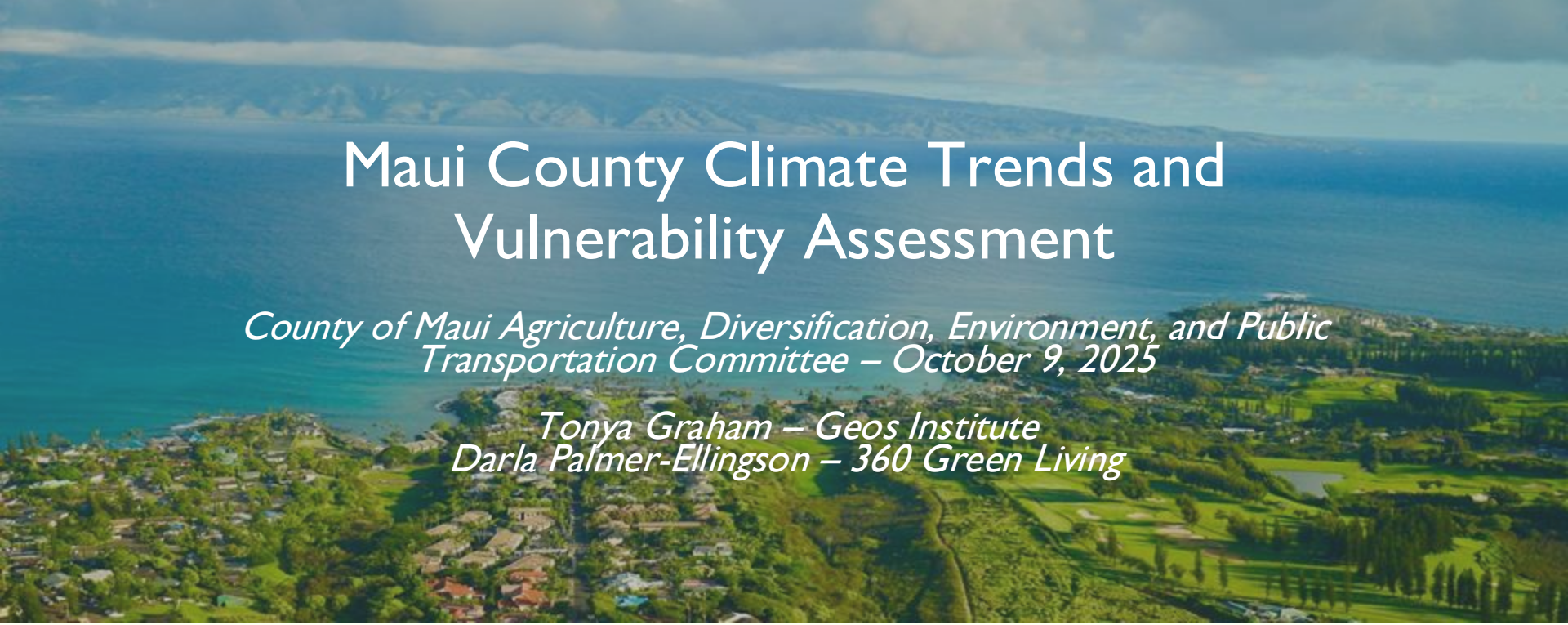

# Maui County Climate Trends and Vulnerability Assessment

*County of Maui Agriculture, Diversification, Environment, and Public Transportation Committee – October 9, 2025*

*Tonya Graham – Geos Institute*
*Darla Palmer-Ellingson – 360 Green Living*

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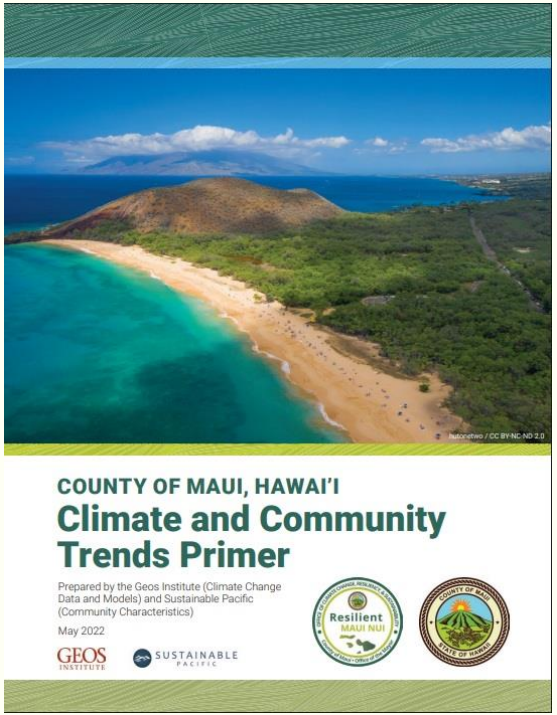
Received at 10/09/2025 ADEPT meeting from Geos Institute and 360 Green Living



COUNTY OF MAUI, HAWAI'I

## Climate and Community Trends Primer

Prepared by the Geos Institute (Climate Change Data and Models) and Sustainable Pacific (Community Characteristics)

May 2022

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SUSTAINABLE PACIFIC

# MAUI COUNTY CLIMATE CHANGE VULNERABILITY ASSESSMENT

December 2022

*Prepared by the Geos Institute for the Office of Climate Change, Resiliency, and Sustainability (CCRS) County of Maui*

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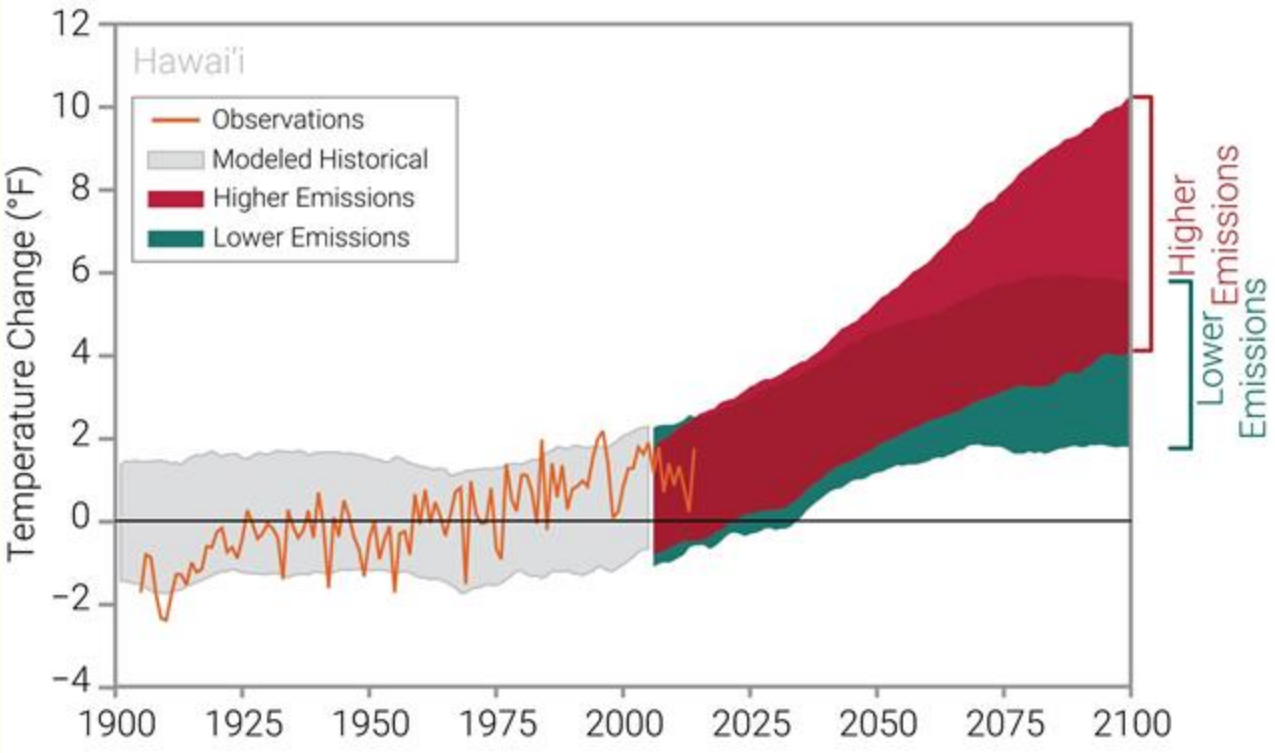
# Which trajectory are we on?




Observed and projected temperature change in Hawai'i, compared to 1951-1980. The higher emissions pathway is RCP8.5 while the lower emissions pathway is RCP4.5. Source: CICS-NC and NOAA NCEI.

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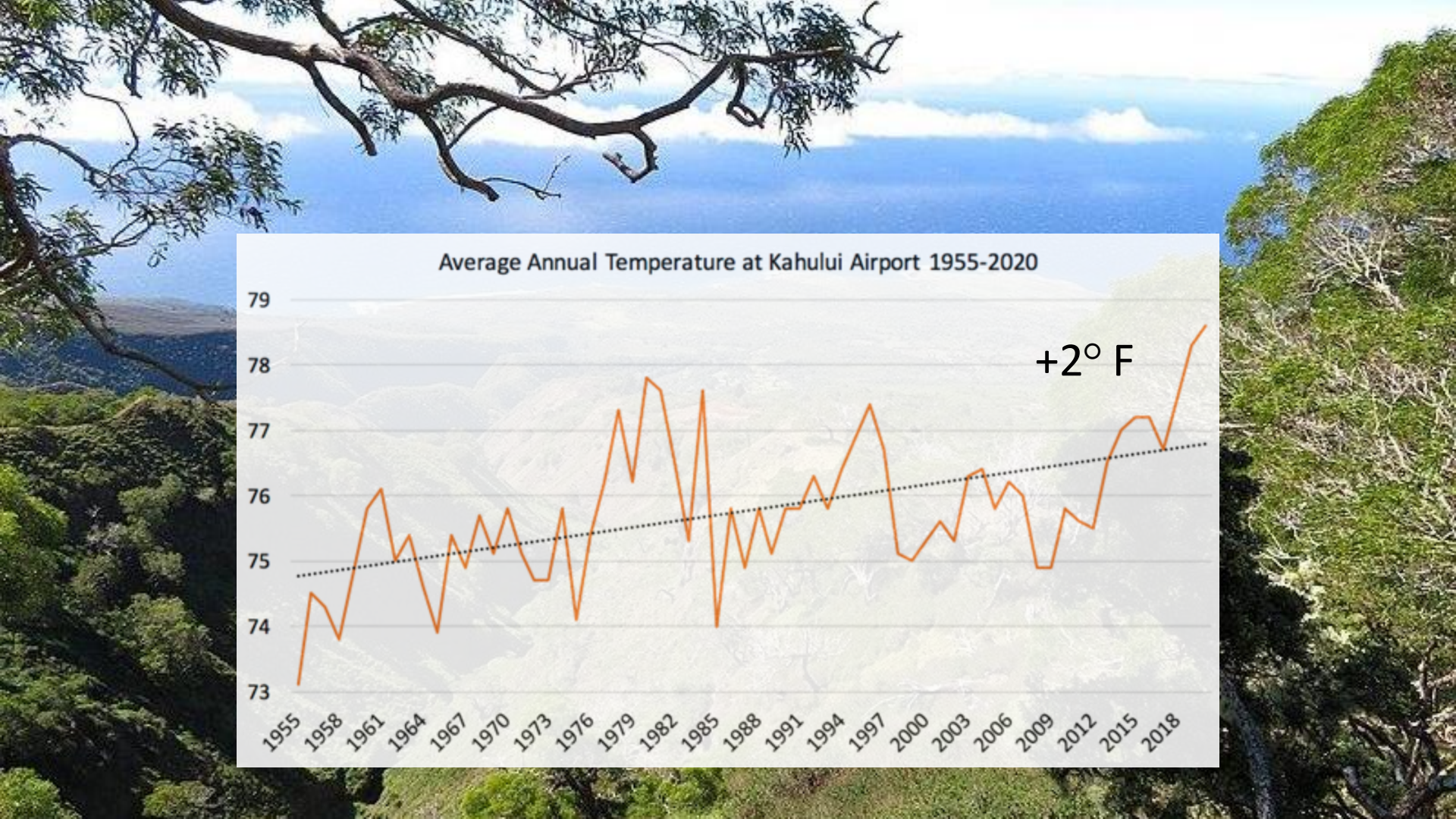
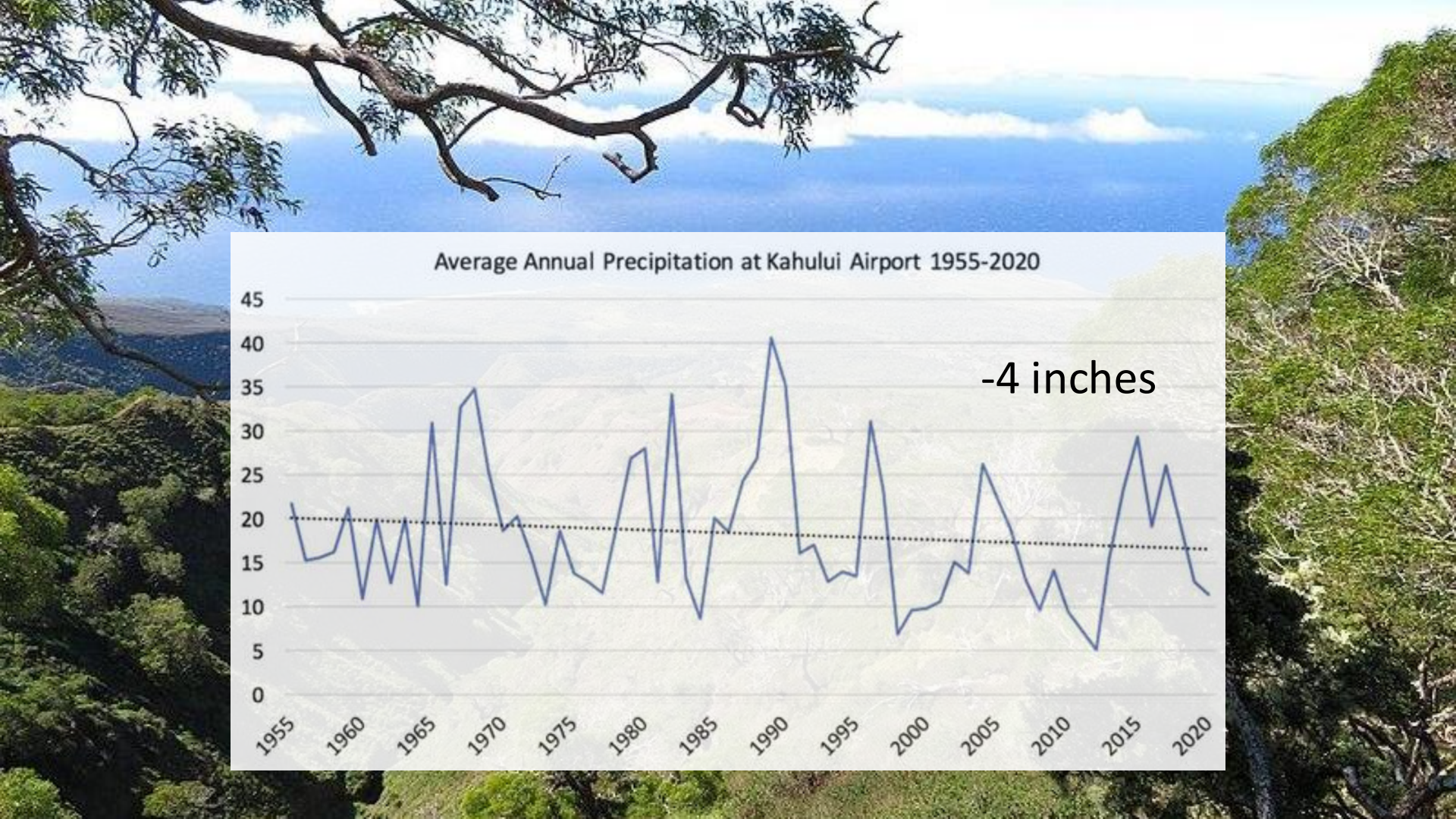

Average Annual Temperature at Kahului Airport 1955-2020
+2° F
79
78
77
76
75
74
73
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018

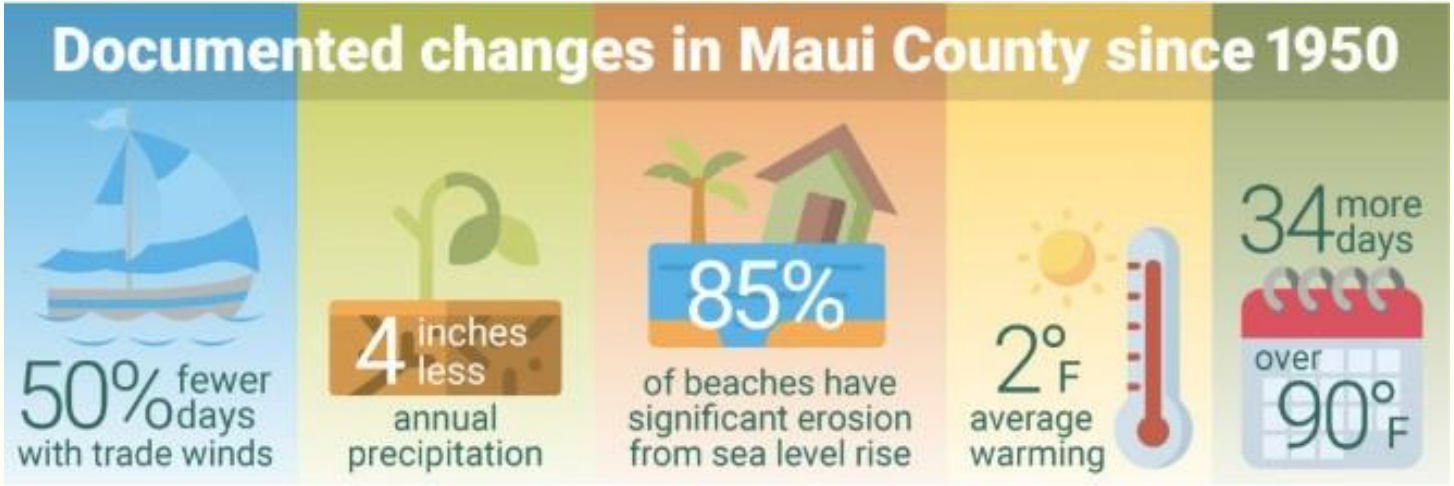

Number of Days above 90° F at Kahului Airport 1955-2020
180
160
140
120
100
80
60
40
20
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


Average Annual Precipitation at Kahului Airport 1955-2020
45
40
35
30
25
20
15
10
5
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
-4 inches

# Decline in Trade Winds

- From 291 days per year to 150 days per year (1973-2019)
- More heat and drought

# Maui County Projections



# Maui County Projections

| Projected Trends for Maui County | Mid-century (2050s) | Late-century (2080s) |
|---|---|---|
| Average temperature[5] | ↑ +2 to +6°F | ↑ +3 to +9°F |
| Number of days with extreme heat[9] | ↑↑ | ↑↑↑ |
| Percent change in wet season precipitation[7] | ↓ −15% | ↓ −23% |
| Percent change in dry season precipitation[7] | ↓ −37% | ↓ −52% |
| Drought severity and frequency[3,9] | ↑ | ↑↑ |
| Frequency of heavy rains and flooding | ↑ | ↑↑ |
| Northeasterly tradewinds[10] | ↓↓ | ↓↓↓ |
| Sea level rise (global average)[2] | ↑ ~1 foot | ↑ 2 to 3 feet |
| Ocean temperature (global average)[16] | — | ↑ +5°F by 2100 |
| Frequency of coral bleaching events[16] | ↑ yearly | — |
| Declines in ocean fishery productivity[16] | ↓ −15% | ↓ −50% |

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# Sea Level Rising Quickly

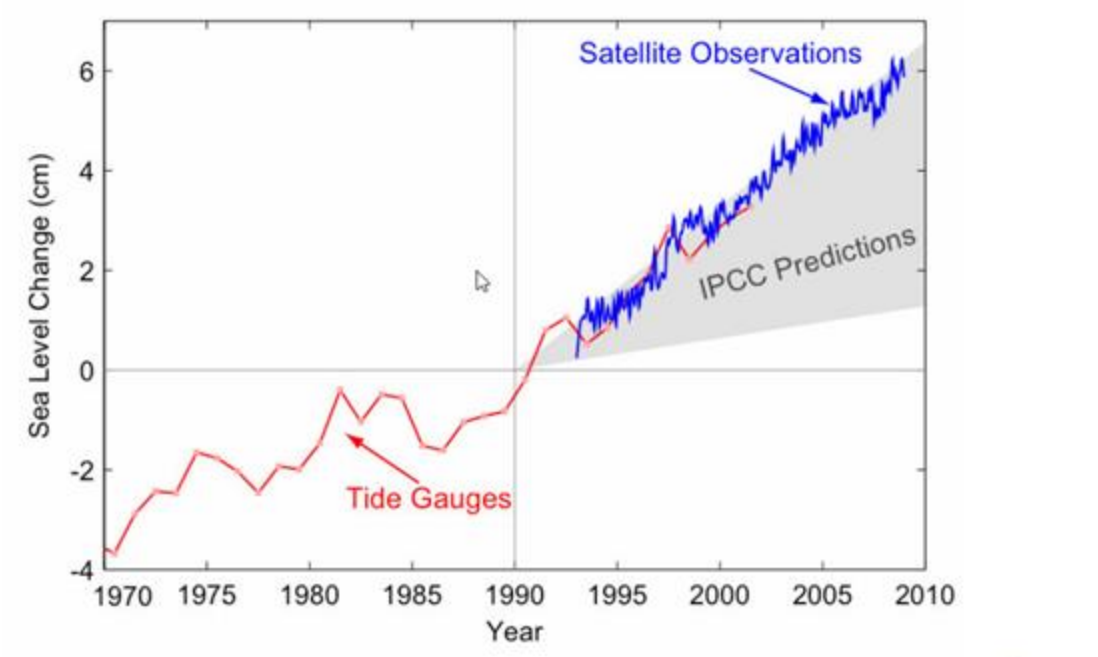


Figure 16: Sea-level change 1970-2010

The Copenhagen Diagnosis
Updating the World on the Latest Climate Science
http://www.copenhagendiagnosis.com/

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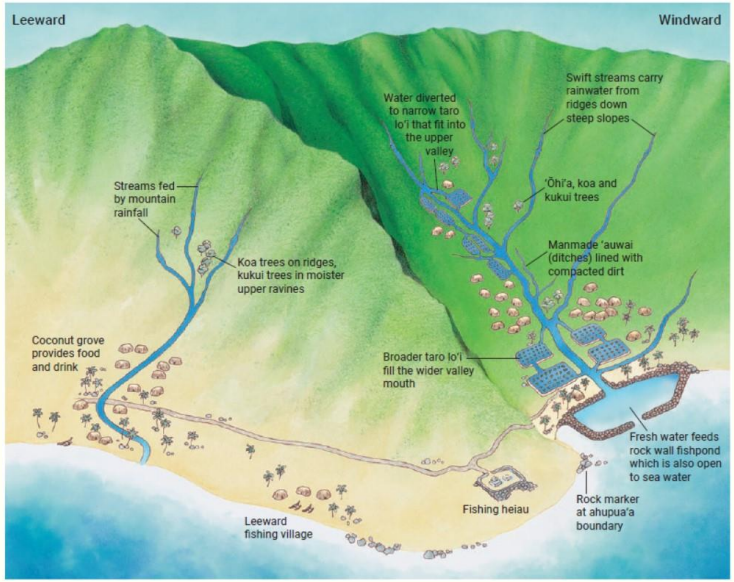
# Community Characteristics

## Natural Systems

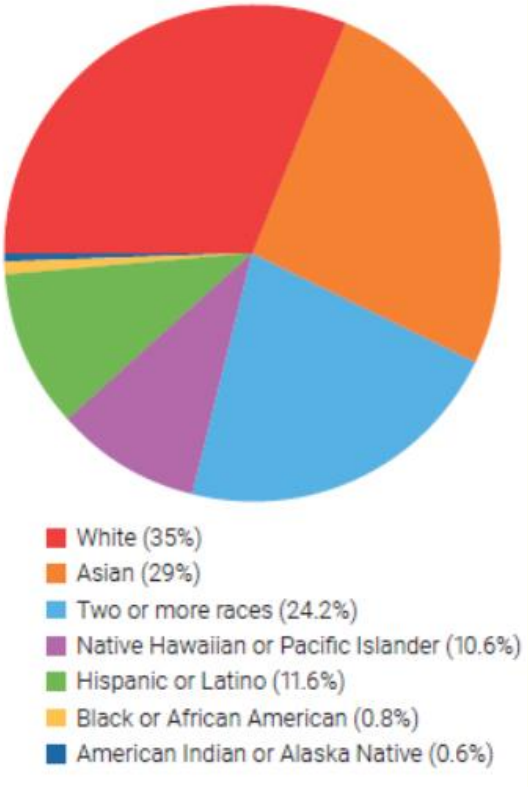
- Early Hawaiians embraced an “island worldview” that treated resources as limited and precious, with rules designed for sustainability.
- Maui County has wet north/east slopes and dry south/west coasts—with microclimates from hot semi-arid to tropical monsoon.
- On Maui, Haiku gets >55 in of rain a year while Wailea/Kihei gets ~7 in.
- The county has extensive coastline: (Maui ~120 mi; Lanai 47; Molokai 88; Kahoolawe 29).



# Community Characteristics

## Demographics

- Age mix and household types shape service needs and evacuation planning
- Population shifts (in/out-migration) change demand for housing, schools, and jobs
- Income vs. cost of living drives affordability stress; many households are cost-burdened
- Renters, multigenerational households, and those in older housing are more exposed to climate shocks

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# Community Characteristics



## Emergency Management

### Flood Risk

- Rainy season: Spring through fall North and East shores see the most precipitation
- Drainage: South and West shores can get standing water after intense rain

### Natural Disasters

- Hurricanes/tropical storms can affect all islands
- Storm-surge exposure affects areas on Maui and Molokai
- Tsunami risk: 61 events in 220 years; annual chance 1–10%.
- Alerts: County system uses a 3-minute tone; sirens tested monthly

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# Community Characteristics

## Infrastructure

- **Energy:** Hawai‘i gets ~35% of its power from renewables (goal 100% by 2045)
- **Water:** Maui’s districts draw from different sources, including surface water, groundwater, ‘Iao Aquifer, plants above Lahainaluna and near Kapalua, wells, and East Maui stream surface water
- **Roads & Transportation:** Coastal roads face sea-level-rise flooding—~13.6 miles at risk. State plans to move vulnerable segments uphill, including 4.5 miles of Honoapiilani Highway.

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# Community Characteristics

## People

**Physical & Mental Health**
Heat and smoke worsen health; disasters interrupt care and power; stress rises

**Economy & Jobs**
Climate events cool tourism, disrupt ag/fisheries, and raise costs; small businesses see downtime

**Vulnerable Populations**
Kupuna, medically fragile, keiki, and low-income renters face higher risks

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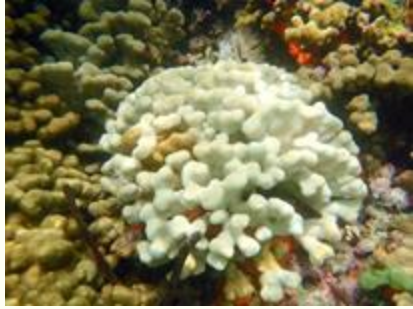
# Vulnerabilities by Community System

# ʻāina and kai



Higher Vulnerability

- **Loss of coral reefs** (*warming waters/acidification/siltation/invasive species*)
- **Harm to beach and shoreline habitats** (*sea level rise/coastal flooding/inundation/erosion*)
- **Harm to watersheds** (*invasive species/pathogens/erosion*)
- **Impacts to groundwater, seeps, springs, and freshwater wetlands** (*larger storms/drought*)
- **Declines in native forest and alpine habitats** (*warming temperatures/precipitation changes/invasive species/drought/wildfire*)
- **Threats to native and endangered species** (*all*)
- **Harm to muliwai (estuaries) and tidal wetlands** (*inundation*)
- **Increase in landslides and erosion along steep slopes** (*larger storms/drought/wildfire/ invasive species*)
- **Negative impacts to anchialine pools** *(precipitation changes/warming waters/storm surge/salinity)*
- **Negative impacts to seabirds and their habitats** *(sea level rise/higher temps/warming waters/ocean acidity/drought/wildfire)*

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# Cultural

Higher Vulnerability

- **Negative impacts to local cultural and spiritual practices and customs** (*all*)
- **Loss of historically and culturally important sites** (*sea level rise/coastal flooding/severe storms*)
- **Risks to food gathering and food production** (*all*)
- **Displacement of kanaka maoli (native people) and destruction of resources leading to loss of identity** (*all*)
- **Out migration displacing kamaʻāina and breaking family bonds** (*all*)
- **In migration furthers cultural divisions** (*climate-driven disruptions in other geographies*)
- **Subsistence fishing at risk** (*acidification/sedimentation/warming water*)
- **Negative impacts to easy-going, outdoor oriented, island way of life** (*all*)

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# Human

Higher Vulnerability

- **Decrease in food access and food security** (*all*)
- **Increase in the overall cost of living** (*all*)
- **Loss of power, water, and communication services during emergencies** (*all*)
- **Negative impacts to mental health** (*all*)
- **Increasing pests and diseases** (*warming temperatures/larger storms*)
- **Social service providers and emergency response overwhelmed** (*all*)
- **Greater difficulty recruiting health care workers** (*all*)
- **Negative impacts to physical health** (*extreme heat/changes in trade winds/wildfire*)
- **Public safety and evacuation challenges** (*larger storms/coastal flooding/wildfire/extreme heat*)

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# Infrastructure

Higher Vulnerability

- **Damage to coastal roads** (*larger storms/coastal flooding/erosion/sea level rise*)
- **Damage to drainage, reservoir, and other infrastructure** (*inadequate systems for larger storms*)
- **Increased disruption of critical supply chains** (*all*)
- **Reduction in groundwater supply** (*drought/larger storms*)
- **Increased risk of electric service disruption in isolated communities** (*larger storms/flooding/landslides*)
- **Buildings at risk** (*all*)
- **Damage to park facilities and restricted beach access** (*SLR/coastal erosion/larger storms*)
- **Impacts to water supply and water infrastructure** (*drought/wildfire/larger storms*)
- **Increased damage to infrastructure** (*wildfire*)
- **Increased damage to utilities** (*larger storms with higher winds*)
- **Increased brownouts** (*higher temperatures/extreme heat*)
- **Increased damage to electric, water and wastewater infrastructure** (*larger storms/inland fl*

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# Economy

Higher Vulnerability

- **Increased risks to agriculture** (*drought/increasing salinity/warmer temps/ invasive species/larger storms*)
- **Government budgets stressed** from cost of climate adaptation and responding to more frequent and severe disruptions (*all*)
- **Household and individual economics harmed** by loss of subsistence lifestyles and resources (*all*)
- **Financial strain on low-wage workers** (*all*)
- **Financial strain on small businesses** (*all*)
- **Financial strain on tourism industry** (*all*)
- **Freshwater supply challenges** (*drought/increasing temperatures/sea level rise*)
- **Coastal businesses and resorts threatened** (*sea level rise/flooding*)
- **Economic harm due to loss of coral reefs and other marine life**
- **Commercial operations at risk of economic shocks** (*larger storms/floods/wildfires/landslides*)
- **Economic harm to agriculture, tourism, and businesses** (*wildfire*)
- **Goals of creating walkable, economically vibrant places increasingly difficult to meet** (*all*)
- **Harm to local fisheries** (*warming water/acidification*)

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# Assessments

**County of Maui Assessments**

- Wastewater infrastructure (Wastewater Reclamation Division)
- Sea Level Rise Vulnerability Assessment for Water Supply Infrastructure (Department of Water Supply)
- Beach Park Vulnerability Assessment (Department of Parks and Recreation)
- Assessment of Coastal Roads for Effects of Climate Change, Sea Level Rise and Shoreline Erosion (Public Works)
- Civic Infrastructure at risk from fire (Emergency Management Agency)
- Groundwater Assessment for Maui Island (Department of Water Supply)

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# Assessments

**Community Assessments**

- Sustainable Molokai – Climate Change and Sea Level Adaptation and Resiliency Plan
- Hawaii Gas – Climate Risk and Mitigation Plan (very early stages)
- Maui Nui Food Alliance Food System - Needs Assessment
- Division of Forestry and Wildlife - Maui Nui Landscape Conservation Plan

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# Additional Stressors

- Remote workers
- Cost of living increases
- Housing cost
- Previous development
- Climate migration

# Community Concerns

## Wildfire Risk and Water Shortages

- **Long-term drying trend:** “Hawai‘i is getting drier… rainfall and streamflow have declined significantly over the past 30 years.” (State climate factsheet).
- **Wildfire:** Analysis of the Aug. 2023 fires highlight the role of pre-existing drought and very low humidity, then winds accelerating spread – warming plus drying set the stage
- **Fire comparison:** Almost 2 years to the date of the Lahaina fires, a portion of Kaanapali hillside burned. In September, 300 acres burned above Paia town.

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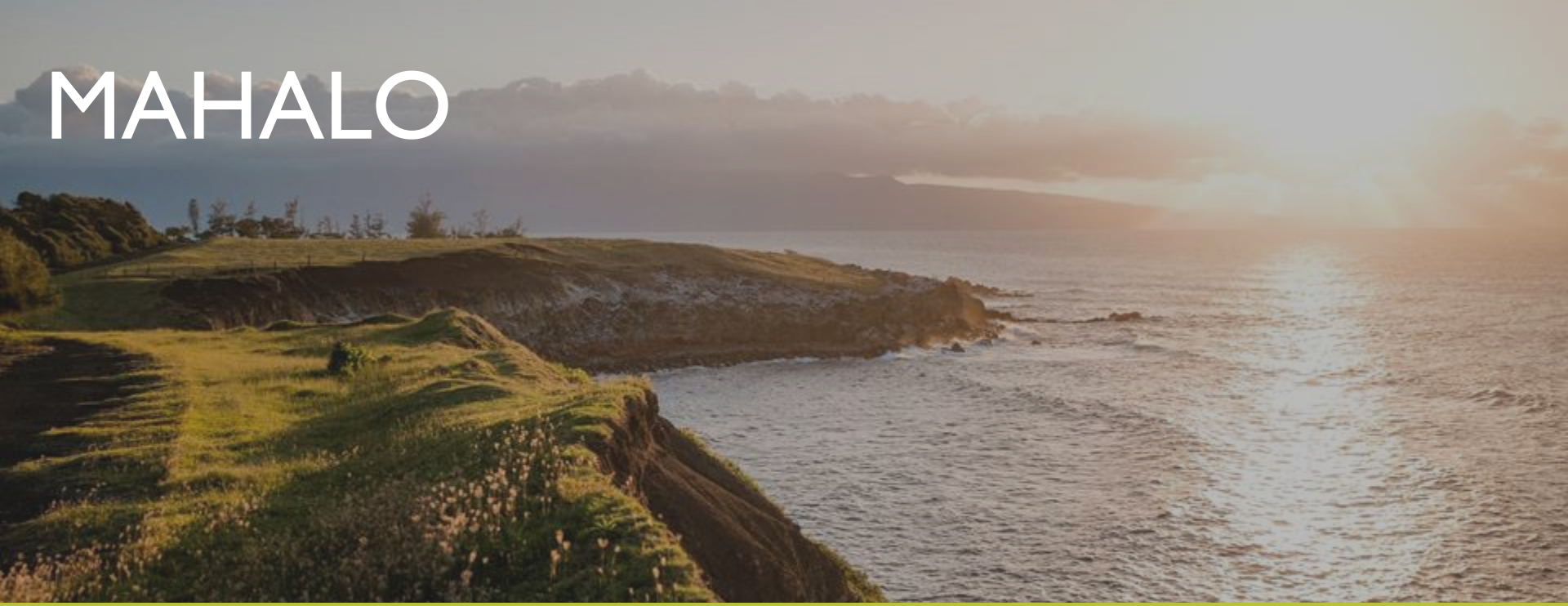
# MAHALO



Tonya Graham – Tonya@GeosInstitute.org
Darla Palmer-Ellingson – Darla@360GreenLiving.com

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