

## Managing ecosystems for disaster reduction services: examples from around the world

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Healthy ecosystems buffer against disasters stated the United Nations University (UNU) in their newsletter (UNU, 2006). As ministers met at the Eighth Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP-8), the UNU urged governments to incorporate the Millennium Ecosystem Assessment findings (see Millennium Ecosystem Assessment, 2005) in national planning processes and poverty reduction strategies to promote ecosystem services that may help reduce the impacts of disasters. Ecosystem services and goods are the benefits, both tangible and intangible, that ecosystems provide.

A major problem of ecosystem services is that they often become evident to humans only after ecosystems have been degraded and risk reduction services cannot longer be provided. Examples are the increase in flood, fire, landslide and drought hazards in fragile tropical forest ecosystems where coca and poppies are cultivated intensively. Another example is the increased frequency of avalanches after cutting forests on steep Alpine slopes.

A widely accepted definition for disaster is hazard  $\times$  vulnerability. A natural hazard is 1) a result of tension release in the surface of the earth (earthquakes and volcanic eruptions) or 2) a natural process due to local topography (gravity driven) either or not combined with meteorological factors. All of those form inherent parts of ecosystems. The vulnerability of humans to natural disasters is also very much determined by the ecosystems they live in and how they use them. Evidence from the Indian Ocean tsunami confirms that in some cases well-established mangrove forests and coastal tree plantations acted as effective wave breakers and helped save both lives and property. The tsunami has also shown the importance of forests in post-disaster recovery, by providing timber for the reconstruction of homes and the fishing boats on which the livelihoods of tens of thousands of families depend. Another example is Iran, where the negative effects of the severe drought, which affected the country from 1999 through 2002, were magnified by non-climatic factors. While severe deficits of precipitation occurred in this period the drought was magnified by an irrigation water efficiency of only 35 percent, which suggests that two thirds of the water is lost, in combination with the cultivation of high water-consuming plants. More than 25 percent of drinking water is lost in eroded pipes. Rangelands were being used for grazing three times more than their peak capacities in a non-drought year, resulting in severe degradation as well as accelerated soil erosion (after UNDP, 2004).

A third example, which is comparable to the function of the mangrove forests during the tsunami are protection forests in the Alps. Such forests cover steep slopes above villages and important infrastructure and protect those against snow avalanches or falling rocks. Without

these forests, the costs of building and maintaining technical protective constructions to decrease the vulnerability of the local populations and their infrastructure would be unaffordable.

To synthesise the above paragraphs we can state that ecosystems play a role in both the hazard factor and the vulnerability factor of natural disasters. Ecosystem management, adapting to disasters that could occur, influences the level of vulnerability of populations, but also in some cases the magnitude of the hazards that occur. An example of the latter is the protection forest in the Alps that reduces the sizes of avalanche release zones and therefore their magnitudes.

Ecosystem management has traditionally been formulated as regulating our use of ecosystems so that basic ecosystem functions, but also their services and goods can be sustained. I would like to add that active intervention in ecosystem functioning, either by creating disturbances or preventing natural disturbances, is also part of ecosystem management. Strictly taken, the reparation of an irrigation system to prevent water loss and therefore optimising the water use would be a form of ecosystem management. In ecosystem management, ecological techniques, but also civil engineering techniques as well as land-use and development planning methods can be used. It assumes that humans are part of the ecosystem and places their needs at the centre of the management approach that strives for maintaining balance between those needs and the functions that are essential for ecosystems. As such the human scale is very important, which means that local diversity plays an essential role in the management strategy. A bad example of ecosystem management would be an extensive drainage plan for Bangladesh, using polders and dikes following the Dutch example. Such a plan would solve the flooding and a part of their malaria problem, but it would also destroy the whole ecosystem, including different habitats that currently serve as livelihoods for the local population.

Why do ecosystems have to be managed? In case of overexploitation, illegal cultivation or forest cuttings as well as in catchments where large dams cause problems for environmental flows downstream the environmental problems are clear. Such cases require intervention. In some cases, however, intervention is required in ecosystems that lost or risk losing their function of providing services that help reduce the impacts of disasters. This could be due to an extreme event, but it could also be the result of natural evolution. A good example of the latter is again the protection forest in the Alps. Mountain forests are self-organising ecosystems if regarded at a landscape scale. They normally do not need any silvicultural intervention for their continued existence. But some forests have become degraded as a result of (former) over-harvesting or heavy ungulate browsing and need to be managed in order to provide sufficient protection. This means that some forests can be left untouched, others can be managed and some need to be managed. Management can vary from silvicultural/eco-engineering to civil engineering techniques. Eco-engineering techniques refer to creating linear gaps to promote natural regeneration by selectively cutting trees and leaving the stems in the forest, which will then act as barriers against hazardous mass movements. Civil engineering techniques refer to the installation of nets, barriers and dams.

A second major problem of ecosystem services, in addition to the earlier mentioned problem of only becoming evident to humans after the ecosystem cannot longer provide risk reduction services, is their high replacement cost and their perceived low market price. Taking the example of a protection forest covering 1 ha that protects a village in the valley against snow avalanches. Replacing this forest by steel snow avalanches barriers would cost 220.000 Euro (expected lifetime 100 years). Optimising the existing forest costs 15.000 Euro (required 2 - 4 times in 100 years). However, it is currently hardly impossible to obtain the same amount as the replacement cost for direct investments in forest management in the Alps. This money would help to keep the disappearing culture landscape open and attractive, the protection forests stable and in good quality and biodiversity in Alpine catchments high. The installation of steel barriers, on the other hand, provides work for a few people from the local village. Instead of investing in the existing ecosystem, something new, expensive and technological is put in place, which is in the eyes of the policy and decision makers often much better than the existing forest ecosystem. This is another problem of selling ecosystem services. Economic valuations of ecosystem services are therefore required to show that investments in nature cannot only be effective but also beneficial. Techniques for doing this are explained in Emerton and Bos (2004).

A major question is where, when and how ecosystem management for disaster reduction should be done in practice throughout the world. In the Alps, detailed technical management guides are increasingly available. The technical side of ecosystem management is, however, only one part of it. This part is currently the most developed as much knowledge on natural hazards and disasters is already available. With regards to the political process, which should aim at building support for integrating ecosystem management into disaster reduction strategies, we are just at the beginning. The special session entitled “Managing ecosystems for natural disaster reduction services: examples from around the world” will present possibilities and limitations of ecosystem management for disaster reduction in different parts in river catchments in different regions around the world. An important issue that will be discussed is how stakeholders can be convinced that ecosystem management, in combination with civil engineering if required, for natural disaster reduction could be effective and beneficial. In addition, we will launch the IUCN-CARE-IWMI book on ‘Ecosystems, Livelihoods and Disasters – An Integrated Approach to Disaster Reduction’ (downloadable at: <http://app.iucn.org/dbtw-wpd/edocs/CEM-004.pdf>).

## References

- Emerton, L. and Bos, E., 2004. *Value. Counting ecosystems as an economic part of water infrastructure*. IUCN, Gland, Switzerland and Cambridge, UK, 88 p.
- Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC, 137 p.
- UNDP, 2004. *Reducing disaster risk: a challenge for development. A global report*. Bureau for Crisis Prevention and Recovery, United Nations Development Programme. New York, USA, 146 p.
- UNU, 2006. Healthy ecosystems buffer against natural disasters. *Update.unu.edu* [online], issue 41, March-May 2006. Available from: [http://update.unu.edu/issue41\\_20.htm](http://update.unu.edu/issue41_20.htm) [Accessed 1 June 2006].