Climate Change Impacts & Adaptation in the Pacific Islands: Findings from the 5th National Climate Assessment

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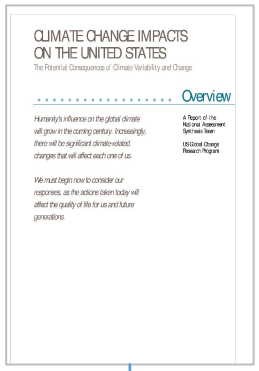
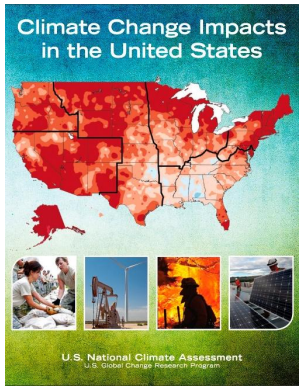
National Climate Assessment (NCA)

- https://nca2023.globalchange.gov/
- The U.S. Global Change Research Program (USGCRP) is a federal program charged with coordinating climate research across the U.S. government.
- Every 4 years, USGCRP is required to produce a National Climate Assessment (NCA) that addresses:
  - 1) what scientists know about climate change, including scientific uncertainties;
  - 2) how climate change affects specific topics important to the U.S.; and
  - 3) the current and projected trends in climate change for the next 25 to 100 years.

National Climate Assessment History



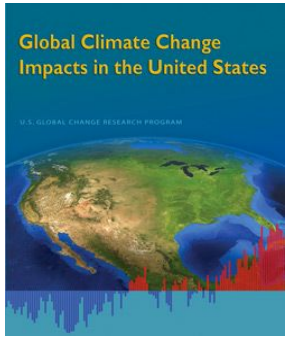
2001



2014

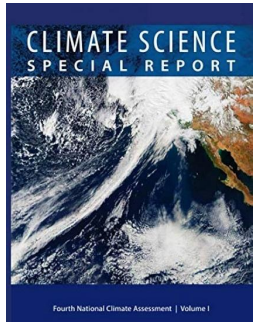
2023

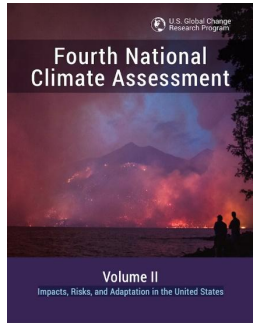
2009



2017-2018

Vol. I





Vol. II

https://nca2023.globalchange.gov/

NCA5 released Nov. 14, 2023

NCA5 also released an interactive Atlas: https://atlas.globalchange.gov/

NCA5 Ch. 30 (HI-USAPI) Author Team

- Author team includes a wide range of geographical & technical expertise (physical & social scientists and cultural practitioners), and a diversity of career stages, affiliations, & previous assessment expertise
  - Authors from Guam, Palau, Hawai‘i (4 islands), CA, and MA!

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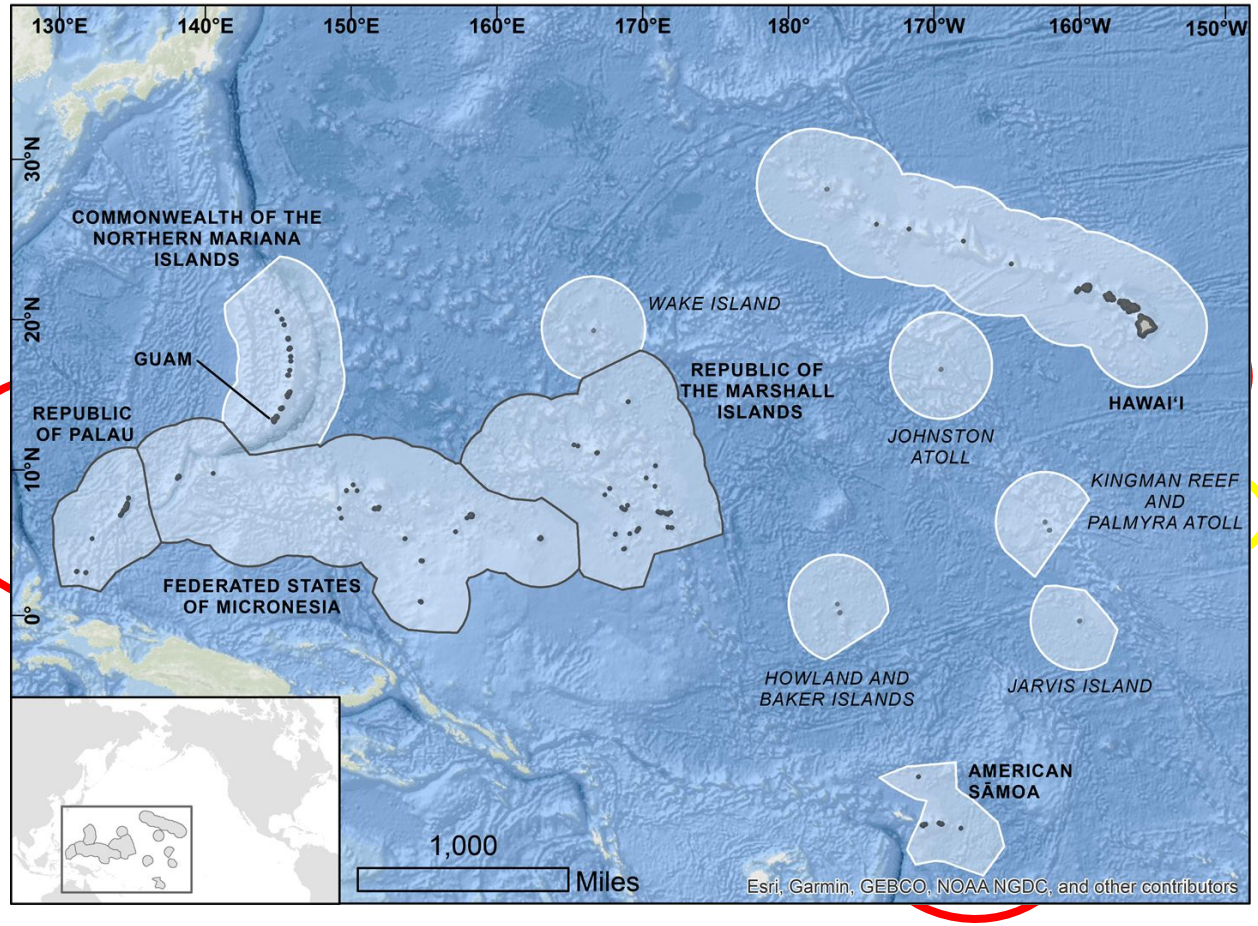
Hawai‘i and US-Affiliated Pacific Islands (USAPI) Region

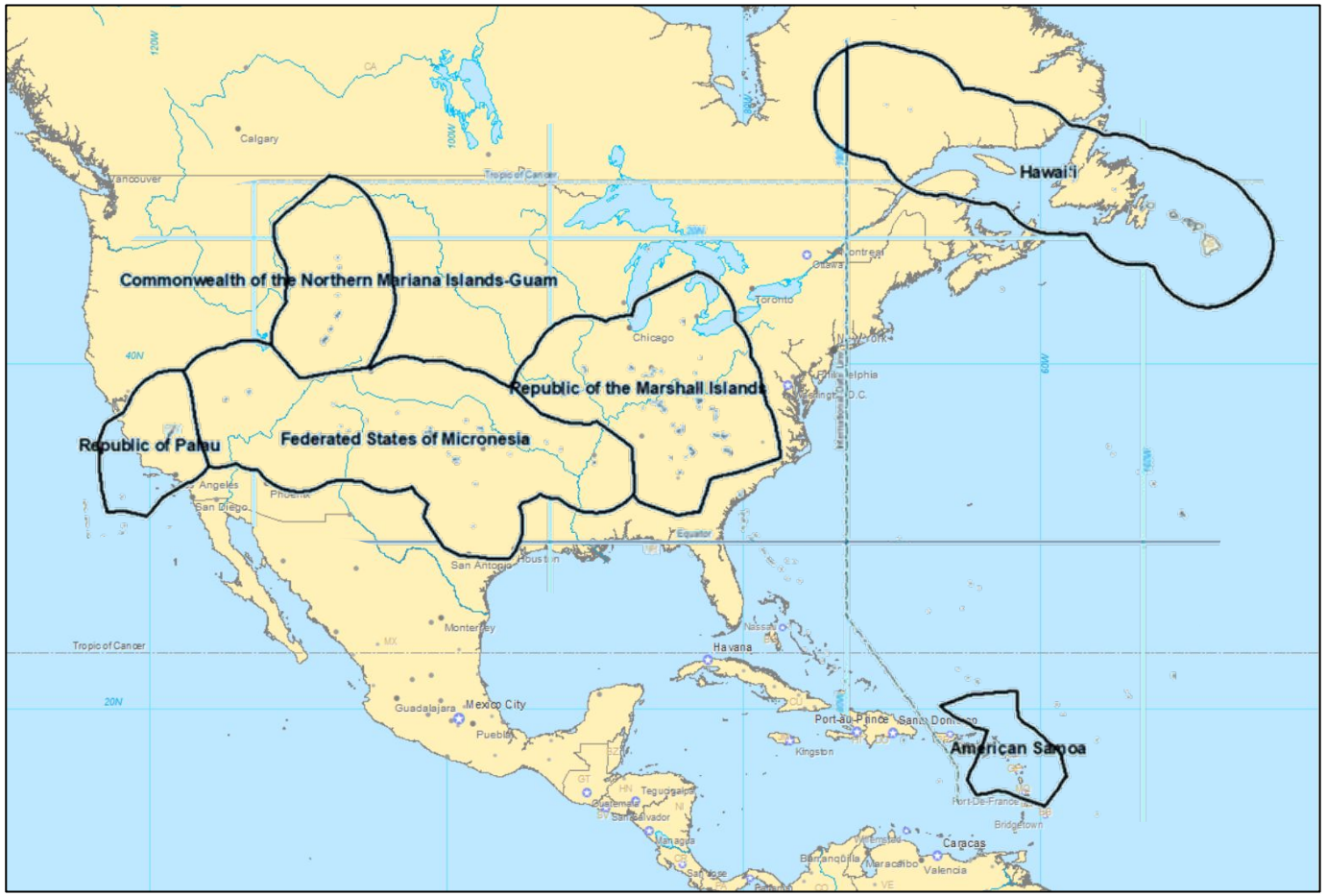


Ch. 30 Region includes:

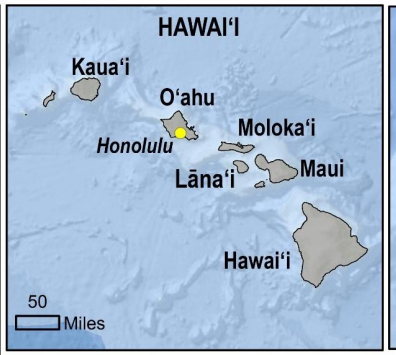
- Hawai‘i
- American Sāmoa
- Guam
- Pacific Remote Islands
- Commonwealth of the Northern Mariana Islands
- Republic of Palau
- Federated States of Micronesia
- Republic of the Marshall Islands

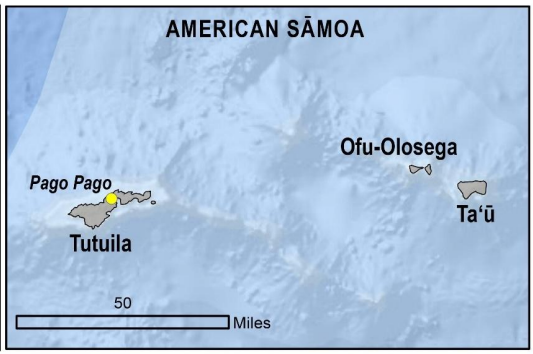
Exclusive Economic Zones (EEZs): **Pacific Islands** (excluding the Freely Associated States, *gray outline*) **define nearly half of the US EEZ**.

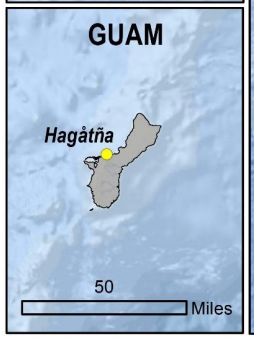
Hawai‘i & USAPI Region

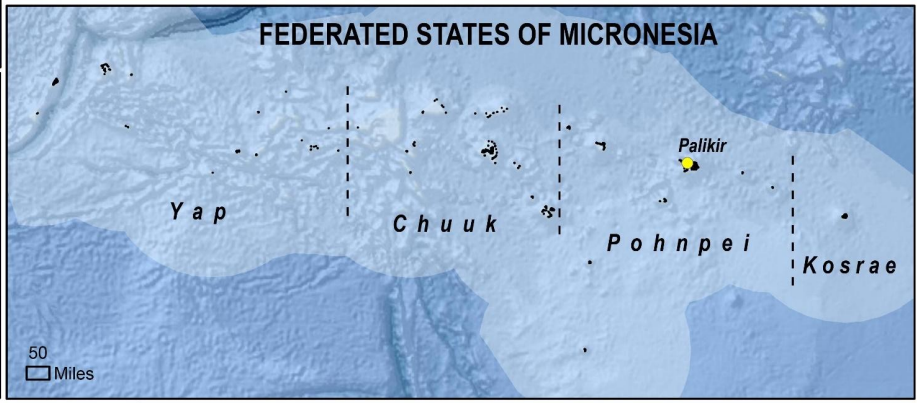


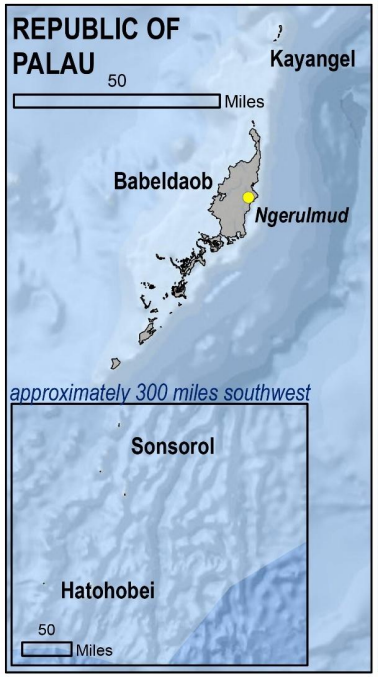
Overlay EEZ layers over continental US (same scale)

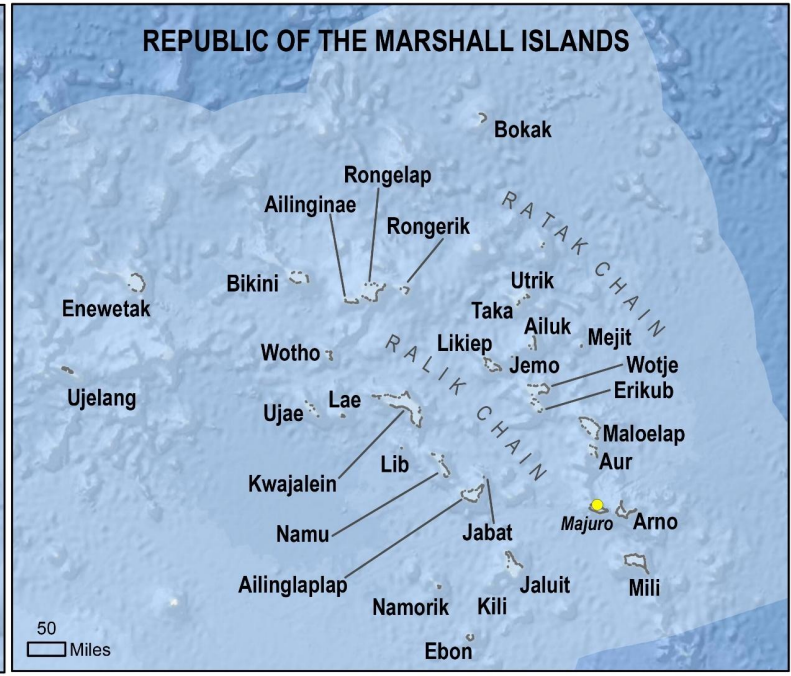






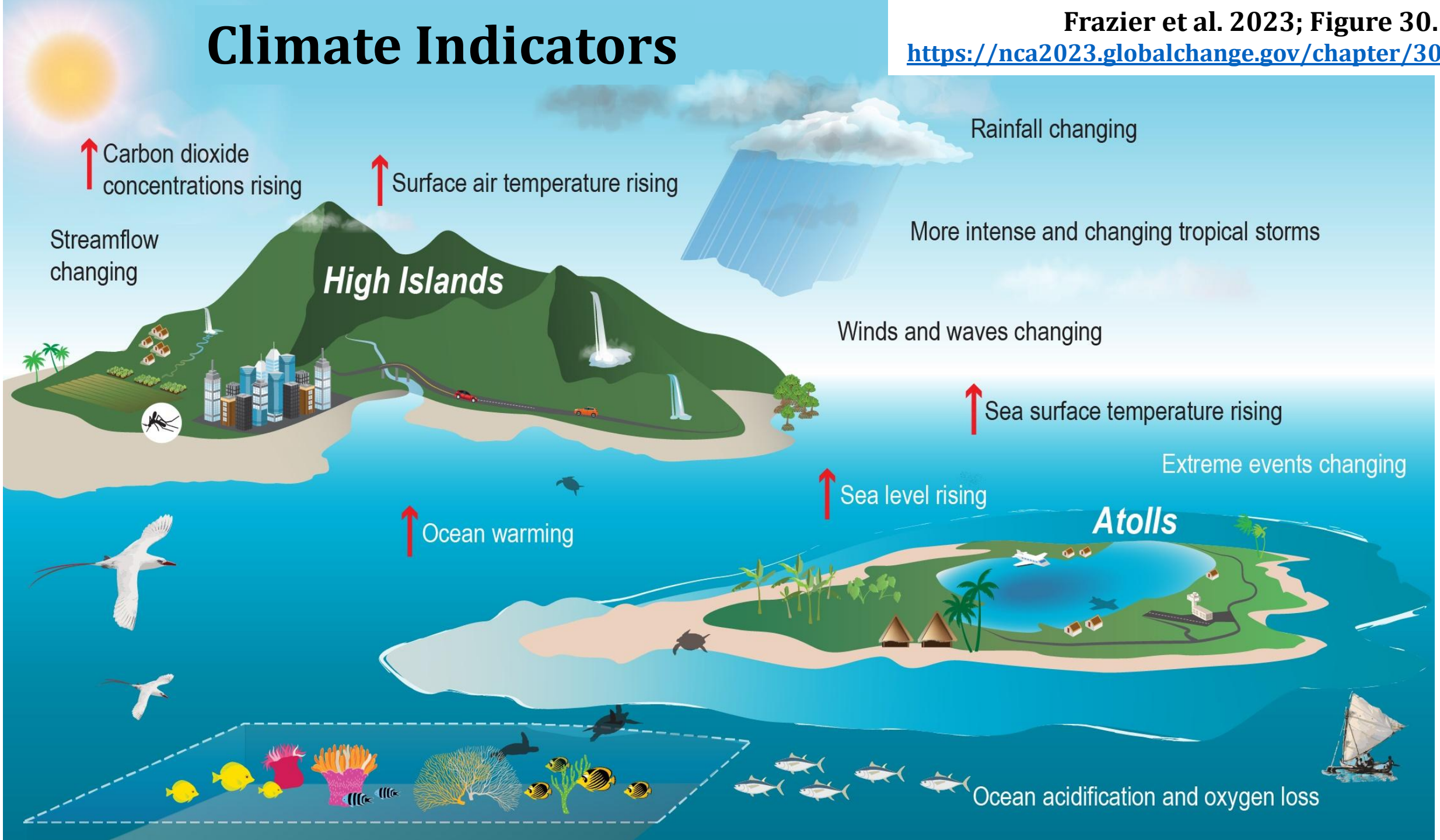






Climate Indicators

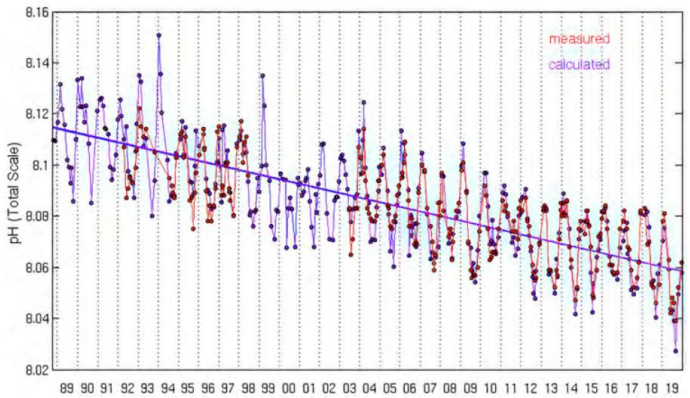
Frazier et al. 2023; Figure 30.5
https://nca2023.globalchange.gov/chapter/30/



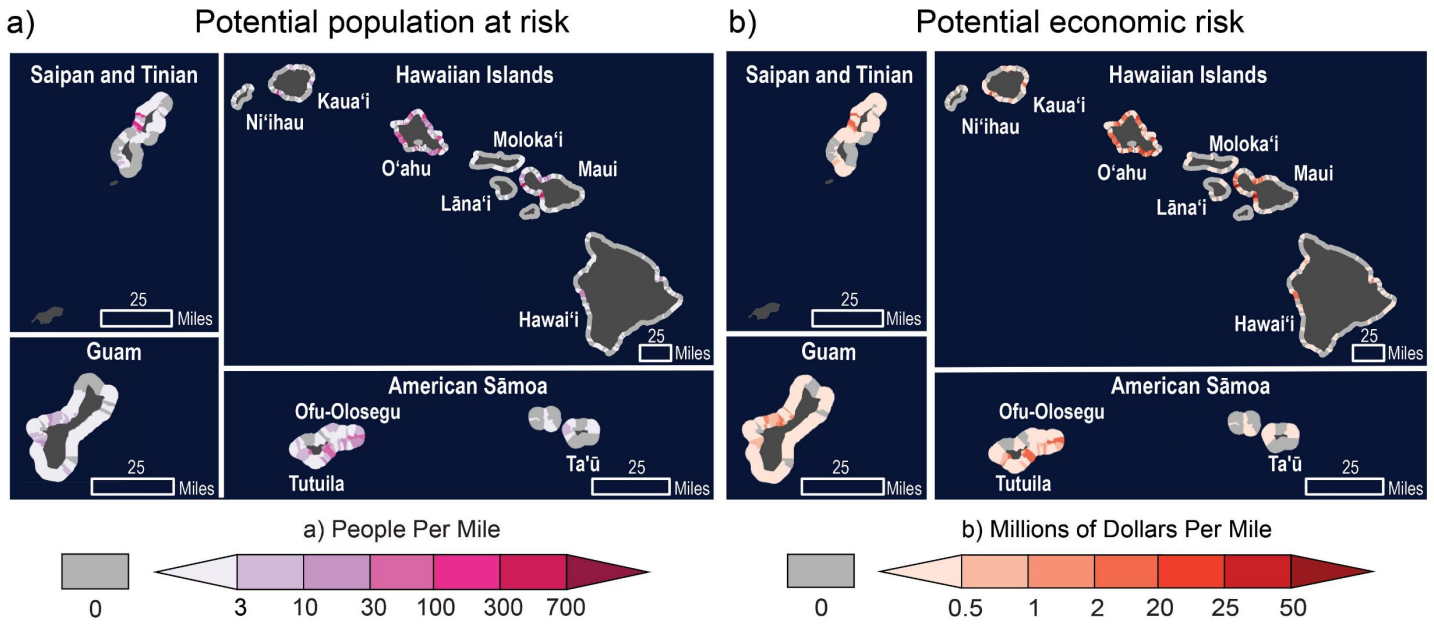
Ocean Changes

- **Sea surface temperature** (SST) increases have exceeded global rates
- **Ocean acidification** has reached levels not seen over past 30 years
- Continuing trends, including **marine heatwaves**, will have dire consequences for coral reefs
- **Coral reef degradation** could affect thousands of people & cause millions of dollars in damages

Ocean pH trends, Station ALOHA



Annual Risk Reduction Benefits Provided by Coral Reefs

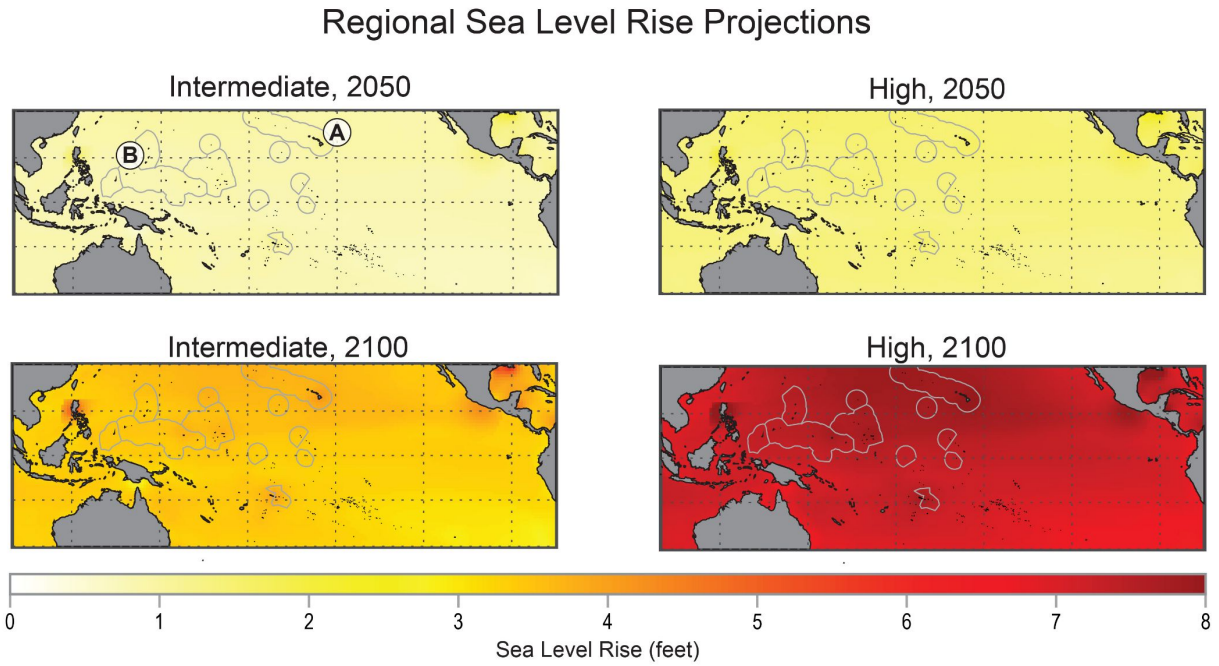


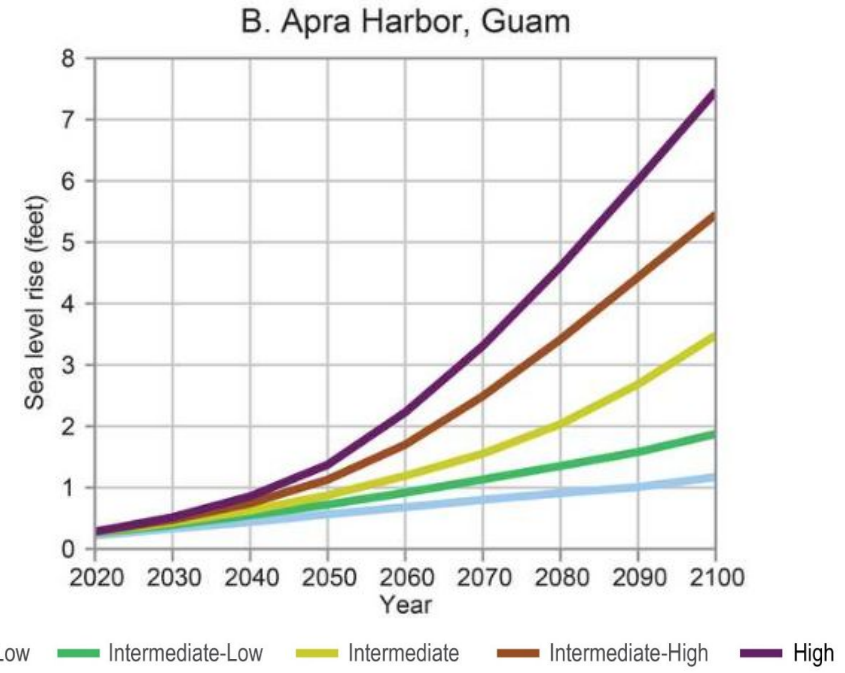
Frazier et al. 2023; Figure 30.10
https://nca2023.globalchange.gov/chapter/30/

Based on Storlazzi et al. 2019

Sea Level Rise (SLR)

- Rates of future SLR strongly depend on the scenario
- Under a **High** scenario *(6.5 ft global SLR),* Guam could see up to **7.5 feet** of SLR by 2100
- SLR will increasingly impact coastal infrastructure, transportation, ecosystems, & communities



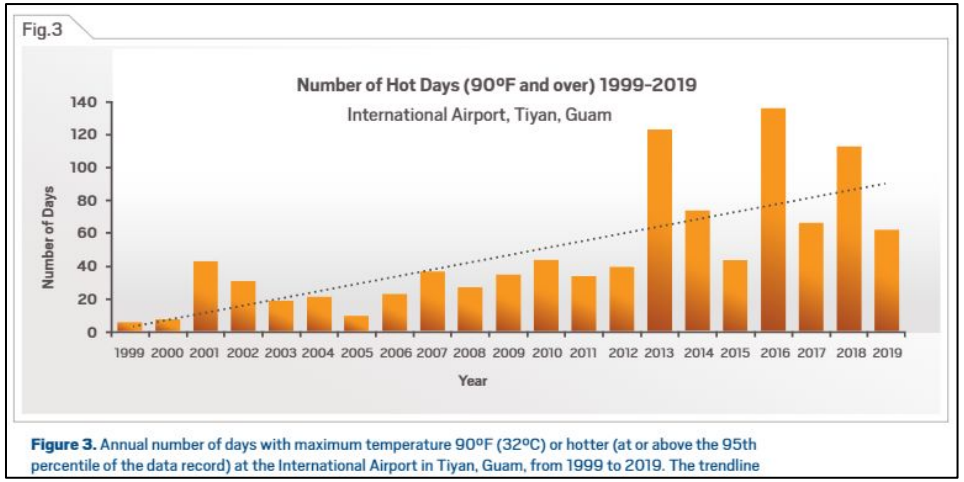


Frazier et al. 2023; Figures 30.4 & 30.10
https://nca2023.globalchange.gov/chapter/30/

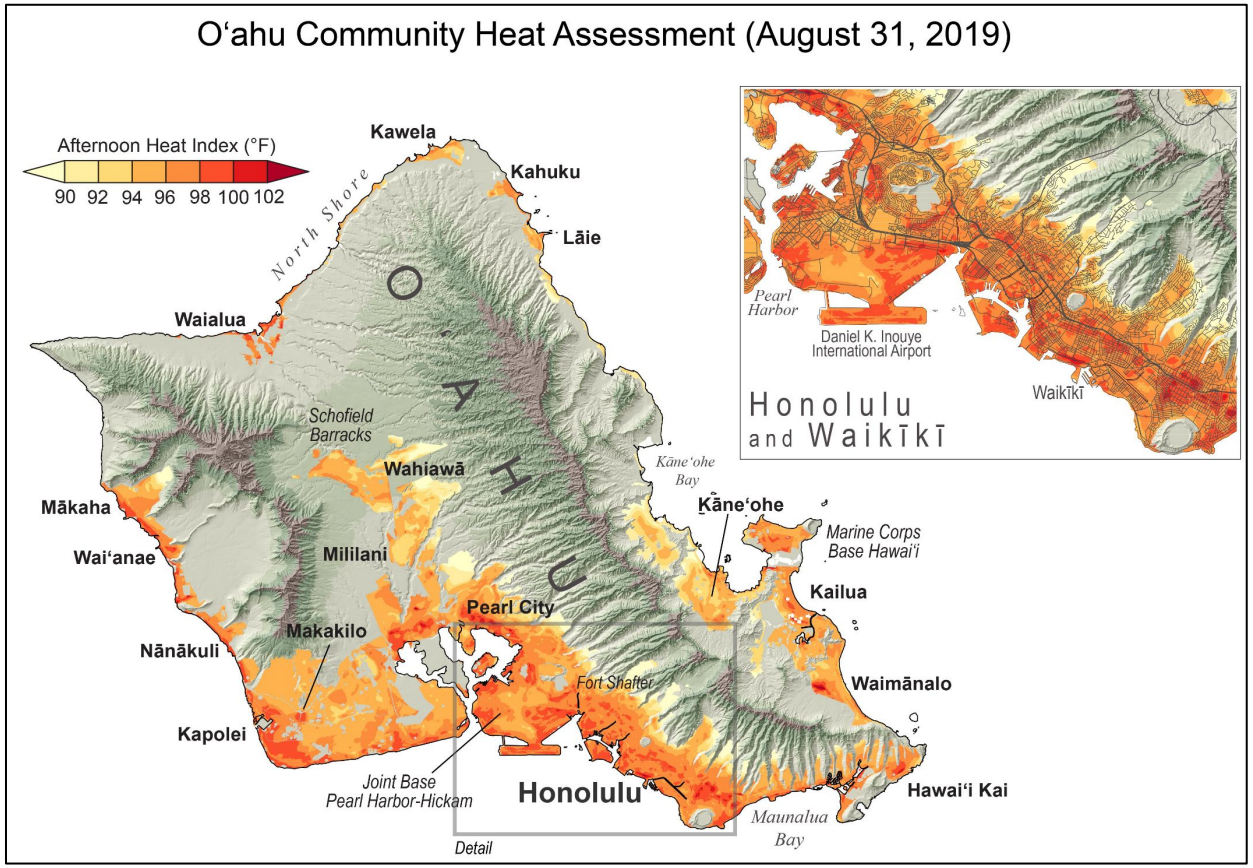
Temperature & Heat

- Between 1951 & 2020, annual average air temps across the Pacific Islands region increased 2°F (1°C)
- Number of "hot days" has increased across Pacific
- High temperatures are responsible for heat-related illnesses, hospitalizations, & death
  - 82% of heat-related deaths in Honolulu are already attributable to climate change

Frazier et al. 2023; Figure 30.9
https://nca2023.globalchange.gov/chapter/30/

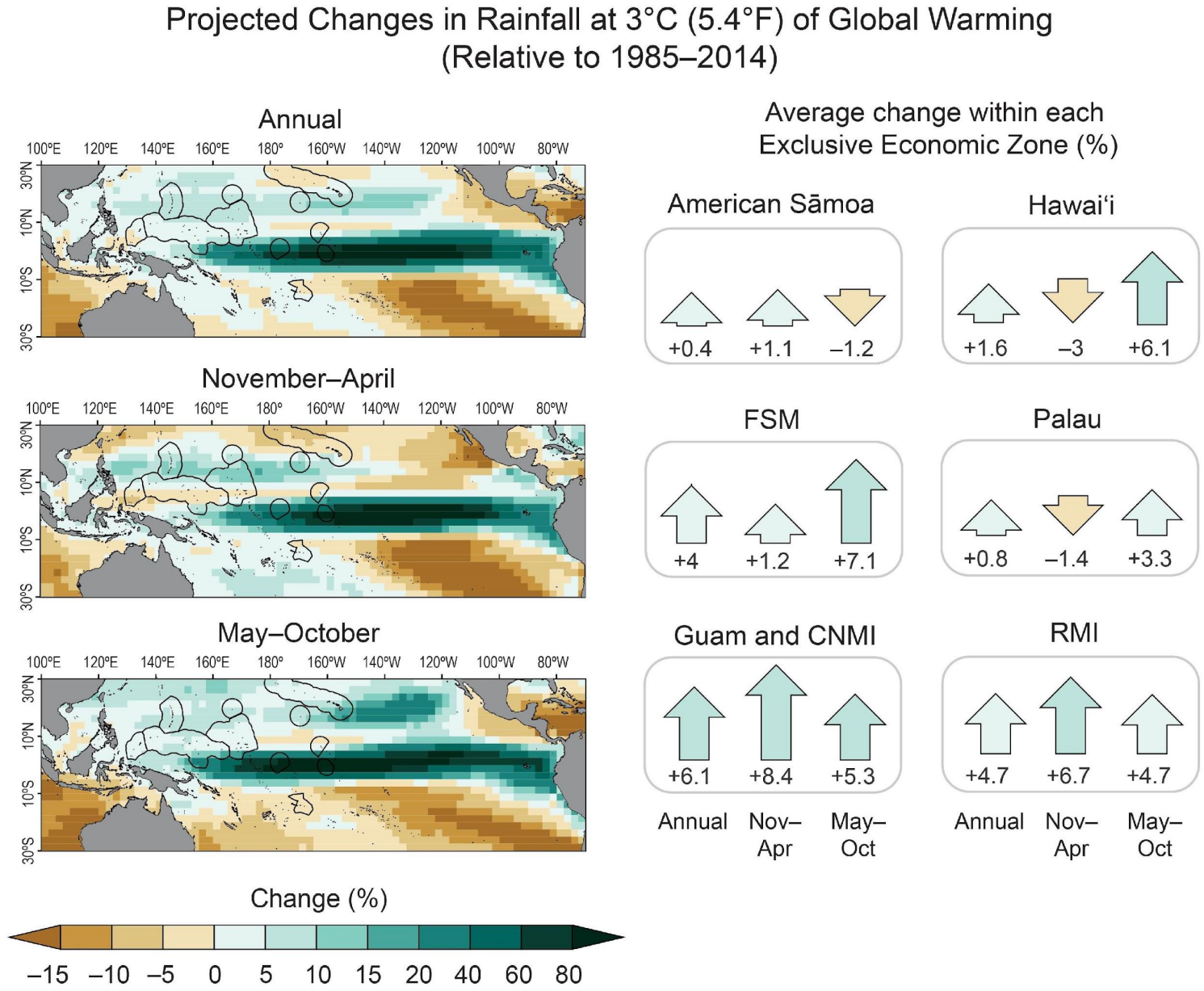


Number of Hot Days at the Guam Airport show a statistically significant warming trend (Grecni et al. 2020)



Rainfall

- The magnitude & direction of projected precipitation changes are **highly uncertain**
- Some islands have seen long-term drying and **increases in drought** frequency, severity, & duration (e.g., Frazier et al. 2022)

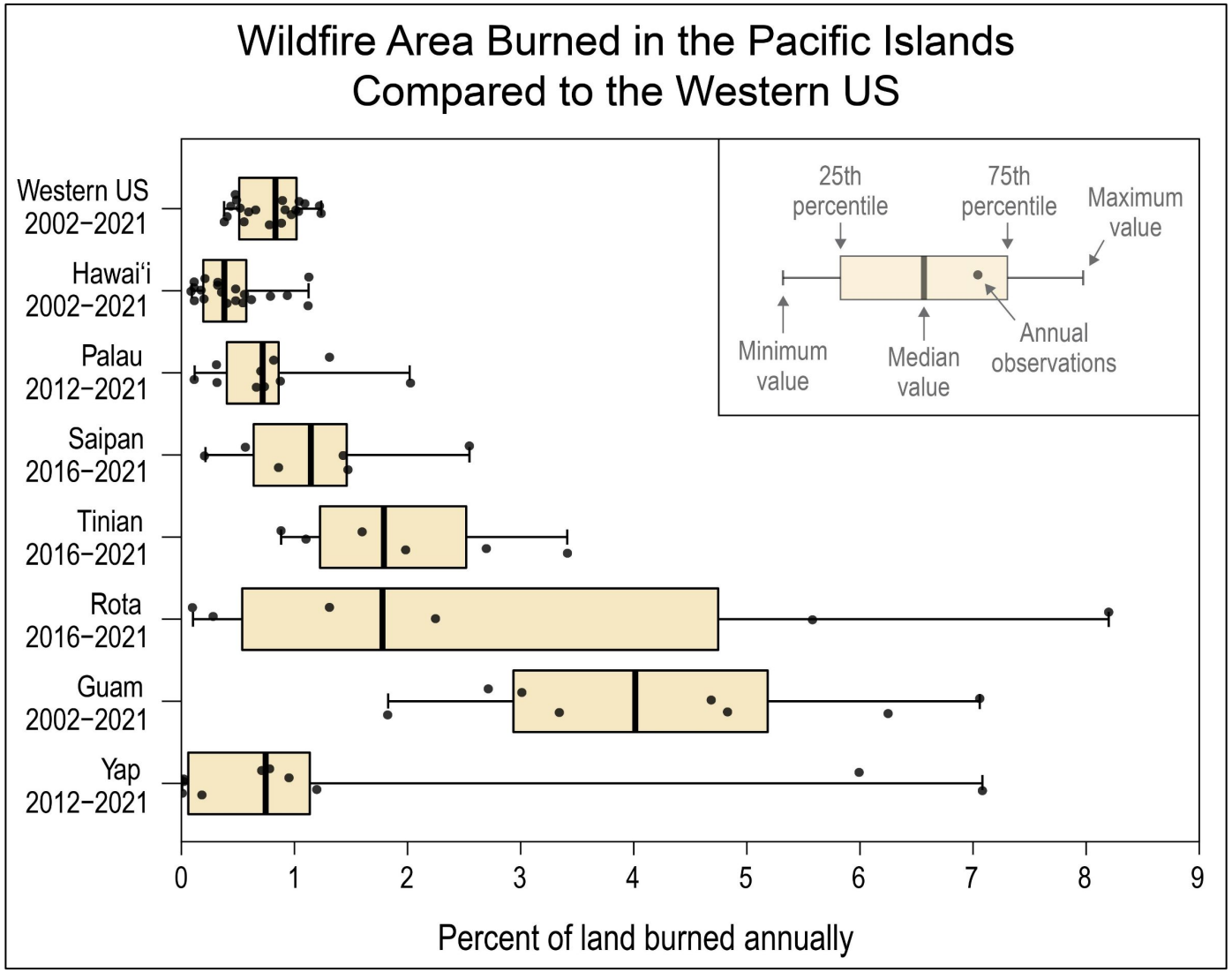


Frazier et al. 2023; Figure 30.3
https://nca2023.globalchange.gov/chapter/30/

Based on Dhage & Widlansky 2022

Wildfires

- Increasingly severe droughts & warming are increasing fire risk (*high confidence*)
- Wildfires **burn large percentages of land** in Pacific Islands compared to the western US.
- Fire-prone invasive vegetation is likely to further increase future climate-driven fire risk
- **Future of fire is highly sensitive to mgmt. & policy decisions**

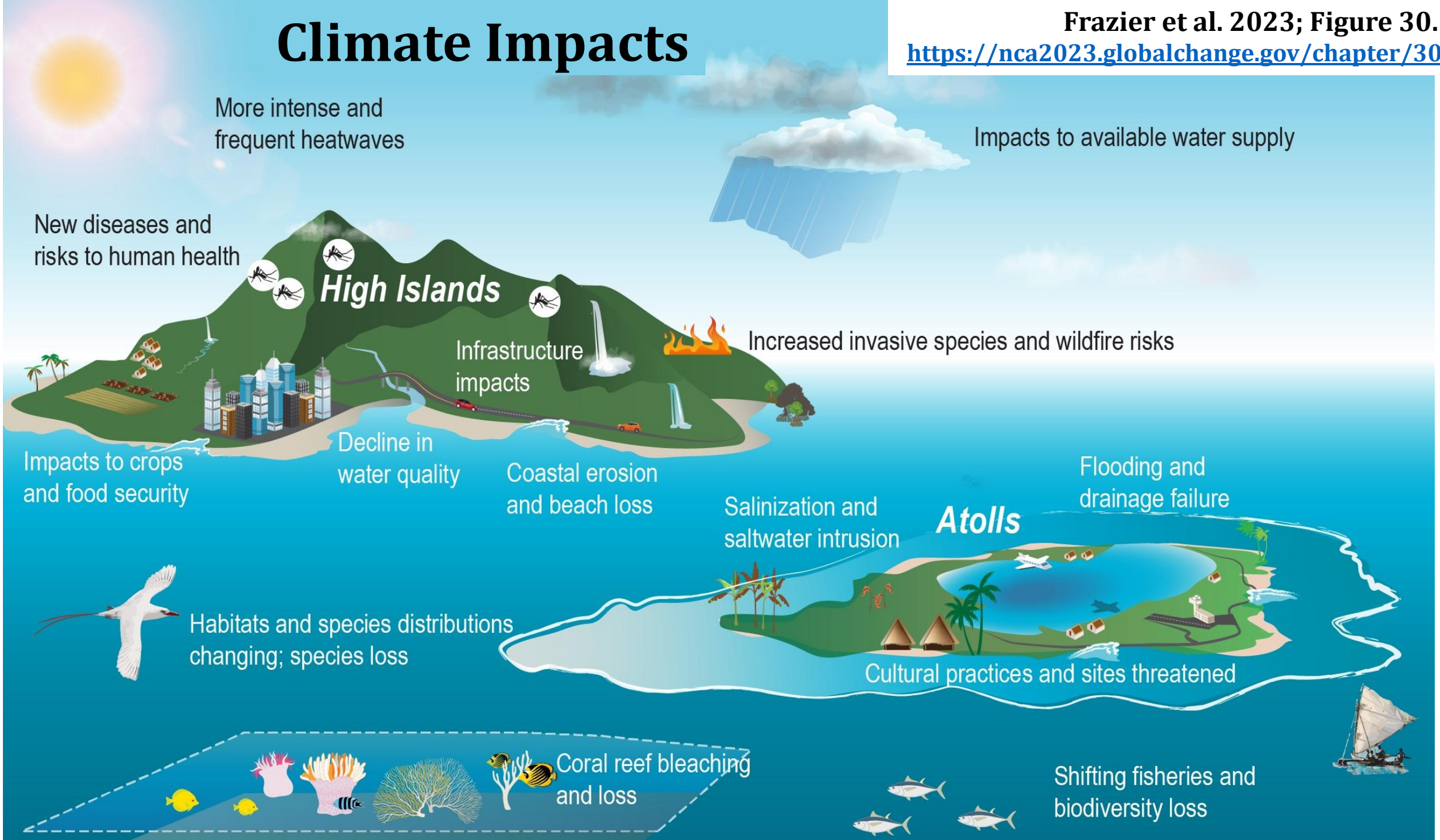


Frazier et al. 2023; Figure 30.13
https://nca2023.globalchange.gov/chapter/30/

*Based on **Trauernicht et al. 2024**: "How people, rainfall and vegetation shape tropical island fire regimes across Micronesia"*

Climate Impacts

Frazier et al. 2023; Figure 30.5
https://nca2023.globalchange.gov/chapter/30/



NCA5 Ch. 30 Key Messages

1. Climate Change Impairs Access to Healthy **Food & Water**
2. Climate Change Undermines **Human Health**, but Community Strength Boosts Resilience
3. Rising Sea Levels Threaten **Infrastructure & Local Economies** and Exacerbate Existing Inequities
4. Responses to Rising Threats May Help Safeguard Tropical **Ecosystems & Biodiversity**
   - *Box 30.5: Blue Carbon Ecosystems*
5. **Indigenous Knowledge Systems** Strengthen Island Resilience

Frazier et al. 2023

https://nca2023.globalchange.gov/chapter/30/

Fig. 30.6. Traditional Palauan fishing important for food security.

Fig. 30.10. SLR is increasingly impacting communities.

Fig. 30.16. Cultural sites are at increasing risk.

Table 30.1 highlights examples of impacts for each jurisdiction across the 5 KMs

Table 30.1. Illustrative Climate Change–Related Impacts Across the Pacific Islands Region

Examples of historical, ongoing, and projected climate change impacts are given for each jurisdiction. Sea level rise is abbreviated as SLR.

Jurisdiction	KM 30.1: Water and Food	KM 30.2: Human Health	KM 30.3: Built Environment	KM 30.4: Ecosystems	KM 30.5: Cultural and Historical Resources
American Sāmoa	Increased extreme precipitation events degrade drinking water quality by stressing the water systems' filtration capacity (KM 4.2).[70,71]	Hot weather worsens chronic health conditions, including heart disease and diabetes, already at emergency levels (KM 15.1).[72]	Climate change threatens fisheries and impacts economic infrastructure, including canneries.[73]	Climate change promotes invasive species spread in native rainforests, home to rare and culturally important plants.[29]	Coastal flooding affects villages that contain burials of relatives and ancestors.[74]
Commonwealth of the Northern Mariana Islands (CNMI)	Access to safe drinking water is threatened as climate change exacerbates ongoing challenges of disposal of military, industrial, and municipal waste.[27]	Super Typhoon Yutu in 2018 negatively impacted mental health and healthcare providers.[75]	Two successive typhoons (2015 and 2018) damaged or destroyed significant portions of the built environment.[27]	Climate change aids species invasions, which threaten the high biodiversity in wetlands and forests, including endemic birds, threatened reptiles, and two species of bats.[27,76]	Coastal historical and cultural sites are exposed to SLR.[27]
Federated States of Micronesia (FSM)	Warmer temperatures and saltwater intrusion are projected to increase disease in staple crops such as taro, bananas, and breadfruit.[77]	Changes to marine and coastal habitats threaten artisanal fisheries, a key protein source.[78,79,80,81,82,83]	In FSM, 59% of infrastructure (89% of population) is within 0.3 miles (0.6 km) of the coast and vulnerable to coastal climate impacts.[84,85]	Highly valued mangrove forests in Pohnpei will be threatened by SLR.[86]	Coastal men's houses *(faluw)* are exposed to SLR and can benefit from historical adaptation measures.[87]
Guam	Northern Guam Lens Aquifer is at risk from hotter weather, drought, and possible increases in demand.[28,88]	In 2018–2019, compound extreme events (flash flooding followed by drought and wildfire) negatively impacted human health (safety, pathogens, and respiratory	Stronger tropical cyclones around Guam will increase the potential for severe damage to the built environment.[53]	Increased frequency of coral bleaching[89] and increased risk of wildfires are expected.[28]	Many cultural and historical resources located along the coast will be impacted by 3 feet of SLR.[90]

Frazier et al. 2023; Table 30.1
https://nca2023.globalchange.gov/chapter/30/

Climate Action

- Adaptation & mitigation actions are already underway, but need to be scaled up
- Many Pacific Island states adopted the 17 United Nations **Sustainable Development Goals (SDGs)** – piloting SDG dashboards to track progress
  - **Guam Green Growth**: https://guamgreengrowth.org/
- Opportunities exist for place-based adaptation & mitigation informed by **Indigenous Knowledge systems**
  - Traditional **agroforestry & aquaculture** investments are critical to strengthen food security & reduce reliance on food imports

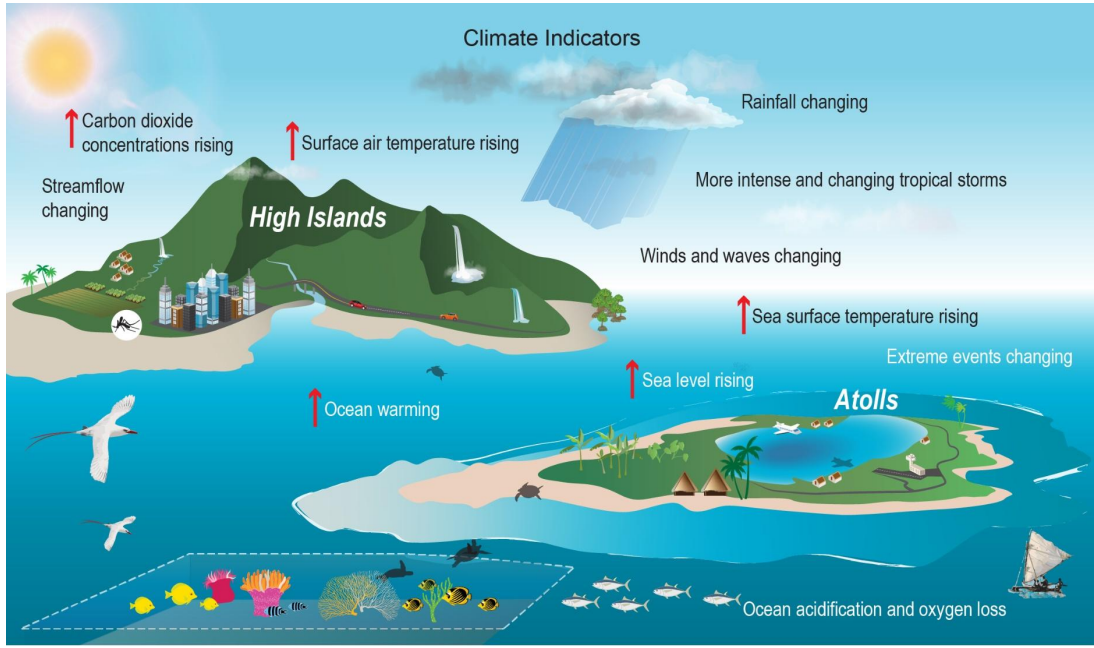
Figure 30.14. Conservation efforts across the region help to **restore ecosystem health & protect native species**.

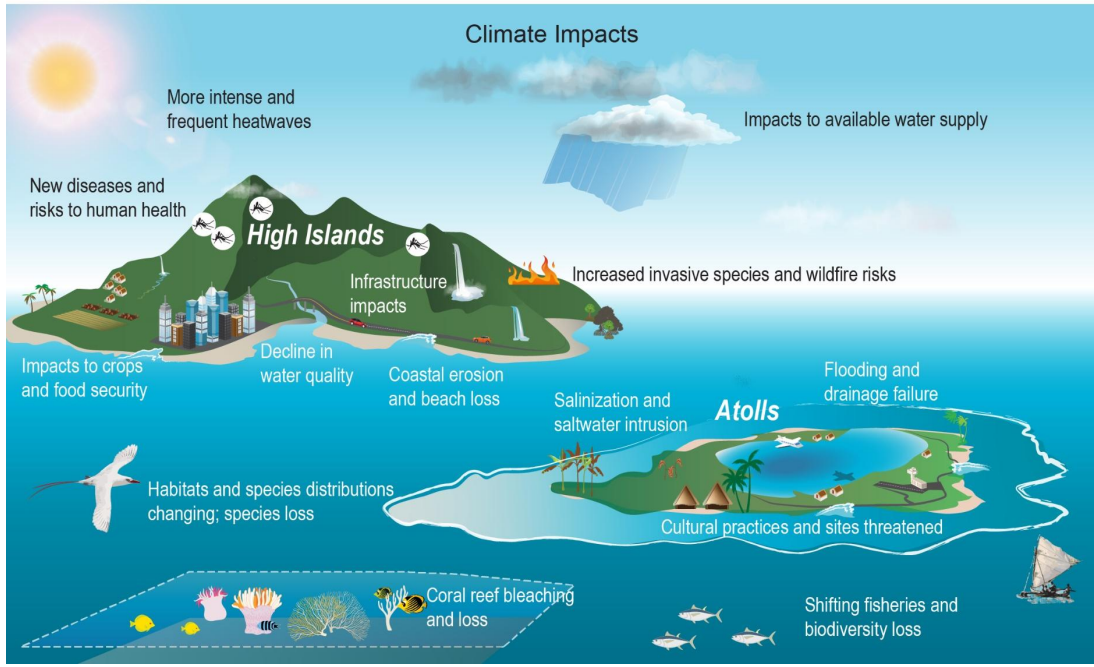
Figure 30.7. Programs aimed at **supporting traditional crops** help strengthen local **food security**.

Frazier et al. 2023; Box 30.2, 30.3, 30.4, and 30.6
https://nca2023.globalchange.gov/chapter/30/

In Summary

- The Pacific Islands region is extremely diverse & experiencing changes in climate
- Climate change **exacerbates inequities** and **threatens** communities & resources
  - Water, food, health, cultural resources, livelihoods, built environment, ecosystems, …
- **Islands are taking action**: striving to reduce emissions & adapt
  - Actions need to be scaled up
- Adaptation actions that center **local and Indigenous Knowledge** can improve resilience





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Thank You! afrazier@clarku.edu

- **To get involved in future NCAs, sign up for the USGCRP newsletter: https://www.globalchange.gov/newsletter-sign up**
- Full NCA5 chapter webinar: https://www.globalchange.gov/resources/nca5-webinar-hawaii-us-affiliated-pacific-islands
- **Read the NCA5 chapter here: https://nca2023.globalchange.gov/chapter/30/**

Check out NCA5's Art x Climate submissions!

JAMES KEUL
FISH IN TROUBLED WATERS
(2013, OIL ON CANVAS)

Extra slides

Data Inequities (Box 30.1)

Fig. 2.4
Annual Temperature

- Histories of colonization
  - Contribute to structural inequities & vu
    that exacerbate the impacts of climate
- Shared challenges with US Caribbear
  under-resourcing has resulted in con
  - Sparse & discontinuous climate data records
  - Lack of downscaled future climate projections
  - Absence of coastal flood hazard modeling & detailed SLR exposure mapping
  - Insufficient information about groundwater & surface water resources
  - Limited data on ecosystem response
- Improved representation of O-CONUS areas across NCA5
  - Still room for improvement (Basile et al. 2024)

PNAS

To be policy-relevant, future climate research must include the noncontiguous United States

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https://doi.org/10.1073/pnas.2315505121

Frazier et al. 2023;
https://nca2023.globalchange.gov/chapter/30/