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INDICATORS FOR ASSESSING PROGRESS TOWARDS THE 2010 TARGET: OPTIONS FOR REPORTING ON THE IMPACT OF CLIMATE CHANGE ON BIOLOGICAL DIVERSITY

Note by the Executive Secretary

I. INTRODUCTION

1. Climate change – along with land-use change, invasive alien species, overexploitation and pollution and nutrient loading – is recognized as a key direct driver of biodiversity loss. However, the framework of assessing progress towards the 2010 target does not include a specific indicator to assess the impacts of climate change on biodiversity. Based on expert opinion, the Millennium Ecosystem Assessment judged that the impact of climate change on biodiversity, although low to moderate over the last century in the biomes addressed under the Convention, was increasing rapidly in all biomes.

2. The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), in recommendation X/5 (para 12 (e)) therefore requested the Executive Secretary to explore options for reporting on the impact of climate change on biological diversity, using the framework of indicators relevant to the 2010 target and to report thereon to SBSTTA at its eleventh meeting.

3. The current note assesses the suitability of the framework for assessing progress towards the 2010 target for reporting on the impacts of climate change on biological diversity.

II. INDICATORS OF CLIMATE CHANGE

4. Indicators of climate change relevant to biodiversity include (i) pressure indicators for assessing changes in the causes of climate change, in particular greenhouse gas concentrations; (ii) indicators for assessing the impacts of climate change on biodiversity; (iii) indicators for assessing the susceptibility of biodiversity to impact of climate change; and (iv) indicators for assessing the magnitude of the effort made to reduce the pressure and/or mitigate the impact.

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A. Pressure indicators

5. Pressure indicators of climate change pertain to the greenhouse gases as underlying cause of climate change. The most relevant greenhouse gases are regulated under the Kyoto Protocol (annex A) of the United Nations Framework Convention on Climate Change (UNFCCC) and include: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). Parties to the Protocol are required to report on emissions of each of these six gases on an annual basis. Trends in the amount of greenhouse gas emissions is therefore a fully functional pressure indicator, which is already being implemented under UNFCCC.

6. The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) uses seven concentration indicators including observed changes for three major greenhouse gases and eight weather indicators for which information exists.

7. The rapidly increasing use of nitrogen-based fertilizers, particularly in tropical soils limited by phosphorous, is leading to dramatic increases in nitrous oxide emissions from this source. Additionally, increased atmospheric nitrogen deposition due to man-made nitrogen emissions, such as intensive livestock rearing, can induce elevated rates of nitrous oxide emission over large areas. Nitrous oxide being one component of reactive nitrogen, the CBD indicator 1/ on *Nitrogen deposition* captures trends in this specific greenhouse gas.

B. Indicators for assessing the impacts of climate change on biodiversity

8. Climate change has multiple impacts on components of biodiversity, their functioning and the way in which biodiversity benefits humans. The observed changes detected through the weather indicators from the IPCC assessment largely fall in two categories, change in temperature and occurrence of weather extremes.

9. The IPCC observed an increase of the global mean surface temperature, particularly on land and in the Northern Hemisphere. This increase is associated with a retreat of polar ice caps and inland glaciers, sea level rise and an increased heat index, affecting land and coastal waters, including in the tropics and subtropics.

10. Observed biodiversity impacts linked to these phenomena include, *inter alia*: changes in migration patterns of animals; changes in the timing of reproduction; changes in the length of growing season; changes in the occurrence of pest and disease outbreaks; changes in the occurrence of invasive alien species; occurrence of coral bleaching and coral die-back; occurrence of flooding, drought, landslides and windfall with associated biodiversity impacts. The link between climate change and observed biodiversity impact is primarily correlational.

11. These impacts on biodiversity can generally be captured by the headline indicators contained in the framework for assessing progress towards the 2010 biodiversity target contained in decision VII/30 and refined through SBSTTA recommendation X/5. In particular, the CBD indicators on *Trends in extent of selected biomes, ecosystems, and habitats*; *Trends in abundance and distribution of selected species*; *Change in status of threatened species*; *Incidence of human-induced ecosystem failure*; *Trends in invasive alien species* and *Water quality in aquatic ecosystems* could help to quantify these impacts and to detect trends.

1/ The term CBD indicator refers to the headline indicators that are contained in the framework for assessing progress towards the 2010 biodiversity target contained in decision VII/30 and refined through SBSTTA recommendation X/5.

12. This would require, however, that data on specific parameters/measures be collected and analysed in a systematic way and possibly be complemented with experimental data to ascertain the correlation with climate change. Such parameters/measures might include: vitality of ecosystems at the edge of their natural climatic occurrence; status of health of coral reefs; frequency of natural fires and area affected; timing of breeding and reproduction of selected species susceptible to climate change; date of arrival of spring migrants and date of departure of autumn migrants; occurrence of physiological, morphological and behavioural (including dietal) changes of selected species susceptible to climate change; trends in abundance of selected threatened species susceptible to climate change; ecosystem area affected annually by extreme weather events (droughts, floods, hurricanes) in a given area; ecosystem area affected by outbreaks of diseases or toxic organisms; changes in water flow in inland waters and associated changes in sediment load and concentration of pollutants. Currently, the only among these parameters for which a suitable monitoring system is being implemented is the status of health of coral reefs. For the others only anecdotal and case study information are available.

13. The biodiversity impacts linked to climate change also affect the availability of ecosystem goods and services. The assessment of *Interlinkages Between Biological Diversity and Climate Change* 2/ and more recently the Millennium Ecosystem Assessment 3/ project that the impacts of climate change may be particularly severe for the rural poor and for some indigenous and local communities. Impacts will become particularly evident in the high latitudes and altitudes. Here, climate change is known, or expected, to lead to a change in the availability of ecosystem goods and services, e.g. of animals targeted by hunters. This aspect of a change in the abundance and distribution of target species can be captured by the CBD indicator on *Health and well-being of communities who depend directly on local ecosystem goods and services*. This indicator is yet to be developed and the causal link of specific trends with climate change are likely to be tenious.

C. Indicators for assessing the susceptibility of biodiversity to impacts of climate change

14. The ability of ecosystems to adapt naturally to climate change and their vulnerability to the impacts of climate change are related to their health and integrity. Natural or near-natural habitats, and particularly large compact blocks of such habitats, are more likely to withstand and delay the physical and biotic changes associated with climate change (higher air and soil temperature; greater wind speeds, higher evapotranspiration; greater extremes in soil moisture; greater activity of many microbes, fungi, arthropods including plant pests and parasites etc.) than degraded or small isolated or fragmented patches of habitats.

15. Although evidence is also correlational here and may require additional experiments two CBD indicators are relevant in assessing the anticipated susceptibility of biodiversity to impacts of climate change: *Coverage of protected areas* as a measure of the area managed for its integrity and *Connectivity/fragmentation of ecosystems* to assess trends in the area likely affected by climatic edge effects.

2/ CBD Technical Series No. 10 http://www.biodiv.org/doc/publications/cbd-ts-10.pdf.

3/ Conditions Chapters 5 and 6, Responses Chapter 17.

D. Indicators for assessing the magnitude of effort to reduce the pressure and/or mitigate the impact

16. The primary response indicator on the efforts to reduce greenhouse gas emissions is the degree of compliance of Parties to the Kyoto Protocol with their obligations. One activity of particular relevance to the Convention on Biological Diversity are activities that remove greenhouse gases resulting from land use, land-use change and forestry (LULUCF). This includes afforestation and reforestation activities, captured by the CBD indicator on *Trends in extent of selected biomes, ecosystems and habitats* and sustainable forest management, captured by the CBD indicator on *Area of forest, agricultural and aquaculture ecosystems under sustainable management*.

17. UNFCCC and its Kyoto Protocol emphasize the crucial role of technology transfer in enabling developing countries to fulfil their climate-change related obligations. Not all types of technology suitable to curb climate change are also biodiversity-related (for example filter technologies). However, technologies associated with LULUCF activities are generally relevant and the degree to which such technologies are being made available to developing countries is captured by the *CBD indicator that is to be developed on technology transfer*.

III. CONCLUSION

18. The suite of headline indicators contained in the framework for assessing progress towards the 2010 biodiversity target, contained in decision VII/30 and refined through SBSTTA recommendation X/5, is – at least in theory – suitable for capturing key impacts of climate change on biodiversity. The CBD indicators should thereby be interpreted in association with other relevant indicators, particularly pressure and response indicators implemented by UNFCCC and its Kyoto Protocol.

19. In attempting statements about the impacts of climate change on biodiversity, each single indicator must be carefully interpreted taking into account evidence and trends shown by the other indicators in the CBD framework as well as the pressure and response indicators implemented by UNFCCC and its Kyoto Protocol. Moreover it is clear that in most cases the link between climate change and changes in biodiversity are correlational and it will in some cases be difficult to prove their causal link unless specific experimental studies are carried out.
