

Impacts of Climate Change on Biodiversity

A review of the recent scientific literature


October 2008



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SUMMARY OF AVAILABLE SCIENTIFIC INFORMATION ON THE VULNERABILITY OF BIODIVERSITY TO THE IMPACTS OF CLIMATE CHANGE AND MITIGATION AND ADAPTATION ACTIVITIES

*Report Submitted by the World Conservation Monitoring Centre of the United Nations Environment
Programme*

Note by the Executive Secretary

1. Annex III of decision IX/16 outlines the terms of reference for the Ad Hoc Technical Expert Group (AHTEG) on Biodiversity and Climate Change including: 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).
2. In order to facilitate the consideration of this item by the AHTEG, the World Conservation Monitoring Centre of the United Nations Environment Programme (UNEP-WCMC) was contracted to prepare a review of the impacts of climate change biodiversity. This work was completed thanks to the financial support of the Government of the United Kingdom of Great Britain and Northern Ireland.
3. The report is reproduced in the form and language in which it was received by the Secretariat.

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The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organization. The centre has been in operation since 1989, combining scientific research with practical policy advice.

UNEP-WCMC provides objective, scientifically rigorous products and services to help decision makers recognize the value of biodiversity and apply this knowledge to all that they do. Its core business is managing data about ecosystems and biodiversity, interpreting and analysing that data to provide assessments and policy analysis, and making the results available to international decision-makers and businesses.

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Executive summary

The IPCC 4th Assessment Report (AR4) concluded that climate change will have significant impacts on many aspects of biological diversity. These impacts will include effects on ecosystems, on their component species and genetic diversity within species, and on ecological interactions. The implications of these impacts are significant for the long-term stability of the natural world and for the many benefits and services that humans derive from it.

Because of the importance of these impacts and of climate change itself, there has been a great deal of recent research, which has added to the evidence base. This review draws on recent research to summarise advances since the IPCC AR4 in our understanding of the impacts of climate change on biodiversity. The evidence for these impacts comes from three principal sources: direct observation; experimental studies; and modelling studies.

The main lesson from recent research is that many of the key findings at time of IPCC AR4 have been strengthened, with a greater range of evidence, including observational evidence, to support them. While there are some specific areas where new understanding has emerged or the balance of evidence has shifted, the larger scale picture is one of increased support for earlier findings.

The IPCC AR4 described the evidence for the effects of climate change on natural ecosystems. More recent observational, experimental and modelling work has pointed to several broad types of major changes to ecosystems as a result of climate change. Modelling studies combined with experimental evidence of species tolerances point to significant changes in the distribution of some ecosystems, principally due to increasing temperature and altered precipitation regimes. Likely distribution changes include poleward shifts in boreal regions and upwards shifts in montane systems, where lack of space at higher altitudes may cause some systems to disappear entirely. Ecosystem distribution changes are also expected to be large in the tropics, where the effects of rising temperatures and reduced precipitation are exacerbated by the effects of land use change. Drier conditions are expected to cause savanna ecosystems to move into equatorial regions now occupied by forests.

In addition to shifting their locations climate change will alter the composition of many ecosystems. Site level reductions in species richness are of concern because under changing environmental conditions, multiple species play a role in ensuring that ecosystem processes can continue. Processes potentially dependent on species richness include carbon storage. Climate change can also facilitate the spread and establishment of invasive species, which can have major impacts on ecosystem composition.

Changes in species composition can lead to changes in the physical and trophic structure of ecosystems,

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