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## DISASTER, ENVIRONMENT AND DEVELOPMENT: OPPORTUNITIES FOR INTEGRATION IN ASIA-PACIFIC REGION

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*“The environment and disasters are inherently linked. Environmental degradation affects natural processes, alters humanity’s resource base and increases vulnerability. It exacerbates the impact of natural hazards, lessens overall resilience and challenges traditional coping strategies. Furthermore, effective and economical solutions to reduce risk can be overlooked.... Although the links between disaster reduction and environmental management are recognized, little research and policy work has been undertaken on the subject. The concept of using environmental tools for disaster reduction has not yet been widely applied by practitioners.”*

The International Decade of Natural Disaster Reduction (IDNDR) concluded that ‘environmental protection, as a component of sustainable development and consistent with poverty alleviation, is imperative in the prevention and mitigation of natural disasters.’<sup>2</sup> Similarly, in

2002, a group of experts from the global change and disaster management communities met in Berlin and prepared a declaration that was presented at the World Summit on Sustainable Development in Johannesburg, South Africa. The declaration pointed to increasing evidence that environmental change and natural disasters are linked. Recently the UN/ISDR Environment and Disaster Working Group have also consolidated that notion. In their report, it is recognized that natural resource exploitation, urban development and environmental degradation all directly affect risk.<sup>3</sup> Changes in weather intensities, circulation, hydrology, and sea level brought about by climate change have increased risk. The loss of ecosystems services that regulate floods and fires increases the vulnerability of vast populations in densely populated coastal areas and flood plains.<sup>3</sup> In contrast, the consequences of natural disaster can be devastating for aquatic

and land-based ecosystems. Urban infrastructure can reduce disaster risk, but in many cities where drainage, drinking water, sanitation and solid waste management are inadequate, they compound risk, while being further eroded by floods and storms.<sup>4</sup>

Moreover, the Hyogo Framework for Action (HFA), the Millennium Declaration and the UN Millennium Ecosystem Assessment have different points of departure but come to the similar conclusion that environment degradation, poverty, and disaster risk share common causes as well as common consequences for human security and well-being. They also make clear that ecosystem services, environment management and environmental information offer opportunities to reduce risk, decrease poverty and achieve sustainable development. Disaster risk reduction must be incorporated, into the MDG process.<sup>1</sup> While international frameworks have recognized the inherent links between disaster reduction, development, and environmental management, little research and policy evaluation has been carried out on the subject.<sup>2</sup>

Although at present the environment management tools are not systematically integrated with the disaster risk reduction framework it is important to realize that the environmental tools were primarily developed from a risk management approach. For example, parts of environmental management include risk assessment, hazard identification, spill response, and emergency/contingency planning. Those activities are central to the practice of disaster risk management. Other parts of environment management address such issues as water quality, protection of flora and fauna, and general health of the ecosystem, all of which may be affected by decisions and actions taken in the pursuit of disaster management.<sup>5</sup>

In order to support advocacy, and to facilitate the design and implementation of environmentally sound solutions to the challenges posed by natural hazards, there is an urgent need to structure a multi-community dialogue and learning

process between the disaster risk management, the humanitarian response and the environment management communities. This chapter, therefore, identifies and analyzes available resources that link environmental issues and management with disasters and risk reduction efforts in the Asia-Pacific region in order: i) to provide a practical and uniform basis for practitioners from various sectors to discuss and agree on concrete plans and activities to further integration; ii) to recommend strategic entry points and platforms for mainstreaming at the regional level. The chapter uses case studies, examples, and the results of the questionnaires and interviews of practitioners and organizations working in environment, disaster, and development fields in Asia-Pacific region.

## DISASTER AND ENVIRONMENT

*Around the globe, land use and land cover changes are eroding the natural buffers that protect communities from hazard risk. These changes also often erode people's capacity to recover from disaster. Other environmental changes, such as anthropogenic global warming, promise to create new challenges to the security and sustainability of communities around the world. There are, however, opportunities to reduce disaster risk, and enhance community resilience. The impacts of disasters, whether natural or man-made, not only have human dimensions, but environmental ones as well.<sup>6</sup>*

### IMPACT OF ENVIRONMENTAL DEGRADATION ON DISASTERS

Environmental conditions may exacerbate the impact of a disaster, and conversely, disasters also have an impact on the environment. The adverse consequences of environmental degradation on human vulnerability to disaster, is in the form of the impacts of deforestation, forest management practices and agricultural practices aggravating the devastation due to a storm or typhoon, causing landslides, flooding, silting and ground- and surface-water contamination.

First, the rapid loss of forest land around the world is changing the rainfall patterns. Deforestation is not only linked with decreased rates of evapotranspiration, but also a reduction in moisture flow and water retaining capacity. These changes, have been linked with the onset of large-scale deforestation, and have led either to drought and desertification or soil erosion, debris flow and floods. In fact, river and lake floods are aggravated by deforestation, which, in turn, causes erosion and clogs rivers. Water quality and quantity in the downstream areas are heavily affected due to the damage of the vegetation in the catchment areas, which reduce agricultural productivity in the downstream areas.<sup>7</sup>

Drought and desertification are considered as the most important impacts of the global environmental degradation. It is predicted that the number of people (currently 2.2 billion) living under moderate or severe water stress will rise to 4.0 billion by 2025.<sup>8</sup> Climate change may decrease water availability in some water-stressed regions and increase it in others. In Africa, Asia and South America, climate change is predicted to exacerbate water stress significantly.

Changes in the land cover significantly modify the concentration of atmospheric constituents. The climate system responds to the human-driven land cover change by changing the amounts of absorbed and reflected solar radiation owing to changes in the reflectance of the earth's surface.<sup>8</sup> Such effects are known to be important for climate locally and regionally and may be significant globally. Global changes have imposed grave concerns to the human health either through increasing the vulnerability of the population or by decreasing their ability to cope. Increased temperatures associated with climate change are expected to increase incidences of vector-borne diseases in most parts of the world. It is anticipated that changes in climate, including changes in climate variability, would affect many vector-borne infections (such as dengue, leishmaniasis, various types of mosquito-borne encephalitis, Lyme disease and tick-borne

encephalitis). Higher temperatures will tend to expand malaria transmission spatially to higher altitudes, higher latitudes, and temporally to larger transmission season. Additionally, a change in climatic conditions will increase the incidence of various types of water- and food-borne infectious diseases.<sup>9</sup> Further, changes in food production, resulting from the changes in the environment, are likely to affect the nutrition and health of the poor in most regions of the world. Climate change is predicted to increase the number of undernourished people in the developing world, particularly in tropics.<sup>9</sup>

Studies show that river catchment areas that are largely deforested or wetlands that have been drained create very different hydrological regimes.<sup>10</sup> When this factor is added to the climate change, it would affect the timing and pattern of rainfall. Eventually, rainfall may become more erratic. In this regard, the timing and volume of expected flooding are becoming more unpredictable. Impacts of deforestation are being felt more severely in the highlands, but they will eventually affect the lowlands: as rivers silt up, this affects crop areas in the lowlands that depend on these waters. Flooding of cities will become more pronounced. According to Wang,<sup>11</sup> it has seen many 'natural hazards' happening frequently due to environmental degradation recently.

Second, the non-sustainable overuse of resources causes pollution and ultimately leads to environmental degradation. In particular, there is an increasing likelihood of human-induced climate change which according to the latest projection of the Intergovernmental Panel on Climate Change, will result in more water-related disasters especially for countries in tropical and subtropical latitudes.<sup>12</sup> These changes in temperature and related local rainfall variations affect the environment through accelerated desertification, land degradation, the availability of water resources as well as reducing the overall agricultural output. In addition, climate change is expected to affect sea levels

and cause climate extremes. All these factors have a compound effect on the occurrence and impact of disasters.

Third, many mangrove swamps and coastal forests are under severe threat from various river basin development activities and flood management projects. Flood prevention projects distort the flow variability and can cause severe deteriorations of the coastal ecosystems. The degradation of mangrove forests significantly reduces their valuable functions such as shoreline stabilization and storm protection. The coastal forests become too degraded to absorb the energy of coastal storms, thereby increasing the flood and storm risks in the coastal zone.

Meteorological and hydrological events, such as typhoons, are hazards that cause heavy rain, high wind and sea surges. But the real damage also happens due to the vulnerability of the people who lie in its path. Post-disaster assessment of hurricanes and typhoons have clearly illustrated that, along with disaster preparedness, proper management of the environment—air, land, water, forests, and wastes, go a long way in reducing the risks and vulnerabilities associated with typhoons. Environmental degradation, combined with human activities, is at the origin of numerous catastrophes such as flooding, desertification, fires, as well as technological disasters and transport accidents.

Some of the global environmental themes include: changing unsustainable patterns of consumption and production, climate change, desertification, drought, forests, industrial development, protecting and managing the natural resource base of economic and social development, waste management, and water conservation all within the overall orbit of disaster management and vulnerability.<sup>13</sup>

### **IMPACTS OF DISASTERS ON THE ENVIRONMENT**

It is important to look at the impact on environment, as damage of environmental resources

affects sustainability and poses challenges in achieving the MDG7 namely ensuring environmental sustainability. Natural disasters are the factors directly causing environmental degradation. Natural disasters reduce natural systems' resilience to the disaster impacts. As a consequence, natural systems are left poorer. Several disasters in the recent past pointed out the issue of environment disaster linkage not only in developing countries, but also for the developed countries like Japan, USA and in Europe. Typhoons 21 and 23 of 2004 of Japan have shown critical needs to interlink disaster and environmental issues. While the environmental degradation causes disasters, the impact of disasters are far-reaching, affecting the environment. Typhoon 23 has produced 48,000 tons of waste products in Toyo-oka city of Hyogo Prefecture of Japan, which amounts of 1.5 year of total waste production of the city.<sup>14</sup> This has not only posed a significant threat to the city's waste management system, it has far-reaching implication to the economy and natural environment. Two specific issues are becoming increasingly prominent on environmental management: impact on the natural environment, and impact of man-made environment. While the natural environment includes the ecology of the affected areas, waste management is the main issue of man-made environment.

Impacts of Indian Ocean tsunami on mangroves, coral reefs, sea-grass, flora and fauna in the affected areas have been assessed with salient environmental issues. In the urban and semi-urban areas where the illegal settlements have encroached the seaside areas, especially the areas which were supposed to be the protected areas under coastal regulatory zone (CRZ), many of these areas were severely affected by the tsunami, affecting people, their habitat and livelihoods.<sup>15</sup> Moreover, many of the areas are waterlogged after the tsunami. Water has not receded from these areas, and most of these land areas are agricultural land.

Also, some of the areas are having problems with waterlogging during high tides. Debris, which often resulted from the destruction of earthquake, tsunami, or flood poses a huge problem for its proper management. Also, tsunami waves, storms, or floods brought timber and wood materials, and deposited on the agriculture land, which also made the land unusable. In general, each disaster has specific impacts on the environment, and these are exacerbated by different factors of the environment. Table 24.1 provides a quick snapshot of the various impacts and factors.

It is important to note that disasters have significant impact not only on natural and man-made environment, but also social environment. For example, in Vietnam flood disasters and their aftermath significantly impact social systems, both the individual households and the community. According to Tran and Shaw,<sup>17</sup> in central Vietnam after the severe flooding the community cohesion was stronger at first, but then broke down due to the stress of the flooding and the recovery process. Furthermore, there was a high rate of out-migration, particularly during the flood season when the main laborers migrated to cities in search of jobs. This left the people at home living more 'at risk', especially the infirm and elderly, and the communes remained without adequate human resources for flood response and recovery. In addition, annual flood prevents many children from going to the school during the flood season. This might cause a large number of children to permanently drop out of school.<sup>17</sup>

It therefore is of utmost importance to incorporate environmental issues, both natural and social aspects, in disaster management. Thus, there is a strong need to make a synergy of environment and disaster issues.

### **DISASTERS AND DEVELOPMENT**

Disasters are an important element of development planning. This because they

significantly affect the society's capacity-both in preparedness and recovery.

### **IMPACTS ON MILLENNIUM DEVELOPMENT GOALS**

Natural disasters directly influence economic development. For example, in Vietnam, natural disasters happen and rob away many achievements of the national socioeconomic development process. In the last five years of the 1990s (1996–2000), natural disasters caused damages and losses of USD 2.3 billion, and killed on the average 2117 people and caused losses of USD 459 million USD.<sup>18</sup> Moreover, disasters have dislocated families who become refugees and forced to migrate elsewhere.

Natural disasters intensify the poverty gap in the population and rapidly increase the poverty rate, especially in disaster-prone areas. In fact, poverty and vulnerability to disasters are integrally linked and mutually reinforcing.<sup>19</sup> The poor are forced to exploit environmental resources for survival, thereby increasing both the risk and exposure to disasters, in particular those triggered by floods, drought and landslides. Deforestation and agriculture on marginal land, or destruction of forests for firewood collection, are often induced, or at least exacerbated, by poverty. These practices directly affect the natural environment, and may hurt the very resource base that these poor people depend on. Indeed, the rural communities, which depend on resource-based activities, are the worst sufferers of disasters.<sup>20</sup> Furthermore, disasters also have negative impacts on the Eight Millennium Development Goals.<sup>21</sup>

### **IMPACTS OF DEVELOPMENT ON FREQUENCY AND SEVERITY OF DISASTERS**

*'Rarely do disasters just happen; they often result from failures of development which increase vulnerability' (Secretary of State of International Development, DFID).*

Sometimes new forms of vulnerabilities are created or the existing ones are exacerbated

**Table 24.1** Samples of environment and disaster linkages

Earthquake	
Potential environmental impacts	Natural gas leaks, household and industrial chemical releases from damaged containers Damage to industrial facilities resulting in toxic release Building waste debris and potential mix of hazardous materials
Exacerbating environmental factors	Topography and land cover Building codes and urban planning/urbanization processes
Flood, storms, hurricanes, typhoons, cyclones	
Potential environmental impacts	Sewage overflow and chemical releases from roads, farms and factories Hazardous debris, chemicals, medical and other materials as disaster debris; water-damaged household chemicals (paint, pesticides, solvents); unsafe water supplies Ground- and surface-water contamination Loss of topsoil due to rapid drain of run off
Exacerbating environmental factors	Habitat and ecosystem destruction (for example, coral reefs and mangroves) Deforestation and water siltation Urbanization and land use/land cover changes
Forest fires	
Potential environmental impacts	Loss of biodiversity and ecologically sensitive habitats Air pollution from smoke and haze
Exacerbating environmental factors	Climate change Deforestation and land use/land cover changes
Droughts	
Potential environmental impacts	Habitat and crop destruction Water scarcity
Exacerbating environmental factors	Urbanization and unsustainable resource consumption Deforestation and land use/land cover changes
Landslides	
Potential environmental impacts	Damage/deterioration of habitat ecosystems Land use functions, including agriculture Ground and surface water contamination
Exacerbating environmental factors	Deforestation Land use/land cover changes

(Source: Reference [16])

because of acts of development. Though not intentional, these pose serious challenges to the target of poverty reduction and achieving the developmental goals. For example, a common practice among road designers is to make the road higher than the flood level of expected design, thereby ensuring uninterrupted access while floods are in full flush. Sometimes this creates a dilemma because the road embankment itself creates higher flood levels on the uphill side of the road and which can exacerbate flooding of homes and other property.

Rapid urban growth is one of the key factors for increase in disaster risk. With a steady growth in the economy, the countries of the Asia-Pacific region are challenged with the increasing pace of migration from rural to urban areas. This has resulted in higher population densities in the urban areas, unplanned development of complex infrastructure and poor governance; all leading to increase in vulnerability to natural disasters. In particular lower-income communities with lack of resources are compelled to gravitate to marginal lands such as floodplains, and stream banks and which are highly vulnerable to natural disasters.

Thus these urban centers often form hotspots where the probability of occurrence of large-scale disasters involving significant mortality, economic loss or both is very high.

Though this urbanization has increased the diversification of economies and improved the living standards, according to the World Bank, this potential is being 'jeopardized by a lack of vision of the kind of economic, social and physical environment desired by town dwellers in the Pacific, an absence of appropriate policies, and poor urban management and service delivery' As a result of the migration the young generation do not have strong links with their traditional village communities and thus the safety nets which have been developed by Pacific Island societies over hundreds of years are weakening. There are an increasing number of people living below the poverty line in

urban areas, squatter and informal settlements and increasing unemployment all leading to increase in vulnerability. This also has direct connection to the urban infrastructure issues like water supply, sanitation and waste disposal. In particular, the waste disposal municipal garbage dumps are usually located on or near coastal areas. They are inadequately sealed for flooding or seawater infiltration, creating a potential environmental hazard.

Examples of unplanned industrialization resulting in environmental degradation are also seen in many countries of the Asia-Pacific region. For example, 1996 witnessed the fish kill in Manila Bay where 30,000 kilos of dead fish were found floating in the bay's shallow shores. The investigation revealed that the fish died of low oxygen levels and internal bleeding when their internal organs absorbed toxic chemical which could be traced to the industrial refuse from the various factories located in the Manila Bay. The fish kill disrupted the livelihood of thousands of fishing families and thus impacted the economy of the region.

With such obvious anticipated results the question could be raised; why development overlooks disaster risks? Perhaps the reason is that incentives are stacked against disaster risk reduction. It is a long-term, low-visibility process, with no guarantee of tangible rewards in the short term, either for politicians in affected countries or for donors. Another reason could be the mismatch between the temporal scale of the problem and the standpoint from which policymakers make key decisions. In the climate change issue for example, the problem has been defined as something that is too remote, i.e. something would play out in the next 50 to 100 years. Therefore, dealing with it provides little incentive for most elected policymakers, given more tangible and politically pressing concerns.

Further, global change occurs at multiple spatial scales and involves complex dynamics at different scales. Research shows that cascading

effects of human activities interact with each other and with local- and regional-scale changes in multidimensional ways. The fact that the issues have different implications at different scales further complicates the system. Challenges involved in integrating research into policy necessitate a thorough understanding of the dynamics between the human actions at different scales, their outputs at these scales, and their implication at different scales. Very often these three events occur at different scales, posing challenges for integration of the information flows into policy.<sup>22</sup>

Hence what is essential is to make sure the message reaches the decisionmakers in a language they understand; wider stakeholders are consulted and realize that ‘disaster risk reduction is everybody’s business, officials from planning and finance agencies are provided with simple cost–benefit analysis and success is demonstrated through high visibility projects and which can be later scaled up.

**INTEGRATION OF ENVIRONMENT, DISASTER AND DEVELOPMENT**

Successful integration of disaster risk reduction, environment management and development is not something that can be achieved by the addition of a new program, a new policy document or even a new department. Rather, it is a shift in approach towards supporting more risk-reducing forms of environment management and development and vice versa, an approach, which will need to pervade all operations, programs and departments. Therefore, sustainable disaster risk reduction and environment management should enlarge and focus on the convergence areas of three sectors: i) Development management; ii) Environment management; and iii) Disaster risk management.

Measures can be carried out within the interfaces between these three areas:

- Disaster–Environment convergence;

- Environment–Development convergence; and
- Development–Disaster convergence.

Figure 24.1 illustrates the current level of the integration of three sectors, and Table 24.2 shows the strategic entry points for the integration to be taken up in the Asia-Pacific region.

**OPPORTUNITIES OF ENVIRONMENT AND DISASTER REDUCTION INTEGRATION**

Opportunities to integrate environmental and disaster reduction strategies are listed below:<sup>3</sup>

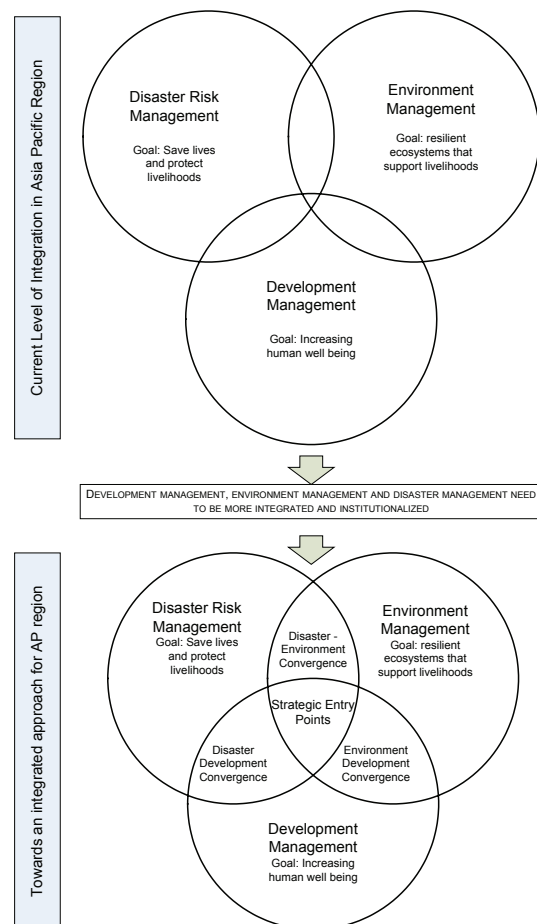


Fig. 24.1 Strategic entry points for integration

**Table 24.2** Three zones of convergencesv

Environment–development convergence	Disaster–development convergence	Environment–disaster convergence
<ul style="list-style-type: none"> <li>– Economic opportunities for the poor</li> <li>– Disaster and environment considerations in economic and infrastructural development</li> <li>– Access to, and viability of, communal resources and biodiversity (including forest products)</li> <li>– Processing and marketing of local products</li> <li>– Health and education</li> <li>– The role of local knowledge in economic development</li> <li>– Adaptation livelihood strategies to Climate Change</li> </ul>	<ul style="list-style-type: none"> <li>– Integration of DRR into government department activities</li> <li>– Land use planning and infrastructure planning</li> <li>– Integration between ‘traditional’ and ‘modern’ agricultural and aquaculture technologies and management systems</li> <li>– Linkages between local ‘informal’ institutions and authorities</li> <li>– Diversity of crops, agro-biodiversity</li> <li>– Seed and input distribution, in particular local seed varieties and inputs</li> <li>– Local research on crops, livestock and economic development that are adapted to the local climate</li> </ul>	<ul style="list-style-type: none"> <li>– Early warning systems</li> <li>– Local disaster risk reduction strategies (national and local institutions)</li> <li>– Natural resource management based protection (mangroves, water catchments, forests)</li> <li>– Disaster risk information and capacities of national/local institutions</li> <li>– National adaptation plans and vulnerability assessments to climate change</li> <li>– Coastal zone management</li> <li>– Urban drainage and water supply, hydroelectricity, solid waste management</li> </ul>

- Engage environmental managers in national disaster risk management mechanisms (and disaster managers in environmental management mechanisms),
- Include risk reduction criteria in environmental regulatory frameworks,
- Assess environmental change as a parameter of risk,
- Utilize local knowledge in community-based disaster risk management,
- Engage the scientific community to promote environmental research and innovation,
- Protect and value ecosystem services,
- Consider environmental technologies and designs for structural defenses,
- Integrate environmental and disaster risk considerations in spatial planning,
- Prepare for environmental emergencies, and
- Strengthen capacities for environmental recovery.

There are a number of areas where environmental management and disaster management can and should interact more positively for mutual benefit and support. Both fields would benefit from continuing and supporting the current movement in the disaster community from ‘reactive’ disaster response to active risk management and from iterative recovery to proactive mitigation and prevention. Parallel efforts would transition the environmental field

from contaminant clean up to risk reduction and pollution prevention, from discrete issues management to environmental management systems, and from flood control to floodplain management.<sup>23</sup>

Integration of sustainability considerations into disaster mitigation and recovery can exploit the considerable overlap between environmental management and disaster management. Planners and practitioners in both fields must recognize that the overall objectives of these fields implicitly promote sustainable communities. Sustainability should be considered both prospectively (in sustainable development planning and mitigation) and retrospectively (in response and recovery). This integration would incorporate and enhance current trends toward 'holistic disaster recovery' (also 'sustainable recovery') that emphasize betterment of the entire community, including environmental improvement and enhancement, through the recovery process.<sup>24</sup> ISDR is even more direct:<sup>1</sup>

*Disaster reduction specialists should be encouraged to anticipate environmental requirements under applicable laws and to design projects that address these requirements, coordinating closely with environmental institutions.*

Environmental management professionals can make considerable contributions during the mitigation and recovery phases of disaster management. They can identify possible improvements and enhancements as well as things to avoid. More importantly, after enhancements or improvements are in place, they can monitor and assess environmental performance indicators to ensure that goals are met. Environmental assessments should be integrated into emergency planning processes. Environmental Impact Statements should (but currently do not) specifically include disaster-hazard considerations. Rapid environmental assessments should be conducted as part of disaster damage assessment and should be an integral part of response/recovery considerations.<sup>25</sup>

Both environmental managers and disaster management managers must be cognizant of the importance of environmental justice/equity issues in the context of hazard and vulnerability. Hazards of any type have a disproportionate impact on the poor and disadvantaged. A number of thorny equity issues are involved in environmental management such as: industrial plant and landfill setting, development in industrial or depressed areas, residential settlement on slopes or in other marginal areas, higher population density, immigrants and language differences, differential access to social services and information sources. Most of these issues have not yet been adequately addressed in emergency management planning or community dialogue.

There are a number of key tools or entry points which offer opportunities for integrating disaster and environment management. Below are some key programs and tools for integrations

#### **National Adaptation Programs of Action (NAPAs)**

The preparation of NAPAs is a new element among the agreements and initiatives established under the United Nations Framework Convention on Climate Change (UNFCCC). Guidelines were set out in 2001 for the development of plans that enable low-income countries to communicate proposed programs of priority action to address the potential impacts of climate change. An emerging principle is that they should concentrate on actions designed to combat urgent problems already caused by present-day climate variability and extremes, problems that may become more acute under future climate change unless remedial action is taken. Key among these is the impacts of extreme climatic events associated with disasters such as flooding, drought and tropical storms. Preparation of the plans is financed by the UNFCCC's Least Developed Countries Fund, and the same source may also be a vehicle for funding subsequent implementation of the priority actions.

### **Integrating DRR concerns into Environmental Assessments for new developing projects**

Though Environmental Assessments (primarily Environmental Impact Assessments) have become mandatory in most of the countries in Asia for project appraisal, much needs to be done to integrate DRR concerns into such assessments. Also efforts need to be taken on adopting environmental assessments at much prior stage (for example, the Strategic Environmental Assessment) so that such concerns of environment and disaster risk are addressed at the policy and plan level and need not wait till the formulation of the particular projects. It is important to integrate DRR concerns into all environmental tools. However, there are two important tools need to be prioritized.

*Environmental Assessments* (primarily EIA) are an absolute requirement for the appraisal process of all new projects. The basic purpose is to examine the potential environmental consequences, both beneficial and adverse, of the proposed project's design. A guidance note prepared by ProVention Consortium on the use of environmental impact assessment (EIA) methodologies as a tool for mainstreaming DRR identifies three essential actions as part of EIA process:

- i) The environmental assessment process should include collation of data on natural hazard-related risks as a fundamental first step in broader project scoping
- ii) Systematic analysis of natural hazards and related vulnerability should be undertaken as a central component of the environmental assessment in areas of risk of natural hazards; and
- iii) A full impact assessment should be required for certain types of projects in high-risk areas.

In this regard, The 'Tools for Mainstreaming DRR: Guidance Notes for Development

### **Integrating DRR in Country Environmental Assessment**

ADB's CEA for Tajikistan, identifies natural hazards, including drought, landslides and earthquakes, as one of the country's key environmental problems and highlights a related reduction in vulnerability as a major element in promoting environmental interventions to reduce poverty. In order to enhance resilience, it recommends support for activities that contribute to greater physical stability (for example, prevention of soil erosion); the exploitation of opportunities for simultaneously reducing vulnerability and supporting livelihoods (for example, drainage of lands prone to mudslides and use of the water collected for irrigation); careful attention to zoning of economic activities; and, more generally, a policy that favours risk reduction over emergency response and reconstruction.

### **Integrating DRR in Strategic Environmental Assessment**

Environmental analysis by the ADB of some specific interventions to support the development of irrigation infrastructure in Cambodia found that these interventions could not be considered in isolation from other proposed government and donor irrigation projects and the potential cumulative environmental impacts collectively associated with these schemes. These impacts included those relating to the implications of large irrigation schemes and water withdrawal for the system of flooding (used to economic advantage in Cambodia in normal years) and water flows. In consequence it was proposed that future ADB investments in the irrigation sector should be conditional on integrated basin development planning, which was currently absent in many parts of Cambodia.

(Source; Reference [26])

Organizations' developed by the ProVention Consortium provides detailed guidance on how to mainstream DRR into EIA process. The document could be downloaded at [www.proventionconsortium.org](http://www.proventionconsortium.org). Some examples from Asia where DRR has been integrated in environmental assessments are given here.

### **Environmental Risk Assessment, and Environmental Assessment Strategies**

As a disaster preparedness measure, a range of policy and strategy tools can be used to reduce the risk and vulnerability of local communities. Of particular significance are tools such as environmental risk assessment (ERA) and EMS. EMS is a relatively new approach, based on the ISO 14001 standard, which when adopted for disaster management, enables the systematic identification and assessment of significant environmental aspects that impact disasters and setting of measurable targets. It also includes the monitoring and checking of steps taken to achieve these targets. SEAs can also be incorporated into local disaster plans. Vulnerability and environmental hazard mapping of local communities will have to be combined with early warning systems that regularly monitor and evaluate the situation.

Environmental codes and standards, and their proper enforcement and monitoring, will go a long way when they are used for disaster preparedness and response purposes. For example, a well-maintained inventory of chemicals and hazardous substances used by local industries, and their proper labeling, will ensure that, during a disaster event, the risks that such materials pose to communities living nearby can be mitigated by proper isolation, handling and segregation.

Clearly then, the above environmental tools for pre-disaster preparedness should focus on the development of policies and strategies, and in strengthening the capacities of local communities and government bodies. Specialized arms of the local government

looking at environmental aspects, such as the BAPPEDALDA in Indonesia, should build capacities to be able to look at the environmental dimensions of their preparedness plans.

For post-disaster recovery and reconstruction, similar strategies and tools can be identified, which will not only aid the recovery process, but will also assist in strengthening future preparedness. Of particular significance here are Rapid Environmental Assessment (REA) and EIA tools. These tools are particularly focused on the assessment and implementation of recovery and reconstruction projects, ensuring that programs and projects not only help affected communities to recover their livelihoods, but also restore the local environment. For example, a set of criteria included in forms for approval of projects in the Aceh area of Indonesia were those related to the potential environmental impacts of proposed projects.

### **Rapid Environmental Impact Assessment**

In normal, non-disaster, situations an environmental impact assessment (EIA) can be used to identify possible environmental impacts and mitigation measures. However, as indicated in Table 24.3, a disaster is radically different from normal conditions, making an EIA inappropriate. Most governments and humanitarian assistance organizations specifically allow for not doing an EIA in emergencies, recognizing that a full EIA would considerably slow emergency assistance.

These guidelines for a Rapid Environmental Impact Assessment (REA) fill a gap in the range of tools available to assess environmental impacts during disasters. The REA is designed to provide input on environmental conditions in disaster situations in a way which is convenient for the fast moving, time compressed operational environment faced in responding to a disaster.

The REA is one of several initiatives to improve the linkages between sustainable environmental management and disaster response. Leaders in this area include United Nations Environment Program, CARE International, UNHCR, the WWF and Benfield Hazard Research Center.

These organizations have not only focused on their own needs, but seek to develop means and methods to assist all interested organizations and communities to better deal with environmental issues before, during and after disasters.

The REA was developed as a collaborative effort of the Benfield Hazard Research Center, University College London and CARE International. Funding for this collaboration has come from the United Nations Environment Program, Royal Norwegian Ministry of Foreign Affairs, Office of U.S. Foreign Disaster Assistance USAID and CARE International. The REA development is guided by an international advisory board and in collaboration with over twenty non-governmental organizations (NGOs) and international organizations (IOs)

### OPPORTUNITIES OF DEVELOPMENT AND DISASTER REDUCTION INTEGRATION

There are, however, a number of key tools or entry points which offer opportunities for putting

disaster risk reduction onto international and national development agendas and setting goals and priorities. These are briefly outlined here and include PRSPs, UNDAFs, donor country assistance strategies/plans, National Adaptation Programs of Action for climate change, tools such as program and project appraisal and early warning systems. There are also many relevant regional initiatives and policy forums, such as the RCC.

### Poverty Reduction Strategy Papers (PRSPs)

PRSPs provide the basis of all World Bank and IMF concessional lending and for debt relief under the enhanced Heavily Indebted Poor Countries (HIPC) Initiative. They are also increasingly used by many other donors as a basis for their bilateral support. PRSPs describe a country's macroeconomic, structural and social policies and programs to promote growth and reduce poverty, as well as associated external financing needs, and are in principle

**Table 24.3** Contextual differences: normal and disaster environmental assessments

Normal assessment	Disaster assessment
<ul style="list-style-type: none"> <li>– Normal Conditions</li> <li>– Considerable lead time</li> <li>– Legal requirement often exists (country and/or donor)</li> <li>– Deliberate and proactive</li> <li>– Will take time, be thorough &amp; extensive: comprehensive data collection</li> <li>– “No project” option is a possible outcome</li> <li>– Location chosen</li> <li>– Duration planned</li> <li>– Beneficiary population identifiable &amp; static</li> <li>– Environmental goals may be made compatible with socio-economic ones</li> </ul>	<ul style="list-style-type: none"> <li>– Disasters</li> <li>– Sudden onset</li> <li>– Rarely a legal requirement but some donor may ask for it</li> <li>– Reactive</li> <li>– May need to be partial in coverage</li> <li>– “No project” outcome is not an option</li> <li>– Unpredictable location</li> <li>– Uncertain duration</li> <li>– Beneficiary population heterogeneous &amp; dynamic</li> <li>– Priority given to “life saving” activities sometime difficult to reconcile with environmental goals</li> </ul>

Source: Reference []

prepared and 'owned' by governments through a consultative process involving civil society and development partners.

Given the pre-eminence of PRSPs in HIPC governments' efforts to address poverty and its cross-sectoral approach, they provide an important opportunity for setting out ways in which disaster risk reduction concerns can be integrated into national poverty-focussed development and associated development assistance. The PRS process provides an entry point for bilateral donors to promote a risk reduction agenda in at least three ways:

- Collaborating with the World Bank's Hazard Management Unit, they can seek to influence the Bank's support for the PRS process in the direction of encouraging governments to integrate risk reduction considerations into key PRSP components. Guidelines might, for example, include a recommendation for a national working group to compile hazard and vulnerability profiles and consider how appropriate risk reduction strategies can be incorporated into the PRSP.
- At country level they can offer targeted support and advice to governments in the preparation of PRSPs, highlighting opportunities for integrating risk reduction concerns into sectoral strategies and indicating willingness to support those areas in which these concerns are addressed.
- They can ensure that funding is available for implementation of risk-reducing activities that are included in PRSPs. While the shift from project-based aid to general or sector budget support means that the scope for earmarking funds for specific activities is reduced, donors can nevertheless ensure that risk reduction principles are highlighted in funding agreements and in systems for ensuring accountability. There is also scope for supporting specific activities outside the framework of direct

budget support, including through UN agencies and NGOs.

Some of the various ways DRR is addressed in the Poverty Reduction Strategy Papers (PRSP) in Asia-Pacific region are shown below.

**PRS identifies DRR as sectoral subpriority:**

Lao PDR—DRR has been included as part of sectoral subpriorities under agriculture

**PRS set specific disaster-related outcome and impact indicators:**

Vietnam—The 2002 PRSP, aims to halve the number of people falling back into poverty due to calamities and other risks by 2010.

**PRS measuring the achievement of DRR indirectly through other output indicators:**

Cambodia—The 2002 PRSP, aims to reduce the area of agricultural land damaged by floods and droughts, the monetary value of flood losses and the number of people affected by drought.

**PRS seeking to integrate DRR into broad development activities:**

Bangladesh: DRR is not explicitly included as part of the four strategic blocks or four supporting strategies on which the PRS is based. However, the extent to which the PRS ensures comprehensive disaster risk management, environmental sustainability and mainstreaming of these concerns into the national development process is identified as one of ten key goals on which the success of the PRS will be judged (Source; Reference [26])

**Country programming framework**

Like the Poverty Reduction Strategy, country programming forms another important window for integrating DRR. Programming framework are developed and applied by all international development organizations. These frameworks are usually applied at a national level with a

typical timeframe of three to five years. If the program does not identify particular focus areas, then usually no related projects can be undertaken in that country on that particular focus area by international financial institutions. The exception is post-disaster response.

The Planning Commission of the Government of Bangladesh draws up five-year plans providing guidelines for all development sectors including water resources sectors. The first five-year plan (1973–78) was formulated in 1973 and the fourth five-year plan (1990–95) was formulated in 1990. The plans have two important components; the macroeconomic framework and the sectoral framework that sets the sectoral targets and policies.

For the first time, the fourth five-year plan (1990–95) placed emphasis on environmentally desirable integrated development and full accounting of externalities of flood control measures. The plan noted that, in the past, the planning and construction of embankments has sometimes proceeded without taking adequate account of agriculture, fisheries, land use and other environmental and socio-economic considerations. The fourth five-year plan proposed to focus attention on these aspects in the planning and implementation of future embankments and other flood control and drainage programs through coordinated planning involving all concerned agencies of the Government as well as the local people. The identification, analysis, assessment and monitoring of such environmental and other impacts and, the inclusion of adequate corrective and compensatory measures, would form an essential component of the flood control, drainage and irrigation projects during the plan.

Ref []

### Sectoral integration

DRR should also be integrated at the sectoral level into policies, budgets and plans and programs. Though the sectoral ministries like health, public works, education etc are often a member of the national disaster management offices, their involvement should be more encouraged from a development point of view and not preparedness and response alone. In this regard, of equal importance is building capacity and awareness of officials from sectoral agencies at both national and sub national level. When programs are to be designed to address these priorities, they should be aligned to the sectoral ministries and tied to their budget. **Some** key themes for mainstreaming of DRR into priority sectors and has been developed by the Regional Consultative Committee on Disaster Management's (RCC) Program on Mainstreaming Disaster Risk Reduction into Development (MDRD) are given here.

### UN Development Assistance Frameworks (UNDAFs)

A noteworthy outcome of the UN Secretary General's efforts to improve coordination across the UN system at country level has been the Common Country Assessment (CCA) and UN Development Assistance Framework (UNDAF), designed to enhance the UN Country Teams' collective analysis and programming respectively in support of national goals and priorities, including the MDGs and PRSPs. In principle, the CCA/UNDAF process, supported by the office of the UN Development Group (UNDG), provides an entry point for "a contribution to developing measures and building capacity for crisis prevention and disaster preparedness; and where applicable to mitigation plans, post-conflict/natural disaster recovery and rehabilitation, and planning the transition from relief to development" and for establishing the necessary partnerships (including with donors) for this purpose. In parallel the UNDG has also estab-

**Agriculture**

- Promoting programs of contingency crop planning; crop diversification;
- Supplementary income generation from off-farm and non-farm activities;
- Effective insurance and credit schemes to compensate for crop damage and loss to livelihood;

**Urban Planning and Infrastructure**

- Introducing Disaster Risk Impact Assessments into the construction of new roads and bridges;
- Promoting the use of hazard risk information in land-use planning and zoning programs;

**Health**

- Vulnerability assessment of hospitals in hazard-prone areas;
- Promoting hazard resilient construction of new hospitals;
- Implementing of disaster preparedness plans for hospitals;

**Education**

- Introducing DRM modules into the school curriculum;
- Promoting hazard resilient construction of new schools;
- Introducing features into schools for their use as emergency shelters;

**Housing**

- Promoting the increased use of hazard-resilient designs in rural housing in hazard-prone areas;
- Utilization of national building codes; and the compliance and enforcement of local building laws in urban hazard-prone areas.

(Source: Ref [26])

lished a Joint Working Group on Transitions with the UN Executive Committee on Humanitarian Assistance (ECHA) to consider relief-development transition issues in natural disasters and complex emergencies, including how the UN Consolidated Appeals Process for emergencies relates to the UNDAF. So far these initiatives have yet to translate into a systematic incorporation of disaster risk reduction concerns into the UN development planning process, but this could change if more substantial donor support were to be targeted to this area.

**National Adaptation Programs of Action (NAPAs)**

NAPAs need to be fully integrated with national development and poverty reduction strategies. They must focus not just on technical responses, but also on wider societal and institutional adaptation that enhances resilience to shocks, including poverty reduction and improved resource management. The extent to which NAPAs can actually promote these linkages under the current funding processes remains to be seen. The NAPA initiative is still at an early stage, with the first countries due to submit plans within 2004 and 2005. Integrating climate change adaptation with broader concerns places special demands on sectoral coordination and policy-making practices. According to UNFCCC, efforts should be made to create a more enabling environment within countries through education and raising awareness on climate change and its impacts; development of skills necessary for implementing adaptation strategies; promoting cross-sectoral approach to policy-making; and developing policy and planning frameworks that can accommodate climate change concerns.<sup>76</sup>

**Program and project appraisal guidelines**

Donor should provide guidance on submitting and assessing funding applications for projects and programs. These do mention assessment of risks to achieving objectives of proposed

activities and environmental impact, for example as a component of logframes, in a 'Risks and undertakings' section or an environmental issues annex for project submissions. However the guidelines do not at present give explicit attention to assessing ways in which activities might be threatened by, or, just as important, might influence disaster risks. Moreover, projects, at least in non-industrialized countries, are steered by donor based agenda rather than actual needs. A shift from donor-driven agenda to local need-based agenda is required for more effective resource management.

### **Early warning and information systems**

Early warning and information and communication systems are key tools for mitigating disaster impacts. In the past 20 years considerable progress has been made in improving systems for providing short-term advance information on extreme weather events, flood surges, volcanic eruptions and food crises which allow timely action to be taken in the realm of disaster management. Yet there is also a need for information systems to support longer-term risk assessment and monitoring, focusing on vulnerability as well as hazards, as a basis for disaster risk reduction initiatives within a development framework.

Overall, early warning and information systems, often with substantial donor assistance, have significantly improved in terms both of information reliability/timeliness and linkages to early response, saving many lives in disasters. Common shortcomings, however, are that while they establish the means to generate or acquire large volumes of data, including remote sensing data, they are weak at analysis and interpretation and sometimes weaker still at communicating their findings to stakeholders in a useful form which leads to action. In many cases their approach is technical, short-term and oriented towards needs for humanitarian assistance. They are far less attuned to generating knowledge that would

improve understanding of longer-term socio-economic and political processes responsible for vulnerability (including conflict), or eliciting action to reduce that vulnerability.

Better analysis of this latter kind could provide a solid foundation for designing strategies to integrate risk reduction into development processes at national and sub-national levels. This will require appropriate levels of investment in expertise, adequate resourcing of system operation, and a commitment to intersectoral collaboration to strengthen information action links.

### **Risk transfer mechanisms**

An emerging area of interest is the potential for financial instruments of risk management in developing countries. The World Bank, for example, is exploring the scope for promoting a range of instruments including public-private partnerships, perhaps linked to corporate social responsibility initiatives, to offer affordable insurance services that would spread the burden of disaster risks for individuals or for governments.

### **International initiatives and policy forums**

There are a great many international policy forums at which bilateral donors can highlight and promote disaster risk reduction concerns, including world conferences and summits on related issues (for example, economic and social development, sustainable development, climate change, food and trade). The importance of Mainstreaming of DRR is recognized by the countries of the AP region and slowly the countries are picking up the momentum to address DRR into development.

## **RECOMMENDATIONS FOR INTEGRATION**

Both The Hyogo Framework of Action (HFA) and Millennium Development Goals emphasized on *environmental and natural resource management*.

**Regional level***Flood Management and Mitigation Program*

The Flood Management and Mitigation Programme of the Mekong River Commission, has five components:

- Establishment of a Regional Flood Management and Mitigation Centre
- Structural and flood proofing measures
- Mediation of trans-boundary flood issues
- Flood emergency management strengthening
- Land use management

**National Level**

- Climate-proofing the Strategic Development Plan in the Federated States of Micronesia
- Mainstreaming DRR into the National Development Strategy of Kiribati

**Sectoral Level**

- Mainstreaming DRR into land use planning in Philippines by NEDA and UNDP (Ongoing)
- PIP on mainstreaming DRR into road sector in Philippines by DPWH, NDCC with support from ADPC, ISDR and SIDA (Phase I completed) (Implemented under RCC MDRD Program)
- Mainstreaming DRR into education sector in Cambodia, Lao PDR and Philippines by Ministry of Education, NDMOs with support from ADPC, UNDP and ECHO (Ongoing) (Implemented under RCC MDRD Program)

Source: Reference [27,

They also encourage the sustainable use and management of ecosystems, including better land use planning and development activities to reduce risk and vulnerabilities. They call for the implementation of integrated environmental and natural resource management approaches that incorporate disaster risk reduction. Existing programs relating to the convergence area of three sectors mentioned above could be the starting points for the integration. This chapter makes an attempt to explore and make explicit the linkages between environment and disasters in order to aim for proactive approaches to reduce disaster impacts. In this final section of the chapter, some strategic entry points are suggested for integration of disaster environment and development (see Table 24.4).

**Climate change adaptation strategies**

As mentioned above, NAPA gives an important and significant space for the community level input. Thus it is one of the important windows for integration. Like PRSP, NAPA also provides an opportunity to integrate DRR and help impact the development decisions of the country. In the Asia-Pacific region, RCC has circulated the questionnaire survey to the RCC member countries to identify which counties are interested in undertaking PIPs on mainstreaming DRR into the NAPA. Based on the results of the survey, RCC would carry out the project in RCC countries members who would express interest to undertake such a project. Following points should be concerned in developing climate change integration strategy. Below are some key entry points:

- i) Advocacy and dialogues and workshops would be conducted to raise the awareness of the stakeholders on integrating EM and DRR into the NAPA and its benefit for the local communities.
- ii) Climate change and sea level rise considerations to be incorporated in strategic and land-use planning for infrastructure and buildings, and social services.

**Table 24.4** Opportunities for integration and recommended strategic entry points

Opportunities of Environment and Disaster Reduction Integration	Opportunities of Development and Disaster Reduction Integration
<ul style="list-style-type: none"> <li>• National Adaptation Programs of Action</li> <li>• Integrating DRR concerns into Environmental Assessments for new developing projects</li> <li>• Environmental Risk Assessment, and Environmental Assessment Strategies</li> <li>• Rapid Environmental Impact Assessment</li> </ul>	<ul style="list-style-type: none"> <li>• Poverty Reduction Strategy Papers</li> <li>• Country programming framework</li> <li>• Sectoral integration</li> <li>• UN Development Assistance Frameworks</li> <li>• National Adaptation Programs of Action</li> <li>• Program and project appraisal guidelines</li> <li>• Early warning and information systems</li> <li>• Risk transfer mechanisms</li> <li>• International initiatives and policy forums</li> </ul>
Strategic Entry Points In Asia-Pacific Region	
<ul style="list-style-type: none"> <li>• Climate change adaptation strategies</li> <li>• Land use planning</li> <li>• Post disaster sanitation and safe water</li> <li>• Livelihood management</li> <li>• Risk transferring</li> <li>• Coastal zone management</li> <li>• Urban planning</li> </ul>	

iii) The plan mentions the need for communities to prepare and implement risk reduction strategies to address natural hazards, while preparing for the anticipated impacts of climate change. These strategies should identify structures, infrastructure and ecosystems at risk.

iv) Potential impact of climate change on agriculture and aquaculture sectors to be determined and the findings to provide the basis for strategies to minimize impacts on these sectors.

### Land use planning

Land use changes and haphazard development are undermining our ability to cope with the natural disasters. Natural coastal vegetation such as mangrove, sand dunes serves as green defense

structures and protects coastal population and property with a bio-shielding effect. This was evident during Asian tsunami in December 2004. The impact of tsunami was less intense on coastal population that was protected by mangroves or sand dunes. Mangroves are very effective at dissipating wave energy and reducing flow velocity. The mangroves in Pitchavaram and Muthupet region of India acted like a shield and reduced the impact of the tsunami. Mangrove regeneration programs need to be incorporated in national programs of coastal states.<sup>28</sup>

Further, while warning systems may provide time interval just sufficient for evacuation thereby saving lives, they are not useful in minimizing damage to property and infrastructure. Proper land use planning is required for locating people and infrastructure in low prone

areas. This necessitates preparation of coastal zone land use planning maps with designated 'vulnerable zones' and identification of evacuation sites.<sup>22</sup>

### **Post-disaster sanitation and safe water**

Disasters create enormous quantities of waste; comprising hazardous waste, vegetation, soil, sediment, and municipal waste from dumpsites and septic tanks, healthcare waste, demolition debris from destroyed buildings, and wastes generated by relief operations. This waste lying on the soil and beaches poses threats to ground-water supplies and the marine environment. It also poses risks to the human health. Sanitation facilities (toilet and washing chambers) are normally destroyed. The addition of displaced families from severely impacted places put additional strain on the local sanitation systems. Sanitation facilities at relief camps are difficult to be managed adequately thus causing additional wastewater. Any disaster management plan must provide a space for sanitation facilities and provision for safe drinking water.

### **Livelihood management**

Majority of the rural population is dependent on ecological resources. During natural hazards, this population suffers enormous loss owing to the loss of livelihood. For example, agriculture sector is often affected by floods or droughts, thus affecting a large number of population with consequential loss of income. Similarly, fisher population is also vulnerable to coastal hazards. Livelihood management plans are necessary for providing security to this section of population. Effective plans for combating the impacts of natural hazards on the livelihoods of low-income communities need to be crafted.

### **Transferring risk**

Despite all precautionary measures, hazards and disasters have devastating impacts on low-income group people. Long-term sustainability of this population needs to be ensured through

strategies that will help them rehabilitate and recover from the hazard impacts. One such strategy is insurance that normally aims at effective hazard mitigation and both ecological and social sustainability. Concerns of precautionary measures, particularly insurance, in the recovery process should not be undermined.

### **Coastal Zone Management**

Observations made by IUCN and other organizations in Thailand and Sri Lanka show how neighboring coasts and islands were affected differently, due in part to the presence or absence of well-preserved mangroves, coral reefs, and coastal vegetation. New scientific insights from ecologists also show that natural ecosystems such as coral reefs and coastal mangrove forests can adapt to change and recover from storms and floods and still provide services of protecting the coast and absorbing pollution. But once these ecosystems are put under pressure by coastal development, they may lose their resilience. Maintaining a critical balance of natural and man-made aspects of the urban environment particularly in eliminating or reducing the disaster risks and hazards, will have to be built into local development plans, for example, enhancing the ability of natural ecosystems such as mangrove forests and coral reefs to act as a 'bio-shield' to protect people and their livelihoods, but also the use of cost-effective and innovative engineering solutions to control coastal erosion. Coastal zone management strategies being considered in the Asia-Pacific region after the tsunami highlight the continuum of inland areas, coasts, and oceans. Below are some key entry points:

- i) Create buffer zones and no-build areas that are clearly set back from the edge of the coast,
- ii) Replant coastal forests and restoration of mangroves, which have been taken up as a part of the environmental recovery process,
- iii) Restoring the health of the coral reefs, and

- iv) Mangrove belts, wetland and watershed protection.
- iv) Environmentally sound disposal of debris and waste, particularly in exploring its recycling and reuse potentials.

### Urban planning

Urban planning has emerged as a big challenge in the recent years. Waste management in urban areas can create severe problems. Similarly, improper urban planning can give rise to traffic hazards, fires or related hazards. Global change and the associated increased frequency of catastrophic events have made emergency management plans a necessity. It is necessary to provide a plan for creating resilient urban areas or 'disaster-resilient cities'. Of particular importance is the quick and environmentally sound disposal of the debris and waste, particularly in exploring its recycling and reuse potentials—so that reconstruction and rehabilitation can commence. Field assessments in Banda Aceh, Maldives, and other regions have shown the haphazard intermixing of different types of wastes such as concrete blocks, bricks, trees, and vegetative matter. The potential for recycling and reusing the debris, particularly those that are inert, was set aside in order to rapidly clear the affected areas and dump the debris in already overloaded landfills. This also resulted, in some cases, in illegal dumping in agricultural fields.

National government must have proper programs in place for dealing with disasters. Below are some key entry points:

- i) Risk exposure to be used as a criterion to rank infrastructure investments nationally across sectors and states,
- ii) Natural hazard risk assessments to be carried out at the state level as the basis of guidelines ensuring that risks to infrastructure are identified and addressed at the design stage,
- iii) Infrastructure must be located, built and maintained in line with codes and practices ensuring that it remains functional for the projected lifetime and avoids unacceptable risks associated with natural hazards and climate change, and

Kent<sup>29</sup> argues that all people have a human right to protection from disasters, and consequently governments have an obligation to provide that protection. He further urges domestic and international agencies to call on national governments to design the institutional arrangements that would assure realization of these entitlements.<sup>29</sup> Further, reducing disaster losses requires policies that address the root causes of disadvantage arising from the differential access to power associated with class and wealth, gender, ethnicity, and age.<sup>30</sup> Policies that are framed with fully informed choices about environment disaster linkages and that integrate concerns for vulnerability of disadvantaged communities may go long way to help reducing impacts of natural hazards.

### ACKNOWLEDGMENT

Phong Tran highly acknowledges the scholarship of Government of Japan, Ministry of Education Sport Culture Science and Technology (MEXT) and the support of the Graduate School of Global Environmental Studies, Kyoto University for this study. Part of this study was done with collaboration of IUCN, WWF, SEI, ADPC and CARE. Sangeeta Sonak acknowledges the short term fellowship from JSPS to visit Kyoto University and conduct this research. Rajib Shaw acknowledges the support from MEXT projects (CASIFICA, Vietnam Kaken, and Water Communities).

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