Media Symposium on Climate Change in the U.S. Virgin Islands 2016: Summary Report

The Foundation for Development Planning, Inc hosted the first media symposium on climate change in the U.S. Virgin Islands on January 30, 2016, at the Emerald Beach Resort on St. Thomas. The symposium was designed specifically for media professionals, and provided them with an opportunity to obtain more information on climate science, climate change issues and impacts, and implications for the U.S. Virgin Islands.

The symposium was structured as a mix of presentations (with question and answer sessions) and a general discussion focused on the perceptions, questions, and needs of the media professionals regarding communicating climate change information to their various audiences.

Presentations

Mr. Lloyd Gardner, President of the Foundation for Development Planning, Inc opened the symposium by welcoming participants, presenters, and invited experts (Appendix 1). In his introductory remarks, Mr. Gardner reiterated the special role of media professionals in communicating with various groups in the U.S. Virgin Islands, as well as the need for community discussions on climate change to be based on the best information available.

Mr. Gardner established the context for the symposium by stating that it is important to pay attention to climate matters because climate change will affect all facets of development. Borrowing from a presentation by Professor Michael Taylor (Climate Studies Group, University of the West Indies, Mona Campus, Jamaica), Mr. Gardner informed participants that:

- Climate provides the context for life in the Caribbean;
- Based on that context, the Caribbean is climate sensitive, hence climate variability presents a challenge; and
- Changing climate demands that Caribbean peoples change their actions and approaches to development.

The introductory statement was followed by presentations (Appendix 2) and question and answer sessions. The presentations covered the following topics:

- Climate Science - Mr. Roy Watlington, Caribbean Coastal Ocean Observing System.
- Climate Change Implications for the U.S. Virgin Islands - Mr. Lloyd Gardner, Foundation for Development Planning, Inc.
- U.S. Climate Program and Implications for the U.S. Virgin Islands - Dr. William Gould, U.S. Forest Service.

- Climate Change Adaptation Planning: Experience from Puerto Rico - Mr. Ernesto Diaz, Puerto Rico Department of Natural and Environmental Resources, Puerto Rico Coastal Zone Management Program.

In addition to the presenters, other invited experts included Dr. LaVerne Ragster (focusing on the health impacts of climate change) and Mr. Stevie Henry (focusing on climate change and land use planning).

Main Discussion Points

1. Communication of Scientific Information to the General Public

The two main concerns for the media professionals in communicating climate issues to the general public revolved around the issues of (i) translating scientific data to make it understandable to the public, and (ii) having climate experts that would be more definitive in linking observable phenomenon or weather events to climate change.

Media personnel suggested that scientific terms should be defined in terms of impact on communities in order for the terms to be useful to the general public. For example, instead of saying “glacial and inter-glacial period”, it may be more easily understood by the public if the period is simply called an ice age. The same concerns apply to questions about the differences between weather and climate, and about what constitutes drastic versus natural shifts in the weather pattern and climate.

Participants wanted to know how to accurately describe the role of humans in climate change, as there are many interlinked factors. The journalists expressed the wish for scientists to state unequivocally whether or not climate change is a leading factor in extreme weather events, but accepted that scientists also need to be sensitive to the imperative for scientific rigor in making cause and effect statements.

Suggestions for future action in communicating climate change information included the following:

- Journalists should consider formulating their questions to scientists in ways that allow them to obtain information without the need for absolutes.
- Establishment of mechanisms or relationships to enable journalists to have access to scientists that can translate technical information and data. An ongoing relationship is necessary because different information is needed by different societal groups, and the way that information is communicated is dependent on the receiving group.
- The Society of Environmental Journalists conducts research on how science is communicated, and should be contacted to ascertain whether the society possesses guidelines on communicating climate change to different groups.

2. Communication with Climate Deniers

Participants shared thoughts and experiences on how best to communicate with persons that do not believe in science or climate change. A representative of the V.I. Source stated that the V.I. Source did a survey on the most compelling issues in the U.S. Virgin Islands, and of the issues identified, climate change was ranked last.

It was noted that the University of the Virgin Islands conducted a similar survey on the issue of climate and health, and found that most persons do not link climate change to their health status or other issues. Participants questioned whether the seeming lack of collective intelligence on climate change was caused by community cultural norms.

Participants agreed that the best approach to communicating climate change to climate deniers is to build storylines that link climate change to the daily lives of people, particularly observable changes that are climate related.

3. Institutional Support for Local Climate Initiatives

The journalists noted that it would be useful to know which agencies should be contacted for information as part of their regular reporting on climate-related issues. Relevant agencies in the U.S. Virgin Islands were identified, as well as online information sources and Caribbean regional organizations focused on climate change and comprehensive disaster management.

Dr. William Gould informed the participants that the Caribbean Landscape Conservation Cooperative and the U.S. Department of Agriculture's Caribbean Climate Hub can provide routine support to conservation initiatives in the U.S. Virgin Islands. He also stated that the landscape conservation design process provides business opportunities, and noted the building of catchments under a program managed by the Natural Resources Conservation Service (U.S. Department of Agriculture).

Participants agreed that climate change affects all areas of society, and should therefore be incorporated into every conversation concerning community development.

4. Climate Change in Development Planning in the U.S. Virgin Islands

The media professionals generally understood the threat of climate change to the Caribbean and U.S. Virgin Islands. However, there was some uncertainty regarding the status of the comprehensive land and water use plan for the U.S. Virgin Islands, and thus specifically how development planning was being affected by climate change. A number of examples of climate affecting land use were provided by Mr. Stevie Henry.

Mr. Gardner reminded participants that the climate change adaptation program for the U.S Virgin Islands was formalized in October 2015 when the Governor of the U.S. Virgin Islands, the Honorable Kenneth E. Mapp, signed the U.S. Virgin Islands Executive Order on Climate Change. He further informed participants that the climate change program included vulnerability assessments for key economic sectors, and as such, the linkages between climate change and existing development plans would be examined as part of the program.

Concluding Remarks

In his concluding remarks, Mr. Lloyd Gardner suggested that the next steps in communicating climate change issues to the general population would be determined

mainly by media professionals and media houses. He informed participants that the Foundation for Development Planning, Inc would be participating in the territorial climate change program, and would provide some information resources on the website of the foundation.

Mr. Gardner also thanked the media professionals, presenters and resource persons for participating in the symposium. Special thanks were extended to Dr. LaVerne Ragster for assisting with logistics and transportation, and to Ms. Kelsey Nowakowski and Ms. Shaun Pennington for providing guidance on the design of the symposium.

Mr. Gardner took the opportunity to remind the participants of the objectives and purpose of the Foundation for Development Planning, Inc, which meant that the foundation intends to participate in sustainable development initiatives in the U.S. Virgin Islands and Wider Caribbean Region.

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Planning for Sustainable Futures

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Join the discussions on Caribbean development at the
FDPI LinkedIn Group

Appendix 1: List of Participants

Name of Participant	Institutional Affiliation
Christina Chanes	WUVI Student Radio Station
Chenzira Davis Kahina	WUVI Student Radio Station
Ernesto Diaz	Puerto Rico Department of Natural and Environmental Resources-Puerto Rico Coastal Zone Management Program
Susan Ellis	St. Croix Source
Lloyd Gardner	Foundation for Development Planning, Inc
William Gould	U.S. Forest Service, Caribbean Climate Hub
Stevie Henry	University of the Virgin Islands-Conservation Data Center
David Knight	St. Thomas Source
Kelsey Nowakowski	V.I. Source
Shaun Pennington	V.I. Source
LaVerne Ragster	Foundation for Development Planning, Inc
Judi Shemel	St. Croix Avis
Roy Watlington	Caribbean Coastal Ocean Observing System

Appendix 2: Presentations

Context

Climate is our context

Caribbean is inherently climate sensitive - our being, our essence, and our livelihoods are inextricably linked to climate.

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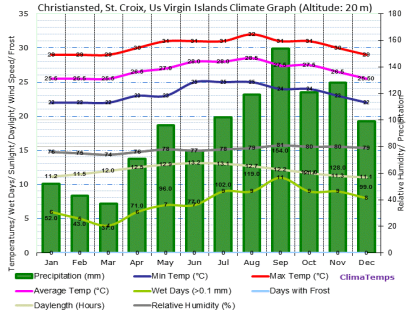
Climate pattern

Distinct historical cycle of dry and wet and hotter and cooler around which we pattern our lives.



Topography and size

Small islands (bounded by ocean) and hilly backbones means life exists on steep slopes or on limited coastal plains.

Livelihood and Wellbeing

Economy (Agriculture, Tourism,)
Health and Wellbeing (diseases and recreation) and Critical livelihood sectors (Water, Energy) bound up with climate

Extracted from presentation by Prof. Michael Taylor, University of the West Indies.

Challenge

Climate is our challenge

Caribbean's inherent climate sensitivity makes it vulnerable when the climate changes. Changes in climate therefore alter our existence as we know it.

1

2

3

Hurricanes
Floods
Drought
High Temperatures
High sea levels
Wind events

Challenge

Climate is our challenge

Caribbean's inherent climate sensitivity makes it vulnerable when the climate changes. Changes in climate therefore alter our existence as we know it.

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Plaskett Seeking Droug… USVI

BY SOURCE STAFF — AUGUST 7, 2015

Delega… territory a…

The U… several m… Departme… stands at … 12 percen… received …

With lit… have been… because g…

USDA Designates St. … Disaster Area as Floo…

BY SOURCE STAFF — AUGUST 26, 2015

As Tropical Storm Erika bears down on t… the U.S. Department of Agriculture announc… St. Croix a "primary natural disaster area" du… by drought this year.

The U.S. Virgin Islands has been under e… several months, to the point where farmers a… Department of Agriculture's water storage is … stands at barely half the normal amount, des… Thomas and St. John this week. And while r… help crops that are already dead.

Wildlife Feeling the Heat of Drought

BY BERNETIA AKIN — JULY 30, 2015

Stories began circulating this month of unusual numbers of bees showing up at some open-air restaurants and…

Wet Weather to Continue Until Midweek

BY LYNDA LOHR — NOVEMBER 28, 2015

Showers and thunderstorms will continue till midweek, meteorologist Carlos Anselmi at the National Weather Service in San Juan said at 6:30 p.m. Saturday.

"The activity and humidity will be high, but most of the showers will be over water," he said.

That wasn't the case Saturday, as St. Thomas and the western ends of St. John and St. Croix got some heavy downpours. Anselmi said radar estimates showed one to three inches of rain fell on St. Thomas, with the northwest part of St. John seeing one to two inches and the western end of St. Croix receiving three inches. Anselmi couldn't connect to the official weather stations at the airports on St. Thomas and St. Croix to get exact amounts.

He said he had reports from the V.I. Territorial Emergency Management Agency on St. Thomas that there were mudslides with rocks in the middle of the road in Altona, debris from flooding in Bovoni and flooding along the waterfront in Charlotte Amalie. Anselmi said he didn't have any reports from St. Croix, but WAPA reported an electrical outage to a portion of Feeder 6A as tree limbs fell on power lines.

The wet weather is the result of a surface trough lingering across the area combined with low level moisture, Anselmi said. He said the system produced moderate to heavy rainfall during the afternoon and close to the evening on

Challenge

Climate is our challenge

Caribbean's inherent climate sensitivity makes it vulnerable when the climate changes. Changes in climate therefore alter our existence as we know it.

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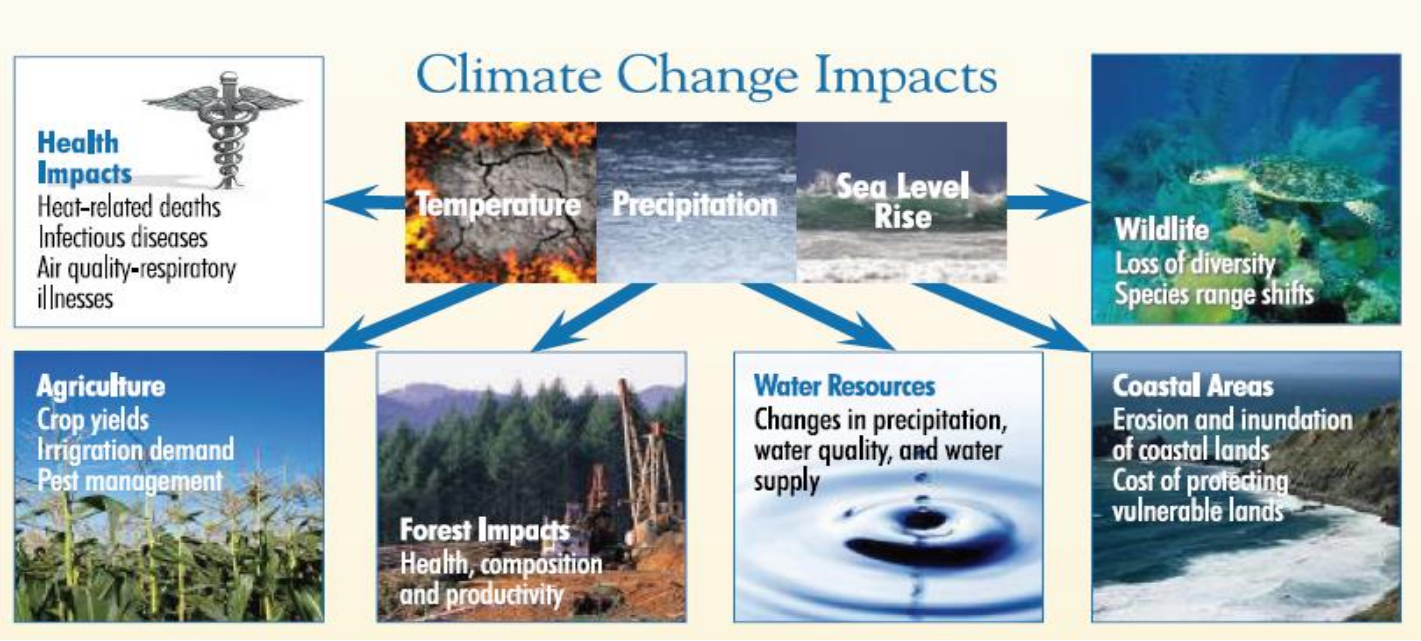
Vulnerability Felt Across Every Sector



Change

Climate is demanding we change…

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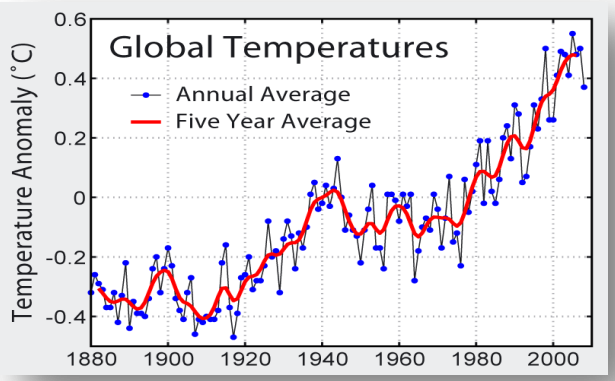
Climate seems to be changing…

Because our ways of life are so vulnerable to climate we have a vested interest in knowing how and whether it will continue to change.

Climate is projected to continue changing until the end of the century.

Because our ways of life are so vulnerable to climate change is a Developmental Issue for the region.



The kind of country we have in the near and far future will depend on what we do with respect to climate now – as normal? take into consideration? in what ways? *our attitudes, actions and approach…*

Climate Resilient Society

FOUNDATION FOR DEVELOPMENT PLANNING, INC.

Media Symposium on Climate Change in the U.S. Virgin Islands

Primer on Climate Science

Roy A. Watlington

Member, CariCOOS Stakeholders' Council

& Retired UVI Professor

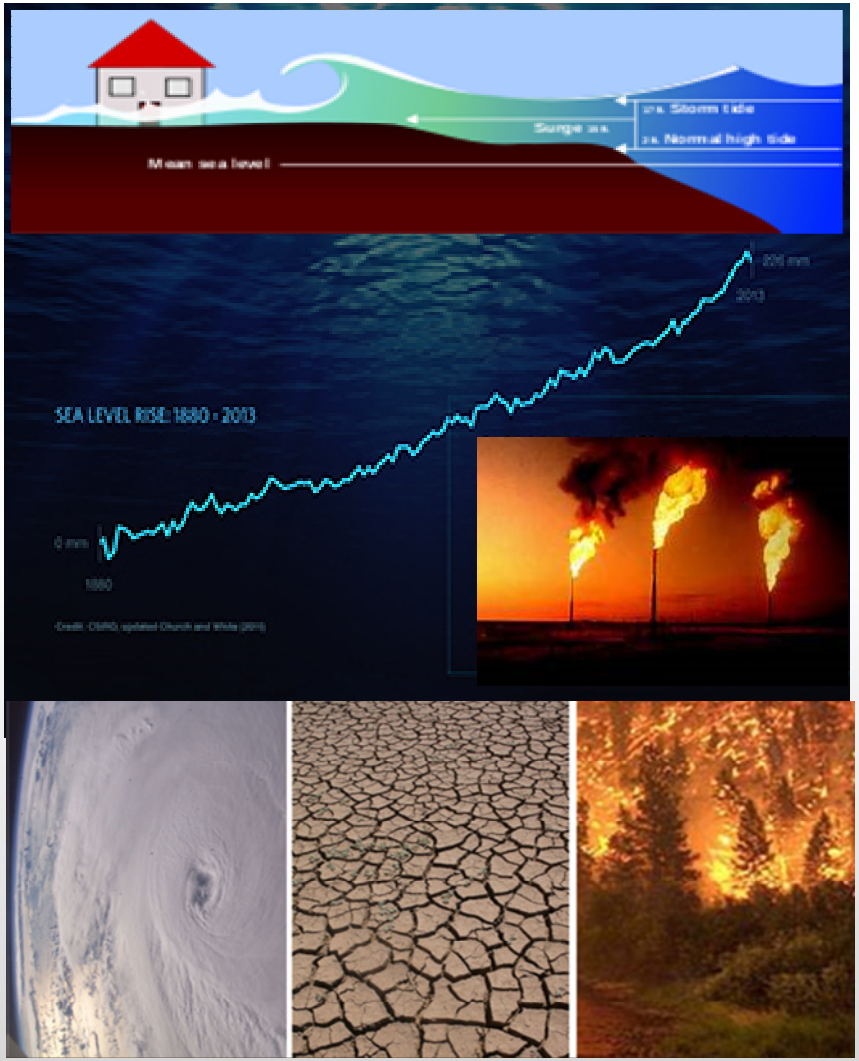
Caribbean Coastal Ocean Observing System

CariCOOS.org

www.caricoos.org

Climate change

- elevated atmospheric temperatures
- altered precipitation: droughts, excessive rain
- elevated ocean temperatures + positive feedbacks (carbon liberation)
- melting of glaciers & sea ice, => sea level rise + positive feedback (more absorption)
- intensified and/or more frequent storms
- coastal and inland flooding, beach erosion, infrastructure,
- compromised agriculture, reefs, fisheries, and other ecosystems
- increasing ocean acidity
- declining water supplies
- spread of disease vectors as a result of inundation and extra-tropical extension of high temperatures.



Fast forward

- The climate is always undergoing change, *e.g.,* glacial-interglacial cycles, such change is explainable by already understood natural processes:

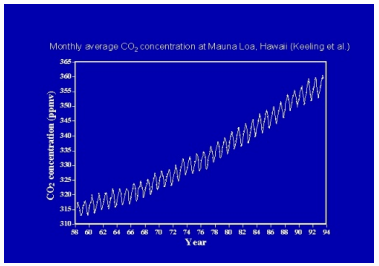
  * solar irradiance variability * Planetary mechanics ("Milankovitch Cycles")

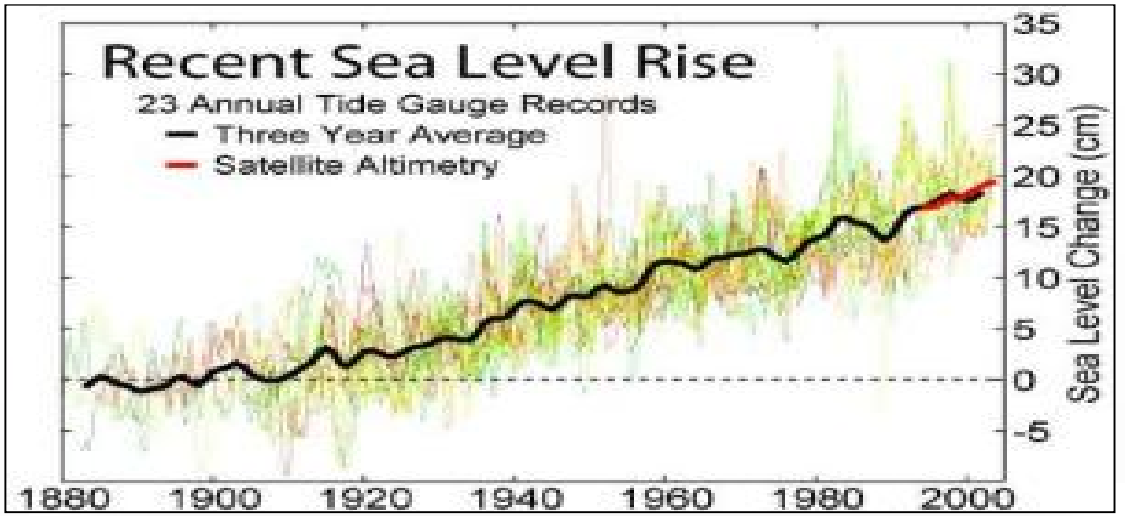
- Accelerated climate change is now unmistakably linked to human activity, primarily the release of greenhouse gases and the destruction of Earth's carbon-sequestering resources
- Once set in motion, warming can be accelerated by *feed-back mechanisms*

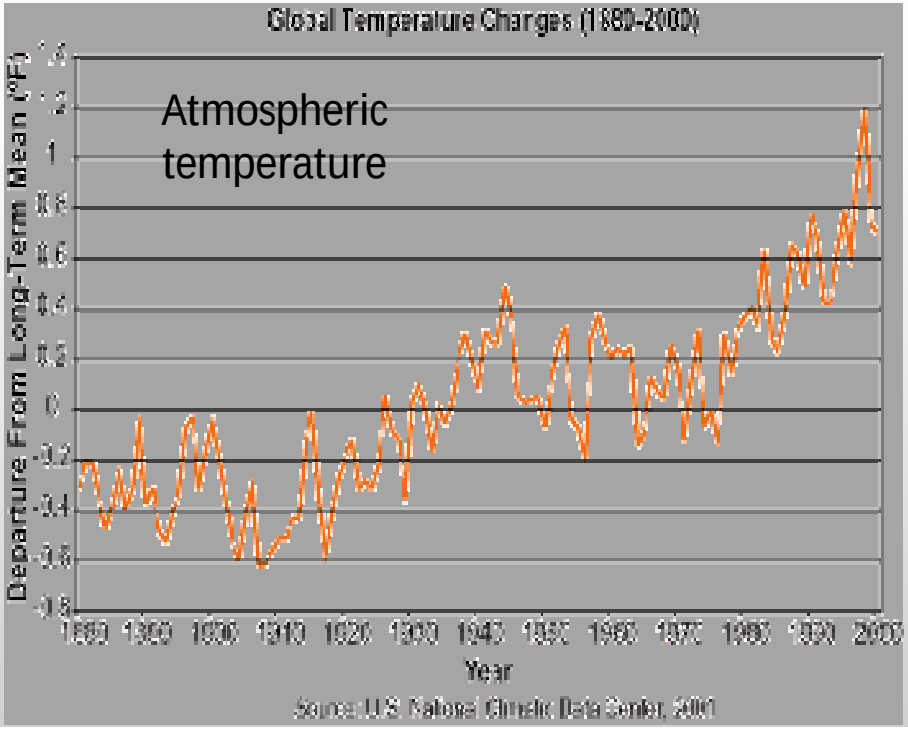
  * ice-albedo loss * CO_2 liberation

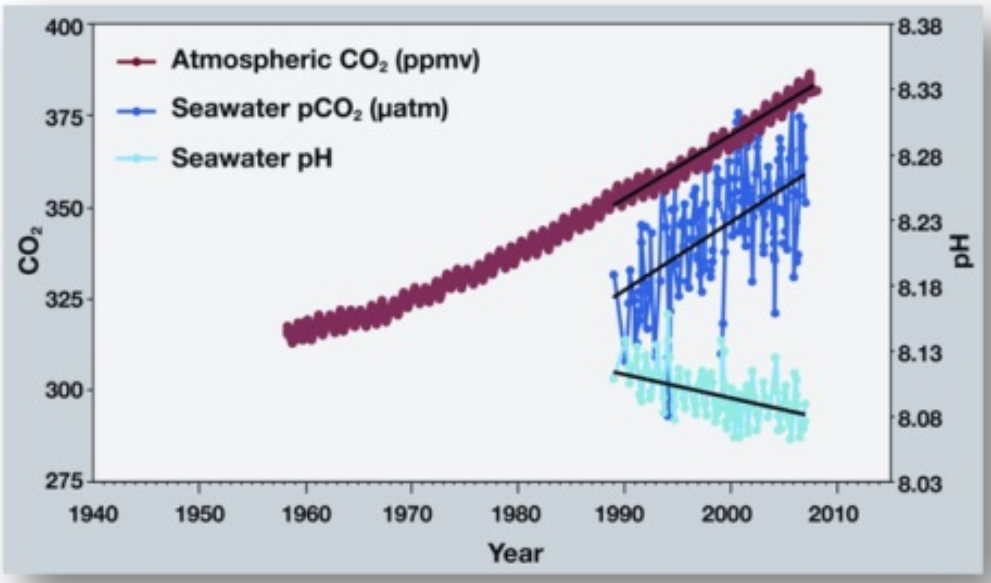
- The ocean's role is primary: heat storage, carbon sequestration, meridional heat transport, biological activity
- Climate change impacts affect agriculture, water resources, biodiversity, coastal hazards, human habitation and health.

Real indicators of climate change







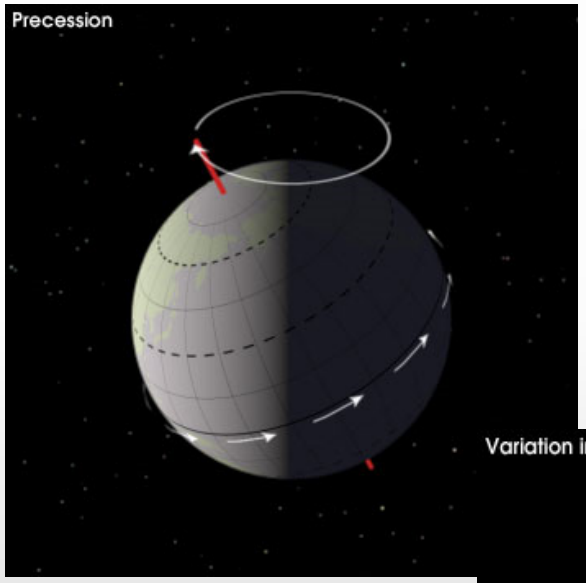


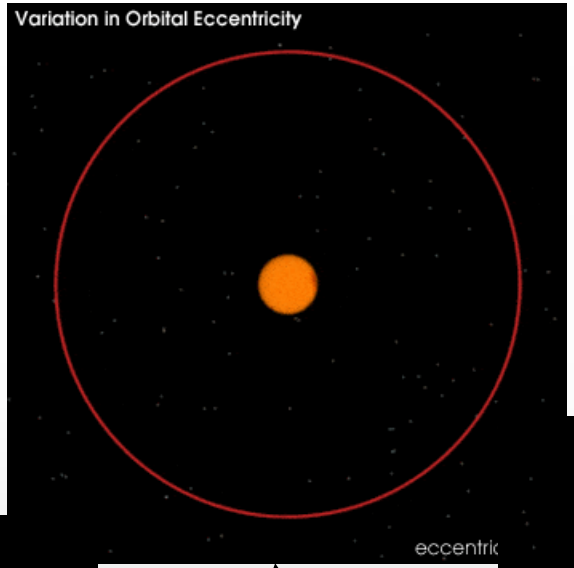
Factors promoting climate change

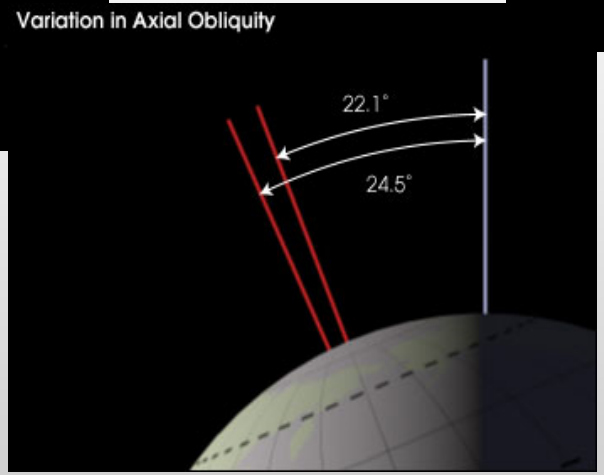
1. Milankovic Planetary Cycles –
   - Ellipticity – changes distance to the sun
   - Obliquity – changes in tilt of the Earth's axis of rotation
   - Precession – orientation of the Earth's axis
2. Geothermal activity – atmospheric occlusion by volcanic activity
3. Thermohaline circulation
   - ocean redistribution of energy gained by insolation
4. Anthropogenic (human) factors since start of the industrial revolution
   - destruction of forests and other photosynthesizers
   - liberation of CO_2 and other greenhouse gases by fossil fuel use and by decay of organic matter as in manufactured goods, etc.

Milankovitch Cycles drive natural “regular” climate changes.

Precession 23,000 years

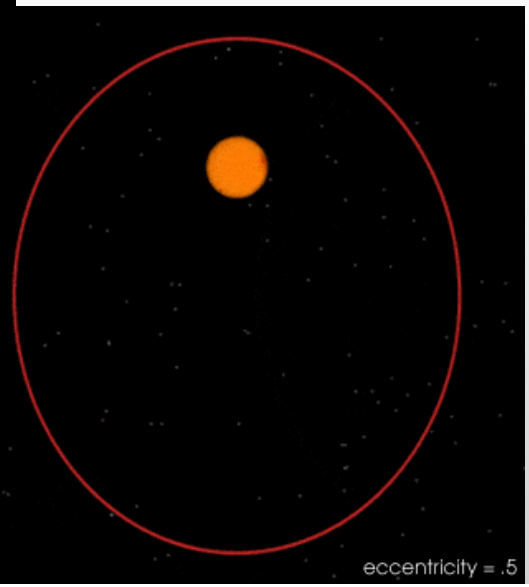






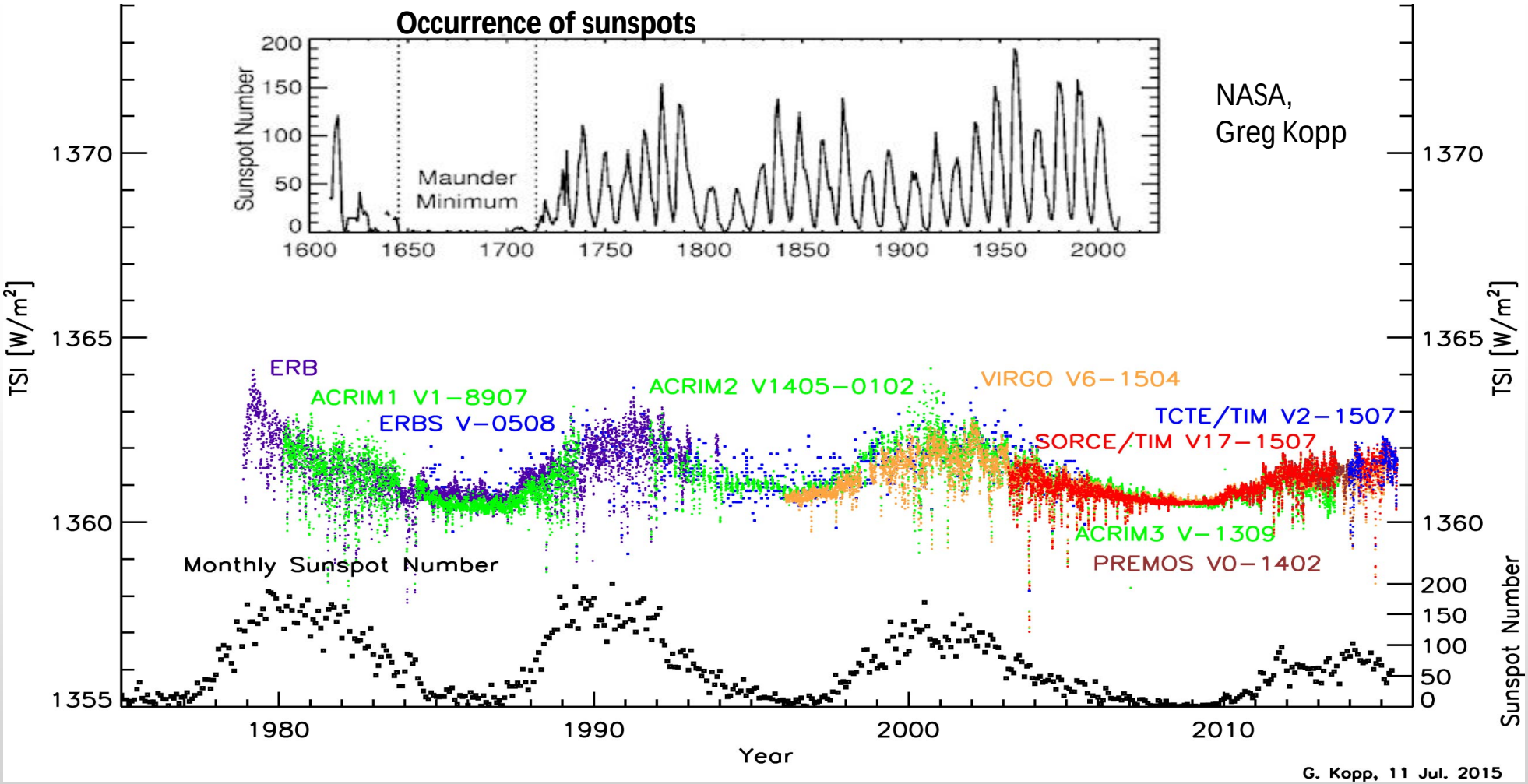
Obliquity (tilt) ➔ 41,000 years

Periodicity 90,000-100,000 years



NASA Earth Observatory

Solar irradiance cycles also drive “natural” climate changes.



Anomalous post-glacial periods of global cooling

“Recent” Climate Change Events

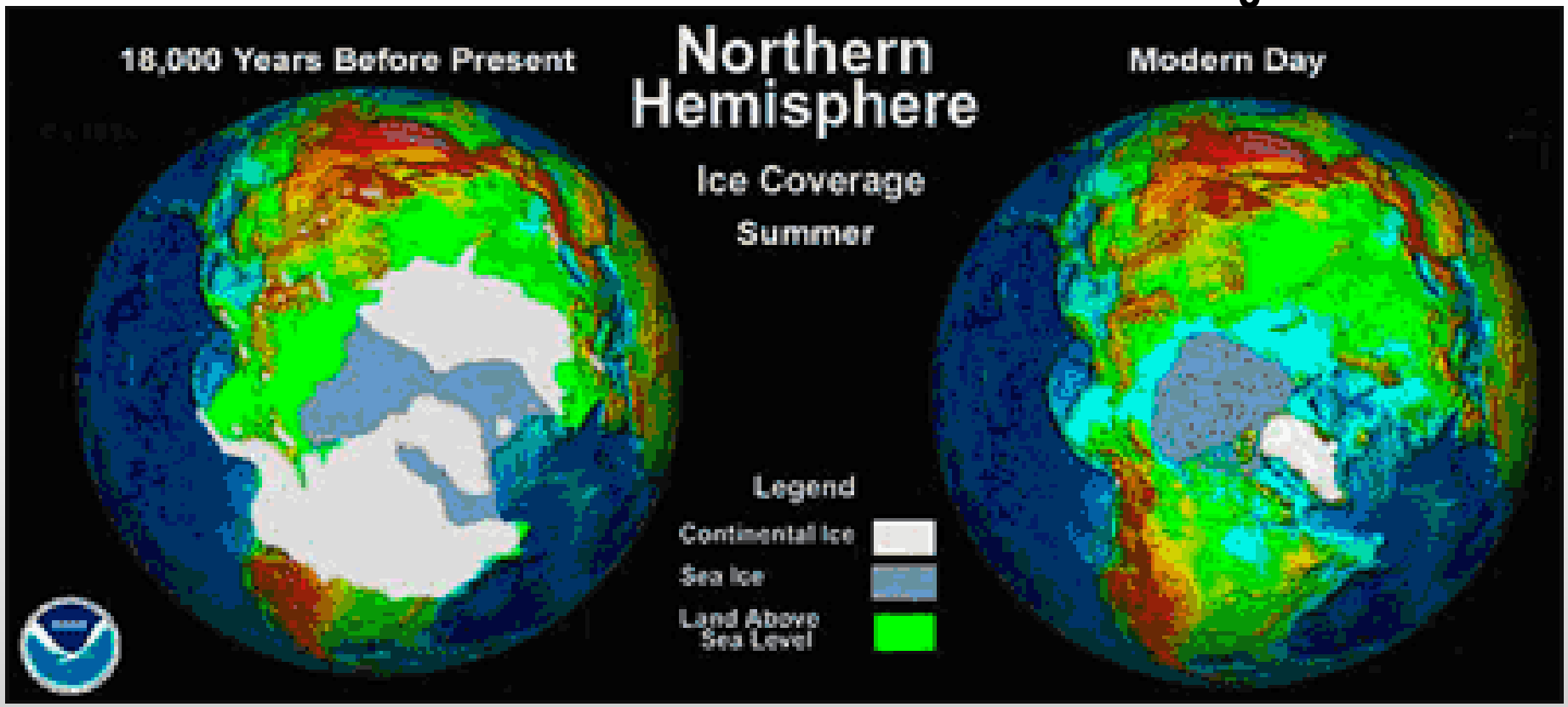
- Older Dryas (12,000 to 11,800 YBP) –extension of tundra vegetation (*Dryas octopetala* wildflower*)*
- Younger Dryas (~11,300-10,000 ybp) started and terminated abruptly – disappearance of woodland cover, extension of alpine/tundra vegetation
- Little Ice Age 1564-1730 – impact on agriculture, retreat from Greenland, food shortages, population changes, etc.

Possible Factors:

- Maunder sunspot minimum – 11 year cycle (e.g., minimum in 1996, maximum in 2000) in 1645-1715 there were 0.1% of the typical abundance of sunspots)
- Changes in the thermohaline circulation

Glacial-Interglacial

Glacial **Interglacial**

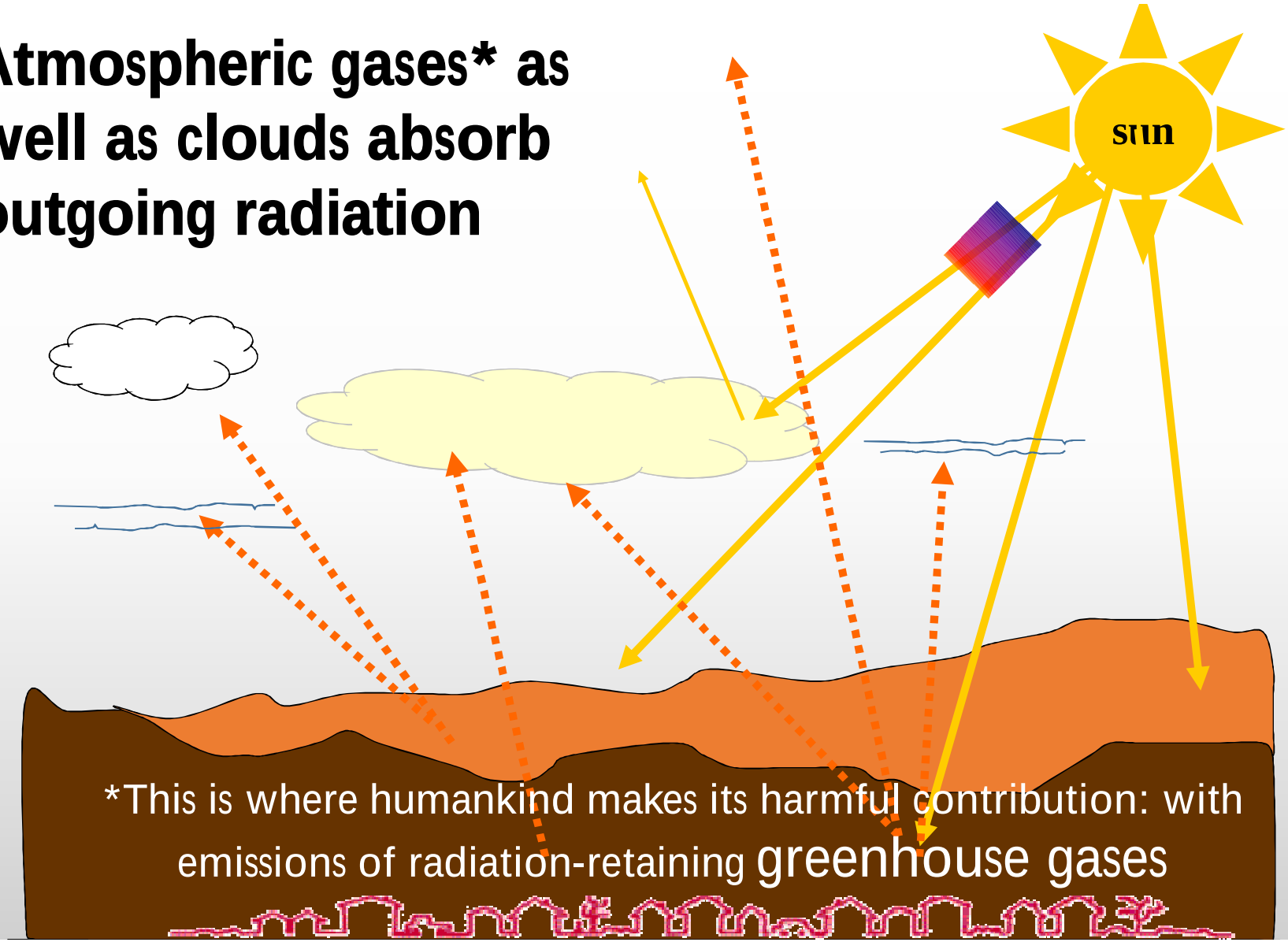


Geothermal (volcanic) activity

Eruptions can cause warming by enhancing the greenhouse effect or cooling by blocking incoming radiation

- **Paleocene volcanism (Late Paleocene Thermal Maximum)**
- **Krakatau, 1883**
- **El Chicon, 1983**

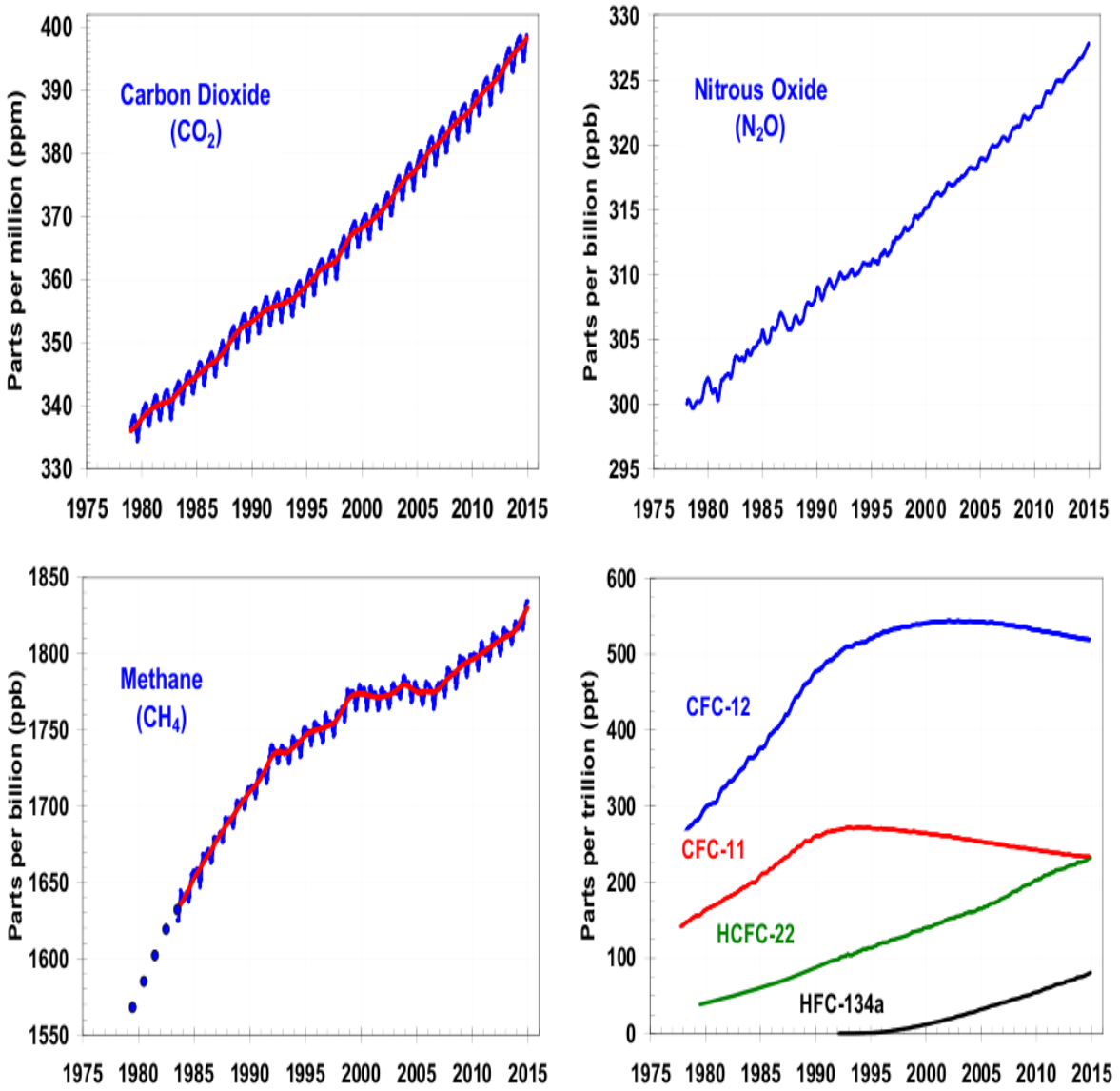
Atmospheric gases* as well as clouds absorb outgoing radiation



Greenhouse gases

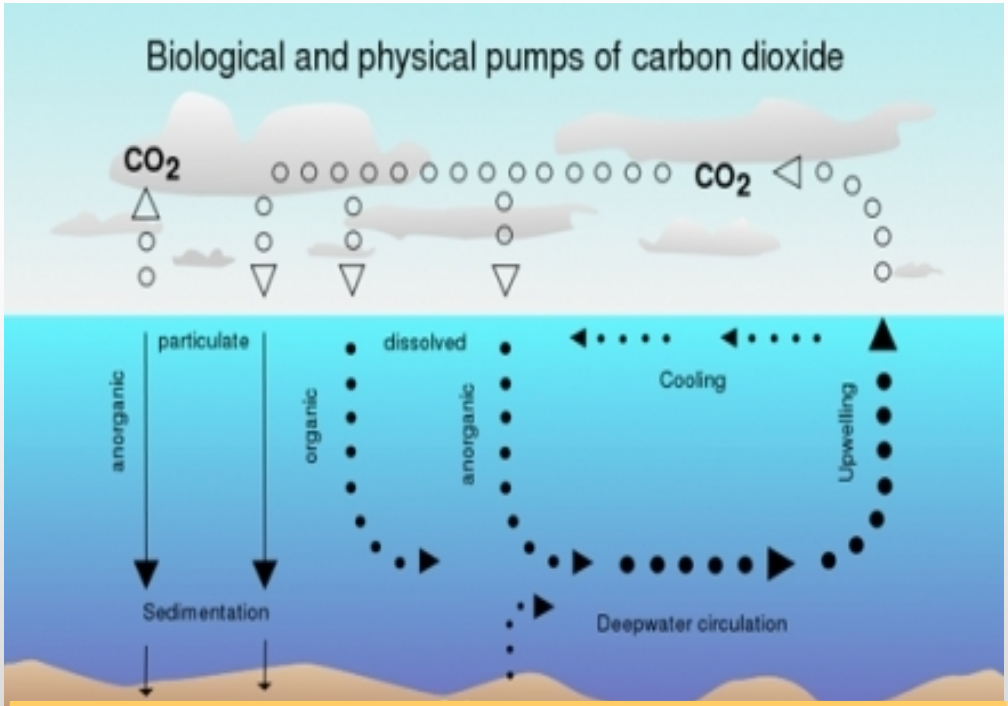
Free in the atmosphere, these gases absorb and hold radiant energy that might have been radiated out to space.

- carbon dioxide (CO_2)
- methane (CH_4)
- nitrous oxide (N_2O)
- water vapor (H_2O)
- chlorofluorocarbons (CFCs)



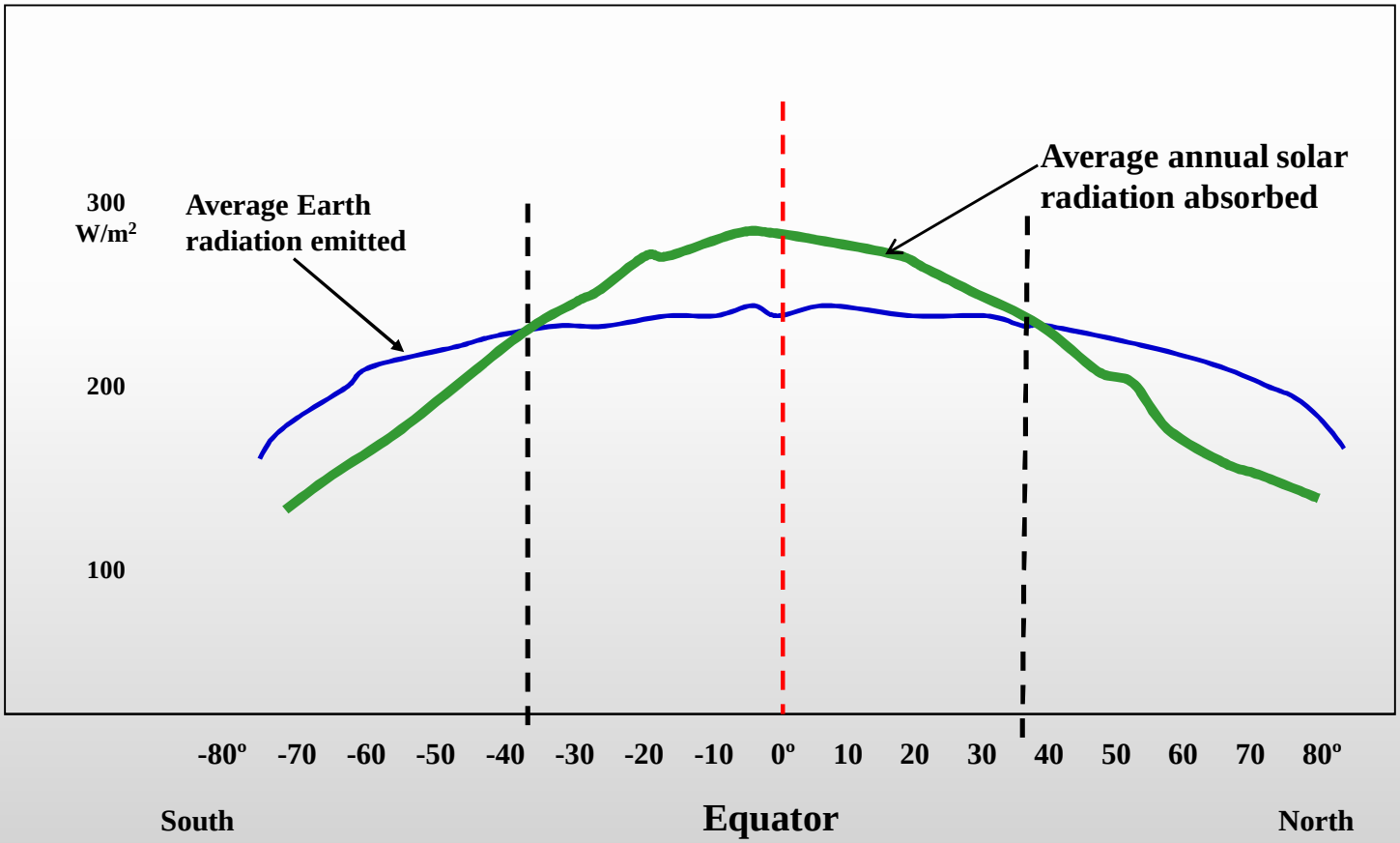
“Positive” Feedback: albedo and CO_2 liberation

Warming reduces ice albedo, increases absorption of heat by exposed dark ground

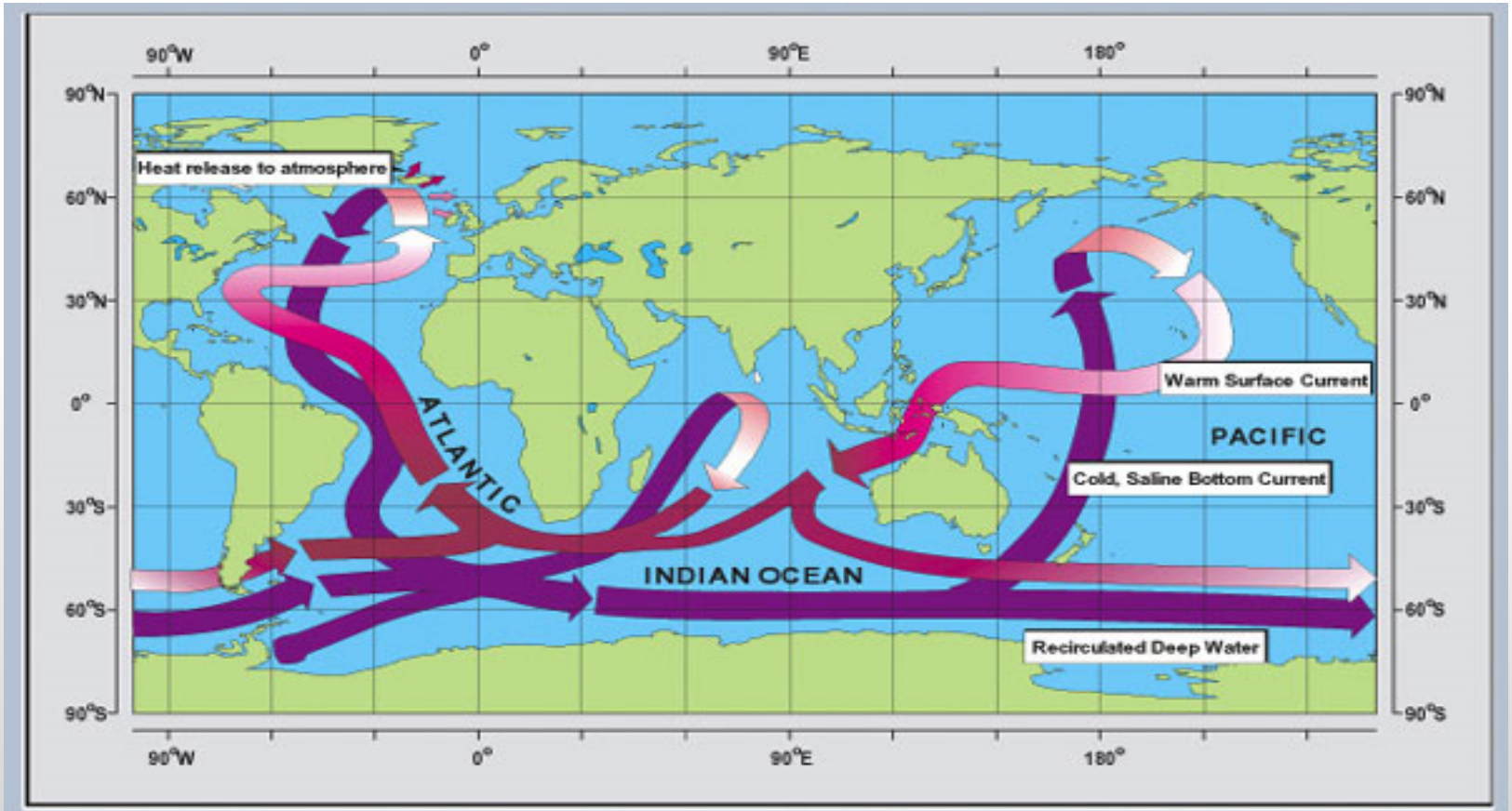


Increased ocean temperatures reduce the ocean’s capabity in sequestering CO_2.

Energy balance as a function of latitude



Global (heat-redistributing) ocean conveyor belt (After Broecker)



Schematic diagram of the global ocean circulation pathways, the 'conveyer' belt (after W. Broecker, modified by E. Maier-Reimer).

Climate facts

- There have been many periods when the Earth's climate warmed and then cooled, sea levels changed accordingly.
- During the time of the dinosaurs (more than 65 Mya), global temperatures were ~6-8°C (11-14 ºF) warmer than today.
- During the last ice age (23,000-15,000 years ago) global temperatures were colder (~ 4°C or ~ 7°F) than today.
- The Older and Younger Dryas periods and the Little Ice Age in historic time were periods of anomalous cooling.
- Sea levels during previous interglacial periods were as much as 20 m higher than today.
- When glaciers were at their maximum 18,000-20,000 years ago global sea level was 120-125 m lower than today.]

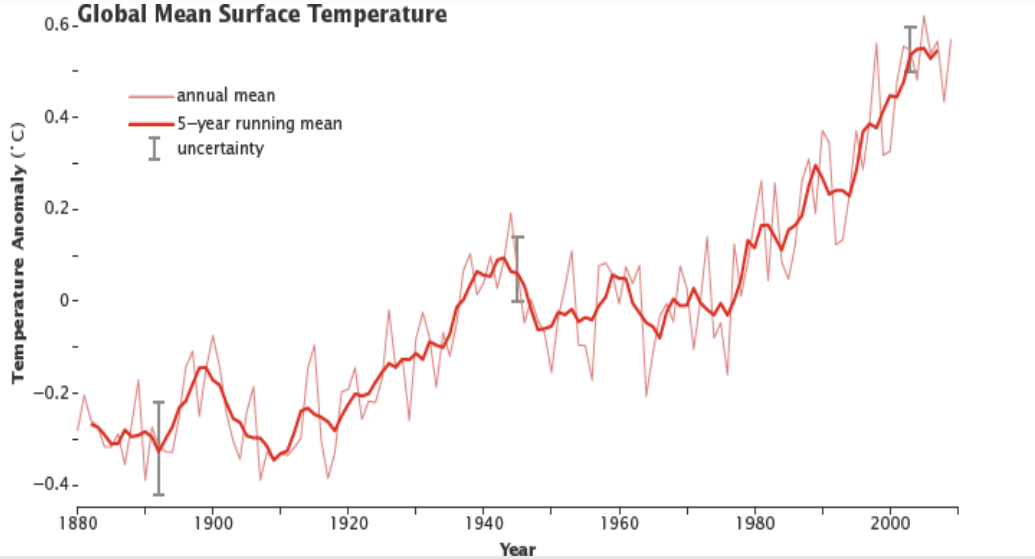
More climate facts

- The Earth's climate has warmed 1.8F (1°C) in the last 100 years.
- Average Arctic ice thickness went from ~ 3.1 to 1.8 m in the period from 1950s-mid 1990s.
- Sea levels during previous interglacial periods were as much as 20 m higher than today.
- Globally sea level has risen at a rate of 2.5-3.0 mm/year or 10-12 inches per century. [EPA]

Possible/likely consequences of global warming

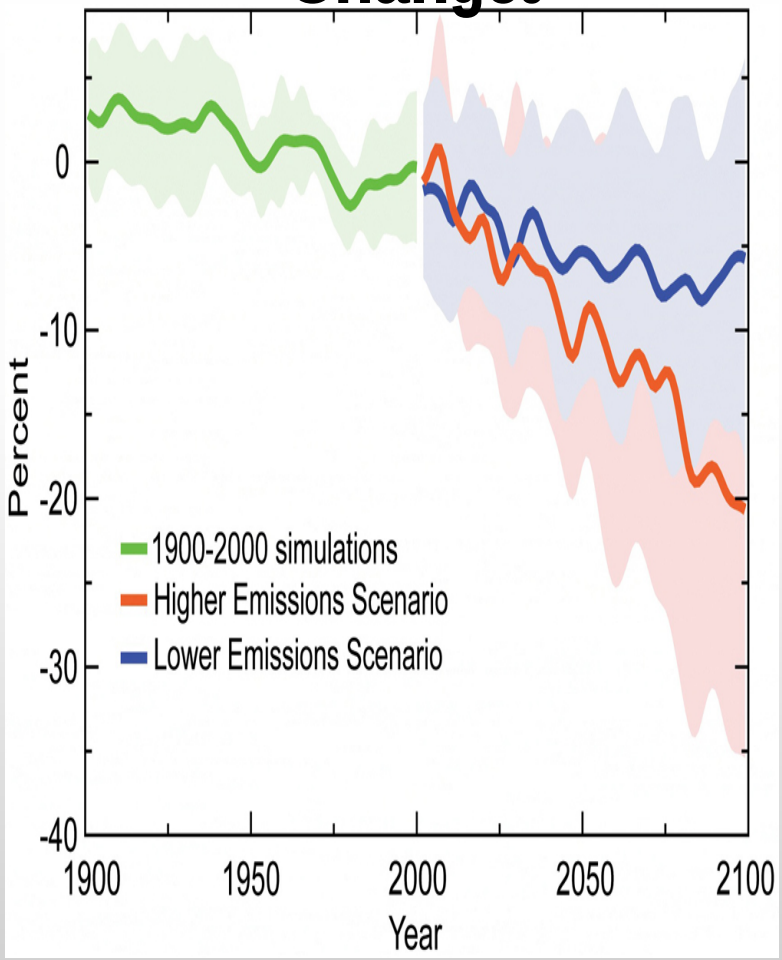
- Melting glaciers and sea ice increases the ocean's volume
- Warming oceans expand and inundate dry land
- A sea level rise of 10 m would flood 25% of the present populated areas
- ½ meter sea level rise would inundate 8500-19,000 km^2 of dry land [IPCC]
- Drastic changes in precipitation distribution and intensity could wreak havoc with agriculture, quality of life
- USGS: "All glaciers will be gone from Glacier National Park (Montana) by the middle of the next century…."
- Iceland (now 11% covered by glaciers) will loose 40% in the next century and lose all cover by 2200.
- Climate modelers suggest that Arctic ice cover could vanish in a few as 55 years.

Global Temperature Changes (1880-2005)

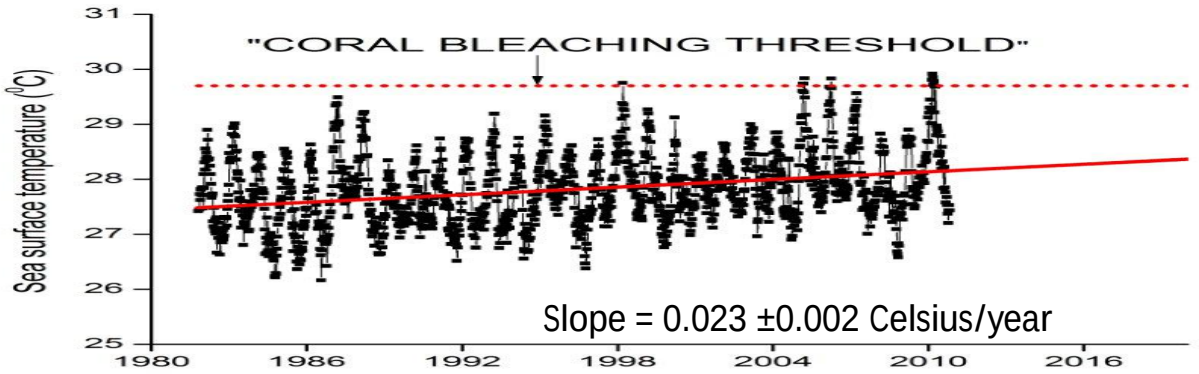


"The global average surface temperature rose 0.6 to 0.9 degrees Celsius (1.1 to 1.6° F) between 1906 and 2005, and the *rate* of temperature increase has nearly doubled in the last 50 years. Temperatures are certain to go up further." (*NASA*)

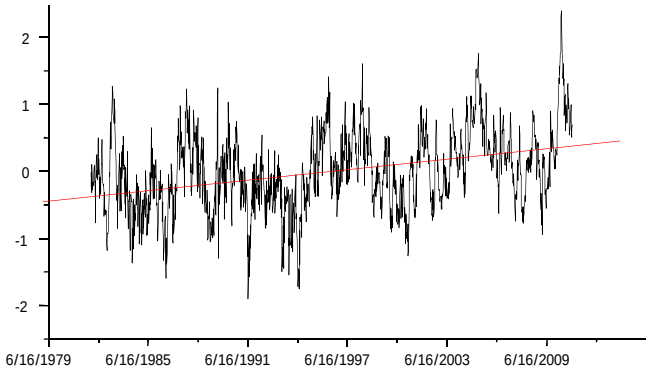
Caribbean Precipitation Changes

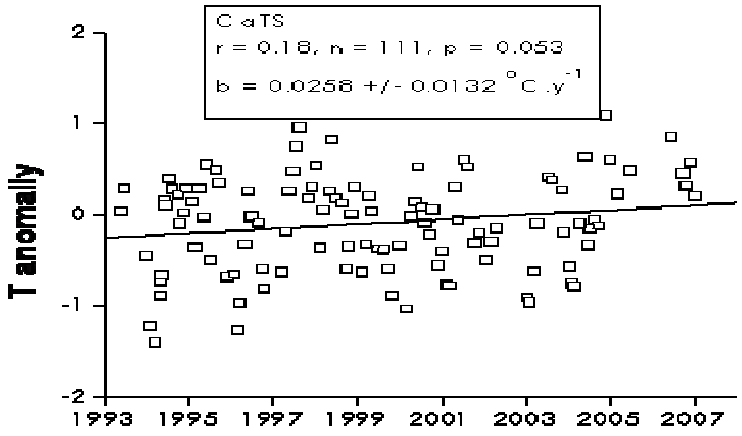


Caribbean Time Series (CaTS) reflects global SST trend

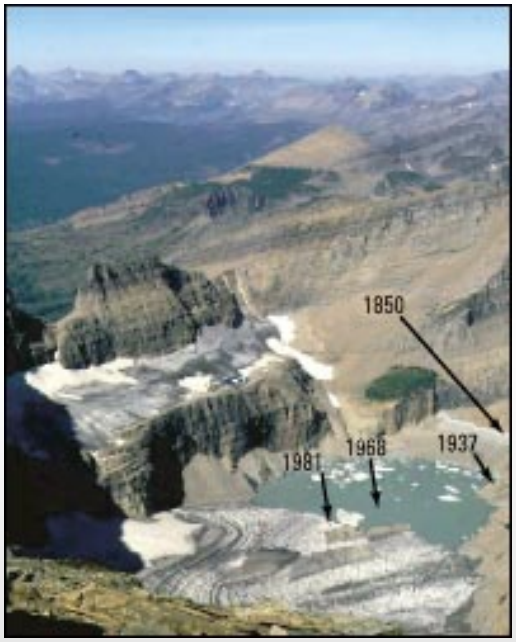


Pirata Station (15°N, 38°W)
Slope = 0.026±0.002 Celsius/year

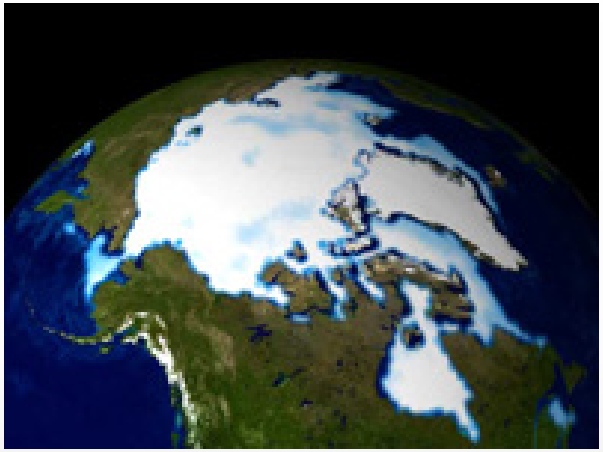


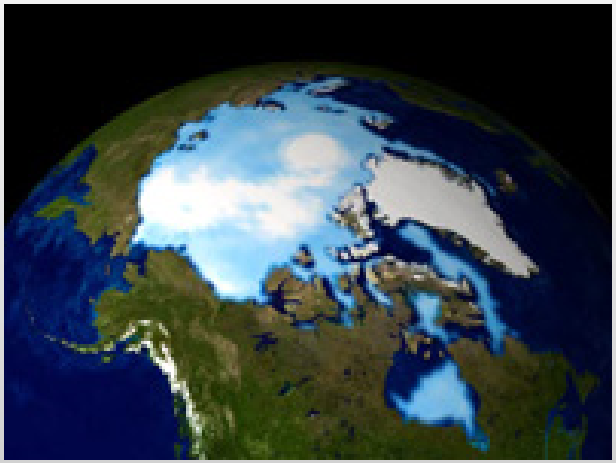


Loss of glacial cover & Arctic sea ice



Grinnell Glacier, Glacier National Park, Montana
(USGS)





Changes in Perennial Arctic sea ice cover

1990 above

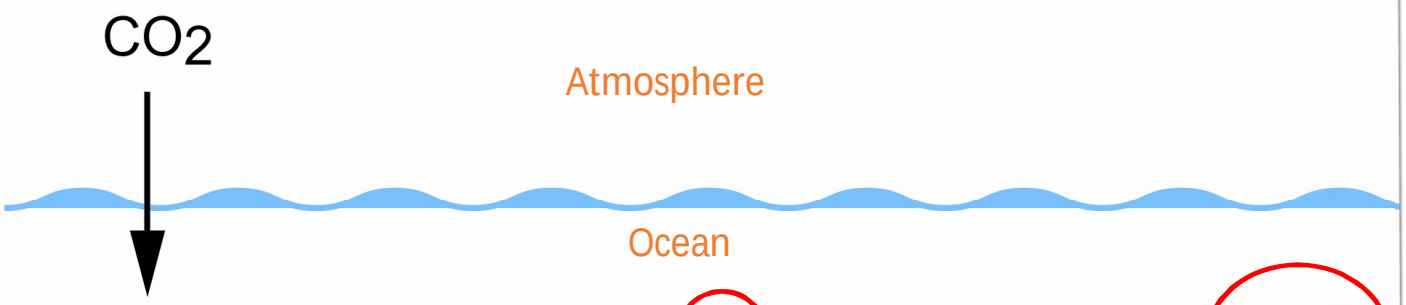
1999 below

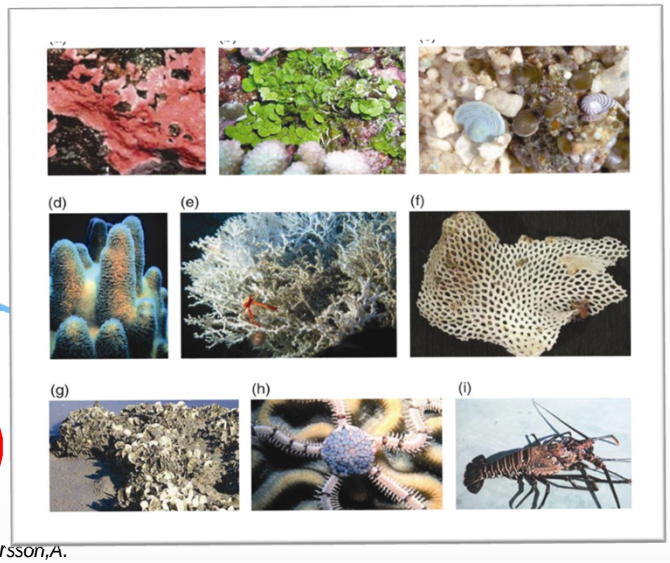
(NASA)

What results from the reality of global warming (atmosphere and ocean) and global sea level rise?

- Increased inundation risk to communities built on coastal flatlands or where residences, tourism development and other commerce are preferably located
- Continual loss of protective fringing reefs and mangroves to development
- Inundation expands habitats for vectors of infectious diseases
- Frequency and/or intensity of storms
- In some regions, tectonic subsidence occurring in/near populated areas amplifies the risk.

Ocean Acidification...





Andersson,A.

Carbonate saturation state

When $CO_2 \uparrow$

$H^+ \uparrow \Rightarrow pH \downarrow$, $HCO_3^- \uparrow$, $CO_3^{2-} \downarrow \Rightarrow \Omega \downarrow$

$$\Omega = \frac{\{Ca^{2+}\}\{CO_3^{2-}\}}{K_{SP}}$$

K_{SP} = the product of the concentrations of those ions when the mineral is at equilibrium

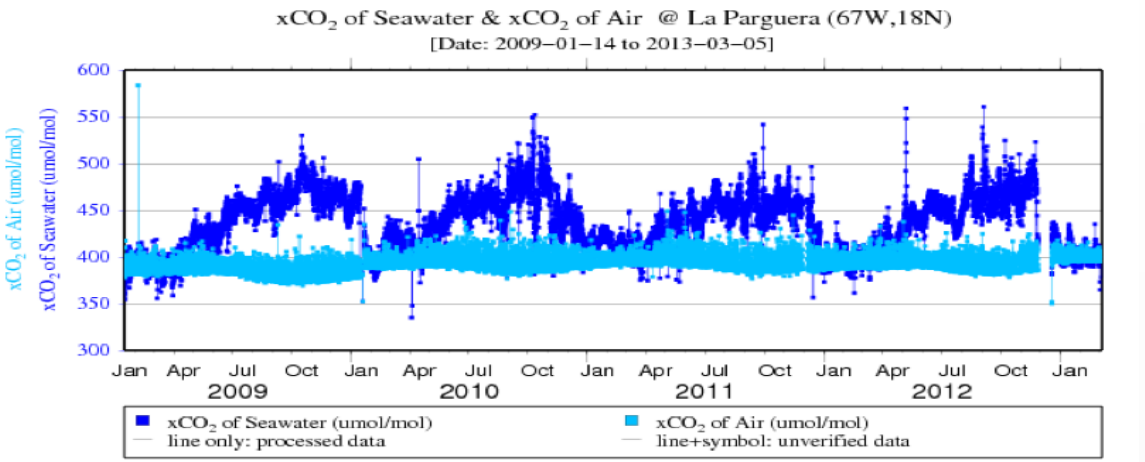
$\Omega = 1$ means equilibrium

$\Omega < 1$ means dissolution

$\Omega > 4.09$ is optimal; $\Omega \sim 3.5\text{-}4.0$ is adequate,

$\Omega < 3.0$ is marginal

Regional findings, … so far …

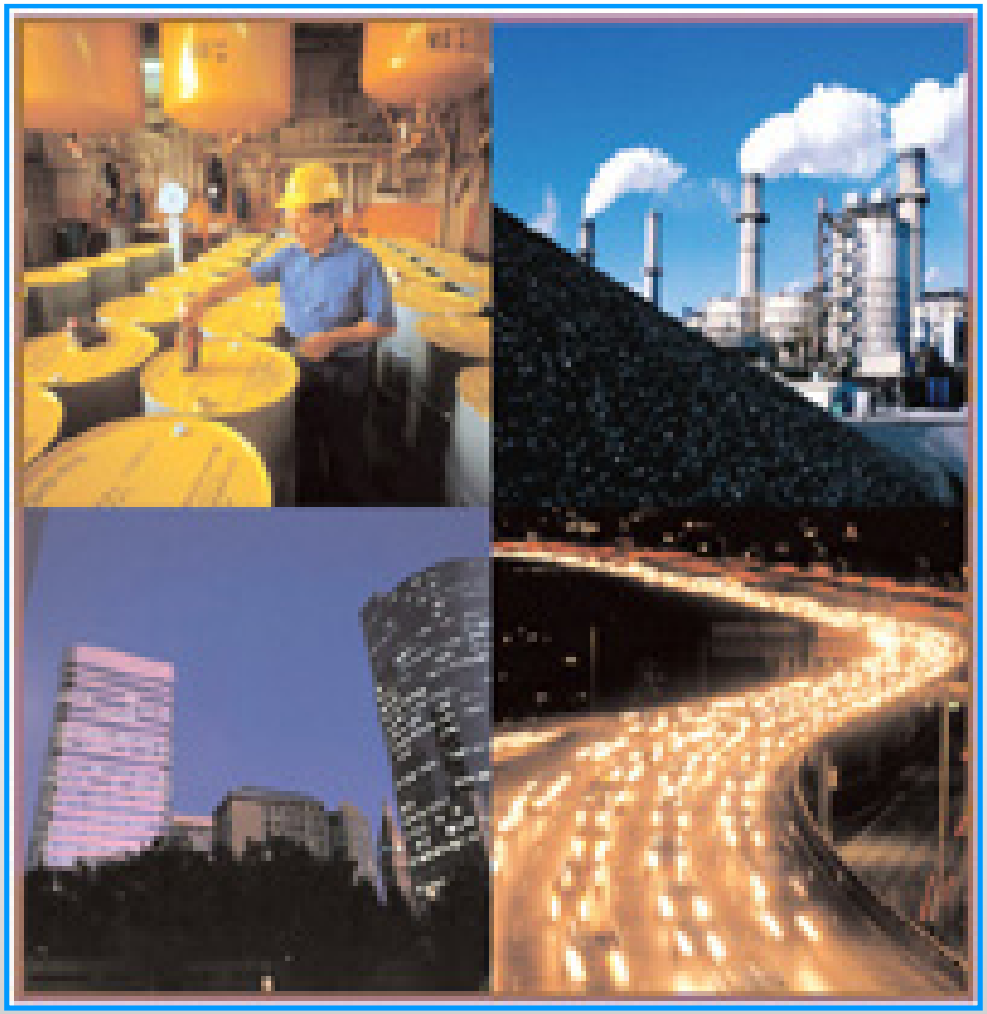


MapCO$_2$ buoy -- A joint project of NOAA/PMEL, NOAA/ICON, CariCOOS, UPR and others

For the Greater Caribbean Region, the mean saturation state Ω has declined from 4.09 to 3.9 at a rate of -0.012 ± 0.001 per year. (Gledhill,*et al.*)
For our region (LaParguera) the CariCOOS MapCO2 buoy shows a mean of 3.75 (Corredor, *et al.*)

BELMOPAN, Belize, October 27, 2014 (AMG) — The effects of climate change are weighing heavily on the fishing and tourism industries in Belize, according to experts at the Caribbean Community Climate Change Centre. Citing increasingly-acidic oceans, the CCCCC has observed declines in marine populations… (www.Antillean.org)

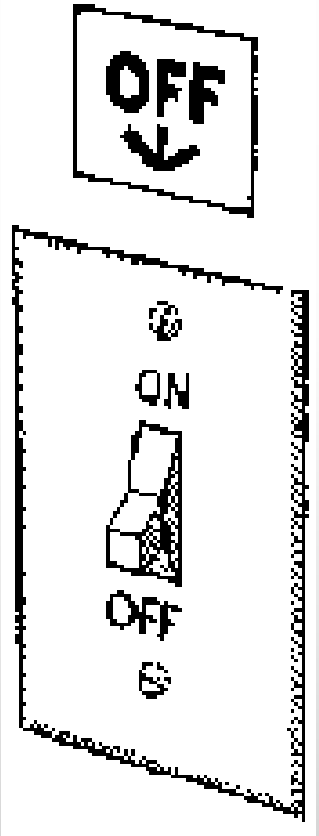
Anthropogenic factors



"Atmospheric concentrations of CO_2 (379ppm) and CH_4 (1774ppb) in 2005 exceed by far the natural range over the last 650,000 years. Global increases in CO_2 concentrations are due primarily to fossil fuel use, with land-use change providing another significant but smaller contribution. It is very likely that the observed increase in CH_4 concentration is predominantly due to agriculture and fossil fuel use. CH_4 growth rates have declined since the early 1990s, consistent with total emissions (sum of anthropogenic and natural sources) being nearly constant during this period. The increase in N_2O concentration is primarily due to agriculture." *(IPCC 2007)*

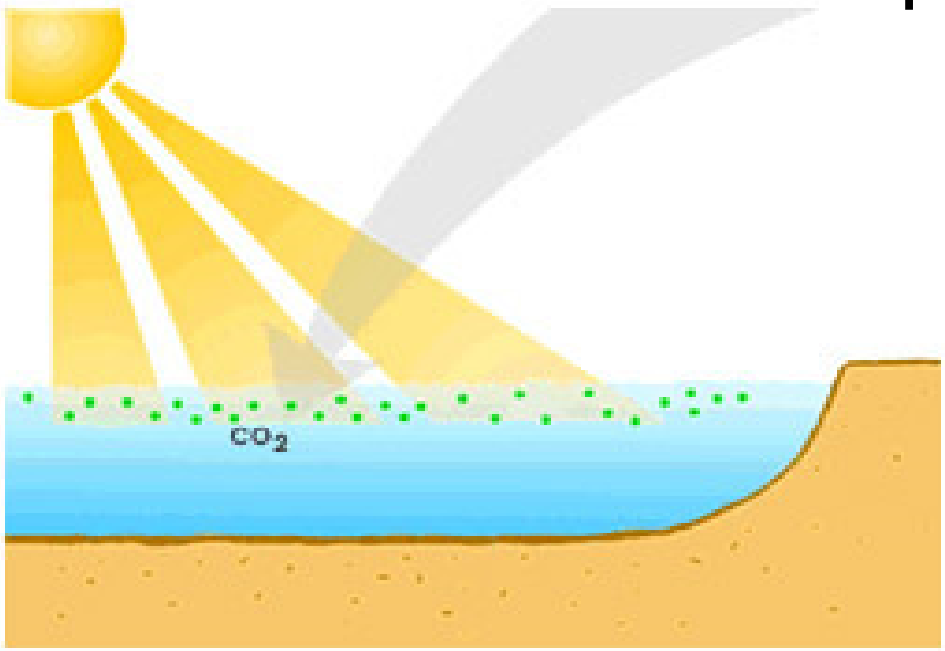
Mitigations

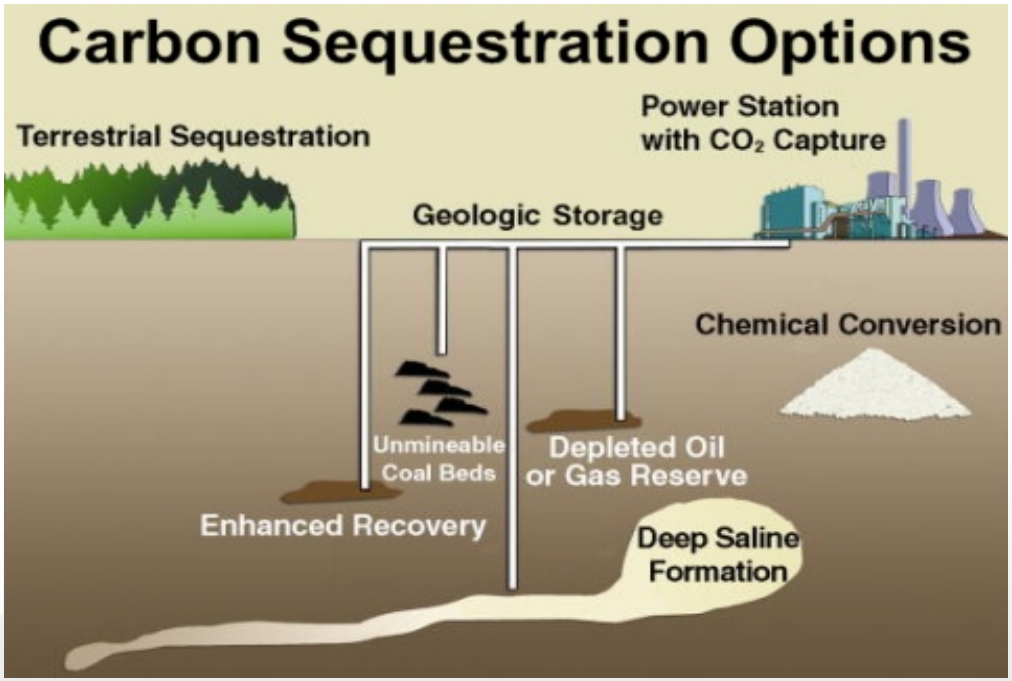
Conserve energy



Develop/use alternative energy sources

Assist the sequestration of CO_2





Facilitate photosynthesis

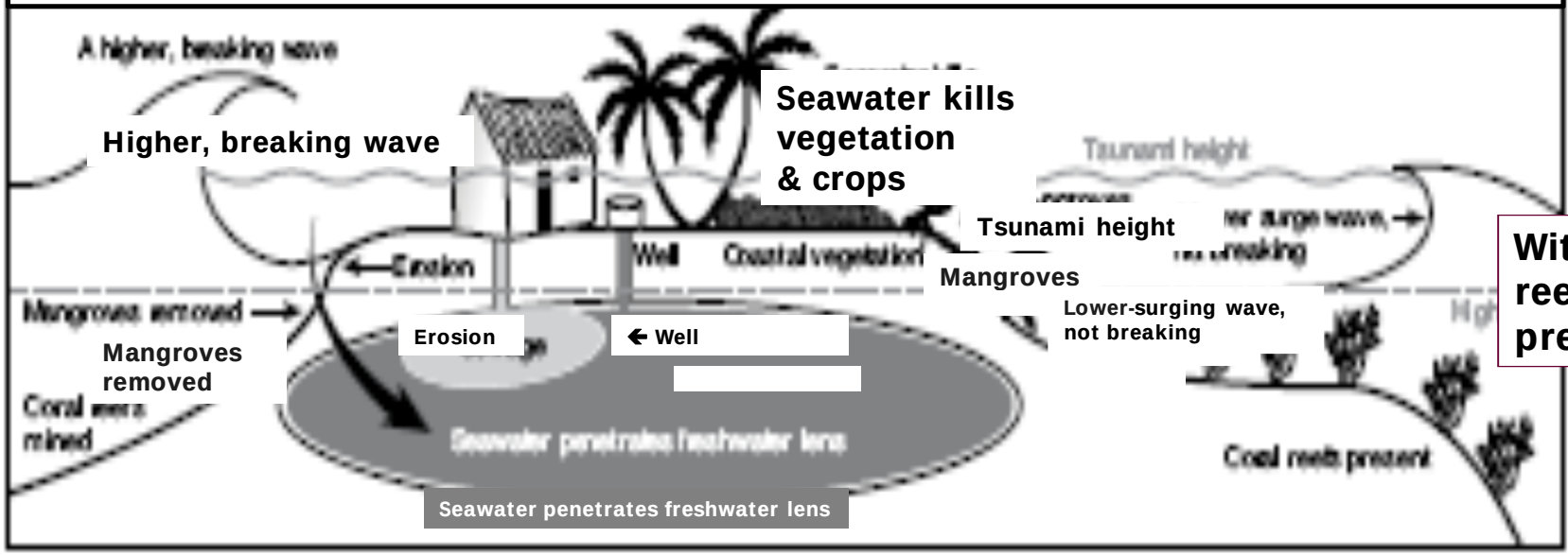
$$6\underline{CO_2} + 6H_2O + light \rightarrow 6O_2 + C_6H_{12}O$$

<u>Increase the storage of carbon in trees and in the ocean.</u>

- **Trees absorb carbon dioxide from the atmosphere and store it in wood.**
- **The healthy ocean absorbs carbon dioxide during primary production.**

Preserve the coral reefs and mangrove stands that protect islands from erosion and seawater intrusion during storm surge and tsunami

Coral reefs mined

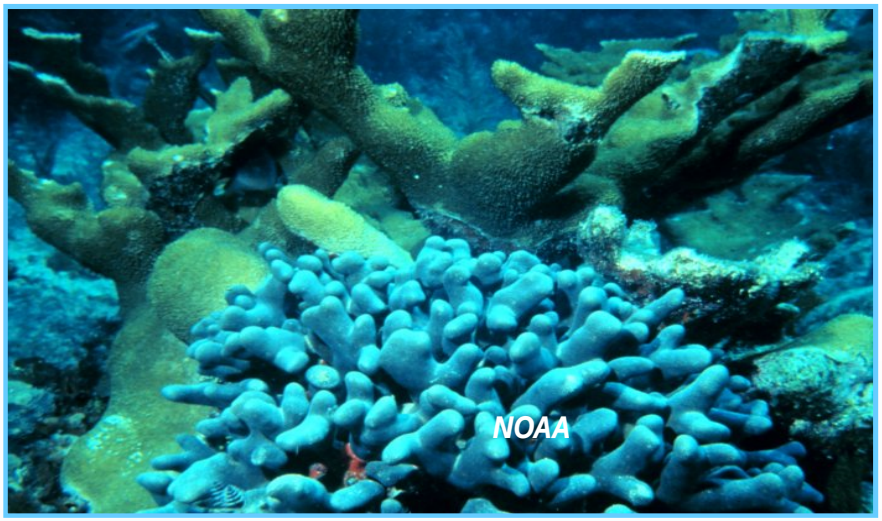


With coral reefs present

Potential impacts of a tsunami or storm surge on a coral island or other permeable interior. The removal of reef flat corals and mangrove trees exposes the shore to greater erosion and penetration of seawater from surging waves. The seawater will damage island agriculture and enter drinking water in the freshwater lens under the islands. It could also liberate septic fields to contaminate freshwater.

www.iucn.org/themes/marine/news/archive2006.htm

Preserve corals, marine vegetation, and phytoplankton that utilize (therefore sequester) CO_2



Unhealthy corals can't support reef communities or carbon sequestration.

At the same time, warming waters seem to be contributing to coral reef diseases.

More re-using and recycling, less deforestation, less burning and less decay

Reduce emissions in waste management:

- ***CO_2 from incinerators and from landfills.***

  Re-using, recycling and waste prevention allow some materials to be diverted from incinerators and thus reduce greenhouse gas emissions of wastes that would have been released during incineration.

- ***Methane emissions from landfills***

  Waste prevention and recycling (including composting) divert organic wastes from landfills, thereby reducing the methane released when these materials decompose. Use less, re-use, recycle.

http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteWhatIs.html

The United Nations Framework Convention on Climate Change has called for limiting global warming to 2°C (3.6°F).

IPCC on mitigation pathways:

"There are multiple mitigation pathways that are likely to limit warming to below 2°C relative to pre-industrial levels. These pathways would require substantial emissions reductions over the next few decades and near zero emissions of CO_2 and other long-lived greenhouse gases by the end of the century. **Implementing such reductions poses substantial technological, economic, social and institutional challenges, which increase with delays in additional mitigation and if key technologies are not available.** Limiting warming to lower or higher levels involves similar challenges but on different timescales."

IPCC "Climate Change 2014" Scenarios to hold to 2°C limit:

"Scenarios leading to CO2-eq concentrations in 2100 of about **450 ppm** or lower are likely to maintain warming below 2°C over the 21st century relative to pre-industrial levels…

"Mitigation scenarios reaching concentration levels of about **500 ppm** CO_2-eq by 2100 are more likely than **not** to limit warming to less than 2°C relative to pre-industrial levels, unless concentration levels temporarily exceed roughly 530 ppm CO_2-eq before 2100. In this case, warming is about as likely as not to remain below 2°C relative to pre-industrial levels. Scenarios that exceed about 650 ppm CO_2-eq by 2100 are unlikely to limit warming to below 2°C relative to pre-industrial levels.

"Mitigation scenarios in which warming is more likely than not to be less than 1.5°C relative to pre-industrial levels by 2100 are characterized by concentration levels by 2100 of below 430 ppm CO_2-eq. In these scenarios, temperature peaks during the century and subsequently declines…."

Climate Change Implications for the U.S. Virgin Islands

Media Symposium on Climate Change

January 30, 2016

Lloyd Gardner

Foundation for Development Planning, Inc.

http://www.fdpi.org

Climate Change Forecasts

1. **Temperature Increase, 2.7-4.8°C** – ecological changes (terrestrial and ocean), pests, diseases, respiratory and other health stresses, infrastructure damage

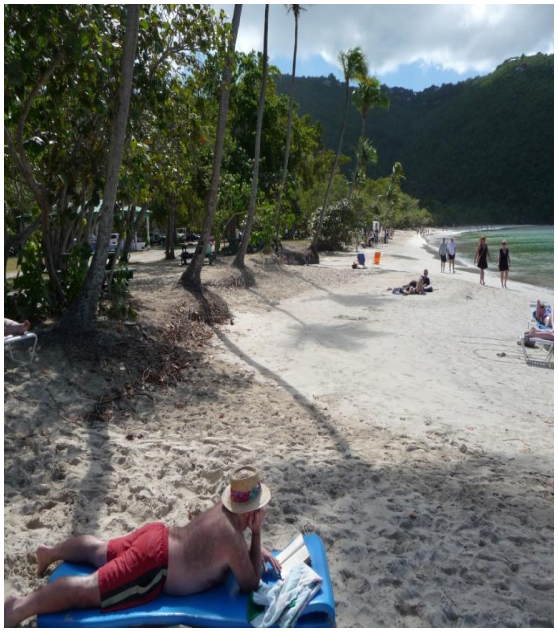
2. **Sea Level Rise, 1-3m** – impact on coastal infrastructure, contamination of groundwater, decreased groundwater availability (for tourism, agriculture, industry, residential use)

3. **Variability of Precipitation** – 20-30% decrease (drought), more intense rainfall events, ecological changes, flood damage, impact on agriculture, decreased potable water availability

Climate Change Forecasts Contd.

4. **Increase in of Extreme Events** – more intense storms, higher storm surge levels, pests, damage (property, infrastructure, crops, productive coastal ecosystems), impact on tourism (damage to physical plant and attractions, reduced visitation), increased insurance costs, ecological changes



Areas of Concern

1. Food security, water security
2. Health security – heat-related mortality, respiratory stresses, increased ciguatera, increase in disease vectors
3. Disruption to livelihoods/economic activities – tourism, financial sector, agriculture, fishery
4. Cost of living increase (insurance, foods, machinery, etc.)
5. Damage to property and infrastructure
6. Disruption of ecosystem services

Response & Rate of Change

Climate Change Adaptation: definition

Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. **It entails any changes in processes, practices, and structures** designed to moderate potential damages or to benefit from opportunities associated with climate change (IPCC, 2001).

Climate Change Adaptation: strategies

1. Integration of climate change adaptation strategies into the physical planning process.
2. Integration of adaptation planning into environmental assessment of projects.
3. Implementation strategies for adaptation in key economic sectors.
4. Adaptation strategies to protect human health.
5. Adaptation strategies for agriculture and food.
6. Building capacity to identify climate change risk and reduce vulnerability.

Climate Change Basics – the Caribbean Connection

Everything is connected

Water

Energy

Transportation

Society

Agriculture

Ecosystems

Health

VI Reef Fest: Climate Change in the Caribbean 11/18/2012 5

Climate Change Health Impacts

1. **Direct** - heat-related mortality, respiratory stresses, increase in disease vectors, diarrheal diseases
2. **Indirect** – food and water stresses, infrastructure failures, ecosystem damage, storm-related mental health, exacerbation of stresses from NCDs, increased stress on health care delivery systems

Information Sources

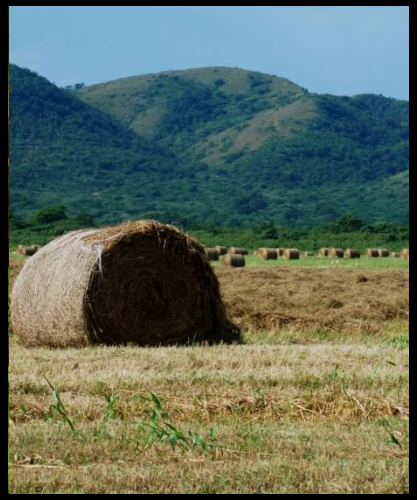
- www.vitema.gov
- http://www.globalchange.gov
- http://caribbeanclimate.bz
- www.cdema.org
- http://pr-ccc.org
- http://www.fdpi.org/program-of-work/climate-change/

Thanks for your attention

Foundation for Development Planning, Inc.

http://www.fdpi.org

US Climate Change Programs: Addressing climate change vulnerabilities for sustainable ecosystem services, agriculture and forestry in the USVI




William Gould, USFS International Institute of Tropical Forestry
wgould@fs.fed.us

USDA CARIBBEAN CLIMATE HUB for Tropical Forestry and Agriculture

The Caribbean Landscape Conservation Cooperative
Bridging science and action, land and sea

Context

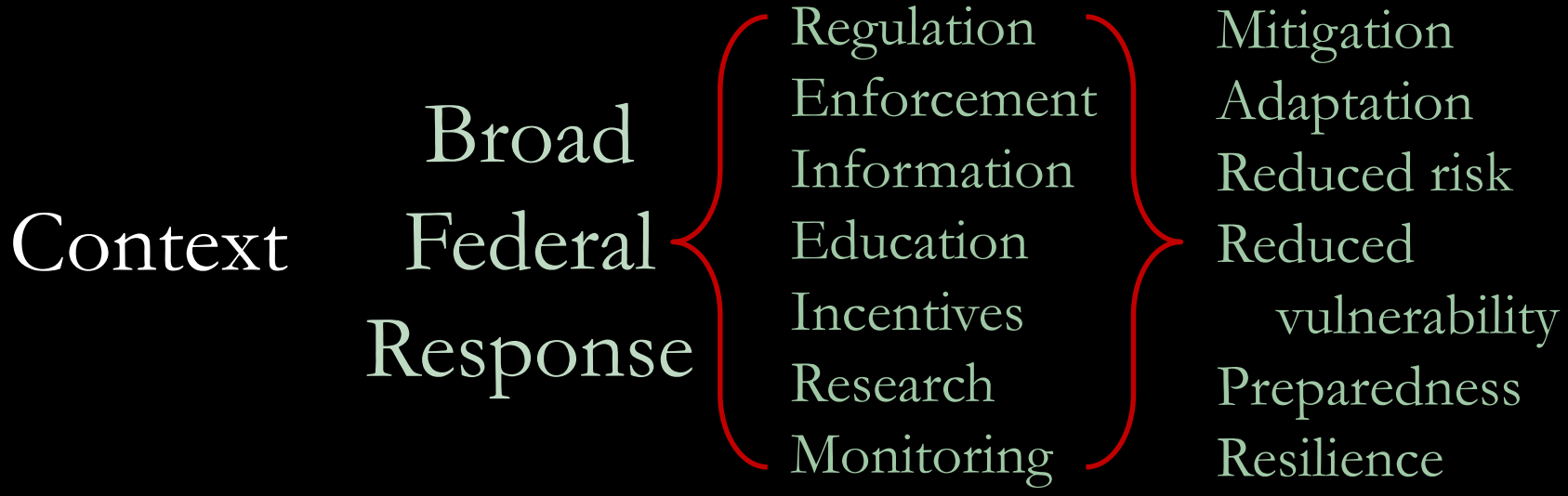
Context

Broad Federal Response

Context

Broad Federal Response

- Regulation
- Enforcement
- Information
- Education
- Incentives
- Research
- Monitoring


Context
Broad
Federal
Response
Regulation
Enforcement
Information
Education
Incentives
Research
Monitoring
Mitigation
Adaptation
Reduced risk
Reduced
vulnerability
Preparedness
Resilience

Presidential orders

Executive Order 13514 of October 5, 2009

Federal Leadership in Environmental, Energy, and Economic Performance

By the authority vested in me as President by the Constitution and the laws of the United States of America, and to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies, it is hereby ordered as follows:

Executive Order 13653 of November 1, 2013

Preparing the United States for the Impacts of Climate Change

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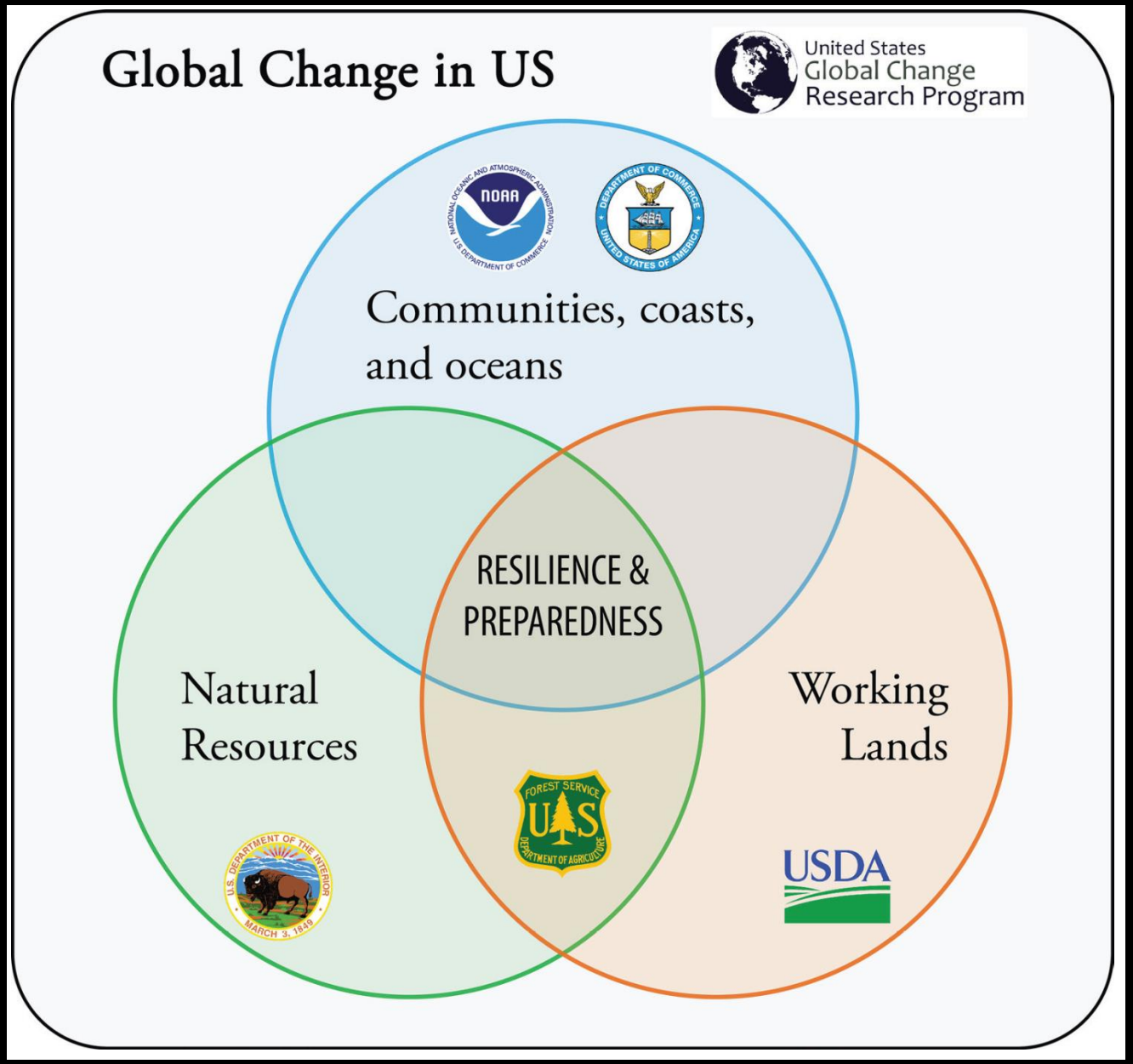
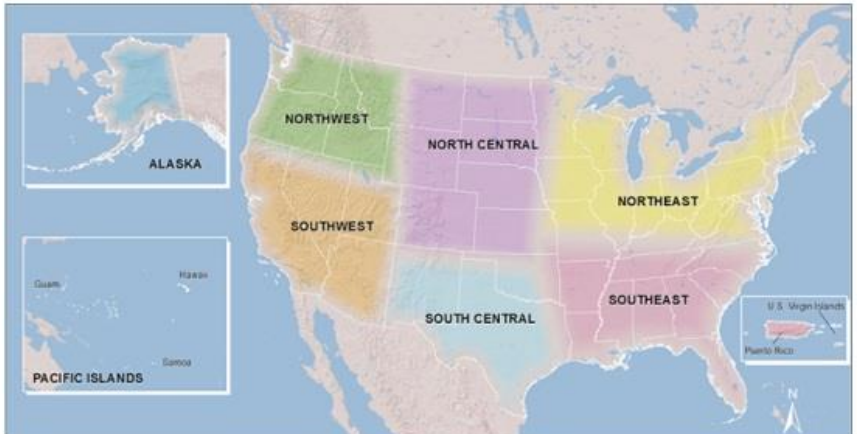
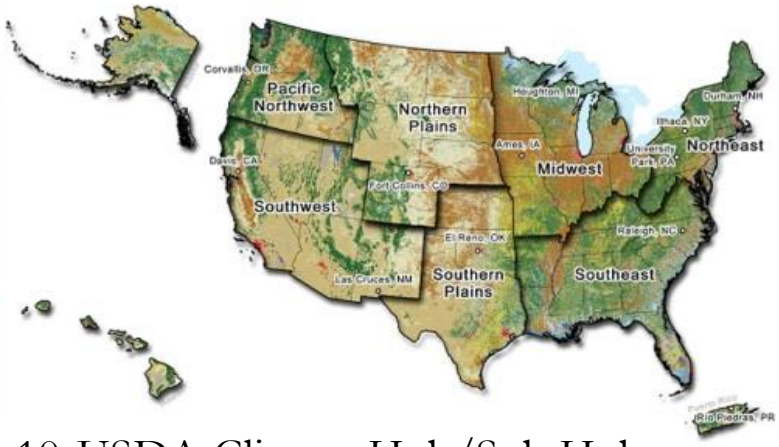
Coordinated Response to Global Change



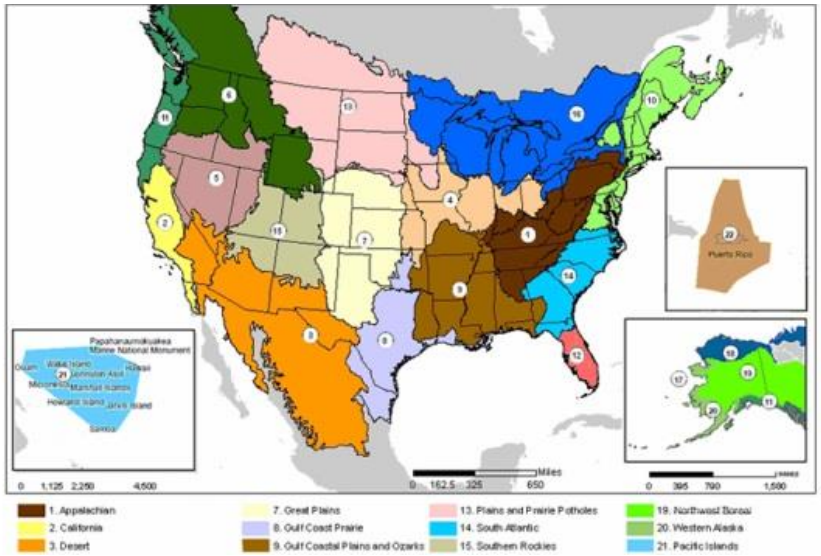
Coordinated Response to Global Change



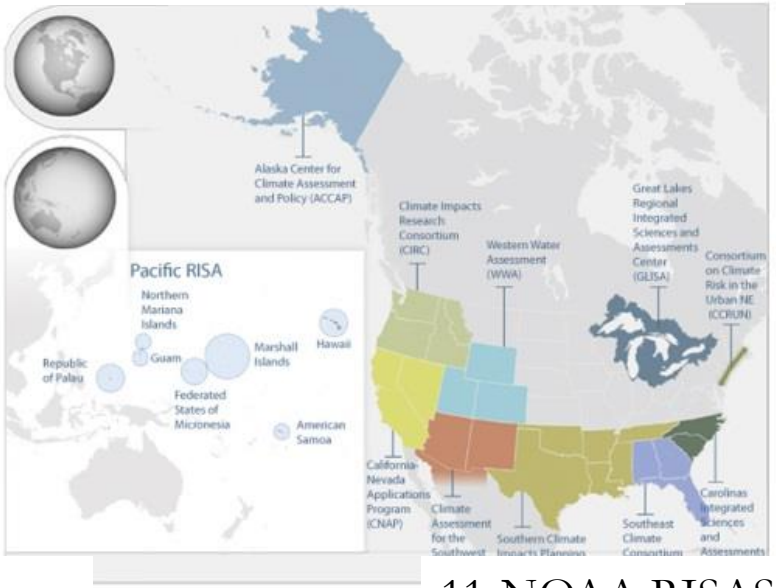
8 USGS Climate Science Centers



10 USDA Climate Hub/Sub Hubs



22 DOI Landscape Conservation Cooperatives



11 NOAA RISAS


USDA
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CLIMATE HUB
for Tropical Forestry and Agriculture
Caribbean
Landscape Conservation Cooperative

Forest Service, National Resource Conservation Service, Farm Service Agency, Agricultural Research Service, APHIS, Rural Development, Foreign Agricultural Service, Risk Management Agency, University Extension and other partners.


USDA
CARIBBEAN
CLIMATE HUB
for Tropical Forestry and Agriculture
Caribbean
Landscape Conservation Cooperative

Fish and Wildlife Service, USGS, National Park Service, NOAA, Forest Service, NRCS, EPA, Army Corp of Engineers, VI DPNR, PR DRNA, TNC, Para la Naturaleza, VI Department of Agriculture, UVI, UPR, Puerto Rico Institute of Culture, Puerto Rico Planning Board, Office of Insular Affairs

Bridging organizations

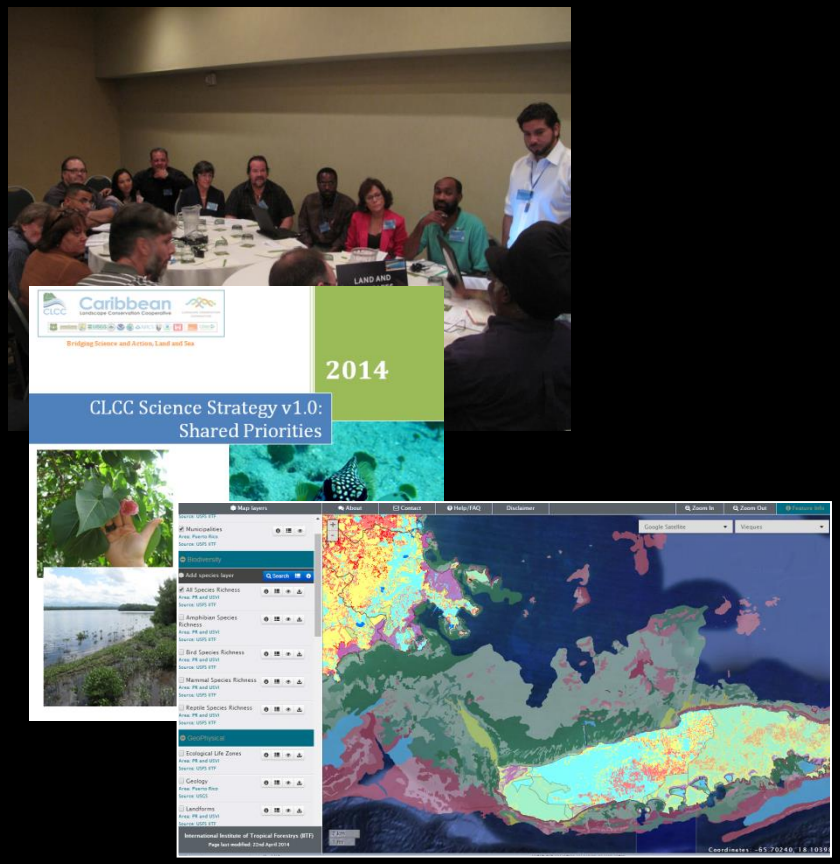
Shared objectives:

- Understand climate change vulnerabilities.
- Understand flow of information.
- Develop and deliver relevant science.
- Frameworks for action and implementation.

Understanding stakeholders and decision makers

Conservation

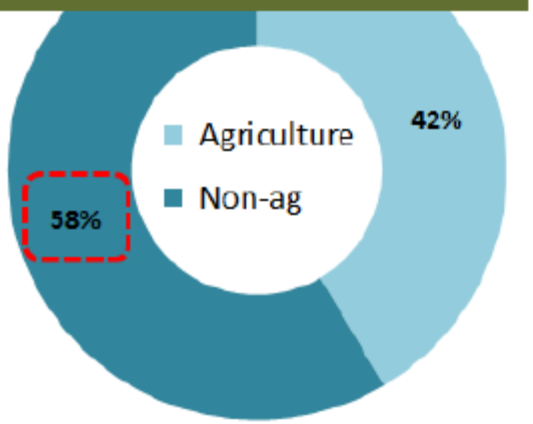
- Strategic planning.
- Structured decision making.
- Setting shared objectives.



Forestry and Agriculture

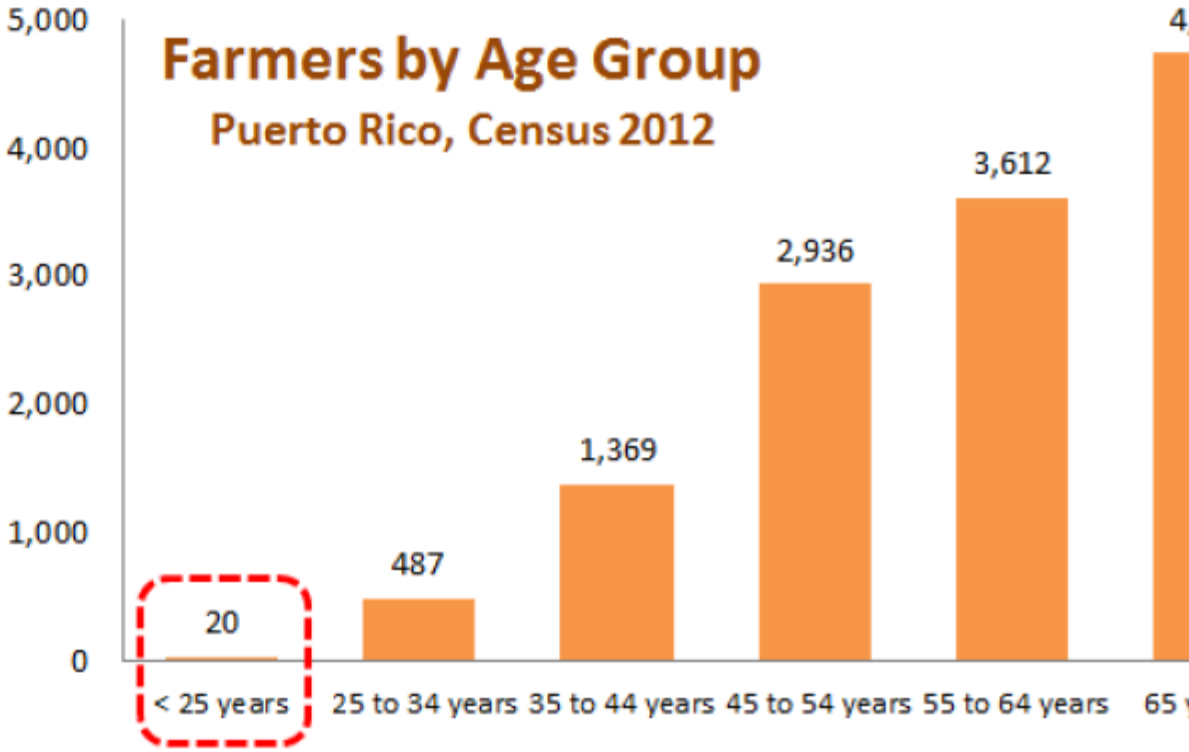
- Mapping stakeholder landscape.
- Knowledge flow: Who gets what information from whom?
- Identifying bottlenecks.

Caribbean Context



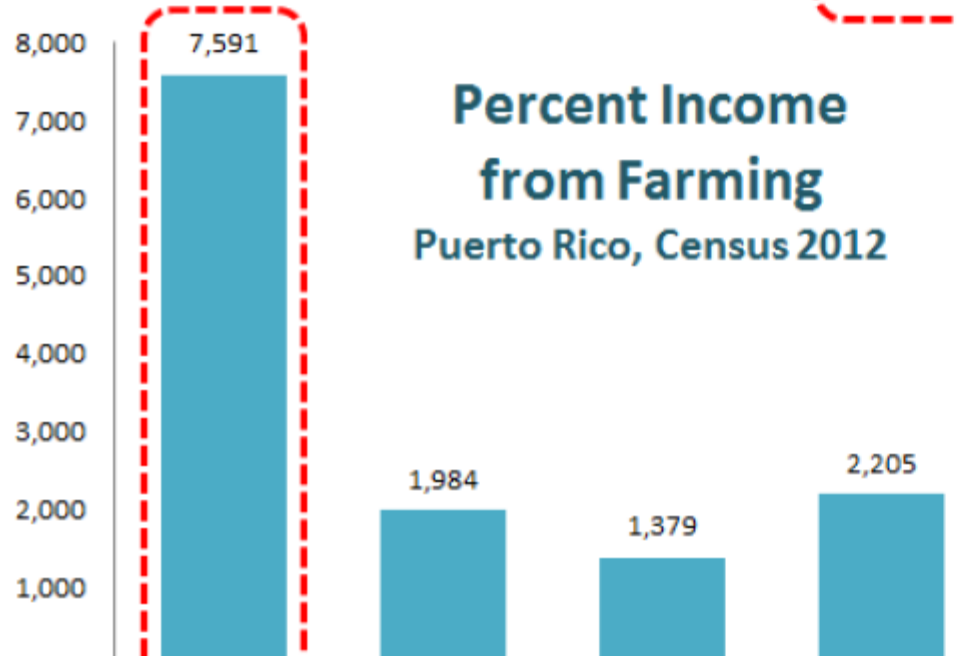
Farmers by Primary Occupation

Puerto Rico, Census 2012



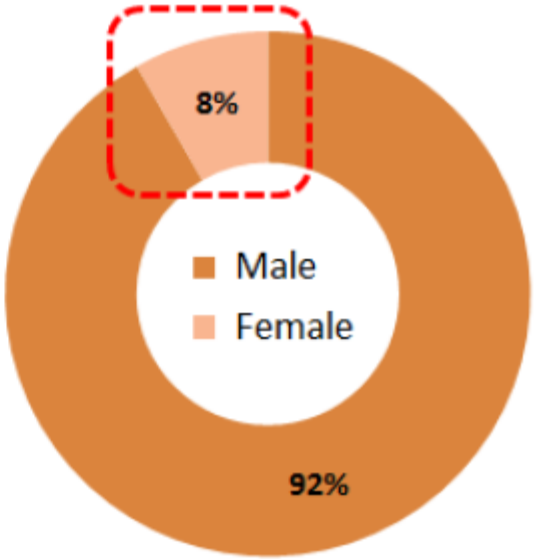
Farmers by Age Group

Puerto Rico, Census 2012



Percent Income from Farming

Puerto Rico, Census 2012



Farmers by Gender

Stakeholder's voices

¡Informac
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Update Extension educational material

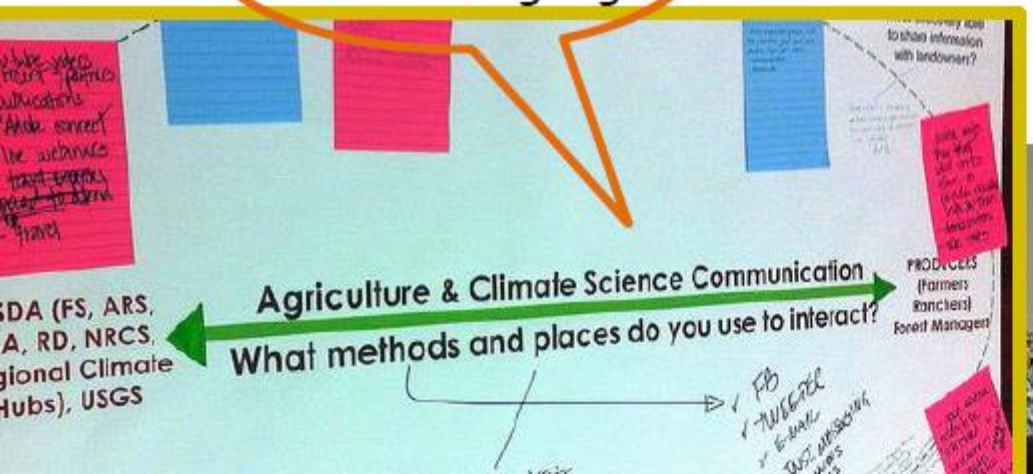
Training for Extension agents

Info sharing in a common language

Best practices & case studies

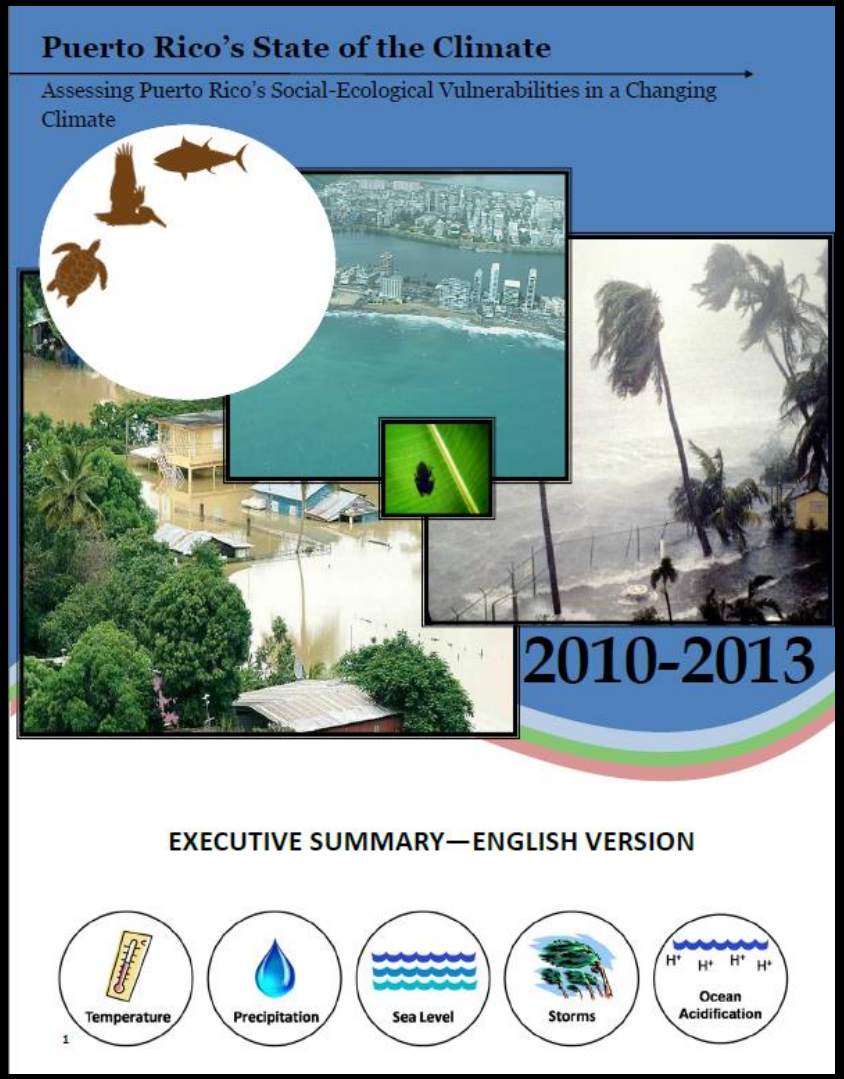
Adaptation demonstration projects

Ohh, and funds implementation capacity buildi

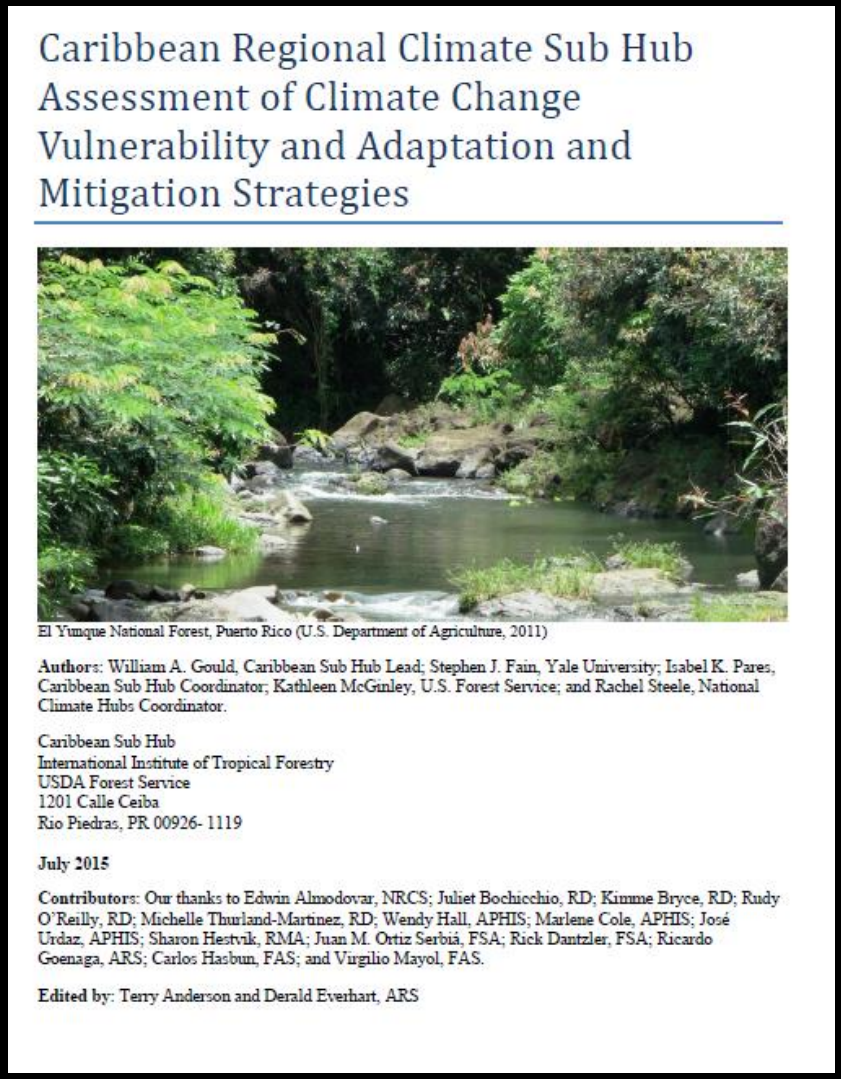


Recent Vulnerability Assessments

Conservation

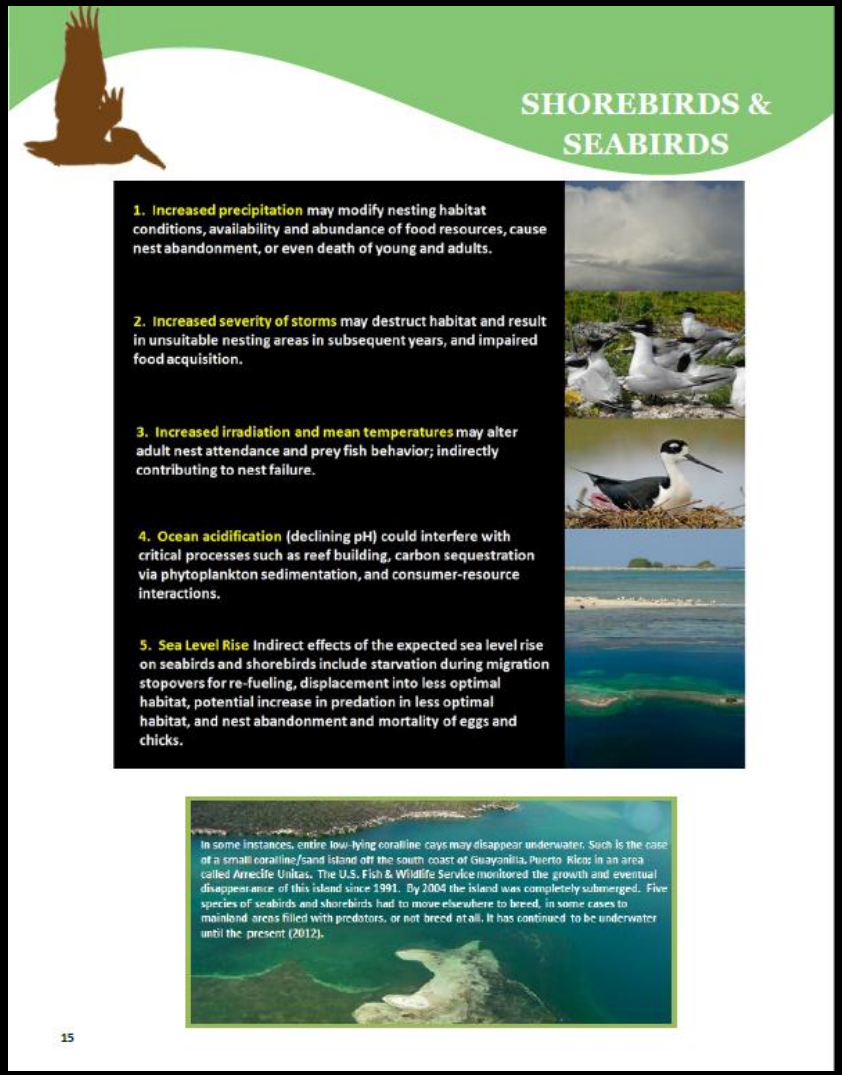


Forestry and Agriculture



Vulnerabilities by resource

Conservation



Forestry and Agriculture

	Coffee	Grasses	Specialty	Livestock	Forestry
Flood and sea level rise					
Drought					
Temperature shifts	Timing and amount of precipitation important to phenology of coffee. Negative effects of increased erosion and nutrient loss.				
Pests and disease					
Socio-economic					
Extreme weather					
Additional climatic factors					

Flow of information:

How does science address vulnerabilities?

Caribbean Landscape Conservation Cooperative

USDA CARIBBEAN CLIMATE HUB for Tropical Forestry and Agriculture

GOAL

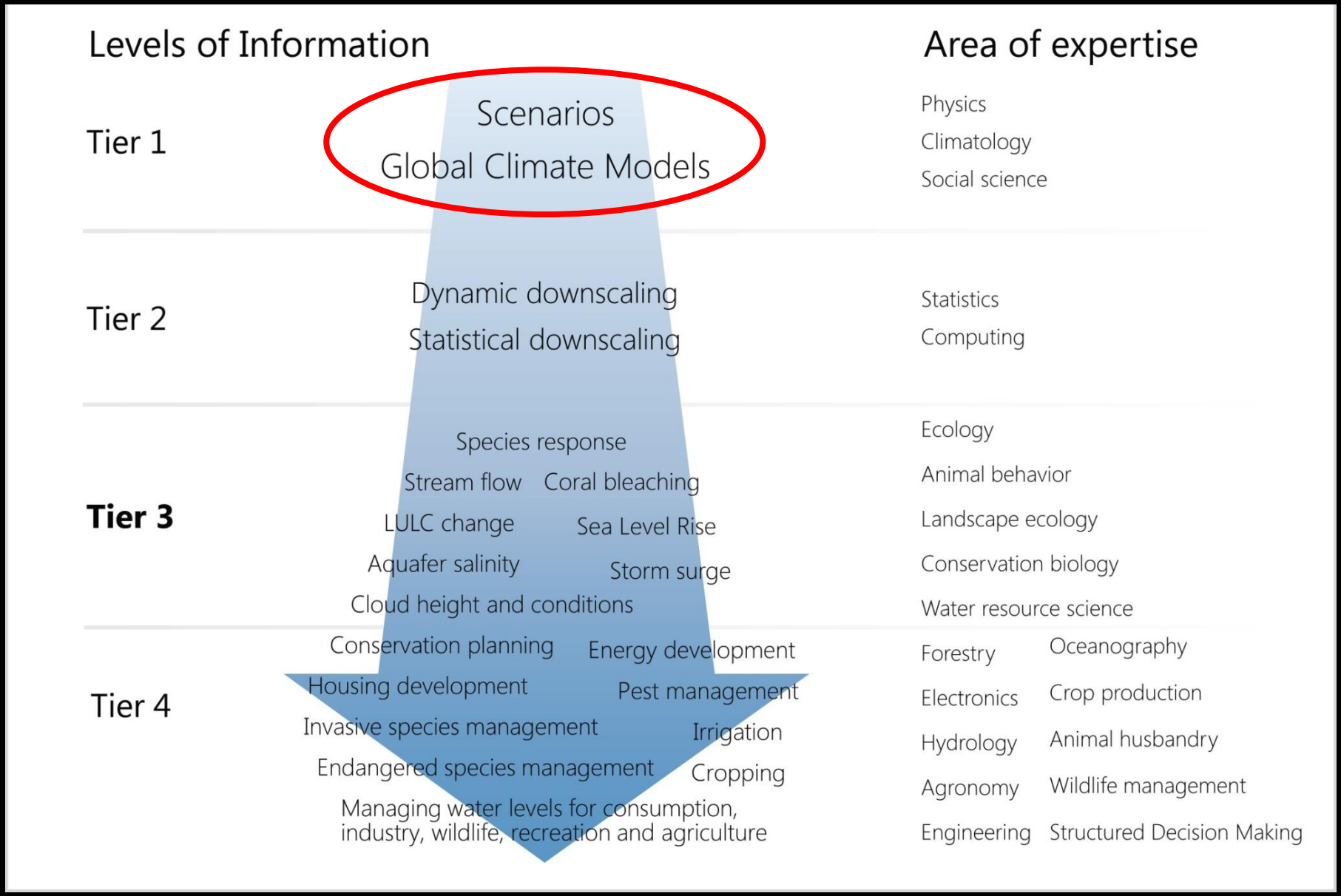
Deliver Climate Science & Services for Conservation, Agriculture and Forestry

Challenge: uncork the adaptation implementation bottleneck

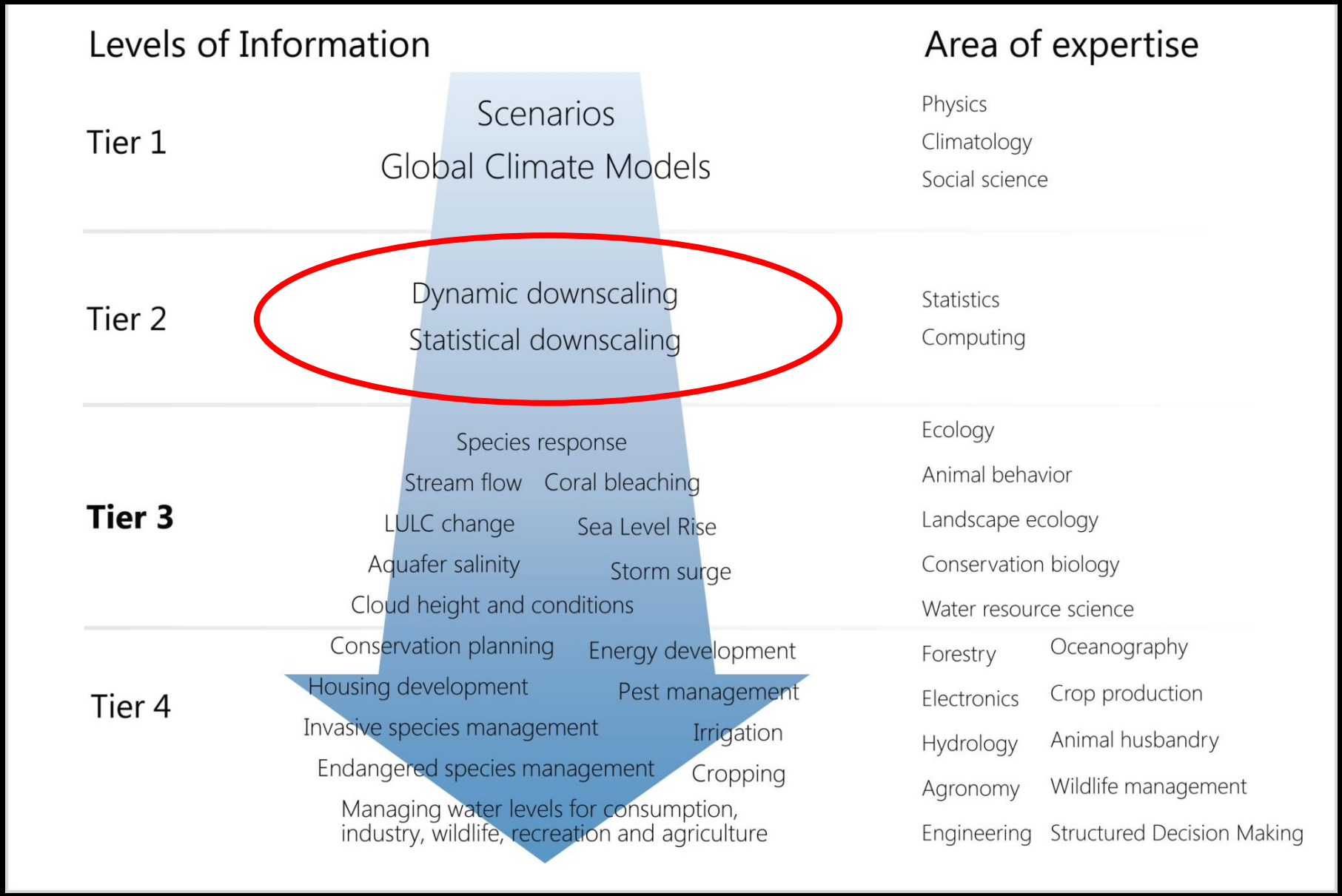
Approach: Work across agencies and organizations focusing on knowledge-to-action gaps.

"The single biggest problem in communication is the illusion that it has taken place."

Cascade of information and modeling needs



Cascade of information and modeling needs



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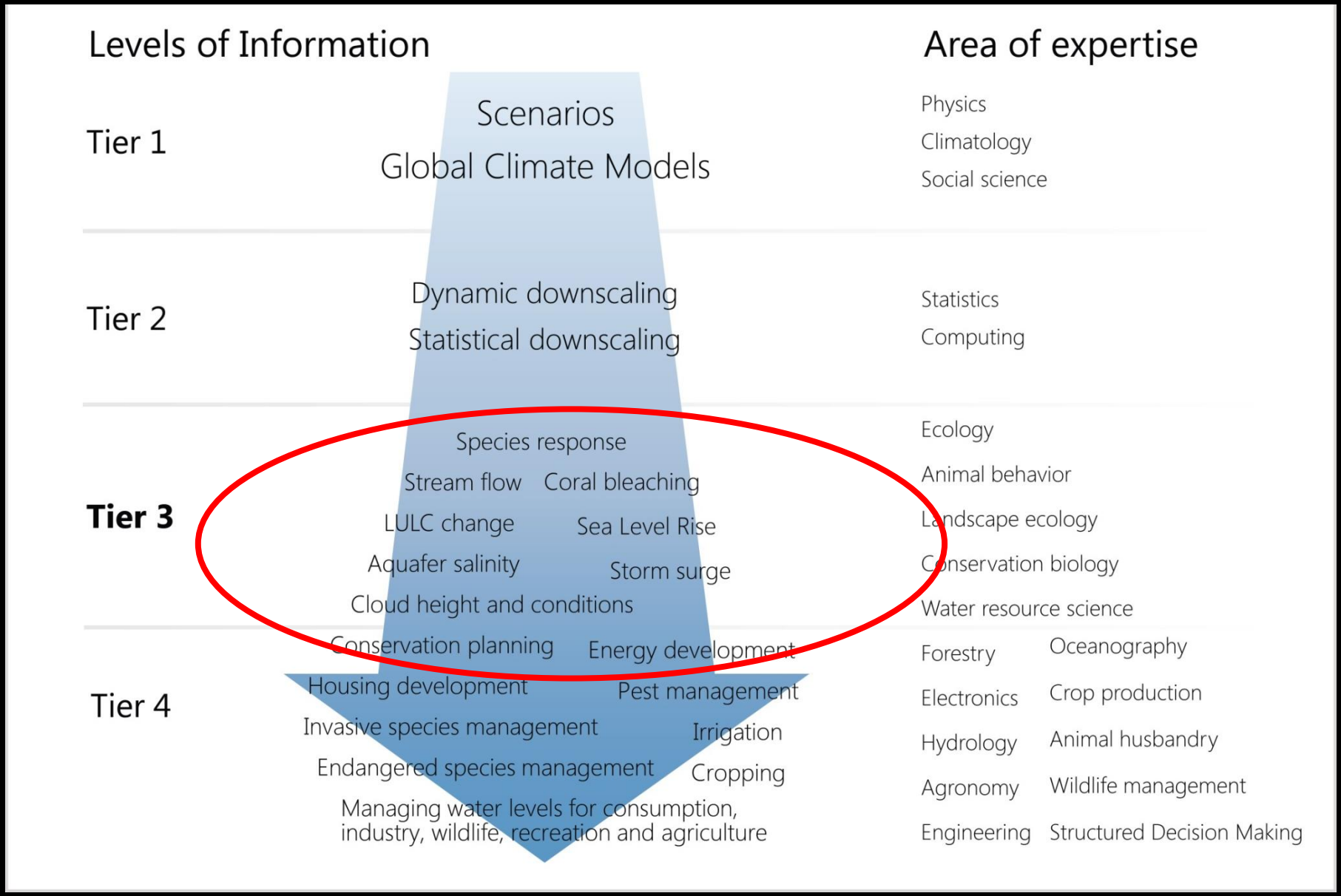

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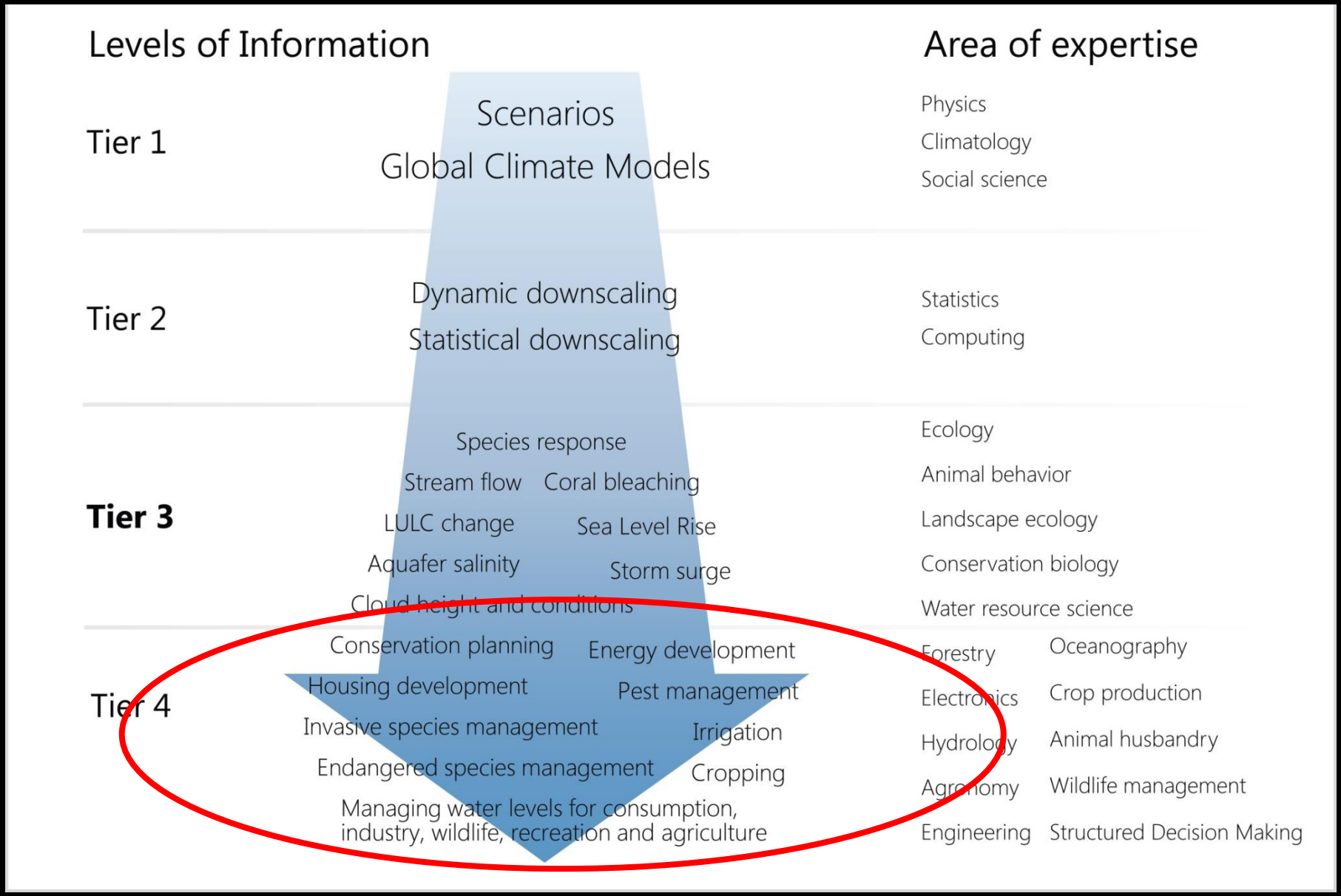
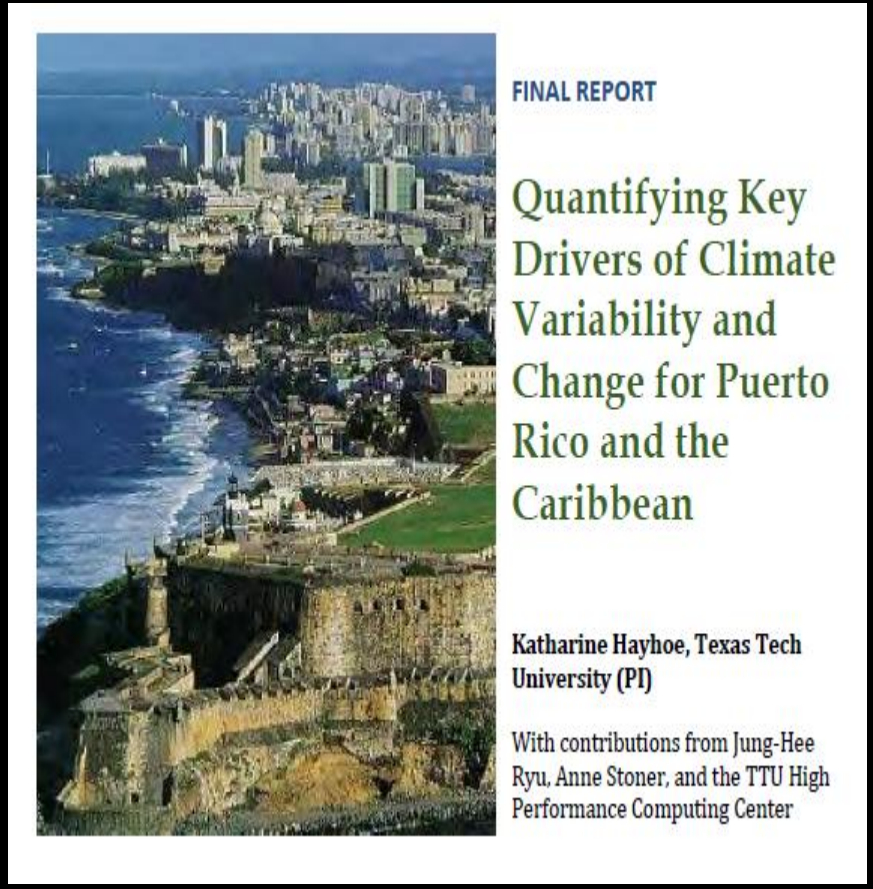


Statistically Downscaled Climate Data

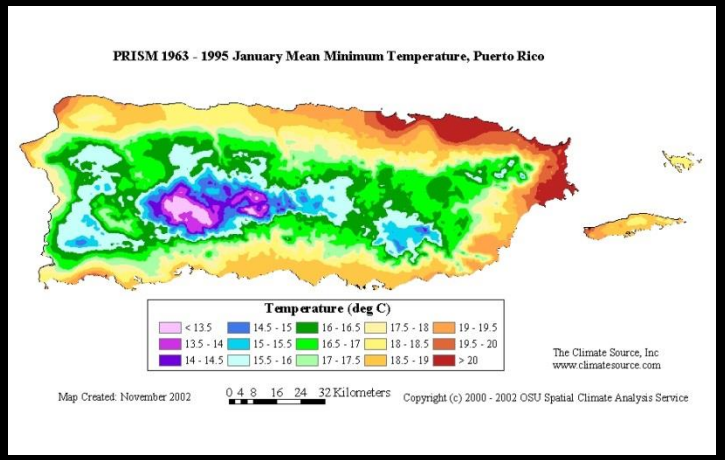
Includes projected changes in 85 secondary climate indicators, including seasonal averages, thresholds, and extremes for temperature and precipitation.



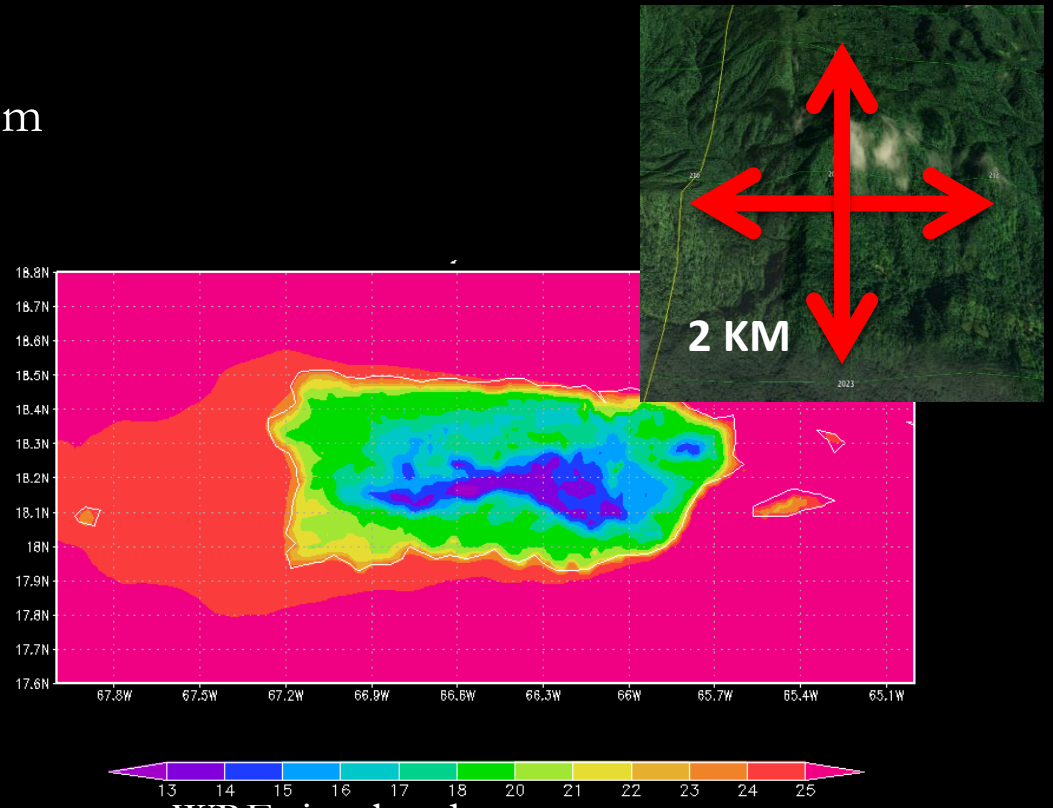
DEPARTMENT of the INTERIOR
SE CLIMATE SCIENCE CENTER

Dynamically downscaled climate data

- High-resolution needed to capture the complex topography and micro-climates.
- Key variables and time steps derived from stakeholder workshops.
  - Cloud density at 600-1000 m
  - Relative humidity



Observations – January Climatology



WRF simulated average temperature
January 4-8, 2005

Ryan et al. in progress

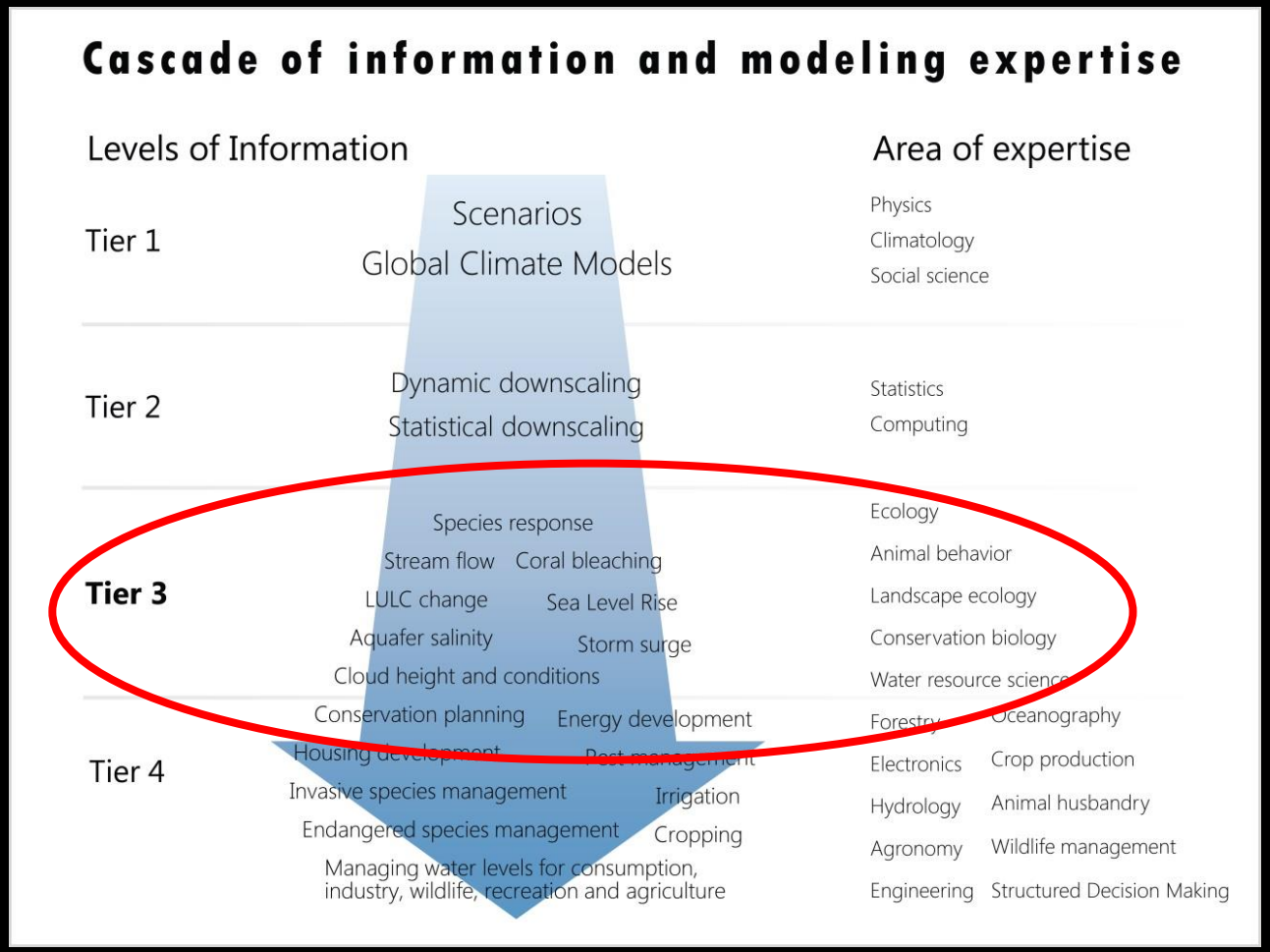
DEPARTMENT of the INTERIOR
SE CLIMATE SCIENCE CENTER

Bridging organizations: Frameworks for climate science delivery

Connecting global with local

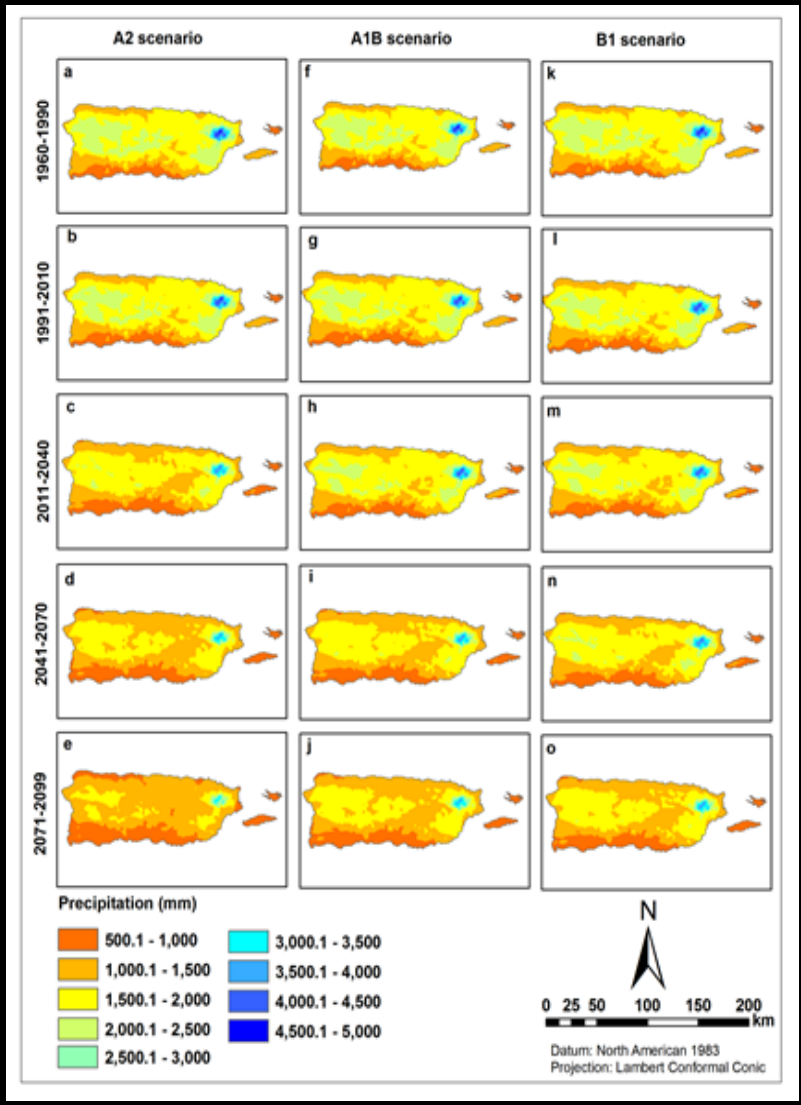
USDA CARIBBEAN CLIMATE HUB for Tropical Forestry and Agriculture

Caribbean Landscape Conservation Cooperative



Land cover change dynamics & future scenarios

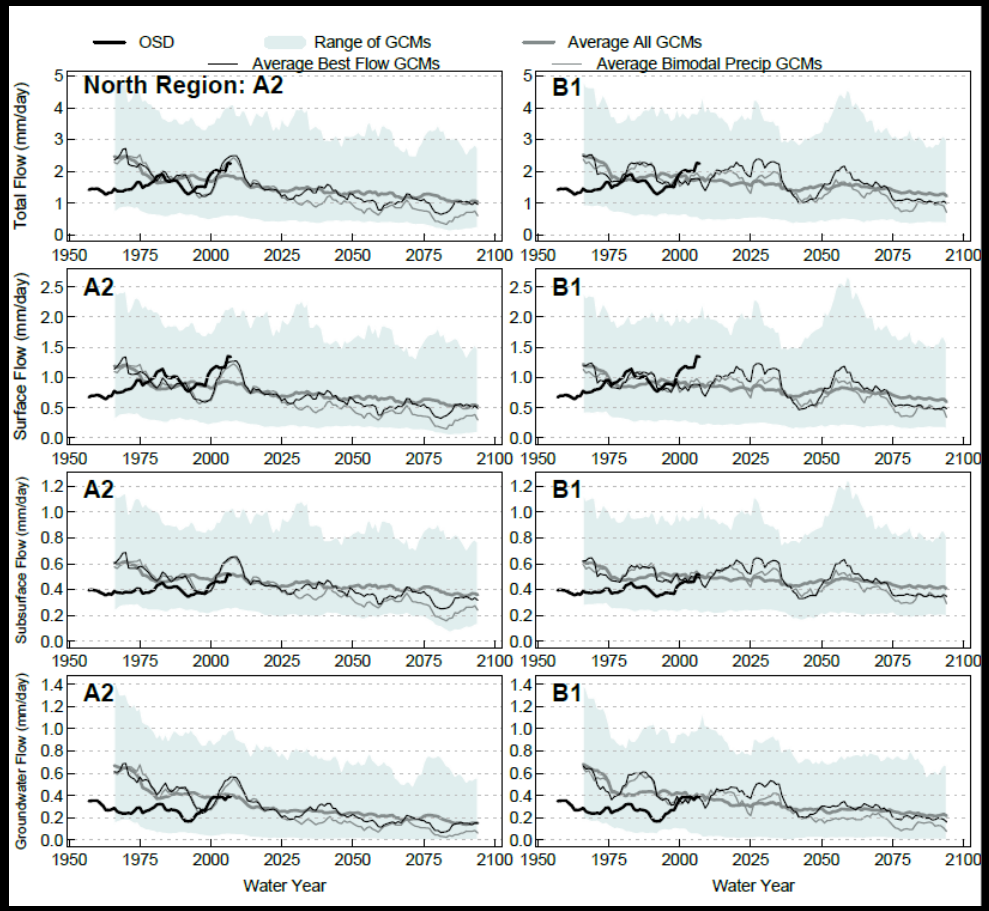
Climate change implications for tropical islands: Interpolating and interpreting statistically downscaled GCM projections for management and planning
Henareh et al. 2015



Modeling stream flow 1960 - 2100

Understanding the propagation of uncertainty

CLIMATE CHANGE AND WATER RESOURCES IN A TROPICAL ISLAND SYSTEM: PROPAGATION OF UNCERTAINTY FROM STATISTICALLY DOWNSCALED CLIMATE MODELS TO HYDROLIC MODELS



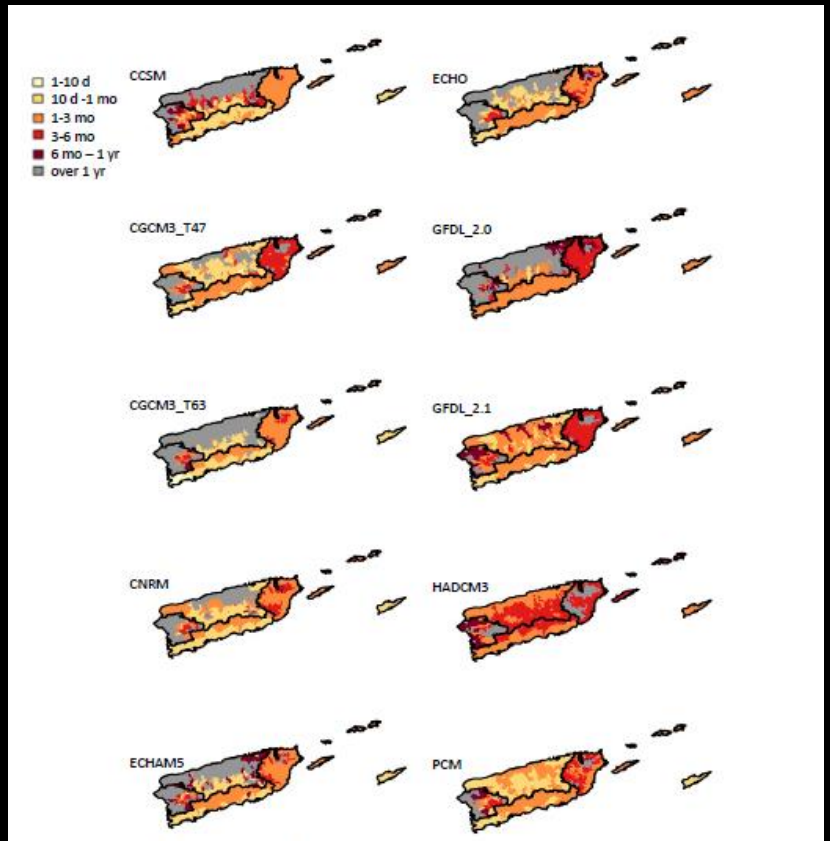


Figure 5. Number of days of data aggregation to accept the KS test null hypothesis that ARRM and MSD are from identical populations, for the total flow variable and each GCM. Black lines outline the four regions. The full figure for all variables and GCMs is Supplementary Figure 7.

Van Beusekom et al. 2015 International Journal of Climatology

Work of interest

- Protected Areas Conservation Action Team
- Cays Conservation Action Team
- VI CCC
- ADAPTA
- Conservation mechanisms/conservation governance
- Landscape Conservation Design

Take home

- Stable frameworks for collaborative response to climate change
- Ability to work across jurisdictions
- Organizational "collaborative" memory that retains data & lessons learned for adaptive responses
- Efficient approach to delivering climate services with local relevance for conservation, foresty, and agriculture

CONSEJO DE CAMBIOS CLIMÁTICOS

CLIMATE CHANGE COUNCIL
PUERTO RICO

The Puerto Rico Climate Change Council

…mainstreaming adaptation, using best science and building resilience.








January 2016

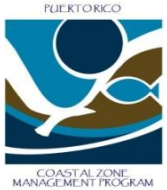
Evolution of Climate Change knowledge in Puerto Rico

- **Before 2007**: farmers, fishers, construction workers, *and…yes, scientists!*
- **2007**: IPCC 4th Assessment Report and The Inconvenient Truth
- **2008**: UPR and Sea Grant's Roundtable to assess the consequences of climate change
- **2008**: Call to action was issued through a letter signed by 130 scientists
- **2008**: Governor's Exec. Order establishes a High level Commission.
- **2009**: PRCZMP –CZMA Section 309 Coastal Hazards Strategy and NOAA Coastal fellowship
- **2009**: UPR Carolina Campus - Climate Change Summits
- **2010**: First meeting of the Puerto Rico Climate Change Council (PRCCC)
- **PRCCC Summits**: 2011, 2012, 2013, 2014, 2015

The State of the Puerto Rico Climate report (2010-2013):

Assessing Social-ecological vulnerabilities in changing climat*e*

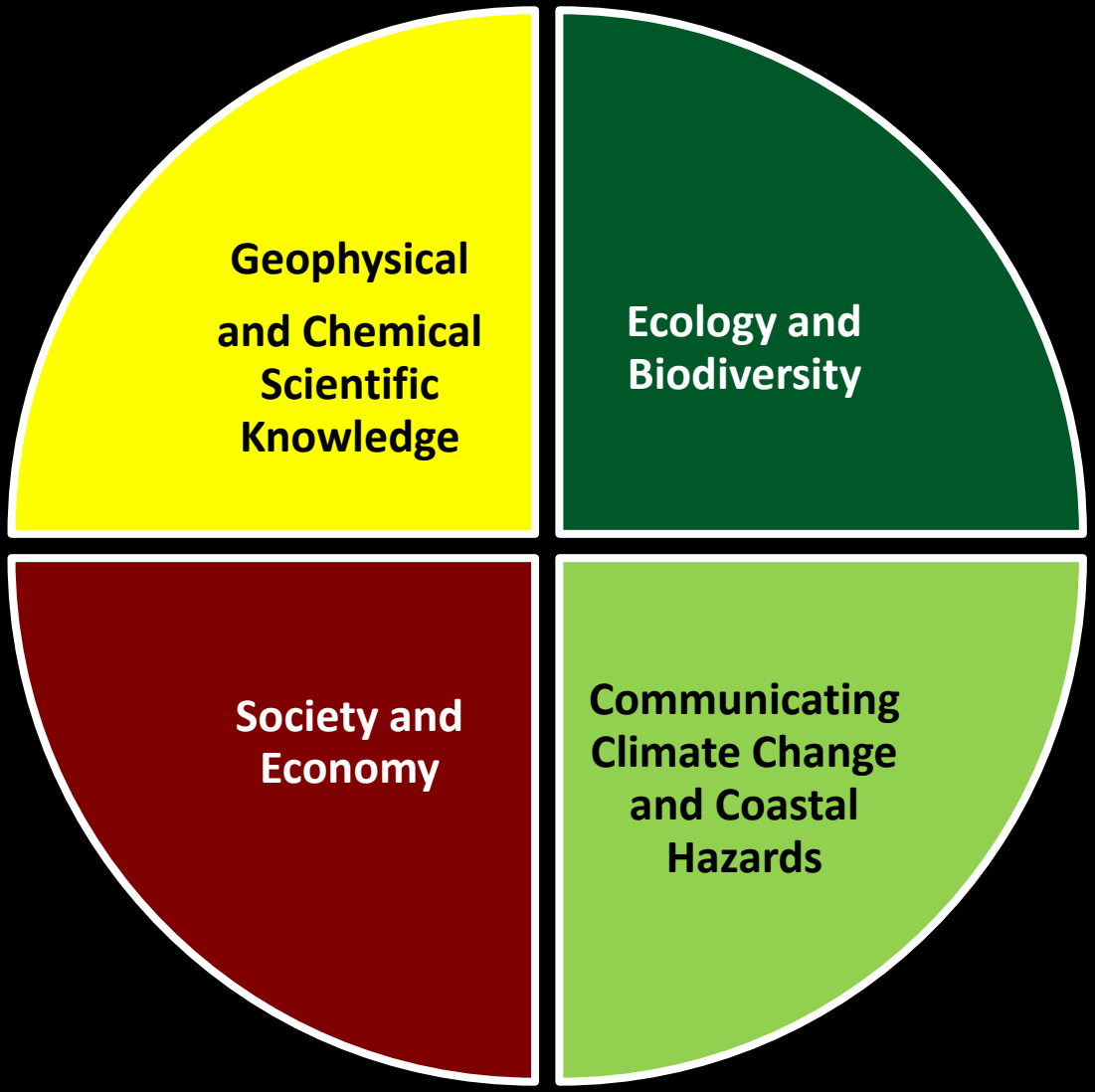
-



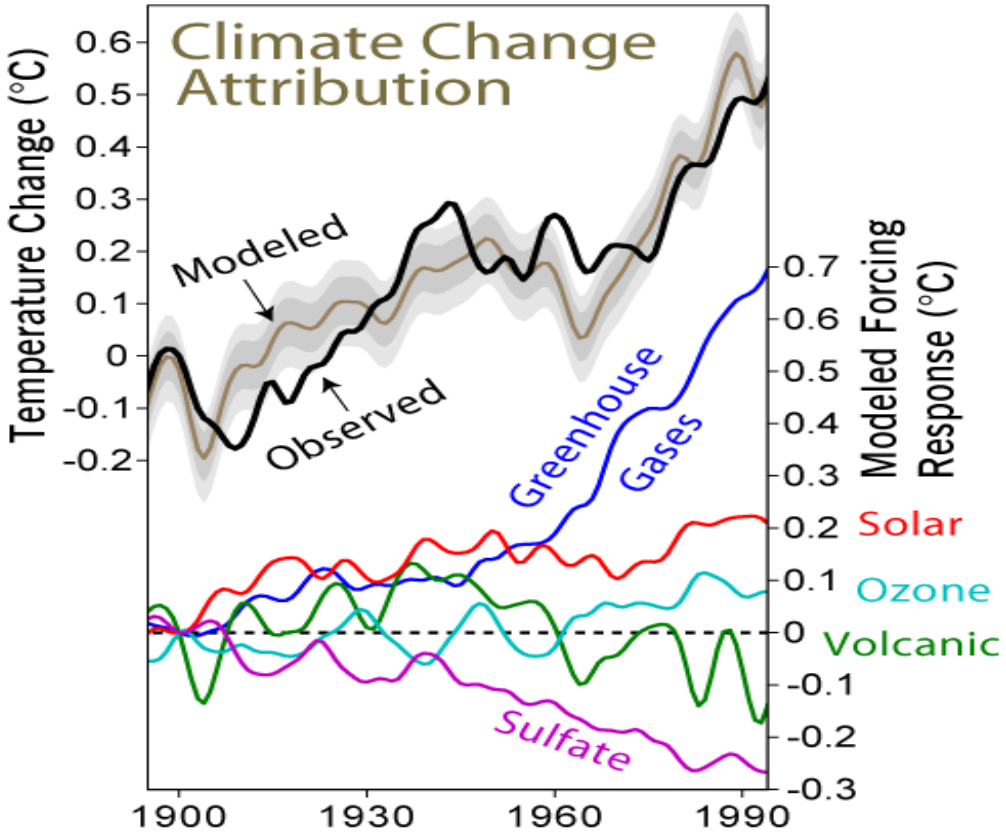
Fideicomiso de Conservación de Puerto Rico
Conservation Trust of Puerto Rico


V REUNION CUMBRE

PRCCC
Working Groups



Drivers of change… Anthropocene!



- Atmospheric temperature
- Precipitation
- Extreme Events / Hurricanes
- Sea Surface Temperature
- Ocean Acidification
- Sea Level Rise

Over 150 scientists, planners, architects, engineers, economists, social scientists, and communicators contributed to the development of **The State of the Puerto Rico Climate Report - a comprehensive assessment of Puerto Rico's social-ecological vulnerabilities**

Coastal Adaptation Strategies

Green and nature-based strategies (i.e., wetlands/dunes - protection/restoration)

Non-structural (i.e., land acquisition, planned retreat, etc.)

Nature-based / Structural (i.e., beach restoration, living shorelines, EbA, etc.)

Structural protection (i.e., revetments, detached breakwaters, levees, etc.)

CONSEJO DE CAMBIOS CLIMÁTICOS
CLIMATE CHANGE COUNCIL
PUERTO RICO

HOME

Working Groups

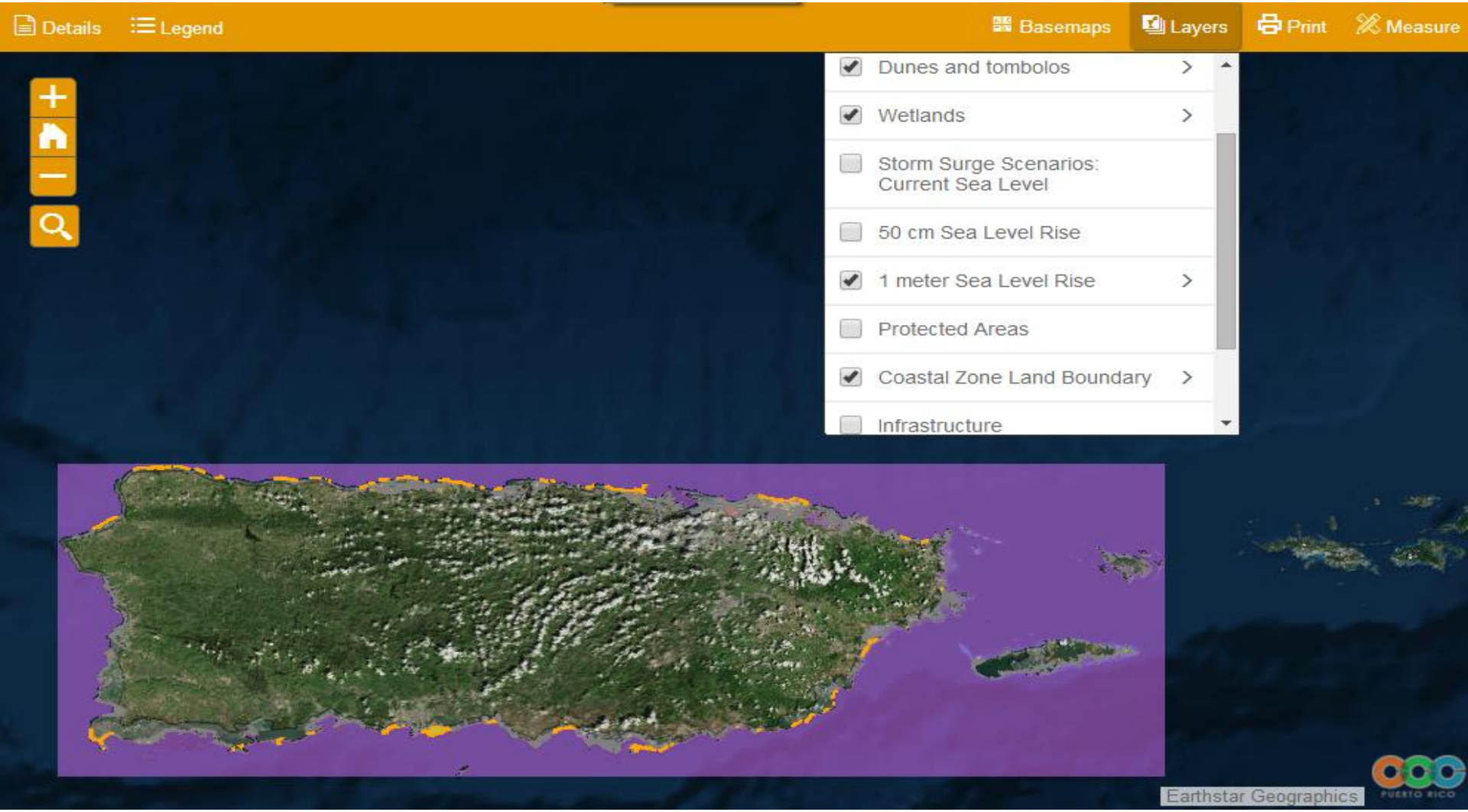
Communicating effectively with specific stakeholders and the public at large is key and in addition to creating a robust understanding of why climate is changing and the social-ecological consequences of these changes

Publications

Current reports from the PRCCC Working Groups and other relevant publications

Climate Data Tool

Puerto Rico Climate Change Council



www.pr-ccc.org

Caribbean Regional Ocean Partnership: USVI - PR

www.caribbean-mp.org

Mainstreaming Adaptation and Using Best Science

- Pilot adaptation plans for 5/44 coastal municipalities
- Climate Adaptation Guide (in print)
- EO 2013-016 Infrastructure agencies to conduct VA and prepare Adaptation Plans
- Climate Adaptation Bill (P. del S. 1357)…approved by Senate
- Outreach and self-vulnerability assessment tool (PRCZMP and NOAA Coastal Fellow project 2015-2017)
- Full disclosure / Right-to-Know Bill (PRCZMP 309 A&S)
- Request to FEMA to include our products as Non-FEMA coastal inundation information in FIRM maps
- PRCCC working groups, information and knowledge exchange, climate and sea level rise modeling, assessments of impacts to water resources and coastal wetlands, biodiversity, critical infrastructure, and human health.
- Future proofing cities project.

www.pr-ccc.org