

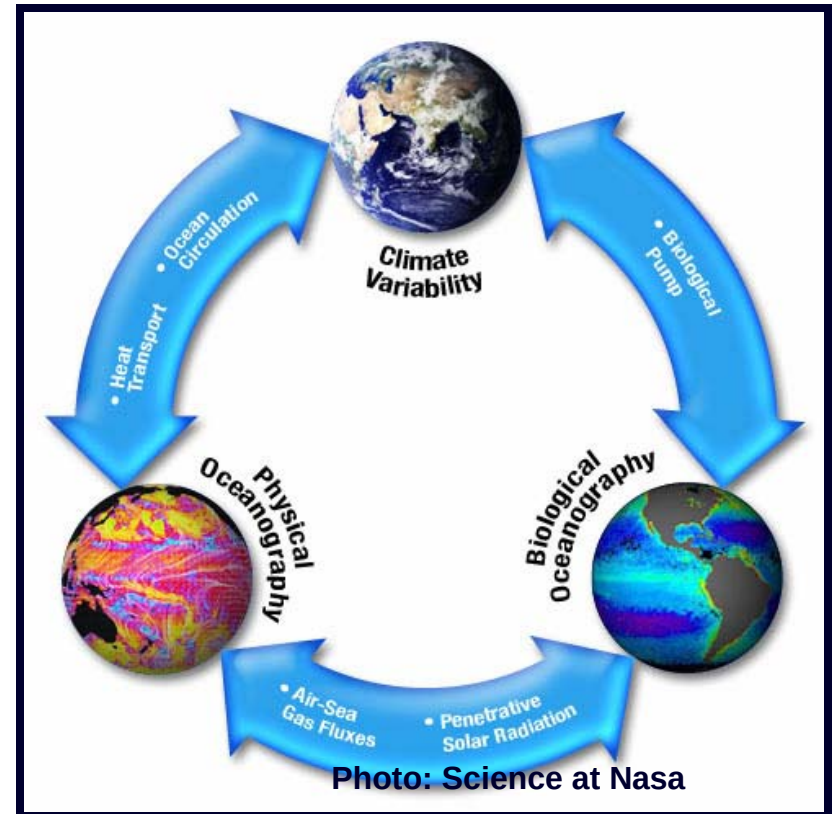
A satellite photograph of the island of Jamaica, showing its green landmass surrounded by deep blue ocean waters. The island's topography is visible, with a central mountain range and coastal areas. The image is partially obscured by a purple banner at the bottom.

By: Dale Webber

CLIMATE CHANGE IMPACTS ON JAMAICA'S BIODIVERSITY

What is Climate?

- The meteorological elements that characterize the general conditions of the atmosphere over a period of time at any one place or region of the Earth's surface.



Expected Global Climate Changes

- 1.4° to 8° C increase in global temperature by year 2100
- Rise in global mean in sea levels of 9-88 cm

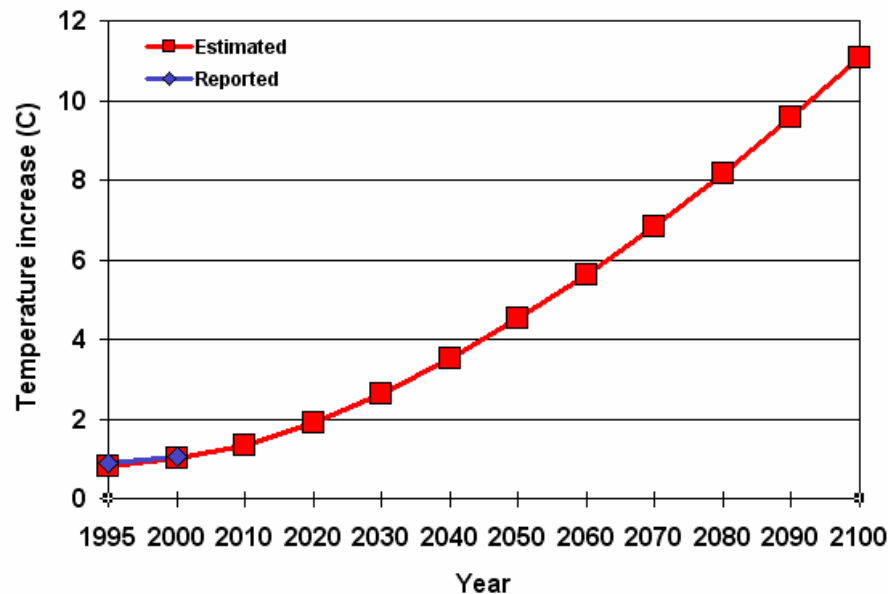


Diagram: Orjan Hallberg

Caribbean Projected Climate Change Impacts

- 0.09 to 0.88 m sea-level rise between 1990 and 2100;
- Area-averaged annual mean warming of Caribbean Sea by $\approx 2^{\circ}\text{C}$ by the 2050s and 3°C by the 2080s;
- Fewer rain days per year but an increase in the daily intensity of precipitation = greater probability of more frequent drought and flood events;
- No significant change in hurricane frequency, but a possible increase of 10 to 20 % in hurricane intensity (Nurse and Sem 2001).

(Walling & Creary-Chevannes)

WHAT IS BIODIVERSITY?

- Coined from the phrase “Biological Diversity”
- Defined by UNEP as:
 - “the variability among living organisms from all sources including, terrestrial, marine and aquatic systems and the ecological complexities of which they are a part.”
- The variety of life on earth, expressed through ecosystems, goods and services that sustain our lives (CBD).
- 3 components of Biodiversity
 - Genetic or hereditary diversity
 - Taxonomic or species diversity
 - Ecosystem or habitat diversity

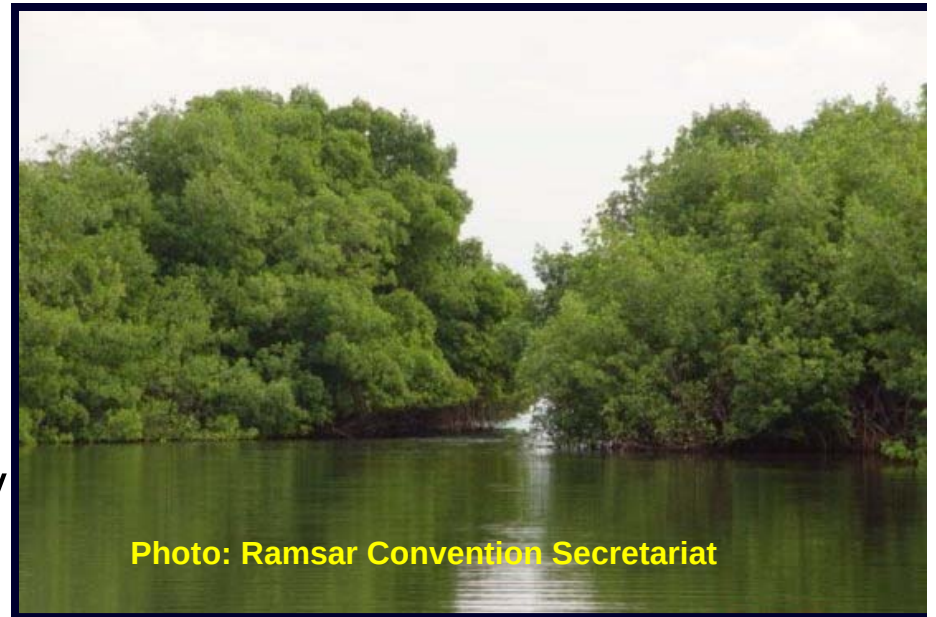


Photo: Ramsar Convention Secretariat

BIODIVERSITY DEFINITION



Biodiversity has a variety of meanings:

- 1) **The number of different native species** and individuals in a habitat or geographical area;
- 2) **the variety of different habitats** within an area;
- 3) **The variety of interactions that occur** between different species in a habitat; and
- 4) **The range of genetic variation** among individuals within a species.

Jamaica's Biodiversity at a glance.

Over 8,000 species recorded

Ranked 5th globally for endemic species

Group	No. of Species	Endemics
Plants (Flowering /ferns/lichens)	>6000	28%
Butterflies	>120	15?
Frogs	19	17
Breeding birds	113	26
Migrant birds	100	
Mammals	22 (21 bats)	4?

Diverse Jamaican community types

1. Wet Limestone Forest
2. Dry Limestone Forest
3. Thorn Scrub
4. Cactus Thorn Scrub
5. Strand Woodland
6. Lower Montane Rain Forest
7. Montane Mist Forest
8. Elfin Woodland
9. Montane Sclerophyll
10. Herbaceous Swamp
11. Mangrove Woodland
12. Marsh Forest





CLIMATE CHANGE IMPACT ON JAMAICA'S BIODIVERSITY

- Ecosystems most vulnerable to climate change impacts include coral reefs, highland forests, and coastal wetlands (mangroves).
- Jamaica's biodiversity already under stress from:
 - human impacts including land use change,
 - pollution,
 - invasive species, and
 - over-harvesting of commercially valuable species.
- Climate change is an additional stress with expected profound impacts on the islands natural ecosystems and their species.

General projected impacts of climate change on Jamaica's biodiversity

- General impacts could be as a result of:
 - Increases in temperature on land.
 - Altered rainfall and runoff patterns.
 - Sea level rise.
 - Increase in sea surface temperature.
 - Altered intensity of hurricanes.

Climate Change: A Threat to Biodiversity

Higher Temperatures

- Change in species abundance & distribution
- Migration to higher altitudes
- Genetic changes in species to new climatic conditions
- Change in reproduction timings (life cycle)
- Increased sand temperatures, can lead to changes in sex ratios (reducing male turtle production).
- Change in length of growing seasons for plants
- Increase in extinction rate



Citrus Swallowtail (*Papilio andraemon*)
Island Hop in Wind Currents

Climate Change: A Threat to Biodiversity

Altered rainfall & runoff patterns

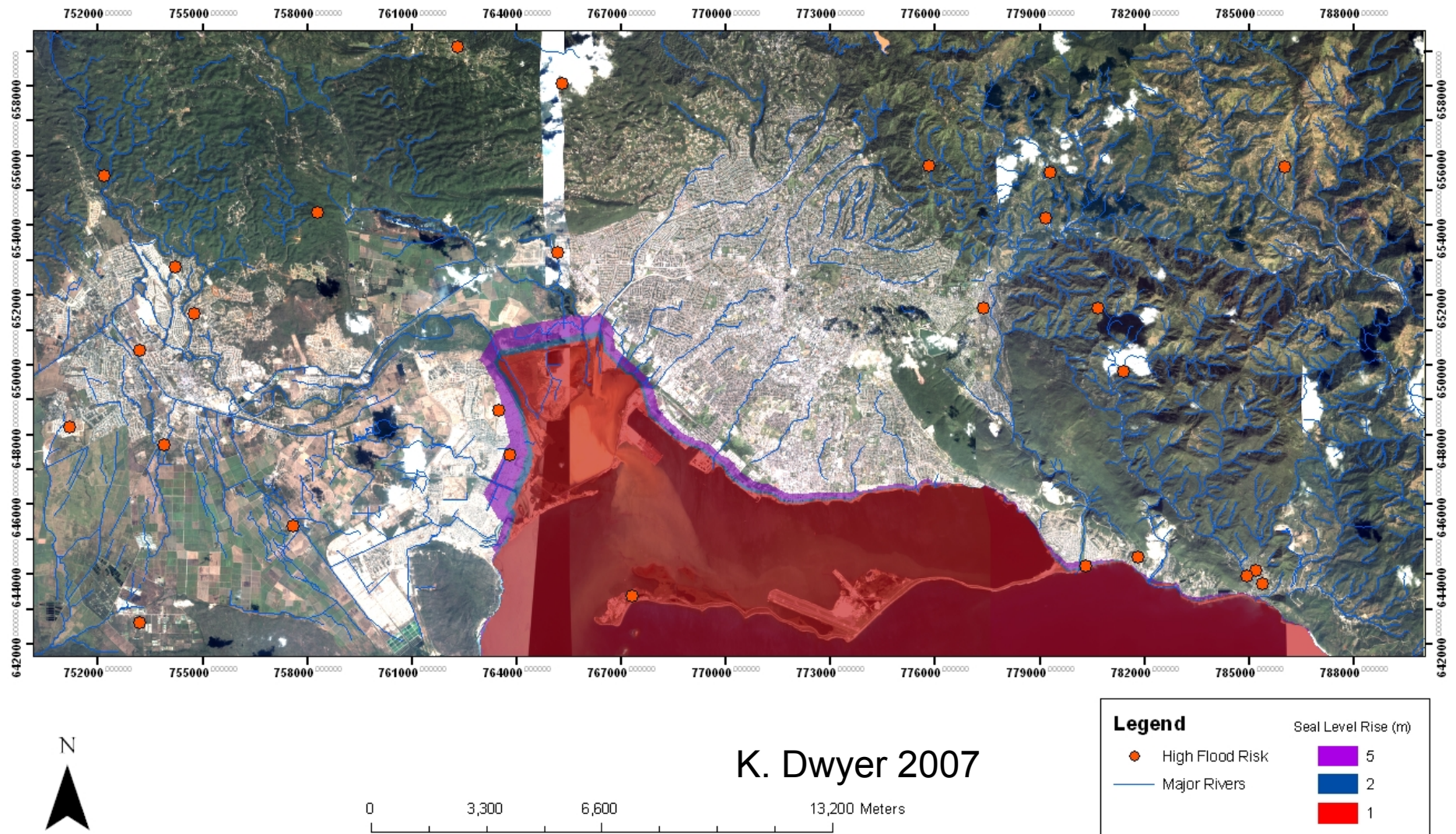
- Drying of ecosystems leading to loss of species and changes in community composition.
- Changes in species distribution and ecosystem composition.
- Changes in the geographical extent of habitats and ecosystems.
- Flooding of nests of various species and death of young individuals.

Climate Change: A Threat to Biodiversity

Sea level rise

- Changes in structure of coral reefs and shallow water marine communities.
- Increased inundation of coastal wetlands and lowlands.
- Loss of estuarine, coastal species and communities.
- Increased intrusion of salt water vegetation into freshwater ecosystems in coastal areas.
- Loss of nesting and feeding habitats particularly for endangered turtle species and crocodiles.
- The cost to protect Jamaica from a one metre sea level rise in 1990 to be US\$462 million (IPCC)

Sea level rise predictions in Kingston Harbour



Climate Change: A Threat to Biodiversity

Higher Sea Surface Temperatures

- Mild warming (+2°C), tropical near-shore communities will change from coral-dominance to algal-dominance.
- Creates conditions that may be suitable for some invasive species to become established in new areas
- High temperatures lead to coral bleaching and even coral death



Healthy (Left) and Bleached (Right) Coral

Jamaica's coral reefs experience massive bleaching due to high sea temperatures in years 1987, 1989, 1990 and 1998.

- The elimination of coral reefs would have dire consequences. Coral reefs provide habitats and nursery areas for numerous commercially important species

Climate Change: A Threat to Biodiversity

Altered hurricane intensity



- Loss of vulnerable island species.
- Changes in species competitive interactions and species and community composition.
- Changes in range of invasive species.
- Increased damage to nests & nesting sites.
- Increased destruction of sensitive habitats:
 - Coral reefs,
 - Mangrove ecosystems
 - Terrestrial (esp. forest) ecosystems.

Port Royal and environs

over 1000 species recorded

Taxon	Number of Species
Macroalgae	98+
Porifera	54+
Cnidaria	156+
Ctenophora	4
Platyhelminthes	3+
Annelida	26+
Crustacea	158+
Mollusca	295
Bryozoa	18+
Chaetognatha	3
Echinodermata	81
Hemichordata	2
Chordata	228-278+

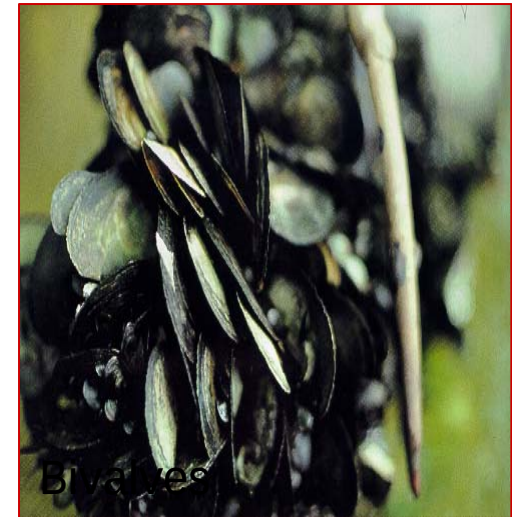
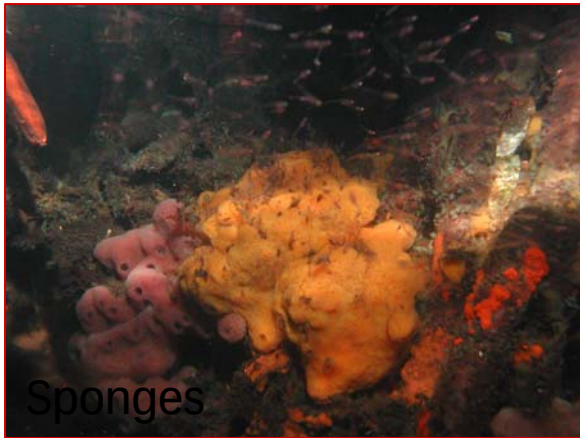
Goodbody, 2004

Mangrove Prop roots



Prop roots hang into the water and provide firm substrate for the attachment of sessile organisms

Sessile Organisms



Value of Mangrove Biodiversity

- Ecological value

- Sediment trap
- Purification (sewage, fertilizers)
- Shoreline and infrastructure protection
- Nutrient release
- Nursery ground
- Habitat for other species
- Refuge during hurricanes and severe storms

- Exploitable resources

- Medicinal
- Food
- Timber cutting
- Tannins

FORESTS AND CLIMATE Vulnerability

- 30% of Jamaica's land area is forest
- Provide a wide variety of goods and services
- Home of several endemic plants and animals
- Small changes in temperature and precipitation have significant effects on forest growth



Jamaican Tody (*Todus todus*)

One of the many endemic birds
found in Jamaican forests

Blue & John Crow Mountains

over 1000 species recorded

Group	No. of Species	Endemics
Plants (Flowering /ferns/lichens)	>500	240
Orchids	>200	65
Snails	100	?
Breeding birds	50	22
Invertebrates	>200	?

Threatened species

- Portland Ridge Frog
- Logger head turtle
- Hawksbill turtle
- Green turtle
- Jamaican slider turtle
- Cricket lizard
- Jamaican Iguana
- Blue-tailed Galliwasp
- Jamaican Boa
- Jamaican Thunder snake

- White Ibis
- Glossy Ibis
- WI Whistling Duck
- Masked Duck
- Black Rail
- Clapper Rail
- Caribbean Coot
- Bridled Tern
- Fish-eating Bat
- Jamaican Hutia (Coney)

Important Jamaican biodiversity habitats/hotspots

- **Cockpit country**
- Hellshire Hills
- Blue Mountains
- Portland Ridge
- Black River
- Canoe Valley
- Port Royal Mangroves
- Harris Savanna
- Mason River
- Portland Bight
- **Pedro Banks**



Jamaica's response to climate change

- Jamaica a Party to the UN Framework Convention on Global Climate Change since 1995.
- In Caribbean Planning for Adaptation to Climate Change Project, NRCA & CMS/UWI is monitoring of coral reef in Discovery Bay, Port Royal Cays, Pedro Banks & 6 islands.

