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CONNECTING BIODIVERSITY AND CLIMATE CHANGE MITIGATION AND ADAPTATION[1]

Key Messages of the Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change

UNFORMATTED ADVANCE COPY

Document prepared by the
Secretariat of the Convention on Biological Diversity

[1] This report has been approved by the Bureau of the Conference of the Parties to the Convention on Biological Diversity. A full review by all Parties to the Convention on Biological Diversity will occur during the fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice.

INTRODUCTION

The conservation and sustainable use of biodiversity and the equitable sharing of the benefits from the use of genetic resources underpin sustainable development and human well being. However, scientific evidence shows that climate change is likely to challenge the realization of sustainable development including the Millennium Development Goals.

In particular, climate change is projected to reduce the livelihood assets of vulnerable people, especially those that are dependent on biodiversity and ecosystem services such as access to food, water and shelter. Climate change is also expected to have a negative impact on traditional coping mechanisms and food security thereby increasing the vulnerability of the world's poor to famine and perturbations such as drought, flood and disease. Finally, the impacts of climate change on natural resources and labour productivity are likely to reduce economic growth, exacerbating poverty through reduced income opportunities.

Anthropogenic climate change is also threatening biodiversity and the continued provision of ecosystem services. Hence the global community has issued an urgent call for additional research and action towards reducing the impacts of climate change on biodiversity and increasing synergy of biodiversity conservation and sustainable use with climate change mitigation and adaptation activities. Furthermore, in the face of multiple and increasing challenges and their likely cost implications, a need has been identified for additional research on ways and means to ensure that biodiversity conservation and sustainable use can provide co-benefits for other sectors, including for climate change mitigation and adaptation.

The interlinkages between biodiversity, climate change, and sustainable development, have been recognized within both the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) as well as other international fora. Article 2 of the UNFCCC, for example, recognizes the importance of limiting climate change to a level that would allow ecosystems to adapt naturally to climate change. The CBD has adopted a number of decisions on biodiversity and climate change, and in 2001 formed an Ad Hoc Technical Expert Group (AHTEG) on Biodiversity and Climate Change, to consider the possible negative impacts of climate change related activities on biodiversity, identify the role of biodiversity in climate change mitigation and identify opportunities for achieving climate change and biodiversity co-benefits.

Since the first AHTEG completed its work, the scientific information and degree of certainty regarding the relationship between biodiversity and climate change has expanded significantly. In order to support additional work on this issue, the second AHTEG on Biodiversity and Climate Change was convened in 2008 in response to paragraph 12 (b) of decision IX/16 B of the Conference of the Parties to the Convention on Biological Diversity.

The second AHTEG was established to provide biodiversity-related information to the UNFCCC process through the provision of scientific and technical advice and assessment on the integration of the conservation and sustainable use of biodiversity into climate change mitigation and adaptation activities, through *inter alia*:

(a) Identifying relevant tools, methodologies and best practice examples for assessing the impacts on and vulnerabilities of biodiversity as a result of climate change;

(b) Highlighting case-studies and identifying methodologies for analysing the value of biodiversity in supporting adaptation in communities and sectors vulnerable to climate change;

(c) Identifying case-studies and general principles to guide local and regional activities aimed at reducing risks to biodiversity values associated with climate change;

(d) Identifying potential biodiversity-related impacts and benefits of adaptation activities, especially in the regions identified as being particularly vulnerable under the Nairobi work programme (developing countries, especially least developed countries and small island developing States);

(e) Identifying ways and means for the integration of the ecosystem approach in impact and vulnerability assessment and climate change adaptation strategies;

(f) Identifying measures that enable ecosystem restoration from the adverse impacts of climate change which can be effectively considered in impact, vulnerability and climate change adaptation strategies;

(g) Analysing the social, cultural and economic benefits of using ecosystem services for climate change adaptation and of maintaining ecosystem services by minimizing adverse impacts of climate change on biodiversity.

(h) Proposing ways and means to improve the integration of biodiversity considerations and traditional and local knowledge related to biodiversity within impact and vulnerability assessments and climate change adaptation, with particular reference to communities and sectors vulnerable to climate change.

(i) Identifying opportunities to deliver multiple benefits for carbon sequestration, and biodiversity conservation and sustainable use in a range of ecosystems including peatlands, tundra and grasslands;

(j) Identifying opportunities for, and possible negative impacts on, biodiversity and its conservation and sustainable use, as well as livelihoods of indigenous and local communities, that may arise from reducing emissions from deforestation and forest degradation;

(k) Identifying options to ensure that possible actions for reducing emissions from deforestation and forest degradation do not run counter to the objectives of the CBD but rather support the conservation and sustainable use of biodiversity;

(l) Identifying ways that components of biodiversity can reduce risk and damage associated with climate change impacts;

(m) Identifying means to incentivise the implementation of adaptation actions that promote the conservation and sustainable use of biodiversity.

The main findings of this group are presented below with the full report available in English only as CBD Technical Series No. 41.

KEY MESSAGES

A. Biodiversity and climate change interactions

The issues of climate change and biodiversity are interconnected, not only through climate change effects on biodiversity, but also through changes in biodiversity that affect climate change

- Conserving natural terrestrial, freshwater and marine ecosystems and restoring degraded ecosystems (including their genetic and species diversity) is essential for the overall goals of the UNFCCC because ecosystems play a key role in the global carbon cycle and in adapting to climate change, while also providing a wide range of ecosystem services that are essential for human well-being and the achievement of the Millennium Development Goals.
    - About 2,500 Gt C is stored in terrestrial ecosystems, an additional ~ 38,000 Gt C is stored in the oceans (37,000 Gt in deep oceans i.e. layers that will only feed back to atmospheric processes over very long time scales and ~ 1,000 Gt in the upper layer of oceans[i]) compared to approximately 750 Gt C in the atmosphere. On average ~160 Gt C cycle naturally between the biosphere (in both ocean and terrestrial ecosystems) and atmosphere. Thus, small changes in ocean and terrestrial sources and sinks can have large implications for atmospheric CO_2 levels. Human induced climate change caused by the accumulation of anthropogenic emissions in the atmosphere (primarily from fossil fuels and land use changes) could shift the net natural carbon cycle towards annual net emissions from terrestrial sinks, and weaken ocean sinks, thus further accelerating climate change.
    - Ecosystems provide a wide range of provisioning (e.g. food and fibre), regulating (e.g. climate change and floods), cultural (e.g. recreational and aesthetic) and supporting (e.g. soil formation) services, critical to human well-being including human health, livelihoods, nutritious food, security and social cohesion.
- While ecosystems are generally more carbon dense and biologically more diverse in their natural state, the degradation of many ecosystems is significantly reducing their carbon storage and sequestration capacity, leading to increases in emissions of greenhouse gases and loss of biodiversity at the genetic, species and ecosystem level;
- Climate change is a rapidly increasing stress on ecosystems and can exacerbate the effects of other stresses, including from habitat fragmentation, loss and conversion, over-exploitation, invasive alien species, and pollution.

B. Impacts of climate change on biodiversity

Observed changes in climate have already adversely affected biodiversity at the species and ecosystem level, and further changes in biodiversity are inevitable with further changes in climate

- Changes in the climate and in atmospheric CO_2 levels have already had observed impacts on natural ecosystems and species. Some species and ecosystems are demonstrating some capacity for natural adaptation, but others are already showing negative impacts under current levels of climate change (an increase of 0.75ºC in global mean surface temperature relative to pre-industrial levels), which is modest compared to future projected changes (2.0-7.5 ºC by 2100 without aggressive mitigation actions).
- Aquatic freshwater habitats and wetlands, mangroves, coral reefs, Arctic and alpine ecosystems, and cloud forests are particularly vulnerable to the impacts of climate change. Montane species and endemic species have been identified as being particularly vulnerable because of narrow geographic and climatic ranges, limited dispersal opportunities, and the degree of other pressures.
- Information in Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR4) suggests that approximately 10% of species assessed so far will be at an increasingly high risk of extinction for every 1°C rise in global mean temperature, within the range of future scenarios modelled in impacts assessments (typically <5°C global temperature rise).

- Continued climate change will have predominantly adverse and often irreversible impacts on many ecosystems and their services, with significant negative social, cultural and economic consequences. However, there is still uncertainty about the extent and speed at which climate change will impact biodiversity and ecosystem services, and the thresholds of climate change above which ecosystems are irreversibly changed and no longer function in their current form.
- Risks to biodiversity from climate change can be initially assessed using available vulnerability and impact assessment guidelines. However, further development and validation of tools is necessary because uncertainties limit our ability to project climate change impacts on biodiversity and ecosystem services.

C. Reducing the impacts of climate change on biodiversity

The resilience of biodiversity to climate change can be enhanced by reducing non-climatic stresses in combination with conservation, restoration and sustainable management strategies

- Conservation and management strategies that maintain and restore biodiversity can be expected to reduce some of the negative impacts from climate change; however, there are rates and magnitude of climate change for which natural adaptation will become increasingly difficult.
- Options to increase the adaptive capacity of species and ecosystems in the face of accelerating climate change include:
    - Reducing non-climatic stresses, such as pollution, over-exploitation, habitat loss and fragmentation and invasive alien species.
    - Wider adoption of conservation and sustainable use practices including through the strengthening of protected area networks.
    - Facilitating adaptive management through strengthening monitoring and evaluation systems.
- Relocation, assisted migration, captive breeding, and *ex-situ* storage of germplasm could contribute to maintaining the adaptive capacity of species, however, such measures are often expensive, less effective than *in situ* actions, not applicable to all species, usually feasible only on small scales, and rarely maintain ecosystem functions and services. In the case of relocation and assisted migration, unintended ecological consequences need to be considered.

D. Ecosystem-based adaptation

Ecosystem-based adaptation, which integrates the use of biodiversity and ecosystem services into an overall adaptation strategy, can be cost-effective and generate social, economic and cultural co-benefits and contribute to the conservation of biodiversity

- Ecosystem-based adaptation uses biodiversity and ecosystem services in an overall adaptation strategy. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to the adverse effects of climate change.
- Examples of ecosystem-based adaptation activities include:
    - Coastal defence through the maintenance and/or restoration of mangroves and other coastal wetlands to reduce coastal flooding and coastal erosion.
    - Sustainable management of upland wetlands and floodplains for maintenance of water flow and quality.
    - Conservation and restoration of forests to stabilize land slopes and regulate water flows.
    - Establishment of diverse agroforestry systems to cope with increased risk from changed climatic conditions.

    - Conservation of agrobiodiversity to provide specific gene pools for crop and livestock adaptation to climate change.

- Ecosystem-based adaptation can be a useful and widely applicable approach to adaptation because it:
    - Can be applied at regional, national and local levels, at both project and programmatic levels, and benefits can be realized over short and long time scales.
    - May be more cost-effective and more accessible to rural or poor communities than measures based on hard infrastructure and engineering.
    - Can integrate and maintain traditional and local knowledge and cultural values.
- Ecosystem-based adaptation, if designed, implemented and monitored appropriately, can also:
    - Generate multiple social, economic and cultural co-benefits for local communities.
    - Contribute to the conservation and sustainable use of biodiversity.
    - Contribute to climate change mitigation, by conserving carbon stocks, reducing emissions caused by ecosystem degradation and loss, or enhancing carbon stocks.
- Ecosystem-based adaptation may require managing ecosystems to provide particular services at the expense of others. For example, using wetlands for coastal protection may require emphasis on silt accumulation and stabilization possibly at the expense of wildlife values and recreation. It is therefore important that decisions to implement ecosystem-based adaptation are subject to risk assessment, scenario planning and adaptive management approaches that recognise and incorporate these potential trade-offs.

E. Implications of reducing emissions from deforestation and forest degradation (REDD) and other land-use management activities on biodiversity and climate change mitigation

A portfolio of land-use management activities including REDD can cost-effectively contribute to mitigating climate change and conserving biodiversity

- A portfolio of land use management activities, including the protection of natural forest and peatland carbon stocks, the sustainable management of forests, the use of native assemblages of forest species in reforestation activities, sustainable wetland management, restoration of degraded wetlands and sustainable agricultural practices can contribute to the objectives of both the UNFCCC and CBD. These activities, in addition to stringent reductions in fossil fuel emissions of greenhouse gases, play an important role in limiting increases in atmospheric greenhouse gas concentrations and human-induced climate change.
- The potential to reduce emissions and increase the sequestration of carbon from land use management activities is estimated to range from 0.5-4 $GtCO_2$-eq per year for forestry activities (REDD, afforestation, forest management, agroforestry), and 1-6 $GtCO_2$-eq per year for agricultural land activities. Achieving this potential is dependent upon the design and mode of implementation of these activities, and the extent to which they are supported and enabled by technology, financing and capacity building.
- Primary forests are generally more carbon-dense and biologically diverse than other forest ecosystems, including modified natural forests and plantations. Accordingly, in largely intact forest landscapes where there is currently little deforestation and degradation occurring, the conservation of existing forests, especially primary forests, is critical both for preventing future greenhouse gas emissions through loss of carbon stocks and ensuring continued sequestration, and for conserving biodiversity. The application of even sustainable forest management practices to previously intact primary forests could lead to increased carbon emissions.

- In forest landscapes currently subject to harvesting, clearing and/or degradation, mitigation and biodiversity conservation can be best achieved by addressing the underlying drivers of deforestation and degradation, and improving the sustainable management of forests.
- In natural forest landscapes that have already been largely cleared and degraded, mitigation and biodiversity conservation can be enhanced through reforestation, forest restoration and improved land management which, through the use of native assemblages of species, can improve biodiversity and its associated services while sequestering carbon.
- While protected areas are primarily designated for the purpose of biodiversity conservation they have additional value in storing and sequestering carbon (about 15% of the terrestrial carbon stock is currently within protected areas). Effectively managing and expanding protected area networks could contribute to climate change mitigation by reducing both current and future greenhouse gas emissions, and protecting existing carbon stocks, while at the same time protecting certain biodiversity.
- In general, reducing deforestation and degradation will positively impact biodiversity conservation, but this will be negated if deforestation and degradation is displaced from an area of lower conservation value to one of higher conservation value or to other native ecosystems.
- Afforestation activities can have positive or negative effects on biodiversity and ecosystem services depending on their design and management and the present land use. Afforestation activities that convert non-forested landscapes with high biodiversity values and/or valuable ecosystem services, increase threats to native biodiversity. However, afforestation activities could help to conserve biodiversity if they, for example, convert only degraded land or ecosystems largely composed of exotic species, include native tree species, consider the invasiveness of non-natives, and are strategically located within the landscape to enhance connectivity.
- The design of REDD will have key implications for where and how REDD is implemented and the associated impacts on biodiversity. Some relevant issues are:
    - Implementing REDD activities in areas identified as having both high biodiversity value and high carbon stocks can provide co-benefits for biodiversity conservation and climate change mitigation;
    - Addressing forest degradation is important because degradation leads to loss of carbon and biodiversity, decreases forest resilience to fire and drought, and can lead to deforestation;
    - Both intra-national and international leakage under REDD can have important consequences for both carbon and biodiversity, and therefore needs to be prevented or minimized;
    - REDD methodologies based only on assessments of net deforestation rates could fail to reflect actual changes in carbon stocks and fail to deliver conservation co-benefits;
    - Addressing the underlying drivers of deforestation and degradation will require a wide variety of ecological, social and economic approaches;
    - If REDD is to achieve significant and permanent emissions reductions, it will be important to provide alternative livelihood options (including employment, income and food security) for those people who are currently the agents of deforestation and degradation.
- While it is generally recognized that REDD and other sustainable land management activities for mitigation have potential benefits, including critical ecosystem services, for forest-dwelling indigenous peoples and local communities, a number of conditions are important for realizing these co-benefits, e.g., indigenous peoples are likely to benefit more from REDD and other sustainable land management activities for mitigation where they own their lands; where there is the principle of free, prior and informed consent, and where their identities and cultural practices are recognized and they have space to participate in policy-making processes. Involving local

stakeholders, in particular women, and respecting the rights and interests of indigenous and local communities will be important for the long-term sustainability of the efforts undertaken.

- There is a range of activities in the agricultural sector including; conservation tillage and other means of sustainable cropland management, sustainable livestock management, and agroforestry systems that can result in the maintenance and potential increase of current carbon stocks and the conservation and sustainable use of biodiversity.
- Policies that integrate and promote the conservation and enhanced sequestration of soil carbon, including in peatlands and other wetlands as well as in grasslands and savannahs, can contribute to climate change mitigation and be beneficial for biodiversity and ecosystem services.

F. Impacts of adaptation activities on biodiversity

Activities to adapt to the adverse impacts of climate change can have positive or negative effects on biodiversity, but tools are available to increase the positive and decrease the negative effects

- Adaptation to the adverse impacts of climate change can have both positive and negative consequences for biodiversity and ecosystem services, depending on the way in which such strategies are implemented, for example:
    - Increasing the diversity of landscapes and interconnecting agro-ecosystems, natural floodplains, forests and other ecosystems can contribute to the climate resilience of both human communities and biodiversity and ecosystem services.
    - Hard infrastructure in coastal areas (e.g. sea walls, dykes, etc.) can often adversely impact natural ecosystem processes by altering tidal current flows, disrupting or disconnecting ecologically related coastal marine communities, and disturbing sediment or nutrition flows.
- In most cases there is the potential to increase positive and reduce negative impacts of adaptation on biodiversity. Tools for identifying these impacts include strategic environmental assessments (SEA), environmental impact assessments (EIA), and technology impact assessments that facilitate the consideration of all adaptation options.
- The planning and implementation of effective adaptation activities that take into account impacts on biodiversity, can benefit from:
    - Considering traditional knowledge, including the full involvement of indigenous peoples and local communities.
    - Defining measurable outcomes that are monitored and evaluated.
    - Building on a scientifically credible knowledge base.
    - Applying the ecosystem approach.[2]
- To optimize their effectiveness and generate biodiversity co-benefits, adaptation activities should:
    - Maintain intact and interconnected ecosystems to increase resilience and allow biodiversity and people to adjust to changing environmental conditions.
    - Restore or rehabilitate fragmented or degraded ecosystems, and re-establish critical processes such as water flow to maintain ecosystem functions.
    - Ensure the sustainable use of renewable natural resources.

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[2] The ecosystem approach includes twelve steps for the integrated management of land, water and living resources to promote conservation and sustainable use in an equitable way. Further details on the ecosystem approach are presented on the CBD website (http://www.cbd.int/ecosystem) and in box.2 on page **Error! Bookmark not defined.** below.

- Collect, conserve and disseminate traditional and local knowledge, innovations and practices related to biodiversity conservation and sustainable use with prior and informed consent from traditional knowledge holders.

G. Impacts of alternative energy and geo-engineering on biodiversity

Some renewable energy sources, which displace the use of fossil fuels, and geo-engineering techniques, can have adverse effects on biodiversity depending on design and implementation

- Renewable energy sources, including onshore and offshore wind, solar, tidal, wave, geothermal, biomass and hydropower, in addition to nuclear power, can displace fossil fuel energy, thus reducing greenhouse gas emissions, but have potential implications for biodiversity and ecosystem services.
    - While bioenergy can contribute to energy security, rural development and mitigating climate change, there is evidence that, depending on the feedstock used and production schemes, some first generation biofuels (i.e., use of food crops for liquid fuels) are accelerating land use change, including deforestation, with adverse effects on biodiversity.[ii] In addition, if a full life cycle analysis is taken into account, biofuels production may not currently be reducing greenhouse gas emissions[3].
    - Hydropower, which has substantial unexploited potential in many developing countries, can potentially mitigate greenhouse gas emissions by displacing fossil fuel production of energy, but large scale hydropower systems can have adverse biodiversity and social effects.
    - The implications of wind and tidal power for biodiversity are dependent upon siting and other design features.
- Artificial fertilization of nutrient limited oceans to increase the uptake of atmospheric carbon dioxide is increasingly thought to have limited potential for climate change mitigation and uncertain impacts on biodiversity.
- Other geo-engineering techniques, such as the intentional and large- scale manipulation of the radiative balance of the atmosphere through injecting sulphate aerosols into the troposphere or stratosphere, have not been adequately studied and hence their impact on ecosystems is unknown.

H. Valuation and incentive measures

The consideration of economic and non-economic values of biodiversity and ecosystem services, and related incentives and instruments can be beneficial when implementing climate change related activities

- It is important to ensure that the economic (market and non-market) and non-economic values of biodiversity and ecosystem services are taken into account when planning and undertaking climate change related activities. This can best be achieved by using a range of valuation techniques.
- Ecosystem services contribute to economic well-being and associated development goals, such as the Millennium Development Goals, in two major ways – through contributions to the generation of income and material goods (e.g., provisioning of food and fiber), and through the reduction of potential costs of adverse impacts of climate change (e.g., coral reefs and mangrove swamps protect coastal infrastructure).
- Both economic and non-economic incentives could be used to facilitate climate change related activities that take into consideration biodiversity, while ensuring conformity with provisions of the World Trade Organization and other international agreements:

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[3] The expert from Brazil disassociated himself from this statement.

- o Economic measures include:
  - Removing environmentally perverse subsidies to sectors such as agriculture, fisheries, and energy;
  - Introducing payments for ecosystem services;
  - Implementing appropriate pricing policies for natural resources;
  - Establishing mechanisms to reduce nutrient releases and promote carbon uptake; and
  - Applying fees, taxes, levies, and tariffs to discourage activities that degrade ecosystem services.
- o Non-economic incentives and activities include improving or addressing:
  - Laws and regulations;
  - Governance structures, nationally and internationally;
  - Individual and community property or land rights;
  - Access rights and restrictions;
  - Information and education;
  - Policy, planning, and management of ecosystems; and
  - Development, deployment, diffusion and transfer of technologies relevant for biodiversity and climate change adaptation (e.g. technology that makes use of genetic resources, and technology to manage natural disasters)
- o Assessing policies in all sectors can reduce or eliminate cross-sectoral impacts on biodiversity and ecosystem services.

- Incentives for climate-change-related activities should be carefully designed to simultaneously consider cultural, social, economic and biophysical factors while avoiding market distortions, such as through tariff and non-tariff barriers.

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[i] Sabine, Christopher L, Richard A. Feely, Nicolas Gruber, Robert M. Key, Kitack Lee, John L. Bullister, Rik Wanninkhof, C. S. Wong, Douglas W. R. Wallace, Bronte Tilbrook, Frank J. Millero, Tsung-Hung Peng, Alexander Kozyr, Tsueno Ono, Aida F. Rios. The Oceanic Sink for Anthropogenic CO2. Science 16 July 2004: Vol. 305. no. 5682, pp. 367 – 371

[ii] Fitzhebert et al. 2008. How will palm oil expansion affect biodiversity? Trends in Ecol. and Evol. 23 (10): 538-545.