

Climate Change and Biodiversity

Presentation to the Regional Workshop for the
Caribbean on Updating National Biodiversity
Strategies and Action Plans (NBSAPs)

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Ottis R.F. Joslyn, MSc.

Climate Change and Biodiversity

Presentation's Focus

- What are the main biodiversity related (including biodiversity based livelihoods) impacts of CC in the Caribbean Region?
- What are the options for supporting biodiversity (and biodiversity based livelihoods) to adapt to CC?
- What are the options for supporting biodiversity based mitigation of CC?
- How can Caribbean Island Countries mainstream CC considerations into biodiversity planning (mitigation and adaptation, with an emphasis on adaptation)?
- How can biodiversity conservation, sustainable use and livelihoods be mainstreamed into adaptation planning?
- How can we ensure these considerations are further mainstreamed into development planning?

Climate Change and Biodiversity

Regional Framework for Achieving Development Resilient to Climate Change

- Defines CARICOM's strategic approach for coping with climate change
- Guided by 5 strategic elements and 20 goals designed to significantly increase the resilience of the CARICOM member states' social, economic and environmental systems

Climate Change and Biodiversity

STRATEGIC ELEMENTS

1. Mainstreaming climate change adaptation strategies into the sustainable development agendas of CARICOM states;
2. Promoting the implementation of specific adaptation measures to address key vulnerabilities in the region;
3. Promoting actions to reduce greenhouse gas emissions through fossil fuel reduction and conservation, and switching to renewable and cleaner energy sources;
4. Encouraging action to reduce the vulnerability of natural and human systems in CARICOM countries to the impacts of a changing climate;
5. Promoting action to derive social, economic, and environmental benefits through the prudent management of standing forests in CARICOM countries.

Climate Trends and TAR Projections



- 1990's warmest decade; 1998 warmest year on record since 1861
 - Over last century temperature rise of $0.6 \pm 0.2^\circ\text{C}$; Projected increase by 1.4 to 5.8°C over period 1990 to 2100
 - Global sea level rose between 0.1 and 0.2 metres. Without precedent during last 10,000 years, sea level projected to rise by 0.09 to 0.88 metres
- Projected rate of warming greater than observed changes in 20th Century

Likely Consequences of Climate Change

- Increased global air temperature
- Drought
- Heavy precipitation
- Increased sea water temperature
- More frequent and intense storms
- Increased in extreme events



Impacts on Ecosystems (Macro impacts on biodiversity)

- Coral reefs – coastal protection threatened, fishery, white sand beaches
- Inundation of wetlands
- Stress on forests and at time destruction – (water, temperature, storms / hurricanes)
 - loss of feeding grounds, nesting and roosting areas [Hurricane David, for example, caused the devastation of feeding and nesting sites of the two Dominica's endemic parrots; the populations of these endangered parrots reached critical low levels, i.e., 60 individuals of *A. imperialis*, and 200 of *A. arausiaca* (Commonwealth of Dominica, 2001, UNFCCC Initial National Communication)]

Flora and fauna have adjusted to gradual and sudden climatic changes.



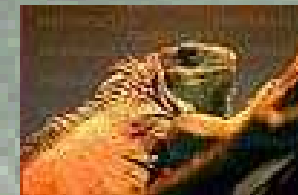
Impacts on Biodiversity

- Probable loss of total mangrove area due to erosion of the seaward margin of the mangroves and loss of protective lagoon bars and sea barriers;
- Relocation and migration of mangroves inland, rather than overall loss. This landward migration can be obstructed if the landward margin of the mangrove area is steep or if there are seawalls and other developments, thereby reducing the areas of coastal ecosystems;
- Change in mangrove forest structure. Landward replacement of black mangrove (*Avicennia*) by red mangrove (*Rhizophora*) and possible increased growth and productivity of the mangrove area;
- Increase in mangrove area and changes to associated wetland community types and distribution. Saline intrusion into inland freshwater wetlands and rejuvenation of scrub mangrove sites
- Increases in salinity can result in reduced seedling survival and growth, and decreased photosynthetic capacity (Ball & Farquhar, 1984)
- Water temperature in excess of 35°C can cause thermal stress in *Rhizophora mangle* (Banus, 1983). Diversity of invertebrate root communities was much reduced, and seedling establishment prevented over 38°C (Banus, 1983)

Species Whose Sex Ratios are Affected by Climate



- E.g. Reptiles - sex of offspring affected by temperature at which eggs are incubated.
 - Increased temperatures produce more male alligators and more female turtles, thus allowing sex ratios to be adjusted in response to environmental changes



However, 4 factors set current phase apart from preceding ones



- Human consumption of natural resources and conversion of natural forests and other habitats to other purposes appear to forcing change
- Increase in human population - any change in climate increases impact on people
- Natural ecosystems scattered among human agriculture and other cultural landscapes
- Anthropogenic influences reduce resilience of populations of many species

Policymakers dilemma as there is a need to deal with changes that may or may not come tomorrow

Ecosystem Response to Climate Change

- Change of 3°C lead to shift in habitat type of approximately 250km in latitude and 500m in elevation – assumes continuity of available habitat
- Migration not as a community – leads to reorganization
- Reproduction major mechanism by which animal species will adapt to GCC. In plants, an increase in CO₂ concentration alters growth rate of reproductive potential.

Ecosystem Response to Climate Change

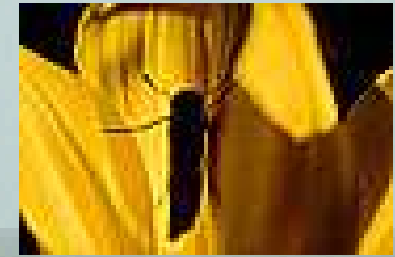
- Heterogeneity of landscape, particularly distribution of various soils, important factor determining forest responses to GCC.
- Under conditions of changing climates, variable responses by resident plants and animals are to be expected and those are likely to be highly unpredictable

Taxa Which May Benefit from Climate Change



- Plants
 - Some thrive on a CO₂ rich atmosphere. An increase in CO₂ concentration to 1000ppm produced an increase in yields of wheat, bigger sugar beet and radishes.
 - When CO₂ is high, stomata are partially closed to reduce loss of water – shrubby vegetation may spread into more barren regions.

Insect Pests



- Plants fertilized by CO₂ less nutritious – more of plant consumed by caterpillars to achieve growth
 - Suggests that insect pests are a bigger threat to crops
 - Locusts, aphids, moths more active



Long-lived trees

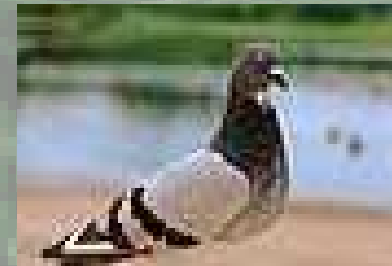
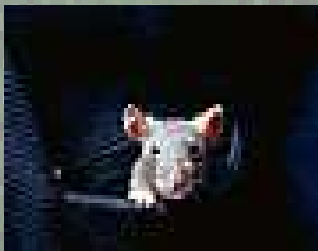


- Trees which disperse wind blown seeds or drop seeds carried by animals have a better chance of survival/migration.



- **Species Commensal with Humans**

Expected to respond well – rats, mice, sparrows, pigeons



Taxa Which May be Threatened

- Rare or already threatened species
 - Species at such low population levels that they require extraordinary conservation action – additional stress could lead to extinction
- Migratory species
 - Need appropriate migratory pathways. E.g. if wetlands dry out at critical times of the year, entire migratory system may break down
- Species dependent on timing of ice melting
 - Early melting could let to PH change in rivers with impacts on fish fry and eggs.
 - Less water may be available in warmer summers

Taxa Which May be Threatened

- Genetically impoverished species
 - Genetic diversity enables species to adapt, so impoverished species may suffer
 - At risk are crops genetically selected for certain characteristics.
- Specialized species
 - Depend on narrow range of habitat conditions – may be unable to adapt to fundamental changes in habitats caused by GCC – (bamboo)
- Montane and Alpine communities
 - » E.g. species that depend on alpine grasslands may find it difficult to survive if grasslands are invaded by shrubs and trees as forests climb elevation

Protected Areas supports Biodiversity based Mitigation of CC

- Strongest tool for conserving biological diversity. Can:
 - Offer refuge to threatened species and communities
 - Provide source of genetic diversity for agriculturalists
 - Help maintain water cycles
- Draw back is limited size. Need much larger areas which will enable variety of microclimates to shift with conditions.
- Also ensure, if possible, the protected area covers wide altitudinal gradient
- Reduce/Prevent pollution of Sea/Ocean from land-based point and non-point sources and from ships
- Conduct reforestation activities and reduce/prevent deforestation

Strategy for Policy

- Pursue “win- win” options which provide societal benefits whether GCC occurs or not
- Explicit considerations of potential future impacts of GCC in conservation plans
- Formulate, approved and implement country specific national climate change strategies and action plans with strong emphasis on adaptation but inclusive of mitigation especially in the areas of energy and land use
- Encourage and promote regional integration, collaboration and coordination

Some Suggested Policy Elements

- Research on potential effects of GCC on biodiversity
- Implement action to conserve sufficient natural habitats to enable natural adaptive mechanisms to function
- Implement action to conserve species likely to be affected by climate change, including both in situ and ex situ efforts
- Design improved international mechanisms for dealing with the impacts of GCC on biodiversity
- Support mitigating actions in other sectors

Considerations for Mainstreaming Biodiversity into National Development Planning

- Education of policymakers along with middle and top managers in the Public Service on the importance of biological diversity, current and potential impacts and consequences from CC and practical and potential actions that must be taken;
- Management of biodiversity incorporated into annual budgets and work plans for all sectors;
- Continue education of students at the preschool, primary, secondary and tertiary levels of the academic system;
- Periodically conduct science fairs on biodiversity and biodiversity based livelihoods emphasizing the sustainable economic opportunities;
- Prepare and submit in 5-years cycle a strategic 5-Years plan on biodiversity to Cabinet

Principles for Future Action

- Maintaining maximum biological diversity assumes far greater urgency in the face of climate change threat.
- Recommending action locally in face of great uncertainty is difficult, but it is sensible to provide local communities with capacity to adapt to these changes based on traditional knowledge about local ecosystems and their management
- Greater scientific attention needs to be given to studying climate change and its implications for all ecosystems - terrestrial, marine and freshwater.

Scientific Information Needs and Gaps

- Enhanced understanding of the relationship between biodiversity, ecosystem structure and function, and dispersal and/or migration through fragmented landscapes;
- Improved understanding of the response of biodiversity to changes in climatic factors and other pressures;
- Development of appropriate resolution transient climate change and ecosystem models especially for quantification of the impacts of CC on biodiversity at all scales;
- Improved understanding of the local to regional scale impacts of climate change adaptation and mitigation options on biodiversity;
- Further development of assessment methodologies, criteria, and indicators to assess the impact of climate change mitigation and adaptation activities on biodiversity and other aspects of sustainable development;
- Identification of biodiversity conservation and sustainable use activities and policies that would beneficially affect climate change adaptation and mitigation (more detailed)

Climate Change and Biodiversity

An aerial photograph of a vast, dense green forest. In the upper right quadrant, a small, light-colored lake or pond is visible, surrounded by trees. The overall scene is a lush, natural landscape.

THANK YOU!!!
QUESTIONS/COMMENTS