



CORAL RESTORATION PERMITTING FRAMEWORK

Presented by: Bert Weeks

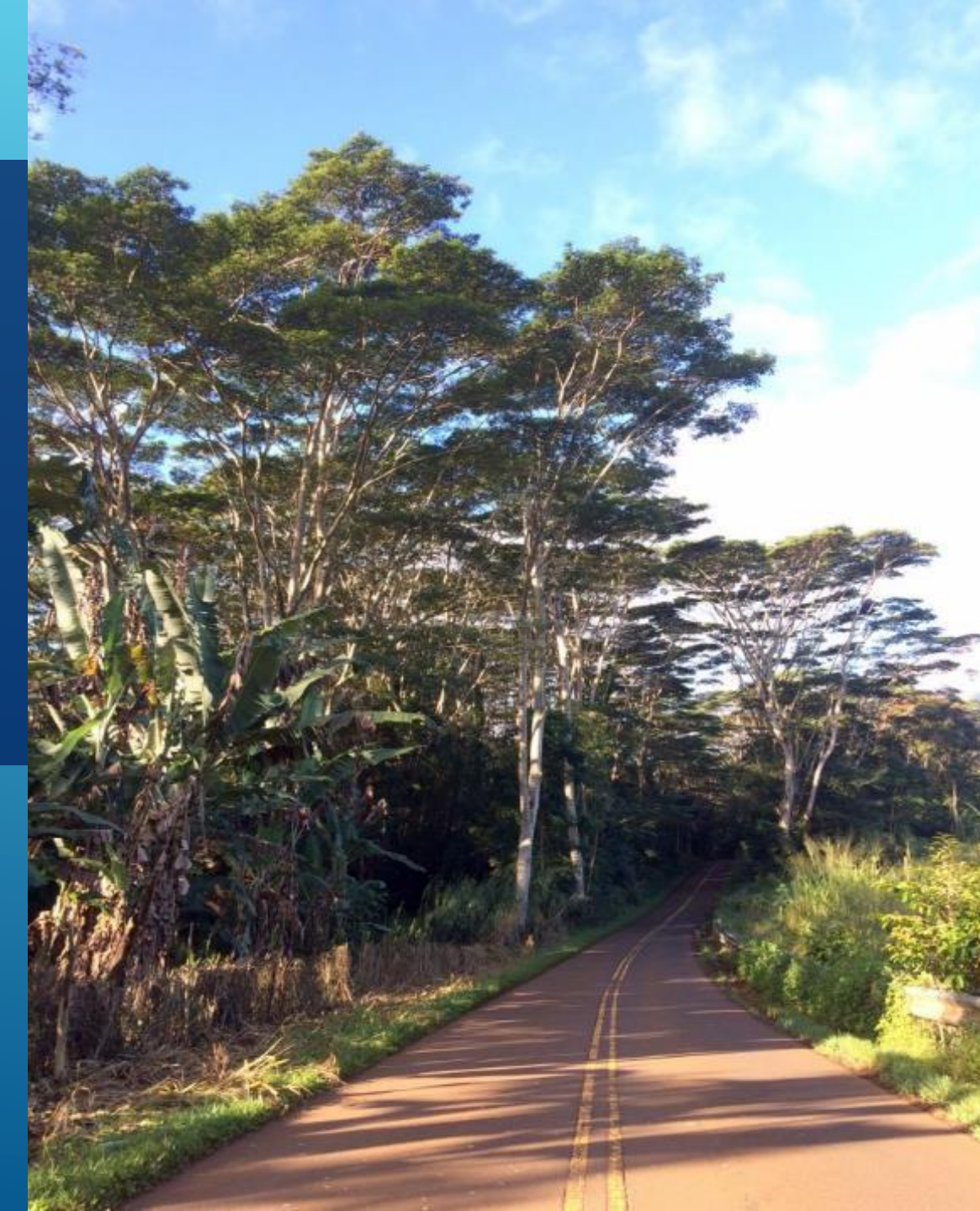
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Hawaii Department of Land and Natural
Resources

Division of Aquatic Resources

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Hawaii 1917: Introduction of Albizia Trees



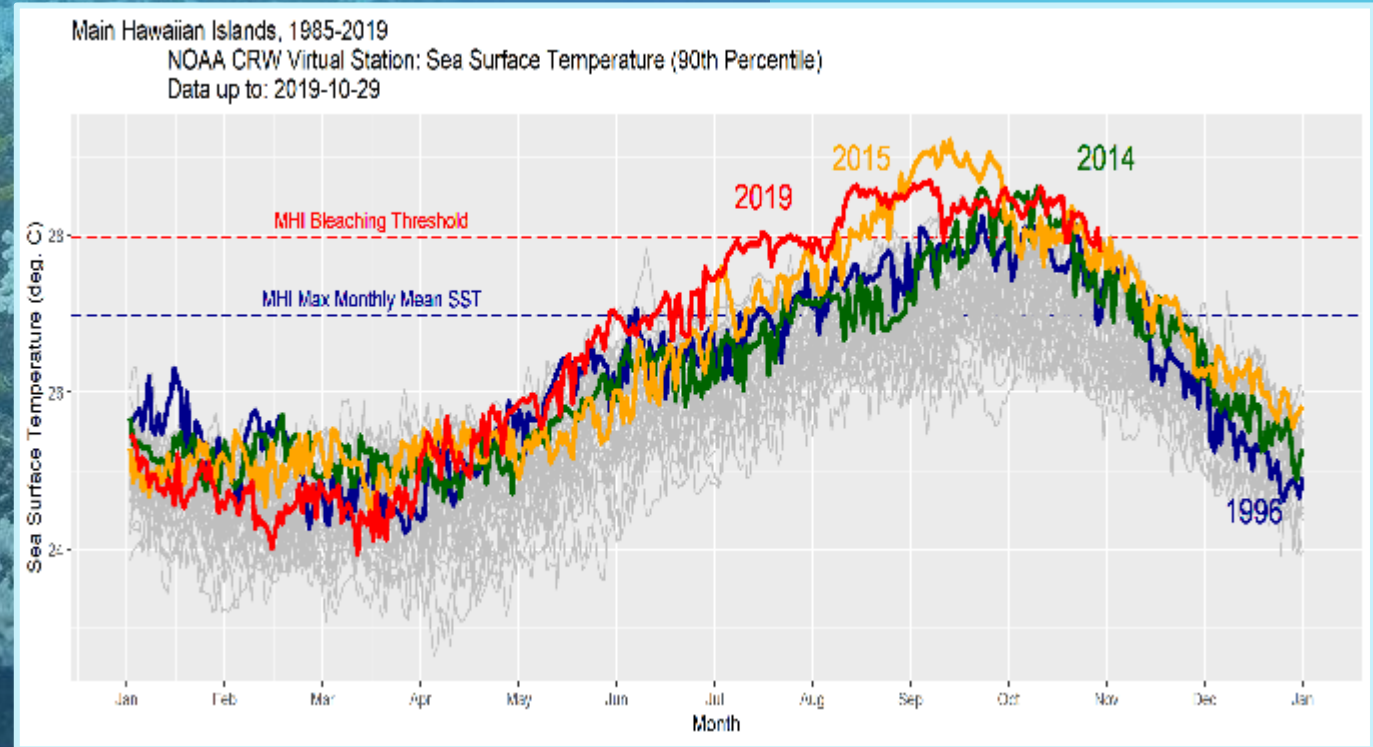
CORALS AS WETLANDS

- ▶ Coastal and marine wetlands include estuarine lakes and lagoons, floodplains, forests, swamps, mangroves, and subtidal seagrasses and coral reefs among many other ecotypes.
- ▶ These wetlands host some of the richest biodiversity on the planet
- ▶ There are hundreds of Wetlands of International Importance (Ramsar Sites) with coral reefs.
- ▶ Hawaii is one of the few places in the US where this wetland ecosystem type is found.

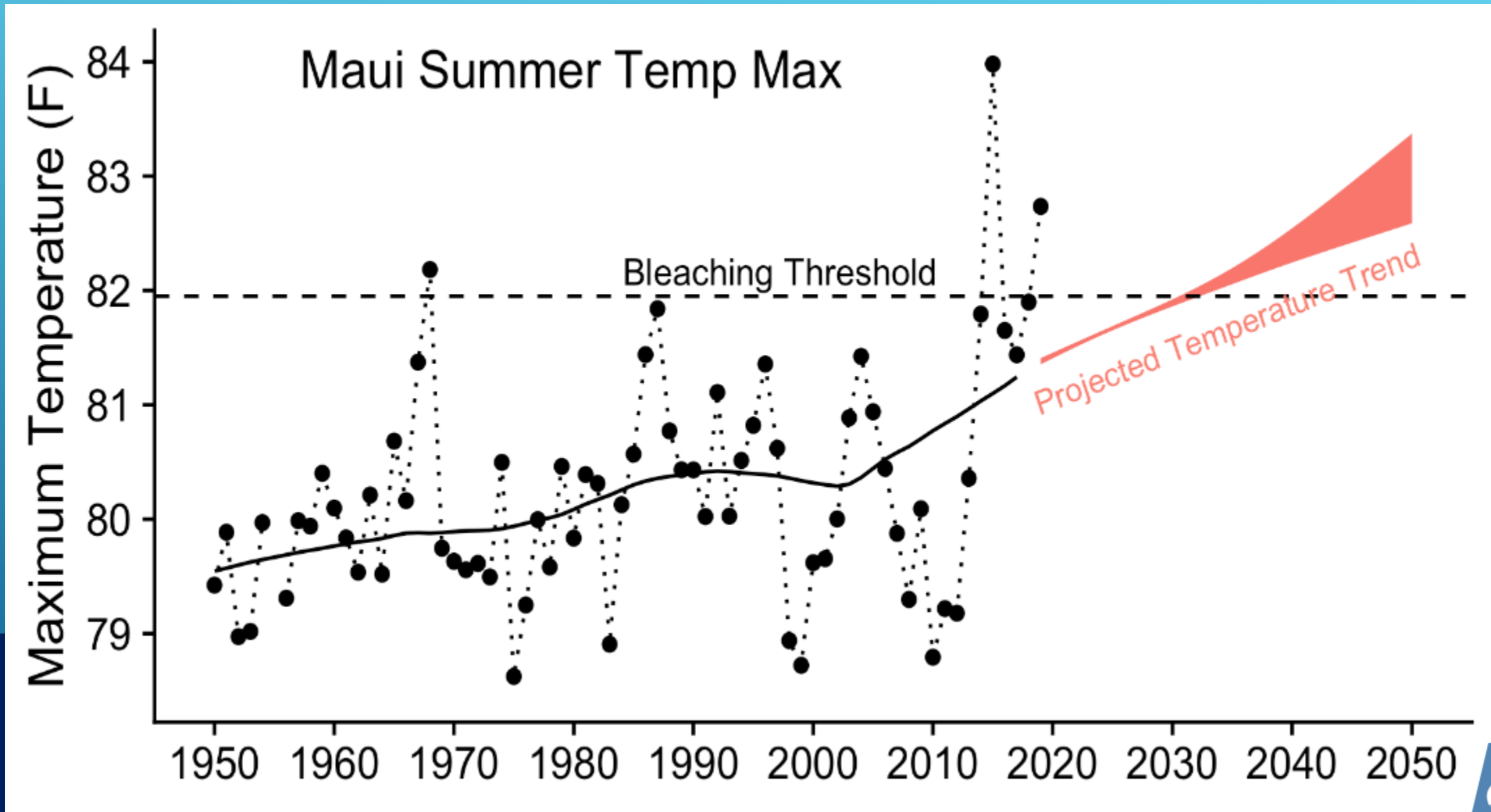


THREATS TO HAWAII'S REEFS:

Bleaching events in
2015, 2016, and 2019



FUTURE BLEACHING PROJECTIONS





WHY ARE CORAL REEFS IMPORTANT?

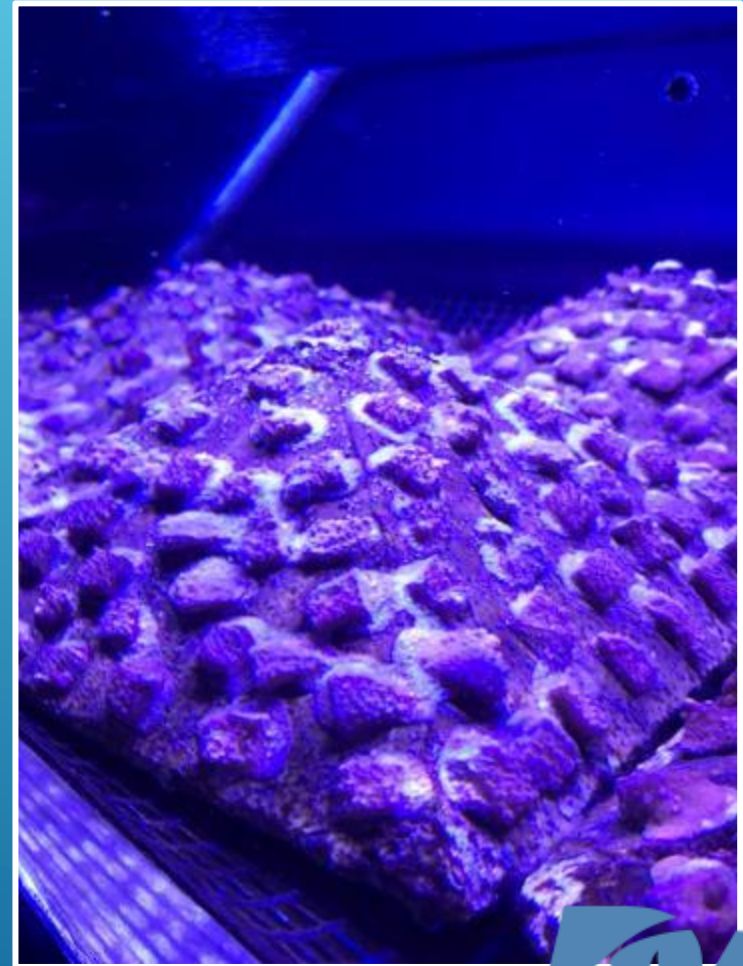


MANAGEMENT EFFORTS

- ▶ Hawaii Coral Reef Strategy 2030
- ▶ Holomua Marine 30x30
 - ▶ Protection and Restoration Pillar

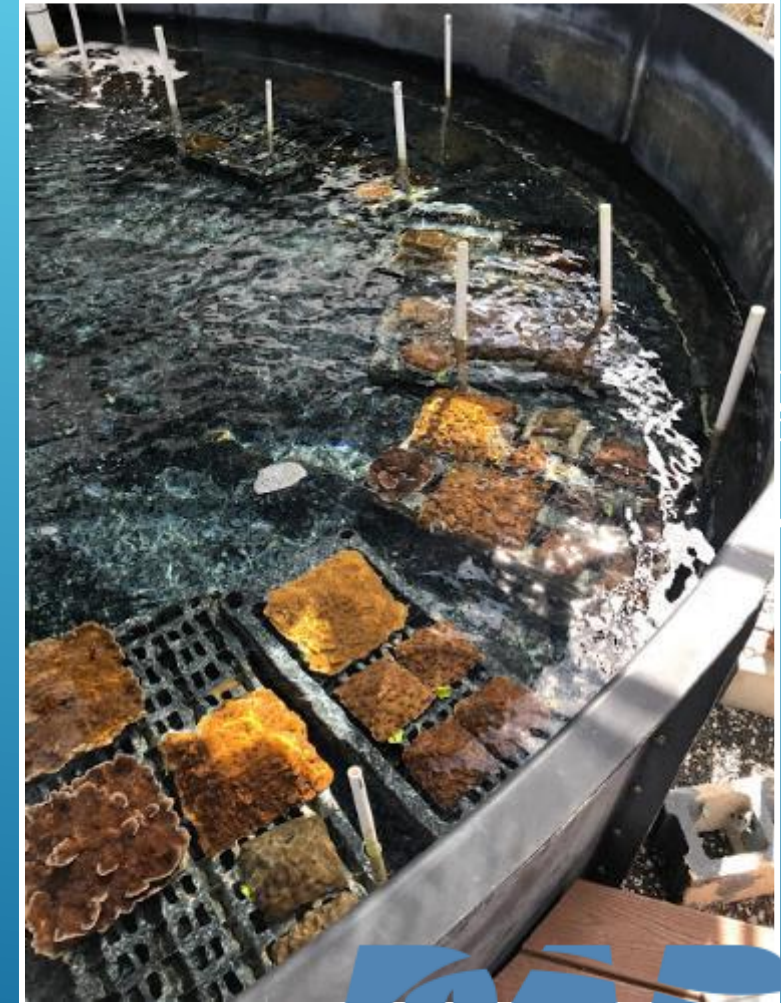


CORAL RESTORATION



PROBLEM

- ▶ Increase in interest of coral restoration projects
- ▶ Permitting system is not equipped to handle this influx



SOLUTION:

Create a permitting framework for coral restoration

GOAL:

“A transparent and efficient way to evaluate coral restoration permits guided by the best available science”





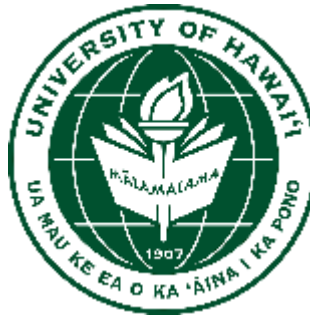
PROJECT OUTCOMES

- ▶ Establish scientific advisory board
- ▶ Create a decision making framework for both restoration methods and site selection
- ▶ Refine and update the Wetland Program Plan's Hawai'i Coral Reef Strategy and develop a new wetland program plan



SCIENTIFIC ADVISORY BOARD: TIER 1

- ▶ Hawaii Department of Natural Resources Division of Aquatic Resources
- ▶ National Oceanic and Atmospheric Administration
- ▶ Hawaii Institute of Marine Biology
- ▶ University of Hawaii at Mānoa
- ▶ US Fish and Wildlife Service
- ▶ The Nature Conservancy



SCIENTIFIC ADVISORY BOARD

Process for Framework Development

Workshop 1 with Scientific Advisory Board (Tier 1) to establish process, methods list

Methods listings vetted by Board of DAR staff (Tier 2)

Workshops 2 & 3 with Tier 1, followed by review with Tier 2

Final decisions about framework criteria from Tier 2

Share out with Scientific Advisory Board and community



CORAL RESTORATION METHODS:

GENETIC MANIPULATION

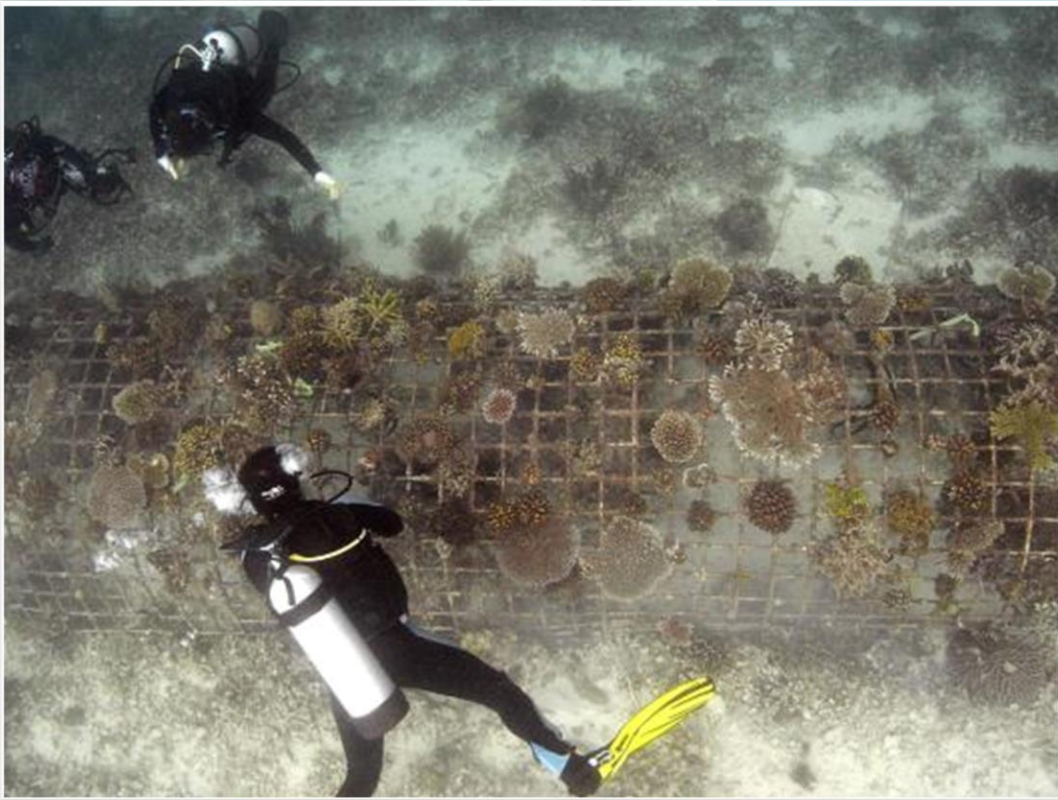
- ▶ GMO Coral
- ▶ Selective Breeding
- ▶ Selective Collection
- ▶ Assisted Migration
- ▶ Cryopreservation
- ▶ Genetic Archiving
- ▶ Live samples/
aquaculture



CORAL RESTORATION METHODS:

ENVIRONMENTAL INTERVENTION

- ▶ Bio-rock
- ▶ Live rock/CCA
- ▶ Artificial Structures



CORAL RESTORATION METHODS

PHYSIOLOGICAL INTERVENTIONS

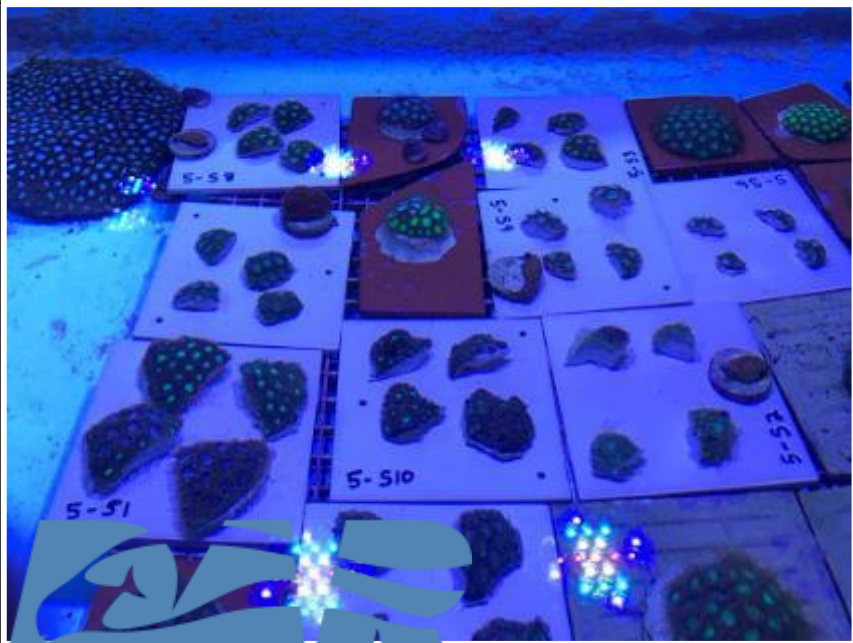
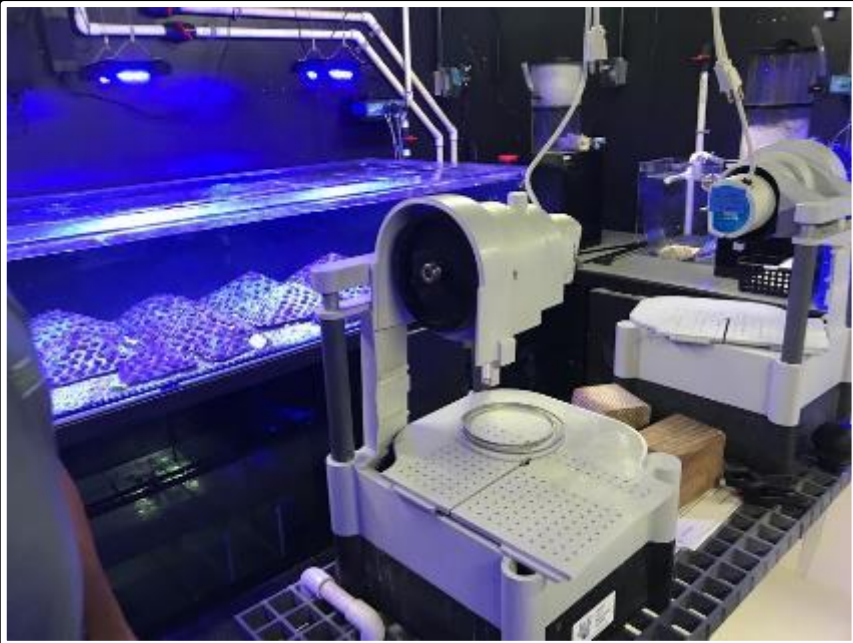
- ▶ Probiotics
- ▶ Phage Therapy
- ▶ Antibiotics
- ▶ Climatization



CORAL RESTORATION METHODS

PHYSIOLOGICAL INTERVENTIONS

- ▶ Nurseries In-Situ
- ▶ Nurseries Ex Situ
- ▶ Translocation
- ▶ Importation
- ▶ Fragmentation/Micro-fragmentation
- ▶ Larval Seeding
- ▶ Transplantation
- ▶ Outplanting/Gardening
- ▶ Introduction





CORAL RESTORATION METHODS

DESIGNATION SCALE

- ▶ Green- methods with lowest risk, standard review
- ▶ Yellow-moderate risk, requires additional review
- ▶ Red-high risk, requires the most review, indicates experimental methods



CORAL RESTORATION METHODS

method				location			
		field	lab	bays	island sector	inter-island	outside HI
Genetic Manipulation	GMO coral	red	green	red	red	red	red
	selective breeding	yellow	green	yellow	yellow	yellow	red
	selective collection	yellow	green	n/a	n/a	n/a	n/a
	assisted migration	red	green	yellow	red	red	red
	cryopresevation	yellow	green	green	green	green	green
	genetic archiving	green	green	green	green	green	green
	live samples/aquaculture	yellow	green	green	yellow	yellow	red
Environmental Intervention	bio-rock	yellow	green	n/a	n/a	n/a	n/a
	live rock/cca	yellow	green	n/a	n/a	n/a	n/a
	artificial structures	yellow	green	n/a	n/a	n/a	n/a
Physiological Intervention	probiotics	red	yellow	red	red	red	red
	phage therapy	red	red	red	red	red	red
	antibiotics	red	yellow	red	red	red	red
	climatization	yellow	green	yellow	yellow	yellow	yellow
Physical	nurseries in situ	green	n/a	n/a	n/a	n/a	n/a
	nurseries ex situ	n/a	green	n/a	n/a	n/a	n/a
	translocation	yellow	green	yellow	yellow	red	red
	importation	red	red	red	red	red	red
	fragmentation/micro-frag	green	green	green	yellow	red	red
	larval seeding	yellow	green	yellow	yellow	red	red
	transplantation	yellow	green	green	yellow	red	red
	out planting/gardening	yellow	green	green	yellow	red	red
	introduction	red	red	red	red	red	red



ADVANCEMENT OF RESTORATION TECHNOLOGIES & EVALUATIONS OF FUTURE METHODS

- ▶ Need to reassess categorizations after 3-5 year
- ▶ Emergency response to catastrophic circumstances

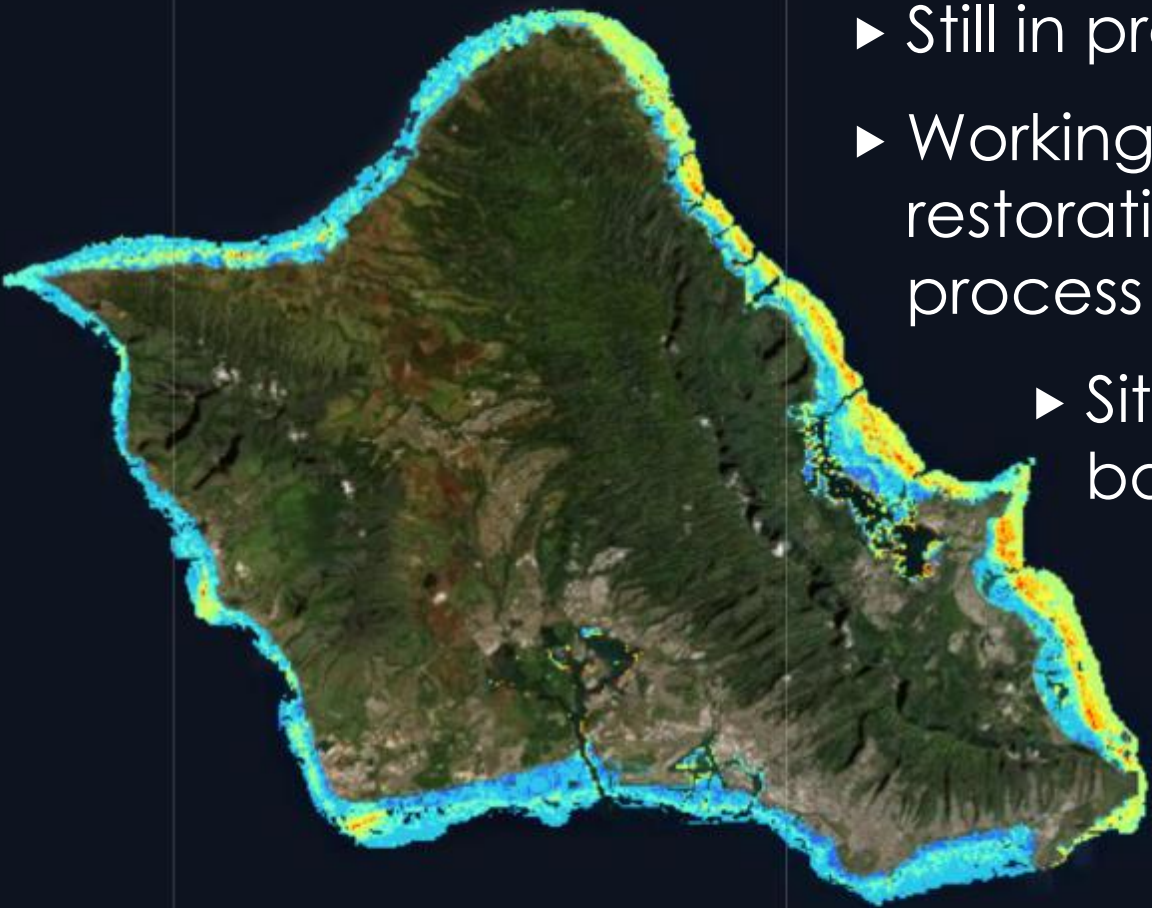


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- or use <Shift>-drag to zoom

Home
Full Screen



LOCATION CRITERIA



- ▶ Still in progress
- ▶ Working with TNC-led restoration planning process
- ▶ Sites assessment based on:
 - Climate Projections
 - Site Vulnerability
 - Human Impacts

absolute | scaled

All Coral Species

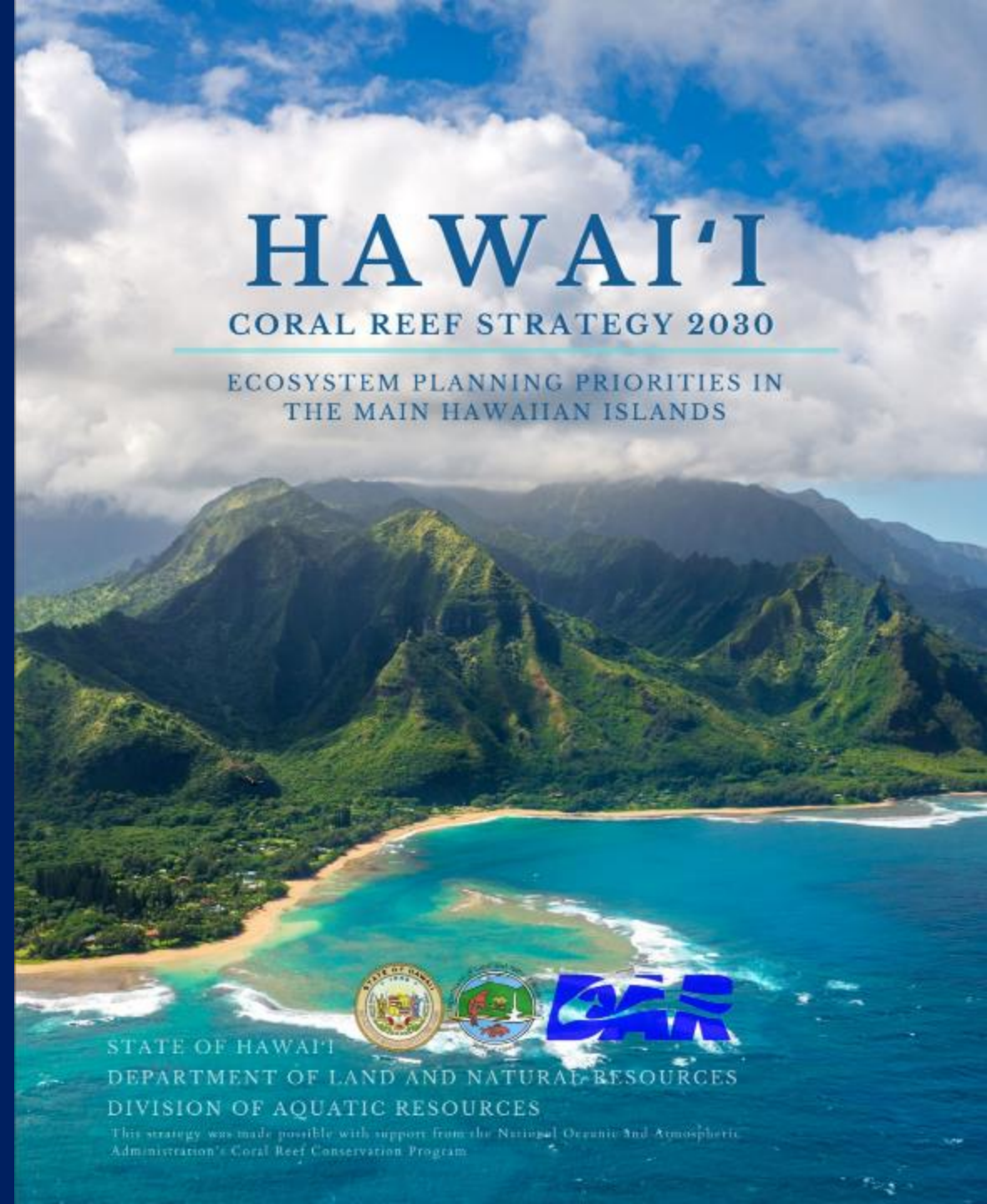
75 - 100
50 - 75
40 - 50
30 - 40
20 - 30
10 - 20
5 - 10
1 - 5
0 - 1

Percent Cover

10 km
5 mi

HAWAII WETLANDS PLAN

1. HCRS 2030: Makai Restoration [[PDF](#)]
2. Wetland Plan: Anchialine Pools & Estuaries



HAWAII

CORAL REEF STRATEGY 2030

ECOSYSTEM PLANNING PRIORITIES IN
THE MAIN HAWAIIAN ISLANDS



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES

This strategy was made possible with support from the National Oceanic and Atmospheric Administration's Coral Reef Conservation Program.



NEXT STEPS

- ▶ Community and cultural based criteria for restoration projects
- ▶ Outreach and education to permit applicants
- ▶ Continue developing Wetland Program Plan with DOFAW
- ▶ Expand WPP to include HI wetland ecotypes
- ▶ Coordinate with stakeholders & resource managers



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DAR Staff

Scientific Advisory Board

The Nature Conservancy

Symbioseas

CONCLUSIONS & QUESTIONS

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Photo: Marvin Chandra, Flickr

