





# Chapter 5

## A selection of disaster reduction applications

This chapter discusses different applications of disaster risk reduction, as outlined in the graphic representation presented in chapter 1. These efforts become possible once risk assessment and institutional capabilities are set in place. The selection of disaster reduction applications discussed in this chapter serves to illustrate the scope of activities and applications in the field and highlighting their strengths and weaknesses.

- 5.1 Environmental management
- 5.2 Land-use planning
- 5.3 Safe building construction and protection of critical facilities
- 5.4 Financial and economic tools
- 5.5 Early warning systems



## 5.1 Environmental management

*A healthy environment enhances the capacity of societies to reduce the impact of natural and human-induced disasters, a fact largely underestimated. As disasters undermine both socio-economic development and environmental management efforts, there is a compelling need to explore how environmental mismanagement changes hazard and vulnerability patterns.*

*Knowledge about natural resources and the use of environmental management should be promoted as a strategy for reducing risks. Environmental actions that reduce vulnerability need to be identified and applied by disaster reduction practitioners. Quantitative measurement of these actions will determine their acceptance and application in political and economic arenas.*

*Integrating environmental management within existing disaster reduction policy frameworks and international strategies will build a safer world. National and regional institutions can best increase societies' resilience to disasters as part of a global environmental management effort. Instilling disaster reduction thinking into environmental performance is a positive proposition.*

*This section will outline the following:*

- *links between environmental management and disaster reduction;*
- *environmental legislation;*
- *environmental policies and planning;*
- *institutional and organizational arrangements;*
- *environmental impact assessments;*
- *reporting on the state of the environment;*
- *ecological and environmental economics; and*
- *environmental codes and standards.*

### Links between environmental management and disaster reduction

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.

Practices that protect the integrity of nature and ensure a wise use of natural resources can provide solutions to reduce vulnerability from which both the environmental and disaster communities will benefit.

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.

Hurricane Mitch highlighted in dramatic fashion the indispensable role of environmental management in sustainable development and natural disaster mitigation. Environmental management tools that make a cost-effective contribution to reducing vulnerability should be identified, adapted and adopted.

Environmental management can become a cost-effective tool for disaster reduction while serving many other objectives including conservation of biodiversity, mitigation of adverse global environmental changes and poverty alleviation.

Similarly, the Ministry of Natural Resources of the Russian Federation recognizes its present



**Box 5.1**

**An eco-museum as a tool for disaster reduction**

The six towns severely affected by the 2000 eruption of Mount Usu, Japan initiated the development of an eco-museum in order to focus people's attention on the damages in agriculture, forestry, fishery and tourism. The eco-museum, to be completed in 2005, will cover the entire affected area. Its aim is to teach the population how to "live with the volcano".

The objectives of the eco-museum include:

- Stimulate tourism and industries in the region.
- Preserve artefacts and recollections of volcanic events.
- Teach history, nature and culture of the area to inhabitants and visitors.
- Introduce disaster reduction activities to inhabitants and visitors.
- Involve inhabitants in development plans.
- Promote cooperation between communities.

difficulty to integrate environmental management in natural disaster reduction policies especially in water management to reduce flood risks.

Environmental actions that reduce vulnerability are seldom promoted in disaster reduction strategies and usually appear only as a beneficial but unplanned side effect. But these activities will add to the options for disaster reduction. Widely disseminating examples of their application to relevant actors will encourage their use.

At present, environmental management tools do not systematically integrate trends in hazards occurrence and vulnerability. Similarly, disaster reduction practitioners do not systematically explore the advantages of using environmental management tools and approaches. Some benefit might be drawn from the fact that environmental tools were developed from a risk management approach. Indeed environmental and social impact assessment processes are geared towards risk identification in the design of plans and projects.

The disaster and environment communities will benefit from efforts to use similar language and approaches. Research work on disaster reduction can benefit from experience gained in integrating environmental concerns in decision-making and development planning. Once tools and policies are developed, capacities will need to be built locally to respond to environmental vulnerability and use environmental management as a means of reducing impacts. In this regard, lessons learnt in the field of women's use of environmental resources as it relates to disaster reduction need to be taken into account.

The World Conservation Union (IUCN) and the International Institute for Sustainable Development (IISD) with the support of the Stockholm Environment Institute (SEI) have launched an initiative to promote the use of environmental management to reduce the vulnerability of communities to the growing threat of climate change and climate-related disasters. It serves as an important step to translate the intuitive recognition of the protective function of natural systems into useful methods for practitioners.

There is a need to put into practice the ninth principle of the Yokohama Strategy: "environmental protection, as a component of sustainable development and consistent with poverty alleviation, is imperative in the prevention and mitigation of natural disasters".

The protective roles of particular ecosystems are known. For example, important wetland functions include water storage, storm protection, flood mitigation, shoreline stabilization and erosion control. These functions are essential for sustainable development and decrease reliance on often more expensive technical alternatives. However, such benefits from wetlands are under threat from natural disasters including storms, drought and floods which will be further exacerbated by climate change. Therefore, the relationships between

*Ecosystems are interdependent networks of organisms of a naturally defined eco-zone that function as a unit. Examples include natural forests, wetlands, deserts, lakes and mountain regions. The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Thus, the application of the ecosystem approach will help to reach a balance of the three main objectives of sustainable development: conservation, sustainable use and the fair and equitable sharing of the benefits arising out of the utilization of resources.*



### Box 5.2

#### Lessons learnt from Hurricane Mitch

“So far, relatively little is being channelled to attack the root causes of vulnerability, or to contribute to the non-structural mitigation of disasters through sound environmental management, integrating regional and integrated territorial planning at a scale that goes beyond individual plots or local communities.

“For these issues to be addressed there is a need to integrate risk management into environmental policy. How do healthy ecosystems contribute to abating risk? What has been the environmental impact of land concentration, misuse of wetlands and massive deforestation?

“Finally, the long term environmental security of Central American societies will depend to a significant degree on the capacity for adaptive and cross-scale in situ management of key buffering ecosystem functions. More applied research is needed on the linkages between local forest management practices and their effects on hazard mitigation.

“There are encouraging initiatives which seek to contribute to more secure human livelihoods through empowering local communities to manage risk locally. There is a growing interest in the restoration of key forest ecosystems, geared to providing local communities with more adapted livelihoods and a secure environment. Mitigation is best applied locally, but requires adequate linkages into the policy sphere to guarantee the long-term governance of the region.

“The new quadrennial programme proposed by the IUCN, provides a key framework in which to apply these ideas to the Central American context. The post disaster context is ripe for proposing innovative approaches to disaster prevention and mitigation.”

Source: P. Girot, World Conservation Union, 2001.

climate change and wetlands deserve more attention by policy makers.

Wetlands also suffer from increased demand on agricultural land associated with population growth, infrastructure development, and river flow regulations, invasion of alien species and pollution.

Adaptive capacities of ecosystems to absorb sudden shifts in climatic, geological or biological components are key features in increasing disaster resilience. In this regard, traditional societies have great adaptation capacities to cycles of environmental change.

Living with flood strategies are cost-effective, relatively easy to implement and more compatible with the environment, and can more easily be incorporated in long-term development planning at little extra cost.

### Global environmental issues and disaster reduction

#### Climate change

Consequences: extreme weather events, changes in boundaries, structure and functioning of ecological systems (forests), food security, water availability, sea-level rise.

Solutions: reforestation, adaptation programmes, disaster preparedness, early warning.

#### Loss of biological diversity

Consequences: loss of natural resources and diversity, interfering with essential biological functions such as regulation of water runoff, control of soil erosion, loss of resilience to disturbances and environmental change.  
Solutions: conservation and restoration (forestry, agriculture, coastal zone management).

#### Freshwater degradation

Consequences: water quality and scarcity, droughts, health risks, economic impact of land degradation on water resources, increase in floods associated with poor land use.  
Solutions: water resources management, land-use management.

#### Desertification and land degradation

Consequences: improper resource use, food security, loss of ecosystem productivity.

**Box 5.3**

**Environmental systems contribute to disaster reduction and security**

Maintaining and rehabilitating resilient environmental and social systems form key building blocks for disaster reduction and security. The fire and smoke episodes of 1997-1998 in South-East Asia, the Russian Federation, the Americas and the Mediterranean helped focus attention on an increasing problem. These episodes were associated with the extreme drought caused by the El Niño event which created conditions for the escape and spread of uncontrollable wildfires.

While some fires were deliberately set to cover up illegal logging, many were intended to convert forest to other land uses. Small farmers, plantation and timber companies, government settlement schemes and subsidy policies were all responsible to some extent of the resulting losses and damages. Better knowledge and monitoring are necessary to distinguish well-balanced natural fires beneficial in maintaining land-use systems from those fires which adversely affect local communities' livelihoods and habitats. Basic structural improvements, accompanied by legislative, economic and technical improvements are needed to make physical infrastructure, natural and human systems and water management more resilient.

Solutions: early warning and drought preparedness and management, alternative livelihood programmes, sustainable land and natural resource management programmes, natural environment and development planning.

Forests play an important role in protecting against landslides, erosion, floods and avalanches. They also safeguard against drought. As shown in Switzerland, continuous care given to forests including rejuvenation, careful diversification of species and structural stability ensure an optimal protective role, and also save money from disruptions caused by natural hazards.

The Yangtze River floods in 1998 showed the consequences of the loss of healthy ecosystems. As a consequence, the Chinese government banned logging in the upper watershed and increased reforestation efforts and prohibited additional land reclamation projects.

China carries out flood prevention and water resources protection as a means to lessen the impact of landslides and floods. In southern parts of France wetlands restoration is used as a means to reduce flood risks linked to decreasing agricultural practice. Related projects involve

methodological development and evaluation, taking into account complex environmental and social fluctuations. Barrier islands, reefs and mangroves contribute significantly to the mitigation of hurricane risks, storms and tidal surges.

Sound watershed management that combines the protection of parks, reforestation, sustainable forestry and agricultural practices is critical to protect downstream communities, agricultural lands and infrastructure.

Environmental services provided by integrated watershed management must be recognized when making policy and investment decisions. This becomes even more important in light of the international or interprovincial nature of river basins.

**Environmental legislation**

In its chapter on integrating environment and development in decision making, Agenda 21 notes, "laws and regulations suited to country-specific conditions are among the most important instruments for transforming environment and development into action".

<<http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm>>

Legislative responses to environmental problems testify to countries' appreciation of the adverse impacts of environmental degradation on socio-economic systems. Many developing countries have by now adopted legislation dealing with a broad range of issues including protection of water resources or biodiversity conservation.

Framework environmental legislation mostly deals with cross-sectoral issues. This includes establishment of environmental standards, the use of economic instruments for environmental management, environmental impact assessment procedures, public participation, education and institutional coordination.

These statutes and basic environmental laws helped overcome the organizationally fragmented and uncoordinated approach to environmental management.



*The China National Wetlands Conservation Action Plan finalized in 2000 is an example of a specific environmental legislation supporting disaster reduction.*

#### Box 5.4

##### Environmental laws and institutions

- Constitutions (environmental component)
- Institutions (national and sectoral)
- Environmental action plans: national or regional, local (Local Agenda 21), sectoral (biodiversity, desertification, climate), specific national goals and targets (where available)
- Legislation – including environmental acts and laws on environmental impact assessment (EIA)
- Command and control measures (standards, bans, limits, permits)
- Mechanism for monitoring and enforcing legislation
- Non-binding guidelines, voluntary codes of conduct (ISO 9000 and 14000)
- Greening operations at governmental level
- Environmental litigation and judicial interventions
- Mechanisms for tracking impact and progress (environmental performance)
- Bilateral and multilateral agreements (e.g. Mekong River Commission, Southern African Development Community protocol on shared waters, UN Convention on Biological Diversity, UN Framework Convention on Climate Change, UN Convention to Combat Desertification)
- Ratification and implementation of international agreements
- Regional environmental and sustainable development bodies and organizations (e.g. South Pacific Regional Environmental Programme, Caribbean Conservation Authority)
- Financial mechanisms
- Transboundary environment laws (e.g. concerning international waterways, UN Law of the Sea)
- Trade policies (e.g. trade agreements, World Trade Organization policies and regulations on the sustainability of resource use)

More than 65 developing countries have adopted such legislation since the 1970s. A continuing process of legal and institutional innovation shows a commitment towards sustainable development. It also provides a vehicle for disaster reduction strategies.

National environmental laws provide some direction for the implementation of environmentally sound disaster reduction planning. Ways should be explored to ensure that environmental laws and disaster reduction strategies are mutually supportive.

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.

The objective of environmental laws also could address the requirements of disaster reduction explicitly by reinforcing the protection of those natural ecosystems that have a protective function. In this spirit, Bolivia is harmonizing its environmental act with its risk reduction and disaster response act.

The existing body of multilateral environmental agreements provides a good basis to enhance options for disaster reduction. Among these are the Ramsar Convention on Wetland Preservation, UN Framework Convention on Climate Change, UN Convention to Combat Desertification, and the UN Convention on Biological Diversity. These legal instruments are negotiated at the international level but are implemented through national policies, strategies, action plans and laws.

Existing legal instruments and ongoing work with sustainable mountain development are also pertinent to disaster reduction. For example, the alpine convention of 1989 places some emphasis on natural hazards and addresses land-use planning, soil and landscape conservation, water management, forests and farming.

Specific obligations to reduce the impacts of natural and human-induced disasters, including land-use planning, watershed management, and early warning, are foreseen in future regional mountain ecosystem agreements.

Disaster reduction goals can also be integrated into non-binding instruments

**Box 5.5**

**The World Conservation Union in Central America**

The World Conservation Union (IUCN) has worked throughout Central America to help in risk reduction and to coordinate with risk specialists in promoting project activities linked to environmental protection.

The promotion of synergies between multilateral environmental conventions has led to greater appreciation of the close relationships that exist between efforts to promote community adaptation, resilience to the natural environment and to reduce the risks of disasters.

A forum organized by the ministry of the environment in El Salvador in October 2001 was built around these concepts. It sought to achieve more common understanding and to explore opportunities by which adaptation practices could be applied in different zones of the country.

such as regional strategies for biodiversity. In this regard, the New Partnership for Africa's Development (NEPAD), an initiative to promote the socio-economic development of Africa, deserves attention. Its draft programme of action includes six priority areas: land degradation, desertification and drought, wetlands, climate change, cross-border conservation and management of natural resources.

**Environmental policies and planning**

As in the case of environmental legislation, environmental and disaster reduction policies need to be mutually supportive as part of the sustainable development agenda.

The critical gap between macroeconomic policy-making and environmental hazard considerations needs to be addressed. Sustainability and long-term benefits will result from integrating hazard thinking into decision-making related to environmental practices.

The characteristics of disaster reduction and environmental policies are similar. Both must meet local needs and sustainable development requirements and produce multiple benefits. Both rely on extensive participation of the public, relevant sectors and stakeholders.

Designing a national environmental action plan is a standardized process that is widely used. Some of the features of integrated environmental and disaster reduction policies include:

- assessment of environmental causes of hazards occurrence and vulnerability;
- assessment of environmental actions that can reduce vulnerability;
- assessment of the environmental consequences of disaster reduction actions;
- consideration of environmental services in decision-making processes;
- interdisciplinary approaches that will ensure the use of natural and social sciences in disaster reduction planning and decision-making;
- partnerships and regional approaches to land use and nature conservation;
- reasonable alternatives to conflicts concerning alternative uses of resources; and
- advice and information to involve actors in enhancing the quality of the environment.

Water policies such as water pricing and hydropower regulation offer examples of environmental policies with beneficial impacts on disaster reduction. They can be designed to promote the sustainable use of water and allow adjustments depending on seasonal forecasts, in order to avoid floods.

Water policies promote work to be undertaken on wetlands, floodplains and open spaces to store or to facilitate runoff. Furthermore, flood and drought risk management are increasingly looked at in the context of water resources and therefore depend on effective international water management.

Policies promoting sustainable management of fuel wood and the development of alternative sources of energy can reduce deforestation and contribute to controlling flood, avalanche and landslides.

Programmes undertaken as a result of commitments under international biodiversity, climate change and desertification conventions will also reduce vulnerability through enhanced natural resource management. In this regard, it will be important that climate change response measures in the energy sector take disaster vulnerability into account.





### Box 5.6

#### Disaster reduction strategies – tools to adapt to climate change

The risk reduction process provides a framework for selecting the best strategies to deal with those aspects of climate change that create or increase a risk to infrastructure, operations, economies or populations. It is a decision-making tool that assists in the selection of optimal or the most cost-effective strategies, using a systematic, broadly accepted public process.

Disaster reduction offers a way to address some of the economic, social, political, technological and institutional constraints to realize the full potential of adaptation to climate change.

Reducing vulnerability to today's climate variability and hazards is an opportunity for no-regrets adaptation to climate change that addresses extreme events. Mutually beneficial and no-regrets risk reduction measures include:

- early warning systems, seasonal climate forecasts and outlooks;
- insurance and related financial means;
- building codes, designs and standards (construction on stilts, redesign of oil rigs);
- promotion of renewable energy sources as mitigation and vulnerability reduction options;
- land-use planning including relocation incentives;
- flood-resistant agricultural practices;
- water management including regional water-sharing agreements, drainage facilities, flood prevention;
- environmental management (beach nourishment, mangrove belts, wetland and watershed protection, forest and agricultural land management);
- coastal zone management; and
- disaster management precepts, upstream vulnerability reduction, information, awareness, networking, reducing uncertainty for decision-making.

The disaster reduction community should take advantage of the body of knowledge existing in the climate change adaptation community. It should also translate its policies and measures for use by that community. Recognition of the inherent links between climate change and disaster reduction will eventually benefit practitioners in both fields.

The disaster reduction and climate change policy agendas cannot remain separated. Therefore several activities, such as the side events conducted in conjunction with meetings on the climate change convention (New Delhi, October 2002 and Bonn, June 2003) have been initiated by the ISDR Secretariat, to bridge the gap between the two communities.

At the Bonn meeting, the concept of a multi-stakeholder process to assess and report on the linkages between disaster reduction and climate change was launched. The involvement of disaster reduction scientists in the next Intergovernmental Panel on Climate Change assessment in 2007 is also being promoted.

Key partners in these activities include: the Intergovernmental Panel on Climate Change; the UN Framework Convention on Climate Change; the Netherlands Red Cross Centre on Climate Change and Disaster Preparedness; the Dialogue on Climate and Water; ProVention Consortium; the IUCN/IISD/SEI project on climate change; vulnerable communities and reinsurance companies, and the World Climate Impacts Programme.

The relationships between market prices, trade policies and the environment are complex. Trade policies based on sound environmental consideration can also contribute to reducing disaster impacts.

National environmental policies can increase communities' resilience by encouraging voluntary contributions and other social contracts. Leasing land, placing it in trust, land-use covenants and tax incentives are some mechanisms that can promote natural capabilities to reduce vulnerability.

The following examples illustrate how several countries and regions in the world include natural disaster reduction in national environmental action plans.

One of the ten programmes, Haiti's national environmental action plan deals with natural disaster management. It is based on a decentralized and participatory approach to planning that includes NGOs, the private sector and bilateral and multilateral donors.

Jamaica gives very high priority to climate change and sea level rise and natural disasters in the implementation of the Small Islands Developing States (SIDS) programme of action.

The Caribbean Planning for Adaptation to Global Climate Change, funded by the Global Environment Facility and executed by the Organization of American States, is one of the most important climate change initiatives in the Caribbean.

**Box 5.7**

**Environmental management and hazard reduction integration**

Although the Dominican Republic's national environmental policy reform does not explicitly address natural hazard vulnerability, it perfectly matches hazard mitigation concerns. Its development objective is to establish the basis for improved environmental management by defining environmental policy reforms and elaborating a national environmental management programme. Primary concerns include curbing deforestation and degradation of watersheds and coastal zones.

Saint Lucia's Integrated Watershed Management Project was initiated in 1994 in response to damages resulting from floods and landslides related to tropical storm Debbie. Apart from pursuing structural rehabilitation, it also supported the formulation of a watershed management plan. This integrated project has served as the basis for more integrated and sustainable development of key watersheds and strengthened the government's capacity in environmental management and flood preparedness.

Both projects are supported by the World Bank.

It supports the development of a policy framework for integrated management and cost-effective response to the impacts of climate change, incorporating tools such as disaster contingency planning.

In 1999, FAO developed a plan of action aimed at helping SIDS meet the challenges of economic change, environmental degradation and natural disasters. The programme focuses on agricultural trade, intensification and diversification of agriculture, fisheries, sustainable management of land, water and forestry resources and strengthening national institutions.

The plan aims at improving disaster preparedness by promoting measures to reduce the impact of hurricanes and cyclones on agriculture and coastal fisheries. It also helps countries assess their national meteorological and hydrological services and support early warning systems. A review of its implementation has identified emerging needs and constraints which will be discussed at a SIDS conference planned for 2004.

The South Pacific Regional Environment Programme (SPREP) has, for many years, incorporated disaster-related activities into its

programme as part of its mandate to manage the shared environment of the Pacific region.

Most activities have been part of the Regional Climate Change Work Programme which emphasizes the impact of extreme weather in the Pacific region and the relationships between climate change and natural disasters. SPREP is also implementing the Pacific Island Climate Change Assistance Programme which focuses on vulnerability assessment and adaptation.

In order to realize the full potential of the resources in the region, SPREP collaborates with other organizations to expand its role in assisting Pacific SIDS to integrate disaster management, sustainable development and sound environmental practices into national planning strategies.

Another SPREP project is the Integrated Coastal Zone Management in the Pacific Islands, which includes hazard mapping and the development of disaster reduction strategies for coastal areas.

The Sub-Regional Action Programme to Combat Desertification (SRAP) in West Africa and Chad provides a strategic and programmatic framework for integrating disaster reduction and management into poverty reduction, environmental protection and sustainable development planning in the area.

Two of the eight priority areas of SRAP focus on enhancing sustainable management of shared

**Box 5.8**

**A project in Bangladesh serving the environment and disaster reduction**

Undertaken by the Bangladesh ministry of environment and forest, the Bangladesh Coastal Greenbelt Project seeks to:

- prevent loss of life and damage to property by cyclones, storms and associated tidal surges;
- protect and improve the coastal environment through increased vegetation;
- help alleviate poverty by generating income through increased tree cover and related activities;
- increase forest resources;
- increase coastal embankment stability;
- establish industries based on forest plantation;
- increase multiple uses for land; and
- create popular awareness about sustainable forest management.

Source: Bangladesh State of the Environment Report, 2001.



### Box 5.9

#### Watershed management for disaster vulnerability reduction

Watersheds are necessary for agricultural, environmental, and socio-economic development. The physical and biological resources of watersheds provide goods and services to human populations, including water protection, attenuation of natural disasters by regulating runoff, protection of coastal resources and fisheries, protection of the environment and protection of productive lowlands. Watershed management programmes need to build on existing environmental initiatives.

The following elements are required for successful watershed management:

- No permanent structures should be located in floodplains.
- All watercourses should have buffer strips.
- Intensive agricultural activity should not be permitted on slopes greater than a specified percentage reflecting land capacity.
- Clear cutting of forests should be limited with forest conservation and sustainable forest management stressed.
- Institutional body should be formally established to address conflicts.
- Public participation of both men and women should be stressed in management decisions.
- Effective management plans and enforcement of environmental and zoning regulation are critical.
- Regional environmental impact assessments are needed to ensure that cumulative impacts of economic activities are sustainable.

The following elements are impediments to comprehensive watershed management:

- Inadequate economic valuation of environmental services.
- Inadequate institutional structure and appropriate land-use practices.
- Inattention to socio-economic issues contributing to poverty, a degraded environment and natural disaster vulnerability.

Several actions are needed to implement watershed management activities:

- Strengthen municipal authorities and their capacity to address land use and watershed management issues.
- Establish a national management strategy.
- Support sound land-use planning.
- Ensure public participation in watershed planning and ecosystems protection, including gender concerns.
- Support policies and market-based incentives that favour reforestation and sustainable forestry on steep upper watersheds.
- Promote participation of private sector through the climate change clean development mechanism.
- Require downstream beneficiaries to pay for watershed services.
- Support critical watershed protection and restoration of key ecological systems to mitigate disaster impacts.
- Support local NGOs to clarify land tenure issues and facilitate access to land property by rural farmers.
- Establish international watershed management frameworks.
- Pursue a research agenda incorporating economic valuation of environmental services, innovative financing, analysis of the relationship between land use and environmental management and the magnitude of losses from natural disasters.

Source: Watershed management for hurricane reconstruction and natural disaster vulnerability reduction, USAID, 1999.

water, plant and animal resources. Furthermore, SRAP provides guidelines for desertification control policies, strategies and actions at the subregional and national levels. In addition, it provides a framework for cooperation between various intergovernmental organizations, such as the West Africa Economic and Monetary Union, the Permanent Inter-State Committee for Drought Control in the Sahel and the Niger Basin Authority.

### Institutional and organizational arrangements

Environmental policies require coordinated organizational structures for their successful implementation. The creation of new ministries responsible for the environment and of high level interministerial advisory councils is still relatively recent, having begun after the UN Stockholm Conference on the Human Environment in 1972.

Almost all Caribbean countries have strengthened their environmental administrative capacities and are integrating environmental considerations into physical planning.

Today, environment ministries exist in some 23 African countries and 11 Asian countries. Environmental functions are sometimes performed by other ministries such as housing, planning, construction, land use, agriculture and forestry. Coordinated organizational arrangements minimize fragmented sectoral approaches.

Environmental management requires cooperative solutions, cutting across many disciplines and sectors. These involve community groups, NGOs, the private sector, governmental institutions, the scientific community and international organizations, as does disaster management. Therefore organizational frameworks in place for environmental issues can be expanded to serve the needs of disaster risk reduction as part of sustainable development planning.

Integrating environmental considerations in other policy domains could save resources. This would require linking work in science, policy, environment and vulnerability reduction. Implementation of sustainable risk reduction measures requires appropriate macro-planning to establish the critical links between policy objectives and field performance.

Intergovernmental programmes and networks focusing on environmental and global change issues can achieve integration and links. An example exists in South Asia with the South Asia Cooperative Environment Programme based in Colombo, Sri Lanka. This intergovernmental organization promotes and supports protection, management and enhancement of the environment in the region. It was established in 1982 by the governments of South Asian countries including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.  
 <<http://www.sacep.org>>

The Asia-Pacific Network for Global Change Research (APN) based in Kobe, Japan is another intergovernmental network dedicated to greater collaboration in the shared interests of industrialized and developing countries in matters related to global change. Its primary purposes are to foster global environmental change research in the Asia and Pacific regions, to increase the participation of developing countries in research, and to strengthen links between the science community and policy makers in matters of global change.

**Box 5.10**

**El Salvador Ministry of Environment and risk reduction**

The impact of Hurricane Mitch in 1998 and the earthquakes in El Salvador in 2001 led to an increased awareness at the El Salvador Ministry of Environment about the relationship between development, the environment and disasters.

Favourable experience of collaboration among local community associations and NGOs in the Lower Lempa Valley Risk Reduction Project provided organizational precedents for more direct involvement by the Ministry in risk and disaster matters.

Following the 2001 earthquakes, it convened a committee of national and international experts to consider the creation of a new technical agency to deal with risk management issues. The National Service for Territorial Studies (SNET) was created in 2001 as an autonomous government agency with an annual budget of about US\$ 2 million.

SNET has four divisions, three of which relate to monitoring the country's geology, hydrology and meteorology. This is the first time that these disciplines have been housed in the same institution in El Salvador. The fourth division deals with integrated risk management issues and develops vulnerability and risk scenarios.

SNET breaks with the tradition of adding risk reduction issues to existing emergency disaster response or civil defence plans. By expanding on the experience of the National Institute for Territorial Studies in Nicaragua, SNET may represent a first step towards establishing a comprehensive risk management system that can serve as a model for other countries. Guatemala has recently requested a feasibility study to consider a similar approach.

Another project, financed by the Inter-American Development Bank (IADB) in the Dominican Republic, is currently considering a far greater role for the ministry of the environment which already has legal authority to act in the area of land use and disaster reduction.





APN activities are decided by an annual intergovernmental meeting, and are supported by a steering group and a scientific planning group. APN member countries include Australia, Bangladesh, Cambodia, China, Fiji, India, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Philippines, Republic of Korea, Russian Federation, Sri Lanka, Thailand, United States and Viet Nam.

<<http://www.apn.gr.jp/>>

Multi-stakeholder processes (MSPs) are one of the recent innovations to promote dialogue to achieve sustainable development. This dialogue model was initiated in 1998 by the UN Commission on Sustainable Development and has since been adopted by other international forums.

MSPs aim to unite interested parties in communication and decision-making based on equality and accountability. They are also based on principles of transparency and participation, developing partnerships and strengthening networks.

During the preparations of the World Summit for Sustainable Development in 2002, stakeholders

#### Box 5.11

##### **Viet Nam's national plan for the environment and sustainable development**

The Vietnamese plan for the environment and sustainable development provides a good example of a comprehensive framework to address environmental planning and management that integrates disaster planning and mitigation. It has a wide variety of components including appropriate organizational structures, well-integrated environmental policies at the sectoral level and environmental legislation. Priority projects and programmes address improved methods of data collection and management, environmental impact assessment procedures and monitoring systems.

The mandate of the central environmental authority covers the coordination of disaster management. The plan also identifies opportunities for regional cooperation in environmental management for sustainable development that include disaster reduction, combating the effects of climate change and anticipated sea-level rise, integrated management of watersheds, catchment areas and floodplains through forest management, and soil and water conservation.

Source: Viet Nam national plan for the environment and sustainable development, 1991-2000, framework for action. <<http://www.mekonginfo.org/>>

came together to work out their contribution to the implementation of the sustainable development agenda. Major inputs that fed into one of the ISDR background papers were drafted through multi-stakeholder electronic forums. The added value of a multi-stakeholder approach ensures an increased sense of ownership and commitment for collaborative actions plans.

#### **Environmental impact assessments**

Legislative frameworks for environmental impact assessments (EIA) already exist and require the commitment of governments, aid agencies and civil society. They also depend on carefully maintained monitoring processes.

Risk reduction considerations could be further assimilated into EIA. A more comprehensive EIA could incorporate periodic vulnerability assessments to take into account the dynamic nature of vulnerability.

An expanded EIA process could provide a basis to ensure that proposed initiatives would include considerations of both disaster reduction and environmental impacts. It is also one tool to evaluate the extent to which climate change is relevant to the sustainability of development projects.

Further, it would allow for an assessment of potential problems as well as benefits of disaster risk reduction activities. Investment in mitigation measures needs to be based on an assessment of socio-economic and environmental consequences.

Disaster reduction specialists could use the EIA model to reorient disaster impact assessments so that they become a planning tool. A post-event impact assessment is an assessment of damage that has already occurred and is therefore not part of the planning process. However, the results can feed into future planning. Further collaboration between disaster reduction practitioners and environmental managers can generate better EIA techniques for use in disaster reduction.

A well designed EIA process incorporating disaster risk can be a key to encouraging the private sector and individuals to consider what impacts their own actions have on vulnerability factors.

**Box 5.12**

**Environmental impact assessments**

An environmental impact assessment (EIA) is a policy-making tool that provides evidence and analysis of environmental impacts of activities from conception to implementation. An EIA must include a detailed risk assessment and provide alternative solutions. It needs to be thorough and well documented and should provide an opportunity for the public to participate in accordance with the law.

An EIA report usually provides a detailed and rigorous analysis on which authorities can decide whether to approve a proposal and under which terms and conditions. Once a particular project is selected, it is monitored to ensure that conditions for approval are adhered to and that the benefits from the EIA are achieved. Monitoring, implementing and auditing within the EIA process provides feedback to further improvement.

However there is still some way to go before EIA processes are fully mastered. A study carried out by the Southern Common Market in South America (MERCOSUR) on the use of EIA showed that even though all three countries concerned had adopted EIA as a preventive environmental management tool, only Brazil had developed significant experience in this area. Furthermore, every emergency and rehabilitation or reconstruction action should be subjected to environmental impact assessment and documentation. This will avoid the re-emergence of inappropriate pre-disaster conditions.

Examples of disaster reduction concerns being integrated into EIA are scarce. The Caribbean Development Bank (CDB) is asking its borrowing member countries to include disaster mitigation measures in a similar manner in its EIA procedures so as to reduce risks associated with investments in their development projects. Furthermore one activity of the recently established Disaster Mitigation Facility for the Caribbean, a partnership of CDB and the Office for Foreign Disaster Assistance/US Agency for International Development (OFDA /USAID), is the development of guidelines for natural hazard impact assessment and their integration into EIA. CDB will also modify its environmental review guidelines.

In India, the regulation of environmental clearances for port projects requires an EIA report, an environment management plan, a risk

analysis study and a disaster management plan. The regulation specifies that the disaster management plan should be prepared on the basis of a risk analysis considering worst case scenarios with respect to specific cases such as oil or chemical spillage, fire, explosions, sabotage and floods. It encourages green buffer zones whenever possible.

As part of its environmental sustainability programme, partnerships to mitigate natural disasters in Viet Nam provide technical assistance for integrating environmental considerations into natural disaster mitigation plans. The relationship between natural disasters and environmental degradation is being studied and guidelines will be produced for the environmental implications of disaster mitigation projects.

**Reporting on the state of the environment**

As natural resources have the potential to reduce disaster risk, it is vital to have a regularly updated status of the environment, including emerging issues on management legislation and development. Some of the most relevant monitoring and reporting systems include:

- UNEP State of the Environment reports undertaken in the context of periodic Global Environmental Outlooks;
- IUCN environment profiles;
- State of the Environment reports for projects financed by the World Bank and other funding agencies;
- Organization of Economic Cooperation and Development (OECD) environmental performance reviews;
- UNCSD national reporting on implementation of Agenda 21, national assessment reports and country profiles; and
- national communications required by the conference of the parties of the international climate change, biodiversity and desertification conventions.

Reporting is a qualitative assessment tool and provides a framework for policy analysis and decision-making. Reporting facilitates the measurement of progress towards sustainable development.



**Box 5.13**

**The Global Monitoring for the Environment and Security (GMES)**

The Global Monitoring for the Environment and Security (GMES) was launched by the European Commission and a group of space agencies, including the European Space Agency for an initial period of 2001-2003.

“The GMES initiative seeks to bring together the needs of society related to the issue of environment and security with the advanced technical and operational capability offered by terrestrial and space-borne observation systems.”

In compliance with the goals of the European Research Area, the aim is to deliver to users a high level of technical information about the environment. It also aims to deliver guidelines (e.g. entire risk management operational systems) in order to develop security policies, including sustainable development policies, protection from environmental threats and natural disasters in Europe.

Continuous monitoring of resources and environmental conditions, detection and assessment of changes and hazards, and means for verifying the impact of policies and practices are its three areas of focus. It is seeking to become “the focal point of attention of a range of stakeholders in various fields related to environment monitoring.”

<<http://gmes.jrc.it>>

Efforts of countries to meet their environmental and sustainable development goals are scrutinized in order to improve their performance in environmental management and develop principles, guidelines and effective strategies to set their priorities better.

Natural disaster concerns are prevalent in these reports. Links between environmental management and flood damage are most frequently described. These reports can also provide essential baseline and vulnerability information on which to develop disaster reduction policies.

Existing reporting guidelines could easily be updated to include a requirement to systematically report on the environmental features and resources necessary to reduce disaster risks. The reporting process could also record ways in which societies mitigate risk through cultural adaptation and appraisal of natural resources.

Environmental mapping, in which community members are asked to locate relevant environmental features and resources on a self-created map of their territory, could be used for risk mapping, including social data such as access to resources by specific

**Box 5.14**

**Bangladesh state of the environment report**

The Bangladesh 2001 state of the environment report prepared under the aegis of UNEP has a well-developed and detailed section on natural disasters. The report describes in detail the disaster management bodies, their main functions and responsibilities in mitigating the impacts of natural disasters.

It includes the following information:

- general introduction on the types of disasters affecting the country;
- pressures on the environment that exacerbate natural disasters including geographical settings, physical, hydrological and environmental pressures;
- state of natural disasters: floods, cyclones, droughts, abnormal rainfall, hailstorms, lightning, tornadoes, earthquakes and erosion;
- impact of natural disasters: climate change, agriculture, salinity intrusion, fisheries, ecosystems and biodiversity; and
- present and anticipated mitigation responses.

Issue	Pressure/Cause	Impacts	Responses
Flood	Excess flow in monsoon Improper infrastructure development 92% of total catchment area across border Drainage congestion due to river bed siltation Deforestation in upper catchment area	Disruption of communication and livelihood systems Loss of agricultural production Disruption of essential services National economic loss Loss of human lives and biodiversity	Comprehensive Disaster Management Plan (CDMP ) Flood Action Plan (FAP) National Water Policy Flood forecast and inundation modelling Dredging of river bed Construction of embankments with sluice gates

groups or household wealth. Community involvement in mapping provides an occasion to discuss resource management issues, particularly with women highly involved as resource users and knowledgeable about indigenous knowledge, social networks and other capacities reducing vulnerability.

The global environmental vulnerability index developed by the South Pacific Applied Geoscience Commission (SOPAC) complements state of the environment reporting. It is a research tool to understand the effects of environmental processes and vulnerabilities, as well as the linkages between environmental vulnerability and human welfare. It is a tool for monitoring sustainable development that will encourage environmental stewardship and risk reduction policies.

### Ecological and environmental economics

It is essential to obtain an accurate picture of the socio-economic and ecological situation when assessing a nation's progress in achieving sustainable development. Of the three interactive spheres of sustainable development, the economic considerations remain dominant. Proving that the integration of disaster reduction with sound environmental management makes economic sense is a major challenge. So is the true valuation of the ecological balance needed to enhance the conservation of nature to reduce disaster risk.

Environmental economics utilizes the tools and mechanisms of economics to measure the value and costs of the environment in currency terms. In conventional economic frameworks, natural resources have been considered in terms of their worth for human use. Beginning in the 1970s, economic analyses to quantify socio-ecological factors began to be adapted.

Environmental economics is now moving beyond the interests of only academic research and international organizations. Decision makers worldwide have started to examine ways in which socio-ecological values and costs can be measured and incorporated in economic and political discourse.

There are numerous national models, including the older forms of National Resource Accounts,

#### Box 5.15

##### Relevant economic incentives and disincentives

- Tax incentives, subsidies and loans to compensate landowners or discourage certain land uses
- User charges, fees for downstream beneficiaries (domestic water use, agriculture, hydropower, fishery, recreation)
- Transfer of development rights to avoid undesirable development
- Easements, legal agreement to restrict type and amount of development taking place on a property
- Land purchase and property rights, usually restricted for exceptional lands (restricted land leases)
- Fines and liability system for damages caused to human settlements or environmental services
- Pricing structures to discourage unsound use of resources

National Systems for Environmental Accounting and the System for Environmental Economic Accounting.

These tools work to reduce fragmentation and overlap of activities that have often resulted in confused policies towards agriculture, tourism and environmental management. Additionally, they pose innovative opportunities to develop more robust indicators of sustainable development.

Quantifying socio-ecological considerations is a huge challenge for risk reduction and environmental management practitioners alike. It is also a challenge to get these concerns onto the political agenda.

From a practical point of view, grants, funds, loan guarantees and investment partnerships are some of the tools countries can use to promote issues that serve both environmental and disaster reduction goals. Other creative options for funding exist. Penalties used to reduce misuses of environmental resources such as in the case of wetlands destruction are also relevant. However limitations of the "polluter pays" principle have to be quickly overcome.

Money generated by trust funds for eco-services under multilateral agreements can be used in disaster reduction activities. The potential to use creative environmental debt reduction strategies can also be explored. Debt-for-nature swaps are used to protect crucial natural resources and the attributes inherently contribute to disaster reduction.





Innovative thinking to combine debt-for-disaster reduction swaps and debt-for-nature swaps could be initiated. This would help the poorest countries implement disaster reduction activities as part of their poverty alleviation strategies.

In a similar vein, other projects financed by the World Bank introduce the concept of incentive payments to realise a variety of environmental services. In Costa Rica, Colombia, Ecuador, El Salvador and Guatemala, projects have been initiated in the areas of sustainable natural resource management, watershed and forest protection, conservation of biodiversity, reduced vulnerability to floods, improved water quality and reduced sedimentation.

### Environmental codes and standards

Coping with environmental and natural hazard risks will require better environmental and disaster risk management. Avoiding economic losses through improved environmental management and performance is possible with the implementation of Environmental Management Systems (EMS) following procedures such as those of the International Organization for Standardization (ISO).

The ISO develops voluntary technical standards which are believed to add value to all types of business, administration and public utility operations. ISO 14000 is a set of generic tools for developing, implementing, maintaining and evaluating environmental policies and objectives.

They contribute to making the development, manufacturing and supply of products and services more efficient, safer and cleaner. Organizations establish their own policies, objectives and levels of ambition. These quality standards constitute an approach of responsible care, which combines safety and prevention of technological disasters.

If upgraded to include disaster resistance, standards for EMS could reinforce business imperatives by demonstrating the application of ISO 14000 to disaster reduction. This could be achieved by including environmental auditing, life cycle assessment, environmental labelling and environmental performance evaluation in EMS.

ISO certification also provides an important basis for communication with businesses, government, financial organizations and environmental groups. People at risk and the disaster community should be added to this list.

If the certification process provides information about the capability of an organization to achieve its stated environmental objectives, it has the potential to provide additional information on its capability to reduce vulnerability to disaster risk and achieve stated disaster reduction objectives.

Another benefit of certification is an expanded scope for marketing. In the same way that green or environmental labelling has emerged, disaster resilience labelling could also be realized. Relevant work in this area has started in Australia, for example.

## Future challenges and priorities

The main areas for future priority action are:

- exploration of the links between environmental degradation and hazard and vulnerability;
- identification and description of environmental knowledge that can be applied to reduce risk; and
- economic valuation of environmental actions.

Disaster and environment practitioners could apply adapted tools resulting in a greater sense of ownership and commitment. Capacities could also be developed for the increased use and regular improvement of these tools.

To achieve this, development of a common language should be encouraged which fosters the exchange of practices among experts in disaster management, environmental management, sustainable development and economics. In this regard, innovative forms of communication should be explored.

Some adjustments in policy frameworks might be necessary to reflect this approach to disaster reduction. Close collaboration would also be beneficial among institutions working on climate change adaptation, biodiversity conservation, land degradation, wetlands management, sustainable development and poverty alleviation. Finally, the integration of risk management with environmental policy will require community participation.