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)*

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 experience 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.

Box E.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.

Table 1

[2] Third Assessment Report of the Intergovernmental Panel on Climate Change
[3] A 'h*azard'* 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

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 realization by focusing on the following four objectives:

1. Increasing public awareness
2. Obtaining commitment from public authorities
3. Stimulating interdisciplinary and intersectoral partnerships and expanding risk reduction networking at all levels.
4. Improving further the scientific knowledge of the causes of disasters and the effects of natural hazards and related technological and environmental disasters on societies.

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 lessen 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 program 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 programs.

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 organizations, 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 emphasizes 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 programs 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 CGCED[4] meeting 2002)

- Risk identification
- Risk reduction
- 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.

[4] Caribbean Group for Cooperation in Economic Development

- *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 minimize 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 e.g. 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 e.g. 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 suggest for exploration are:

  - Budget self-insurance
  - Market-Insurance and Reinsurance
  - Public asset coverage
  - Risk pooling and diversification
  - 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 green house gas (GHG) mitigation, it was realized 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 Tenth 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 (e.g. insurance).

The Caribbean Planning for Adaptation to Global Climate Change (CPACC) Project was a project developed for twelve 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 program of adaptation to GCC in vulnerable coastal areas.

Project activities focused 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 focused on actions that can be taken immediately prior, during or shortly after a disaster event to reduce damage, injuries and death i.e. 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" i.e.

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*[5]*; 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 kilometers 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:-

[5] Under Component 6 of the CPACC Project studies on coastal vulnerability and risk assessment were carried out for three pilot countries.
[6] Under Component 4 of the CPACC Project, country teams prepared 'Issues Papers' on climate change issues relevant to their national circumstances.

- Increasing population density and growth rates
- Growth of the tourism industry: A paradigm shift from agriculture to uncontrolled coastal development
- 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 on-going 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.

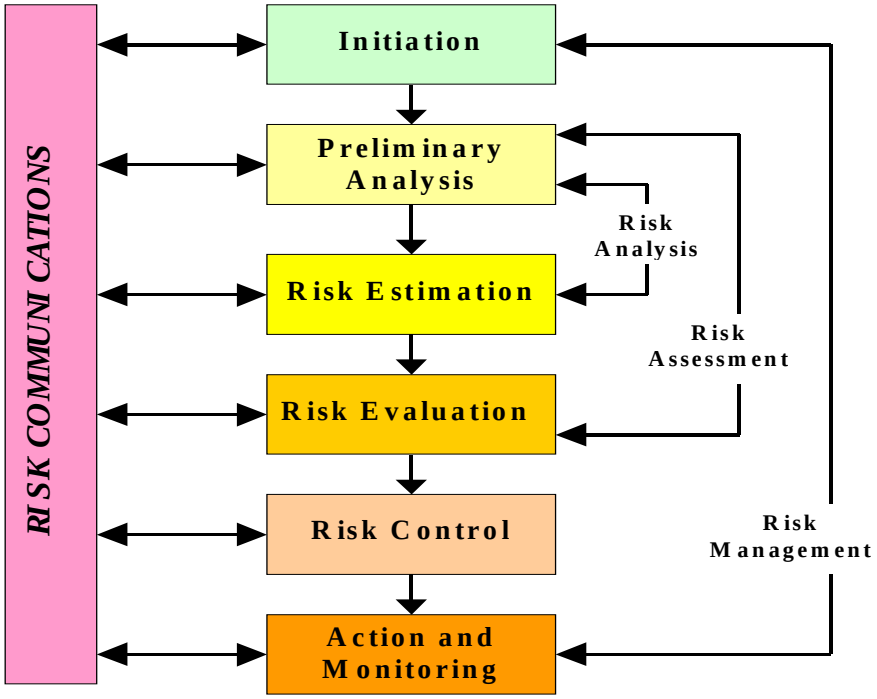
Under the ACCC project use is being made of the Canadian Standards Association (CSA), "Risk Management Guidelines for Decision Makers" an approved National Standard of Canada. These guidelines are being adapted to assess climate change risks in the Caribbean. The project is designed to:

- 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; and
- Identify an appropriate process to initiate the integration and consideration of risk management processes between the various sectors.
- 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 standardized management or systems analysis approach (*Figure 1*).

Figure 1: Steps in the Canadian Standards Association Risk Management Decision-Making Process



Source: CAN/CSA Q850-97 Risk Management: Guideline for Decision Makers

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 standardized set of terminology used to describe risk issues, thus contributing to better communication about risk issues, and
- provides for an explicit treatment of uncertainty.

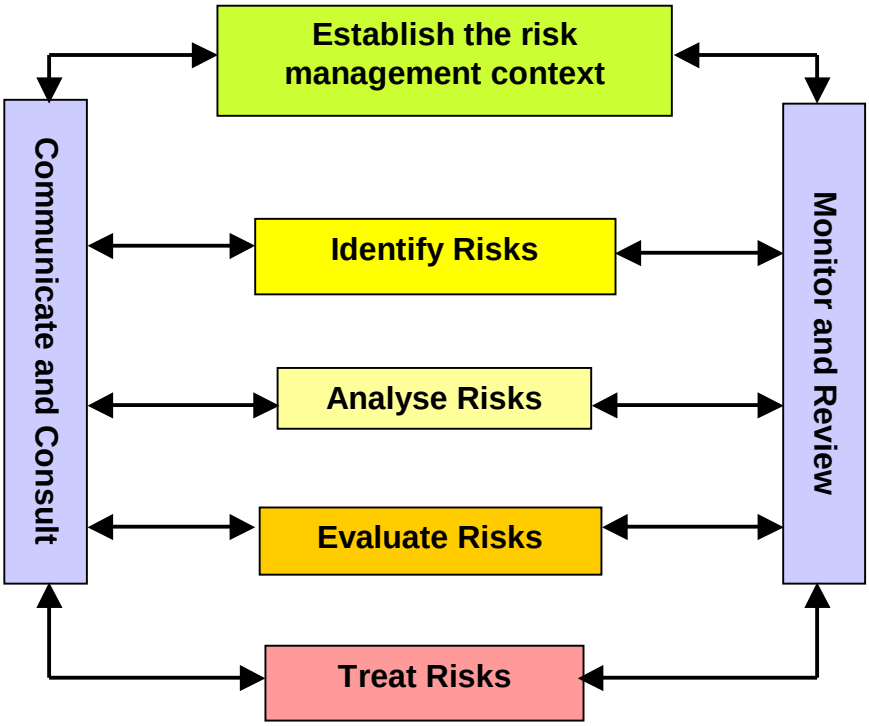
Comprehensive Hazard and Risk Management (CHARM): Guidelines for South Pacific Island Countries

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 modeled on the AS/NZS 4360:1999 standard to ensure it meets accredited standards and thus recognized 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:

a. communication and consultation
b. monitoring and review
c. effective documentation

Figure 2: Steps in the 'CHARM' Risk Management Process



Source: Comprehensive Hazard and Risk Management (CHARM): Guidelines for Pacific Island Countries

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 utilized 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 rationalize terminology utilized 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 focused 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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