KAUA'I CLIMATE ADAPTATION PLAN

Technical Advisory Group Meeting #1

11/9/2021 | 5:30PM - 7PM HST

TODAY'S AGENDA

1. Welcome and introductions
2. TAG roles and responsibilities
3. Overview of the Climate Adaptation Plan
4. Overview and discussion of technical deliverables and data sources
5. A look ahead

WELCOME & INTRODUCTIONS

Name, Affiliation

When you think about climate change solutions, what is one word that comes to mind?

Kauaʻi County Team

Planning Department:

Ka`aina Hull, Planning Director

Marie Williams, Long Range Planning Manager

Alisha Summers, Project Research Assistant

Alan Clinton, Administrative Planning Officer

Ruby Pap, Sea Grant Coastal Land Use Extension Specialist

Office of Economic Development:

Ana Espanola, Sustainability Coordinator

Christina Kaser, Energy Coordinator

Niki Kunioka-Volz, Agriculture Specialist

Office of the Mayor:

Polly Phillips, Mayor's Administrative Aid

Kauai Emergency Management Agency:

David Kennard, Disaster Assistance Project Manager

TECHNICAL ADVISORY GROUP

Roles and Responsibilities

Technical Advisory Group Objectives

- 21-member group of scientific, cultural, and youth experts
- Serve as an advisory body for Climate Adaptation Plan
- Help to ensure the KCAP process is utilizing the best available data and tools to assess vulnerability and generate adaptation recommendations for Kaua‘i

TAG Organization and Meetings

- Approximately four meetings over the course of 2021/2022
- Homework TBD
- Meetings will be facilitated by Raimi + Associates and Ruby
- Conversational style – no voting
- Flat TAG organization – everyone is on equal footing
- Meetings will be recorded and notes will be taken

TAG Roles + Responsibilities

- Attend TAG meetings
- Share your ideas – your honest and thoughtful input is critical
- Review materials prior to meetings (sent via email)
- Attend community workshops and other community meetings (strongly encouraged)
- Talk with neighbors, family and friends to encourage CAP Participation
- Be a champion for the project

TAG Ground Rules

- Share from our own knowledge and experiences
- Allow other voices to be heard (don’t dominate the discussion)
- Respect everyone's opinions and ideas
- Agree to disagree if needed
- Mute when not speaking
- Raise virtual hand to speak
- Keep camera on if possible
- What else?

CLIMATE ADAPTATION PLAN OVERVIEW

Climate Adaptation Plan Overview

Objectives

- Engage the community in adaptation planning, especially those most vulnerable to impacts
- Build upon related plans, including the General Plan and Multi-Hazard Mitigation and Resiliency Plan
- Assess our exposure and vulnerability to climate risks and hazards
- Identify priority actions to build adaptation into plans, infrastructure investment, and decision making
- Establish a framework for how the County will adapt to climate change
- Integrate greenhouse gas emissions reduction into strategies

Our Team

Raimi + Associates

Ron Whitmore,
Principal-in-Charge and Project Manager

Eric Yurkovich,
Technical and Equity Lead

Robyn Wong,
Climate and Sustainability Research and Analysis

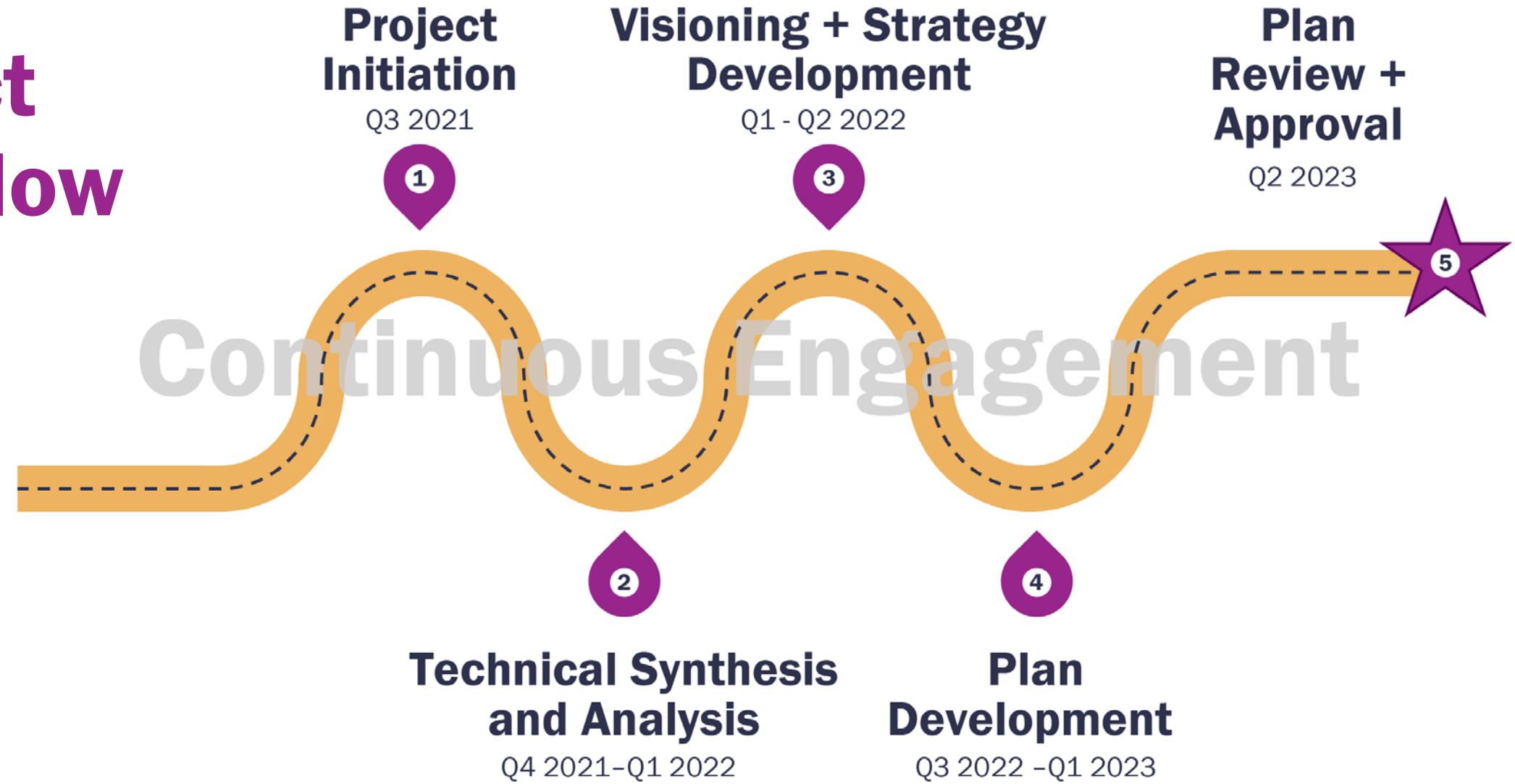
HR&A Advisors

Jeff Hebert, Hannah Glosser, Carl Hooks
Policy and Finance Support

Dr. Charles “Chip” Fletcher

UH Manoa School of Ocean and Earth Science and Technology, Technical Support

Project Workflow



Key Engagement Activities

Ongoing Guidance

- County Interdepartmental Resiliency Team
- Technical Advisory Group

Information and Updates

- Website
- Fact Sheets
- Educational Videos
- Emails and Social Media

Key Engagement Activities

Listening by Phase

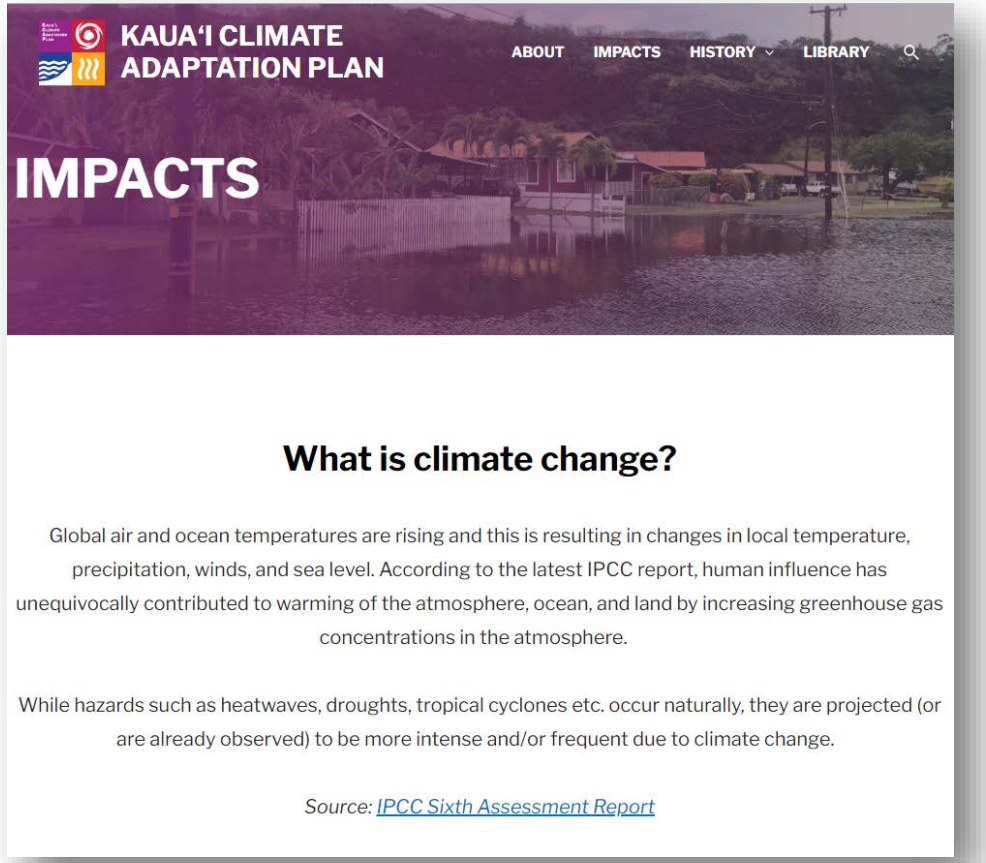
- Interviews
- Online Surveys
- Community Open Houses and “Deep Dives” Workshops

Approval

County Council

Engagement Underway

- Talk stories
- Interviews with community organizations, agencies
- Project website
- Development of a Youth Engagement Program



https://kauaiadaptation.com/

Pause for Questions so far?

Q1:

On the CAP?

Q2:

On engagement?

Q3:

On TAG roles / responsibilities?

TECHNICAL DELIVERABLES & HAZARDS OVERVIEW

Technical Synthesis & Analysis

Climate Hazards White Paper

- Brief white paper summarizing climate hazards and stressors, building on existing work
- No new downscaling to be completed

Vulnerability & Equity Assessment

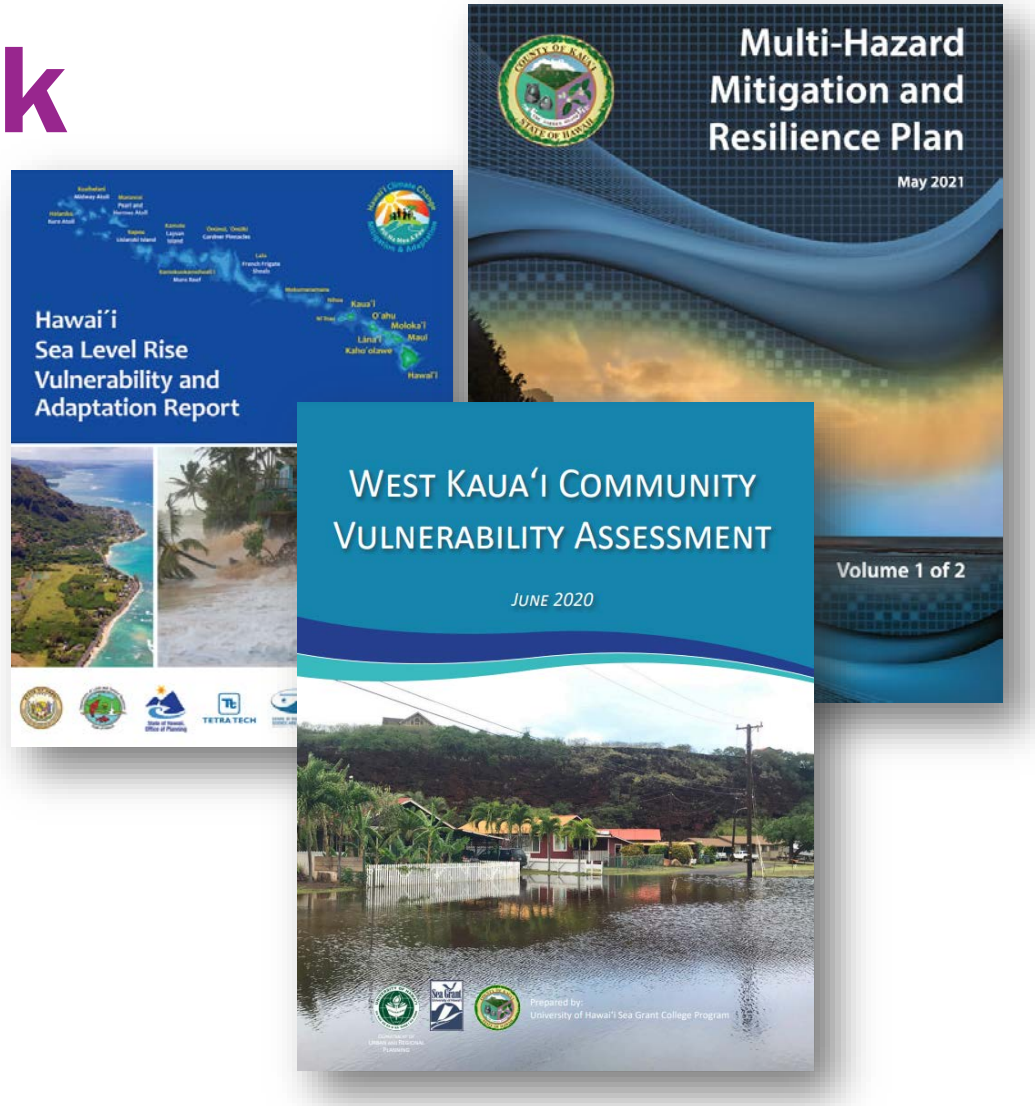
- Summary of vulnerability assessments for the County, building on existing work
- Creating a social vulnerability assessment
- Publishing through an online mapping tool

Adaptation Strategy Menu

- Matrix of existing, proposed, and potential adaptation strategies and actions

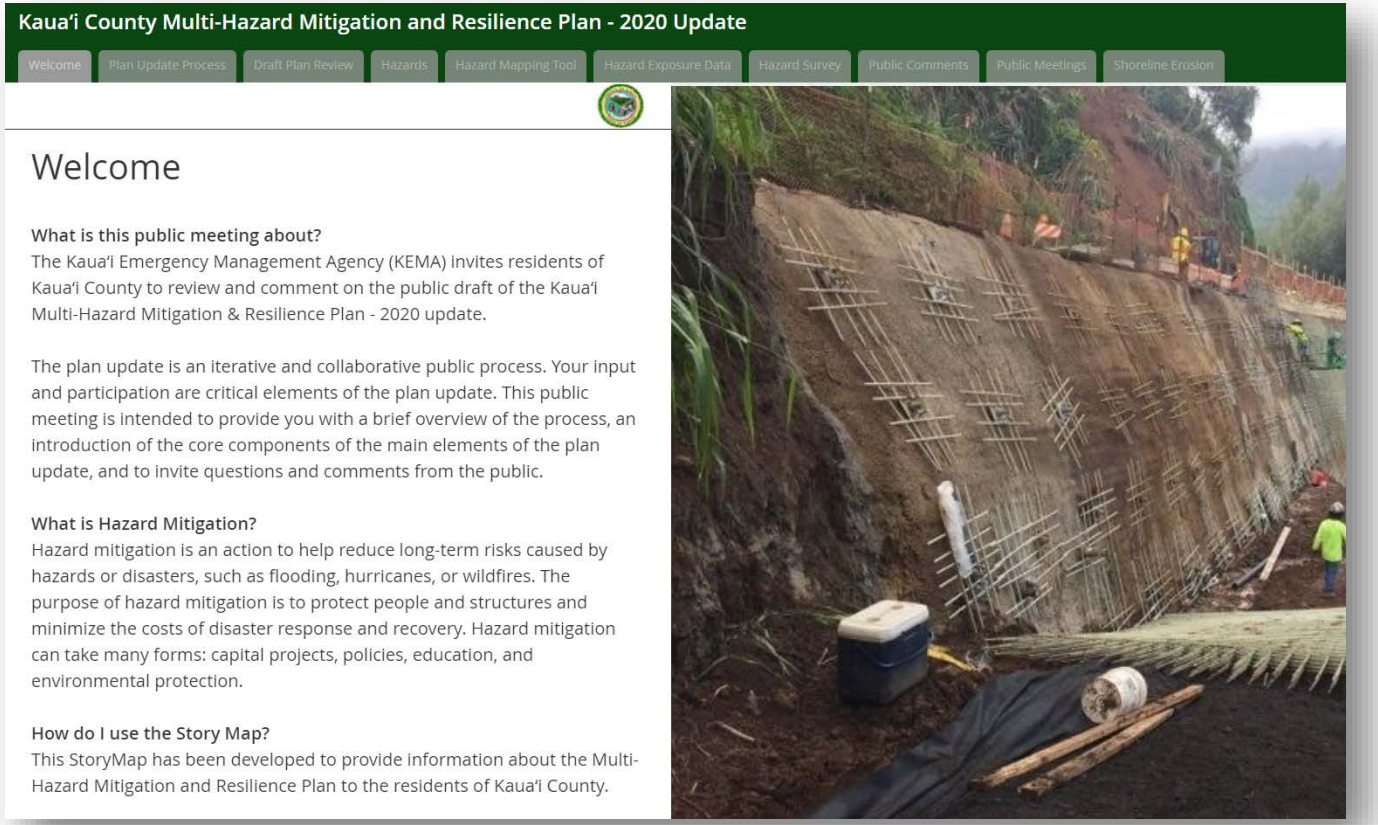
Building on Existing Work

- Multi-Hazard Mitigation and Resilience Plan
- West Kauaʻi Community Vulnerability Assessment
- Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report
- Hawaiʻi Highway Climate Adaptation Action Exposure Assessments
- Kauaʻi Climate Change and Coastal Hazards Assessment



Translating Technical Materials to Build Community Knowledge & Understanding

- Factsheets
- Educational videos
- Vulnerability mapping tool



Questions to Consider

Q1:

What parts of the story (or data) resonate with you? And what do you feel will resonate with the community?

Q2:

What parts of the story are missing?

Q3:

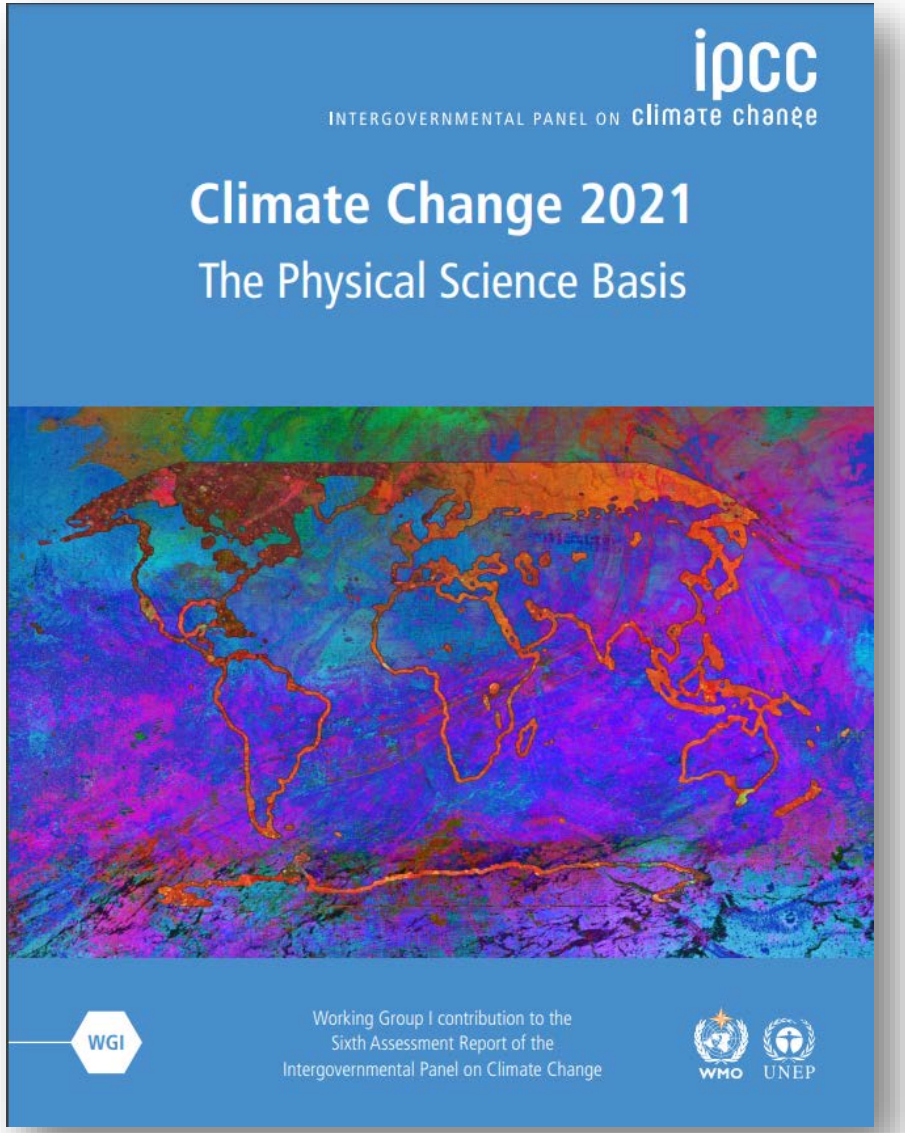
Is this information clear and accessible to you?

Q4

Are there data sources or resources we should consider incorporating into this analysis?

Current State of the Climate

- **It is "unequivocal" that human emissions of carbon dioxide and other greenhouse gas emissions have warmed the atmosphere, ocean, and land**
- Recent changes across the climate system are unprecedented. Human-induced climate change is already affecting many weather and climate extremes in every region across the globe
- Evidence of observed changes include heatwaves, heavy precipitation, droughts, and hurricanes



Source: Intergovernmental Panel on Climate Change 2021. Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis

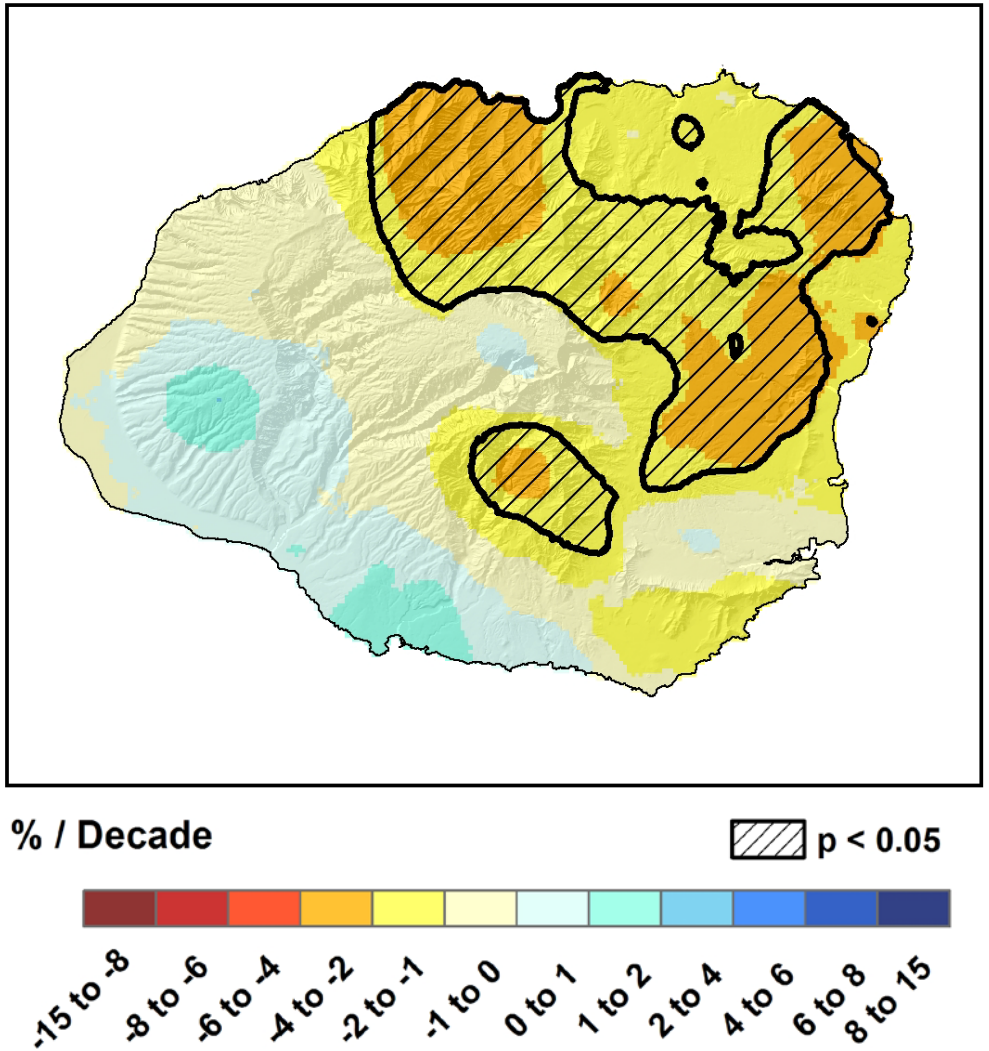
Projecting Change: Greenhouse Gas Emission Scenarios

- Greenhouse gas emission scenarios help understand a range of potential climate projections
  - RCP 2.6 is an aggressive emissions reduction scenario that assumes global greenhouse gas emissions will be significantly curtailed.
  - RCP 8.5, often referred to as a “business-as-usual” scenario, is consistent with a future where there are few global efforts to limit or reduce emissions.

Changing Precipitation

- An overall decline in rainfall over the past 30 years
- Increase in periods of heavy rainfall and drought
- Reduced streamflow

Annual Rainfall Trends (1920-2012)



Source: Giambelluca, T.W., et al. (2013) Online Rainfall Atlas of Hawai'i

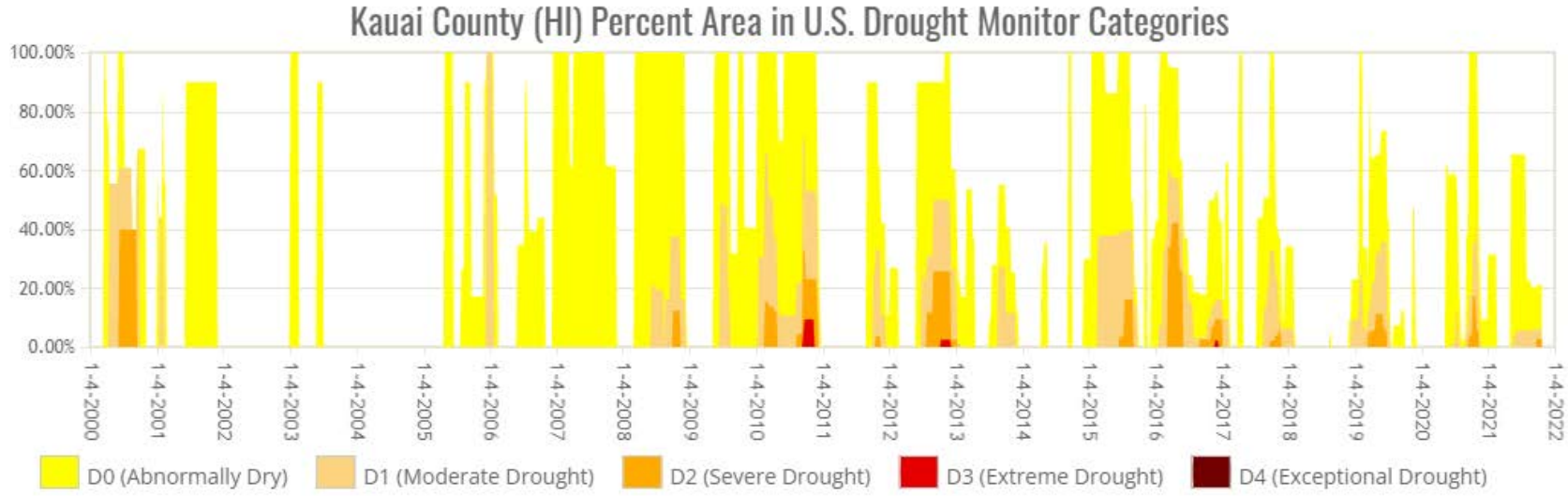
High Intensity Storm Events

- Over 81 flood events between 2005 and 2020, with severe flooding in 2018 and 2020
- High frequency flood events (e.g. 10-year floods) anticipated to increase with a changing climate
- Extreme precipitation events are more frequent in La Niña years and less frequent in El Niño years

Flooded roads in Kaua'i , Hawaii, 15 April 2018. Photo: Hawaii DOT

Longer Periods of Drought

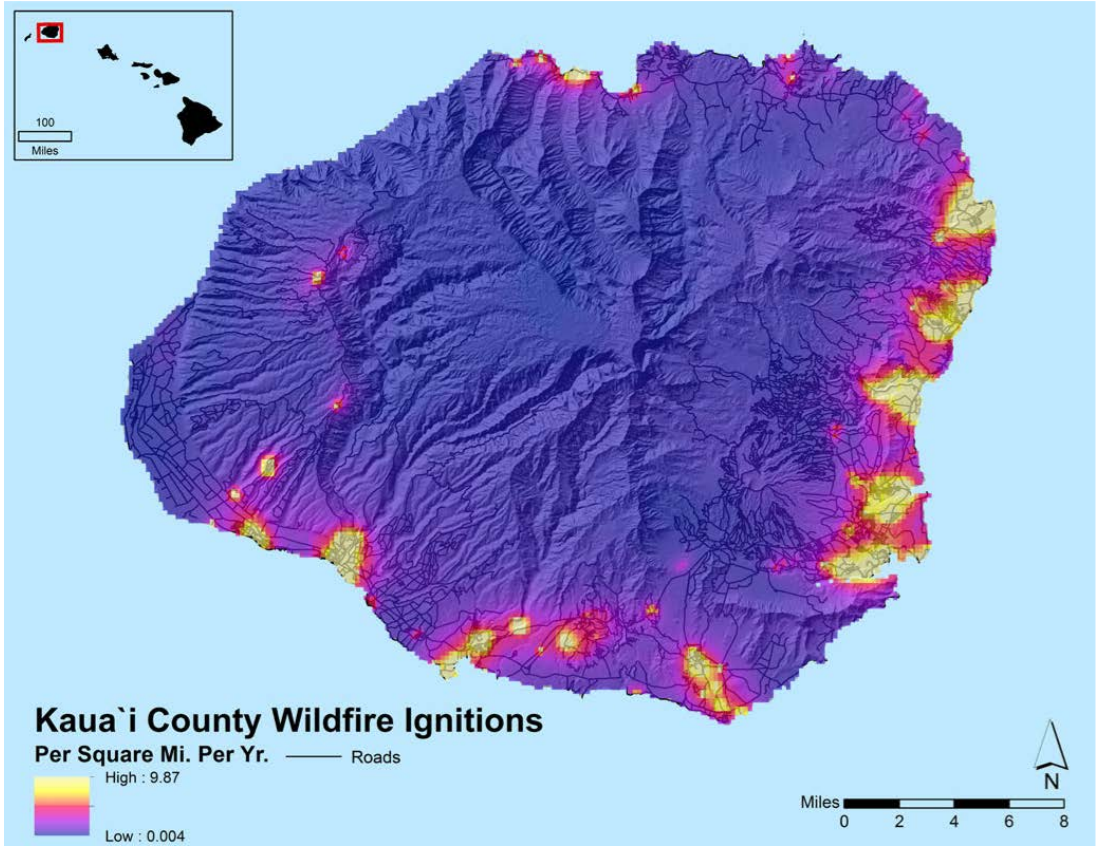
- Droughts are common, with longer periods of drought experienced on Kaua‘i from 1980 to 2011
- Continued changes in precipitation patterns (decline in rainfall, higher intensity events) may increase drought frequency, intensity, and duration



Source: US Drought Monitor. (2021). Time Series

Increasing Wildfire

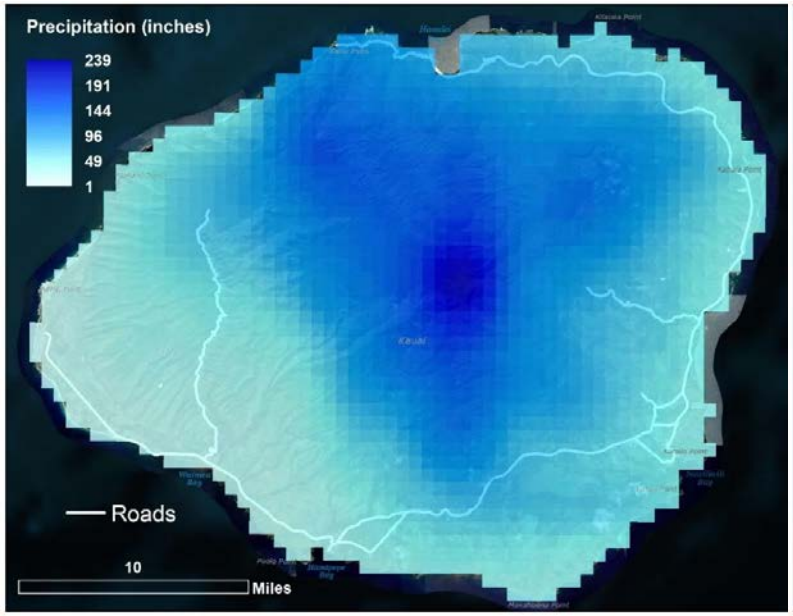
- Number of wildfires has increased in recent decades
- Wildfire risk anticipated to increase (increased grass/scrublands, rainfall variability)



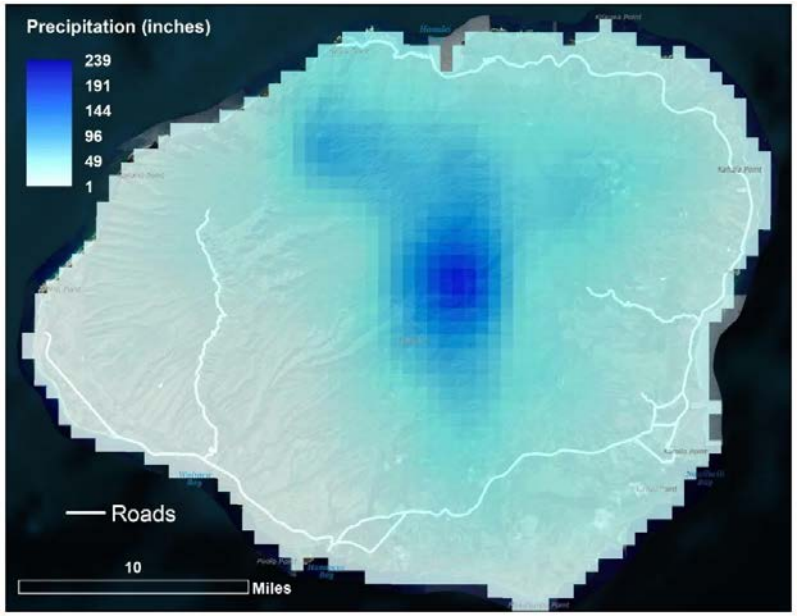
Note: Wildfire ignition density (number of ignitions per unit area) from point-based wildfire location data using mathematical smoothing functions. The variation in ignition density over a landscape provides an illustration of where ignitions are most frequent using a straightforward, quantitative value (e.g., number of ignitions per square mile per year).
Source: Trauernicht, C., and M.P. Lucas. 2016. Wildfire ignition density maps for Hawaii.

Precipitation Values During the Wet Season

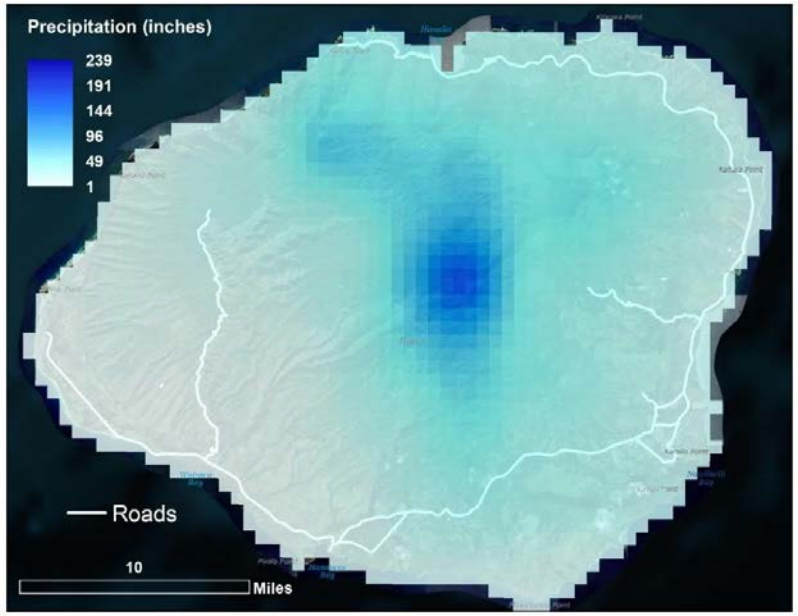
Historic Baseline (1975-2005)



Mid-Century (2041-2070)



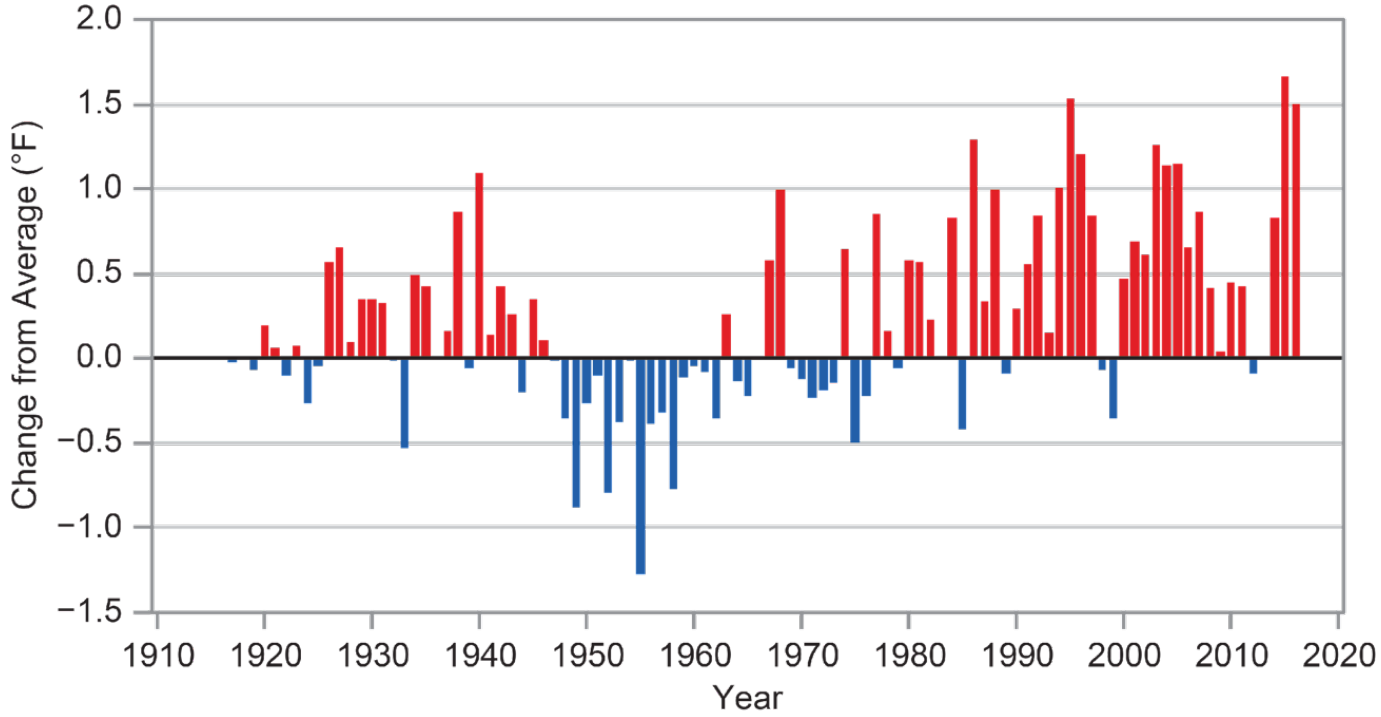
End of Century (2071-2100)



Note: RPC8.5 emissions scenario, 97.5th-percentile of climate model ensemble results
Source: Timm, O.E., T. Giambelluca, and H. Diaz. (2015). Statistical downscaling of rainfall changes in Hawai'i based on the CMIP5 global model projections.
Map Source: Hawai'i Department of Transportation. (2021). Hawai'i Highway Climate Adaptation Action Exposure Assessments

Increasing Temperature

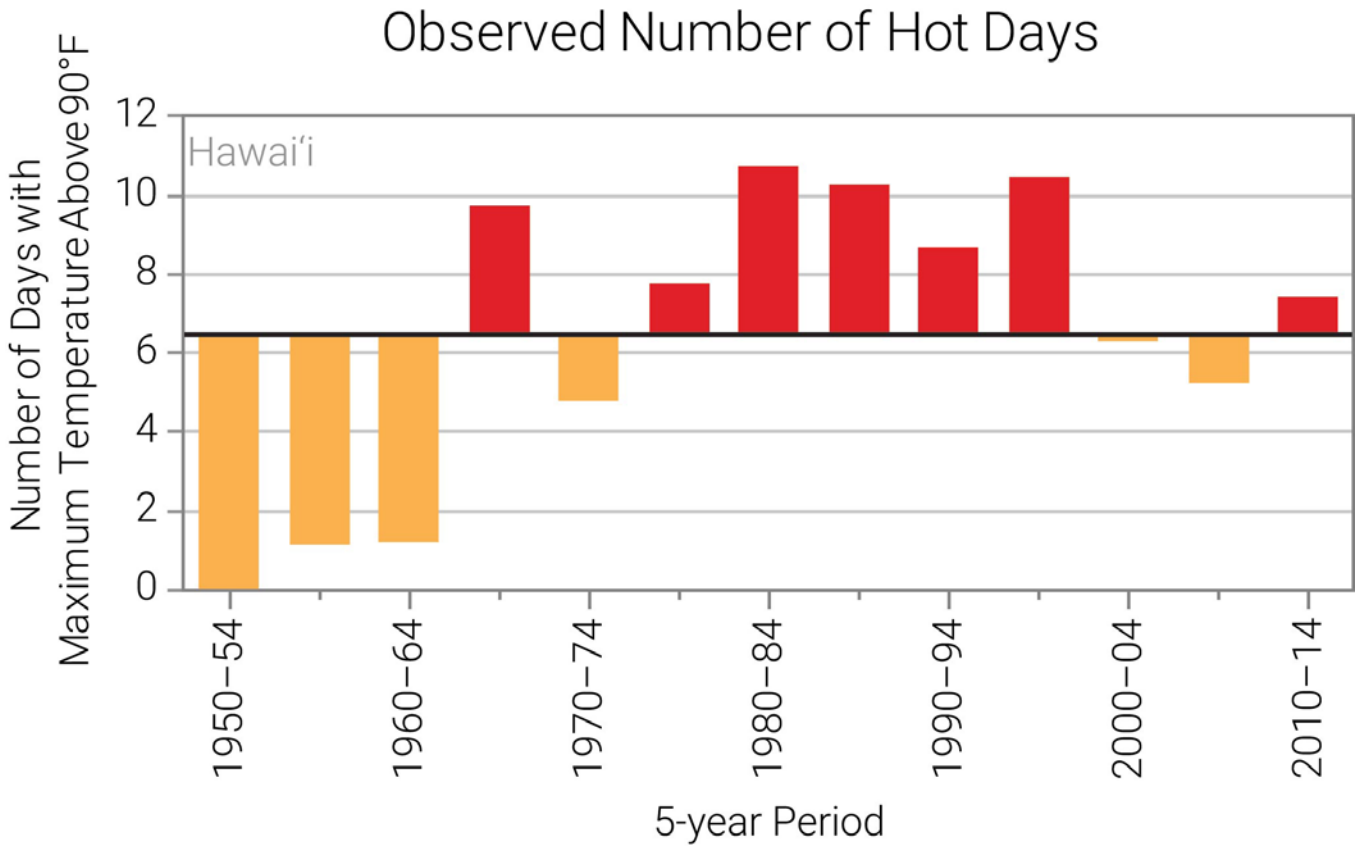
- Average annual temperature has risen by 2°F since 1950
- Warmest years 2015 and 2016
- Temperature increase is greatest at higher elevations



Source: Keener, V., et al. (2018) Hawai'i and U.S.-Affiliated Pacific Islands, 4th National Climate Assessment

More Warm Days & Nights

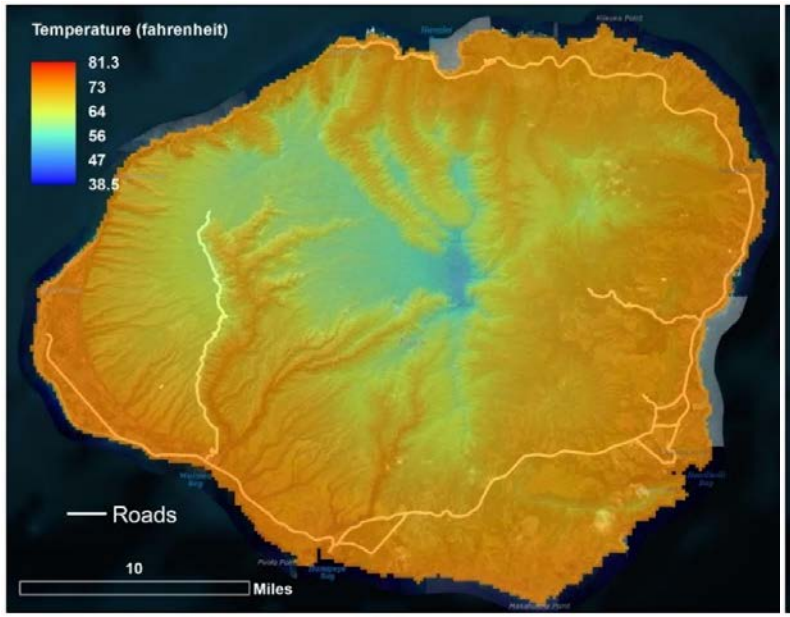
- Warm days (+90ºF) and warm nights (+75ºF) above average since 1980



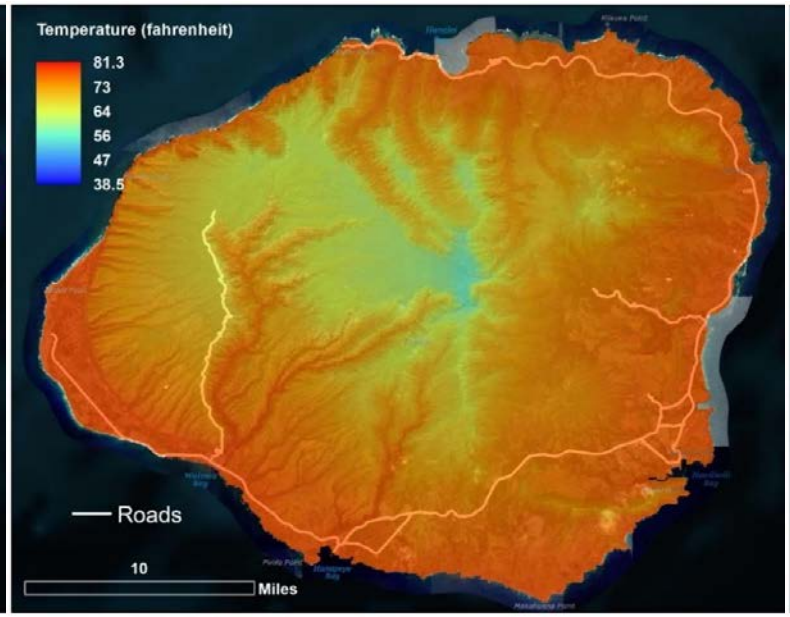
Source: CICS-NC and NOAA NCEI.

Annual Mean Temperature Values

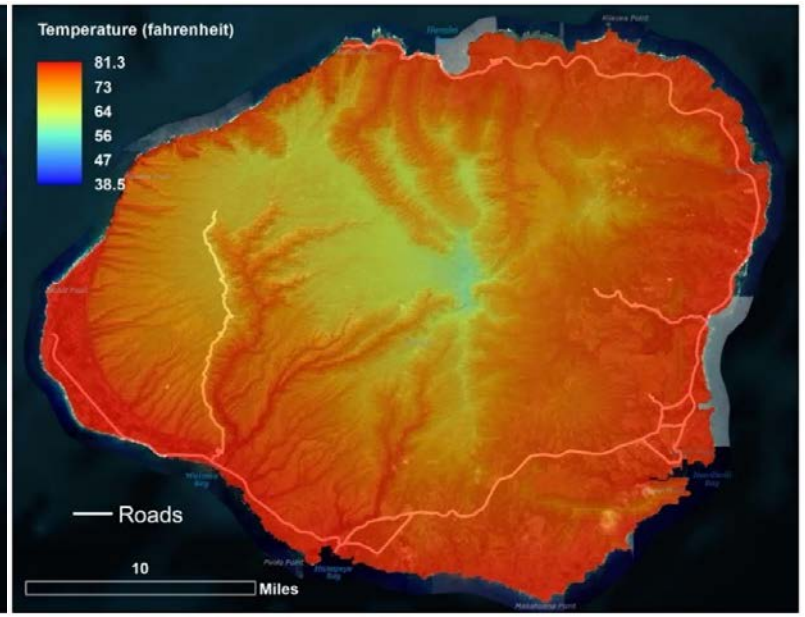
Historic Baseline (1976-2005)



Mid-Century (2040-2069)



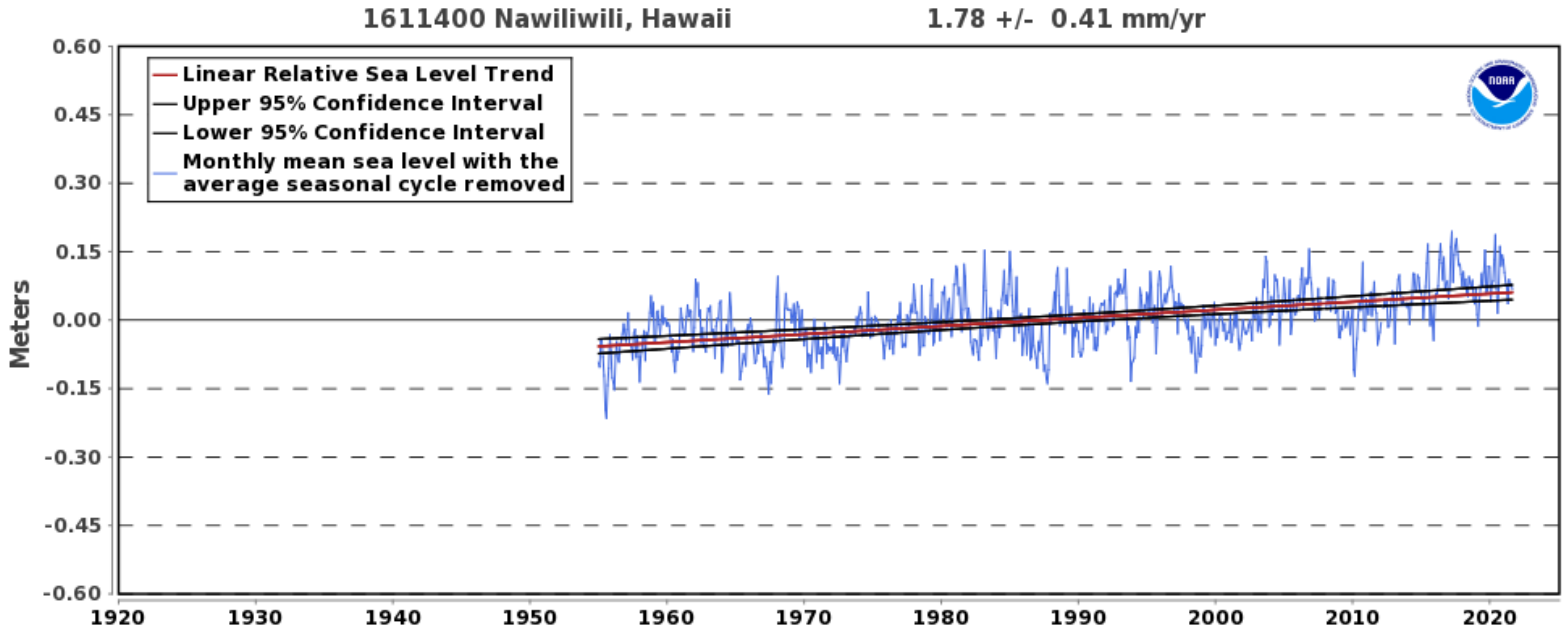
End of Century (2070-2099)



Note: RPC8.5 emissions scenario, 97.5th-percentile of climate model ensemble results
Source: Timm, O.E. (2017) Future Warming Rates over the Hawaiian Islands Based on Elevation-Dependent Scaling Factors.
Map Source: Hawai'i Department of Transportation. (2021). Hawai'i Highway Climate Adaptation Action Exposure Assessments

Rising Sea Levels

- Sea levels rose 0.58 feet between 1955 and 2020 at Nāwiliwili Harbor
- Global sea level is rising at increasing rates due to global warming, ocean thermal expansion and the melting of land-based glaciers and ice sheets.
- Global mean sea level has increased by 8-9 inches since 1880



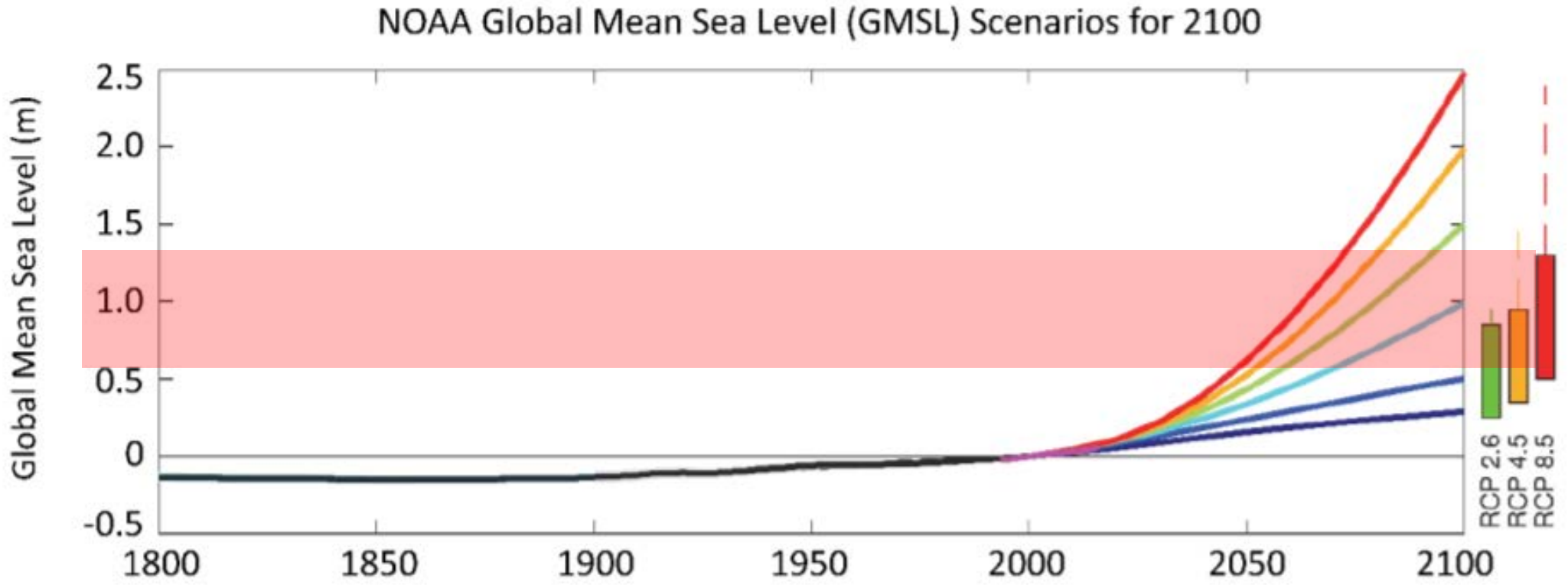
Source: NOAA Tides and Currents. (2021). https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=1611400

Tidal Flooding

- Already see during annual events like King Tides (highest of the high tides)
- Anticipated to increase in the future

King Tides, Source: Kauai.com
https://www.kauai.com/blog/kauai-king-tides

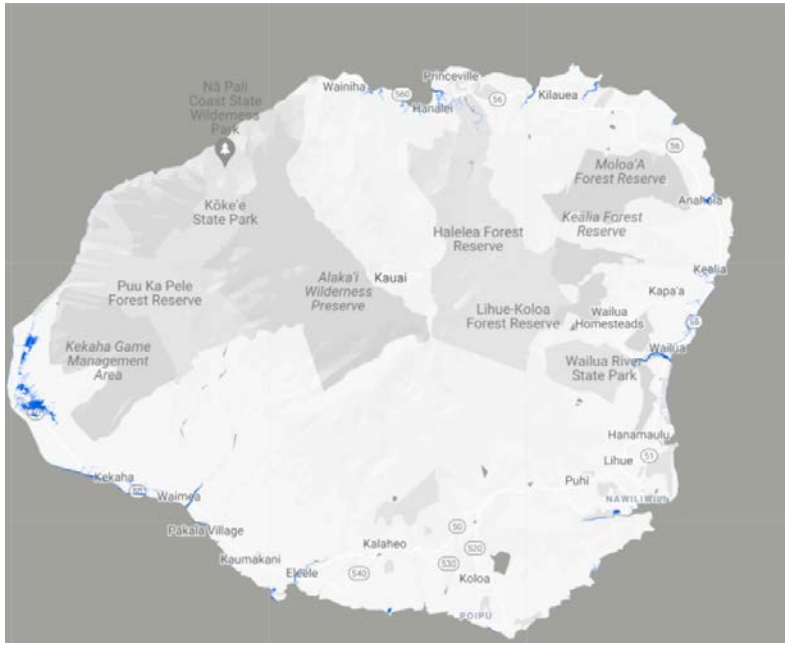
Global Mean Sea Level Rise Scenarios



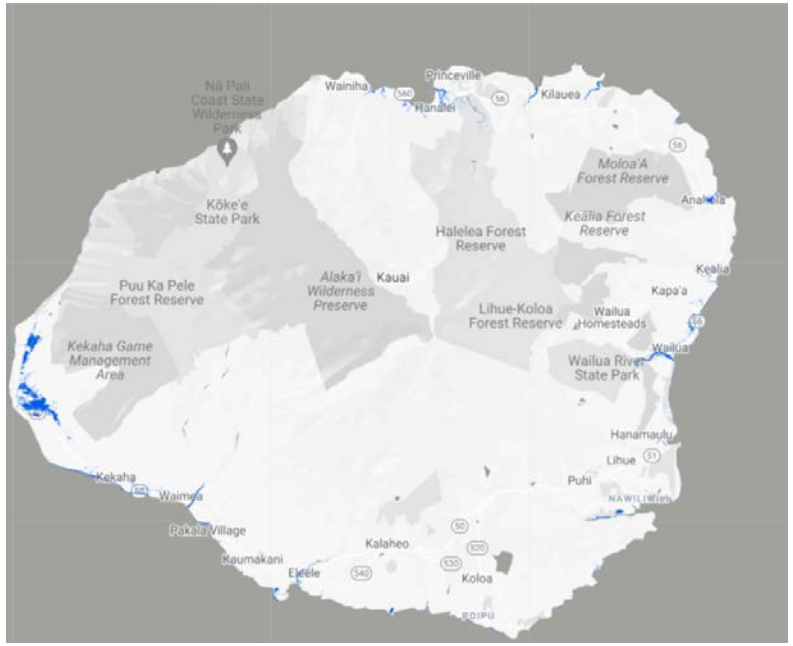
Source: Sweet et. al. (2017). Global and Regional Sea Level Rise Scenarios for the United States.
Note: Observed (black and purple) GMSL and projected GMSL rise scenarios from NOAA. The Intermediate (light blue) scenario projects 1 meter (3.2 feet) of GMSL rise at 2100. The Extreme (red) scenario projects 1 meter of GMSL rise in the 2060s and as much as 2.5 meters (8.2 feet) of GMSL rise at 2100.

Passive Sea Level Rise Flooding

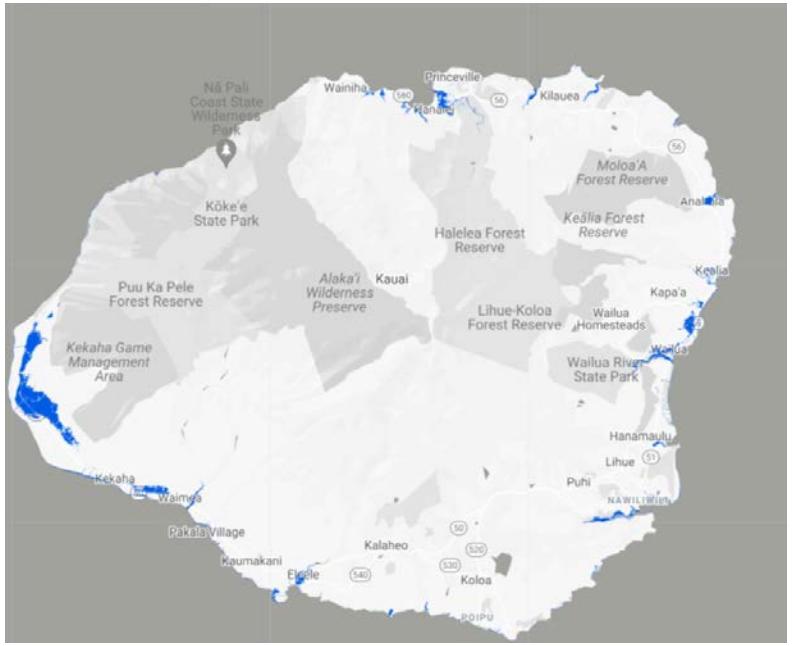
Near-Term, 0.5 Feet (2030)



Mid-Century, 1.1 Feet (2050)



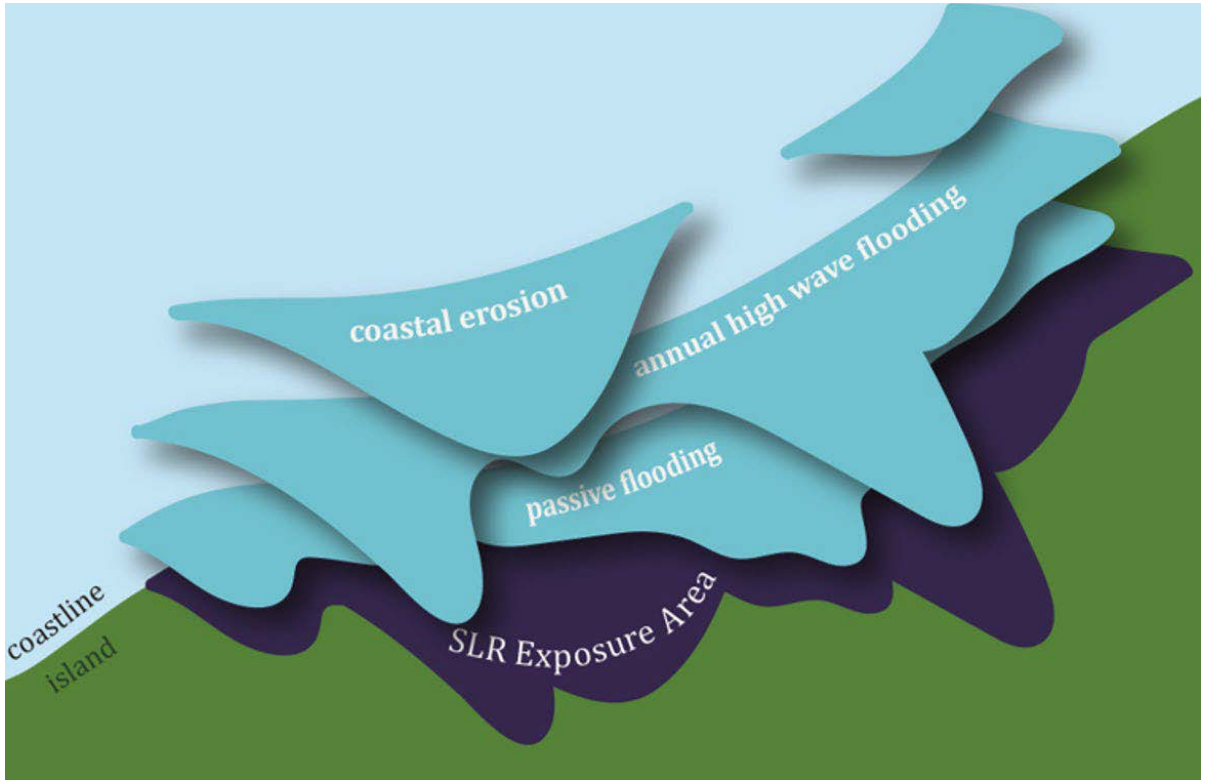
End of Century, 3.2 Feet (2100)



Note: RPC8.5 emissions scenario
Source: Hawai'i Climate Change Mitigation and Adaptation Commission. 2021. State of Hawai'i Sea Level Rise Viewer. Version 1.04.

Combined Exposure to Sea Level Rise

- **Passive flooding:** Low-lying areas susceptible to flooding by sea level rise
- **High wave flooding**: Large waves annually on all open coasts
- **Coastal erosion:** Beach profile change due to sea level rise

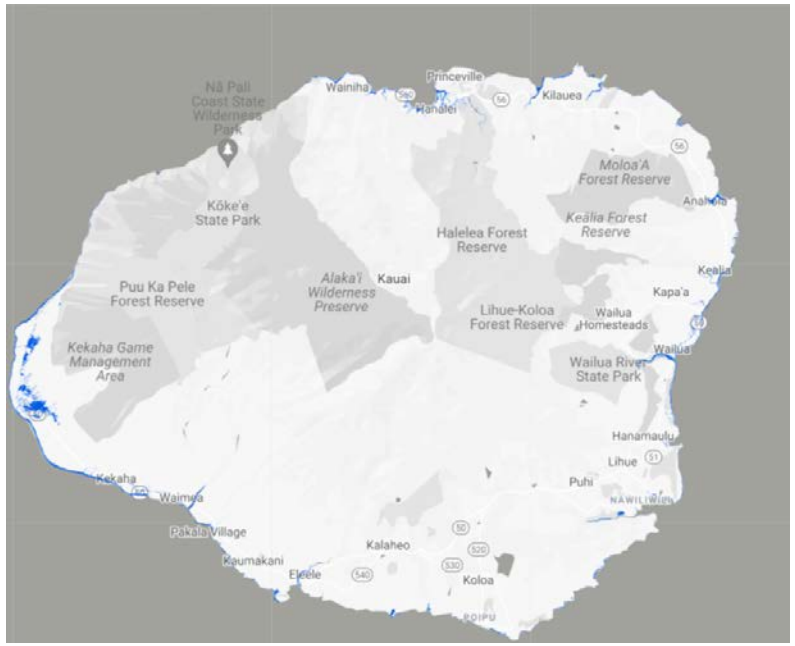


Source: Hawai'i Climate Change Mitigation and Adaptation Commission. 2017. Hawai'i Sea Level Rise Vulnerability and Adaptation Report

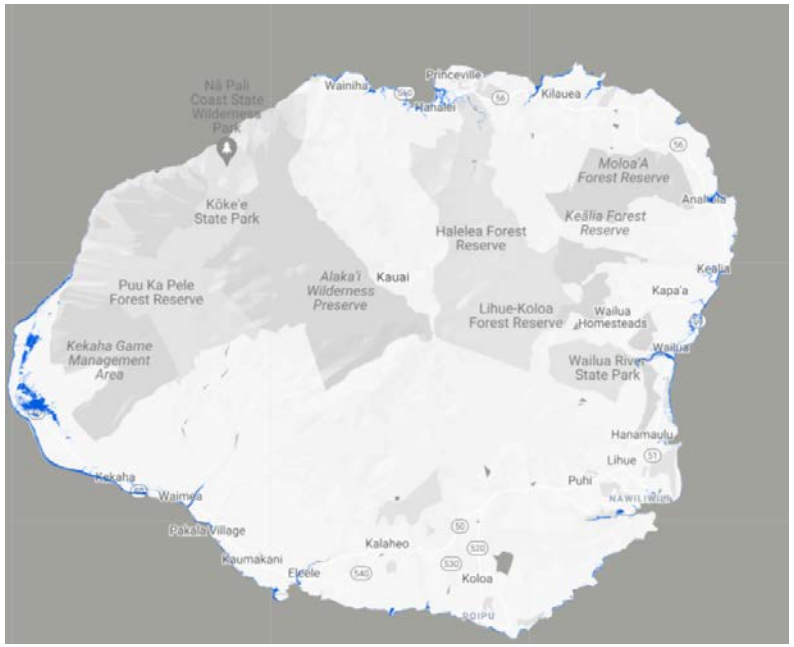
Coastal Flooding

Three chronic flooding hazards were modeled: passive flooding, annual high wave flooding, and coastal erosion

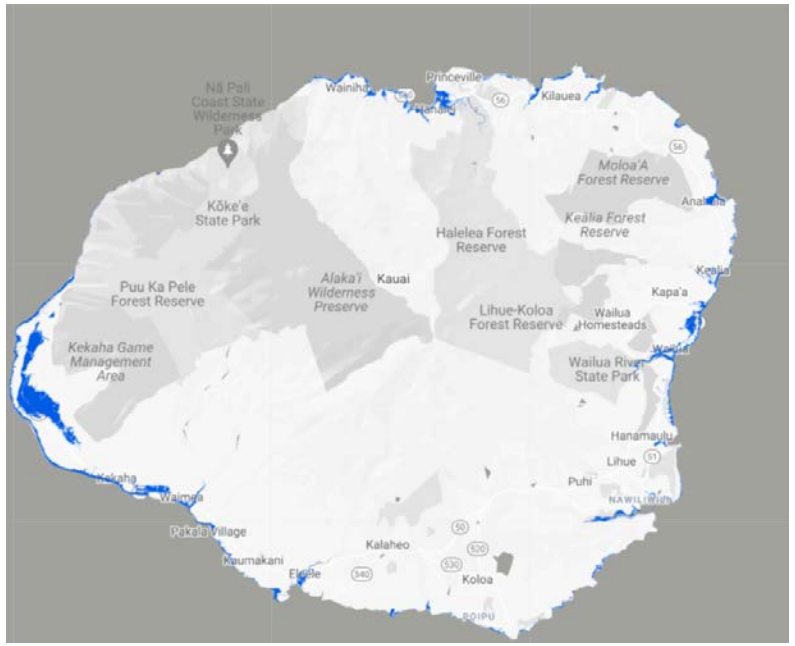
Near-Term, 0.5 Feet (2030)



Mid-Century, 1.1 Feet (2050)



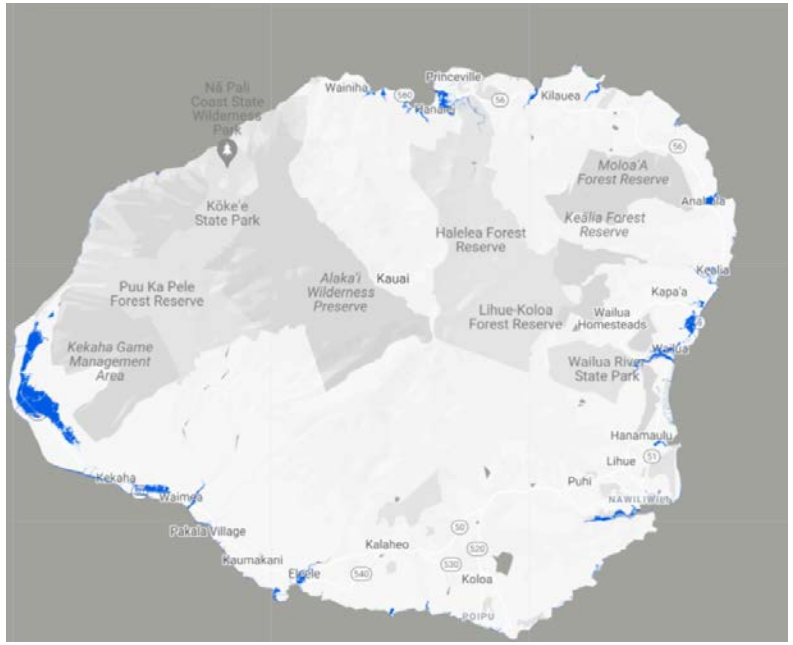
End of Century, 3.2 Feet (2100)



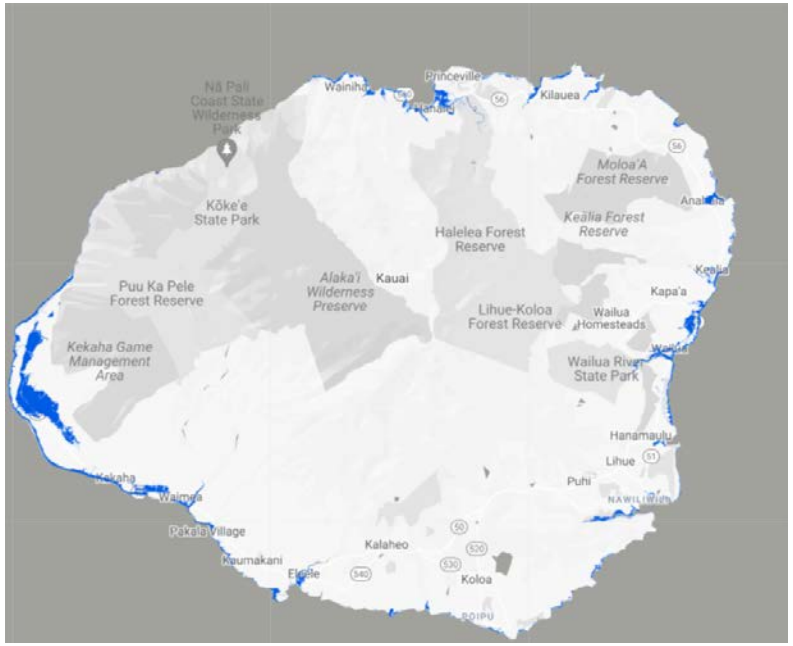
Note: RPC8.5 emissions scenario
Source: Hawai'i Climate Change Mitigation and Adaptation Commission. 2021. State of Hawai'i Sea Level Rise Viewer. Version 1.04.

Comparison of Flood Scenarios

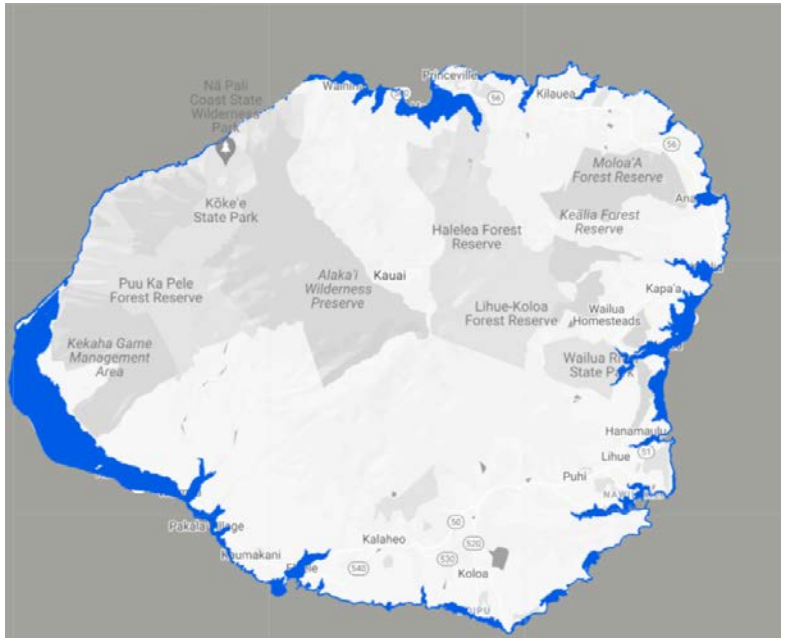
Passive, 3.2 Feet (2100)



Combined, 3.2 Feet (2100)



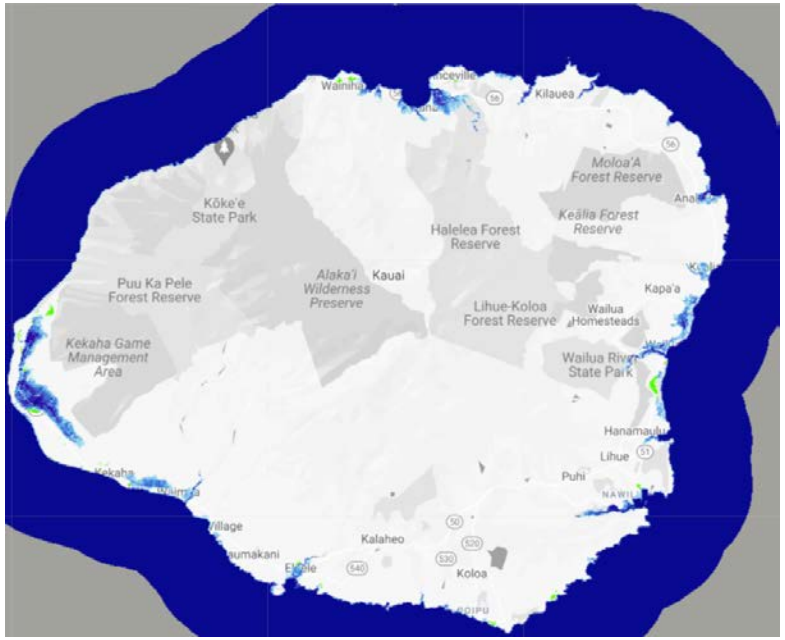
Passive + 100 Year, 3.2 Feet (2100)



Note: RPC8.5 emissions scenario. The term 100-year flood indicates that the area has a 1% chance of flooding in any given year.
Source: Hawai'i Climate Change Mitigation and Adaptation Commission. 2021. State of Hawai'i Sea Level Rise Viewer. Version 1.04.

More Extreme Sea Level Rise

Passive, 6 Feet



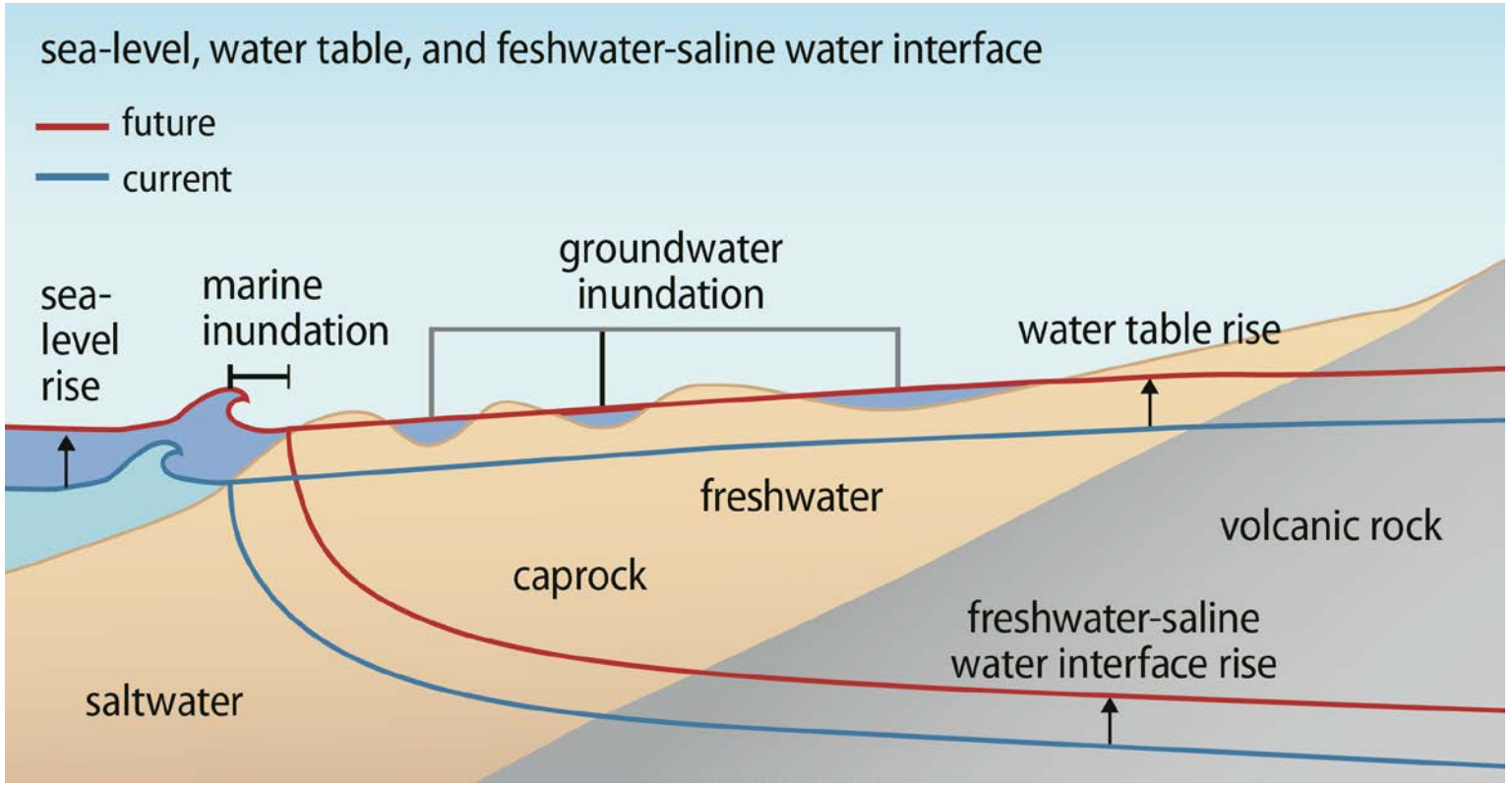
Source: NOAA Office for Coastal Management. Sea Level Rise Viewer. https://coast.noaa.gov/slr/

Q1:

How do you recommend we deal with the uncertainty associated with climate projections, especially for hazards like sea level rise that may be happening more quickly?

Groundwater Flooding

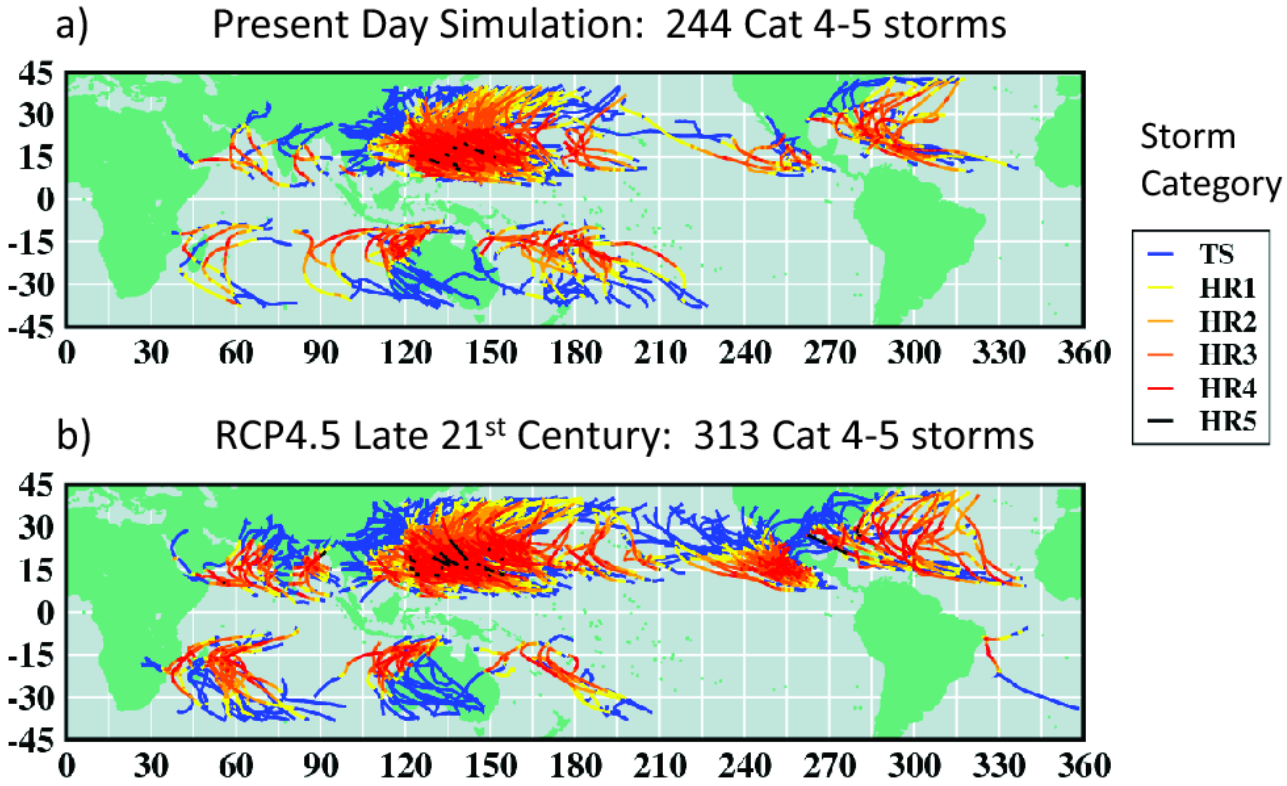
- Rate of rise in groundwater levels in response to rising sea levels is determined by geologic and hydrologic conditions near the shoreline
- Passive flooding model provides an estimation of groundwater induced inundation
- May underestimate future extent of inundation



Source: Hawai'i Climate Change Mitigation and Adaptation Commission. 2017. Hawai'i Sea Level Rise Vulnerability and Adaptation Report

Tropical Cyclones

- Major cyclones becoming more likely over last 40 years
- Anticipated increase in tropical cyclones near Hawai‘i
- Higher sea levels contribute to greater coastal inundation



Note: Tracks of simulated category 4-5 tropical cyclones for (a) present-day or (b) late twenty-first century under conditions of decreasing greenhouse gas emissions in the second half of the century (RCP4.5). Storm categories on the Saffir–Simpson scale are depicted by the track colors, varying from tropical storm (blue) to category 5 (black; see legend). The number and intensity of storms in Hawaiian waters significantly increases.
Source: Knutson, T.R., et al. (2015) Global Projections of Intense Tropical Cyclone Activity for the Late Twenty-First Century from Dynamical Downscaling of CMIP5/RCP4.5 Scenarios

Historical and Expected Climate Impacts

Climate Hazard	Past Trend	Future Trend
Average Rainfall	Declining (last 100 years)	Decreasing wet season rain
Heavy Rainfall Events	Increasing (last 100 years)	Increasing
Drought	Increasing length (last 40 years)	Increasing with changing rainfall / temperature
Wildfire	Increasing (last 100 years)	Increasing with changing rainfall / temperature
Average Temperature	Increasing (last 70 years)	Increasing
Warm Days & Nights	Increasing (last 45 years)	Increasing
Sea Level Rise	Increasing (last 65 years)	Increasing
Tidal Flooding	Unknown	Increasing with higher SLR
Tropical Cyclones	Increasing (last 40 years)	Increasing

Questions For Discussion

Q1:

What parts of the story (or data) resonate with you? And what do you feel will resonate with the community?

Q2:

What parts of the story are missing?

Q3:

Is this information clear and accessible to you?

Questions for Discussion

Q1:

Are there data sources or resources we should consider incorporating into this analysis?

Q2:

How do you recommend we deal with the uncertainty associated with climate projections, especially for hazards like sea level rise that may be happening more quickly?

NEXT STEPS

Upcoming TAG Meetings

Meeting #2 – Q1 2022

- Review initial vulnerability assessment findings
- Review initial social vulnerability assessment findings

Meeting #3 – Q2 2022

- Review final vulnerability assessment findings
- Review initial adaptation strategies

Meeting #4 – Q3 2022

- Review adaptation strategies and actions

Homework! Assignment 1

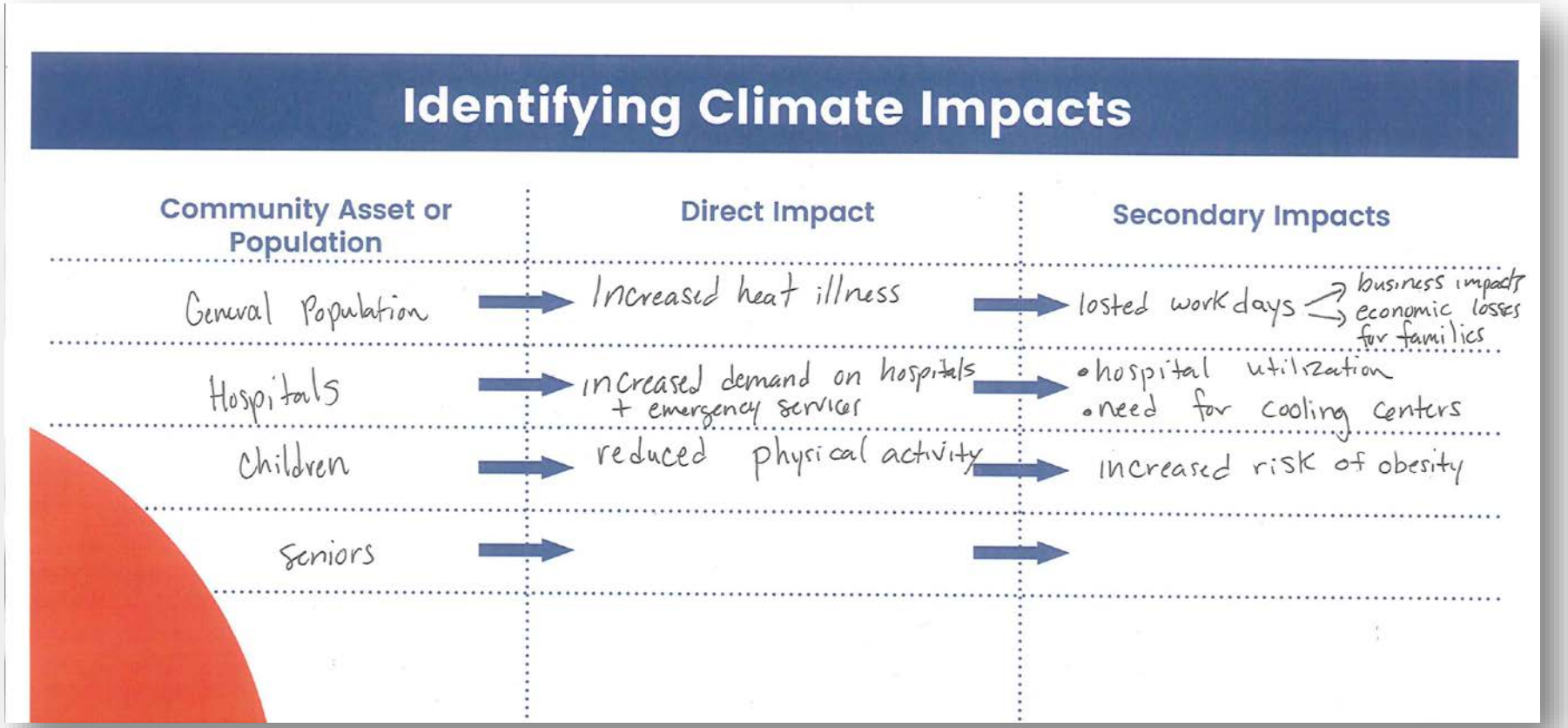
- Review the presentation again
- Answer the following questions
  - Are there data sources or resources we should consider incorporating into this analysis?
  - Is there work you, your organization, or your colleagues / friends doing that would be valuable for the CAP?

Homework! Assignment 2

- **Purpose:** To identify **direct** and **indirect** impacts from key climate hazards and identify most important impacts for Kauaʻi
- **Exercise:** Sketch out pathways illustrating the direct and indirect impacts of climate change, with geographic locations identified as appropriate

- We will share in TAG #2!

Homework! Assignment 2



Hazard:

Asset:

Community Asset or Population	Direct Impact	Indirect Impacts

MAHALO!

for your time and contributions to the discussion!