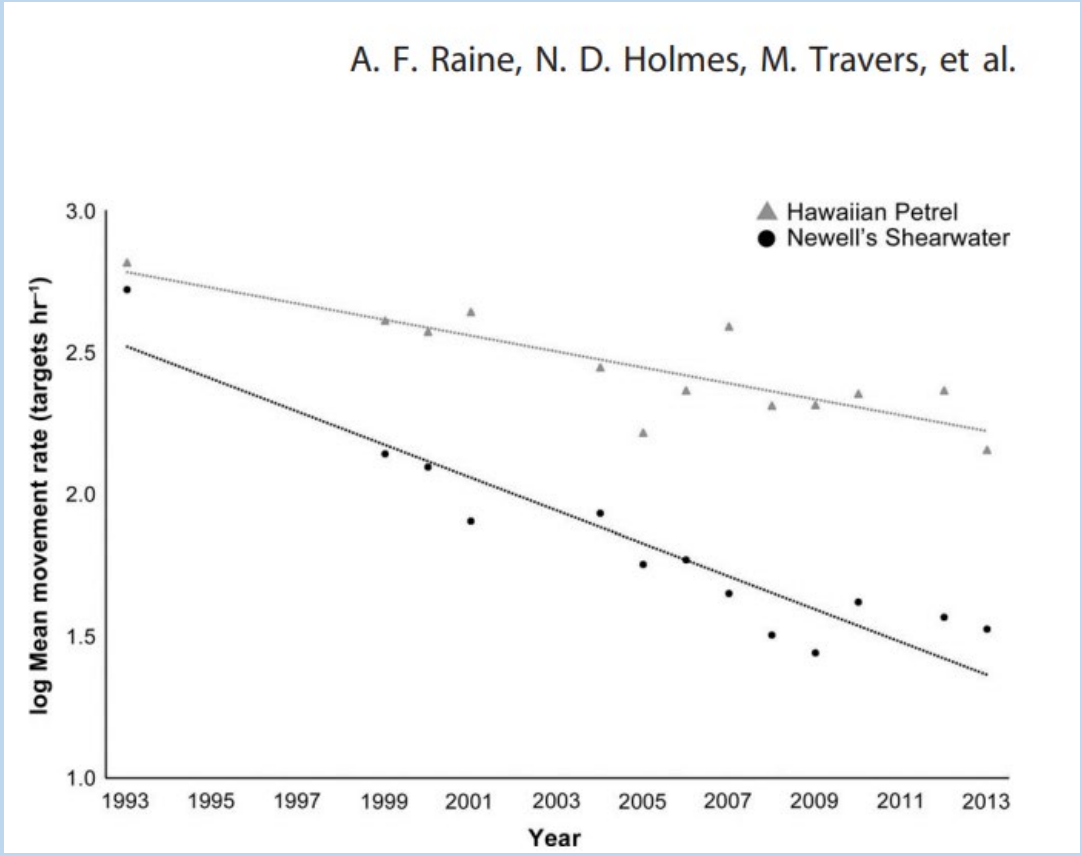
Seabird Recovery

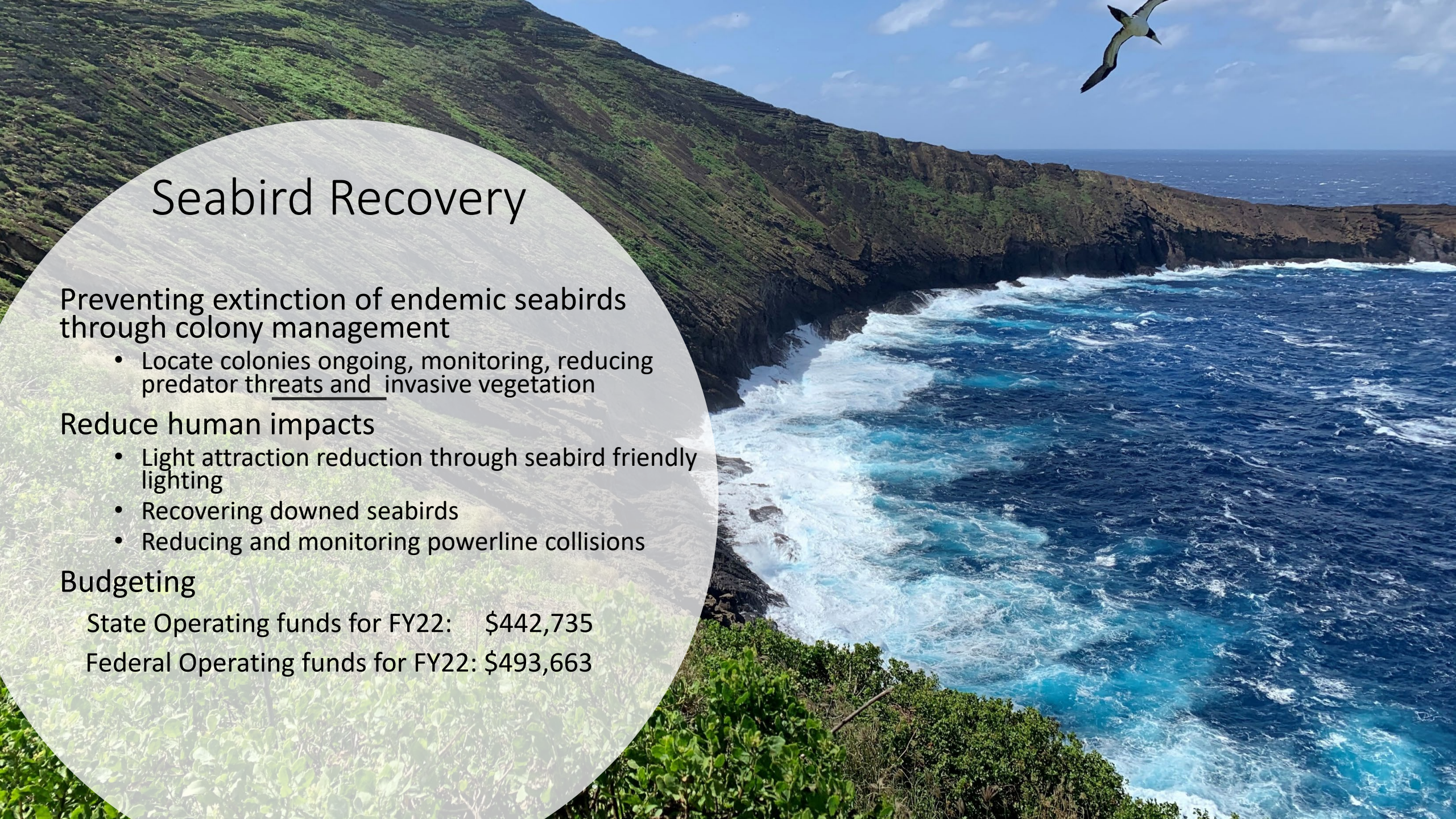
- Kauai Seabird Recovery
- Lehua Island
- Maui Nui Seabird Recovery
- Big Island Seabird
- Oahu off-shore islands

Listed Species of seabirds

- **Newell's shearwater or A'o** (*Puffinus newelli*)
  - Federal & State Status: threatened
  - IUCN listed as critically endangered
- **Hawaiian petrel or 'Ua'u** (*Pterodroma sandwichensis*)
  - Federal, State and IUCN listing: endangered

- **Band-rumped storm petrel** or **'Ake 'ake** (*Oceanodroma castro*)
  - Federal & State Status: endangered





Seabird Recovery

Preventing extinction of endemic seabirds through colony management

- Locate colonies ongoing, monitoring, reducing predator threats and invasive vegetation

Reduce human impacts

- Light attraction reduction through seabird friendly lighting
- Recovering downed seabirds
- Reducing and monitoring powerline collisions

Budgeting

State Operating funds for FY22: $442,735

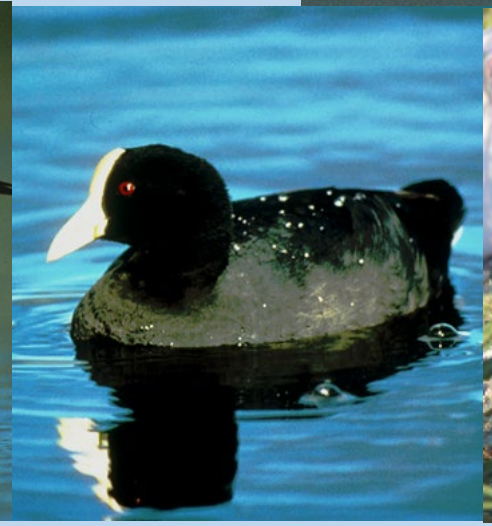
Federal Operating funds for FY22: $493,663

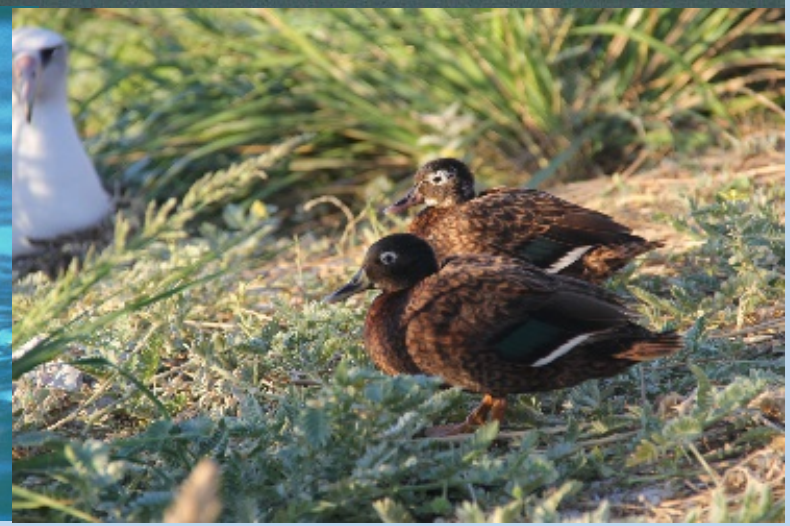
Waterbird Recovery

- Wetland Restoration
- Endangered Species recovery

Listed species of waterfowl and waterbirds

- Nēnē or Hawaiian Goose, (*Branta sandvicensis)*
- Aeʻo or Hawaiian Stilt, (*Himantopus mexicanus knudseni)*
- Koloa Maoli or Hawaiian Duck, (*Anas wyvillian)*
- ʻAlae Keʻokeʻo or Hawaiian Coot, (*Fulica alai)*
- ʻAlae ʻUla or Hawaiian Gallinule, (*Gallinula chloropus sandvicensis)*
- Laysan Duck (*Anas laysanensis*)





Waterbird Recovery

Preventing extinction of endemic waterbirds through wetland management

- monitoring, reducing predator threats and invasive vegetation

Wetlands require long-term funding for maintenance and management

Wetlands provides ecosystem services such as reduction of water pollution and a safe haven for endangered waterbirds and plants.

Budgeting

State Operating funds for FY22: $183,971
Federal Operating funds for FY22: $239,250
Maui CIP for Kanaha Pond Predator fence:
State $300,000 Federal $932,868

Lehua Island

284-acre Wildlife Sanctuary

April 2021 rat free

<u>Next Phase includes:</u>

- Plant restoration
- Endangered species attraction through competitive grant funds
- Biosecurity
- Long-term funding needed

CIP needs

Lehua Facility Improvements

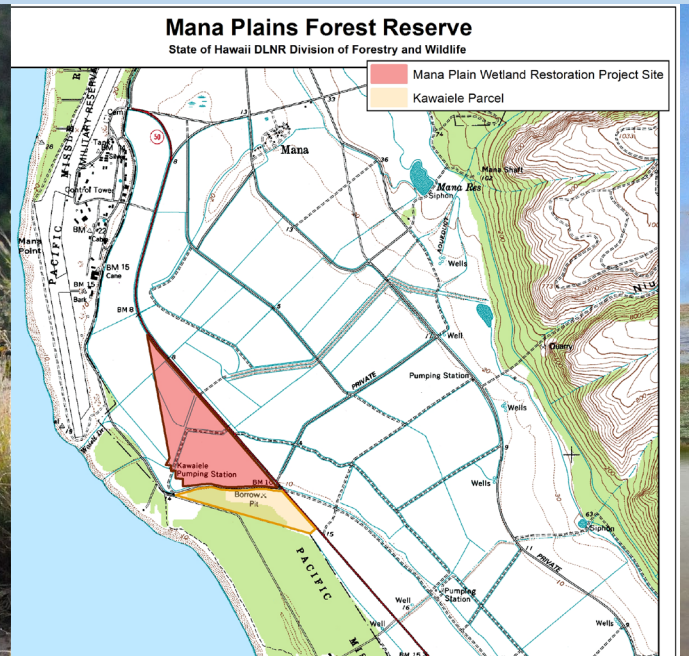
$60,000

Kanaha Pond Wildlife Sanctuary

- A 240-acre wetland site on the island of Maui.
- The wetland provides ecosystem services such as reduction of water pollution and a safe haven for endangered waterbirds and plants.
- DOFAW received competitive federal funds and CIP funds to replace the existing fence with a predator exclusion fence, would be the largest of it's kind in Hawaii
- Additional funds needed to complete project. CIP request: $700,000

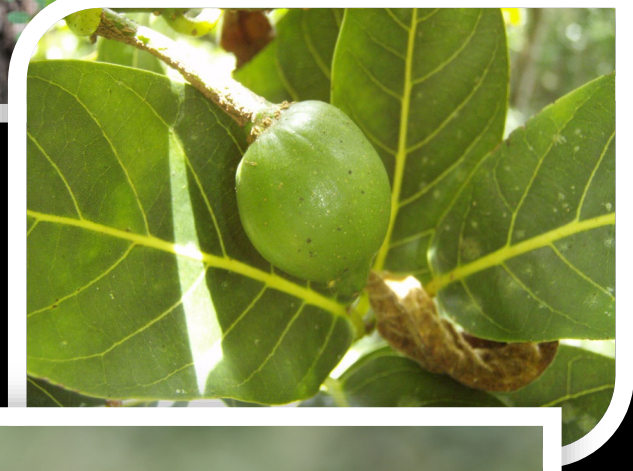
Mana Plains

- A 105-acre wetland site on the island of Kauai.
- Once restored the marsh will provide ecosystem services such as reduction of water pollution and a safe haven for endangered waterbirds and plants.
- PHASE 1: DOFAW received competitive federal funds to restore the wetland which is currently overgrown with invasive species.
- CIP request: $400,000 for Phase II & III, to complete the impoundment and water delivery system into the new 105 acre



Maunakea Uau and Silversword Fence

- CIP request: $160,000 for fence
- May 2021, the first 'Ua'u was discovered on Maunakea since 1954.
- Project would also protect endangered silversword populations.



Department of Land and Natural Resources
State of Hawaii

FORESTRY AND WILDLIFE
HAWAII

PC: DOFAW Josh VandeMark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i‘i

PC: DOFAW Josh VandeMark


PC: DOFAW Adam Williams

PC: Hawai‘i Volcanoes National Park


Kāhuli
O`ahu Tree Snails

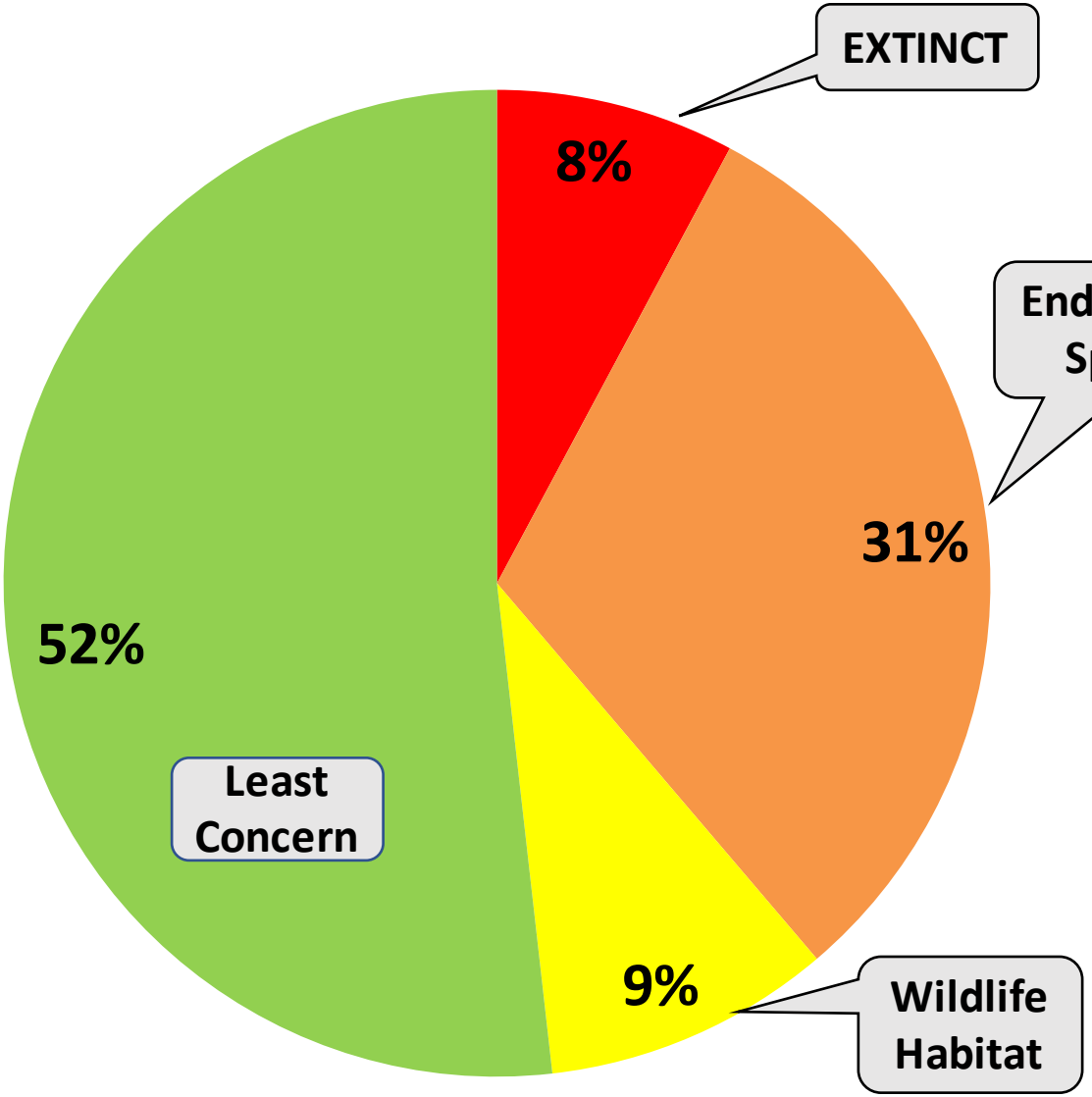

O`ahu `Elepaio

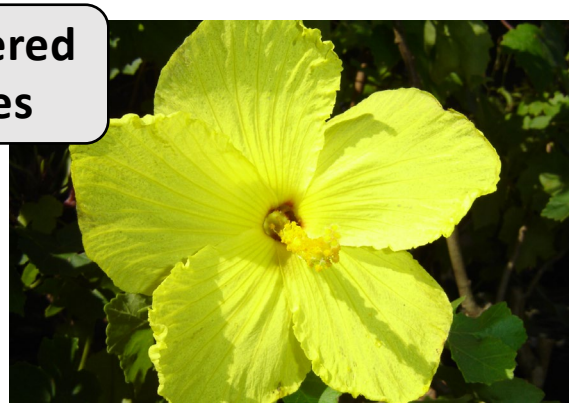
EXTINCT SPECIES

CYANEA GIFFARDII Rock

This rare and curious Lobeliaceæ was photographed in the rainforests near 23 miles, along the Volcano of Kilauea road, Hawaii; elevation, 2500 feet.

Hawaii‘s native plants are in urgent need of conservation





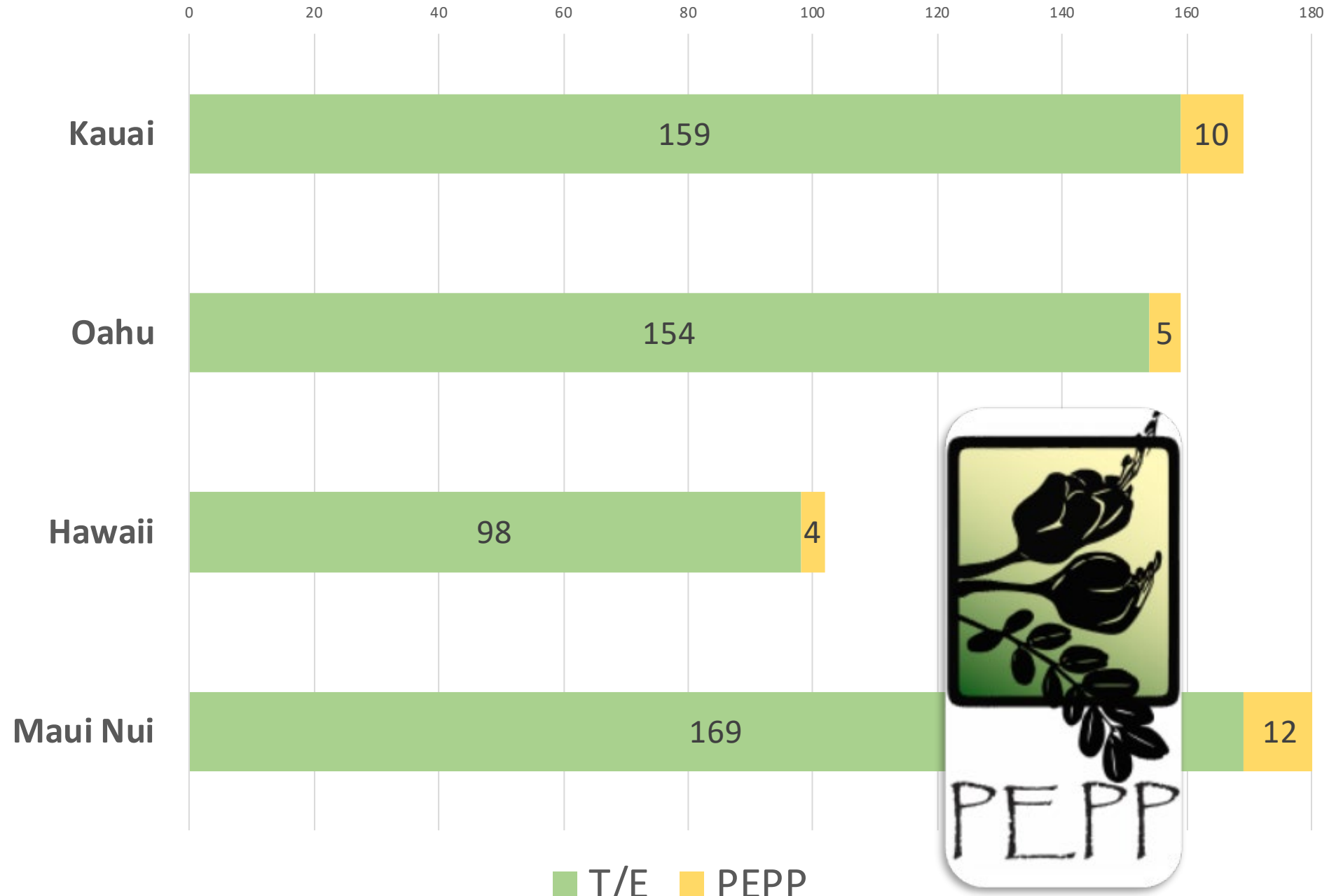
Hawai‘i has over 450 federally listed Endangered plants!

Number of federally listed threatened or endangered plants by state (USFWS, 2021)

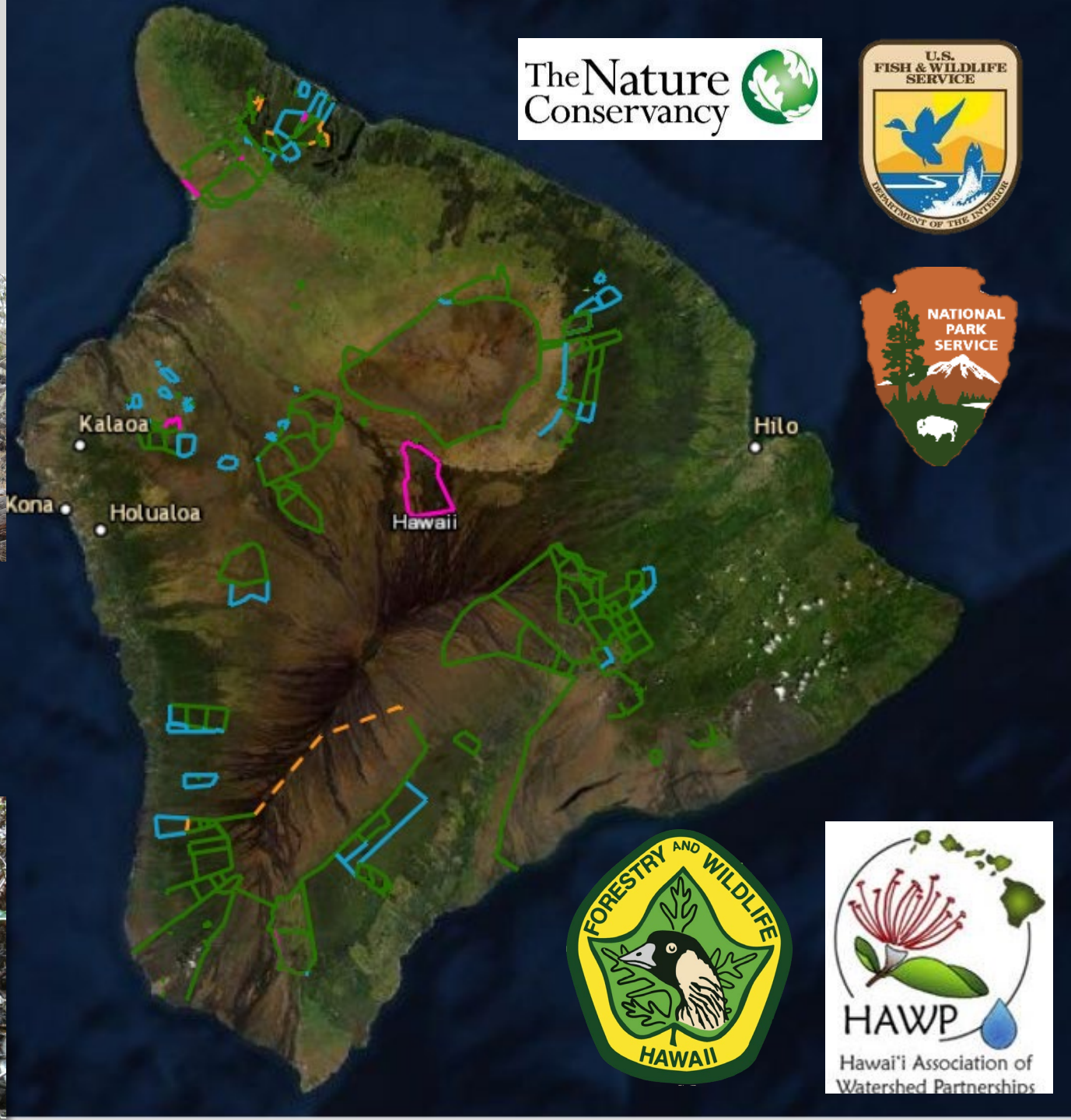
***Argyroxiphium sandwicense* subsp. *macrocephalum* (Asteraceae)**
Haleakala National Park, Maui

***Brighamia rockii* (Campanulaceae)**
Moloka‘i

Number of rare plants by district



Threat Control



The Nature Conservancy

U.S. Fish & Wildlife Service

National Park Service

Forestry and Wildlife Hawaii

HAWP
Hawai'i Association of Watershed Partnerships

ANIMALS

WEEDS

RATS

SLUGS






Pritchardia kaalae

Seed Storage

Delissea kauaiensis

Cyanea augustifolia

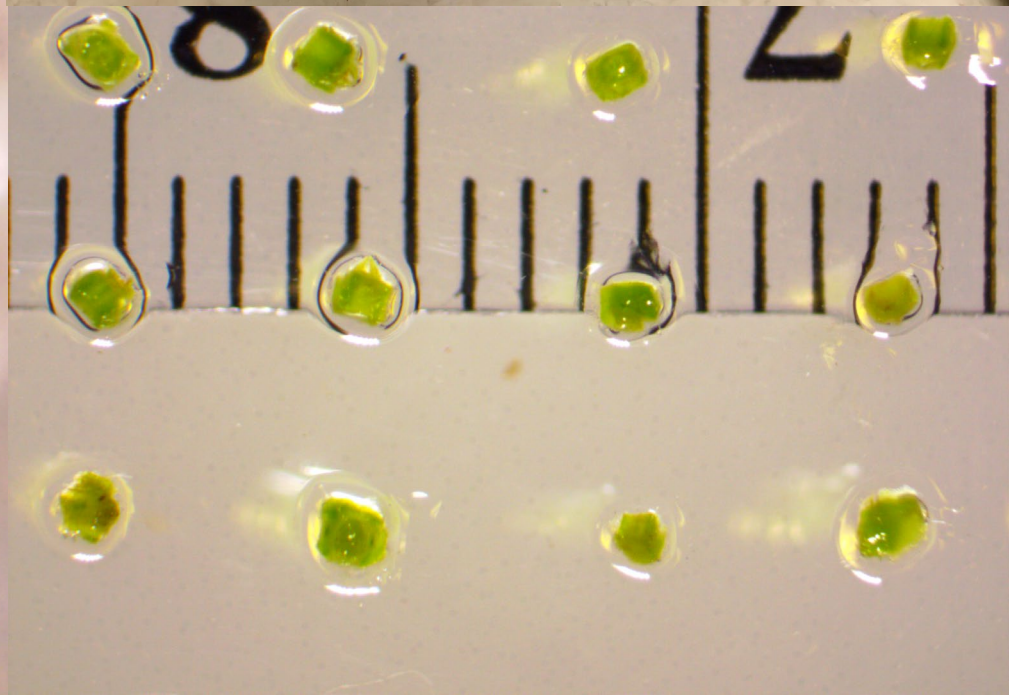
Brighamia insignis

Lobelia gaudichaudii

CIP Requests: D109, D129, D177

Cryogenic Storage

LYON ARBORETUM



Kanaloa kahoolawensis

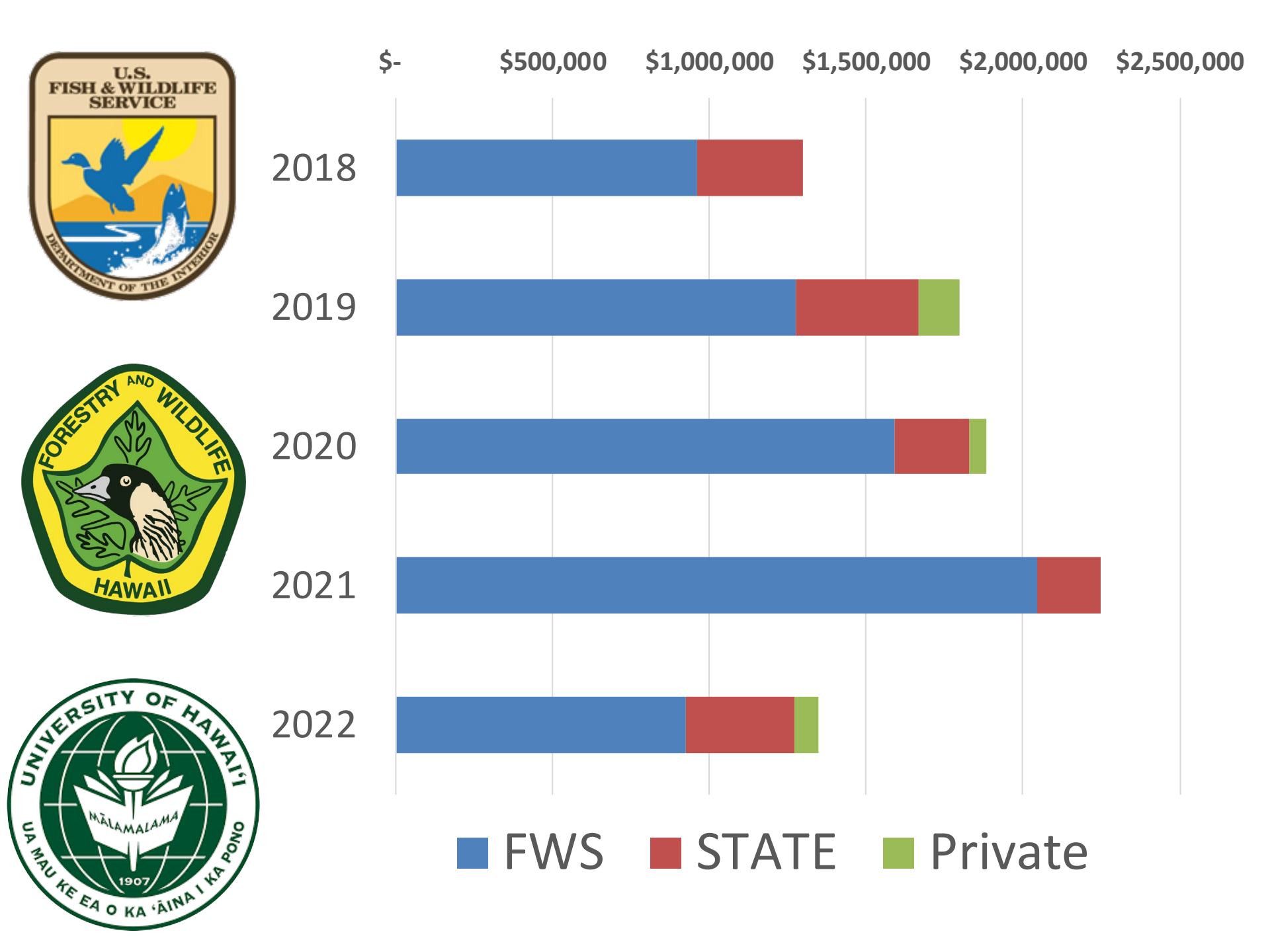
Discovered: Kahoolawe 1992
Listed Endangered in 1999
Threats: Extinct in the Wild

1999: 2 wild plants
2007: 1 wild plants
2014: 0 wild plants

2019: 2 in cultivation on Maui
2021: 20 in cultivation

Needs: Nursery infrastructure, increased staffing

Nurseries: Kauai, Oahu, Maui, Hawaii Isle


$-
$500,000
$1,000,000
$1,500,000
$2,000,000
$2,500,000
2018
2019
2020
2021
2022
FWS
STATE
Private

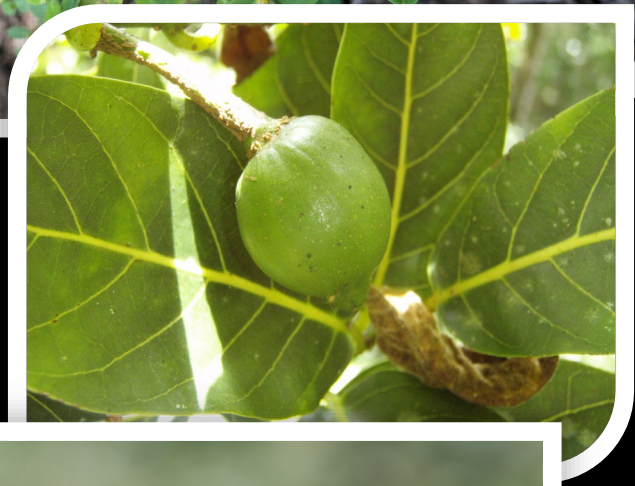
- Extinction rate for plants is increasing
- Timely intervention prevents extinction
- New technology: drones, seed banking, cryogenics

- ❑ Increased frequency/intensity of wildfire
- ❑ Increased frequency/intensity of storms
- ❑ Biosecurity

→ Maximize Federal funding for plants (RAWA)

→ Hawaii CIP Requests D109, D129, D177




Matt Keir
Botanist
DLNR-DOFAW
Matthew.J.Keir@hawaii.gov

Hawaiian Forest Birds – an extinction crisis

Proposed delisting of 8 Hawaiian forest birds due to extinction

Species Name	Last Confirmed Sighting
Kauai akialoa	1969
Kauai nukupuu	1899
Kauaʻi ʻōʻō	1987
Kamao (Large Kauai thrush)	1987
Maui ākepa	1988
Maui nukupuʻu	1996
Kākāwahie (Molokai creeper)	1963
Po`ouli	2004

Over 50 species of honeycreepers prior to human arrival

Now only 17 remain

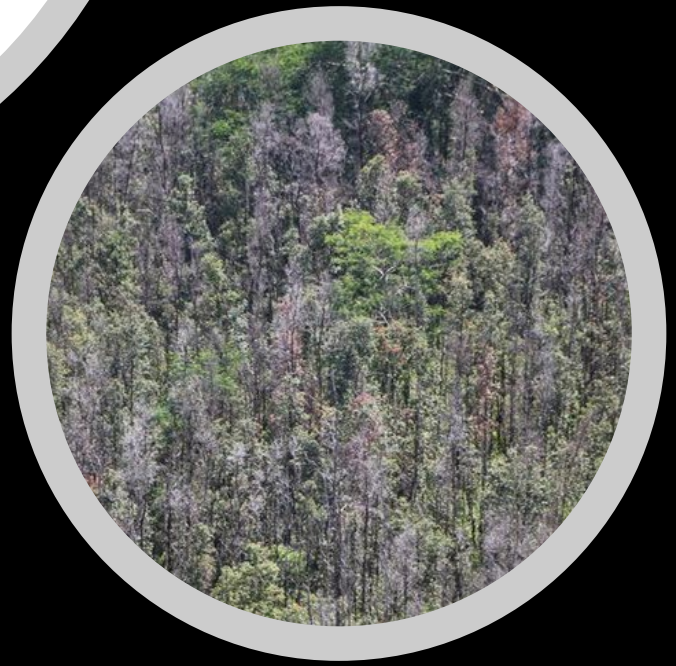
Majority of remaining are threatened or endangered

The Most Endangered Hawaiian Honeycreepers

Kiwikiu	ʻAkikiki	Palila	ʻAkekeʻe	ʻĀkohekohe	ʻAkiapōlāʻau
~150 Individuals	Less than 100 individuals	~1,050 Individuals	~1,160 Individuals	~1,750 Individuals	~1,900 Individuals

Other threatened and declining honeycreepers

Threats to the Forest Birds



- Habitat loss and degradation
- Rapid ‘Ohia Death
- Introduced predators: rats, cats, mongooses
- Introduced mosquito-borne diseases

Culex quinquefasciatus


Last Refugia

Importance of Hawaiian Forest Birds

- Uniqueness and diversity of this group
- Symbolic species
- Plants and birds have coevolved
- Importance of these birds to Hawaiian culture

Paxton et al. 2018. *Research and management priorities for Hawaiian forest birds*

- Protect Key Habitat for Forest Birds
- Implement Landscape-Level Mosquito Control Program
- Understand the Genetic Basis of Disease Immunity
- Assess the Efficacy of Predator Control
- Conduct Reintroductions and Translocations to Achieve Conservation Goals
- Strengthen Captive Breeding Capacity
- Reassess Monitoring Strategies
- Establish a Hawaii Forest Bird Leadership Group

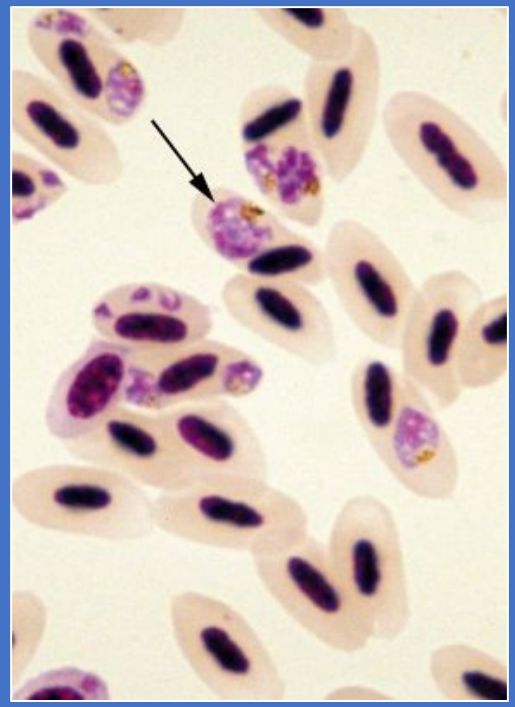
Introduced Mosquitoes and Malaria

- All mosquitoes are non-native to HI
- Southern House Mosquito introduced in 1826 (Lahaina)
- Avian malaria introduced early 20th century
- Leads to rapid mortality of honeycreepers
- Mosquitoes and malaria parasite are cold intolerant

J. Jeffrey

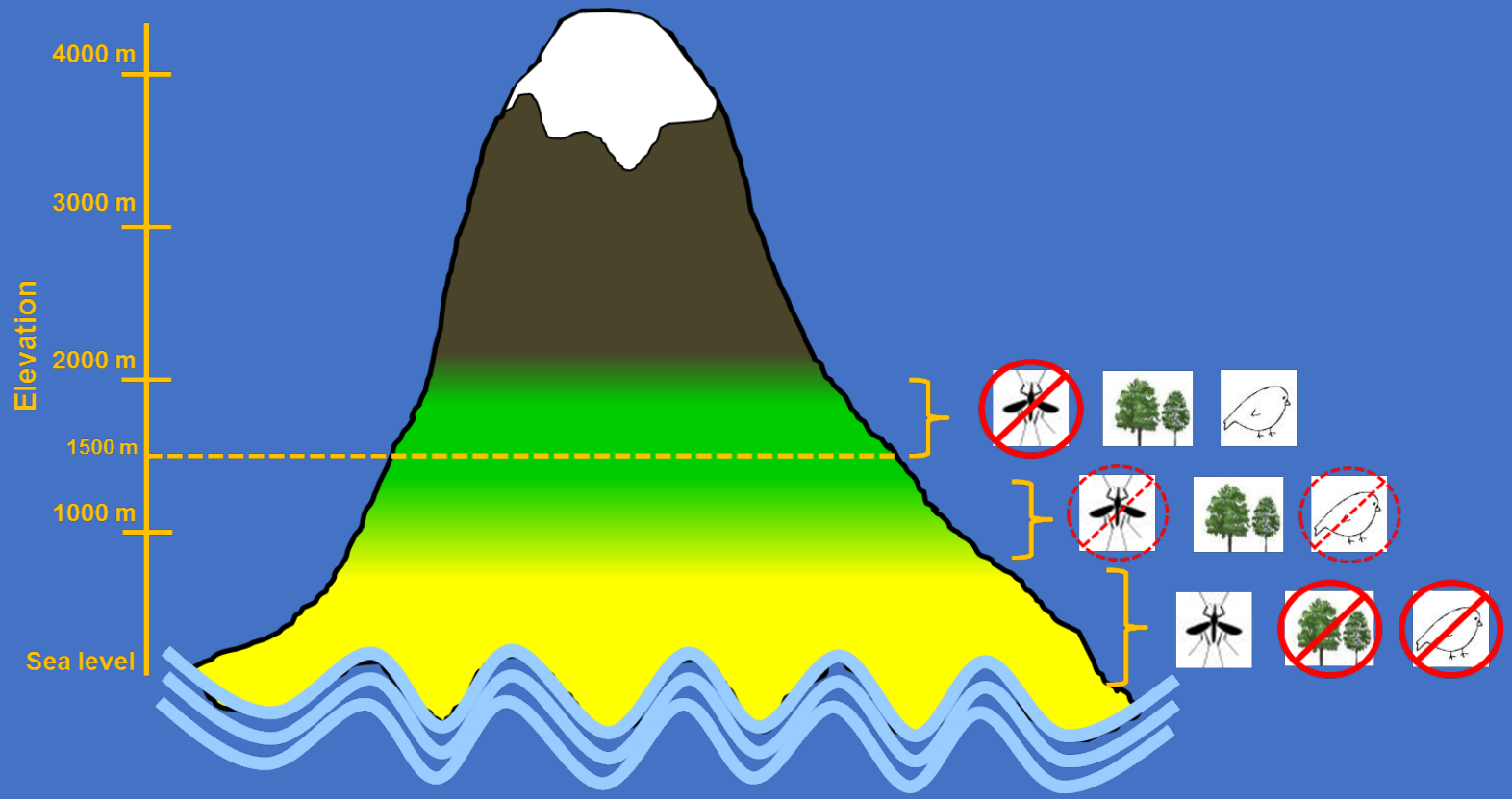
B. Mossman

Malaria parasites in red blood cells



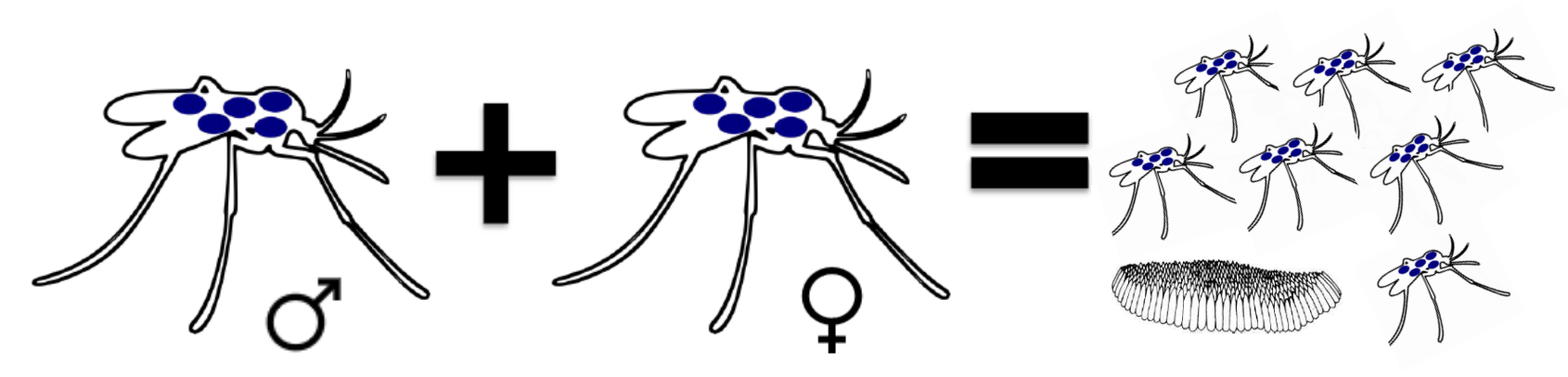
C. Atkinson, USGS

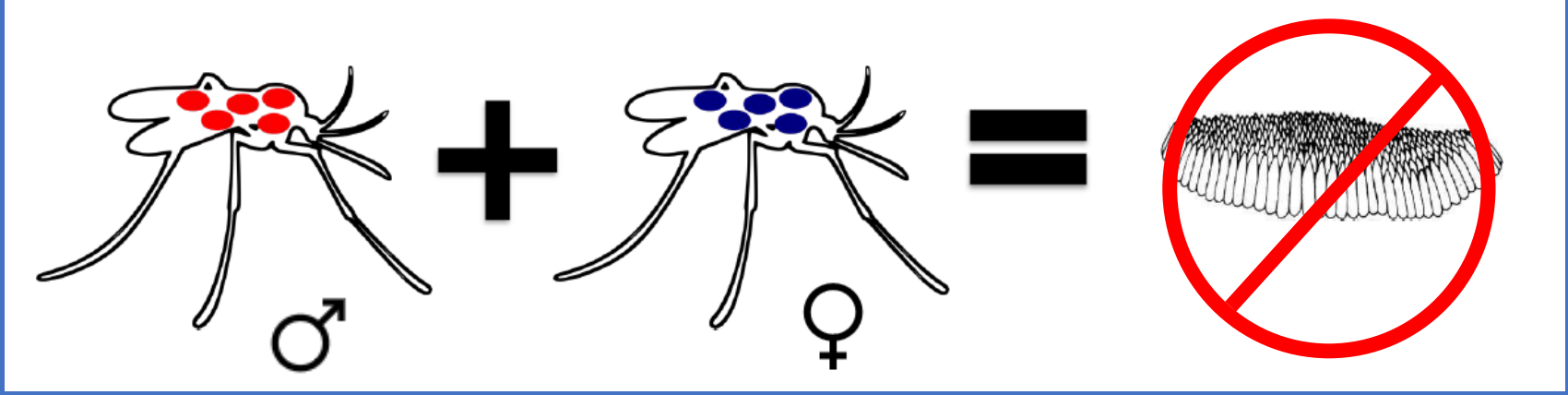
Climate Change, Mosquitoes, and Malaria



- Increasing temperatures and altered rainfall patterns
- Allow mosquitoes to disperse into higher elevations
- Forcing birds to the very highest elevation forests

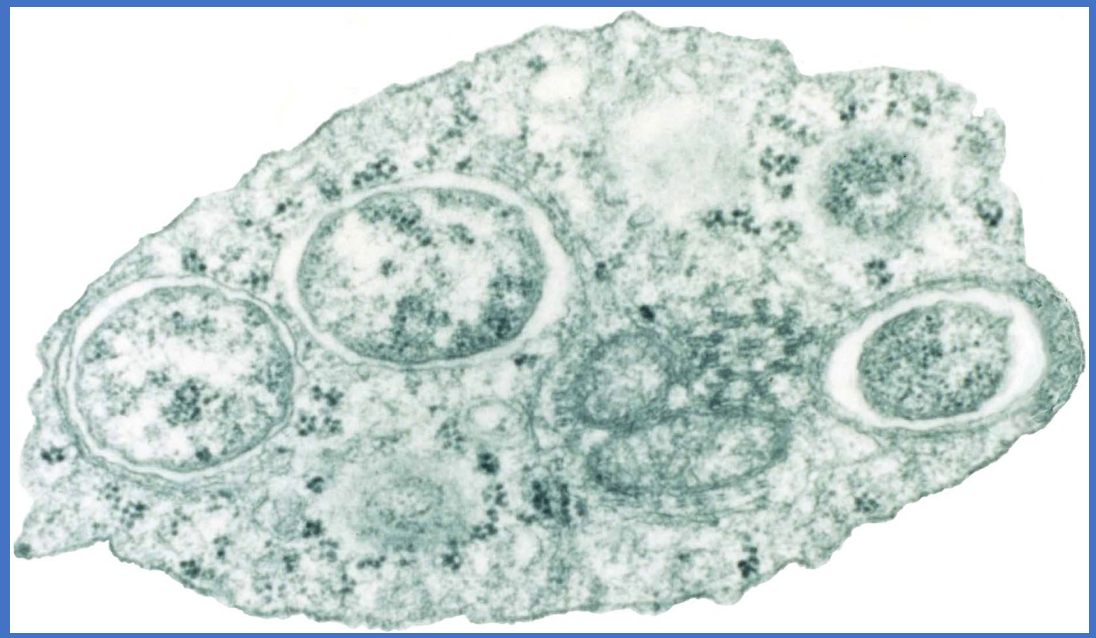
What is Incompatible Insect Technique? ("Mosquito Birth-Control")





Wolbachia to the Rescue

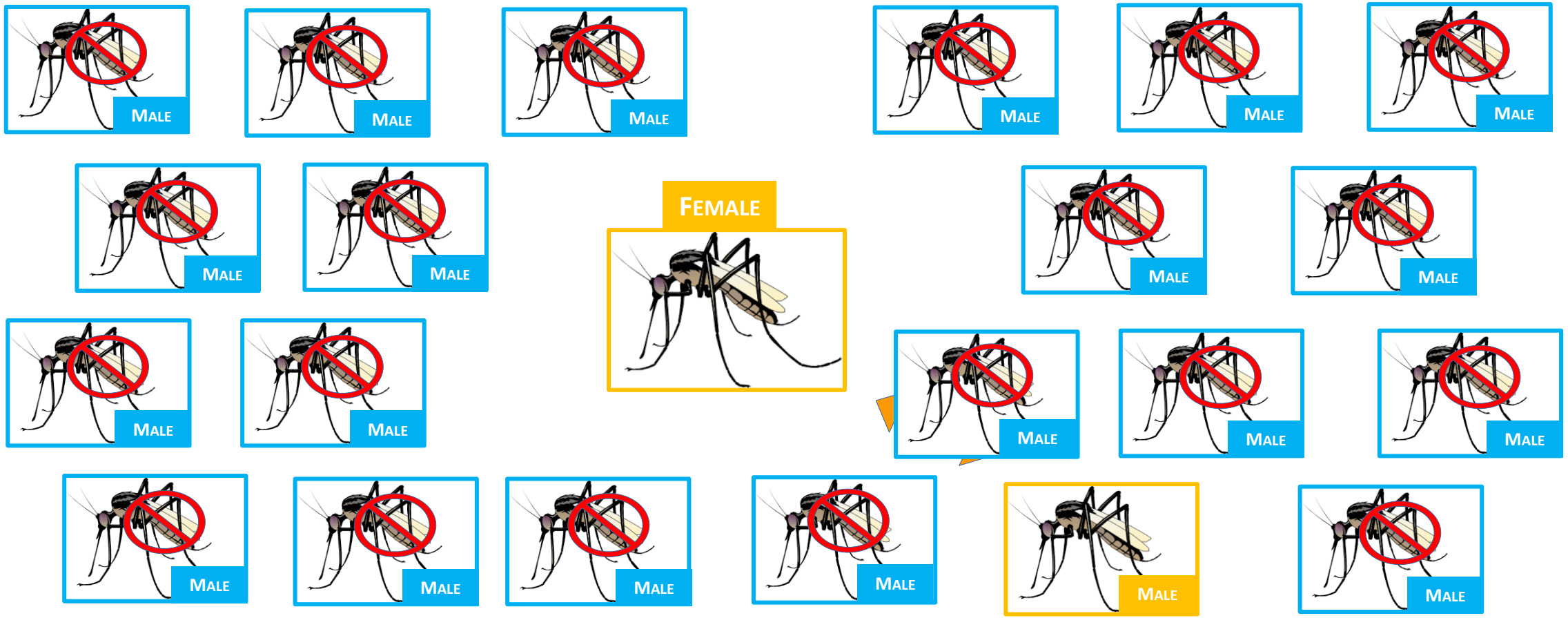
- Bacteria
- Identified in 1924 from a mosquito
- Found in ~60% of all insect species
- Present in Hawai‘i
- Passed to offspring by mothers



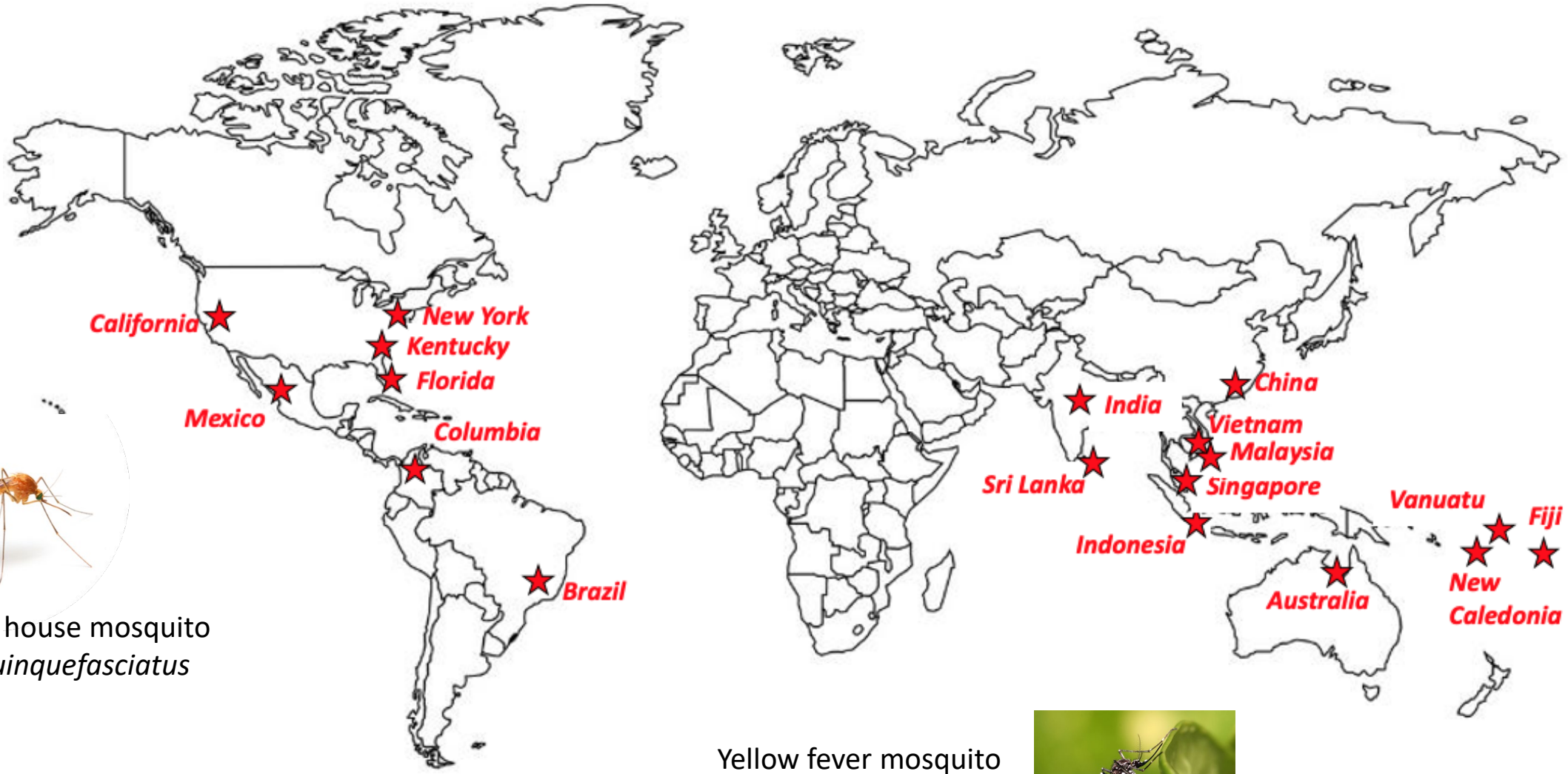
Scott O’Neil

Incompatible Insect Technique

(aka “Mosquito birth-control”)



Wolbachia IIT used Worldwide



Southern house mosquito
Culex quinquefasciatus

Yellow fever mosquito
Aedes aegypti

Potential Approach

- Initial releases at an individual site once per week to once per month.
- Releases likely be most frequent from May to October
- Monitoring – “Fine-tuning” timing, frequency, spacing

Application & Operations: rearing and logistics

Next steps

- East Maui environmental assessment – public scoping meetings Dec 14 and Jan 6, anticipated completion late 2022
- Kauai environmental assessment to be conducted concurrently
- Statewide environmental assessment
- Import permit with Hawaii Department of Agriculture
- Development of insectary in Hawaii for holding/rearing
- Mass rearing and deployment

Project Timeline

Research & Community Engagement

2020
Planning, permitting, & community engagement

Transinfection of *Culex*

HDOA Import Permit

2021
HDOA import permit

Begin informal & formal EA process

Submit EPA Experimental Use Permit (EUP)

2022
Lab/cage trials under EUP permit

Submit Sect. 18 Emergency Exemption permit

HDOA and local requirements

2023
Submit Sec. 3 EPA Biopesticide Registration

Pilot, meso-scale releases under Sec. 18

Facility permitting

2024
Landscape-Scale Releases on East Maui, Kauaʻi
Begin process for other islands

THE HAWAII INVERTEBRATE PROGRAM:

Using habitat enhancement, captive rearing and translocations to stabilize and recover populations of rare and endangered species

David Sischo and Cynthia King

State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Hawaii Invertebrate Program

1

State of Hawaii - DLNR

- DLNR holds the constitutional and statutory authority to protect native plant and wildlife resources in the State
- DLNR regulates activities relating to wildlife on both private and State lands
- Invertebrates are wildlife and are protected equally

2

3

Invertebrate diversity in Hawaii

4

HIPsters and projects

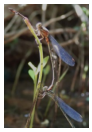
Snail Extinction Prevention Program

- 2.5 Field Technicians
- 1 AmeriCorps Intern
- 1.5 Lab Technicians
- UH Manoa student help

David Sischo

Insect Captive Propagation Projects

- 1 Research Entomologist
- 3 Entomology Technicians
- 1 AmeriCorps Intern
- UH Manoa student help



Will Haines

Maui Nui Survey Project

- 1 Field Technician

Will Haines

Yellow-faced bee Project

- UH Manoa Researcher
- 1 Field Technician

Karl Magnacca

Funding support for to UH Manoa

- Kaena Point Arthopod Surveys
- Hawaiian Drosophila Research Stock Center
- Yellow-faced Bee Microbiome

Additional projects

- Kauai stag beetle (*Apterocyclus spp.*)
  Noctuid moth (*Aumakua omaomao*)
  Fabulous green sphinx moth (*Tinostoma smaragditis)*
- Blackburn's sphinx moth (*Manduca blackburni*)

5

DLNR insectary and captive rearing

6

Megalagrion xanthomelas
The Orangeblack Hawaiian Damselfly

- Listed as endangered in 2016
- Breeds in lowland pools and slow-moving streams
- Widespread population decline due to habitat loss and introduction of invasive predators
- Adults take around 3 weeks to reach sexual maturity
- Currently only known established population on O‘ahu is at Tripler Army Medical Center

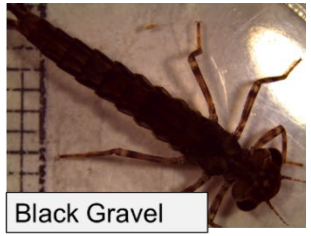
Photos by Will Haines

Ideal Release Site Criteria

- Absence of predators, especially mosquito fish (*Gambusia sp.)*
- Water temperature between 22-28°C
- Abundance of prey items for naiads
- Attractive for breeding
  - Adequate sun exposure
  - Vegetation for oviposition
- Absence of nearby ecological sinks
- Landowner able to harbor endangered species

Gambusia affinis
Photo: Bishop Museum

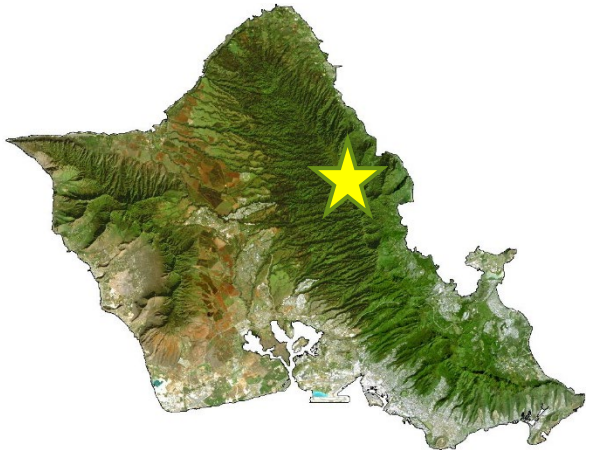
Megalagrion xanthomelas
The Orangeblack Hawaiian Damselfly



Photos by Will Haines

Megalagrion xanthomelas
The Orangeblack Hawaiian Damselfly

- Army Land
- Elevation: 120 m
- Water Temperature: 22-25°C
- Spring fed
- Over 4700 adults were released June 2020 -June 2021
- Oahu Army Natural Resource Program (OANRP) outplanted attractive vegetation along the stream, built pools, and cleared canopy for greater sun exposure



Will Haines


Hawai`i Snail Extinction Prevention Program (SEPP)

13


N. Hayes & N. yeung
N. Hayes & N. yeung
. Hayes & N. yeung

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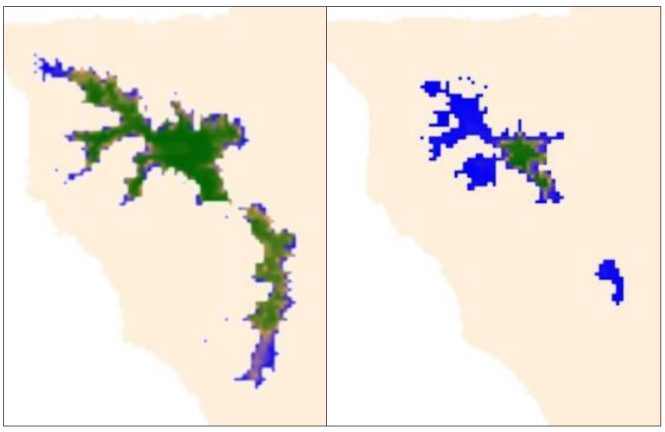
Climate change



17

We are preparing for the near total extirpation of 10 genera, ~100 species within the next 1-10 years

Achatinella, Partulina, Perdicella, Newcombia, Auriculella, Amastra, Laminella, Leptachatina, Endodonta, Cookeconcha, Plueropoma

18

Strategy Moving forward

- **Crisis mode, "man the life boats"**
  - *Captive rearing, stopgap measures such as predator control, rapid construction of predator-proof fences*
- **Stabilization and recovery**
  - Increase population redundancy across the landscape and in captivity
  - Work towards Landscape-scale predator control and eradication

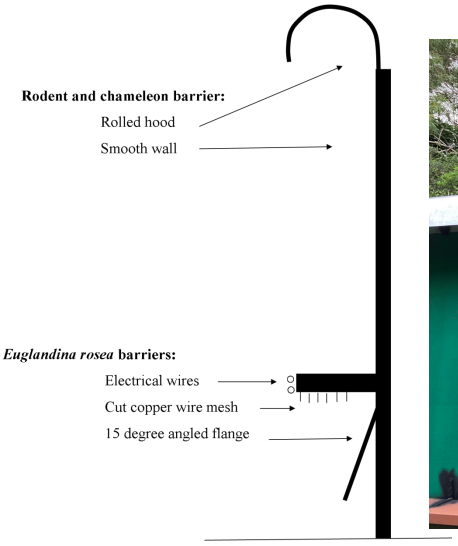
19

Captive Propagation

- 40 critically-imperiled species from eight genera, and five islands

20

Predator Exclusion



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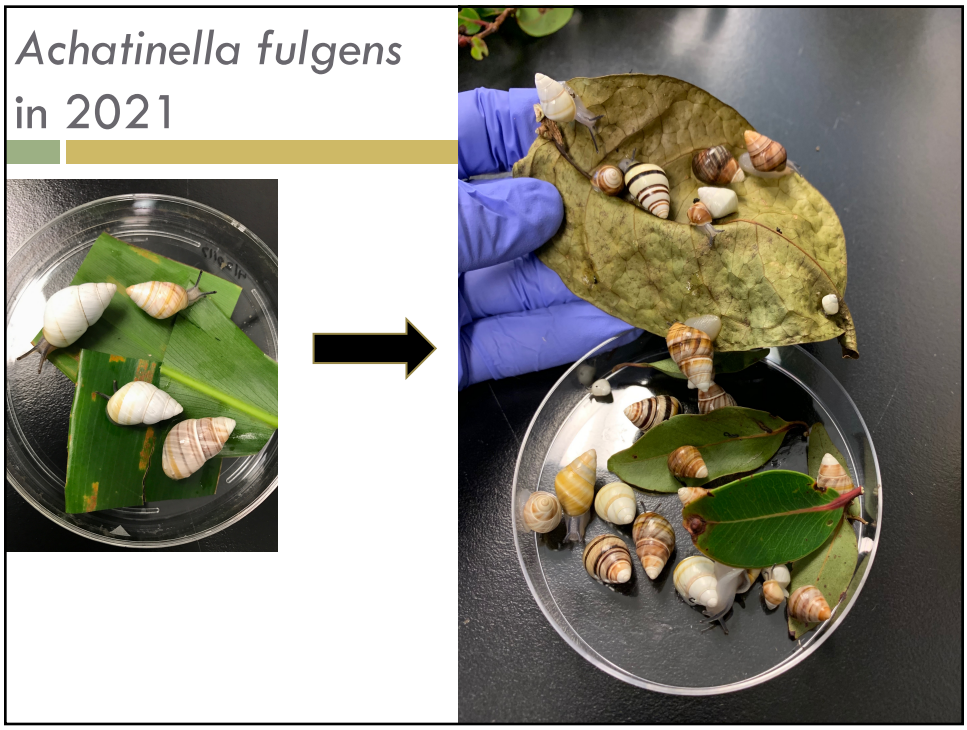
23

Achatinella fulgens

- In 2016 the last six known *Achatinella fulgens* were pulled from the wild

Ruth, Bernice, Emma, and Lili, the only known adult A. fulgens in the world (2016).

24



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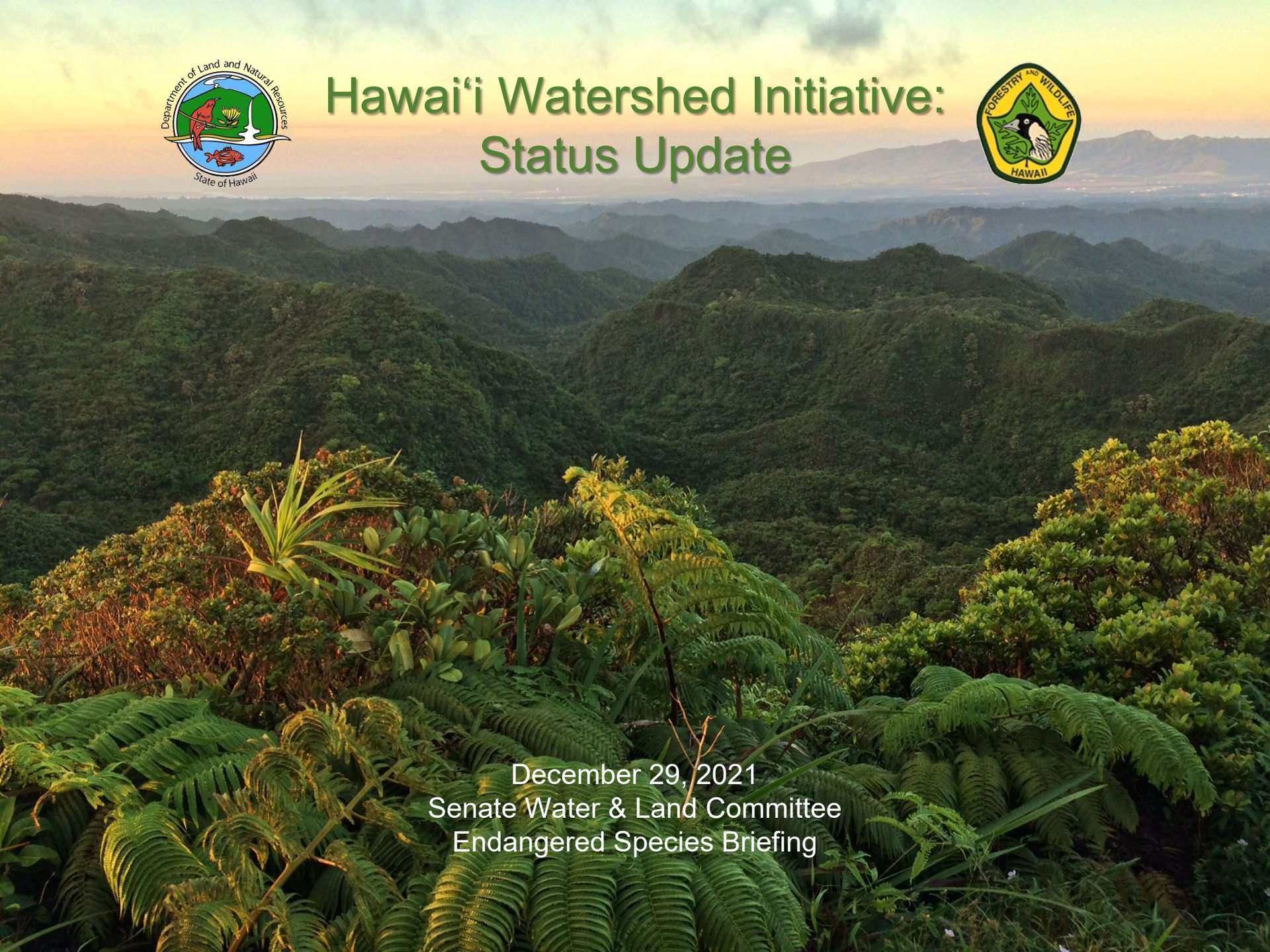
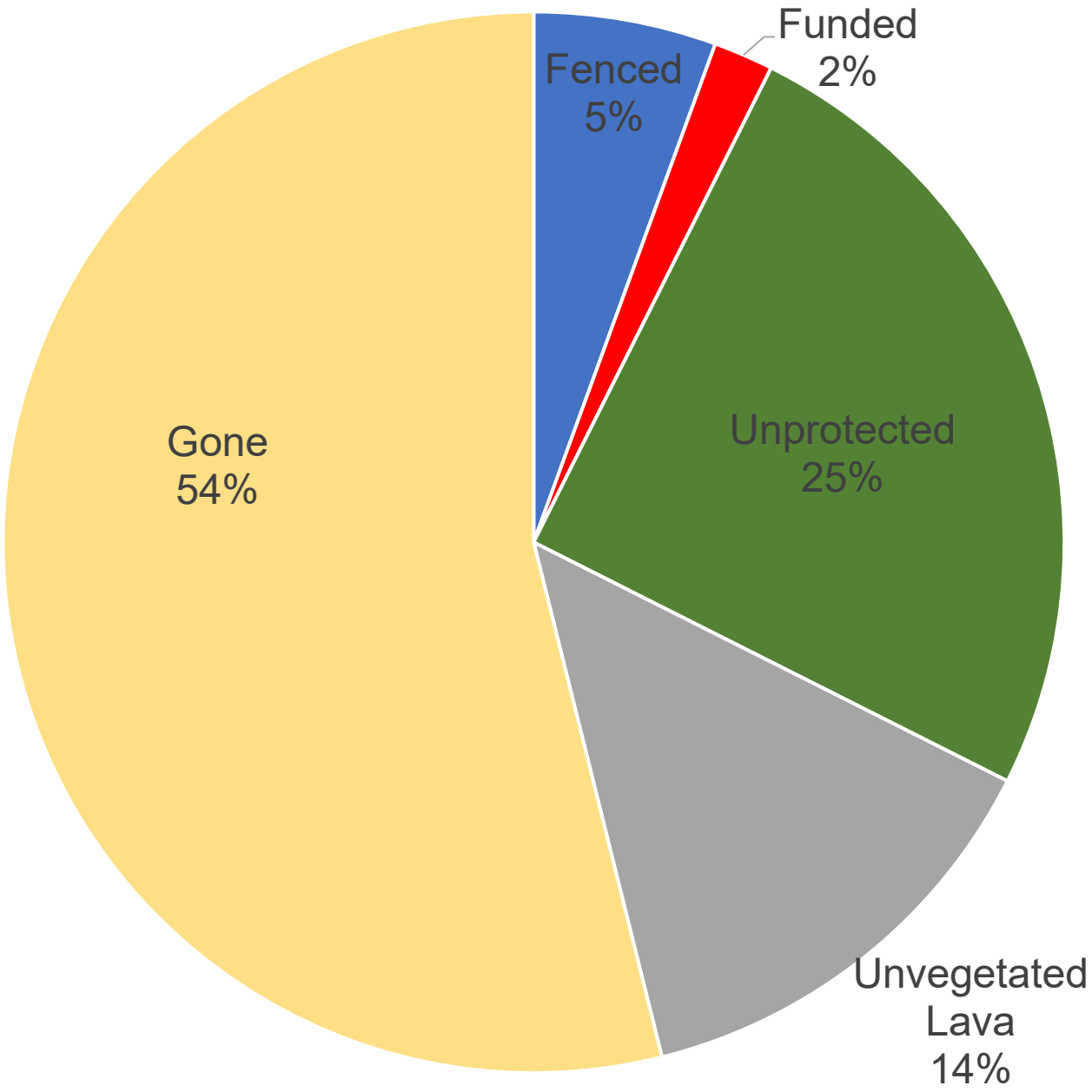
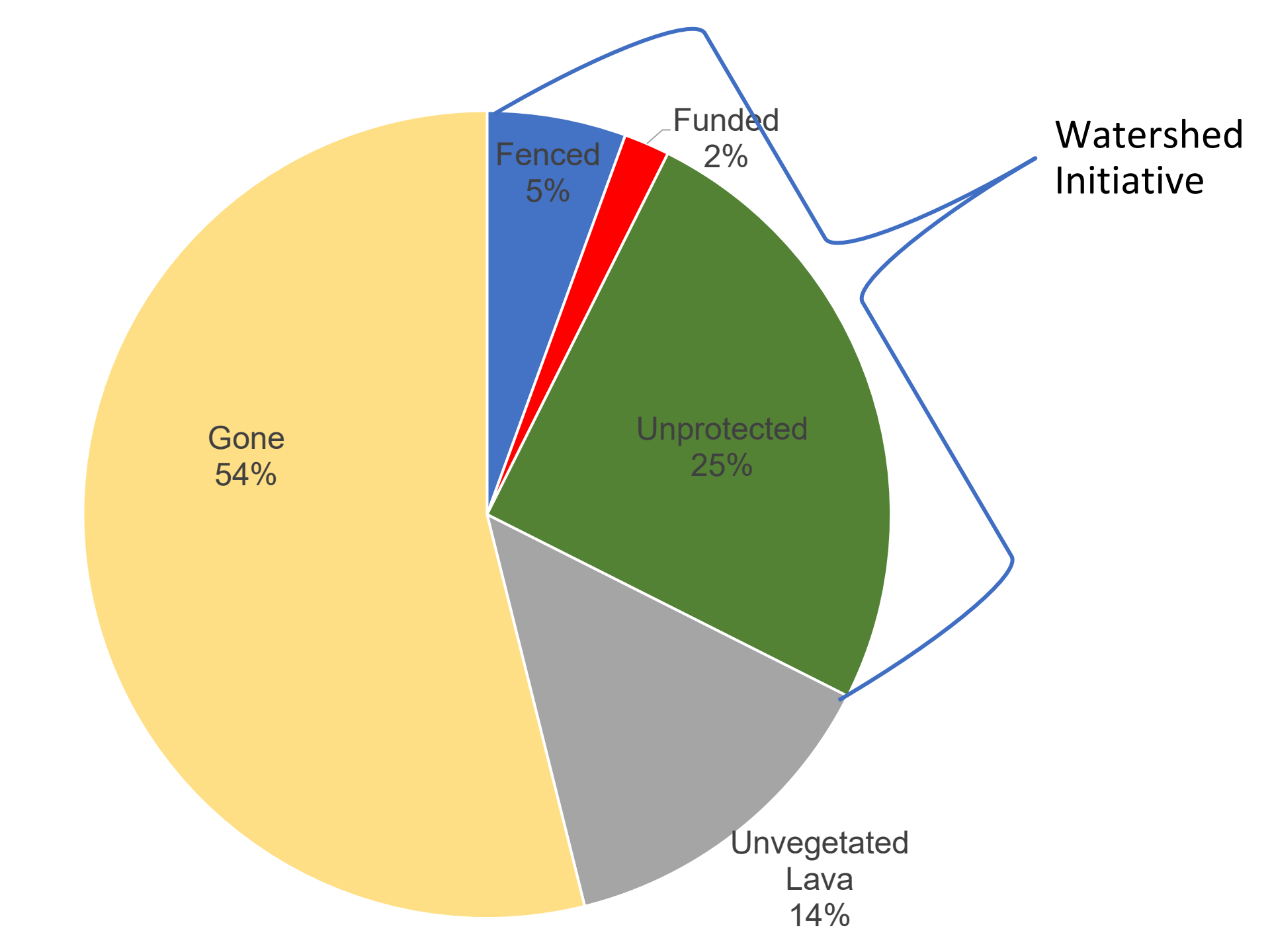
Hawai‘i Watershed Initiative: Status Update



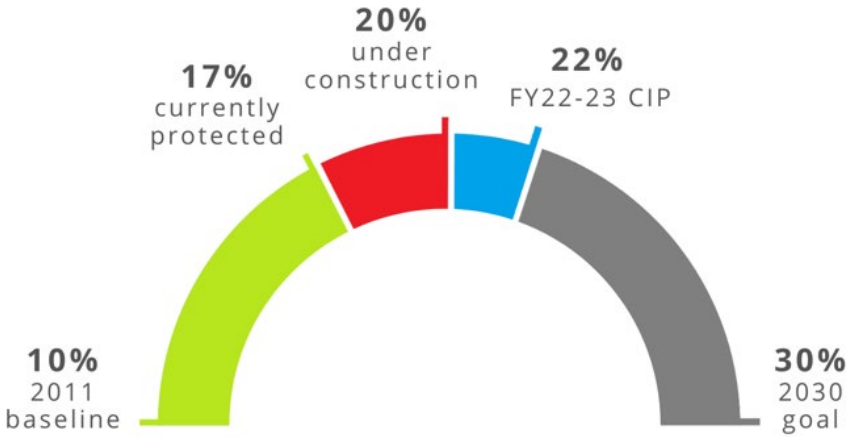
December 29, 2021
Senate Water & Land Committee
Endangered Species Briefing

Native Vegetation Status

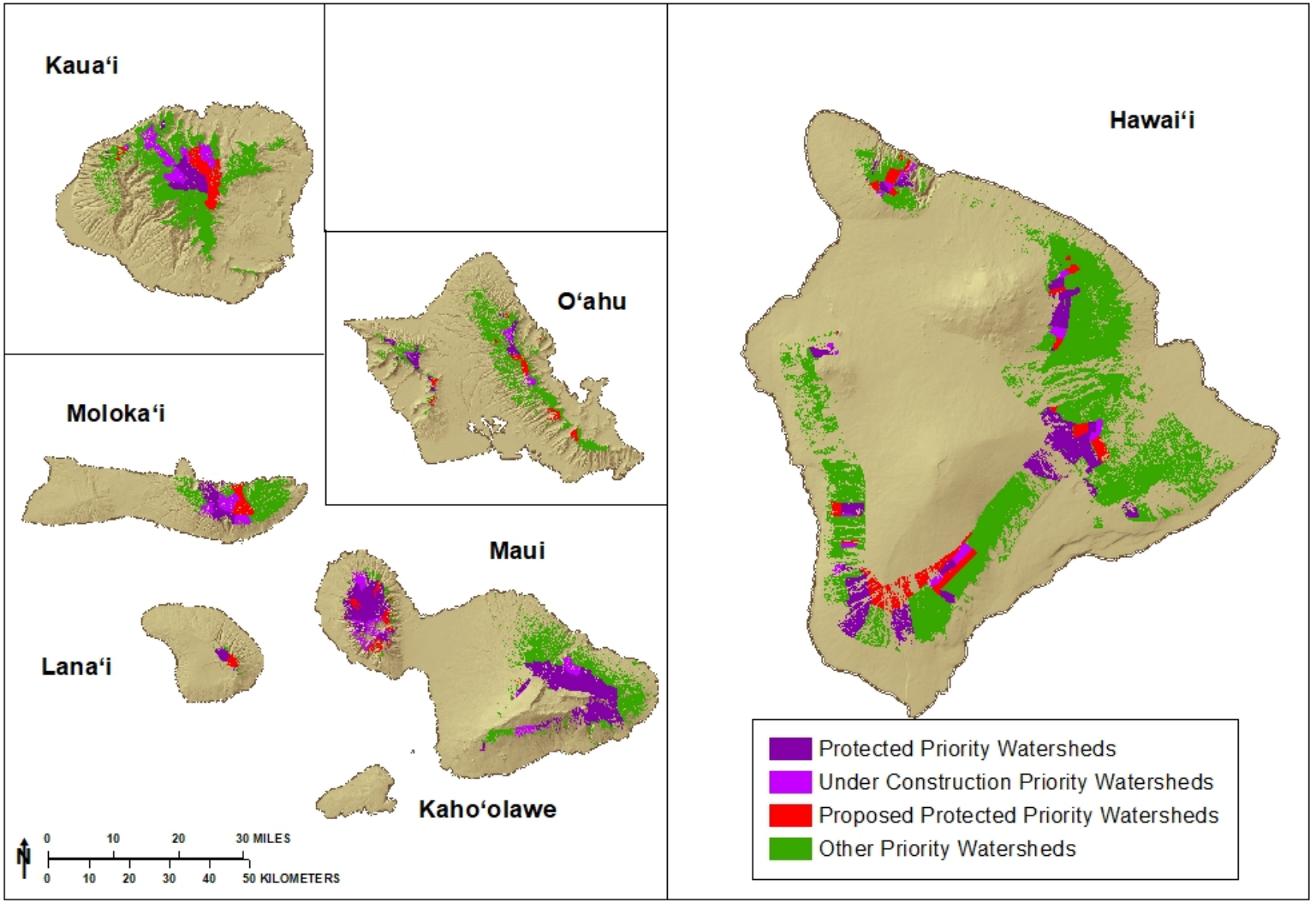



Fenced
5%
Funded
2%
Watershed
Initiative
Unprotected
25%
Gone
54%
Unvegetated
Lava
14%

30x30 Watersheds Progress Report



30x30 Watershed Plan



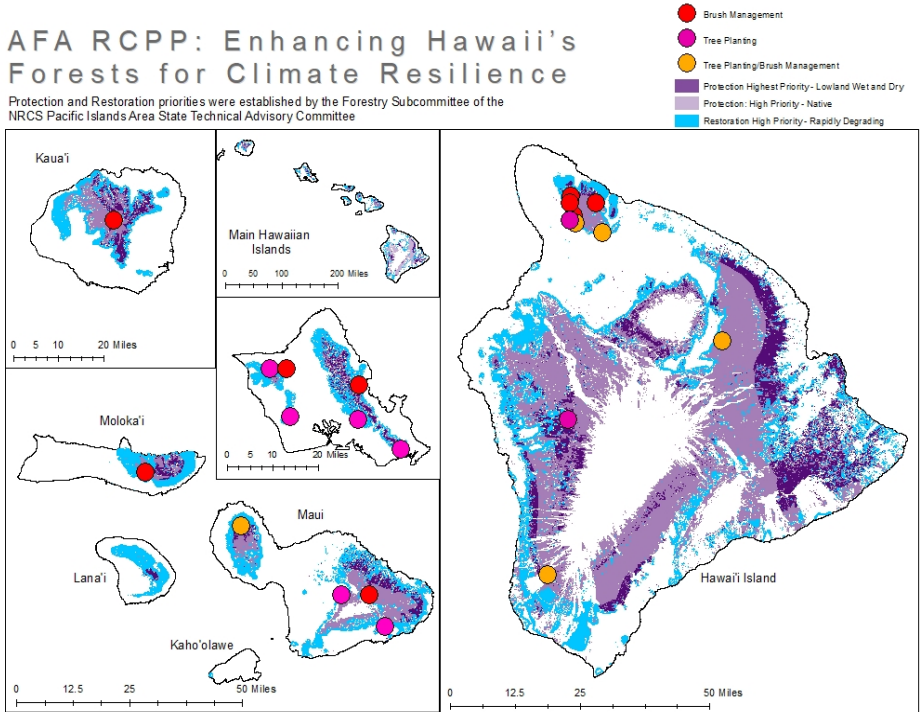
Features approximate and subject to change. DOFAW 587-4170.

Watershed Initiative Updates

- $4m additional CIP requested in FY23
- FY21 built 13 miles of fence
- 39 fence projects under construction

Leveraging State Money

- 30x30 CIP critical for match
- Since 2013, CIP and operating funds have been matched by over $49 million in grants from non-State sources
- Funding supports local jobs

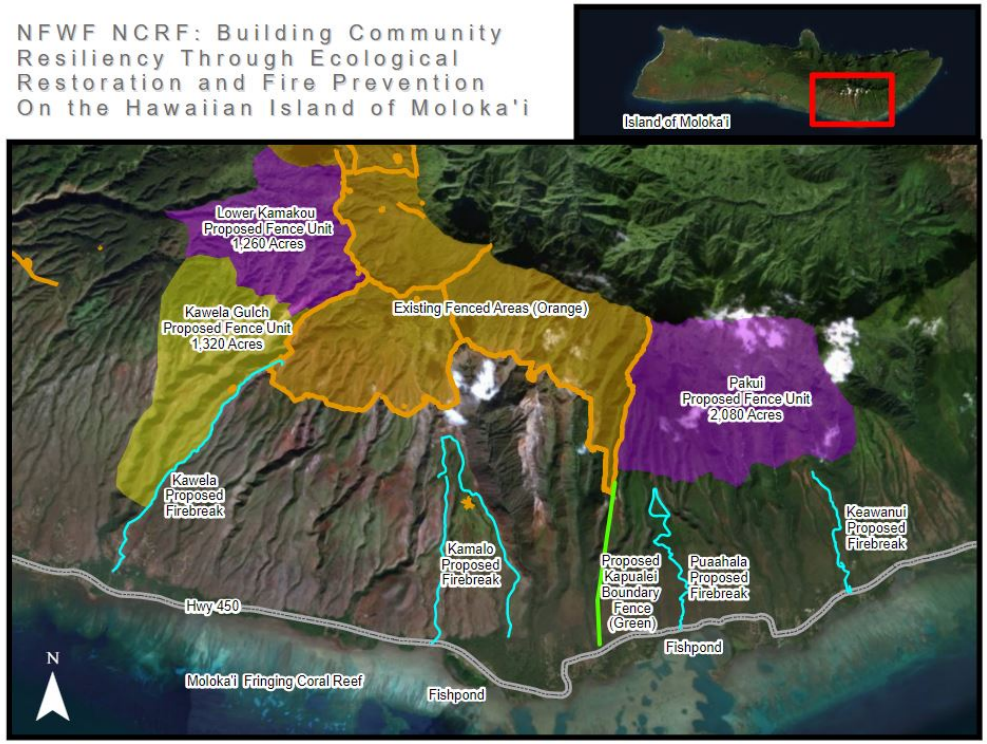


NRCS RCPP AFA Award

- $5.2 million
- Plant 210,000 trees
- Remove invasive weeds from 1,650 acres

REPI Pu‘u Wa‘awa‘a & Oahu

- $1.28 million
- 350 acre fence to exclude hoofed animals
- Planting of native species and weed control
- Firebreaks

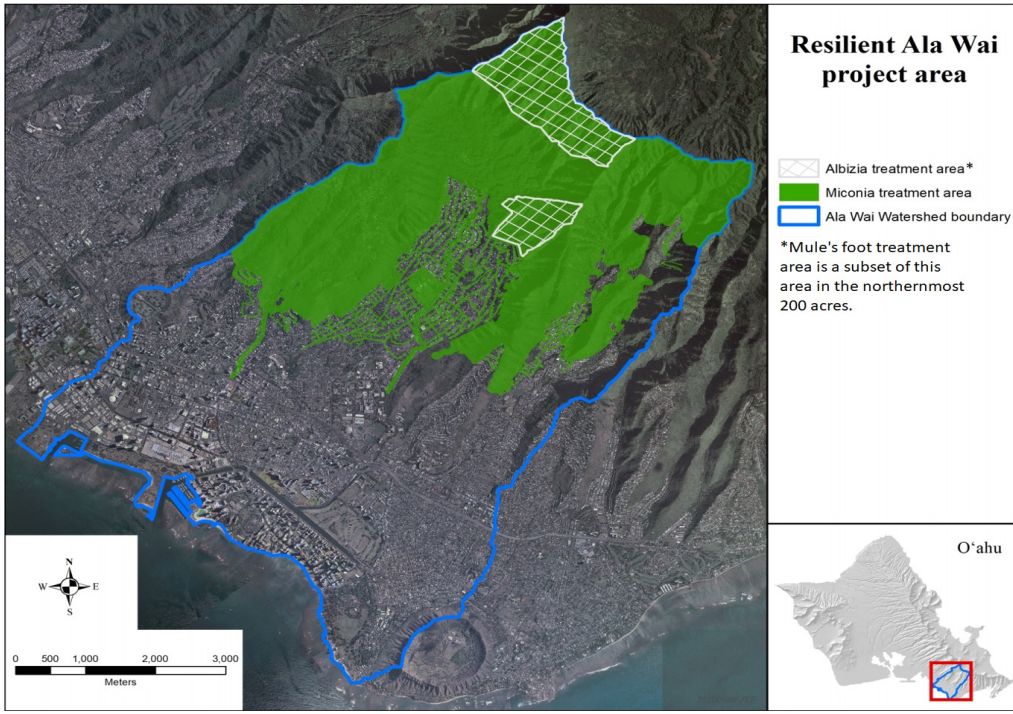


NFWF Molokaʻi Community Resilience

- $1.8 million
- Kawela Gulch fence
- Ungulate removal and weed control
- 13.4 miles fire breaks

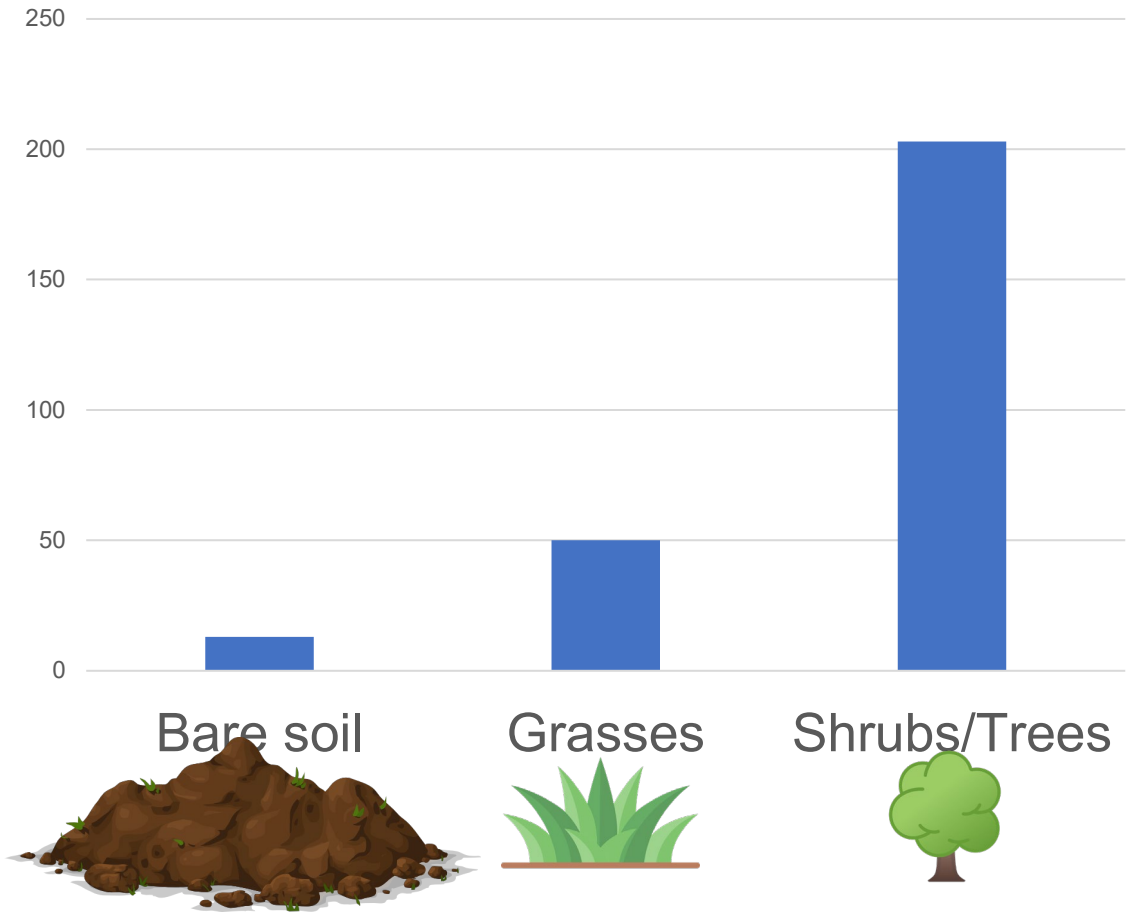
NFWF Ala Wai Flood Mitigation

- $1.6 million
- Control 1,000 albizia trees
- Miconia control 4,000 acres
- Mule’s foot fern control 200 acres



Water Infiltration Rates

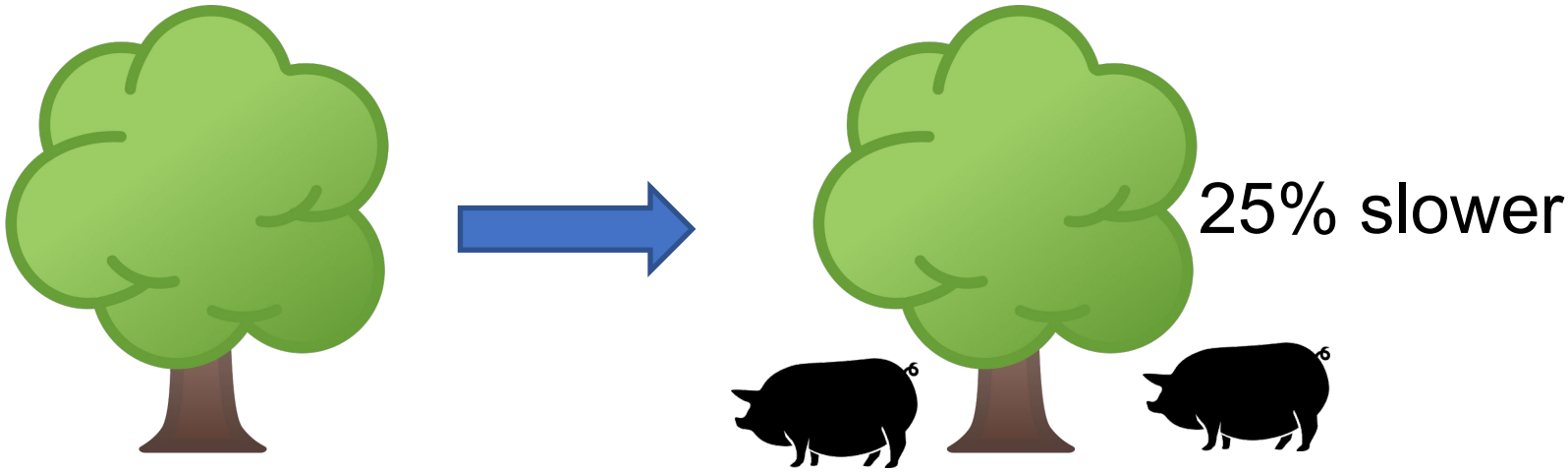
- Field-saturated hydraulic conductivity (K_{fs}) mm/hr



Perkins, K., J. D. Stock, J. R. Nimmo. 2018. Vegetation Influences of Infiltration on Hawaiian Soils. Ecohydrology. https://onlinelibrary.wiley.com/doi/abs/10.1002/eco.1973

Fenced Native Forest

Unfenced Native Forest



•Berio Fortini, L., Leopold, C.R., Perkins, K.S. Chadwick, O., Yelenik, S., Jacobi, J., Bishaw, K., Gregg, M., Rosa, S., 2021. Landscape level effects of invasive plants and animals on water infiltration through Hawaiian tropical forests. *Biol Invasions*. https://doi.org/10.1007/s10530-021-02494-8

South Shore, Molokaʻi

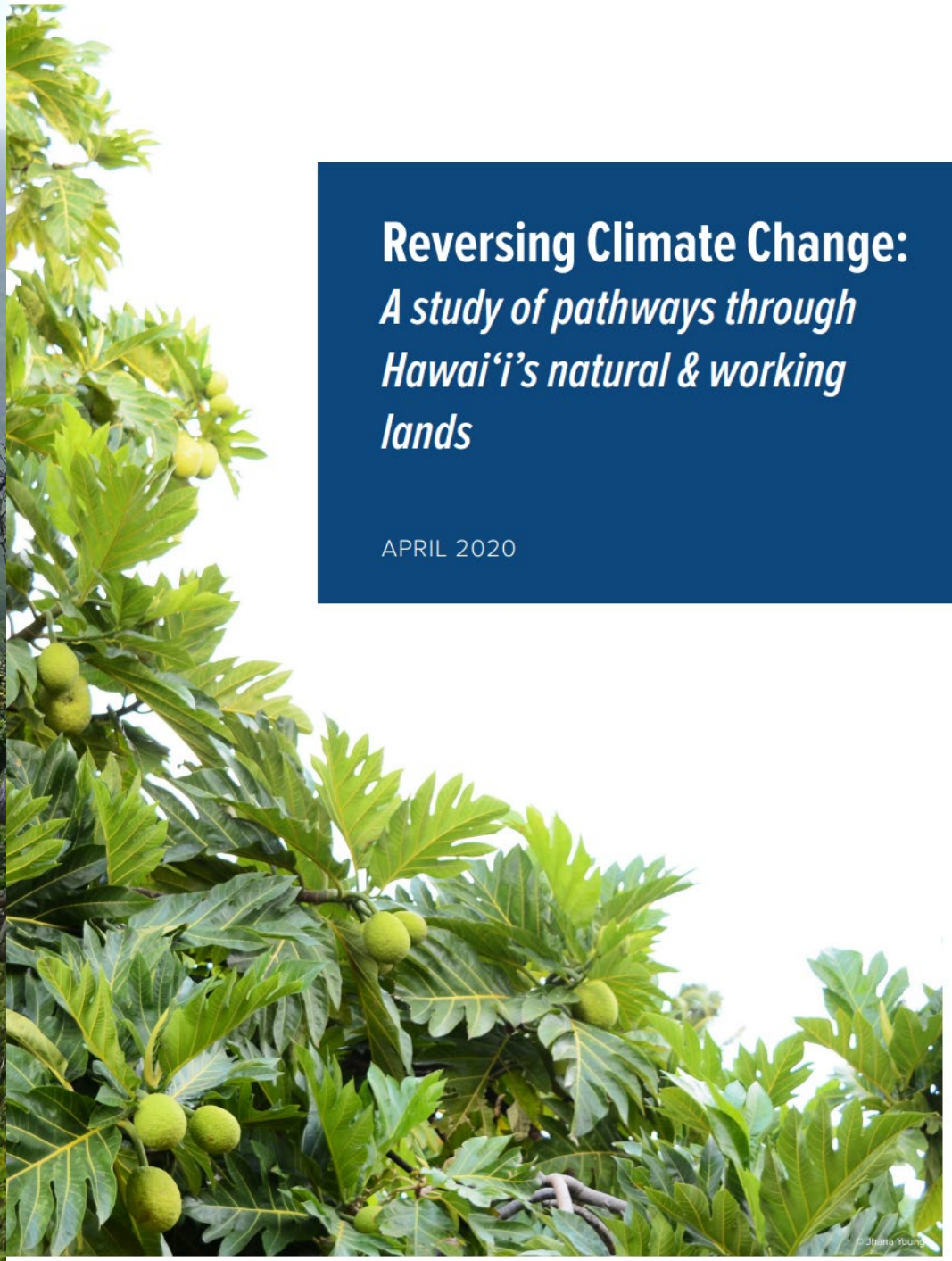
- Since 2009, 10-fold decrease in erosion due to ungulate control

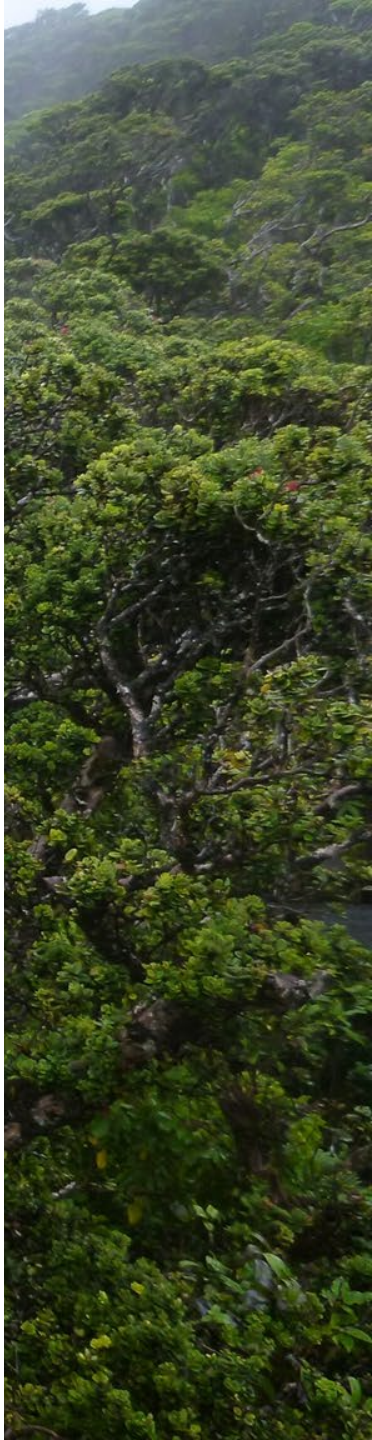
Jacobi, J., J. Stock, 2013. Update on U.S Geological Survey Ridge-to-Reef Research in the Kawela-Kamalo Area, Molokai. Findings are preliminary from an ongoing study.


2009


2015


2020





Reversing Climate Change:
A study of pathways through Hawai‘i’s natural & working lands

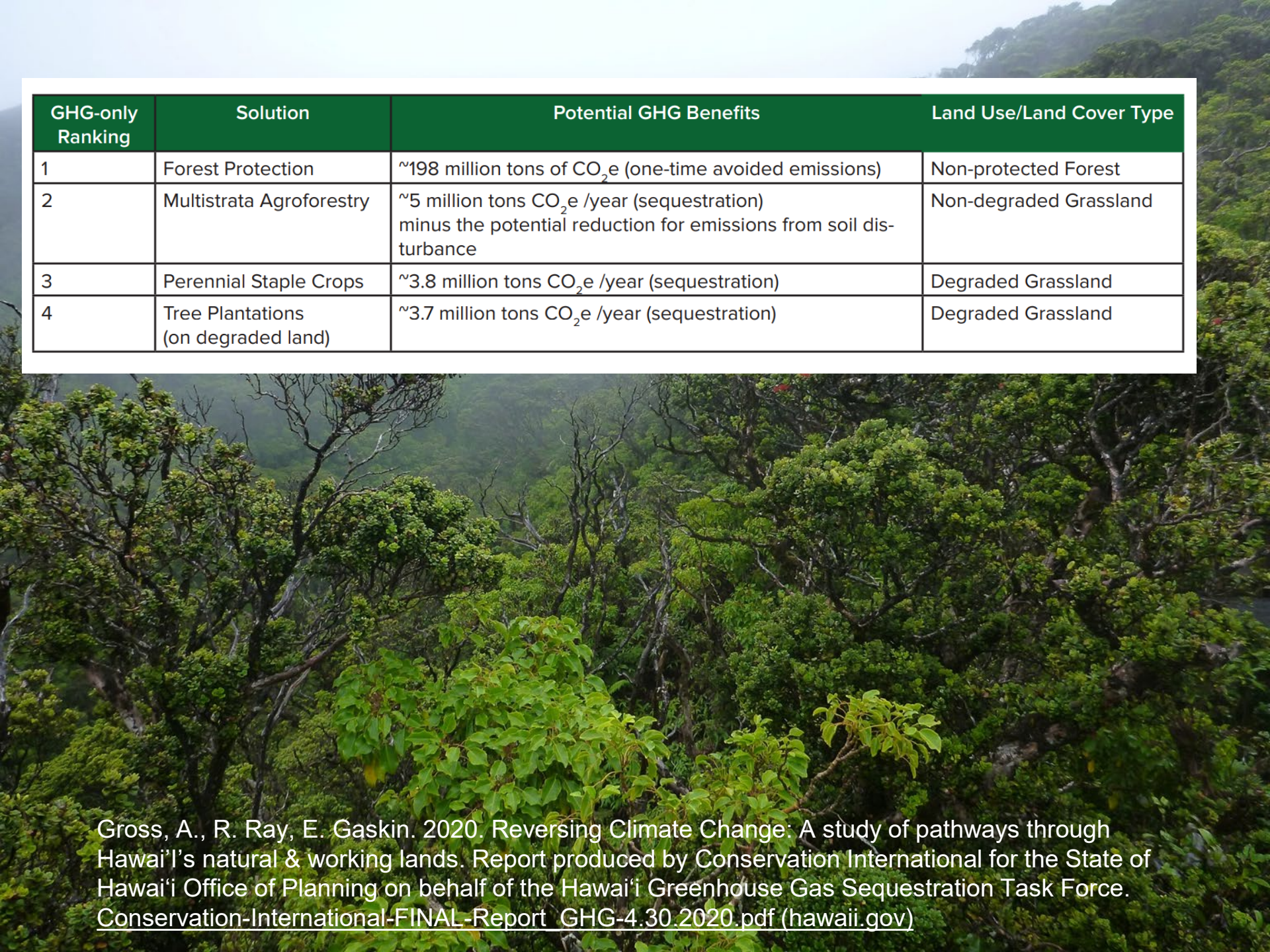
APRIL 2020

Food and Land Use Solutions from Project Drawdown Potentially Applicable to Hawai‘i Lands

Food Sector Solutions	Land Use Sector Solutions
Silvopasture	Tropical Forests Restoration
Regenerative Annual Cropping	Temperate Forests Restoration
Perennial Staple Crops	Peatland Protection and Rewetting
Conservation Agriculture	Tree Plantations (on degraded land)
Tree Intercropping	Bamboo Production
Managed Grazing	Forest Protection
Abandoned Farmland Restoration	Indigenous Peoples' Forest Tenure
Multistrata Agroforestry	Coastal Wetland Protection
Perennial Biomass Production	Coastal Wetland Restoration
Nutrient Management	
Farm Irrigation Efficiency	
Biochar Production	

Gross, A., R. Ray, E. Gaskin. 2020. Reversing Climate Change: A study of pathways through Hawai'I's natural & working lands. Report produced by Conservation International for the State of Hawai‘i Office of Planning on behalf of the Hawai‘i Greenhouse Gas Sequestration Task Force. Conservation-International-FINAL-Report_GHG-4.30.2020.pdf (hawaii.gov)

GHG-only Ranking	Solution	Potential GHG Benefits	Land Use/Land Cover Type
1	Forest Protection	~198 million tons of CO_2e (one-time avoided emissions)	Non-protected Forest
2	Multistrata Agroforestry	~5 million tons CO_2e /year (sequestration) minus the potential reduction for emissions from soil disturbance	Non-degraded Grassland
3	Perennial Staple Crops	~3.8 million tons CO_2e /year (sequestration)	Degraded Grassland
4	Tree Plantations (on degraded land)	~3.7 million tons CO_2e /year (sequestration)	Degraded Grassland



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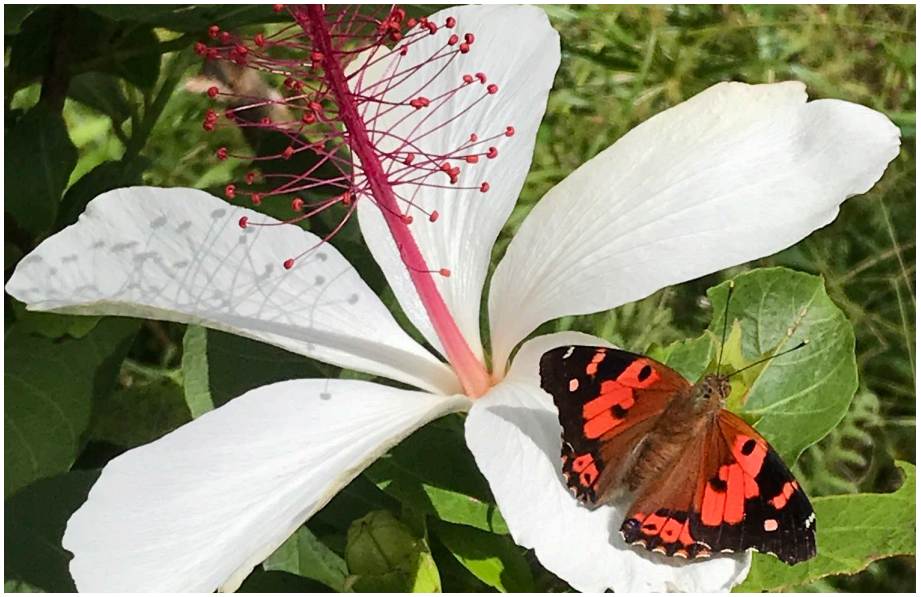


Emma Yuen, Native Ecosystems Program Manager
Department of Land and Natural Resources
Division of Forestry and Wildlife

Protected Species Program

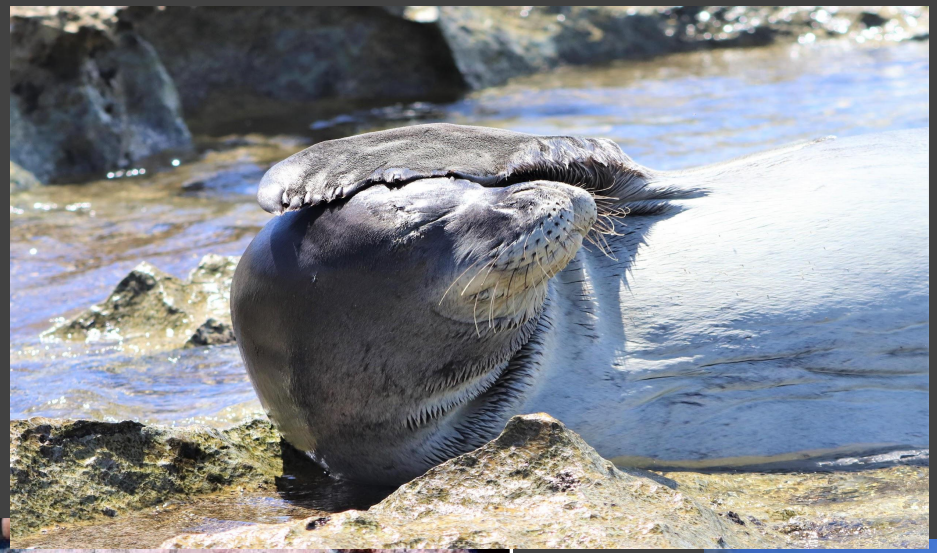
Division of Aquatic Resources
Department of Land and Natural Resources
State of Hawai‘i

Hawai‘i Division of Aquatic Resources

PROTECTED SPECIES PROGRAM
PSP

Department of Land and Natural Resources
State of Hawaii

ESA listed marine species of Hawaii



Deron Verbeck

Mark Deakos

Pelagic species

Hawai'i Division of Aquatic Resources

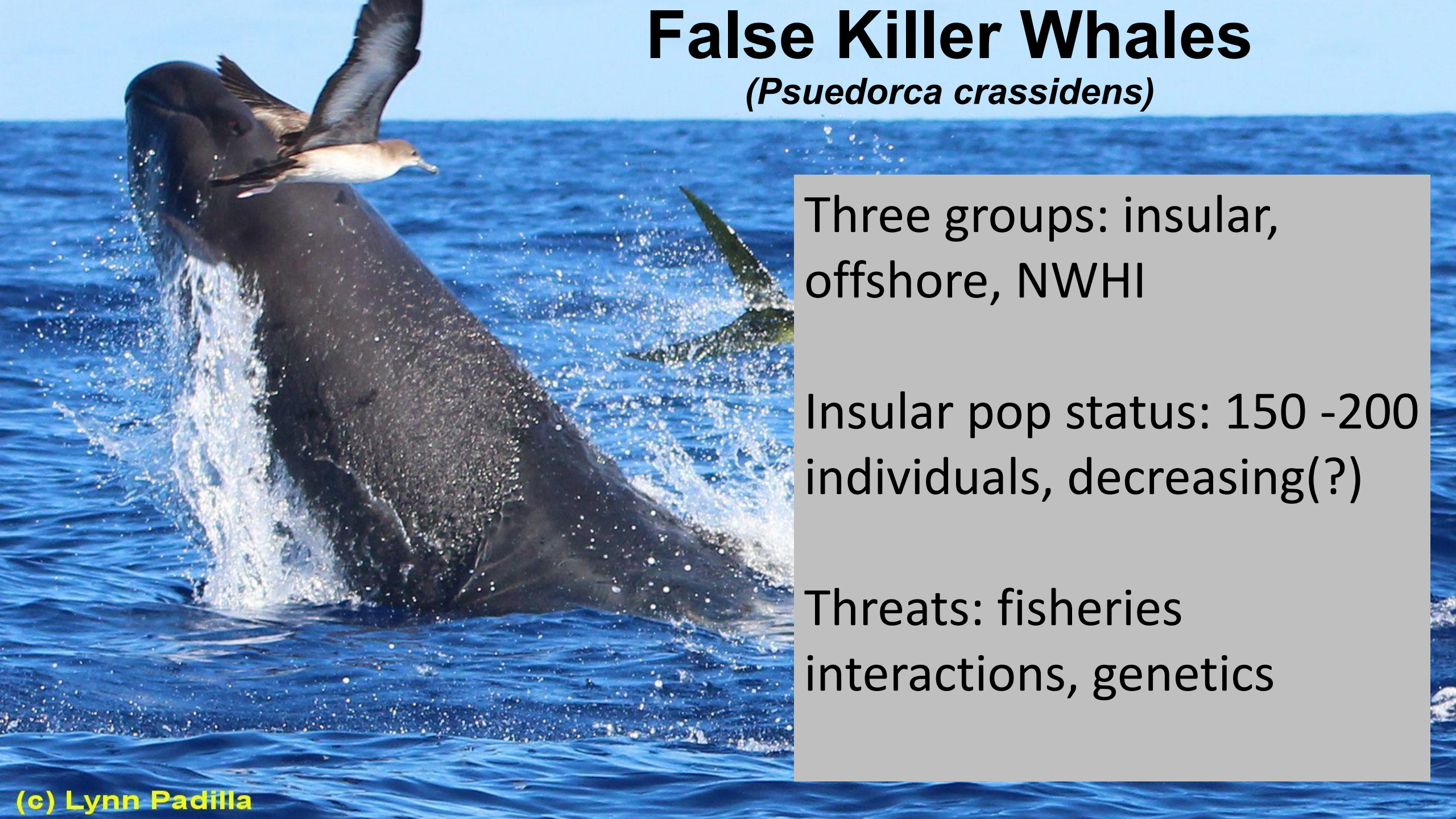
PROTECTED SPECIES PROGRAM
PSP

False Killer Whales

(Psuedorca crassidens)

False Killer Whales

(Psuedorca crassidens)



Three groups: insular, offshore, NWHI

Insular pop status: 150 -200 individuals, decreasing(?)

Threats: fisheries interactions, genetics

Honu: green sea turtles
(Chelonia mydas)

Honu: green sea turtles
(Chelonia mydas)

Central North Pacific DPS

Pop status: unknown total, increasing 5-7% annually

Honu: green sea turtles
(Chelonia mydas)

Threats:
- Nesting habitat loss
- Fisheries interactions
- Nesting disturbance

Current issues:
- Increased basking MHI
- Native harvest push

Hawaiian monk seals
(Monachus schauinslandi)

PROTECTED SPECIES PROGRAM
PSP

Hawaiian monk seals
(Monachus schauinslandi)

Pop status:
- 1,400 total
- 350 MHI

Recovery goals:
- 3,000 total
- 500 MHI

Growth rate: ~ 2% annual

Hawaiian monk seals
(Monachus schauinslandi)

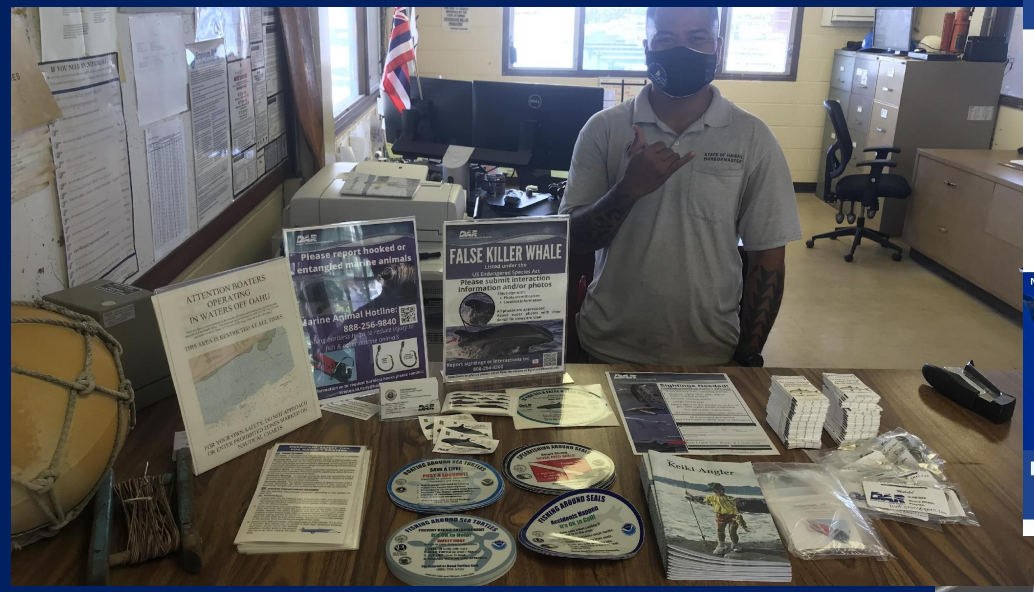
Threats (MHI):

- Intentional killings
- Toxoplasmosis
- Fisheries interactions

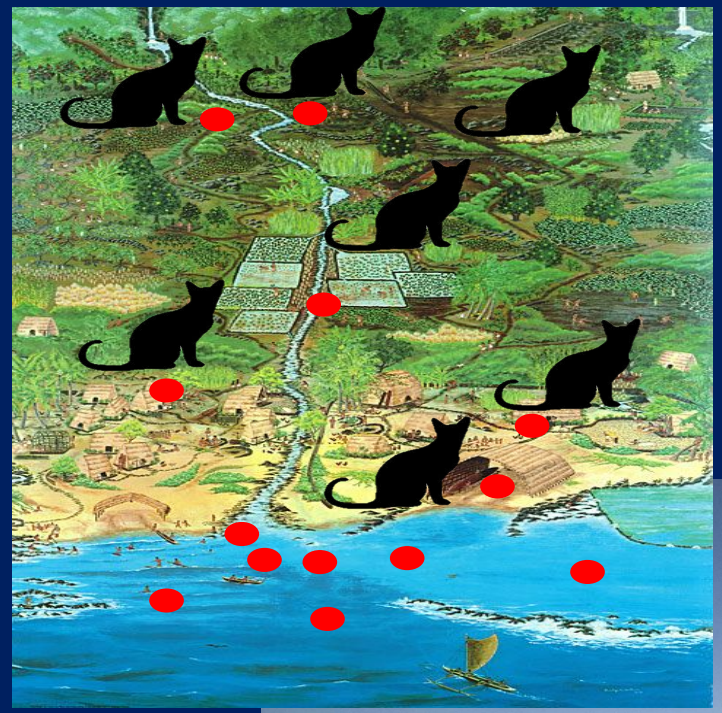
PROTECTED SPECIES PROGRAM
PSP

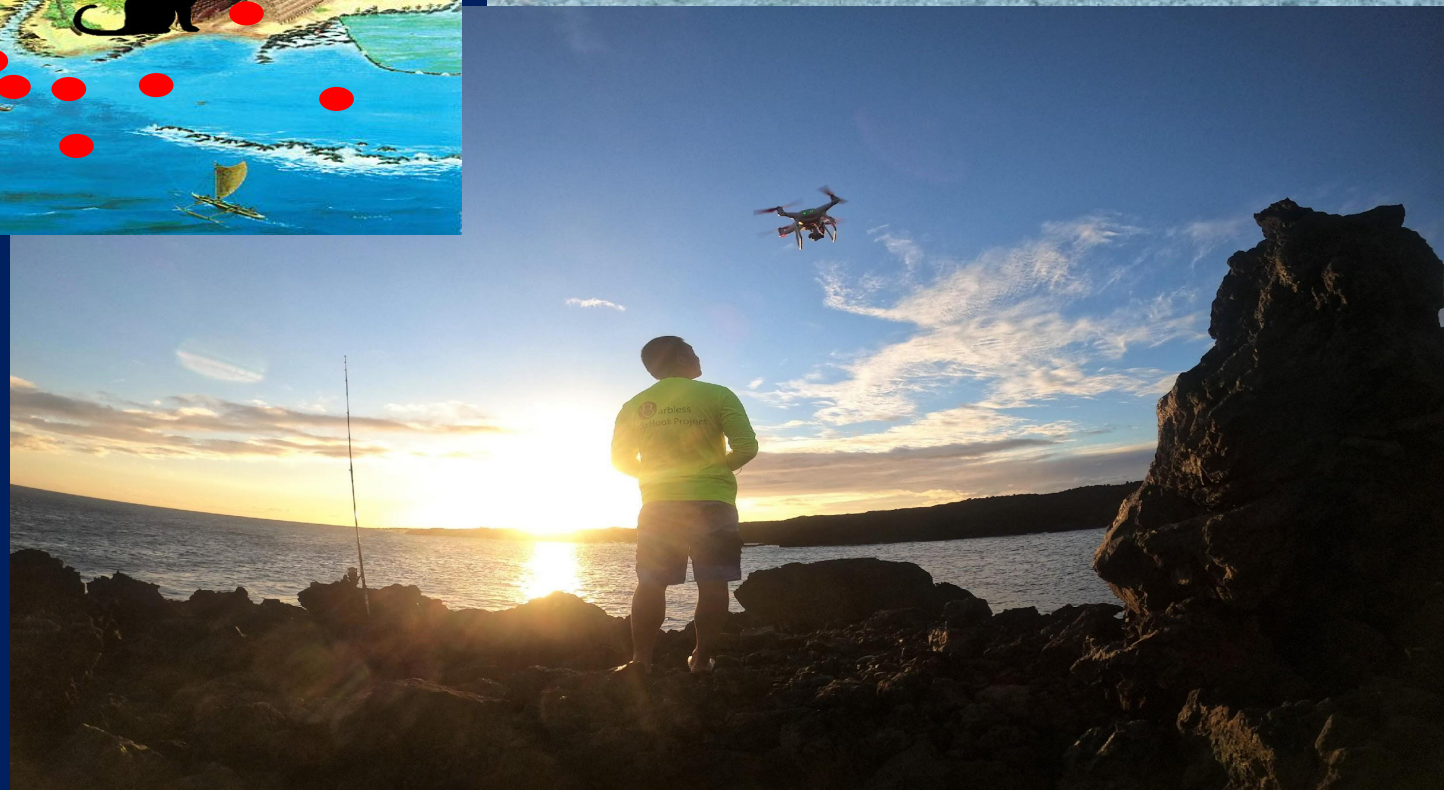
Key Projects

- Barbless Circle Hook Project
- Monk Seal Monitoring and Response
- Formal Education
- Targeted Outreach
- Volunteer Program
- Communications



Key Projects





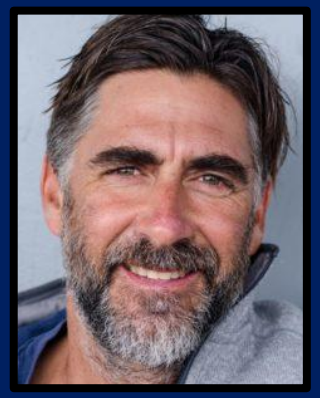
- Collaboration with PIFSC
- Debris and Entanglement Removal
- Management actions
- Disease Reduction
- State Management Plan

Protected Species Program Staff

Mimi Olry
Marine Mammal Response
Field Coordinator
Kaua‘i

Kristen Kelly
Coordinator
O‘ahu

Kendra Babcock
Biologist
O‘ahu



Dr. Ryan Jenkinson
Lead
O‘ahu

Kehau Kimokeo
Outreach & Education
Associate
Maui Nui

Kyla Herrmann
False Killer Whale
Project Associate
O‘ahu

CJ Kow
Outreach & Education
Associate
Hawai‘i Island