



## The Role of Ecosystem Management in Climate Change Adaptation and Disaster Risk Reduction

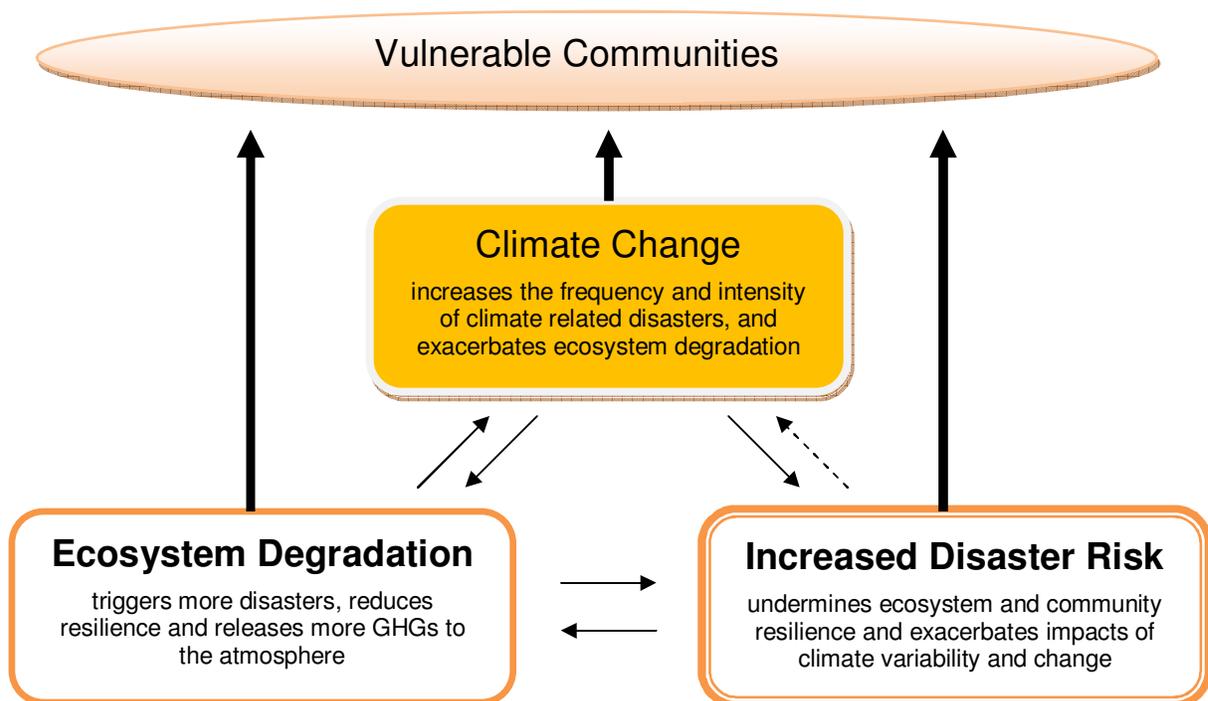
### Summary

This Issues Paper firstly analyzes the vicious spiral between climate change impacts, ecosystem degradation and increased risk of climate-related disasters; secondly, defines the central role of ecosystem management in climate change adaptation and disaster risk reduction and their multifaceted linkages; and thirdly, assesses the challenges for enhanced ecosystem management for climate change adaptation and disaster risk reduction.

Given the increasing importance of ecosystem management in adapting and responding to climate change impacts and associated disaster risks, the paper concludes that **political commitment at the highest level is urgently needed if ecosystem management is to have the adequate weight it deserves in the post-2012 climate change agreement**. It is further recommended that adequate financial, technological and knowledge resources be allocated for integrating ecosystem management in the climate change and disaster risk reduction portfolios, including within national policy-setting, capacity building, planning and practices, particularly in developing countries vulnerable to climate change impacts and increased risks of climate-related disasters.

### 1. Vulnerable communities at risk: climate change, ecosystem degradation and increasing risk of climate-related disasters

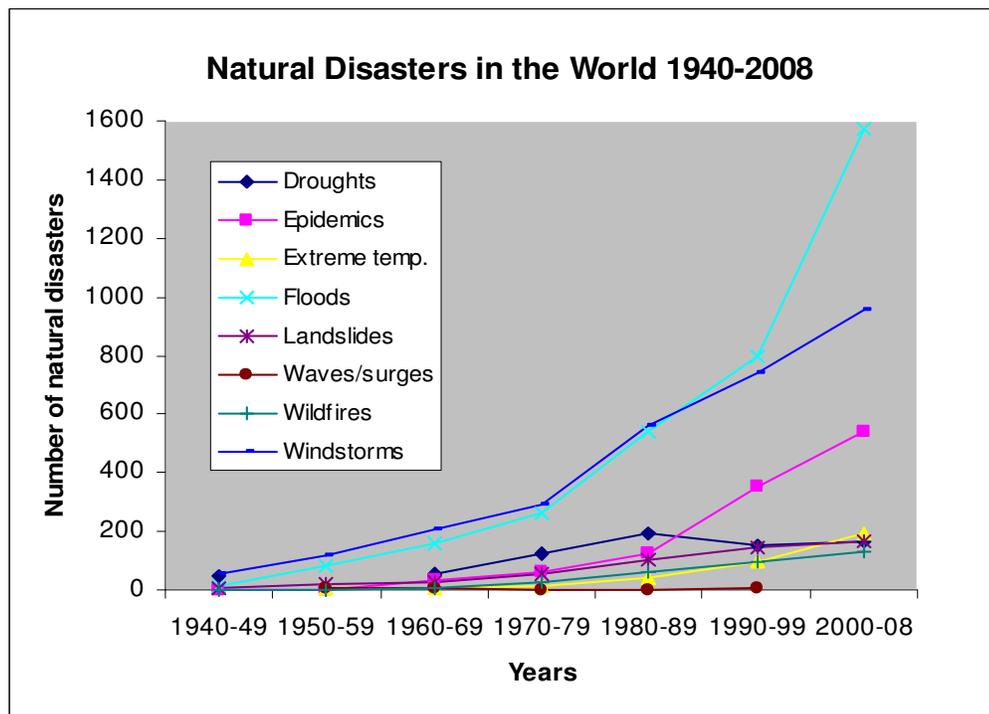
Science has established that global climate change increases the frequency and intensity of climate-related disasters such as floods, fires, and droughts, and causes ecosystem degradation. This in turn reduces the resilience of ecosystems and human societies against the impacts of climate change and the increased risk of disasters. Ecosystem degradation compromises the carbon sequestration ability of natural systems, and may turn these systems from carbon sinks to sources, thus exacerbating the downward spiral. Unwise use of ecosystems by human beings aggravates this vicious cycle as illustrated in Figure 1 below.



**Figure 1.** Simplified illustration of the complicated interactions between climate change, ecosystem degradation and increased disaster risk



- a) **Climate change increases the risks of climate-related disasters**, which cause the loss of lives and livelihoods, and weaken the resilience of vulnerable ecosystems and societies. Communities around the world are already vulnerable to the impacts of climate related hazards. Figure 2 shows a sharp increase in the occurrence of natural disasters such as floods, droughts, extreme temperatures, and wildfires from 1960 to 1989, and an even more rapid increase since 1990. While this trend may not be wholly attributable to climate change, the increase in the frequency and intensity of climate related hazards does correspond to temperature increase, and is projected to continue even if greenhouse gas emissions were to be stabilized today (IPCC, 2007), thus further aggravating the vulnerability of communities, assets and livelihoods.



**Figure 2.** Number of natural disasters in the world, 1940–2008. Sources: The OFDA/CRED International Disaster Database: [www.em-dat.net](http://www.em-dat.net) and "EM-DAT: The OFDA/CRED International Disaster Database [www.emdat.be](http://www.emdat.be) - Université Catholique de Louvain - Brussels - Belgium"

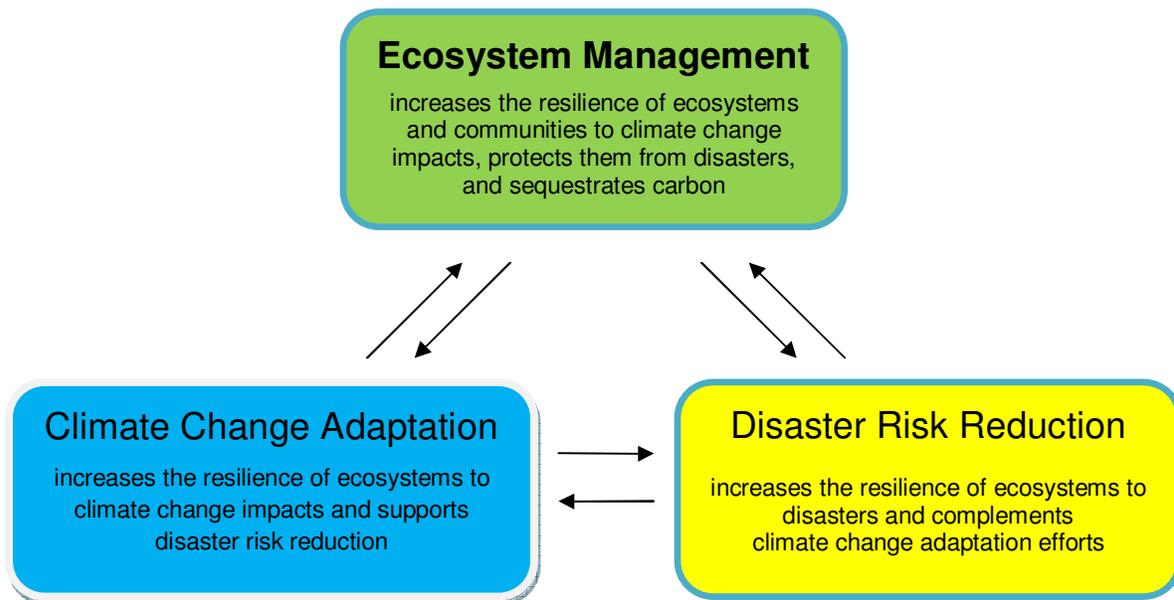
- b) **Climate change exacerbates ecosystem degradation.** The IPCC Fourth Assessment Report (AR4) projected, "The resilience of many ecosystems is likely to be exceeded by 2100 by an unprecedented combination of change in climate, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land-use change, pollution, over-exploitation of resources) (high confidence)." Tundra, boreal forest, mountains, Mediterranean-type ecosystems, mangroves and salt marshes, coral reefs and the sea-ice biomes are amongst these vulnerable ecosystems. Substantial changes in the structure and function of terrestrial, freshwater and marine ecosystems are very likely to occur. In particular, 20-30% of species assessed so far are likely to be at an increasingly high risk of extinction as global mean temperatures exceed 2 to 3°C above pre-industrial levels. If the temperature increases by more than 4°C, few ecosystems will be able to adapt, more than 40% of global ecosystems are projected to be transformed, and major extinctions will occur around the globe.



- c) **Ecosystem degradation triggers more disasters and reduces nature's and societies' resilience against climate change impacts and disasters.** Ecosystem degradation is a process which will eventually lead to the collapse of the ecosystem. The degradation process reduces the capacity of the ecosystem to buffer the impacts of climate change, for example, more frequent heavy rains, droughts, melting glaciers and sea level rise. Biodiversity loss from ecosystem degradation could cause the break down of food chains and eventually the collapse of the ecosystem, leading to biological disasters such as the invasion of new species. Hence ecosystem degradation also increases the vulnerability of natural and human systems to the impacts of disasters such as floods, landslides and storm surges. The worst case scenario is the collapse of the ecosystem, leading to the total loss of its buffering ability and other services to human well-being.
- d) **Ecosystem degradation reduces carbon sequestration in the ecosystems** and may turn them from carbon sinks to sources, exacerbating the vicious spiral. The IPCC projects that *"the terrestrial biosphere is likely to become a net carbon source by 2100, while ocean buffering capacity begins saturating, thus amplifying climate change, given continued greenhouse gas emissions at or above current rates and other unmitigated global changes, such as land use changes (high confidence)."*

## 2. Breaking the vicious spiral: The multiple benefits of ecosystem management

In a world where climate change is resulting in more unpredictable weather patterns, sea level rise and more frequent and extreme storms, the regulating services provided by ecosystems are critical for climate change adaptation and disaster risk reduction. Examples of these services include climate and water regulation, protection from natural hazards such as floods and avalanches, water and air purification, carbon sequestration, and disease and pest regulation. These services determine the central role of ecosystem management in climate change adaptation and disaster risk reduction as shown in Figure 3 below.



**Figure 3.** Central role of ecosystems in disaster risk reduction and climate change adaptation

The definitions of the three cornerstones in Figure 3 are listed in Box 1 below.



**BOX 1. Definitions of ecosystem management, climate change adaptation and disaster risk reduction**

**Ecosystem management** is defined in this paper as “an integrated process to conserve and improve ecosystem health that sustains ecosystem services for human well-being.” It is a summary of many definitions covering two streams of thinking: (1) maintaining or improving ecosystem health; and (2) ensuring the delivery of ecosystem services to human well-being.

**Climate change adaptation** is defined by the IPCC as “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”

**Disaster risk reduction** is defined by UNISDR as “The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.”

**a) Ecosystem management increases the resilience of natural systems and human societies to climate change impacts.** Managing ecosystems to conserve and improve their health is crucial for sustaining the various ecosystem services important to human well-being. Healthy ecosystems also act as buffers, increasing the resilience of natural and human systems to climate change impacts and disasters.

Ecosystem-based adaptation strategies cut across all sectors. Some examples of these strategies include using mangroves for coastal defense, flood plain management for flood defense, and maintaining genetic diversity for adaptation in the agricultural sector. Good practices already exist on the ground, such as wind-sheltering and breaks to increase resilience of rangelands in Sudan, re-forestation of mangroves to protect shorelines from storm surge and sea-level rise in the Philippines, sea-level rise land acquisition programmes in the US, and drought adjustment of planting dates and crop varieties in Mexico and Argentina. However, these practices are limited and very much on an *ad hoc* basis, and much more needs to be done. Two major approaches for adapting to and managing climate risks are already in place to enhance the role of ecosystem management, and full advantage should be taken of them: Integrated Water Resource Management (IWRM) to manage increasing water scarcity, and Integrated Coastal Zone Management (ICZM) to manage the threat of sea level rise.

**b) Ecosystem management also maximizes co-benefits of mitigation of climate change** by reducing emissions and fixing carbon through good practices such as Land Use, Land Use Change and Forestry (LULUCF) activities and Reduced Carbon Emissions from Deforestation and Forest Degradation (REDD), reducing the loss of natural habitat and deforestation as well as increasing or maintaining carbon stocks in ecosystems. Managing ecosystems to enhance biological carbon sequestration (biosequestration) is a promising tool in the efforts to mitigate climate change, and may often also support the achievement of other societal goals. The discussion about possible ways of reducing carbon emissions in various land uses, such as forestry and agriculture, is gaining momentum. Given the high rates of global forest loss and associated GHG emissions (18-25% of annual emissions), reducing emissions from deforestation and forest degradation would make a major contribution to meeting emission stabilization targets.

**c) Ecosystem management provides physical defense from climate-related disasters.** Healthy ecosystems protect societies from disasters and improve their ability to cope with the impacts. Mountain meadows, bushes and forests protect people in the downstream from landslides and flash floods from glacier lake outbursts due to the accelerated melting of high mountain glaciers and snows. Coral reefs provide offshore breakwaters which reduce the impacts of sea surges and tropical storm waves before



they reach the shoreline. Mangrove forests act as revetments or dikes: depending on their health and extent, mangrove forests can mitigate 70-90% of the energy from wind-generated waves (UNEP-WCMC 2006).

**d) Climate change adaptation and disaster risk reduction increase the resilience of ecosystems.**

There is a need for proactive adaptation and disaster management measures to reduce the negative impacts of climate change and disasters on ecosystems. Well designed adaptation measures can increase the resilience of ecosystems, and also reduce the risk of climate-related disasters. Adaptation is a process starting from identifying and projecting climate change impacts to fully responding to these impacts by reshaping the development pathways and ways of ecosystem management. It helps disaster risk reduction in terms of being prepared for and protected from future climate-related disasters. On the other hand, disaster risk reduction contributes to the overall adaptation process, and if done well, can enhance the adaptation process by establishing the foundation for addressing long-term climate change impacts. Climate change adaptation and disaster risk reduction are both dependent on the regulating services provided by ecosystems, and contribute to building their resilience.

**3. Enhancing ecosystem management: from science to policy to action**

**The facts shown above make clear the central role of ecosystem management in climate change adaptation and disaster risk reduction, both of which are significant priorities in the international environmental and political agenda such as those of the UNFCCC and Hyogo Framework for Action. However, while the science is clear, corresponding policy needs to be more explicit and action on the ground needs to be enhanced.**

The science is clear and calls for action, yet there is no explicit recognition of the role of ecosystems or actionable policies set in the UNFCCC or its Bali Action Plan agreed at COP13. While the Hyogo Framework for Action recognizes ecosystem management as an essential element of reducing underlying risk factors, efforts at environmental management for disaster risk reduction have been largely on an *ad hoc* basis. Amongst the multilateral environmental agreements, only the Convention on Biological Diversity (CBD) through its Ad Hoc Technical Expert Group on biodiversity and climate change, has started addressing the linkages between ecosystem management, climate change adaptation and disaster risk reduction.

National policies and local actions taking an integrated approach to address the downward spiral of climate change impacts, ecosystem degradation and increased climate-related disasters are largely lacking. The current National Adaptation Programmes of Action (NAPAs) under the UNFCCC are limited to least developed countries and merely include a vague role of ecosystem management. It is of paramount importance to prioritize the role of ecosystems across all countries. Climate change can trigger a broad shift towards a global civilization that is sustainable, but only when we seize the opportunity and start acting now. A few vulnerable countries are taking action despite the slow political processes in the international negotiations.

**4. Key message to COP15: urgent need for highest level political commitment**

It is obvious that many countries have been quick to show commitment to climate change adaptation and disaster risk reduction. However, the role of ecosystem management, though central to both climate change adaptation and disaster risk reduction, has yet to be well recognized at the political level. In recent years, several Parties to the UNFCCC have started to recognise the central role of ecosystem management in climate change adaptation and disaster risk reduction, and called for ecosystem-based adaptation in the context of the Long-term Cooperative Actions (LCA) at the 14<sup>th</sup> Conference of the Parties in December 2008. More work however needs to be done before this recognition becomes the consensus of all the Parties to the UNFCCC. COP 15 in December 2009, from which the world is eagerly



expecting a post-2012 climate change agreement, will provide a crucial opportunity for increasing the profile of ecosystem management and highlighting its important role in climate change adaptation and disaster risk reduction.

**Given the increasing importance of ecosystem management in adapting and responding to climate change impacts and associated disaster risks, political commitment at the highest level is urgently needed if ecosystem management is to have the adequate weight it deserves in the post-2012 climate change agreement. Political support is also needed for the systematic integration of ecosystem management into climate change adaptation and disaster risk reduction policy frameworks and practices. It is further strongly recommended that adequate financial, technological and knowledge resources be allocated correspondingly for integrating ecosystem management in the climate change and disaster risk reduction portfolios, including in national policy-setting and awareness raising, capacity building, planning and practices, particularly in developing countries vulnerable to climate change impacts and increased risks of climate-related disasters.**

The UNFCCC Secretariat at its Vienna conference (2007) on “Investment and financial flows to address climate change” estimated that by 2030 developing countries will require additional financial support between 28-67 billion USD a year to enable adaptation to climate change. Globally, overall additional investment and financial flows needed for adaptation in 2030 amount to several tens of billion USD. There are allocations in this estimation for various sectors, yet adequate financial resources should also be explicitly allocated for ecosystem management in the climate change portfolio. The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN REDD), supported by the Government of Norway, has set a very good example of the use of ecosystem management for biosequestration and reducing carbon emissions. It is recommended the same approach be applied to use ecosystem management for climate change adaptation and disaster risk reduction.

Meanwhile, knowledge and technology support to vulnerable countries should also be adequate and timely. For instance, there is a need to start developing guidance on mixed engineered/ecosystem-based adaptation and disaster risk management solutions.

An unprecedented level of cooperation is urgently required from the policy and scientific communities to act on the combined threats of climate change, disasters and continuous ecosystem degradation. This will help foster closer links between ecosystem management, climate change adaptation and disaster risk reduction communities, as well as between science and policy such as the links between the IPCC and UNFCCC and IPCC, CBD and the IPBES<sup>1</sup> process, and catalyze North-South and South-South cooperation.

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