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Forests and Adaptation to Climate Change: What is at Stake?

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Locatelli and Pramova assert that the linkage between forests and climate adaptation is two-fold: first, forests play a role in the adaptation of broader society (‘forests for adaptation’); second, adaptation is needed for forests (‘adaptation for forests’). In the first instance, they argue that since forests provide services that enhance human well-being and reduce social vulnerability, they should be considered in planning adaptation policies and practices across broader areas of the economy. In the second instance, because climate change drives change in forests, they urge the need to implement measures for reducing negative impacts of climate change on forests. The paper also explores the emerging concept of “ecoystem-based adaptation.”

While forests have a place in science and policy related to climate change mitigation, their place in climate adaptation still needs to be built up. The linkage between forests and adaptation is two-fold: first, forests play a role in the adaptation of broader society (**‘forests for adaptation’**); second, adaptation is needed for forests (**‘adaptation for forests’**). In the first instance, because forests provide ecosystem services that contribute to human well-being and reduce social vulnerability, forests should be considered when planning adaptation policies and practices in areas of the economy beyond the forest sector. In the second instance, because climate change is an important driver of changes *in* forests, we need to define and implement measures for reducing the negative impacts of climate change *on* forests. We present the challenges and opportunities related to both ‘forests for adaptation’ and ‘adaptation for forests’.

A Vital Role for Ecosystems

It is increasingly recognized that well-managed ecosystems can help societies to adapt to both current climate hazards and future climate change by providing a wide range of ecosystem services (Turner et al., 2009). A secure flow of ecosystem services can significantly reduce social vulnerability. For example, mangroves protect coastal areas against storms and waves, forest products provide safety nets for local communities when agricultural crops fail and hydrological ecosystem services (such as base flow conservation, storm flow regulation, and erosion control) are of utmost importance for buffering the impacts of climate change on water users. The conservation and sustainable management of ecosystems and their services can generate multiple socio-ecological benefits and also promote long-

term approaches to climate change adaptation (CBD, 2009).

Maintaining nature's capacity to buffer the impacts of climate change is often less costly than having to replace lost ecosystem functions by heavy infrastructure or technology. According to the Economics of Ecosystems and Biodiversity group (TEEB, 2009), cost-benefit analyses indicate that public investment should support ecological infrastructure (forests, mangroves, wetlands, etc.) because of their contribution to adaptation to climate change. In many cases, an ecosystem investment can be justified solely on the basis of one valuable service but it becomes even more attractive when the whole range of services is considered (TEEB, 2009). Additionally, ecological infrastructure can often be more adaptive than engineered infrastructure because ecosystem management can be modified more easily in the face of unexpected changes. Ecosystem management can also strive to enhance ecological resilience and facilitate natural adaptation processes, so that ecosystems can adapt to unanticipated environmental changes and continue to deliver services.

Challenges

However, deforestation and forest degradation are observed in most tropical countries, where forest sustainable management and conservation still face major barriers. Climate change is now adding new challenges related to the many uncertainties involved, the potential scope and severity of impacts, and the unprecedented speed and type of change that threatens to undermine fundamental ecosystem resilience (IPCC 2007). Although environmental management problems have always been associated with varying levels of uncertainty, limited information, and risk, we need to rethink and reform management and conservation approaches in the face of climate change. It is difficult to extrapolate from current ecological knowledge how ecosystems will adapt to a changing climate and how cumulative ecosystem vulnerability might evolve. Models show us that climate change will very likely affect the distribution of ecosystems and species, with consequences for the flow of ecosystem services. Decision-making approaches that assume static natural resource conditions might then lead to ecologically inappropriate, socially undesirable and costly interventions.

Ecosystem goods and services can help societies adapt to climate change but they can also be degraded as a result of badly planned adaptation actions. Maladaptation and short-term coping strategies may create additional pressures on ecosystems, for example if forest products used as safety nets come from unsustainably managed forests. This suggests that new approaches are needed to ensure that ecosystems are considered when planning adaptation measures and projects. In particular, there is a need to increase cross-scale and cross-sectoral linkages in adaptation planning, as ecosystem benefits and management costs generally occur in different locations and in different sectors of society.

Ecosystem-based Adaptation: an Emerging Concept

Ecosystem-based adaptation (EbA), an emerging concept both in science and in international discussions on climate change and biodiversity, offers opportunities for both ecosystems and ecosystem-dependent communities to overcome the challenges mentioned above (IUCN, 2009). EbA is a set of adaptation policies or measures that consider the role of ecosystem services in reducing the vulnerability of society to climate change in a multi-sectoral and multi-scale approach (Vignola et al. 2009). Such policies and measures also aim at reducing the vulnerability of ecosystems and their services to different threats, including climate change and land-use change.

EbA strategies can target the conservation or restoration of specific ecosystem services that are crucial for societal adaptation in a particular region. For example, many forests are already managed for ensuring a reliable provision of clean water for societies, but management plans and priorities may need to be modified in the future under climate change. Stakeholders might choose to focus on certain goods and services that they value more for their contribution to social resilience. Forest management can evolve towards a better conservation of water in places where the population is particularly vulnerable to changes in water quantity or quality. Furthermore, such strategies can be cost-effective and generate a variety of environmental, social, economic and cultural co-benefits. Thus, they may well have the potential to align objectives that can otherwise be conflicting, namely poverty alleviation, development, biodiversity conservation, and climate change adaptation and mitigation (CBD 2009).

In order to ensure that ecosystems like forests will be able to contribute to the adaptation of broader society and to provide multiple co-benefits, EbA must reduce current threats to ecosystem services (e.g., deforestation and forest degradation) as an important first step for reducing forest ecosystem vulnerability. However, it should also aim at reducing *future* threats by implementing forest adaptation to climate change. In this sense, EbA is an overarching framework for forests and adaptation, in which 'adaptation for forests' is needed to ensure the role of 'forests for adaptation' (Locatelli et al., 2010). In places where ecosystem conservation and sustainable management are already being implemented and non-climatic threats are minimized, specific adaptation measures can be incorporated into those practices. Forest adaptation measures for example can aim to buffer forests from perturbations or facilitate evolution of the ecosystem towards a new state that meets altered conditions (Guariguata et al., 2008). Buffering measures focus on preventing perturbations such as fire, invasive species, insects and diseases. Measures that facilitate system shift or evolution do not aim at resisting or reverting changes, but rather at easing transitions and managing natural adaptation processes that would lead the ecosystem towards a socially-acceptable state. An example of a facilitating measure is the reduction of landscape fragmentation to enhance connectivity between habitats which in turn eases species migration. Another facilitating measure for forests consists of conserving a large spectrum of forest types for their value and resilience; for instance, ecosystems across environmental gradients or biodiversity hotspots.

One of the first two adaptation projects accepted in the UNFCCC Adaptation Fund in September 2010 is a good example of EbA. This project aims to improve water management and decrease water problems for the poor in the Honduras capital region of Tegucigalpa. It puts a strong emphasis on the role of forests in regulating water and the negative impacts of deforestation in water catchments. According to the project document, ecosystem management (including the creation of protected areas) must consider issues of water supply for cities and sensitive ecosystems such as cloud forests. The project developers recognize that there are currently no mechanisms in place to conserve the forests and 'green belts', which provide important ecosystem services and are threatened by deforestation and urbanization. In addition to this emphasis on 'forests for adaptation', the project also addresses 'adaptation for forests' by aiming to increase the connectivity between protected areas around Tegucigalpa for increasing ecosystem resilience as the climate changes. This project is a positive sign of mainstreaming forests into adaptation policies, as well as adaptation into forest management.

Next Steps

There is a need to better understand EbA and its benefits. This approach to adaptation is not a panacea but has the potential to improve the sustainability of adaptation strategies and more research is needed to evaluate when, where and for what problems EbA is an effective and efficient approach. For this purpose, improved analyses of the trade-offs between different land-uses are needed in order to better manage landscapes for reducing social vulnerability to climate change. We also need to better understand the trade-offs between short term and long term benefits of EbA and other adaptation strategies. A more comprehensive understanding of the temporal dimensions of change might be useful to evaluate how ecosystems and resource uses might change in landscapes. This can lead in turn to the preparedness of stakeholders regarding possible impacts and the anticipated development approaches to deal with them. Evolving human values and a range of associated socio-cultural factors will influence what kind of change and strategies are acceptable and for this reason it is critical to engage stakeholders in scenario building and decision making.

Adaptive management lies at the core of EbA strategies where, ideally, actions are monitored, evaluated and adjusted based on a continuous re-assessment of the risks and vulnerabilities of both ecosystems and societies. Forest stakeholders for example can implement different adaptation measures and observe the outcomes. As monitoring must be in place to enable reflection and new decisions, sets of criteria and indicators related to forest management and human well-being should be applied. Within the framework of adaptive management, both science and local knowledge systems play an important role in understanding forest dynamics and the effects of the actions carried out.

As far as forest ecosystems are concerned, sustainable forest management (SFM) can provide an effective framework for addressing forest adaptation in an integrated manner as SFM practices adopt a holistic approach including social, economic, and environmental goals. A widely agreed definition of SFM is "a dynamic and evolving concept aiming to maintain and enhance the economic, social, and environmental values of all types of forests for the benefit of present

and future generations”• . Adaptation to climate change can be incorporated into the thematic areas of SFM through an adaptive and participatory management approach.

An important challenge for effective EbA is determining the roles and responsibilities of stakeholders involved in adaptation. Various levels of government, private actors in the forest sector, and local and indigenous communities will need to adjust their activities to adapt to the effects of climate change on forests. Among these groups, differing perceptions of risk and levels of responsibilities may create barriers in the negotiating and decision-making processes for adaptation. Multi-stakeholder learning is absolutely essential if we are to overcome these challenges, build adaptive capacity and encourage different governance models, including community-based conservation. Investing in the institutions needed for flexible, participatory and adaptive management of ecosystems will give societies a solid foundation for negotiation and mobilization in order to reduce vulnerability.

EbA also presents the challenge of developing and applying policy instruments that integrate forests into societal adaptation. The instruments must link different sectors, especially sectors managing forests and sectors benefiting from forest ecosystem services. Using forests for adaptation will modify the costs and benefits of forest management. If the objective of providing ecosystem services to vulnerable sectors is added to the objectives of forest management, forest managers may face higher costs or lower benefits, while other sectors may receive benefits from ecosystem services (GlÃ¼ck et al. 2009). Financial transfers from sectors benefiting from ecosystem services to sectors managing the ecosystems could be encouraged through EbA. These financial transfers may help remove the financial barriers to SFM and forest adaptation in a cross-sectoral way, with payments for ecosystem services appearing as a natural instrument, in addition to other instruments facilitating information sharing and technical assistance.

In theory, EbA represents an opportunity for achieving the dual purpose of better managing forests and facilitating sustainable processes of societal adaptation. In practice, EBA requires new modes of local and national governance that include multi-sectoral processes, stakeholder participation, and flexible institutions, such as policy networks (or network governance) (GlÃ¼ck et al. 2009). EBA can also be facilitated by a better integration of international policies related to forests, climate change mitigation and adaptation, and biodiversity. For instance, a global mitigation mechanism such as REDD+ (Reduction of Emissions from Deforestation and Forest Degradation) has the potential to contribute to adaptation by improving local livelihoods, strengthening local institutions, and conserving ecosystem services. But REDD+ can also have negative effects on the adaptive capacity of local forest people by reducing their access to land and forest resources. Therefore, a better integration of policies for adaptation and mitigation in forests is necessary at the local, national, and international levels.

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