival or coping level of human society at any level of risks
● More concerned with single-disaster event management	● Deals more with the management of the total situation connected with disaster impacts, including connected risks

We need to note that in human adaptation, the concept of human society includes both human communities and their socio-economic, cultural and political inter-relationships, as well as natural ecosystems within the physical space of those human communities. This is the holistic concept of life propounded by Africans. However, we recognise that human and natural systems will adapt somewhat autonomously, achieving social and ecological resilience, respectively, albeit not totally independently. Furthermore, given the level of development of mitigation capabilities in Africa and the cost of such programmes, we propose that we focus more attention on improving conditions for the adaptation of human systems in Africa than on conventional protection measures that promote adaptation to protect natural systems.

Planned Versus Autonomous Adaptation

Planned adaptation (prospective risk management) is anticipatory hazard management or reduction, albeit with strong elements of disaster mitigation. Planned adaptation can also be described as forward-looking vulnerability reduction and pre-emptory resilience evolution. It has elements of both programmed and autonomous responses. There cannot be completely or purely planned adaptation because the timing and scale of occurrence of climate change and natural hazard events and effects are largely unknown. This assertion applies more to adaptation to climate change effects than natural hazards. Furthermore, it is difficult for all members of any given society to adapt in similar ways to any given risk complex. Hence, there will be variations in any planned adaptation response. In practice, planned adaptation will supplement autonomous adaptation.

It is instructive to note that adaptation to climate change effects on the supply of ecological services has both supply and demand aspects. Both aspects involve spontaneous or autonomous adaptation and planned adaptation based on deliberate policy directions. For example, with regard to water resources, supply adaptation measures include improved water storage, water body pollution control in settlements, migration from water-stressed locations, afforestation to improve dry-season flows in river basins, zoning of agriculture away from water body boundaries, and, artificial recharge of ground water resources. Within the African context, resource, policy and institutional constraints limit the options of supply adaptation to short-term, mainly private, measures. On the demand side, adaptations decisions involve forced reductions in use and planned improvement in efficiency of use and loss reduction.

Implications of Emphasising Autonomous Adaptation for Operationalising Risk Management

Planned adaptation is necessary but not sufficient; it is only part of the solution complex but plays the key role of providing the parameters, incentives, institutions, policy and legal and regulatory framework for autonomous adaptation. As indicated earlier, there cannot be purely planned or autonomous adaptation in a mutually exclusive manner. But given the low level of development in Africa, planned adjustment has a key role to play in engendering effective autonomous adjustment. Where socio-economic development is low, as in Africa, the scope for autonomous adjustment is low. But that condition of low public resources in developing countries reduces or weakens the ability of the state to promote or finance planned adaptation. This is the development constraint or dilemma of integrating human adaptation and risk reduction in developing countries. However, it is instructive to note that in Africa and other developing countries, community links and social security networks naturally promote or point to a preference for autonomous survival which is a precursor to planned adaptation.

De-emphasising planned adaptation in favour of autonomous adaptation of communities and individuals implies de-emphasising the use of international response mechanisms for ex-post mitigation, in favour of developing national and local level indigenous risk management capabilities for disaster management, community hazard assessment and local livelihood security planning. Local-level processes facilitate autonomous responses.

This shift towards autonomous adaptation also requires a global initiative built on the perception of risk management as a global common good, particularly risks from changing environment due to climatic change.

To facilitate the emergence of this initiative, we need to be clear about the objectives, payoffs and potential costs. The main objective should be defined in human terms and be about achieving people-level impact that enhances social capital, involves a variety of actors, promotes broad-based ownership for agreed actions, increases access to knowledge of, and, disseminates best practices in risk management and human adaptation. The acceptance of climate change and natural hazard risk as a global public good will facilitate adequate international response to disasters in Africa.

Operationalising Risk Management and Adaptive Management in Building Resilience in Africa

We advocate that adaptive management and risk management processes are integrated into the sustainable development strategy of African countries. This implies a concern with the need to protect livelihoods against risk and uncertainty from climatic change. However, it is very important to realise that climate change is only a factor, albeit a key one, in shaping the adaptive response of Africa to her development needs within the historical and present context of her situation. Thus, optimal development policies and strategies for Africa's total development will have to take into account other considerations, such as poverty, globalisation, technology and investment.

The paper identifies some essential factors to be addressed in operationalising adaptive management in Africa. These cover the following:

Integrating Adaptive and Risk Management in Long-term Sustainable Development Strategies

This is the only way to institutionalise the practice of risk management within the development administration regime of African, and other, developing countries. This involves, among others, establishing a long-term vision that integrates environmental considerations with other pillars of sustainable development and ensures convergence, complementarity, coherence and coordination between the components of the integrated framework, including determining ways of handling trade-offs among adaptation and other strategy processes (OECD, 2001).

In integrating climatic risk management in development management, the role of economic policies and frameworks, particularly poverty reduction strategies, in risk management and adaptive management becomes important. Economic frameworks derived from the Washington Consensus, such as Structural Adjustment Programmes (SAPs), focus on markets and tend to weaken public support for the poor and marginalised who need most attention in developing effective climatic risk management strategies. However, markets are weak in Africa and require public support to be able to provide the requisite elements of effective risk management. Furthermore, Poverty Reduction Strategy Papers (PRSPs) are medium-term processes with three-year timeframes and may not suitable vehicles for incorporating long-term risk management development programmes. Thus far, none of the first five full PRSPs completed directly or explicitly covers the development of climate change risk adaptation interventions as policy instruments for reducing poverty in the countries that prepared them.

Building Adaptive Management Strategies on the Foundation of Indigenous Knowledge Systems and Traditional Coping and Survival Practices

Traditional risk management and response systems are very flexible in addressing issues of livelihood sustainability arising from environmental and natural risks. These range from risk reducing technologies through informal social relations to share risks to formal institutional support mechanisms. Examples of traditional mechanisms include traditional land tenure systems that help reduce vulnerability of migrant farmers, assistance from family and social and community networks, and traditional taboos on community natural resource use (Vordzorgbe, 2001). Given their relative effectiveness in according some degree of resilience to both human and natural systems, there is a strong role for traditional knowledge systems, practices and institutions. However, several of these coping strategies are unable to assure livelihood security from extreme events and require expansion, deepening and strengthening as well as integration in more robust risk management mechanisms linked to national, regional and global systems.

Developing and Strengthening the Analytical and Planning Base for Instituting Adaptive and Risk Management

This involves, among others,

- Supporting relevant national institutions to institutionalise modelling climate change and impact scenarios; many African countries require assistance in developing the capability to undertake integrated assessment modelling.

- Facilitating modelling of human and natural systems to characterise panarchy relations in Africa as part of the process of developing Africa-specific planned adaptation models and understanding autonomous adaptation in the region.

- Supporting the application of risk assessment approaches, including formal quantitative risk assessment, to natural disaster and climatic change risk management in Africa. This includes undertaking integrated environmental risk assessment as a diagnostic and planning tool, that goes beyond environmental impact assessment, in Africa (PAES, Geoplan International, CLEIAA and World Bank 2001).

- Developing policies based on application of socio-economic analytical frameworks that take account of risk and uncertainty, such as safety-first rules and cautious sub-optimising behaviour (incorporating notions of safety, danger distance and information feedback) in development programming (Anderson, Dillon and Hardaker 1977, Day 1979). These models of decision analysis bring more realism to the analysis of the behaviour of human societies and individuals in response to disaster and climatic change risk and uncertainty than conventional risk-less Pareto-optimal neo-classical economic theory.

- Applying scenario planning as a risk management tool necessary to identify likely future outcomes and corresponding actions to achieve those outcomes in the development of integrated sustainable development plans that incorporate climatic change and disaster risk management interventions. We should note that

adaptation, whether autonomous or planned, is but one mechanism for engendering resilience (International Council for Science, 2002).

Basing the Development of Risk Management Capabilities on an Enhanced Science and Technology Foundation

A key element in the role of the development factor in risk management is the extent and degree of application of science and technology (S&T). As known, S&T enhances understanding and development of coping capabilities with regard to environmental phenomena, thereby facilitating achievement of resilience. The Second Report on International Scientific Advisory Processes on the Environment and Sustainable Development (UNEP, 2000) highlighted the general need for specialised scientific knowledge of environmental and biosphere dynamics. This injunction is perhaps more pertinent to the African situation than other regions due to the lower level of application of S&T. There is the need to strengthen the scientific base of risk and adaptive management capabilities in Africa through enhancing the application of S&T in improving adaptive management capacity, including the development and widespread adoption of ecosystem-friendly technologies, particularly for energy, transport, industry, agriculture, settlement development.

Incorporating the Gender Dimension in Integrated Adaptive and Risk Management Strategies

In Africa, as elsewhere, it is women, the poor and the socially disadvantaged that bear the brunt of disasters while being least endowed to address climate change impacts. Given the crucial but differentiated gender roles in coping with climatic change risks, there is the need to integrate gender considerations in the development and application of risk management processes (UNDAW and UN/ISDR 2001).

Utilising Multi-stakeholder Processes in Developing Adaptive Management Processes

Strategies for adaptive management and risk management involve the collaborative efforts of diverse groups of society and require ownership by concerned stakeholders to be effective. Achieving this calls for the adoption of multi-stakeholder process (MSP) approach in developing adaptation and resilience strategies. This approach will facilitate dialogue among various stakeholders, such as policy makers, resource managers, traditional authorities and local major groups, on climate change and adaptation policies and programmes. Furthermore, given the importance of indigenous knowledge systems in developing adaptive management in Africa, the need for MSP is critical.

Building Bridges and Staying Engaged through Partnerships for Facilitating Adaptive and Risk Management Practices

Using MSP engenders linkages with various stakeholders in the form of partnerships for the effective design and implementation of adaptive management frameworks. Furthermore, the state needs to develop public-private partnerships in this area. In Africa, this need is even more pressing because of the weak nature of both the state and civil society, including the private sector. To facilitate this process, there is also the need to form a network or platform of regional and global partnerships for addressing issues of risk management in Africa and elsewhere.

Enhancing Information, Education, Communication and Awareness

Efforts to reinforce improved environmental monitoring through multilateral environment assessments such as the Millennium Ecosystem Assessment are necessary, but the outcomes need to be regionalised and their recommendations brought effectively to the attention of leaders of developing countries to enhance the chance of their application. For example, most governments and leaders in Africa are unaware of the Integrated Global Observing Strategy (IGOS), its components, sponsoring agencies and its themes. Hence, a substantial amount of awareness creation, education and data simplification and localisation would be required to make the outputs of the IGOS useful to national risk management processes in Africa. Also, there is the need to bring the notion of climate change and possibility of resultant hazards home to communities far away from hazard locations or where current risks are low as a way to increase awareness of disaster effects. Furthermore, since we are starting from a lower level of information and knowledge on adaptive and risk management in Africa, we need to vastly improve the information and knowledge base through various means and initiatives.

Developing Risk and Adaptive Management within the Context of Conflict Management

Disasters and other stresses often result in conflicts in access to and use of natural resources. Given the high frequency and magnitude of conflicts in Africa, there is the need to integrate the management of both phenomena, including through applying conflict management principles to risk management, particularly at the response and mitigation stages.

Placing the Development of Adaptive Management within the Context of Africa Region and Global Frameworks

The operationalisation of the concept of adaptive management in Africa needs to be within the context of existing development frameworks. African development is currently receiving heightened attention due to growing international support for the New Partnership for African Development (NEPAD) and the upcoming World Summit for Sustainable Development (WSSD). Consequently, development efforts in adaptive and risk management must be linked to WSSD outcomes, particularly the planned special initiative for Africa, and NEPAD. The Environmental Action Plan for the Implementation of the Environment Initiative of the NEPAD contains a specific programme area on combating global warming and climate change in Africa. This programme will, among others, provide support to countries to determine the region's vulnerability to climate variability, to develop and promote appropriate climate change adaptation strategies and programmes, and, to develop and implement Clean Development Mechanism (CDM) projects (UNEP, 2002 B). The Draft Plan of Implementation for the World Summit for Sustainable Development also calls for support to Africa to address adaptation needs relating to climate change, climate variability, extreme weather events and sea level rise, as well as to deal effectively with natural disasters, including their humanitarian and environmental impacts (United Nations, 2002). This support includes assistance for capacity strengthening, including at the local level, for effective disaster management, including observation and early warning systems, assessments, prevention, preparedness, response and recovery.

Developing Capacity of Individuals, Organisations and Governments at the Community, Local, National, Sub-regional and Continental Level to Develop and Institutionalise Adaptive Management in Africa

Capacity development for risk and adaptive management is required in all the areas discussed in this section as well as to develop African capacity for international negotiations, and, access of African countries to adaptation projects financed under the UNFCCC. However, these areas of support need to be informed by some guiding principles for effective development assistance in risk management:

- In promoting adaptive management, the key role of the precautionary principle becomes evident and paramount. This is most pertinent in the case of Africa where the information and knowledge gap in risk and adaptive management is largest.

- Africa is at the lowest level of disaster mitigation, since the region has received relatively less support in institutionalising disaster risk management. Therefore, operationalising risk and adaptive management in Africa with international support must be informed by the principle of meeting common needs but with special priority for Africa based on its special situation and needs (Rio Principle 6).

- In addition, Africa deserves special treatment because of the ecological debt the world owes it due to the high levels of carbon sequestration and minimal GHG emissions and effluents discharge from the continent.

- There is an additional case for special treatment for Africa in developing risk management capacity in developing countries. Globalization has resulted in increased marginalisation of Africa. In interaction with climate change effects, that are expected to be most disastrous in Africa due to the low resilience factor, Africa is a double loser (Olmos, 2001).

- Successful capacity development for effective risk management will need to be guided by some considerations presented in Vordzorgbe (2002). The first is that capacity development is a multi-faceted process. This requires adopting the systemic, integrative and multi-modal approach that considers: (i) the norms and culture of the recipient partners, (ii) the public and private processes and interactions that are in play, (iii) the interests of all stakeholders.

- Integration of the technical, institutional, sectoral and other aspects. This ensures capacity development that is sustainable and accountable, and, promotes ownership by partners. The second factor is to balance the need for detailed up-front preparation with more incremental approaches to learning by doing. This requires implementing small capacity development initiatives, rather than big projects, sensitivity to the national context, and showing long-term commitment. This approach directly complements adaptive management. The third requires effective operational mechanisms for pooling of donor partner resources in designing and implementing common intervention initiatives in any capacity development partnership, partly through reform of aid management systems by all partners.

In addition, target or recipient partners have to ensure the following:

- Existence of a development framework from which capacity needs are derived;
- Realistic needs assessment based on sound and comprehensive capacity analysis;
- Willingness to modify the legal, regulatory, institutional and policy framework to make capacity development work;
- Ability to provide agreed counterpart resource and other requirements to ensure that capacity development programmes are implemented as planned;
- Conducive environment and incentives for individuals, institutions and systems to exercise their developed capacities;
- Location and gender balance in capacity development initiatives;
- Policy stability and transparency; and
- Long-term commitment to agreed capacity development goals.

Finally, capacity development for disaster and adaptive management should to be guided by the recommendation of the First Pan-African Capacity Building Forum in Mali in October 2001: there is the need for a new paradigm, a new relationship based on mutual trust and obligation, respect, and shared vision and commitment, a new model and instruments based on partnership, local ownership and empowerment, and, a practical framework for implementation, taking into account the complexity of the process of capacity development.

Some Recommended Roles for UNDP

The championship role of the UNDP in supporting the development of risk and adaptive management in Africa must be based on its comparative advantage in this area. It is the only integrated development agency in the UN system, it has local presence and a long history of involvement in issues of disaster and risk management, it plays a co-ordinating role of the UN system at country level and is perceived by national leaders as a neutral agency sympathetic to African issues. Furthermore, the UNDP focuses on upstream activities of capacity building support for empowerment and participatory approaches, and, knowledge networking. Thus, the UNDP, in cooperation with ISDR and UNEP, is well placed to play a leading role in institutionalising adaptive management in Africa.

Despite this strong institutional capability and competence, UNDP's global role in adaptive and risk management must recognise that: its activities have been more prominent in the Latin America and Caribbean region than in Africa in the subject matter and that it has focused relatively less on developing the scientific and analytical knowledge base of climate change, climate variability and extreme weather events than other relevant UN and non-UN agencies.

Consequently, applying the concept of differentiated responsibilities, the thematic role of the UNDP could be as:

- *Facilitator* engendering change in the environment for disaster risk management and adaptive management practice.

- *Advocate* for coordinated, timely and enhanced action in several areas, including marshalling political leadership commitment, promoting modifications in policy, legal and regulatory frameworks conducive to adaptive management, and supporting the coordination of mobilisation of financial resources at all levels.

- *Catalyst* source of ideas and seeding actions to elicit response from other actors.

- *Capacity developer* for enhancing adaptive management practices, as discussed earlier in this paper. This last role would be expected to feature highly on the agenda of the recently launched UNDP Capacity 2015 Programme.

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21. Vordzorgbe, Mr. Seth Doe	Chief Executive	DevCourt, Ghana
22. Wilches-Chaux, Dr. Gustavo	Consultant	Colombia

Agenda

Seminar Host: UNDP, Cuba
Seminar Sponsor: UNDP Bureau for Crisis Prevention and Recovery (BCPR)
Moderator: Dr. Allan Lavell

Monday, June 17

Welcome and Opening Remarks 1:00-1:30 pm

- Welcome remarks by the Government of Cuba, Dr. Gisela Alonso Domínguez, Presidenta de la Agencia de Medio Ambiente, Ministerio de Ciencia, Tecnología y MedioAmbiente (CITMA)
- Remarks by **Mr. Andrew Maskrey**, BCPR
- Remarks by UNDP Resident Representative - **Mr. Luis Gómez-Echeverri**

PAPER PRESENTATIONS

Part 1 - Problem Definitions and Concepts 1:30-2:30 pm

- Dr. John Soussan (with Dr. Ian Burton): **Adapt and Thrive: Combining Adaptation to Climate Change, Disaster Mitigation, and Natural Resources Management in a New Approach to the Reduction of Vulnerability and Poverty**
- Dr. Hans Foussel (with Dr. Richard J.T. Klein): **Vulnerability and Adaptation Assessments to Climate Change: An Evaluation of Conceptual Thinking**
- Dr. Thomas Gutierrez (Cuba): **Extreme Events, Risk and Adaptation: What we Know and What we Need to Know**

Part 1 - Continued 2:45-4:30pm

- Dr. Fernando Ramírez: **Global Climate Change and Risk: Thoughts Without Quotes...to Confuse Us even More**
- Dr. Maxx Dilley: **Managing Risks of Climate-related Losses on Decadal Time Scales**
- Mr. Pascal Girot: **Scaling-up: Resilience to Hazards and the Importance of Cross-scale Linkages**
- Discussion

Part 2 - Bringing Things Together: Policy and Issues 4:30-5:30pm

- Prof. John Hay: **Sustainable Development through Risk Management: Integrating Disaster Reduction and Adaptation to Climate Variability and Change**
- Dr. A.R. Subbiah: **Establishing a Common Ground to Bring Together Disaster Reduction and Climate Change Communities – Challenges and Opportunities**

Tuesday, June 18

Part 2 - Cont'd 8:30-10:00am

- Dr. Ian Burton: **Risk Management and Burden Sharing in Climate Change Adaptation and Natural Disaster Mitigation**
- Mr. Gustavo Wilches-Chaux: **Ethical Basis of Risk Management**
- Dr. Emma Tompkins: **Building Resilience to Climate Change Through Adaptive Management of Natural Resources**
- Discussion

Break

Part 3 - From Concept to Regional Perspectives and Experiences 10:15-12:30pm

- Mr. Rene Castro: **Adaptation Responses from the Latin American Energy Sector with Unintended Consequences to Global Climate Change**
- Dr. U. N'O Trotz: **Disaster Reduction and Adaptation to Climate Change – A CARICOM Experience**
- Dr. José Llanes (Cuba): **The Caribbean: An Opportunity for Cooperation in the Reduction of Risk and the Adaptation to Climate Change**
- Mr. Brian Challenger: **Linking Adaptation to Climate Change and Disaster Mitigation in the Eastern Caribbean: Experiences and Opportunities**
- Dr. Seth Vordzorgbe: **Risk Management and Adaptation: Reflections with Implications for Africa**
- Discussion

Lunch

Keynote Presentations

- **Dr. Gustavo Wilches-Chaux**
- **Dr. Al Binger**

Discussion Theme 1 - Problem Definition: Concepts and Semantics
2:45-4:00pm

Break

Discussion Theme 2 - The Context for Adaptation and Risk Management
4:15-5:45pm (Development, Sustainability, Security)

Wednesday, June 19

Discussion Theme 3 - Relating the Two Problems Conceptually and in Programming Terms 8:30-9:45am

Discussion Theme 4 - Practical Considerations, Policy, Interventions and Guidelines 9:45-11:00am

Break

Summary and Integration of Results 11:15-12:30pm
Programming and Next Steps Confirmation of Meeting Outcomes 12:30-1:30pm
Concluding Remarks 1:30-1:45pm

- Remarks by **Mr. Luis Gómez Echeverri**, UNDP Resident Representative
- Remarks by **Mr. Andrew Maskrey**, BCPR

Abbreviations

CCA	Common Country Assessment
CCAD	Comisión Centroamericana de Ambiente y Desarrollo (Centro-American Commission for Environment and Development)
CCAIRR	Climate Change Adaptation through Integrated Risk Reduction
CDM	Clean Development Mechanism
CEJA	Commonwealth Environmental Journalists Association
CEPAL	Comisión Economica para America Latina y el Caribe (Economic Commission for Latin America and the Caribbean)
CHARM	Comprehensive Hazard and Risk Management
CIFOR	Center for International Forestry Research
COP	Conference of the Parties
DDRMA	Departimiento de Desarrollo Regional y Medio Ambiente (Department for Regional Development and Environment)
DFID	UK Government Department for International Development
EDI	Environmental Degradation Sub-index
ENSO	El Niño Southern Oscillation
EU	European Union
EVI	Environmental Vulnerability Index
FLACSO	Facultad Latinoamericana de Ciencias Sociales (Latin American Faculty of Social Sciences)
GCC	Global Climatic Change
GCM	General Circulation Model
GCM	Global Climate Model
GDP	Gross Domestic Product
GEC	Global Environment Centre
GEF	Global Environment Facility
GHG	Green House Gas
GNP	Gross National Product
HIPC	Highly Indebted Poor Countries
ICE	Information Centre for the Environment

IDNDR	International Decade for Natural Disaster Reduction
IGCI	International Global Change Institute
IISD	International Institute for Sustainable Development
IMA	Institute of Marine Affairs
IPCC	Intergovernmental Panel on Climate Change
IRI	Intrinsic Resilience of the Environment to Risks
ITDG	Intermediate Technology Development Group
IUCN	International Union for Conservation of Nature and Natural Resources
KP	Kyoto Protocol
LAC	Latin American and Caribbean
NAPA	National Adaptation Plans of Action
NASS	National Adaptation Strategy Studies
NGO	Non Governmental Organisation
OECD/DAC	Organisation for Economic Co-operation and Development/ Development Assistance Committee
PICCAP	Pacific Islands Climate Change Assistance Programme
PNUD	Programa de las Nacioned Unidas para el Desarrollo (United Nations Development Programme)
PRSP	Poverty Reduction Strategy Paper
REI	Risk Exposure Sub-index
SIDS	Small Island Developing States
SOPAC	South Pacific Applied Geosciences Commission
SPREP	South Pacific Regional Environment Programme
SURF	Sub-regional Research Facility
TAR	Third Assessment Report
UN	United Nations
UNDP	United Nations Development Programme
UNDAF	United Nations Development Assistance Framework
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VARG	Vulnerability and Adaptation Resource Group
WG	Working Group
WMO	World Meteorological Organisation