

# Navigating Change in the Pacific Islands

One NOAA Seminar - May 1, 2013

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# Pacific Islands Regional Climate Assessment (PIRCA)

## Aims

1. Assess the state of climate knowledge, impacts, and adaptive capacity in HI and USAPI
2. Support decision making in the face of a changing climate.

## Participants

Government agencies (federal, state, local), NGOs, businesses, community groups

## Activities

- Dialogs, workshops, literature reviews
- Analyzing scientific consensus, knowledge gaps, sectoral needs, adaptive capacity

## Products

Technical report (Spring 2012), NCA chapter, fact sheets, forum (Winter/Spring 2013)

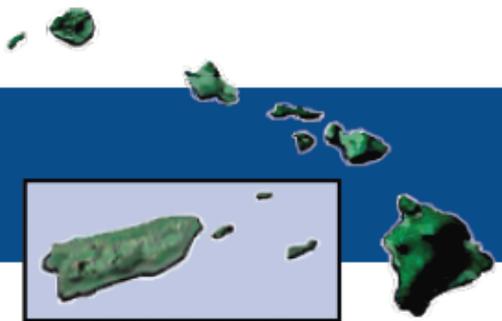
# More than 100 collaborators from diverse organizations





- US Global Change Research Act of 1990
- Incorporate climate science into larger context to identify vulnerabilities
  - Evaluates effectiveness of mitigation and adaptation activities
  - Identifies economic opportunities
  - Integrates scientific information from multiple sources
  - Highlights gaps in knowledge
- Help fed govt prioritize science investments

More on the NCA at <http://assessment.globalchange.gov>



# Islands

Climate change presents the Pacific and Caribbean islands with unique challenges. The U.S. affiliated Pacific Islands are home to approximately 1.7 million people in the Hawaiian Islands; Palau; the Samoan Islands of Tutuila, Manua, Rose, and Swains; and islands in the Micronesian archipelago, the Carolines, Marshalls, and Marianas.<sup>530</sup> These include volcanic, continental, and limestone islands, atolls, and islands of mixed geologies.<sup>530</sup> The degree to which climate change and variability will affect each of the roughly 30,000 islands in the Pacific depends upon a variety of factors, including the island's geology, area, height above sea level, extent of reef formation, and the size of its freshwater aquifer.<sup>531</sup>

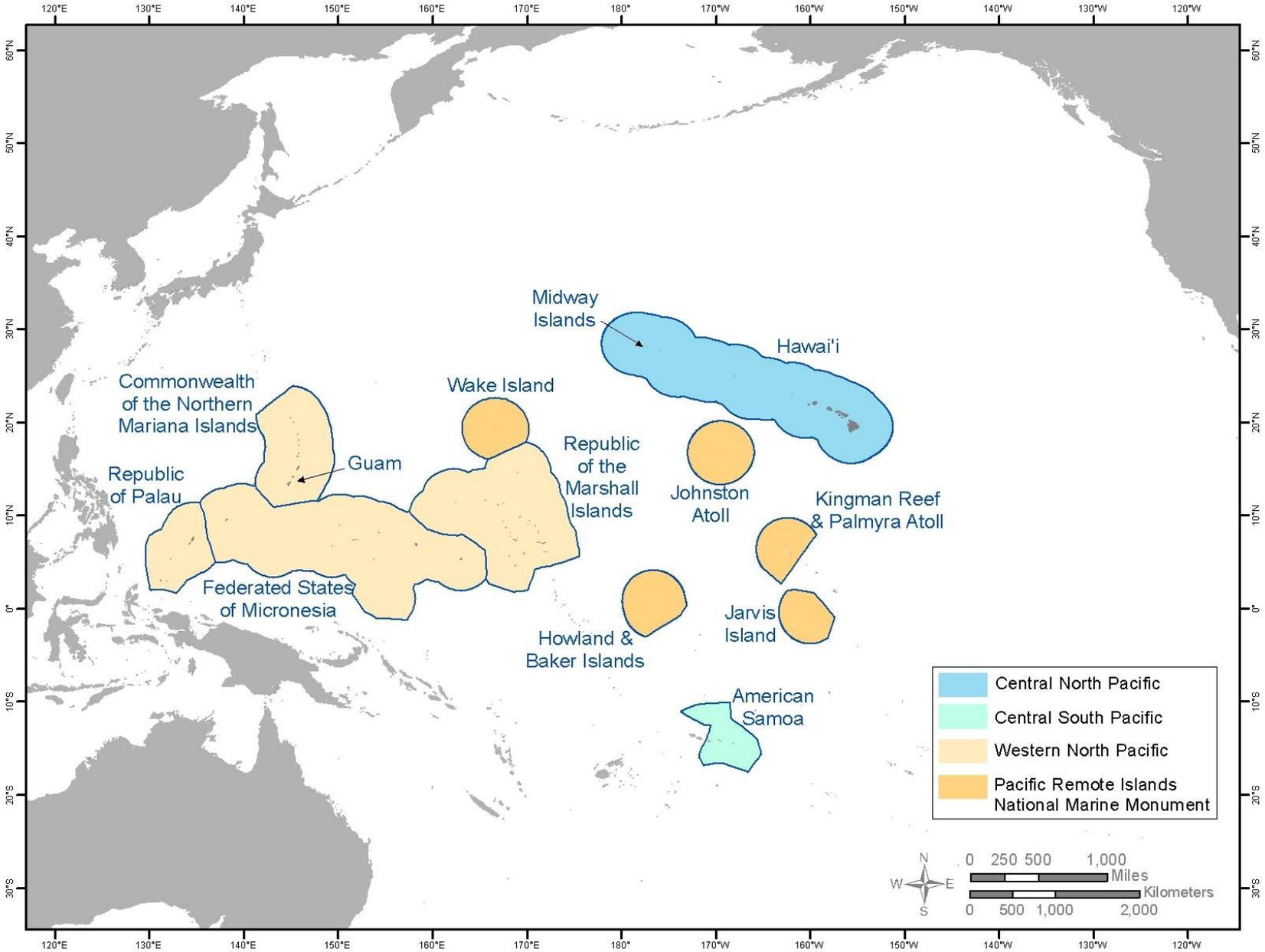
In addition to Puerto Rico and the U.S. Virgin Islands, there are 40 island nations in the Caribbean that are home to approximately 38 million people.<sup>532</sup> Population growth, often concentrated in coastal areas, escalates the vulnerability of both Pacific and Caribbean island communities to the effects of climate change, as do weakened traditional support systems. Tourism and fisheries, both of which

Small islands are considered among the most vulnerable to climate change because extreme events have major impacts on them. Changes in weather patterns and the frequency and intensity of extreme events, sea-level rise, coastal erosion, coral reef bleaching, ocean acidification, and contamination of freshwater resources by salt water are among the impacts small islands face.<sup>533</sup>

Islands have experienced rising temperatures and sea levels in recent decades. Projections for the rest of this century suggest:

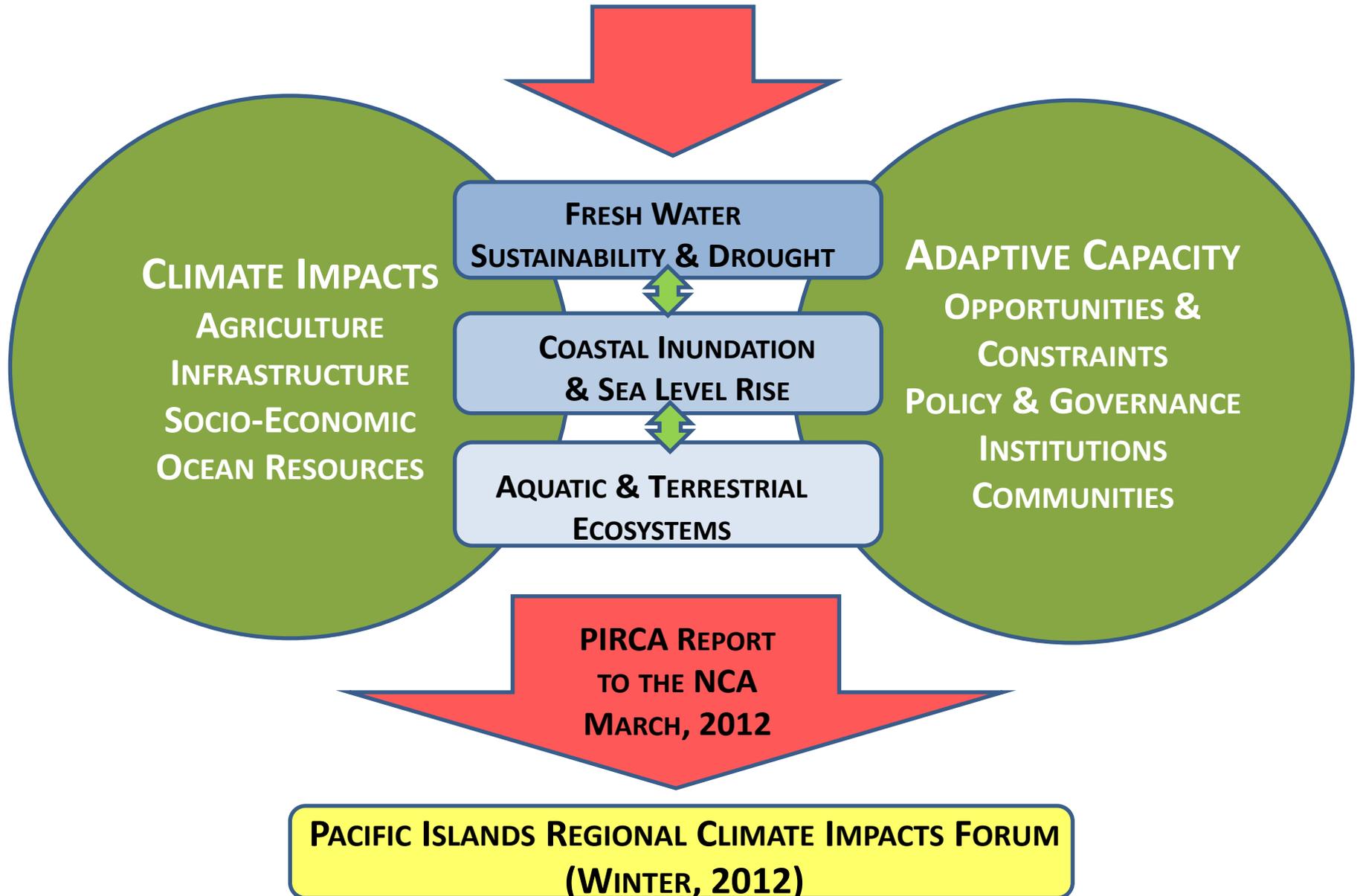
- Increases in air and ocean surface temperatures in both the Pacific and Caribbean;<sup>90</sup>
- An overall decrease in rainfall in the Caribbean; and
- An increased frequency of heavy downpours and increased rainfall during summer months (rather than the normal rainy season in winter months) for the Pacific (although the range of projections regarding rainfall in the Pacific is still quite large).

# Geographical Scope is Hawai'i and US-Affiliated Pacific Islands

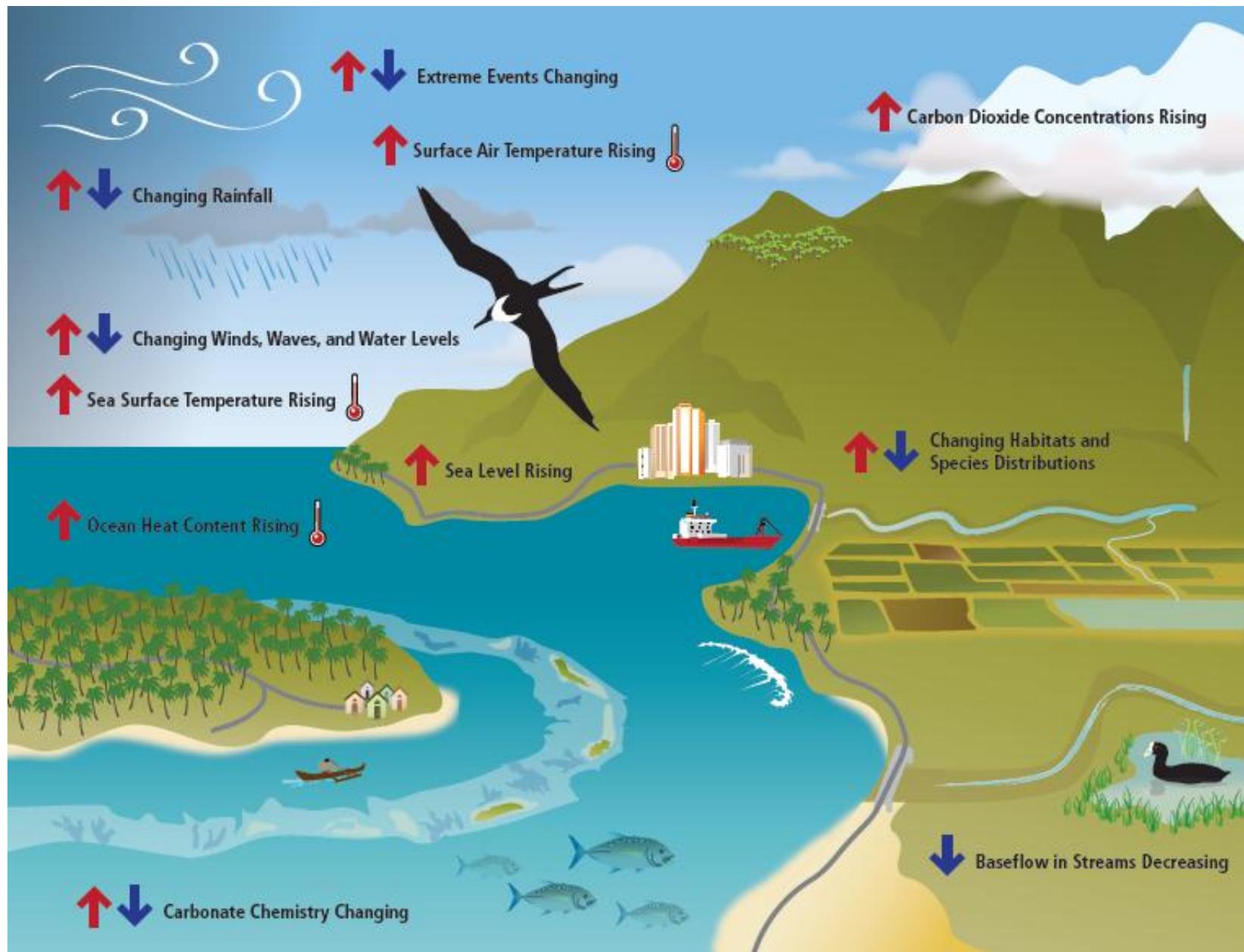


(Figure courtesy of Miguel Castrence, East-West Center)

**REGIONAL CLIMATE PROGNoses: (1) WESTERN NORTH PACIFIC (2) CENTRAL NORTH PACIFIC (3) CENTRAL SOUTH PACIFIC**



# Indicators of a Changing Climate in the Pacific Islands Region

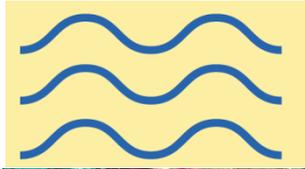


(Figure courtesy Susan Yamamoto)

# Key Messages



Fresh water supplies more limited



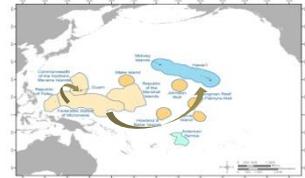
Coastal flooding and erosion



Changes in marine ecosystems



Native plant & animal stress/extinction



Increasing migration



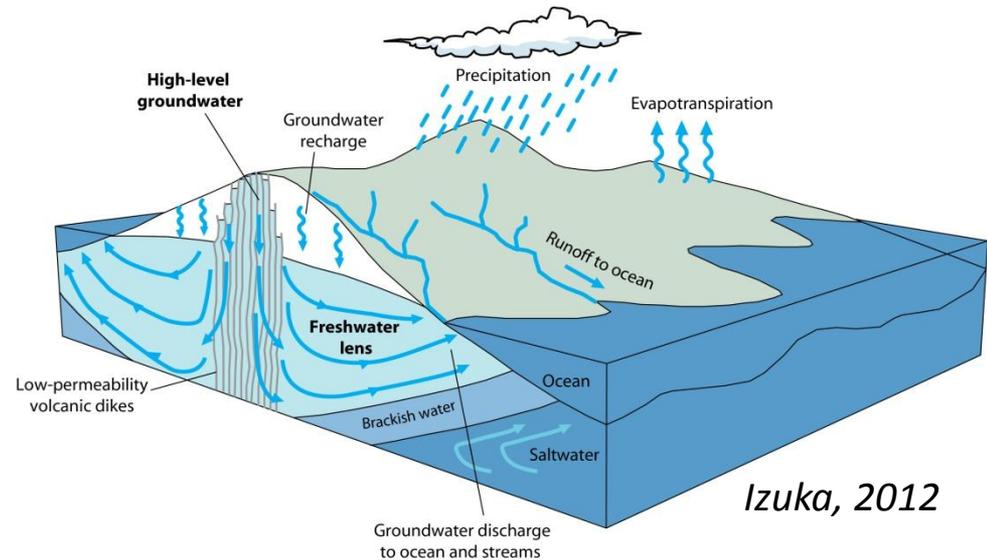
Threats to indigenous cultures

(Figures and pictures courtesy:  
Susan Yamamoto, US FWS, Miguel Castrence, Melissa Finucane)



# Freshwater Supplies are Limited and Threatened

- Pacific Islands have **limited and fragile freshwater resources**, making them more vulnerable to climate stresses than continents



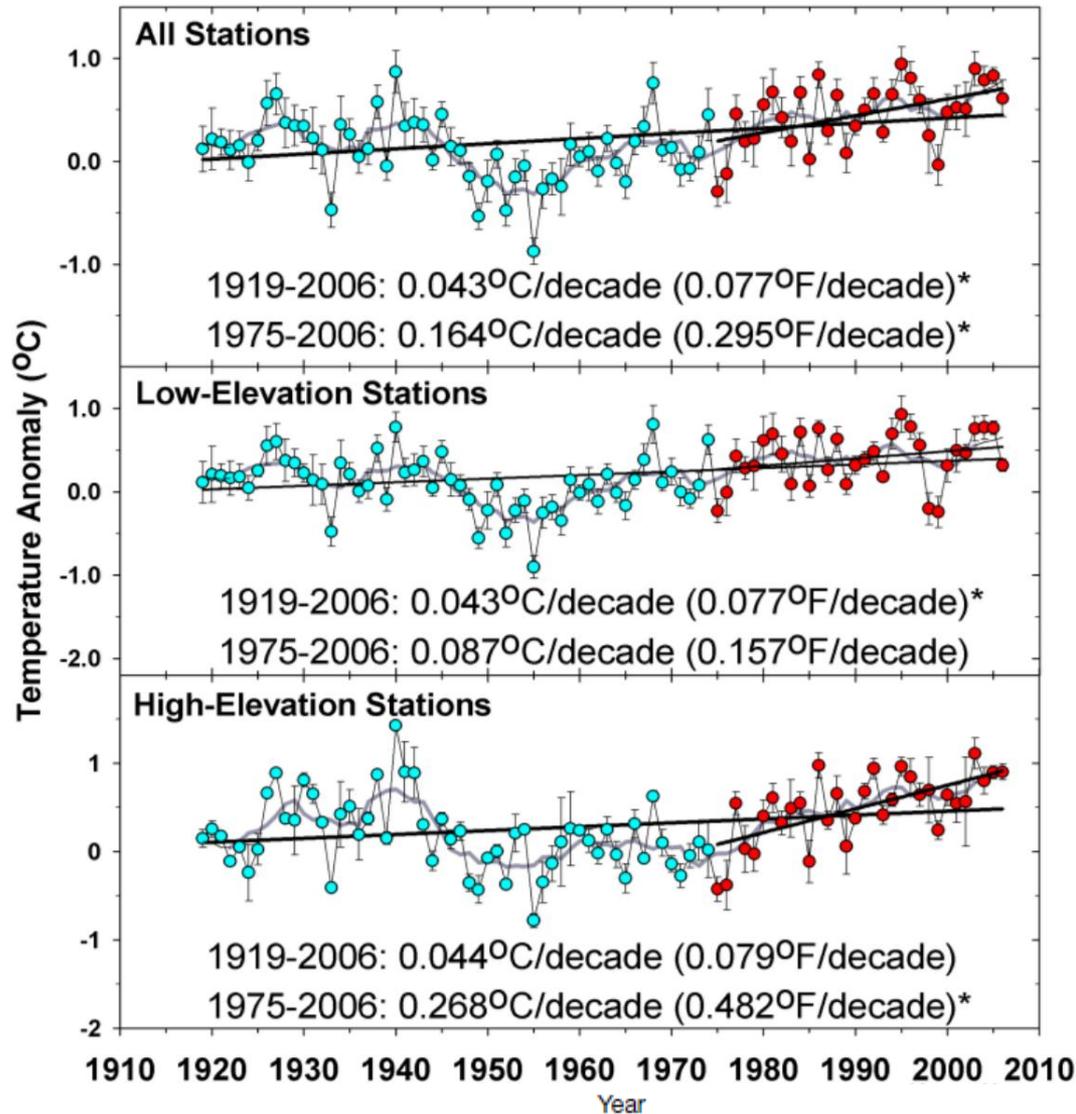
- The Pacific Islands region has **high natural climate variability**. This makes it difficult to detect long-term regional climate trends and make accurate predictions
- To accurately assess trends in water resources as climate changes, **data and basic monitoring** are severely needed



# Air Temperature is Rising

PCCSP, 2011

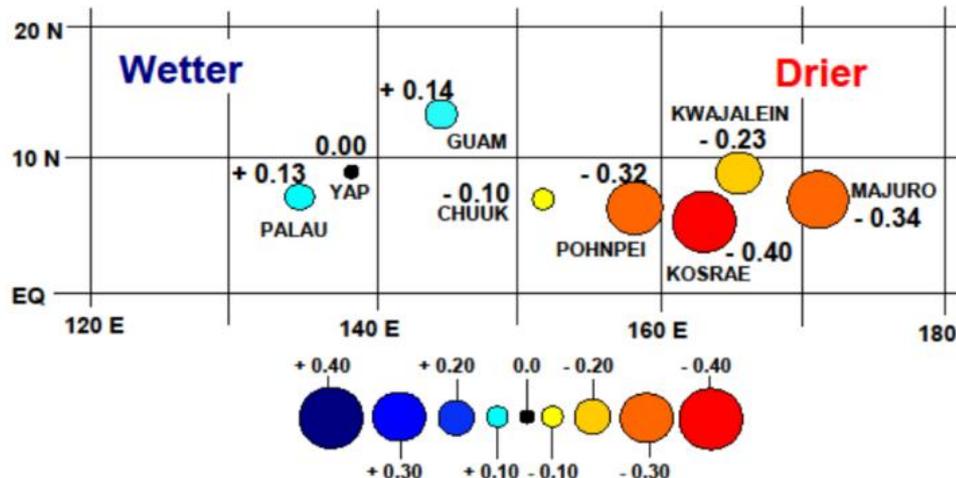
- Average, min, and max air temperature has risen **significantly** in Hawai'i in the past 100 years, and in Micronesia over the past 60 years
- In Hawai'i, this has accelerated in the past 30 years
- Increasing air temperature is **more rapid at high-elevations** (>0.5 mile above sea level)



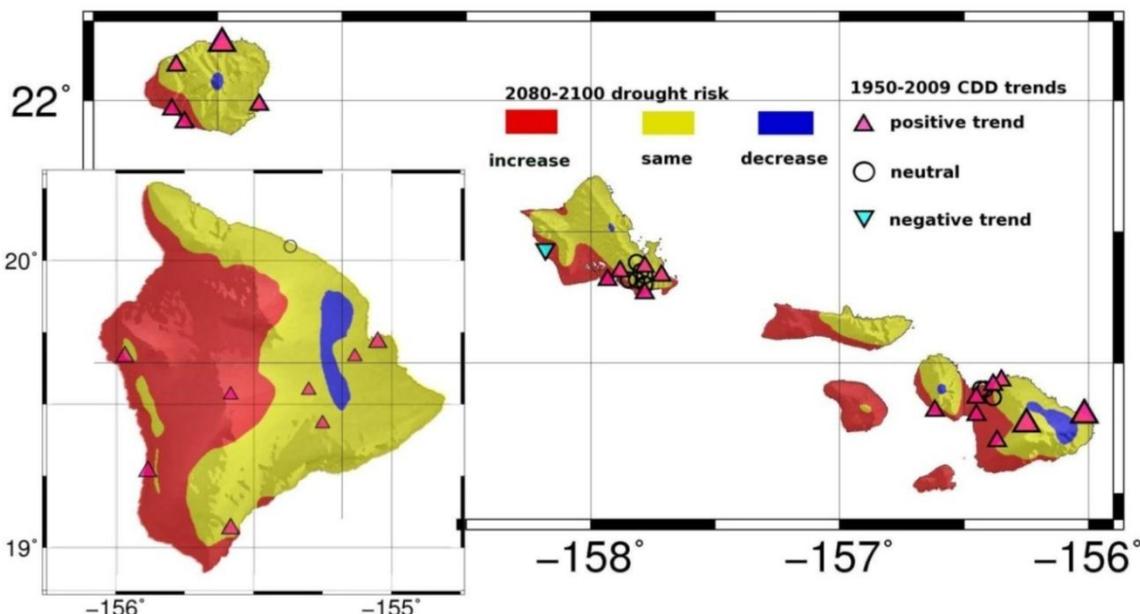


# Precipitation & Drought Patterns are Changing

From **1950-2010**, data shows that **islands in east Micronesia are getting significantly drier**, while those in west Micronesia have gotten very slightly wetter.

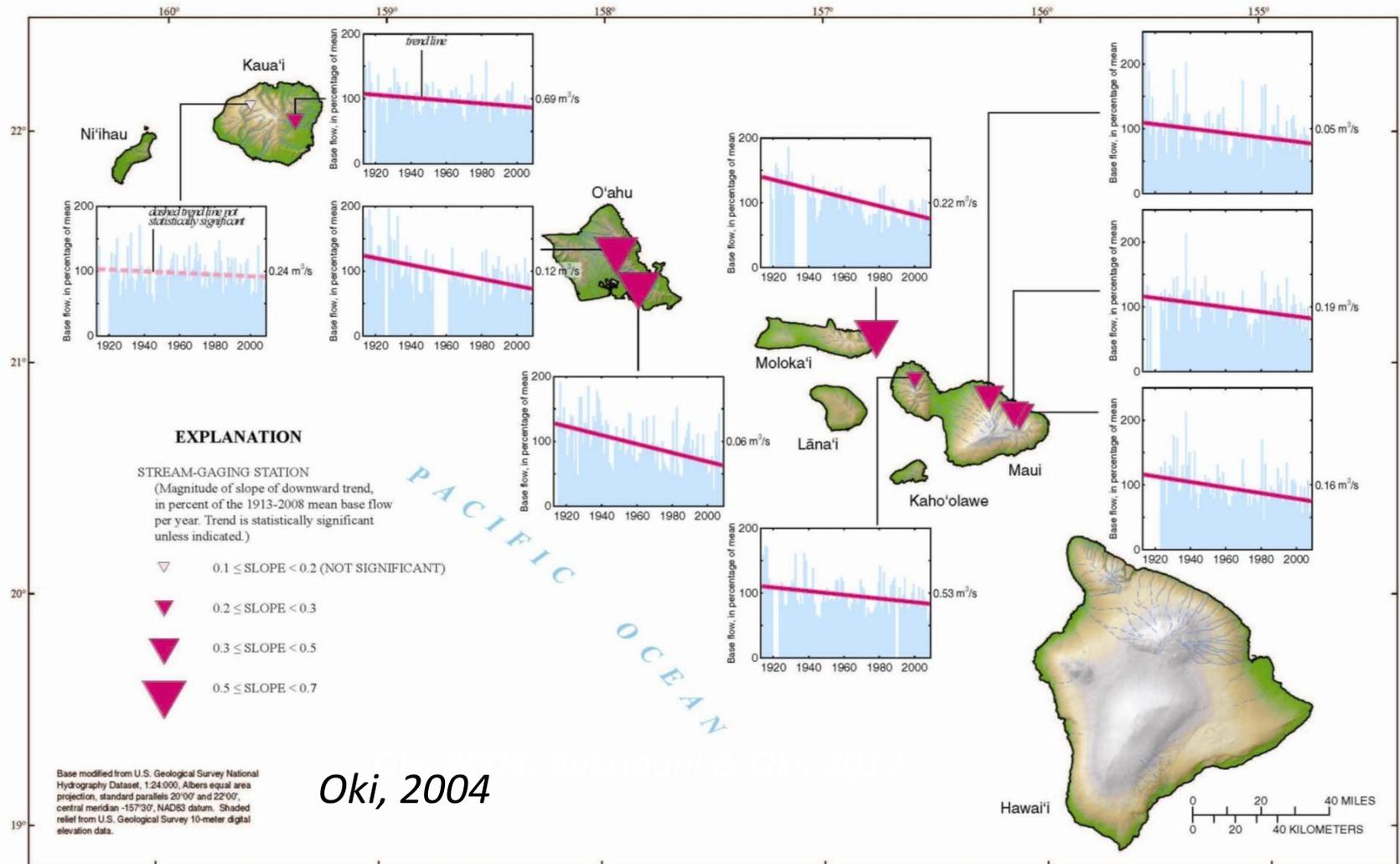


*Modified and updated from Guard & Lander)*



In the past 30 years, annual precipitation has **decreased significantly**, all Hawaiian Islands have experienced **greater** numbers of CDD and **fewer** days of intense rainfall

# Base Flow in Streams is Decreasing

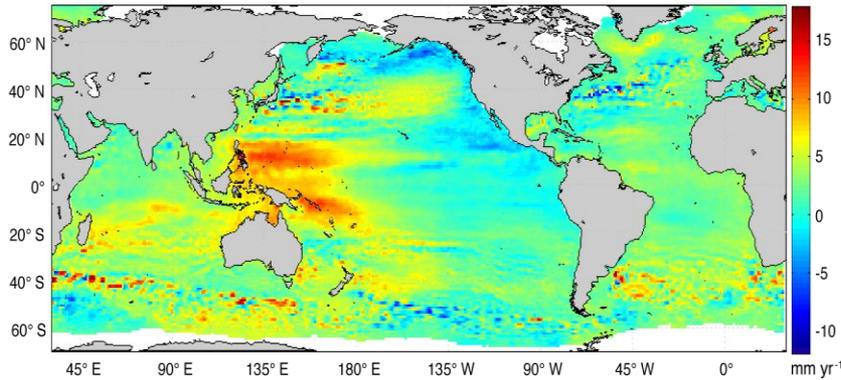


In Hawai'i, base flow, the groundwater component of streamflow, has shown significant downward trends of 20-70% in the past 100 years

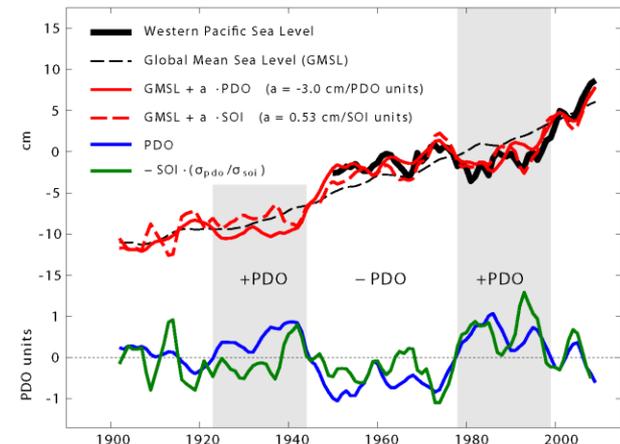
# Key Messages – Sea Level Rise and Coastal Inundation on Pacific Islands

Sea Level is Rising

Sea Level Rise is Non-uniform and Non-steady

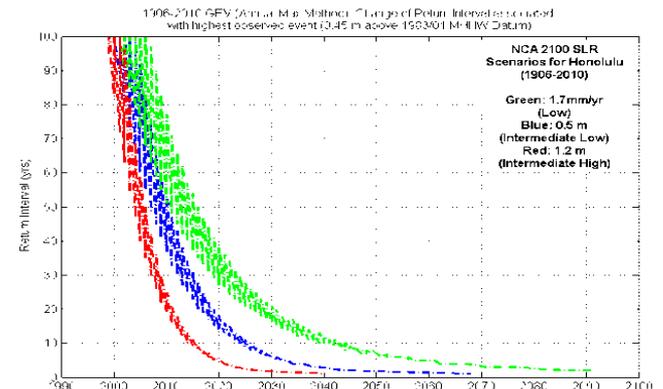


Sea-level trend for 1993-2010 from Aviso altimeter. Merrifield 2011



Merrifield et al. 2012

Increasing Mean Water Levels Means More Frequent Extreme Water Levels



# Increased Flooding and Erosion Will Threaten both Natural and Built environments

Rising sea levels, coupled with high water levels caused by storms, will incrementally increase coastal flooding and erosion, damaging coastal ecosystems, infrastructure and agriculture, and negatively affecting tourism. **Atolls are especially vulnerable** over the near to mid-term (next 25 to 50 years), with impacts varying with location and depending on how natural sea level variability combines with modest increases of mean levels.



# Ecosystem Impacts

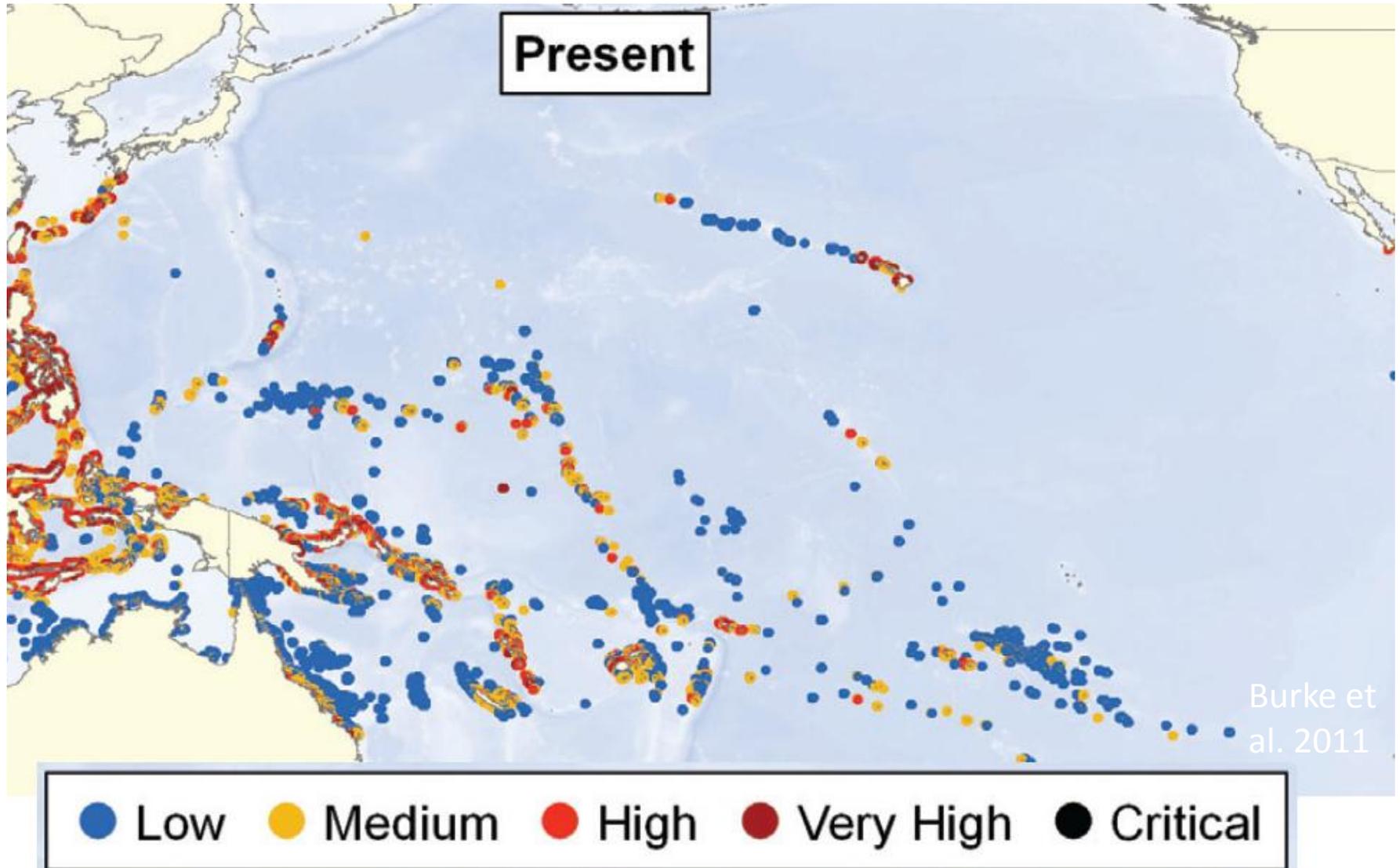
Observed and projected impacts to a variety of ecosystems, habitats, and species threaten a region marked by high biodiversity and a population dependent on ecosystem services for food, livelihoods, and cultural tradition.

**Coral reefs** impacted by increasing sea-surface temperature, sea-level rise, changes in waves and currents, and ocean chemistry changes.

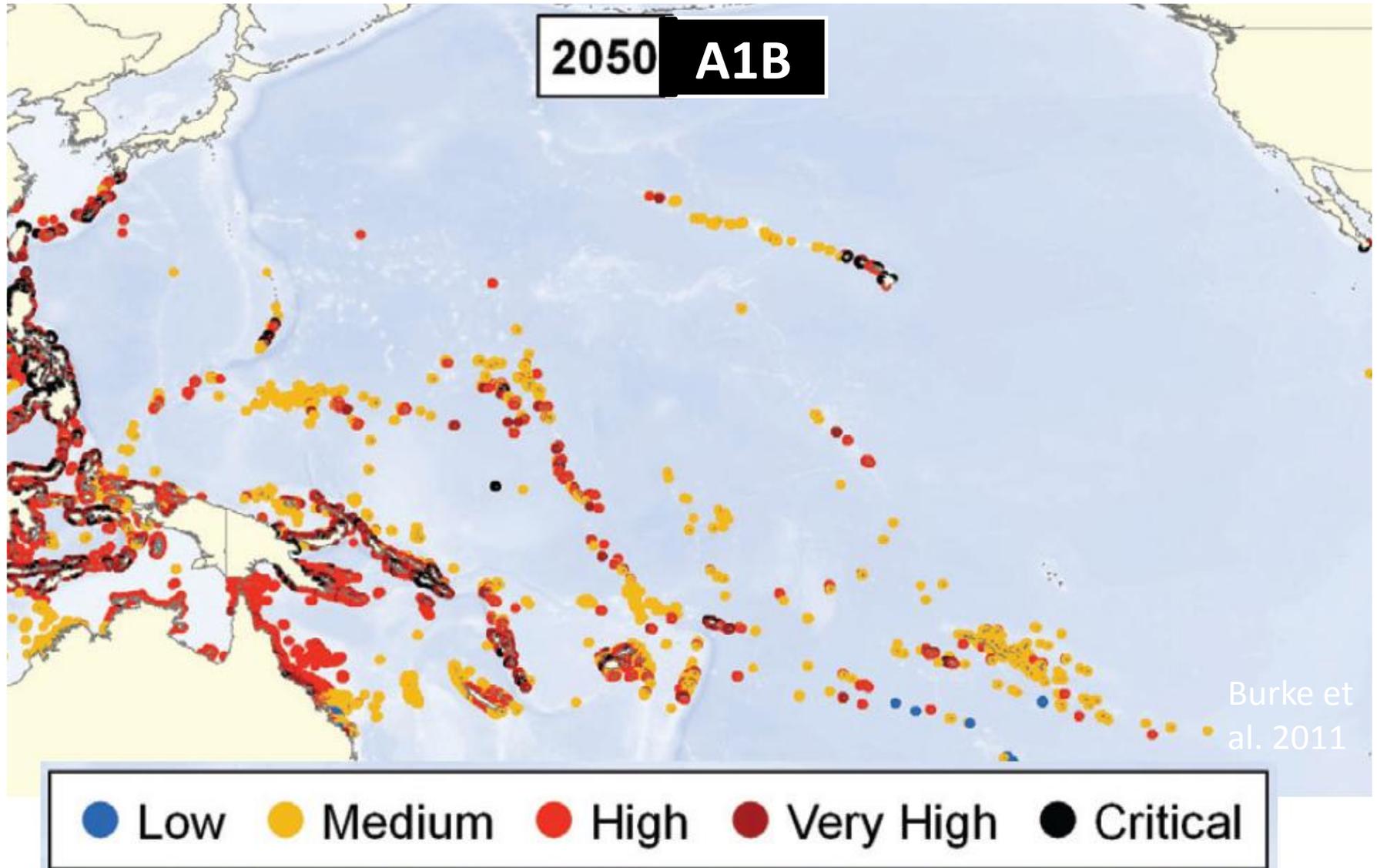


Jim Maragos/U.S. Fish and Wildlife Service

# Integrated threats to coral reefs (development, fishing, pollution)



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# Mangrove and Seagrass Ecosystems

- Mangroves vulnerable to sea level rise, especially along developed or steep coasts.
- Seagrasses vulnerable to increased temperature, runoff.



# Low Island Ecosystems



Nukuaro Atoll, FSM. Photo NASA

# High Island Ecosystems



- **Existing climate zones are projected to shift, generally upslope, with some eventually disappearing.**
- **High elevation ecosystems are at high risk, due to increase in ambient temperature and decrease in rainfall.**

# Freshwater Ecosystems

- **Increased precipitation** may lead to increased coastal erosion, decreases in coastal water quality, and changes in terrestrial and aquatic species distribution.
- **Decreased precipitation in Hawai'i will likely cause a gradual decline** of native aquatic species as stream flows decline and coastal wetlands are more affected by sea level rise.



'O'opu nopili

# Invasive Species Interactions

- **Invasive species' responses to climate change will interact with those of native species to determine the composition of future ecosystems.**
  - Invasive marine and freshwater algae, fish, invertebrates
  - Terrestrial weeds, invertebrates, disease vectors



# Cultural & Community Impacts

The changing climate poses serious consequences to the **Pacific Island lifestyles and indigenous cultures.**



# Climate change will force human migration

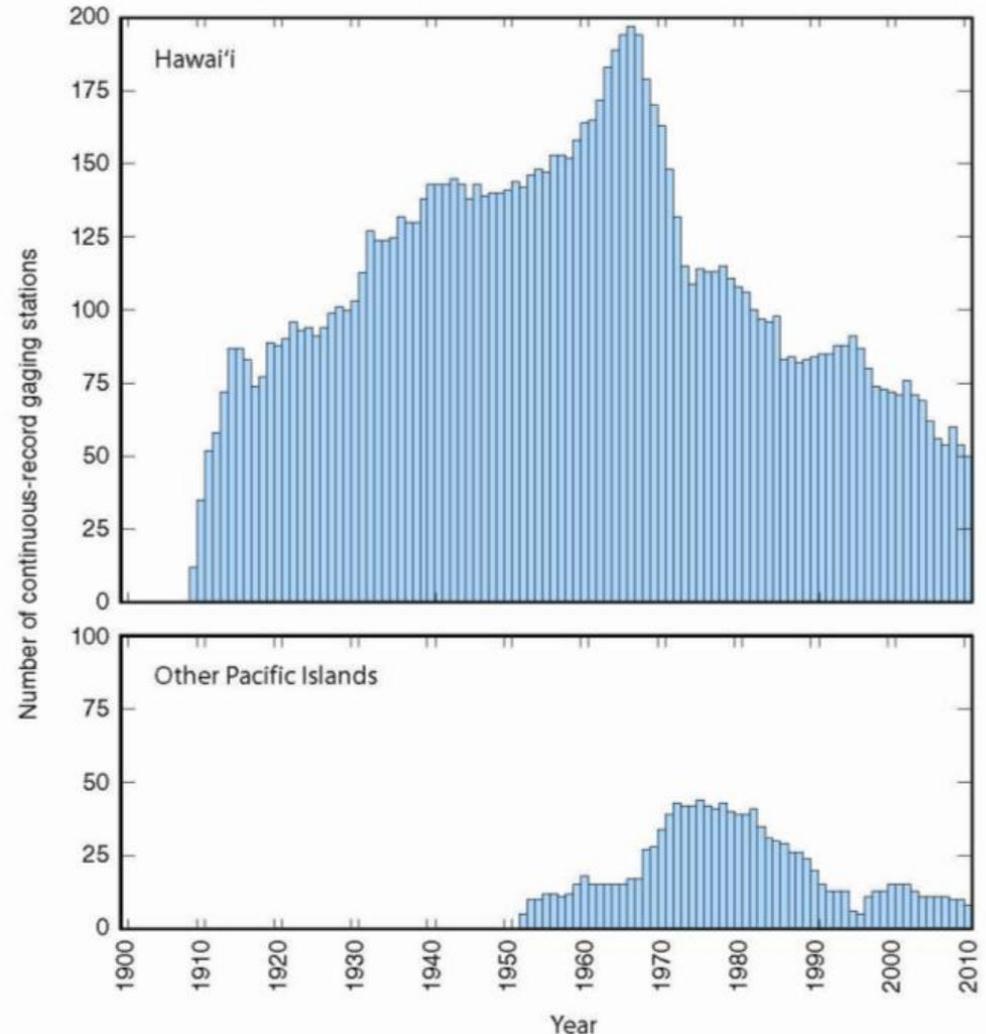
- There is no single legal entity that governs climate migrants
- Projections of the number of global climate migrants by 2050 range from **25 million to 1 billion**
- Unlike other populations, **many Pacific Islanders will not be able to migrate domestically**, as their entire country is only a few feet above sea level
- (3/9/13) PACOM Chief calls climate change **biggest security threat to Pacific Region:**

“**The ice is melting and sea is getting higher,**” Locklear said, noting that 80 percent of the world’s population lives within 200 miles of the coast. The US military, he said, is beginning to reach out to other armed forces in the region about the issue.

<http://www.bostonglobe.com/news/nation/2013/03/09/admiral-samuel-locklear-commander-pacific-forces-warns-that-climate-change-top-threat/BHdPVCLrWEMxRe9IXJZcHL/story.html>

# Data & Observations are Needed to Support Adaptation and Management

- The Pacific Islands region has experienced a **decrease in climate monitoring stations**
  - Rainfall, streamflow, waves, and ecosystem data are all critical
- The ability to assess future climate changes in meaningful detail **is at risk**



*Number of USGS stream gages, USGS Pacific Islands Water Science Center, 2011*

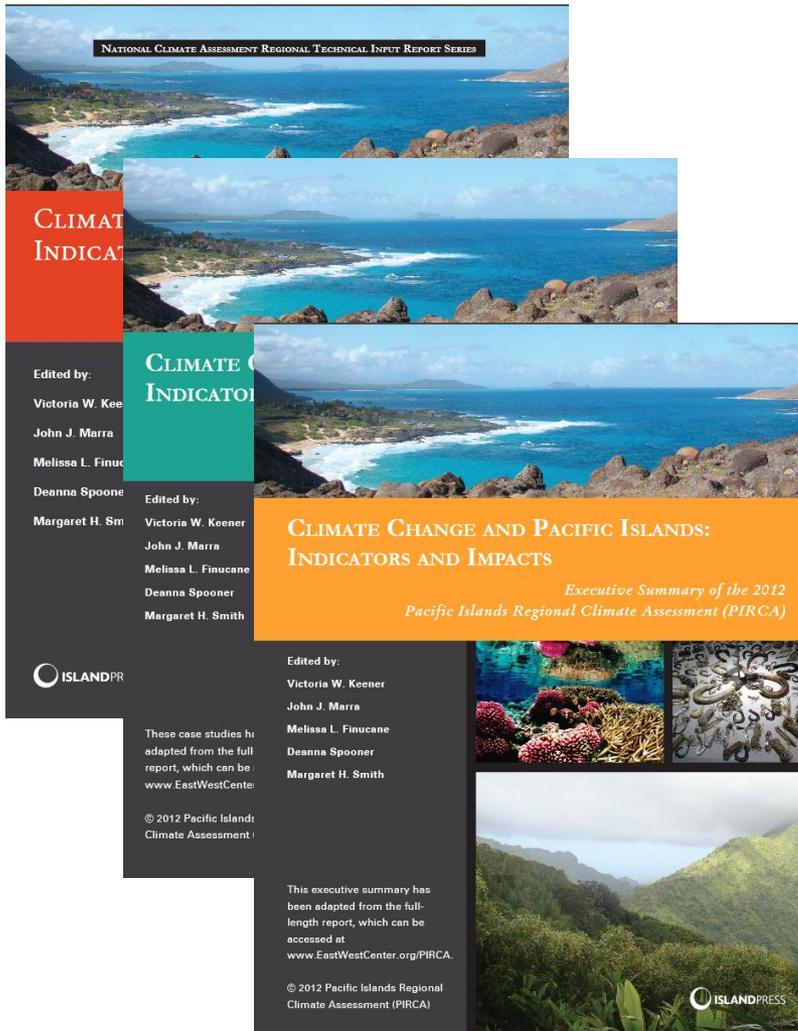
# Partnerships Between Research Scientists and Decision-Makers are Crucial

- The Pacific Islands face complex and **multidimensional problems**
- **Neither science nor management alone** can adequately address climate change impacts

**Ms. Olai Uludong** is the incoming Lead Negotiator for the UNFCCC representing the Alliance of Small Island States



# PIRCA has been well received



Since PIRCA report released 12/4/12:

- Unique PIRCA page views = 2,216
- Products distributed =
  - 150 full reports
  - 600 case studies
  - 900 executive summaries
  - 300 flash drives
  - 606 downloads
- Audiences at 14 PIRCA presentations > 560
- Media stories = 10
- Full page ad in Honolulu Advertiser with letter addressed to Obama = 1

# For more on PIRCA

## Web

[www.EastWestCenter.org/PIRCA](http://www.EastWestCenter.org/PIRCA)

[www.cakex.org](http://www.cakex.org)

## Email

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