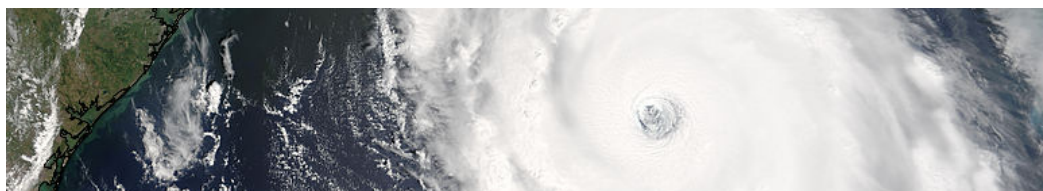


# Climate change and ecosystem services



The poorest countries and the poorest people are those most vulnerable to the effects of climate change. Changes in the climate also impact biological diversity and thereby an ecosystem's ability to deliver goods and services for human well-being. Moreover, ecosystem services play a central role in both adaptation to and mitigation of climate change. Sustaining biological diversity and ecosystem services are hence important both in our efforts to deal with climate change and to reach the UN's Millennium Development Goals. Such measures are in other words both cost-effective and have the capacity to create many potential synergies.

## Impacts of climate change on biodiversity, ecosystem services and food security

- *Increased vulnerability and reduced resilience.* About 20–30 percent of all species are at risk of extinction if the global average temperature rises by 1.5 to 2.5 degrees. As a result, ecosystems are becoming more vulnerable and their long-term capacity to adapt is decreasing drastically.
- *Impact on agriculture.* A warmer climate with changes in patterns of drought and/or increased precipitation, will affect agricultural production: some agricultural land will no longer be possible to cultivate, growing seasons will change and crop production will decrease, not the least in Africa<sup>1</sup>. In certain countries the harvest from non-irrigated agriculture might decrease by up to 50 % by 2020. Loss of biodiversity will result in a disruption of ecosystem services important for agriculture, such as pollination by bees.
- *Impact on fisheries.* The rise in temperature will impact fish stocks in both marine and fresh waters, and is expected to have negative consequences for both fisheries and aquaculture (cultivation of plants and animals in water). In addition, increasing levels of carbon dioxide in the atmosphere are expected to lead to a gradual acidification of the ocean with negative consequences for those marine organisms with calcium-based shells (e.g. corals) and species which are dependent on these, e.g. as nurseries. Taken together, these effects will negatively impact food security, especially for those directly dependent on fishing.

## Biodiversity and mitigation to climate change

- *Reduced deforestation:* More than one third of all greenhouse gas emissions are related to agriculture and forestry. The contribution from deforestation alone is approximately 20 percent (more than the entire transport sector which contributes about 14 percent). Reducing deforestation is a cost-effective way of reducing CO<sub>2</sub> emissions.
- *Tree plantations* can contribute to CO<sub>2</sub>-sequestration, but may also have detrimental social consequences if, for example, local people's user and access rights are disregarded and/or unclear.
- Increasing the levels of *organic material in agricultural soil* could sequester large amounts of CO<sub>2</sub> and also contribute to increased agricultural productivity and enhanced supply of ecosystem services. For this to happen on a large scale, changes to current agricultural practices are required in many cases.

<sup>1</sup> In colder latitudes, agriculture may initially benefit slightly from warmer temperatures but will ultimately be impacted adversely.

### Facts

#### – biological diversity

**Biological diversity** (biodiversity) is the variation of life in all its forms: from genes to species to ecosystems to landscapes.

**An ecosystem** is a functional unit of interacting animals, plants, micro-organisms and their physical environment, e.g. a lake or forest.

**Ecosystem services** are the benefits that an ecosystem provides which are essential for our survival e.g. food production, bioenergy, water purification, climate regulation, soil production, erosion control and mitigation of the effects of natural catastrophes. The United Nations global study, the Millennium Ecosystem Assessment which was completed 2005, showed that 60% of the 24 studied ecosystem services were in the process of being depleted.

**Resilience** refers to the capacity of a social-ecological system both to withstand perturbations from e.g. climate or economic shocks and to rebuild and renew itself afterwards. There is a strong correlation between biodiversity and an ecosystem's resilience, and its ability to deliver ecosystem services.



- *Wetlands* function as carbon sinks, under certain circumstances, for example peat bogs.
- *Biofuels* are being launched as an alternative to fossil fuels on a wide front, and can potentially, if production occurs in a socially and ecologically sound way, also contribute to poverty alleviation and economic development. The climatic benefits, however, are dependent on previous land use, production patterns (e.g. extent of use of fertilisers and associated effects) and transport range of the produced fuel. If biofuel production occurs on previously forested land, the climatic benefits may be neutral or even negative, while biodiversity – and ecosystem services (e.g. water availability) can be negatively affected. Biofuel crops may also compete with local livelihood systems and affect food security for local people.

## Biodiversity and adaptation to climate change

Sound management of biodiversity and ecosystem services is often a highly cost-effective way to adapt to climatic change:

- *Agriculture*: Maintaining diversity of local varieties, crops and agricultural systems contributes to risk distribution, decreased vulnerability, and increases the ability of the agricultural system to adapt. Increased levels of organic matter in soil contribute to increased harvests and improved ecosystem services, such as nutrient cycling and water retention.
- *Coastal zones*: Conservation of mangrove forests and coral reefs is a cost-efficient measure to protect coastal zones against weather-related catastrophes (storms and typhoons). It also benefits biodiversity and fisheries since spawning grounds for fish are preserved, and it is favourable for tourism.
- *Forested mountain areas* are important as water sources, but also for their capacity to absorb and moderate the consequences of flooding (and increased water flows from glacial melting).
- *Wetlands* have a buffering effect (e.g. against drought and flooding), as well as a rich species diversity, and also contribute to other ecosystem services such as removal of nitrogen from agricultural runoff.

## Recommendations: Important aspects to include in dialogue with collaborating partners

Measures taken in support of both adaptation to and mitigation of climate change, should include the sustaining of biodiversity and ecosystem services as an important starting point. This also pertains to assessments of biofuel projects and tree plantations.

- Ensure that environmental impact assessments consider the relationship between climate, biodiversity and ecosystem services, prior to making contribution decisions.
- Promote pro-poor measures that reduce deforestation and forest degradation, including actions against illegal logging and in support of effective and ecologically sustainable forest management which respects local and informal rights and social structures. A possible REDD-mechanism (financial incentives for reducing emissions from deforestation and forest degradation) under the post-2012 framework of the Kyoto Protocol should consider effects on local communities and poor people, and strive to ensure a fair sharing of benefits.
- Support to coastal zone management should include maintaining of mangrove forests and coral reefs as a strategic and cost-effective measure for coastal zone protection.
- Support to the agricultural sector should promote methods which reduce the emissions of greenhouse gases, improve risk distribution and protect ecosystem services, by building on a diversity-based agriculture which includes local varieties and crops (with traits such as drought and heat resistance), does not contribute to drainage of wetlands, and encourages locally adapted agricultural systems.

### SwedBio

SwedBio is a program at the Swedish Biodiversity Centre (CBM) initiated 2003 by Sida with the purpose to promote a proactive approach to biodiversity within the frame of Swedish development aid. SwedBio strives for the advancement of a fair, sustainable and productive use of, as well as sound management of biodiversity, as a base for poverty reduction. SwedBio supports initiatives in developing countries that contribute to method and policy development concerning biodiversity and poverty reduction. SwedBio also provides expert advice to Sida, for instance during assessments and follow-up of programs in various sectors.

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Some suggested further reading and references:

- Millennium Ecosystem Assessment: <http://www.maweb.org>
- Reports of the Intergovernmental Panel on Climate Change (IPCC): <http://www1.ipcc.ch/ipcc-reports/assessments-reports.htm>
- Stern Review on the Economics of Climate Change: [http://www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm)