APPENDIX

PANAMA STATEMENT

from the
Climate Change and Biodiversity Symposium in the Americas
Panama City, Panama • February, 2008

Biodiversity

Biodiversity means the variability among all living organisms, including diversity within species, between species and of ecosystems. This diversity is the result of four billion years of evolution.

Biodiversity supports human societies ecologically, economically, culturally and spiritually. Despite its importance, ecosystems are being degraded and species and genetic diversity are declining at an alarming rate. This is due to the impact of a number of forcing agents, including a changing climate, growing human populations and increasing resource consumption.

The decline in biodiversity is now recognized as one of the most serious environmental issues facing humanity. A global goal has been defined – to reduce the rate of loss of biodiversity by 2010 (www.biodiv.be/convention/2010target/links/lnk-world/int-conv/cbd/2010_target).

Advice and Guidance

1. Support the establishment of a climate change and biodiversity monitoring and information network throughout the Americas. This network will provide:

   (a) a transect of scientific expertise and/or on-the-ground monitoring across chemical, climate and ecological gradients to allow for unique investigations into the impacts of climate change on forest biodiversity and improve our understanding of its adaptive capacity;
   (b) mechanisms for the sharing and communicating of information, data and science on climate change and biodiversity;
   (c) training on monitoring tools and methodologies, analysis techniques, data management and verification tools needed to support adaptation options and decision-making; and
   (d) a network secretariat, located at the Smithsonian Institution, for overall coordination of the monitoring network.

2. Support the establishment of a climate change and biodiversity research network throughout the Americas. This network will provide:

   (a) integrated research on climate change and biodiversity, including new global and regional climate change models, hazards and extremes, and other human pressures impacting forest biodiversity;
   (b) expert scientific advice on adaptation options and opportunities to reduce the impacts of climate change on biodiversity;
   (c) an exchange of scientists, environmental managers and community leaders to increase the scientific capacity, training and development of new study methods and monitoring techniques for both climate change and biodiversity; and
   (d) interlinking of research groups, such as Environment Canada's Adaptation and Impacts Research Division and the Smithsonian Institution, by taking advantage of new scientific developments (e.g., **www.cccsn.ca**, **www.hazards.ca**) to support the next generation of model development, transfer functions and adaptation science for effective decision-making.

3. Support the development of research activities as indicated in a recent UK Royal Society report (**http://royalsociety.org/**) on climate change and biodiversity. The chief aim of this research would be to improve our understanding of biodiversity in underpinning ecosystem structure and function, in climate regulation, and in human livelihoods. The interrelationships between biodiversity and climate change require further research and evaluation by the scientific community. In particular, the hypothesis that systems with high biological diversity are more resilient to global change than less diverse systems requires testing.

4. Support the development of scenarios for impacts on biodiversity and ecosystem services under different levels of climate change. Such scenarios are urgently needed now to identify adaptive management priorities and potentially dangerous levels of biodiversity loss.

5. Support the articulation of the benefits, needs and applications of seasonal climate forecasts for adaptation to reduce the effects of climate change and biodiversity losses, in preparation for the World Climate Conference (WCC-3) in Geneva in 2009 (**www.wmo.int/pages/world_climate_conference/index_en.html**).

The United Nations Convention on Biological Diversity

www.cbd.int/

In response to this crisis of present and impending loss of biodiversity, the United Nations in 1993 brought into force the United Nations Convention on Biological Diversity (CBD). The three objectives of the Biodiversity Convention are:

- The conservation of Biodiversity;
- The sustainable use of Biological Resources; and
- The fair and equitable sharing of the benefits that result from the use of Genetic Resources.

Scientific studies now make it clear that the climate is changing at regional and global levels and that many ecosystems are already being impacted by these changes. Climate change has been described as one of the major challenges of the 21st century to

conserving biodiversity, combating desertification and ensuring the sustainable use of natural resources – particularly since the rate of global climate change projected for this century is more rapid than any change that has occurred in the last 10,000 years. Its threats to ecosystems and to the spread of desertification are further compounded by the fact that humans have altered the structure of many of the world's ecosystems through habitat fragmentation, land degradation, pollution, and other disturbances, making ecosystems more vulnerable to further changes. Responses to deal with these threats will require improved scientific understanding of the linkages between the climate, biodiversity and the processes of desertification, along with an enhanced environmental forecasting capability to predict potential biodiversity and land use changes that may occur.

A summary of some anticipated effects of climate change on biodiversity is provided in Table 1. It should be remembered that in a region as vast as the Americas, there are significant differences over short distances and time-scales in the changing climate, its variabilities and extremes. Given the number of scientific studies that point to the differing localized rates of species and ecosystems adapting or maladapting to the changing climate, it is clear that the Americas can ill-afford the loss of even one species.

The Millennium Ecosystem Assessment

http://www.millenniumassessment.org/en/index.aspx

The global Millennium Ecosystem Assessment (MEA) (2005) further clarified the impacts on biological diversity and emphasized that protecting biodiversity is in the self-interest of all humans and their societies. Biological resources are the pillars upon which civilizations are built. Loss of biodiversity threatens essential ecosystem goods and services, while also interfering with the earth's hydrological, weather and climate systems. The various goods and services provided by ecosystems include:

- provision of food, fuel and fibre;
- provision of shelter and building materials;
- purification of air and water;
- detoxification and decomposition of wastes;
- stabilization and moderation of the Earth's climate;
- moderation of floods, droughts, temperature extremes and the forces of wind;
- generation and renewal of soil fertility, including nutrient cycling;
- pollination of plants, including many crops;
- control of pests and diseases;
- maintenance of genetic resources as key inputs to crop varieties and livestock breeds, medicines, and other products;
- cultural and aesthetic benefits; and the
- ability to adapt to change.

The UN Framework Convention on Climate Change

http://unfccc.int/2860.php

The UN Framework Convention on Climate Change (UNFCCC) seeks to stabilize greenhouse gas (GHG) concentrations in the atmosphere at a level that will avoid dangerous human interference with the climate system. Because the climate of the future will eventually respond to all of the GHGs collected in the atmosphere over time, even cutting future GHG emissions to zero will not stop most changes. Hence, ecosystems and communities will need to adapt to climate change even if anthropogenic emissions are reduced to near zero.

Climate change is likely to have significant impacts on most or all ecosystems, since the distribution patterns of many species and communities are determined to a large extent by climate. However, ecosystems and biodiversity responses to changes in regional climate are rarely simple. At the most basic level, changing patterns of climate will alter the natural distribution limits for species or biological communities. In some cases, it may be possible for species or communities to migrate in response to changing conditions if there are no significant barriers to migration. Rates of climate change will also be critical, and these will vary at regional and even local levels. The maximum rates of


TABLE 1

Examples of Projected Impacts of Climate Change on Biodiversity

(Adapted from CBD Information Report, Annex 1: Biodiversity and Climate Change, 2007. UNEP/CBD/SBSTTA/12/7)

The Changing Climate	Projected Climate Impacts	Impacts on biodiversity
Increased air temperatures	Increased number of hot days	■ Increased heat stress on biodiversity, loss of sensitive species and possible extinctions ■ Increased exposure to pests and diseases ■ Increased drying of wetlands and waterways ■ Invasion by more heat-tolerant species
	Increased water temperature	■ Decreased dissolved oxygen ■ Increase in instances of disease among fish ■ Loss of cold- and cool-water fish species ■ Increased vulnerability to invasive alien species ■ Reduced productivity of marine systems (coral reefs and seagrass beds) and possible extinctions
	Sea level rise	■ Salt water intrusion in coastal wetlands and other inland waters (islands especially vulnerable) ■ Inundation of lowlands and coastal wetlands ■ Increased mortality and disturbance of critical habitat ■ Increased erosion (beaches/coastal cliffs)
	Melting permafrost	■ Changes in nutrient cycling and soil biodiversity ■ Reduced access to food sources as a result of repeated freeze-thaw cycles ■ Loss of cryosoil-based ecosystems and species ■ Land instability, increased sedimentation and erosion ■ Drainage of lowland Arctic tundra
	Decreased ice cover (later freeze and earlier breakup)	■ Reduced winterkills ■ Changes in deposition of sediments in floodplains, affecting aquatic life
	Glacial retreat and decreased snow cover	■ Changing hydrological regimes ■ Changes in seasonal cues for mountain biodiversity ■ Increased predation ■ Disruptions in hibernation patterns ■ Reduced insulating protection from snow ■ Loss of snow bed ecosystems and species

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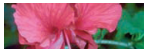
The Changing Climate	Projected Climate Impacts	Impacts on biodiversity
Changes in precipitation regimes	Increased instances of drought	■ Loss of ground cover leading to desertification and loss of soil biodiversity ■ Increased water stress on biological communities ■ Reduced availability of food and fodder ■ Salinization, compaction, cementation of soils ■ Increased risk of fire ■ Changes in natural flow regimes of rivers and streams ■ Changes of alpine grassland to steppe
	Increased flooding	■ Increased erosion of soil biodiversity ■ Increased land degradation ■ Increased threats from water-borne disease ■ Increased habitat destruction from flooding ■ Changes in natural flow regimes of rivers and streams
	Decreased freshwater availability in lakes and coastal zones	■ Decline of water levels and availability in freshwater lakes ■ Significant impacts on near-shore coastal biodiversity (e.g. bird and aquatic species) ■ Disappearance of coastal wetlands ■ Emergence of new land and property ownership issues
Increased frequency of extreme climatic events	Disruption in growth and reproduction	■ Changes in biodiversity, biomass and productivity ■ Changes in fires, insects and disease regimes ■ Increased mortality ■ Damage to forest structure, alteration of succession patterns and landscapes
	Heightened storm surges	■ Increased mortality of ecosystems and disturbance of critical habitat ■ Habitat loss (especially mangroves, reefs, sandbars and beaches) ■ Increased erosion and sediment damage




spread for some sedentary species, including large tree-species, may be slower than the predicted rates of change in climatic conditions.

The most vulnerable ecosystems will include those habitats where the first or initial impacts are likely to occur, and those where the most serious adverse effects may arise or where the least adaptive capacity exists. These include, for example, Arctic, mountain and island ecosystems. Tools and guidance in the form of scientific predictions of ecological states are essential to pinpoint priority ecosystems and to guide climate change response options.

Organisms and ecosystems have a natural but limited ability to adjust to climate change. It is clear that as the climate has cooled and warmed over the past hundreds of thousands of years, the various major ecotypes and the animal communities that inhabit them have shifted cyclically to the north and south. Projected climate change, primarily driven by human-induced causes, is faster and more profound than anything in the past 40,000 years, and probably the last 100,000 years (IPCC, 2007). The UN Intergovernmental Panel on Climate Change (IPCC) Working Group II report suggests that 20 to 30 percent of global plant and animal species are likely to be at increased risk of extinction if increases in global average temperature exceeds 1.5 to 2.5 degrees Celsius.

The UN Convention to Combat Desertification

http://www.unccd.int/

The UN Convention to Combat Desertification (UNCCD) promotes an innovative approach to managing dryland ecosystems and arid regions and recognizes that desertification is caused by climate variability and human land management activities. Desertification is defined by the UNCCD as "land degradation in arid, semiarid and dry sub-humid areas resulting from various factors, including climatic variations and human activities" (Millennium Ecosystem Assessment, 2005). Desertification involves the loss of biological and economic productivity, as well as complexity in croplands, pastures, and woodlands.

The UNCCD recognizes that combating desertification is necessary to improve conditions in developing countries, particularly the least developed. To combat desertification and mitigate its effects in countries experiencing serious drought and/or desertification, the UNCCD outlines long-term integrated strategies that focus simultaneously on improved productivity of land and the rehabilitation, conservation and sustainable management of land and water resources. Its chief mechanism for implementing them is through the development of action programs to manage dryland ecosystems and arid regions (UNEP, 1996).

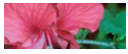
Addressing the underlying causes of desertification and drought and identifying measures to prevent and reverse them, action programs have been detailed for Africa, Asia, Latin America and the Caribbean, and the Northern Mediterranean (UNEP, 1996). The UNCCD also recognizes that the implementation of the UNFCCC, the CBD and related environmental conventions will play a significant role in combating desertification.

Examples of Climate Change Adaptation Options for Biodiversity

Adaptation options can be classified under many general thematic approaches, which include the following:

i. Adaptation Strategies:

- Ensure options are of the do-no-harm variety
- Improve predictions or plausible scenarios of future climate change
- Develop National Adaptation Plans that include biodiversity
- Undertake Adaptive Capacity Studies
- Prioritize intact or relatively unaffected habitats for protection
- Engage local people in planning and implementing mitigation and protection strategies
- Design reserves to protect vulnerable life stages
- Respond to changes already inherent in the system
- Improve integrated monitoring and detection programs



ii. Planned Adaptation

- Build corridors
- Reintroduce species, with great care
- Assist species regeneration
- Employ ex-situ conservation if extinction is imminent
- Manage for disturbances to the ecosystem
- Account for projected effects of climate change when designing new protected areas
- Track and manage invasives (e.g., control or eradicate invasive species)

iii. Building Ecological Resilience

- Reduce fragmentation
- Protect space, functional groups, climate refugia and multiple microhabitats in replicated areas
- Maintain a natural diversity of species, ages, genetic diversity and ecosystem health
- Provide buffer zones and flexibility of land uses
- Ensure connectivity of habitats along gradients
- Reduce other related and cumulative stressors

iv. Technological Adaptation Solutions

- Efficient management of rain/snow water availability
- Changes in timing/type of irrigation and fertilization
- Inoculate with soil biota important to plant vigor
- Establishment of aquaculture
- Diversion of fresh water
- Seawalls, dykes and tidal barriers
- Bridges to cross inundated areas
- Increase density and reliability of climate monitoring

v. Behavioral Adaptation Solutions

- Early-Warning Climate Alert and Response Programs for Biodiversity
- Prediction of climate extremes and hazards for emergency preparedness and disaster management of critical biodiversity
- Risk management assessments and priority setting of behavioral-based action plans to reduce the impacts of a changing climate on the functioning of biodiversity
- Redefinition of critical biodiversity thresholds to the new multiplier climate

vi. Regulatory/Policy Adaptation Actions

- Re-zone coastal areas
- Establish protected areas
- Natural forest regeneration or avoided deforestation
- Decrease nutrient enhanced run-off
- Non-chemical control of pest/disease outbreaks
- Establish no-take zones
- Landscape scale management of water availability and quality
- Change trade policies

vii. Economic Adaptation approaches

- Changes in grazing management and water management
- Apply modifications in agricultural land base and incentives for more sustainable agriculture and forestry
- Offer incentives to control the spread of invasive species
- Eliminate incentives that accelerate habitat loss
- Adopt energy efficient technologies for both adaptation and mitigation benefits

viii. Adaptation Science

- Model the buffering capacity of forest habitat for biodiversity in a changing climate, especially in urban parks and school yards
- Reduce other pressures/threats
- Introduce species tolerant to salt, drought, pests or higher temperatures
- Rehabilitate damaged ecosystems
- Multi-cropping, mixed farming, low-tillage cropping or low-intensive forestry
- Apply integrated models for climate and biodiversity prediction
- Improve the understanding of extremes/hazards and cumulative events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