

Reducing the Risk of Disasters and Climate Variability in the Pacific Islands



PAPUA NEW GUINEA COUNTRY ASSESSMENT



THE WORLD BANK

SOPAC

Acronyms and Abbreviations

CCA	Climate change adaptation
CTI	Coral Triangle Infrastructure (Plan of Action)
DAL	Department of Agriculture and Livestock
DEC	Department of Environment and Conservation
DL&PP	Department of Lands and Physical Planning
DMPGM	Department of Mineral Policy and Geohazards Management
DNPM	Department of National Planning and Monitoring
DRM	Disaster risk management
DRR	Disaster risk reduction
ENSO	El Niño Southern Oscillation
GEF	Global Environment Facility
GIS	Geographic Information System
HFA	Hyogo Framework for Action
HYCOS	Hydrological Cycle Observation System
NAP	National Action Plan
NARI	National Agricultural Research Institute
NDC	National Disaster Center
NDM	National Disaster Management (Act)
NGO	Nongovernmental organization
OCES	Office of Climate Change and Environmental Sustainability
PICCAP	Pacific Island Climate Change Assistance Program
PNG	Papua New Guinea
SOPAC	South Pacific Applied Geoscience Commission
SPC	South Pacific Commission
SPREP	Secretariat of the Pacific Regional Environmental Program
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
UPNG	University of PNG

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Introduction

The World Bank policy note “Not If, But When” shows the Pacific island countries to be among the world’s most vulnerable to natural disasters. Since 1950, natural disasters have directly affected more than 3.4 million people and led to more than 1,700 reported deaths in the region. In the 1990s alone, reported natural disasters cost the Pacific islands region US\$2.8 billion (in real 2004 value). The traditional approach of “wait and mitigate” is a far worse strategy than proactively managing risks.

The Hyogo Framework for Action (HFA) 2005-2015 lists the following five key priority areas for action for ensuring preparedness and readiness to disaster risk reduction (DRR) and climate change adaptation (CCA) challenges:

- (1) *Ensure disaster risk reduction is a national and local priority with a strong institutional basis for implementation.* Key components include:
 - Strengthening national institutional and legislative framework resources for the development and implementation of disaster risk management policies, programs, laws, and regulations in all relevant sectors and authorities at all levels of administrative and budgets on the basis of clearly prioritized actions;
 - Developing and tracking progress through specific and measurable indicators;
 - Developing resources for risk management policies and programs;
 - Promoting community participation.
- (2) *Identify, assess, and monitor disaster risks and enhance early warning.* Key components include:
 - Strengthening national and local risk assessments,
 - Establishing institutional and community capacities for effective early warning,
 - Developing and sustaining technical infrastructure and information management capacities for effective data collection and hazard analysis,
 - Building cooperation mechanisms for analyzing regional and emerging risks.
- (3) *Use knowledge, innovation and education to build a culture of safety and resilience at all levels.* Key components include:
 - Strengthening networks and mechanisms for information management and exchange,
 - Promoting inclusion of risk reduction in school and community education and training,
 - Furthering research into risk and hazard analysis and cost-benefit analysis for risk reduction actions,
 - Promoting public awareness to engage media and community interest.
- (4) *Reduce the underlying risk factors.* Key components include:
 - Integrating environmental and natural resource management with risk reduction,
 - Strengthening safety-nets by improving social and economic development practices in health, food security, livelihoods and other sectors,
 - Incorporating risk management into land-use planning and other technical measures.
- (5) *Strengthen disaster preparedness for effective response at all levels.* Key components include:
 - Strengthening institutional capacities and training and learning mechanisms to include risk reduction in all aspects of disaster management,
 - Strengthening contingency and preparedness planning,
 - Promoting community participation.

In reviewing the Communiqué of the 39th Pacific Islands Forum in Alofi, Niue (August 19-20, 2008), Forum leaders “reaffirmed the continued urgency of addressing the challenges posed by and the impacts of climate change as a regional priority” and “committed their governments to provide the necessary national resources and policy focus to addressing the challenges of climate change.” The Secretariat of the Pacific Regional Environmental Program (SPREP), South Pacific Applied Geoscience Commission (SOPAC), South Pacific Commission (SPC), the University of the South Pacific, and others were asked to assist the Pacific island countries in working together and focusing on the following:

- Pursuing and implementing mitigation and adaptation measures;
- Mainstreaming human security issues;
- Improving preparedness for the impacts of increasing natural disasters through implementation of national action plans;
- Addressing the vulnerability of Pacific Islands to climate change and subsequent impact on people, land, water, food security, infrastructure, and natural resources;
- Continuing to work collaboratively to rationalize the roles of the various regional organizations and to harmonize donor engagement; and
- Improving the capacity of countries in the region to engage in the ongoing United Nations Framework Convention on Climate Change negotiations for a post-2012 global climate change agreement.

In several respects, the Niue Declaration is consistent with the overall HFA priorities. The main focus on climate change is expanded to some degree by reference to the vulnerability of the Pacific to natural disasters as well as the need for National Action Plans.

This report reviews the extent to which DRR and

CCA activities have progressed in Papua New Guinea (PNG) in line with recent international declarations as well as those of Pacific leaders. It identifies consistencies and gaps or impediments with the HFA principles as a basis for identifying opportunities in line with the HFA recommendations. The review also takes into account other existing frameworks such as the Pacific Plan and the *Disaster Risk Reduction and Disaster Management Framework for Action 2005–2015: An Investment for Sustainable Development in the Pacific Island Countries*, adopted by the Pacific Forum in 2005. The focus is on DRR and CCA activities, as opposed to disaster management measures that prepare for, respond to, and recover from disaster events after they occur. While some specific sector activities are addressed in the assessment of PNG national and local government policies and institutional arrangements, the report does not provide a comprehensive summary of sector-by-sector activities. Instead, it refers to other reports that have covered this and complements these with suggestions for taking the necessary follow-up steps and actions.

The country assessment aims is to deepen the understanding of the gaps, opportunities, and needs at the national level toward stronger operational disaster and climate risk management in the Pacific islands and to link closely to other ongoing and future efforts by other donors and stakeholders, such as the SOPAC regional initiatives following the Madang Framework and the National Action Plans (NAPs), to ensure synergy and avoid duplication. The assessment tries to focus on practical, proactive measures that PNG can take to inform its national development policies and plans, and strengthen its capacity to reduce the adverse consequence of natural hazards such as storm surges and tsunami and others related to extreme weather, climate, and oceanic conditions.

This assessment highlights the current country status, gaps, opportunities, and barriers related to (a) national policies, strategies, plans, and activities in management

of natural hazards; (b) the enabling environment for a comprehensive risk management approach to natural hazards; and (c) the capacity to undertake such a comprehensive approach, including institutional arrangements, human resources, public awareness, information, and national budget allocations. It also reviews and identifies the need for informed policy choices; improved decisions; and strengthened regulations, legislative and policy-level changes required to support proposed country-level activities through both country efforts and those of other stakeholders.

With respect to achievement of the first HFA priority area, while both international- and regional-level leaders have voiced strong support for appropriate DRR and CCA actions, there is clear evidence of systemic difficulties among many Pacific island countries in establishing and maintaining a viable enabling environment and promoting a cross-sector focus for DRR and CCA activities. PNG was among the first countries to adopt the HFA but has not been able to integrate its priorities into the country's disaster risk management (DRM) strategies. Available evidence shows that ad

hoc and externally driven approaches have not provided satisfactory results so far, and HFA emphasis upon a strong government commitment, ownership, and action at all levels is one of the primary and early challenges to be surmounted in achieving the goals of the International Strategy for Disaster Reduction.

This PNG assessment report begins by explaining the context of the country in relation to disaster risk reduction and climate change adaptation. It follows with sections on key country findings and detailed country assessment that focus on some vital components relevant to HFA achievement: overall legal, institutional, policy, and related framework; adopting and mainstreaming policies; data and knowledge; risk and vulnerability assessments; monitoring and evaluation; awareness raising and capacity building; planning and budgetary processes; and coordination within a sustainable framework. From this assessment, possible opportunities for addressing the identified gaps and needs within the HFA are presented in the final section. The proposals for future support are presented in Annex A. ❖

Country Context

PNG has a population of 6.3 million people, 80 percent of who live in rural subsistence communities. The country is located in the South West Pacific between latitudes of 1° and 12° south and, at 463,000 square kilometers, is the largest of the Pacific island states (Figure 1). It occupies the eastern half of the mainland island of New Guinea with three additional islands and over 600 lesser islets and atolls to the north and east. The main islands are volcanic in origin with rugged interiors up to an elevation of 4,496 meters.

The country has a national capital district and 19 provinces (8 coastal, 5 highland, and 6 island) administered by provincial governments. While the provincial governments have relative autonomy in their affairs, devolved functions often go unattended primarily because of provincial (human and financial) resource constraints. This results in the Central Government maintaining a strong presence. In the past, the Government created special “authorities” to try to address particular issues and to overcome perceived shortcomings in central and provincial bureaucracies. It now appears that these authorities are also being sidelined

as key resources are transferred to more single-focus areas of activity via other channels.

Customary landowners control 97 percent of the land while 3 percent is government-owned alienated land. While 1989 legislation (the Physical Planning Act) provides for land-use management of all land through national and provincial land boards, there appears to be little influence exercised on customary land use with only 2 percent (mostly government-leased land on-leased for development or mining purposes) subject to planning rules.

Over 80 percent of the population live in a rural environment and have traditionally been particularly susceptible to extremes of climate (rains and drought) related to the El Niño Southern Oscillation (ENSO). Evidence points to significant potential for increasing variability related to climate change, resulting in more frequent or more extreme weather-related events in some parts of the country.

PNG is particularly prone to natural disasters including earthquakes, volcanic eruptions, tsunamis, cyclones, river and coastal flooding, landslides, and droughts. The highlands, with 2.2 million people in many thousands of small villages, are subject to weather extremes of heavy rainfall and drought. Increasingly, landslides are occurring from population pressures on uncontrolled land use. The coastal areas and the many coral atolls are low-lying, and nearly 500,000 people in 2,000 coastal villages are vulnerable to weather extremes and inundation.

PNG experiences 2 to 3 national-level activations (and numerous smaller local activations) for disaster events per year, and in the past 15 years there have been 7 events of significance covering flooding, volcanic eruption, tsunami, landslide, and drought. The DRR planning is promoted through the National Disaster Center (NDC) within the Department of Pro-

Figure 1. Map of Papua New Guinea



Source: Asian Development Bank.

vincial and Local Government Affairs; however, there appears to be little ongoing activity at this time. The CCA-related activities previously fell under the jurisdiction of the Greenhouse Unit within the Department of Environment and Conservation (DEC) but are now the responsibility of the recently created Office of Climate Change and Environmental Sustainability (OCCES), which reports to the Prime Minis-

ter's Office. The initial focus will be on carbon trade, though CCA policies are expected to be a part of the country's nascent overall climate change framework.

The key findings of the PNG assessment are summarized in the next chapter followed by the detailed assessment and identification of risk reduction opportunities. ❖

Key Country Findings

As the largest Pacific island country and one of the most exposed to hazards and potential impacts of climate change, PNG has precarious arrangements to manage or reduce the impact from this exposure. Effective and sustainable risk reduction cannot be achieved without clear governance with explicit allocation of accountabilities and government commitment that cuts across all at-risk sectors. Nor can it be achieved without an understanding of the hazards being addressed and the risks arising from them. In the absence of recovery support following a disaster, communities are forced to pick themselves up with meager resources and continue from where the disastrous event left them. Cycles of disasters in vulnerable communities negate government objectives to alleviate poverty.

Overall, this assessment report has made several key observations of DRR and CCA issues and their impact in PNG.

High-level exposure. The island country is highly vulnerable to hazards and climate extremes, and facing potentially greater variability and extremes due to climate change. An expected rapidly growing rural population (2.8 percent growth per year) will add stresses to land and water resources and increase exposure to hazards. Adding to this, a low-level recognition of hazards and marginal-level monitoring of hazards (except volcanic) and climate change leaves PNG with an inability to assess vulnerability or identify risk issues.

Information and coordination. Despite a good level of historical hazard data, it is difficult to access this information. Also, a lack of analytical tools and up-to-date data makes it difficult to follow trends. Low-level cooperation and coordination between government agencies, with strong silo effects and little information sharing, is exacerbated by weak information systems.

Provincial responsibility. Functions in disaster management, land use, and the environment have devolved

to the provincial level, but an almost complete lack of resourcing and support in many areas hardly allows these functions to be fulfilled. It is reported that in only 4 of the 19 provinces could disaster management arrangements be described as other than nominal. A period of disaster management development (with a fledgling DRR component) up until 2006 resulted in a reasonable level of awareness among departments and provinces.

Decisionmaking. The National Disaster Center, which currently lacks government commitment, is not functionally effective and is increasingly marginalized in decisionmaking and advocacy. However, this weakened position puts the Government and PNG communities at risk since expectations remain for disaster management capability from the National Disaster Center. Despite externally driven administrative structures that have come and gone over 8 years for the coordination and development of CCA advice and business, none have resulted in any policy development or department commitment.

Human resource capacity and application. Despite a good level of DRR/CCA awareness at the principle-levels of government, there is still a lack of appreciation of how disaster risk reduction and climate change adaptation might impact a sector's activity or an individual's job. Consequently, there is little government-promoted DRR/CCA activity of any significance. And where there is adequate staff capacity within departments, the lack of resources, systems, and tools leaves staff with an inability to influence outcomes. Even with well-developed legislation in the areas of physical land use and the environment, there is little application and no effective involvement of other departments, according to reporting by departments with administrative responsibility.

Private sector involvement. Significant stakeholder/NGO activity provides for local disaster response capability as part of development programs. This activ-

ity has a future DRR/CCA focus but is currently pre-occupied with disaster management issues. There is a national stakeholder/NGO coordination mechanism for responding to disaster events, which offsets the lack of commitment of the National Disaster Center. The PNG assessment team became aware of some climate change mitigation activity (which had commercial drivers), but there were no examples of adaptation or risk reduction in terms of private sector activity.

Food and water security. The National Agriculture Research Institute and the National Fisheries Authority, as well as other institutions, with support from NGOs and donors are undertaking climate hazard-related work in food and water security to reach the relative Millennium Development Goals. These institutions are lacking a champion, are under-resourced, and have limited capacity to promulgate their work.

Infrastructure. Construction experts brought several examples of infrastructure failures to the attention of the PNG assessment team. Weather events and inadequate attention to design parameters caused the failures in the examples.

Education and training. Despite capacity for DRR/CCA and hazard assessment curricula within the University of PNG (UPNG), government connections are weak and the capacity is underutilized.

Any proposals dealing with DRR/CCA issues must clearly show political and institutional commitments, without which there is little point in proceeding. Proposals must address the establishment of clear institutional frameworks and governance accountability across appropriate sectors and between levels of government. The political commitment in PNG has risen in response to the increased frequency and impact of

extreme weather events in several parts of the country. The Prime Minister is now recognized as a champion for the disaster management agenda.

The CCA agenda must also be driven from the national level since there is no provincial structure. The opportunity exists to integrate the institutional arrangements for climate change adaptation and disaster risk management while maintaining separate programs as appropriate.

In the context of development programs, there are opportunities identified to support sector programs in the food and water security and fisheries, which have some relationship to potential climate change but which have not been initiated by climate change considerations. All have elements of technical development and promulgation of outcomes to communities. Any initiatives should be ideally linked with a governance framework development in a bottom-up/top-down context. Resources required for these initiatives are substantial, and cooperative arrangements through those sectors are needed.

The way forward is strongly dependent on the continued presence of an in-country champion to provide some basis for a sustainable outcome. Any initiatives should also result in capacity development throughout PNG. Further work is required to identify appropriate areas of activities that meet these criteria and for the development of project contexts with the appropriate sector. Any proposals should form the basis of a longer-term strategic commitment.

A summary of broad situations, gaps, and opportunities is shown in Table 1. The final chapter of this PNG report expands on these opportunities. ❖

Table 1. Summary of Key Gaps and Opportunities for DRR and CCA in PNG

Situation	Gap	Opportunities
There is a lack of commitment to hazard monitoring, vulnerability analysis, and understanding of risk to inform DRR and CCA activity.	There are insufficient monitoring networks; poor access to historical time-series data; and a lack of analysis tools, mapping, and risk assessment.	Refocus the hazard-related functions and enhance the capacity for improved monitoring, data analysis, and use of hazard information in DRR and CCA. Integrate hazard-related functions and development of vulnerability assessment skills.
Government policies on DRR and CCA are unformed, and coordination structures are ineffective leading to a lack of budget commitment to initiatives. The conditions for mainstreaming do not exist.	DRR and CCA are not priority areas for government commitment. Agencies with roles in these areas do not feel they can make a difference.	Assist with development of policy frameworks, identify champions, and facilitate DRR and CCA practice within and across agencies.
Existing arrangements for land use and environmental management are not being applied to address hazardous situations.	There is a lack of cooperation and coordination between agencies, as well as a lack of access to data and analyses to support measures.	Integrate the focus for CCA and DRR and establish policy frameworks and institutional structures and accountabilities for coordination.
There is a lack of commitment to the functions of the National Disaster Center and their provincial counterparts, leading to a marginalizing and isolation of their roles.	Disaster response arrangements are poorly structured and resourced leading to uncertain and delayed responses to events. There is ineffective advocacy and support for DRR activities.	Promote the championing of the National Disaster Center functions and support the strengthening of legislation, enabling environment, and institutional arrangements for DRM.
There are particular vulnerabilities with food and water security in the relatively short term related to climate extremes and variability associated with the ENSO. This is being exacerbated by land use pressures and potentially by climate change.	There is a lack of support from national and provincial levels, which results in local initiatives becoming unsustainable and failing.	Support programs to address these vulnerabilities and promulgate measures to reduce the risks.

Detailed Country Assessment

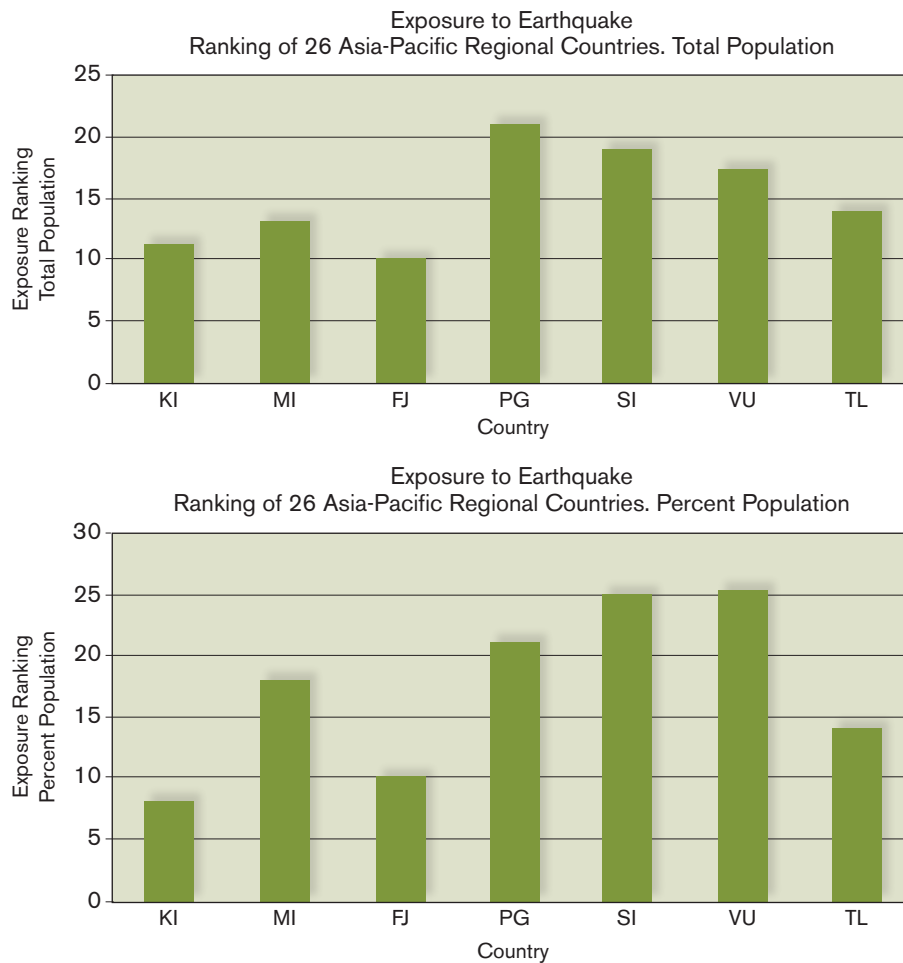
Earthquake and other hazard impact in PNG

A 2008 study of 26 Asia-Pacific regional countries by Geoscience Australia for AusAID shows that PNG ranked within the top 6 of these countries as having the highest percentage of population exposed to earthquake hazard, as well as having one of the highest total populations exposed to earthquake in the Asia-Pacific region (in absolute terms). PNG also ranked close behind the Philippines, Indonesia, and Vanuatu in having the highest percentage of population exposed to severe volcanic risk (Figure 2).

The economic effects of disasters in PNG have been severe and manifold in the past. Over the past 25 years, the country has had 508 earthquake-related fatalities, 9 deaths from volcanic eruptions, 2,182 from tsunami/wave surges, 47 from cyclones, 58 from flooding, 314 from landslides, and 98 from drought.

The East New Britain provincial capital of Rabaul was rendered nonfunctional by volcanic ash eruptions in 1994. And although the capital was moved to a new site at Kokopo, ash-falls are a continuing severe threat. In 1998, a localized but severe 10-meter-high tsunami devastated coastal villages in the Aitape-Sissano area

Figure 2. Exposure to Earthquake



Note: KI (Kiribati), MI (Marshal Islands), FJ (Fiji), PG (Papua New Guinea), SI (Solomon Islands), VU (Vanuatu), TL (Timor-Leste).
Source: Geoscience Australia (2008).

on the north coast of the mainland. More recently, a landslide on the Highlands Highway virtually paralyzed trade and fuel transport. Unexpected landslides are a threat due to the highly active major tectonic boundary; unexpected landslides are a short-notice threat to the second largest city in PNG.

Legislation and institutional framework

In terms of the country policy, legal, institutional, and overall DRR/CCA framework, the PNG Government took several steps. The DEC-administered *Environment Act 2000* provides for the regulation of environmental impacts from development, environmental protection, and national water resources management. It is a reasonably coherent document and provides for development of environmental policies. While not specifically addressing climate change, it includes climate as an element within which policies can be developed.

The *Physical Planning Act 1989*, administered by the Department of Lands, provides a strong enabling tool for managing land use to reduce hazard or climate change risk. It has the ability to apply to both customary and alienated land. About 97 percent of PNG land is customary land, and 3 percent is alienated. The Physical Planning Act has been applied to just 2 percent of customary land, which is subject to a government lease and on-leased for development purposes. Where land is subject to physical planning, it is a requirement that both environmental and hazard issues be addressed.

In limited situations where the Physical Planning Act has been applied, planning applications have reportedly not been referred to the relevant departments for hazard or environmental input, therefore it is doubtful if due considerations have been made. The Department of Lands noted that the Physical Planning Boards relied on the applicant's summary of impacts and often issues were overridden.

Similarly the Environment Act 2000 provides a satisfactory enabling environment for the management and control of activities contributing to environment, land, and water risks. However, the application of controls and conditions seems to be routinely neglected, placing significant risk on land stability and water management and use.

In 1998 a Climate Change Country Team was established with funding from the Pacific Island Climate Change Assistance Program (PICCAP) under the UN Framework Convention on Climate Change (UNFCCC). In November 2000 the PNG Initial National Communication was published. It was adopted under the UNFCCC in 2002. The focus of the Initial National Communication for adaptation purposes was on low-level coastal areas and the potential impacts of sea-level rise on inundation, food production, and coastal zone management. In 2000, the Initial National Communication made note of the following:

- The range of adaptation strategies to minimize and adjust to impacts of climate change does not need extensive, new interventions but should rather enhance current practices.
- The ability of PNG to adapt to climate change will depend on a fundamental shift in institutional, technological, and cultural factors associated with sound management practices and the mainstreaming of environmental considerations at planning and policy levels.
- Vulnerability assessment was needed to identify the degree of future risks induced by climate change, variability, and sea-level rise.
- The detection of climate change is still uncertain as it is based on current data sets, which have a short period of observations.
- There was an obvious need for a widespread climate network to effectively monitor climatic variables unique to this part of the world.

- There was a realization of the importance of climate change, and related programs would be coordinated and implemented to improve understanding of the science, impact, and adaptation measures of climate change and variability.
- There would be commitment to developing a range of adaptation measures through agriculture, land use, fisheries, and forestry.

There is no climate change policy, and until recently there has been no structure for cross-departmental co-ordination. The Government's Office of Climate Change and Environmental Sustainability reports to the Prime Minister's Office. The OCCES is staffed with 50-60 people comprising staff seconded from other departments and supported by a number of specialists. Its present functions include establishing a climate change policy and strategy to define and manage programs for land, water, biodiversity, reduced emissions, and climate change adaptation; and performing the role of the designated national authority. The Government's priority is on reduced emissions from avoided deforestation although the OCCES with assistance from donor partners is preparing a National Climate Change Framework that would highlight reduced emissions from several sectors as well as reduced vulnerability to climate change and the associated adaptation policy implications.

For DRR, the relevant legislation is the *National Disaster Management Act 1984* (consolidated to No 3 of 2004) (NDM Act). The document focuses on preparedness and response arrangements for disasters. It establishes the National Disaster Committee comprising department heads of government agencies with a role in disaster management. The Committee supervises the national state of preparedness, maintaining the National Emergency Plan, coordinating departmental relief actions through the National Disaster Center, and advising the Government on national emergency declarations. Currently the Committee is not engaged,

and the Government has made recent emergency declarations without the Committee meeting.

The NDM Act establishes the National Disaster Center to serve the National Disaster Committee, coordinate disaster situations, and support provincial disaster management activities. The National Disaster Center supports provinces in planning and co-ordinating national relief and surveillance during disasters. The Center seems to be isolated from decisionmaking and does not access department resources. Its response function is limited to the extent that the Disaster Management Team, established by donors and stakeholders as a support body, has in recent times provided the disaster response coordination. The UNDP-chaired Disaster Management Team reports that during the November 2007 Oro floods (the largest in 20 years), the Team managed the relief response for 6 weeks until government resources were activated through the National Disaster Center.

A revision of the National Disaster Management Act has been drafted to clarify powers under the Act. However, much work is required on the initial draft to provide for explicit functions across agencies and sectors and to provide for a national focus on risk reduction. For several reasons, this work is not progressing as initially expected.

The National Disaster Center advises that the Disaster Management Plan 1987 is out of date and non-functional. The current operational document for response management is a 2003 National and Provincial Disaster and Risk Management Handbook. This Handbook includes significant elements of disaster risk management but the intended supporting policy (the *National Disaster Mitigation Policy* prepared in 2005) has not yet been adopted.

Other working arms of government have been established in the effort toward disaster risk management and climate change adaptation:

- ***PNG Climate Change Working Team.*** This team, established in 2007 by the National Disaster Center as a risk reduction initiative under the chairmanship of University of PNG, met once but was not supported by DEC and has been overtaken by the DEC intention to establish an office for climate change.
- ***National Disaster Awareness and Preparedness Committee.*** This is a sub-committee of the National Disaster Committee set up pre-2003 to support activities of the National Disaster Center. It was chaired by the University of PNG, which was founded in 2006 to prepare provincial baseline data for planning purposes. While some residual activity on the baseline surveys continues, the meetings of the sub-committee have lapsed in recent times due to lack of support.
- ***Provincial Disaster Committees.*** The NDM Act establishes Provincial Disaster Committees comprising the Provincial Administrator and Provincial Department Heads and reporting to the Provincial Executive Council. The Committee prepares emergency plans for the province, co-ordinates relief operations during a disaster, and addresses hazards in provincial development plans. A Provincial Disaster Coordinator is appointed for all provinces. The National Disaster Center notes that some capacity exists in only 3 or 4 provinces (Morobe, East New Britain, Milne Bay, and maybe New Ireland), but in the remaining 15 provinces the Coordinators are grossly under-resourced to do their job, and none has a focus on addressing hazards or reducing risks. Coordinators appear to have good awareness of risk-reduction and climate change issues but did not recognize it as part of the job, perhaps because of unclear upstream messages.

Coordination among government agencies

The DRR coordination function is the role of the National Disaster Center (as part of its weakly mandated disaster risk management function). The National Disaster Committee is required to approve and report on the Center's annual work plan. With the functions of both the Committee and the National Disaster Center marginalized in recent times, there is little coordination or promotion of this function across government agencies.

The CCA policies are not yet in place and the OCCES, the mechanism for addressing the policies, was only recently established. While there has been activity between departments on climate change mitigation and carbon credits, there has been no capacity for adaptation activity and no coordination among government agencies in recent years.

The relatively little coordination effort highlights the urgent need for a well-articulated DRR/CCA integrated policy and clarification of the respective roles of the existing entities as these functions become more of a continuum (rather than distinct activities).

Over the years, the Government has taken several steps to create legislation, entities, and in some cases, guidelines to implement, monitor, and enforce the rules and regulations. In spite of these efforts, there continues serious deterioration in the performance of many of these entities; severe silo-restrictive relationships; lack of clear overall policies to inform strategic directions; inability to utilize available instruments and tools as designed; and continued difficulty of coordinating funding, policy, and institutional arrangements for DRR and CCA activities.

These are not insurmountable obstacles and can be reasonably addressed given the political and strategic commitment to do it. However, it is also important

to recognize that without commitment these issues are unlikely to improve—even if all of the funding aspects are addressed. Initiatives should therefore target a broader-based area.

In disaster risk management, the SOPAC process of the High-Level Advocacy Team has so far reportedly been unable to engage through the National Disaster Center to initiate support for the DRM National Action Plan because the internal conditions are not yet appropriate for this initiative. At the time when either the DRR or CCA initiative is commenced, the opportunity should be taken to promote the concept of integrated risk reduction with a single focus on hazard and climate change risk management. Given the separation of the external funding streams for these activities over the past 10 years, this concept will require a significant adjustment in donor attitudes as well as an integrated internal cross-sector commitment.

Coordination among donors and key stakeholders

The mechanisms for donors to engage with Government on hazard and climate change risk are weak; and apart from some programs for hazard monitoring, there have been few initiatives and little coordination between donors and stakeholders. Donors acknowledge this and have seen risk reduction as a regional issue. This is in contrast to initiatives for disaster management preparedness and response where donor and stakeholder coordination through the Disaster Management Team effectively weakened the functioning of the National Disaster Center. Attention to redress this situation is needed.

There appears to be incomplete but developing understanding on the part of donors of the crosscutting CCA issues (and their relationship to disaster risk reduction) particularly given the weak in-country institutional arrangements. Also, the absence of in-country DRR/

CCA program development, leading to potential for donors to identify ad hoc initiatives for funding, is a problem. There is an apparent lack of donor coordination mechanisms and leadership both in-country and at the regional level for effective identification and sustainable support of CCA and DRR initiatives

Donors generally see a new and increasing CCA focus for the future and are apparently anticipating the need to identify and fund appropriate initiatives. The complexities around this are now being recognized as a crosscutting issue and the weak in-country institutional frameworks for engagement. With this circumstance, the need for donor and stakeholder coordination is becoming increasingly important for effective and sustainable support. This is a regional issue, and donor leadership will be needed.

One small but important element in focusing donor attention on DRR and CCA issues as priorities is to ensure that they are integral to the next government strategy paper (the mid-term development strategy). Previous national strategies have failed due to political instability, weak institutional capacity and arrangements, and lack of ownership and commitment. It appears that those things are still issues.

Planning, budgeting, and allocating

Poor planning and budgeting will have a detrimental impact on key assets for DRR/CCA activities available in PNG. For example, food and water security programs initiated after the 1997/98 droughts (occasioned by normal climate variability induced by ENSO) today suffer from lack of funding. The monitoring and understanding of how climate change may exacerbate future drought cycles has not advanced.

Planning and budgets are formulated at the business unit level and promoted through the budget process by their respective departments. For cross-sector ac-

tivities, individual departments are expected to budget for their separate components. There is little experience of cross-sector budget initiatives. In the future, departments and ministries must do some level of promotion if DRR and CCA initiatives are to get into the national budget stream.

Even in once well-functioning entities, there is a tendency toward increasing fragmentation and deterioration of quality in service. For example, apart from volcanic monitoring, there seems to be only nominal understanding of these hazards since monitoring has been reduced to marginal levels over recent years. While there is a significant body of historical data available, it is generally not easily accessible and tools for analysis and mapping are not available.

PNG Geological Department. The newly formed Department of Mineral Policy and Geohazards Management (DMPGM) addresses seismology with a staff of 9, volcanology with a staff of 16, and geotechnical issues with a staff of 7. The new Department inherits the policy and geohazard management functions from the previous Department of Mining following the formation of the Mineral Resource Authority early in 2008. The DMPGM has a policy unit focused on minerals policy and regulation. While there is no current geohazards management policy, the potential exists for its development.

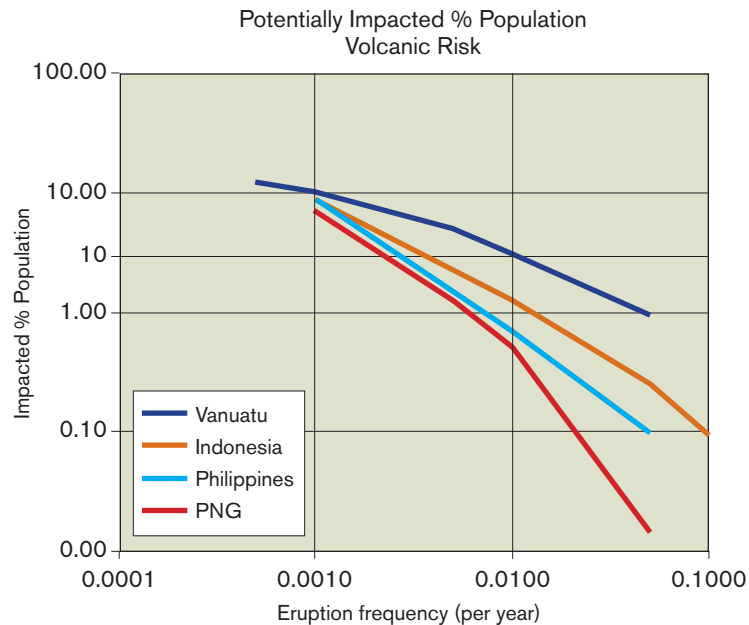
- **Seismology.** In the mid-80s there was a seismic network of 16 stations with both seismographs and accelerographs. The system has gradually run down and is now ineffective. There is a European Union funding proposal to install 6-10 new seismographs to resurrect the monitoring and assessment capacity. Adding accelerographs to these proposed installations would provide a capacity for identifying potential areas of high impact. The last major magnitude-8 earthquake was an event in the New Ireland region in 2000. Some of the highest

seismic activity in the world has happened in parts of New Britain, New Ireland, and Bougainville.

- **Volcanology.** There are 16 active volcanoes in PNG—6 of them classified as high risk. Nine of the 16 are monitored in real-time. Monitoring and understanding of vulnerability have reduced the incidence of deaths from eruptions over the past 50 years. A relatively high percentage of the PNG population is exposed to volcanic eruption. Figures from an Asia-Pacific regional report by Geoscience Australia (2008) broadly imply that a collective PNG population of around 20,000 to 30,000 people is likely to be affected by the 1-in-100-year volcanic event or, in other words, face a 50 percent chance of exposure to volcanic eruption in a 70-year timeframe (Figure 3). The rapidly growing population is associated with the growing tourism, palm oil, and timber industries.

The Geoscience Australia report points out that large eruptions in PNG occur at an average interval of 25 years or less, based on the 11 large eruptions there since 1800. West New Britain, where the frequency of eruptions is roughly 1 in 70 years, and other areas along the northern mainland coast have the highest volcanic eruption hazard. The report notes that New Britain has the highest concentration of calderas in the Asia-Pacific region, reflecting the long-term hazards faced by this region. The report also suggests that the Madang and Morobe provinces remain highly vulnerable to volcanic tsunamis such as the one produced by the 1888 collapse of the Ritter Island volcanic cone between New Britain and the PNG mainland, causing the destruction of many coastal villages.

- **Geotechnical.** The geotechnical unit covers landslides and slope stability, erosion (including coastal), and tsunamis. This unit is severely depleted but makes use of Mineral Resource Authority

Figure 2. Potentially Impacted % of Population at Volcanic Risk

Source: Geoscience Australia (2008).

staff for emergency situations. While the previous geotechnical staff were transferred to the Mineral Resource Authority, the new DMPGM budget makes allowance for 7 new staff (unfilled at time of assessment reporting). Landslide potential is high over large areas of PNG, given the combination of the island's steep mountain ranges, volcanism, high seismicity, and high annual rainfall. Three of the world's largest landslides recorded in the last 120 year have occurred in PNG. In the Highlands area, intensified land use due to increasing population and increasing climate variability are adding to the problem. The Geohazards Australia report points out that the model developed as part of the World Bank Hotspot program ranks PNG among the countries with the highest landslide hazard profiles in the world.

Neither the geotechnical unit or the Department of Environment and Conservation give much at-

tention to coastal erosion under existing climate variability or to the potential impacts of climate change. Both however acknowledge it is an issue. But since coastal erosion is ranked with the landslide issue, there is little capacity to even start to address it. There is no "big picture" view of the geotechnical hazards. Overall the Geological Survey has the skills to provide hazard and vulnerability assessments but lacks the tools and policy commitment to undertake this work. On-going monitoring to inform future decisions is minimal except in the context of volcanoes.

PNG National Weather Service. The National Weather Service sits within the Department of Transport. In recent years, the Service has decreased from 107 positions to 66. The Service operates 3 observation networks. There is a network of 14 synoptic weather stations with data continuously contributing to the regional and international weather systems (including

the Pacific Islands Climate Prediction Project) through Melbourne. This network is roughly banded and provides only limited detail for local forecasting. Responses are thus mainly reactive rather than based on predictive information. A rainfall network of 57 gauges is operated with volunteers providing monthly records of 24-hour rainfall. This network had comprised 1,000 stations, but now its usefulness for monitoring rainfall trends across a country of highly complex terrain is seriously compromised. There is a 4-station synoptic network that includes measuring sea level and temperature as part of the Pacific Island Climate Prediction Program. There is also a Manus Island SEAFRAME station for sea-level and climate monitoring.

The National Weather Service is developing a seasonal predictive climate capability and has just commenced a monthly climate outlook providing 3- and 6-month predictions. However, the National Weather Service notes these predictions are based on coarse data and have limited geographic scope for the complex PNG topography.

Overall, the National Weather Service feels its monitoring network is falling below a credible level. Staff consider that the existing data systems are inadequate for detailed trend analyses. There is little ability to identify local climate change trends. Increasing climate variability (the threat of droughts and other extreme events) linked to the annual direction of the Southern oscillation is becoming a major concern for the Service.

Water Resource Management Branch. The Water Resource Management Branch within DEC is responsible for the management of national water resources under the Environment Act 2000. The Water Resource Management Branch undertakes river monitoring and the allocation of groundwater resources. The Branch is not adequately equipped to carry out these functions.

The Water Resource Management Branch reported that over the past 10 years river monitoring has reduced from 130 stations to less than 10 and that the national network was effectively closed. In March 2008 only 1 station on the Ramu River was fully effective, and 2 stations were to be reopened. Additionally, all 4 stations on the Laloki catchment were to be reopened by mid-2008 and a new station was to be constructed on the Goldie River. Some 4 to 6 representative regional stations will be required as part of the Pacific HYCOS project. A hydrological strengthening study undertaken in the late 1990s recommended a credible system of 72 stations was required nationally.

Although the historical record of hydrological monitoring in PNG is strong (going back to the 1960s with an emphasis on hydro-power project investigation), data digitizing, database development and analysis, and catchment-mapping capability is deficient. The Water Resource Management Branch reported that flood records have not been analyzed since 1997, and low-flow records do not exist to contribute to understanding potential drought conditions.

There is a draft Sustainable Water Action Plan in preparation arising from the SOPAC 2002 Pacific Regional Action Plan on Sustainable Water Management, but actions were not included in the 2008 budget and work plan of the Water Resource Management Branch. Proposals exist for the installation and system support of pilot HYCOS catchment monitoring, with support from the European Union through SOPAC. However, details and planning are sketchy and national commitment for on-going operation is lacking.

The PNG National Water Board serves urban areas outside Port Moresby and relies on the Water Resource Management Branch for what little hydrological information is available. Understanding of groundwater resources is limited. A limited study following the 1997 drought indicated the availability of

good groundwater capacity and quality. With surface waters increasingly coming under threat from rapid population growth and runoff and point source pollution, the National Water Board is concerned that previously plentiful water resources are now requiring active management. They say the available information and tools are not adequate for this—particularly given the potential climate change impacts that have not been quantified.

The 2007 SOPAC-managed report on Integrated Water Resources Management in Pacific Island Countries noted that only 20 percent of the rural population of PNG have access to an improved water supply and that, given the impacts of floods, droughts, and climate variability, there is an urgent need to apply integrated water resources management involving all stakeholders and focusing on catchment units. It noted there were institutional, legislative, operational, strategic, capacity, public consciousness, and resource-related barriers to overcome.

At this juncture, there are few indications that these issues are being acknowledged or adequately addressed at a strategic level within government. This situation can be significantly improved by programs aimed at enhancing the capacity of the Water Resource Management Branch to better meet its statutory obligations and service the needs of client bodies and civil society through the implementation of hydrological monitoring on an integrated catchment management basis.

Summary. Across PNG, core hazard understanding and on-going monitoring necessary to inform risk reduction initiatives, whether from disasters or climate change, is considered to be seriously deficient. While this is clearly understood within individual agencies (both hazard agencies and client agencies who have a need of the information), there is little acknowledgment of this issue at the Government strategic level. Identified aid programs to strengthen monitoring networks (European Union for seismic and HYCOS

for hydrologic) will have little long-term impact if operating capacity and budgets and information systems with tools for analysis are not also addressed. There is a need for institutional strengthening to ensure hazard and vulnerability information is available to inform future risk reduction decisions.

Gaps

- *Inadequate “big picture” understanding of the wide array of hazards to which PNG is subject.* With degraded monitoring and analysis capability across all hazards, including potential climate change impacts, it is difficult to identify the allocation of appropriate resources on a priority basis. There is significant historical data available that could provide relatively quickly an overview to inform a minimum monitoring and vulnerability analysis program. This said, the relative short-term potential for drought conditions and the large population exposure to critical water shortage should be addressed as a matter of urgency.
- *Unavailability of a common database system (GIS and dual transfer mode capable) for storing hazard monitoring data with access to analysis tools for identifying trends, vulnerabilities, and risks.* All hazard sectors reported an inability to readily store and access monitoring data for analytical and mapping purposes.
- *Shortage of adequate data monitoring networks to meet future needs for vulnerability and risk assessments.* Across the range of geophysical, hydrological, and climatic hazards, the absence of data collection means future DRR/CCA efforts will be unfocussed unless concerted efforts are made to upgrade the networks.
- *Absence of a hazard policy.* Across the hazard sectors, there is a lack of clarity around the scope, purpose, and end use needs of monitoring and its relationship to environmental, resource, land use, and disaster planning and management purposes.

- *Specifically there is insufficient understanding of the national water resource for urgently needed integrated water resource management.* With a history of devastating droughts and the potential for climate change and population pressures to increase both the likelihood and severity of such future events, it is essential that water resource management be instituted and supplementary arrangements for supply be investigated and put in place where necessary.

Vulnerability and risk assessments

Following on the status of hazard monitoring, there is little government focus on risk and vulnerability assessment. A National Disaster Mitigation Strategy, drafted two years ago by the National Disaster Center, sets out a clear appreciation of the issues but sits unadopted by the PNG Government. It now needs support within the Government for its adoption and use.

Within the National Disaster Center there is a Risk Management Unit of 4 people with responsibilities for hazard information, training, public awareness, and risk reduction. The unit has developed a set of project proposals for reducing risk, but it was not made available to the assessment team and details are sketchy. There is no commitment to this either from the National Disaster Committee or individual agencies, and there is no budget provision. This is a fundamental governance issue where a structure exists for hazard risk reduction, but there is no policy or institutional commitment to make it effective.

At this juncture, there are few indications that these issues are being acknowledged or adequately addressed at a strategic level within government. This situation can be significantly improved by programs aimed at enhancing the capacity of the Water Resource Management Branch to better meet its statutory obligations and service the needs of client bodies

and civil society through the implementation of hydrological monitoring on an integrated catchment management basis.

The responsibility for climate change adaptation now rests with the OCCES. But there is no CCA policy, and there was no effective government focus on it since the Initial National Communication of November 2000 was adopted under the UNFCCC in 2002. At this point there is understanding of the extreme incidence of climate variability across PNG but only generic understanding of how those extremes might be affected by climate change across the rugged and complex PNG topography.

In 2007 the National Disaster Center formed the PNG Climate Change Working Team to address climate change hazard risk issues. The team met only once, but the initiative did not advance after DEC announced plans to form an Office for Climate Change.

In the agriculture, fisheries, and forestry areas, there is awareness of drought, food security, and forest degradation issues, but analysis has been coarse and programs to address them are grossly underfunded. These were initiated after the 1997/98 drought associated with the last ENSO cycle and were established under the Millennium Development Goals rather than as climate change projects. It is the expectation of DEC that focus will come to these issues with establishment of the OCCES adaptation program.

Within the Environmental Science and Geography Department of the University of PNG, courses are offered in hazard and risk management, climate change variability and disaster reduction, remote sensing, integrated catchment and coastal management, and other related topics. There is also a UNICEF-funded Center for Risk Reduction. There is significant capacity to contribute to government initiatives, but government connections are not strong.

Gaps

- **Extension of all the gaps under knowledge, data, and tools.** Filling these gaps is a fundamental requirement for advancing concerted actions for risk reduction in the country both for climate change and disaster hazards.
- **Separation between CCA and DRR in addressing risks and vulnerability.** A split focus means dilution of advocacy, skills, and resources in an area struggling to get attention.
- **Lack of connection with University of PNG.** This means critical skills and resources are not being accessed.

Mainstreaming into planning, policy, legislation, and regulations

The separation (or silo effect) between departments and agencies and lack of co-ordination is endemic in PNG. Of concern in the evaluation of DRR and CCA linkages is that both governmental bodies and NGOs have noted that the National Disaster Center is marginalized within governmental operations. Further, government and nongovernment sector bodies point out that there is no co-ordination mechanism for climate change adaptation.

Mainstreaming of risk reduction efforts is not occurring. While land use legislation requires consideration of hazards and environmental impacts, for example, these inputs are not sought from the government hazard agencies or DEC in national or provincial land-use planning considerations.

As another example, design manuals for roads and infrastructure from the 1980s in use today are in need of upgrading for local conditions. The Department of Works advises that consultants make their own interpretation of design parameters often without reference to local hazard information. The DEC Water Resource

Management Branch has not been approached by infrastructure consultants for hydrological data in the past two years. There are reports of new road developments being washed out by rainstorms or landslides—even for donor-funded projects that are specified to be risk and climate proofed. In the provinces, design manuals are not used at all. [Note: This situation is common across the region and could be addressed by the review and revision of appropriate engineering guidelines and building codes on a regional basis to ensure that risk and climate proofing of infrastructure and buildings is considered on a proper basis.]

In its policy note “Not If But When”, the World Bank defines mainstreaming of risk management as the inclusion of natural hazards and climate change considerations into the following categories:

- National development plans and strategies and sectoral and spatial (including community-level) plans—with budget commitment;
- Policies, regulations and codes of practice—with enforcement; and
- Programs and projects—with appropriate hazard assessment and design.

It identifies prerequisites in the form of:

- **Strengthening a national enabling environment** by accountable performance budgeting; inter-sectoral coordination mechanisms; appropriate institutional set-ups; staff capacity and national champions; and enforceable legislation, standards, and codes; and
- **Supporting decisionmaking** with public awareness of initiatives; context-specific information targeted; relevant analysis, mapping, and risk evaluation instruments; and implementation support tools.

Putting these things in place is clearly a long-term, multi-faceted process with several possible starting

points. Any starting point should include strong national government support, some level of existing capacity and enthusiasm, and a commitment to a policy framework on which to build or enhance an institutional set-up.

There is currently no policy framework within the DRR or CCA areas to develop the planning and institutional arrangements to support these conditions for mainstreaming. Most of these needs were identified in the 2000 PNG Initial National Communication. None of them were explicitly identified in the Government Medium-Term Development Strategy 2005-2010. There are no coordinated initiatives in current sector budgets.

There is potential to develop an adaptation policy, which could address the above framework, including integration with other hazard risk reduction initiatives through the OCCES-prepared National Climate Change Framework.

Capacity in DRR context exists with a potential to grow. The Prime Minister has emerged as a champion to promote risk reduction initiatives although there has been a lack of commitment to a policy and institutional framework. There is more optimism now. The potential to facilitate the development of a framework by the National Disaster Center, which also covers the provinces, can be realized. The provincial arrangements should provide for both CCA and DRR activity in an integrated platform.

Gaps

- *Conditions for mainstreaming of risk reduction activities do not exist and the Government is currently showing little commitment to this area.* There has been a lack of acceptance by Government that disaster and climate change risk needs its attention. The recent establishment of an Office for Climate Change creates an opportunity to address this. The initiative itself is not a sufficient driver, and clear

commitments and championing of risk reduction would provide a basis for starting. It is fundamental that sustainable risk reduction cannot be achieved without engagement and commitment from the Government.

- *A dysfunctional disaster management arrangement under the National Disaster Center exacerbates the potential for mainstreaming.* Until this is addressed, the conditions for addressing DRR issues will not exist.
- *There is no evidence of the private sector filling these gaps and driving change in Government thinking on CCA and DRR issues.* In the regulatory vacuum, which exists around these issues, the responsible departments report that the private sector is exploiting weaknesses in the system rather than filling the gaps.

Monitoring and evaluation

As indicated in the above discussion, there is no monitoring and evaluation of risk reduction activities in PNG relating to either disaster risk reduction or climate change adaptation.

Gap

- *There is an absence of policy definition, commitment, and reporting requirements across agencies that addresses their role in addressing hazard and climate change risk.* Development of policy for hazards monitoring and management, risk reduction, and climate change adaptation should include elements for monitoring and evaluation.

Awareness raising and capacity building

At the national level, there is adequate awareness of the disaster and climate change hazards among those departments encountered in this assessment and also at the provincial level. However, there was a

general sense that resources and skills available were inadequate to deal with them and little appreciation that they would impact a sector's activity or an individual's job. Exceptions to this existed within the hazards monitoring areas, the National Agricultural Research Institute (NARI), and the National Water Board where frustrations were expressed at the lack of resources to address the issues. There is a need for a greater understanding of the relationship between hazards and the practical means for starting to deal with them. This is a fundamental capacity issue, which needs to be dealt with at a pragmatic level.

Gaps

- *Government strategy indicates no acceptance that disaster and climate change hazards represent substantial risks.* Until there is policy commitment to addressing these issues, there is little scope for sustainable reduction activity or for engaging existing capacity in the University of PNG or NGOs.
- *Practical understanding of risk reduction mechanisms is lacking.* Any mechanism can be applied with varying degrees of complexity according to the level of information available. This applies to both DRR and CCA issues, but a pre-condition is the acceptance that the risk exists and can be influenced.
- *A general capacity shortage exists for DRR and CCA initiatives, especially dealing with technical data analysis and vulnerability and risk assessments.* Filling this gap is a fundamental requirement for advancing concerted actions for risk reduction in the country.

Implementation of actual risk-reducing measures

With a continuing weak government commitment to DRR and CCA activity and unsupportive structures and policies, there is little implementation being promoted, coordinated, or undertaken at the government level. Without a strong enabling environment or gov-

ernment or local authority partnership, civil society and private sector initiatives are likely to be unsustainable. Among potential initiatives identified by donors and stakeholders was a UNDP-sponsored Pacific Adaptation to Climate Change Project for lowland food security and sustainable land management under ENSO-induced drought conditions. [Note: this project has received funding approval from the GEF Pacific Alliance for Sustainability and will be the first significant project for PNG initiated as a CCA activity.]

The Gazelle Restoration Project was not initiated as a risk reduction activity. Following the 1994 Rabaul eruption in East New Britain, the Gazelle Restoration Project got started to rehabilitate the Gazelle peninsula in a joint effort where National and Provincial Governments worked to relocate and recover from a disaster. This World Bank-funded project (1999 to 2007) relocated the provincial capital from Rabaul to Kokopo and re-established infrastructure, social, and administrative services.

Two government research institutions have been involved with activities arising from climate variability following the 97/98 droughts and initiated under Millennium Development Goals. The National Agricultural Research Institute at Aiyura in the Eastern Highlands Province addresses food security under extremes of drought and excessive rain, and the National Fisheries Authority addresses sustainable inshore fishing under conditions of sea temperature rise and coral bleaching. While not initiated as CCA activities, both areas of activity relate to food security under extreme climate conditions and both are now grossly underfunded. These activities could be re-funded as CCA initiatives. Highlights of discussions with the assessment team and representatives of these institutions follow.

National Agricultural Research Institute. Low-level awareness across governmental bodies at the national, provincial, and district levels compounds the potential

threats to rural production and communities from climatic variability and change. The lack of adaptive responses especially in the areas of food production and the provision of safe water was seen as a major threat to the health and prosperity of rural communities. Local-scale initiatives under NARI address the looming rural water crisis by providing wells in villages. Some 36,000 villages in PNG are without secure water supplies. This is a potential disaster management issue.

The overarching role of NARI and programs in natural resources management, rice and grain, and integrated pest and disease management, which focus on climate risk reduction and food security, is to address the threat of extreme drought conditions in the highlands. The research being undertaken on reducing the risks to food security and on building resilience by broadening the range of foods produced in PNG has ramification for coastal lowland and highland provinces.

The NARI is dealing with funding constraints. Under consideration is the type of projects being proposed and level of funding being sought from governmental bodies and donors. There is a strong need for targeted donor support. The funding constraints are partially attributed to a logistical situation—NARI comes under the Department of Higher Education rather than the Department of Agriculture and Livestock.

Overall, NARI has already made a significant contribution in raising awareness and providing a simple tool to assist subsistence producers to reduce the risks arising from drought conditions in the highlands. Proposals have been prepared seeking funding to further the development and production of drought-resistant varieties of sweet potato. Awareness-raising activities in relation to water security have commenced but need considerable support to make an impact at all levels of civil society.

National Fisheries Authority. The National Fisheries Authority has overarching responsibility for man-

aging the nation's fisheries. The management of fish stocks is articulated in the Fisheries Management Plan. Through the current plan, management is based largely on commonly used approaches that give emphasis to biological controls, including size of animals being taken, spawning cycles, and catch and effort data obtained from fishers and processors. Across the world such approaches have been criticized because they do not conserve stocks or contribute to the sustainability of specific fisheries. The failure of this commonly used approach is evidenced in PNG by the rapid decline in prawn and barramundi fisheries.

Among Pacific island countries there is wide acceptance that fish stocks need to be managed on a regional as well as a national basis. This recognition encompasses the threats to fisheries from over-fishing, climate variability (as evidenced by coral bleaching), and the degradation of the ecosystems that support the fisheries. The latter may be due to a combination of physical, chemical, and biological changes that lead to reduction or loss of habitat. In response to this situation with respect to coral bleaching, a regional Coral Triangle Infrastructure (CTI) Plan of Action is being put into place. The CTI Plan of Action embeds an ecosystem approach to management that can be implemented at the community level. The implementation of this Plan of Action requires donor input.

There is a current move by the National Fisheries Authority to change the management of fisheries to an ecosystem- and community-based approach. The Authority is aware of the risks from climatic variability and climate change to the nation's fisheries and the livelihoods of fishermen. The Authority views the community- and ecosystem-based approach as the most appropriate for reducing vulnerability and risk and for ensuring the sustainability of the nation's fisheries. Furthermore, this approach will contribute to attaining the 5 goals of the GEF-supported CTI Plan of Action: (a) introduce effective management sys-

tems for *priority seascapes*; (b) apply *ecosystem approach* to fisheries management; (c) expand and improve management and representation of effectively managed *marine protected areas*; (d) support *climate change adaptation* measures to sustain economic development and global services from vulnerable coastal and marine ecosystems; and (e) improve *threatened species status* in coastal and marine ecosystems.

The National Fisheries Authority recognizes that ecosystem-based management of fisheries is in the national interest. Also, the Authority has identified the Gulf of Papua prawn fishery, which is in decline, as needing an ecosystem-based management approach, primarily reducing risks due to impacts of climatic variability, extreme weather events, and climate change. These impacts, for example, include the loss of habitat due to shore erosion and degradation of mangrove communities or siltation due to flood discharges from degraded catchments. However, it has been recommended that 10 percent of the effort of the CTI Plan for Action (which embeds ecosystem management principles) be directed toward addressing climate change issues. This policy thrust is taken up in a proposal for a project that seeks to demonstrate the climate proofing of the Gulf of Papua prawn fishery.

In this context, community-based fisheries have been piloted and established in PNG and its neighboring countries. The inherent strength of community-based fisheries is that local-level management is owned and implemented by the local people. This approach requires the devolution of management powers back to the community. The first step in this process is to have

the concept accepted by all resource managers. The second is to utilize the biological and other information gathered from local fishermen to develop ecosystem-based management strategies that are specific to localities and implementable using local resources.

Community-based fisheries are being operated by NGOs. While this process is achieving outcomes, they have not been fully documented or assessed. The chief scientist of the National Fisheries Authority believes further pilots of community-based management of fisheries should be extended nationally and climate proofed in order to provide stronger implementation. This provides the impetus for a proposal on climate-proofing demonstrations of community-based fisheries management.

Gaps

- Hazard events continue to occur and cause harm and implementation of risk reduction measures continues to lack focus.
- Food security and sustainable management issues identified from the 1997/98 drought are likely to be exacerbated by climate change, and current resourcing is inadequate to deal with them – particularly given the next ENSO-induced drought could occur within the next 5 years.
- Limited resources hinder the activities of NARI and National Fisheries Authority.
- Limited capacity restricts promulgating the results of their programs. ❖

Opportunities for Investment

From the PNG country assessment, it is evident from the gaps and impediments that a wide range of risk reduction initiatives for investment can be identified. Due to the weak policy and institutional frameworks evident in PNG, opportunities for investment have been restricted in ways that contribute as follows:

- Reducing actual risk,
- Building on existing in-country capacity, and
- Supporting or informing sector risk reduction policy frameworks within country priority activities.

These are all conditions for sustainability. In addition, any initiative to be funded should have an identified senior-level government or political champion to promote the activity and ensure its implementation.

PNG already has established policies, institutions, systems, and related structures, as do many other Pacific island countries, to address DRR/CCA challenges. The National Action Plan and other programs have been prepared and awaiting implementation. Unfortunately, there are significant gaps in the 5 key HFA areas discussed in this report; while efforts have been made to address the gaps, funding, staffing, and related operational support remain untapped. Also, while some efforts are made to identify and address simple, high-yielding, short-term priority issues, it appears that more effort is needed to fully categorize such needs and decide upon short-, medium-, and long-term programs.

The priority list, identified by PNG policymakers and sector officials (in consultation with local stakeholders and donor partners), reflects a great deal of consultation, discussions, and analyses. The impediments and gaps noted in this report could still create serious obstacles if they are not addressed as part of the preparation process to implement the priority activities.

Following are the six priority areas identified as opportunities for investment in PNG:

- (1) *Develop a Coordinated Hazard Policy and Integrated Spatial Hazard Risk Information and Mapping System for PNG.* The purpose of this initiative is to establish a clear hazard policy for PNG covering all hazards and to develop an integrated information system to put hazard monitoring onto a credible basis to provide for informing and promoting hazard and risk reduction issues. A champion would need to be identified in the Ministry of Mineral Policy and Geohazards Management with support from the National Weather Service and the Water Resource Management Branch. This initiative also includes entering historical hazard datasets and enhancing the proposed new EU-funded seismic network.
- (2) *Develop and promulgate a climate change adaptation policy framework.* This initiative follows up on a request from DEC for support to establish the CCA policy framework for the new Office of Climate Change. It would strengthen the enabling environment for addressing climate change adaptation and provide the opportunity for linking to other hazard risk reduction issues across sectors. Discussions in country would be needed to confirm the commitment to this initiative.
- (3) *Disseminate drought-coping strategies to at-risk rural communities.* This initiative is a companion to the previous initiative to address the substantial task of disseminating and distributing the material to many thousands of highland subsistence villages without which their vulnerability continues.
- (4) *Develop a water supply action plan for rural communities at risk from drought.* This initiative addresses the potentially extreme water security issue in rural PNG during ENSO-induced drought conditions. It is acknowledged by the PNG National Water Board and involves a survey of the

issue and development of appropriate responses. Because of the uncertain scope and the need for a champion and supplementary donor funding, this initiative is set as a provisional proposal. This priority area however represents a seriously vulnerable situation.

- (5) *Support demonstration projects for climate-proofing community-based fisheries in vulnerable coastal areas.* This initiative is for the development of a demonstration project for community-based fisheries and involves an evaluation and feasibility assessment of risk reduction techniques for climate-proofing community fisheries. Because the fisheries sector was not reviewed in this assessment to consider fully other regional initiatives, this initiative is set as a provisional proposal requiring further evaluation. It is nevertheless a potentially doable initiative.
- (6) *Support a demonstration project of an ecosystem-based management system for a prawn fishery.* This initiative addresses the stressed prawn fishery in the Gulf of Papua where food security and livelihood risk are exacerbated by climate variability and change. Like priority areas 4 and 5, this initiative is a provisional proposal.

In Annex A, each of these opportunity proposals is expanded to provide preliminary information on indicative scope, costs, and times. Identified by national stakeholders to fill recognized gaps, the proposals encapsulate the priorities that could be supported by the World Bank and any development partner or could be added to existing or planned interventions.

There is also an opportunity for linkages with the planned World Bank-supported Productive Partnerships in Agriculture Project. Two activities have been identified with a total estimated cost of US\$600,000:

- Increasing capacity for climate monitoring and the dissemination of climate information in the highlands (capacity building, technical assistance, equipment) where the effects of climate variability seem to be felt more severely because of high altitude;
- Increasing capacity for quarantine and surveillance of cocoa borer in East New Britain and Bougainville, the two main producing provinces (additional equipment, some technical assistance to improve planning, and contribution to the operating costs of the Quarantine Authority and the community-based surveillance network).

The opportunity also exists to re-cast the institutional framework for disaster risk management (including a mandate for disaster risk reduction) and provide for the integration of CCA arrangements. Such a framework would address functions, accountabilities, and relationships across agencies and sector groups and between levels of government and into communities. As with many of the listed proposals, there is no apparent champion at the government or senior officials level to support these issues.

Any initiatives should ideally link the development of governance frameworks, in-country capacity development, and on-the-ground activity in a bottom-up/top-down continuum. Activity could be initiated at the national or provincial level depending on where the support lay.

Further work is required to identify appropriate champions and groupings and areas of activity and for the development of project contexts with the appropriate sector. Any proposals should form the basis of a longer-term strategic commitment with sustainable support. ❖

Annex A. Proposals for Support in PNG

<i>Proposal</i>	P1 Develop a Coordinated Hazard Policy and Integrated Spatial Hazard Risk Information and Mapping System for PNG				
<i>Country/sector</i>	PNG: Geohazards, Meteorology, Hydrology, Mapping				
<i>Scope</i>	National, Multi-department				
<i>Goal and purpose</i>	Inform and promote hazard and risk reduction issues through a coordinated hazard policy framework and with an integrated spatial hazard and risk information system				
<i>Lead agency</i>	Ministry of Mineral Policy and Geohazards Management with Geohazards Division, National Weather Service, Water Resource Management Branch, National Mapping Bureau, DL&PP, DEC, NDC				
<i>Cost and duration</i>	US\$300,000 over 3 years				
<i>Hazards targeted</i>	<i>Risk reduction measures</i>	<i>Key gaps/barriers</i>	<i>Actions and tasks</i>	<i>Cost US\$k</i>	<i>Time-frame</i>
River flood Cyclonic wind Storm surge Storm wave Tsunami Earthquake Volcano Landslide	Addressing hazard and risk issues across sectors as a matter of policy Having hazard and risk data accessible to sectors for planning and development purposes	Lack of policy commitment to hazard information Lack of a common geographic database across departments Inadequate basic climate and hazard data collection capabilities Lack of tools and capacity to assess risks Risk mapping not integrated into planning process	Provide technical assistance support to hazard departments to: <ul style="list-style-type: none"> Establish a coordinated government policy on the collection and storage of hazard data, the development of vulnerability, risk and trend information and its presentation and sharing across sectors for planning and development purposes Assess needs and develop an integrated spatial database with analysis tools and mapping capability Identify requirements and acquire appropriate map and image bases for hazard mapping and land use management purposes for urban, rural, coastal and highland applications Enter existing and historical datasets across all hazards and develop initial vulnerability and risk information Enhance seismometer network installation (EU funded) with installation of accelerometer equipment	60 160 80	3 months 12 months 2 years

Continues

Annex A. Proposals for Support in PNG *Continues*

Proposal	P2 Development and promulgation of a Climate Change Adaptation policy framework.					
Country/sector	PNG: Institutional					
Scope	Strengthen the enabling environment for addressing climatic variability and climate change, through facilitating the development and implementation of a whole-of-government climate change adaptation policy framework for PNG.					
Goal and purpose	National					
Lead agency	DEC with Office of Climate Change and DNPM					
Cost and duration	US\$600,000 over 1.5 years					
Hazards targeted	Risk reducing measures	Key Gaps/Barriers	Actions and Tasks	Cost US\$k	Time-frame	
Cyclones and extreme storm events		Absence of documented national CCA and DRR policy applicable at national, provincial, district and local scales. Limited professional capacity to develop and implement climate change adaptation policy and practice. Poor mechanisms to disseminate knowledge of the potential impacts of climatic variability, and climate change across governments.	Facilitate the collaborative development of a whole-of-government climate change adaptation policy framework across PNG linking to hazard risk reduction issues across sectors.	150	Latter half of 2008	
Storm surge			Prepare awareness materials to: promulgate the policy; raise awareness and initiate capacity building initiatives.	50	Latter half of 2008	
Drought			Disseminate information on the 'whole-of-government' climate change adaptation policy to governmental departments and authorities, educational institutions, and the non-government sector	50	2009	
Flooding			Workshop the policy materials at national, provincial and district levels to: raise awareness of the links between disaster risk reduction and climate change adaptation; and enhance governmental and non-governmental capacity to address CCA-DRR issues.	350	2009	
Hail damage						
Bushfires						
Sea level rise and erosion						
Saline intrusion in coastal streams and ground water						
Coral bleaching and increased acidity of sea water						

Annex A. Proposals for Support in PNG *Continues*

Proposal	P3 Disseminate drought-coping strategies to at risk rural communities				
Country/sector	PNG: Agriculture, Settlements				
Scope	Sustainable food production through equipping rural communities to cope with frequent and prolonged El Niño-induced drought events				
Goal and purpose	Drought prone rural communities				
Lead agency	NARI, DAL				
Cost and duration	USD\$3 million over 3 years				
Hazards targeted	Risk reducing measures	Key Gaps/Barriers	Actions and Tasks	Cost US\$k	Time-frame
Severe drought conditions every 3 to 5 years brought on by El Niño events in the Pacific Ocean causing widespread food shortages in highlands, lowlands and islands regions.	Provide rural communities in drought-vulnerable districts with contingency measures to cope with intermittent or prolonged drought conditions,	Limited capacity for research information and technology transfer and dissemination via extension providers. Lack of resource centers in the drought-vulnerable districts. Limited preparedness for drought by farming communities. Worldwide shortage of contingency food supplies	Establish resource centers on existing NGO, CBO, school, and DAL bases in some 64 drought-vulnerable districts. Train and equip the resource center personnel to disseminate the drought-coping information, drought-tolerant cropping material, and other resources to their local communities. Provide communities in drought-vulnerable parts of PNG with information and training on drought-coping strategies: Adapt and demonstrate the implementation of these strategies (including crop irrigation and food processing and storage) to fit in with normal farming and household activities under different environmental conditions.	1,800 200 1,000	By end of 2011

Annex A. Proposals for Support in PNG *Continues*

Provisional Proposal	P4 Develop a water supply action plan for rural communities at risk from drought			
Country/sector	PNG: Water, Settlements			
Scope	Water security in the face of climate change induced risks Identify and evaluate appropriate and culturally acceptable water-supply facilities for drought prone rural communities			
Goal and purpose	Drought prone rural communities without secure water supply			
Lead agency	PNG National Water Management Board, NARI, DEC			
Cost and duration	US\$4.5 million over 3 years			
Hazards targeted	Risk reducing measures	Key Gaps/Barriers	Actions and Tasks	Cost US\$K
Major El Niño drought events similar to those experienced in 1997.	Develop an action plan to demonstrate the necessity and feasibility of water supply (potable and irrigation) provision in drought vulnerable regions. Detail the activities, costs and interventions required	Provinces and districts in PNG have not been classified according to their vulnerability to drought and associated risks. No prioritization of surface and ground water supplies for intervention purposes Adequacy and appropriateness of community water supply facilities have neither been demonstrated nor evaluated.	Survey drought prone regions of PNG in order to classify districts according to drought vulnerability. Identify and evaluate appropriate (drinking, household, and crop irrigation) and culturally acceptable water-supply facilities for rural communities Determine accessibility of ground water reserves and assess the feasibility of water supply provision to village communities. Use case/pilot studies to demonstrate and evaluate the suitability of different facilities	
				Time-frame

Annex A. Proposals for Support in PNG *Continues*

<i>Provisional Proposal</i>	P5 Support demonstration projects for 'climate proofing' community based fisheries in vulnerable coastal areas				
<i>Country/sector</i>	PNG: Fisheries, Settlements				
<i>Scope</i>	Sustainable commercial and community fisheries Reduce the risks to community based fisheries and fishers from climatic variability and change.				
<i>Goal and purpose</i>	Coastal communities				
<i>Lead agency</i>	National Fisheries Authority				
<i>Cost and duration</i>	US\$1.12million over 3 years				
<i>Hazards targeted</i>	<i>Risk reducing measures</i>	<i>Key Gaps/Barriers</i>	<i>Actions and Tasks</i>	<i>Cost US\$k</i>	<i>Time-frame</i>
Extreme storm and cyclonic events	Introduce community-based management of fisheries.	No research to determine the vulnerability of PNG fisheries to disasters and risks associated with climatic variability and change.	Assess the feasibility of establishing community based coastal fisheries.	450	
Physical disturbance to or possible destruction of seagrass, mangrove, and coral habitats	Climate proof community managed fisheries in vulnerable coastal regions.	Community based management of fisheries is still to be fully evaluated for PNG	Evaluate the climate risk reduction techniques and benefits of community-based fisheries.	150	
Sediment loads from catchment discharges			Demonstrate and evaluate the suitability/ effectiveness of different approaches to 'climate proofing' community fisheries at selected coastal locations	450	
Coastal flooding and droughts		Procedures for establishing community-based fisheries are yet to be fully documented.	Evaluate and document the effectiveness of the Gulf of Papua demonstration project.	40	
Coral bleaching			Develop suitable roll-out strategies for the take up of 'climate proofing' for community fisheries.	30	
Sea water Temperature changes					
Acidity of near-shore sea waters					

Annex A. Proposals for Support in PNG

<i>Provisional Proposal</i>	P6 Support a demonstration of an ecosystem management based prawn fishery project				
<i>Country/sector</i>	Fisheries				
<i>Scope</i>	Sustainable commercially and community fisheries Reduce the risks from climatic variability and change by having ecosystem-based management.				
<i>Goal and purpose</i>	Gulf of Papua prawn fishery				
<i>Lead agency</i>	National Fisheries Authority				
<i>Cost and duration</i>	US\$1.35 million over 3 years				
<i>Hazards targeted</i>	<i>Risk reducing measures</i>	<i>Key Gaps/Barriers</i>	<i>Actions and Tasks</i>	<i>Cost US\$K</i>	<i>Time-frame</i>
Extreme storm and cyclonic events	Introduce ecosystem-based management of fisheries.	No research to determine the vulnerability of PNG fisheries to disasters and risks associated with climatic variability and change.	Assess the feasibility of establishing ecosystem based prawn fisheries.	450	Year 1
Sediment loads from catchment discharges	Climate proof ecosystem managed fisheries in vulnerable coastal and offshore regions.	Limited evaluation of ecosystem based management of fisheries	Evaluate the climate risk reduction benefits to the prawn fishing industry and fishers that could accrue from having ecosystem-based management of fisheries in the Gulf of Papua.	150	
Coastal flooding and droughts		No documented procedures for establishing ecosystem based fisheries.	Demonstrate the scientific basis, the mechanisms and processes to optimize institutional and stakeholder ownership of the implementation of ecosystem based management of prawn fisheries	680	
Coral bleaching			Evaluate and document the effectiveness of the Gulf of Papua demonstration project.	40	
Sea water Temperature changes			Develop suitable roll-out strategies for the take up of ecosystem based management of prawn fisheries in PNG.	30	
Acidity of near-shore sea waters					
Physical disturbance to or possible destruction of seagrass, mangrove, and coral habitats					

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Special thanks and appreciation are extended to the partners* who support GFDRR's work to protect livelihood and improve lives: ACP Secretariat, **Australia**, Belgium, Brazil, **Canada**, **Denmark**, **European Commission**, Finland, **France**, Germany, India, Ireland, **Italy**, **Japan**, **Luxembourg**, **The Netherlands**, **Norway**, **Spain**, **Sweden**, **Switzerland**, Turkey, **United Kingdom**, **United States**, UN International Strategy for Disaster Reduction, and **The World Bank**.

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