Caribbean Natural Resources Institute

Climate change and biodiversity in the Caribbean: the knowns and unknowns

Presentation to regional CBD NPSAP/CEPA workshop
Integrating climate change into NBSAPs session
Trinidad 4 November 2008

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Climate change and biodiversity in the insular Caribbean (CCBIC) project 2006-2008

- Caribbean component of a global assessment of ‘hotspots’ funded by the John D and Catherine T MacArthur Foundation;
- Goal: To increase understanding and consensus on what is known and not known about the predicted climate change trends and their impact on biodiversity in the islands of the Caribbean

Project approach

- Interdisciplinary multi-sectoral approach
  - Regional steering committee
  - Thematic working groups (WGs)
  - Regional meeting to review (WG) findings and discuss next stepes
- Wide geographic spread (i.e. all the Anglophone, Hispanophone and Francophone independent countries and dependent territories)
- Close partnership with WWF Canada for Cuba

Project outputs

- Three main reports in English on status of current research:
  - Trends and scenarios for climate change in the insular Caribbean;
  - Impacts of climate change on marine and coastal ecosystems;
  - Impacts of climate change on terrestrial ecosystems

- Available from: http://www.canari.org/macarthurclimatechange.html

Project outputs

- 25-page summary of project findings in English and Spanish for different target audiences
- A strategic research agenda
- A preliminary capacity needs assessment

Available by the end of 2008.

Working Group 1 team

- Dr. Abel Centella, Instituto de Meteorologia (INSMET),
- Prof. Anthony Chen, Climate Studies Group Mona (CSGM) , Chairman
- Dr. David Farrell, Caribbean Institute of Meteorology and Hydrology (CIMH)
- Dr. Michael Taylor (CSGM)
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Caribbean Data Sets

- Caribbean Institute for Meteorology & Hydrology (CIMH)
  - All member countries of CMO (All English Speaking)
  - http://www.cimh.edu.bb
- Caribbean Climate Interactive Database (CCID)
  - Interactive statistics
  - Climate Studies Group Mona, UWI Mona
  - michael.taylor@uwimona.edu.jm
- Center of Climate
  - http://www..met.int.inf.cu
- Parameters
  - Precipitation (intensity and duration), temperature (daily maximum and minimum), wind speed, direction, radiation, relative humidity among others
  - Processed
- Data sets vary with some data sets containing more parameters than others.
- Some unprocessed data exist

21st century projections for Caribbean: temperature

- **Very likely (> 90% probability) that Caribbean temperatures will increase**
- **Slightly below global average of 3.4ºC (above pre-industrial level) by end of century** (based on IPCC A1B)
- Agreement of observation, global models, statistical downscaling, good physical basis
- Extent will depend on actual green house gas emissions

21st century projections for Caribbean: precipitation

- **Likely (> 66% probability) drying in the Greater Antilles in June, July and August (JJA)**
  - General Agreement between Global Models
  - A Global model run for the Caribbean show decrease in JJA (Angeles et al, 2007)
  - Some statistical runs show decreases in JJA
  - Drying trend in observed data (Neelin et al., 2006)
  - Theoretically, drying is probable in Greater Antilles (Chou and Neelin,2004)

21st century projections for Caribbean: hurricanes

- Likely (>66%) that intense tropical cyclone will increase in some regions
  - **Not enough information to make specific statement about the Caribbean**

21st century projections for Caribbean: sea level

- Modelling
  - Large deviation among models
  - No regional modelling
  - Global mean rise expected: 0.2 to 0.5 m up to 2090s
- General statement: Sea levels are likely (>66% probability) to continue to rise on average around the small islands of the Caribbean, near the global mean

Post WGI and Post IPCC Projections for Sea Level rise

- "*If current climate models from the IPCC included data from ice dynamics in Greenland, the sea level rise estimated during this century could be twice as high as what they are currently projecting*,"
  - University at Buffalo scientists (Science Daily, Feb. 12, 2008)
- More than double (guardian.co.uk, September 01 2008)

Actions needed to address key gaps: data deficit

Put in place:

- mechanisms to facilitate the sharing of data located in existing archives and databases scattered throughout the Caribbean.
- structures/programmes to capture data that is not yet digitized and not yet available for use by researchers.
- programmes, infrastructure, and instrumentation to enable and/or support the capture of new data.

Actions needed to address key gaps: data deficit

- Subject existing data to rigorous quality control techniques in order to build a climate database for use by other sectors.
- Acquire useful datasets from sources outside the Caribbean, e.g., detailed bathymetric and ocean circulation maps of the Caribbean region,
- Create additional databases (where possible) of variables deemed necessary for interdisciplinary work e.g. soil moisture, SST)

Actions needed to address key gaps: capacity

- Invest in postgraduate training
  - Caribbean climate variability and change,
  - numerical modelling of climate,
  - oceanography,
  - modelling of climate change impact on various sectors including biodiversity
- Support student exchanges within and outside of the region.
- Support for staff education and training numeric and impact modelling,
  - interpretation of results,
  - methods for analyzing climate change, etc.

Actions need to address equipment gaps

- Acquire appropriate equipment and software, e.g. massive storage devices, high speed intranet, radar networks, satellite images, software licenses and professional packages
- Update meteorological infrastructure to ensure recording of quality data.

Actions to address the knowledge gap

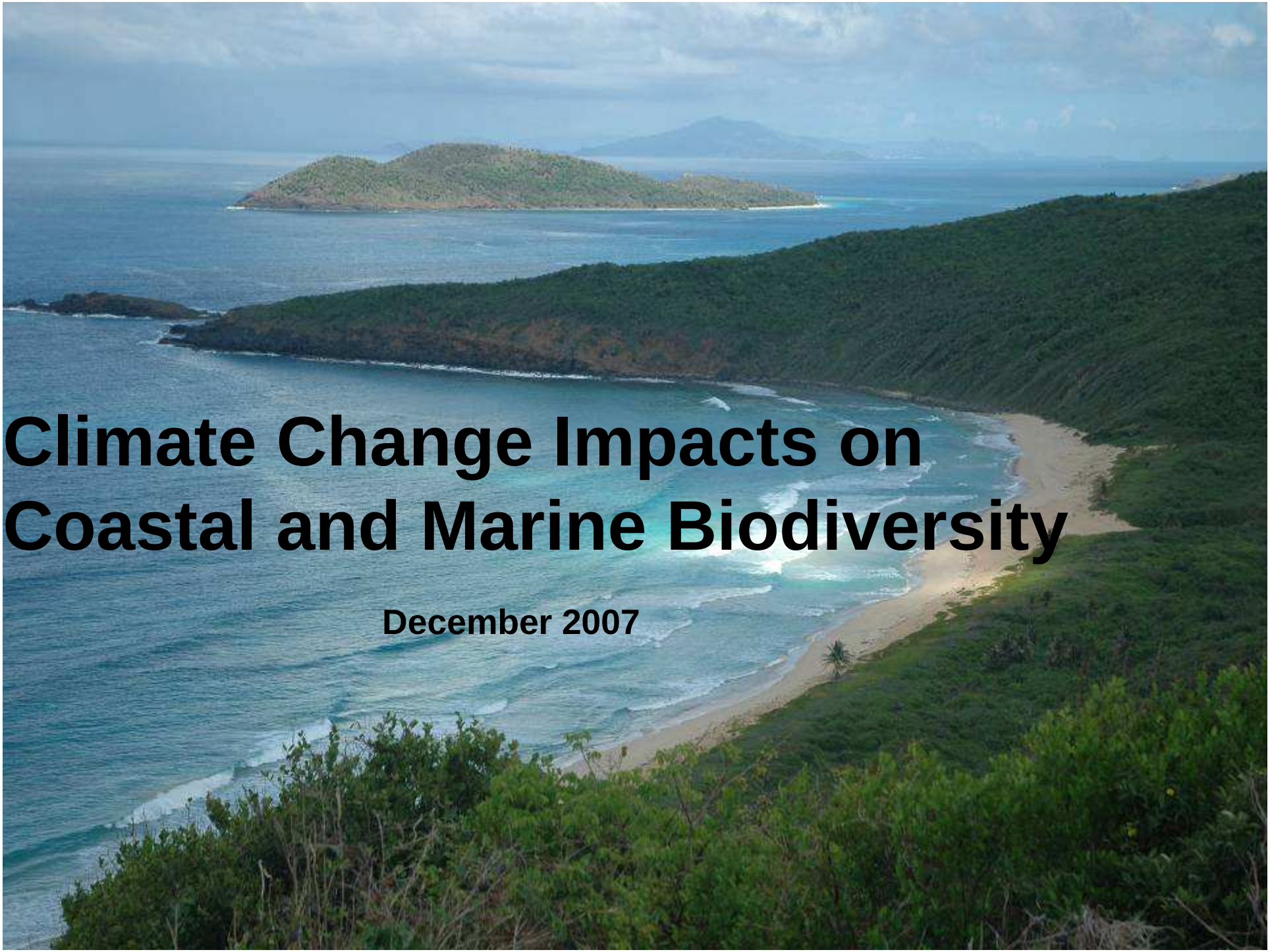
- Develop online mechanisms for storing and disseminating information
- Develop a Caribbean climate atlas.
- Facilitate dialogue between climate researchers and scientists of other sectors
- Support graduate student research and cross disciplinary training.

WG1: Making the case to sceptics

- Even if conditions were stabilized, increases in temperature and sea level rise will occur during 21st century due to the long life time of greenhouse gases in the atmosphere and the 'long' memory of the ocean
- There are many advantages to be gained by investing in addressing the identified gaps, outside of global warming concerns.
  - Increased capacity in climate studies will lead to better forecasting of daily weather and of seasonal changes, such as drought and floods.
  - Crop models and climate models could be combined to predict crop yields.
  - Models could be run to determine the effects of deforestation, or better yet, the effects for re-forestation, etc.

Research Idea
Reforest Haiti

- Use regional climate models to simulate what would happen in the future if Haiti is reforested
  - Impact on climate, human well being
- Use results to develop reforestation and land use plans which will generate carbon credits and improve human well being.



Climate Change Impacts on Coastal and Marine Biodiversity

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Team

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General comments on main knowledge gaps

- Available information very generic both for habitats and species; the ability to define boundary conditions for different species and different climatic scenarios is a long way off
- Conflicts in available information
- Insufficient ground truthing for model studies
- Limited information, especially for the smaller islands
- There is a wealth of difficult-to-access information in the unpublished literature
- Level and depth of information varies according to the particular system

Gaps and recommendations

1. Long term monitoring of changes in coastal and marine ecosystems
2. Connectivity between systems in the insular Caribbean
3. Modeling of circulation changes
4. Sea level and sea surface temperature data
5. Ocean acidification
6. Diseases and invasive species
7. Algal blooms and plankton
8. Remediation techniques and ecosystem resilience
9. Biological research and assessments
10. Species response to changes in temperature

1. Long-term monitoring of changes in coastal and marine ecosystems

Gaps

- Large variation from island to island in existence of data relating to spatial extent of ecosystems, inventories of flora and fauna, and monitoring of ecosystem changes
- Accessibility of data
- Analysis of results

Recommendations

- Compile and analyze existing data and prepare a regional baseline against which future changes can be compared
- Establish an effective data management and data sharing mechanisms

2. Connectivity between systems in the insular Caribbean

Gaps

- Connectivity and interrelationships between species and systems in the Caribbean large marine ecosystem
- Recruitment and retention of coral larvae

Recommendations

- Research to better understand interrelationships in the Caribbean large marine ecosystem
- Predictive models on how climate change will affect key species, and predator/prey relationships
- Analyze potential changes in environmental services and economic benefits

3. Circulation changes in the Caribbean Sea & adjacent

Gaps

How temperature change will affect water circulation in the Caribbean Sea and adjacent water bodies, sites of upwelling and downwelling, and marine flora and fauna

Recommendations

Predictive models to show horizontal and vertical water movements likely to result from climate change and their effects on dispersal, productivity, migration and habitats of marine flora and fauna

4. Sea level and sea surface temperature data

Gaps

- Accurate sea level change data
- Sea surface temperature data

Recommendations

- Establish a representative network of tide gauge stations
- Establish an effective temperature data collection system including nearshore waters

5. Ocean acidification

Gaps

- Calcification response to increased CO_2 in key species
- Changes in calcification rates
- Mechanisms of calcification
- Diurnal and seasonal cycles of the carbonate system

Recommendations

- Select key species and conduct research into calcification rates, responses and mechanisms
- Establish baseline and long-term monitoring of pH and calcification rates on corals

6.Diseases and invasive species

Gaps

- Coral diseases and how they respond to temperature changes
- Diseases affecting Caribbean marine mammals and turtles
- Distribution and abundance of marine invasive species

James Cervino © 1997

This sea fan has been hit by a potentially lethal infection of Aspergillus, a normally land-based fungus. The reddish growth is a secondary infection with cyanobacteria.

Recommendations

- Develop a database of diseases affecting marine species and determine their present and future trends
- Prepare a database of marine invasive species

Select key diseases for further research in relation to climate change

7. Algal blooms and plankton

Gaps

- Current trends in algal blooms and plankton distribution, and how these are impacted by changes in climatic parameters

Recommendations

- Baseline survey and long term monitoring of algal blooms and plankton distribution patterns in the region and the effects of changes in climatic indicators

8. Remediation techniques and ecosystem resilience

Gaps

- Incomplete knowledge on ecosystem remediation techniques suitable for national and regional situations and their efficacy

Recommendations

- Compile information on ecosystem remediation techniques
- Involve the wider community in monitoring selected sites and implementing measures that strengthen the resilience of the ecosystem to change

9. Biological research and assessments

Gaps

- Information on basic biology, behaviour, distribution, abundance, migration and habitats of smaller odontocetes, seabirds and waterfowl, in particular

Recommendations

- Determination of biology, status assessments, life histories and impacts of climate change on selected species

10. Species responses to changes in temperature

Gaps

- Uncertainties about future fish stocks, including spawning times, in the light of climate change

- Sex ratio in turtle hatchlings and increasing temperatures

Recommendations

- Select key species for detailed research on tolerance levels and increased temperatures

Final thought from WG2

A time for research
and also a time for action

Report of the Working Group on Terrestrial Biodiversity

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Methodology

- Team split into two groups:
- 1) focused on the Spanish and French speaking countries of the Caribbean and conducted in depth assessments of ***Cuba***, the ***Dominican Republic***, and ***Haiti***.
- 2) focused on the English-speaking islands and conducted in depth assessments of:

  -***Antigua and Barbuda*** –small, low-lying, dry, OECS state.

  -***The Bahamas*** – low-lying, dry, archipelagic state.

  -***Dominica*** – small, mountainous, water-rich OECS state.

  -***Jamaica*** – large, mountainous

"The expected impacts of climate change on terrestrial biodiversity in the Caribbean islands, was rather scarce and almost absent in the reviewed literature"

- This is valid for the literature found in Spanish, English and French.

- ***Baseline knowledge on terrestrial biodiversity*** exists but not equally complete for all islands

Biodiversity: species lists, ecology.

- ***Species lists are available*** for all islands, although the compiled information did not allow for identification of whether there are gaps for some groups
- ***The vegetation formations and/or ecosystems are identified.*** The information obtained did not allow for identification of the degree of knowledge on the ecology of species and formations.

Protected area distribution and status

All countries have declared protected areas.

- Information on the **degree of biodiversity protection, or coverage of biodiversity** by the established protected areas, **is not always available**.
- Current management **plans of protected areas do not take climate change into account**.

Species distribution maps

- Only regional maps identified are for fungi
- TNC vegetation maps available but suitability for modelling needs checking
- Only national map of vegetation fragmentation identified was Cuba

Agrobiodiversity

- the main plants and animals that are traditionally used by people are identified.
- not all countries have the species used by people and the genetic resources are protected by law or are in situ collections.
- risk that these resources and traditional knowledge will be lost, and not only due to the projected impacts of climate change but also due to other socio-economic pressures. There is an urgent need to record the oral traditional knowledge.

Main gaps and challenges

- Information on the expected impacts of climate change on the terrestrial biodiversity of the Caribbean island is scarce;
  - ***need for a data porthole*** through which data and information on the impact of CC on the regional biodiversity can be accessed**.** The facility should be maintained in different languages
  - Development of regional network of institutions working on climate change and biodiversity

Main gaps and challenges

- Information/knowledge of regional biodiversity widely dispersed/not easy to access;
- Attempts should be made to standardise existing and future databases to ensure a compatible structures to facilitate sharing, exchange, and use of biodiversity data at the regional level.
- Databases on biodiversity in the region need to be geo referenced, including the altitude

Main gaps and challenges

- No standardised record of observations on transformations of phenology and behaviour of biodiversity
- Absence of phenological studies in the climate change-related literature;
- Information on invasive and introduced species is disperse and incomplete

Capacity gaps

- Data collection and monitoring
  - capacity for collecting biological data patchy - not in all the countries and not for all the taxa.
  - need to develop local capacities for collecting biodiversity data rather than relying on foreign scientists
  - local monitoring capacitiy needs to be developed, particularly **monitoring the impacts of climate change on biodiversity.**

Suggested guiding principles from WG3

- All approaches to biodiversity adaptation to climate change should consist of “win-win” measures. Actions should be oriented not only to allow biodiversity to adapt to projected climate change. Such actions should also solve current environmental problems.

- The impact of GCC on biodiversity will be assessed for natural, agro-and-modified ecosystems. Climate change will impact all the biodiversity in different ways and different intensities. Impacts will not be limited to wildlife.

Suggested guiding principles from WG3

- The preservation of biodiversity, so that it can adapt to climate change, should occur not only in protected areas but also outside them.
- The analysis of climate change impacts on terrestrial biodiversity should incorporate socio-economic impacts like population pressure and economic pressures on land use intensity, and incomplete legal framework for biodiversity protection