CLIMATE CHANGE AND DEVELOPMENT

CONSULTATION ON KEY RESEARCHABLE ISSUES

SECTORAL ISSUES
SECTION 2.6. ECOSYSTEMS
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Climate Change and Ecosystems

Links between climate change and ecosystem changes and biodiversity are firmly established. Observed climate change, especially warmer regional temperatures, has already affected biodiversity and ecosystems, causing changes in species distributions, population sizes, the timing of reproduction or migration events and an increase in the frequency of pest and disease outbreaks (Gitay *et al*. 2002; Kappelle *et al*. 1999; Parmesan and Yohe 2003; Root *et al*. 2003; Walther *et al*. 2002). Climate change is projected to increase the risk of extinction for many species (Thomas *et al*. 2004). The Millennium Ecosystem Assessment (Reid *et al*. 2005) identifies climate change as one of "The most important direct drivers of change in ecosystems" and states that "By the end of the century, climate change and its impacts may be the dominant direct driver of biodiversity loss and changes in ecosystem services globally."

Different ecosystems suffer varying levels of stress. Many coral reefs have undergone major, although often partially reversible, bleaching episodes when local sea surface temperatures have increased (Buddemeier *et al*. 2004). Among the major biomes, climate change is likely to be the dominant driver of biodiversity change in tundra and deserts, whereas species invasions and water extraction are important drivers for freshwater ecosystems (Reid *et al*. 2004).

The Millennium Ecosystem Assessment also notes evidence for climate change (in combination with other stresses such as over-harvesting, invasive species and nutrient loading) increasing the likelihood of non-linear changes in ecosystems (including accelerated, abrupt and potentially irreversible changes), and the important consequences of this for human well-being. Examples of large-magnitude non-linear changes as a result of climate change include (Reid *et al*. 2005):

- Disease emergence; warming of the African Great Lakes may create conditions that increase the risk of cholera transmission in nearby countries.
- Regional climate change; deforestation generally leads to decreased rainfall. Forest existence depends on rainfall, so the relationship between forest loss and precipitation decrease can form a positive feedback loop .

Climate change induced ecosystem changes are subject to high inertia. This means that the time frame for solving ecosystem-related problems once they are identified is long, and that the impact of climate change drivers cannot be lessened for years or decades (Reid *et al*. 2005).

Links between climate change, ecosystems and poverty alleviation have been less well explored in published literature. Poor people generally depend more on ecosystem services and products for their livelihoods than wealthy people (Reid 2004; IISD 2003; Nyong 2005). Poor people are therefore severely affected when the environment is degraded or their access to it is restricted (Bass *et al*. 2005). Those most vulnerable to climate change are the poorest groups in the poorest countries of the world. This is because they live in areas more prone to flooding, cyclones, droughts etc., and because they have little capacity to adapt to such shocks. They are often heavily dependent on climate-sensitive sectors such as fisheries and agriculture, and the countries they live in have limited financial, institutional and human capacity to anticipate and respond to the direct and indirect impacts of climate change (Huq *et al*. 2003).

Climate change will probably adversely affect ecosystem services therefore posing development challenges, including providing clean water, energy services, and food; maintaining a healthy environment; and conserving ecological systems, their biodiversity, and their associated ecological goods and services. Examples from the Millennium Ecosystem Assessment (Reid *et al*. 2005) include:

- Water availability and quality are projected to decrease in many arid and semiarid regions (high certainty).
- The incidence of vector-borne diseases such as malaria and dengue and of waterborne diseases such as cholera is projected to increase in many regions (medium to high certainty)
- Agricultural productivity is projected to decrease in the tropics and sub-tropics (low to medium certainty) and there are projected adverse effects on fisheries.

Some ecosystem services in some regions may initially be enhanced by projected climate changes. As climate change becomes more severe, however, the harmful impacts on ecosystem services outweigh the benefits in most regions of the world (Reid *et al*. 2005).

Conservation of biodiversity and maintenance of ecosystem integrity appear to be imperatives in improving the adaptive capacity of poor groups to cope with climate change. Functionally diverse systems may be better able to adapt to climate change and climate variability than functionally impoverished systems. A larger gene pool will facilitate the emergence of genotypes which are better adapted to changed climatic conditions. As biodiversity is lost, options for change are diminished and human society becomes more vulnerable.

Links between climate change, biodiversity and desertification have begun to be explored by those seeking synergies between the three main multilateral environmental agreements (De Koning and Gamperl 2002; Gitay *et al*. 2002; Reid 2003; Watson *et al*. 1998; CBD Ad Hoc Technical Expert Group on Biodiversity and Climate Change 2003). Successful implementation of technologies and measures that can combat desertification or enhance biodiversity often have the additional benefit of creating environments that can better mitigate or adapt to climate change. However, synergies are not easily effected because the different multilateral environmental agreements have separate constituencies, administration arrangements, negotiators and guiding scientific bodies (Raustiola 2001). Proven links between climate change, ecosystem change and poverty should influence how countries tackle the Millennium Development Goals (MDGs) and will also need addressing through national development plans such as Poverty Reduction Strategy Papers (PRSPs).

Responses to climate change can impact biodiversity and livelihoods, and likewise biodiversity can provide opportunities to respond to climate change. Mitigation activities include investment in renewable energy (bio-energy plantations, hydropower schemes etc.), the Clean Development Mechanism, offsetting carbon emissions from institutional/individual activities, and forest or peatland conservation and management activities. Some of these activities only support climate change mitigation but other activities have additional ecosystem and livelihood benefits (Naughton-Treves 2004; Reid 2003; Reid 2004). Non-structural alternatives to big infrastructure projects (to mitigate or adapt to climate change) and 'bottom-up' approaches rooted in existing community-based strategies for managing resources and reducing vulnerability to climatic shocks would benefit from greater support (Burton *et al*. 2003; Reid and Alam 2005). Examples of such projects include local

agro-ecological activities in Nicaragua, Honduras and El Salvador, electricity generation from biogas in Brazil and mangrove rehabilitation in Vietnam (Reid 2004).

Key actions that improve ecosystem management, and are also likely to improve the power of poor people to reduce their vulnerability to climatic shocks and creeping climate change impacts, are worthy of greater support. These would include:

- Natural resource governance initiatives, such as country-led national forest programmes – which are showing promise for integrating ecosystem health and human well-being where they are negotiated by stakeholders and strategically focused (Mayers and Bass 2004).
- Local responses to problems of access and use of natural resources – which are collectively more significant than efforts led by governments or international processes but require their support to spread. E.g. *campesino* forestry organizations in Central America, forest user groups in Nepal, the National Council of Rubber Tappers in Brazil, people's natural resource management organizations in the Philippines, and the Landcare movement in Australia. Policy frameworks could better assist such groups to build on what they are already doing and to enable new partnerships (Sizer *et al*. 2005).
- Government-community collaborative resource management and company-community partnerships – in which local people link with other key actors to win more benefits for themselves where they have strong local organizational capacity and political capital to mobilize resources and negotiate for better benefits (Borini-Feyerabend *et al*. 2004; Mayers and Vermeulen 2002).
- Enabling people who live with natural resources to secure their rights and strengthen their powers to negotiate fair division of control, responsibility, and benefits with other actors (Ribot and Larson 2005).
- Development of semi-natural and mixed-species, mixed-age farm-scale and large-scale plantations where land degradation has occurred – these can provide a large range of products, provide 'insurance' against unfavourable market conditions, reduce the effects and economic consequences of insect and disease attacks, harbour considerable diversity of flora and fauna and contain the spread of wildfires (CIFOR 2003).

Key Research Questions:

- What makes ecosystems resilient to climate change?
- How can increased ecosystem resilience to climate change support human adaptive capacity?
- Where are the 'hotspots' for ecosystem and human vulnerability in the event of climate change? In forested areas (Macqueen *et al*. 2004)? Or desert areas where non-linear climate induced changes could impact dryland livelihoods? Or coral reefs (coral reef bleaching could severely affect the livelihoods of coastal communities) and fisheries?
- In biomes/ecosystems that are particularly vulnerable to climate change, what ecosystem management practices can help cope with such changes and create the most positive outcomes for human welfare?
- How can we increase high-level governance, policy and institutional coherence between multilateral environmental agreements and development processes with a view to supporting activities which alleviate poverty and provide benefits under the main multilateral environmental agreements?
- How can we shift investment and funding towards projects with multiple livelihood, biodiversity and climate change benefits (or at least projects which do no harm in these additional contexts), as opposed to initiatives (such as large hydropower schemes), which might meet one goal, but which have significant negative impacts on ecosystem integrity, biodiversity, climate change mitigation or adaptation, and local livelihoods.
- How can we increase and improve support for 'bottom-up' approaches rooted in existing community-based strategies for managing resources and reducing vulnerability to climatic shocks?
- How do we use what we already know about biodiversity, climate change and poverty/livelihoods to generate action and change on the ground for the benefit of poor people? Lessons learned on the importance of engaging with and supporting local governance, the importance of local, national and international political processes (Bass *et al*. 2005), and the key role of access to land and resources, need building on.
- Debt relief, supporting good local governance or securing commitment from high-income nations to change consumption patterns and reduce greenhouse gas emissions may have greater ultimate 'pay-offs' in terms of providing livelihood, biodiversity and climate change benefits than, for example, investing in activities to make the CDM operational. How do we prioritise activities and efforts?

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