

The #OhiaLove Project: Banking Seeds of a Hawaiian Keystone Species During the Rapid 'Ōhi'a Death Crisis

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Matthew Keir, Laukahi Hawai'i Plant Conservation Network
Jill Wagner, Hawai'i Island Seed Bank







Rarity of the Hawaiian Flora

- $\approx 90\%$ endemism in flowering plants
- $\approx 30\%$ federally listed or candidate
- $>40\%$ of U.S. listed plants from HI
- 10% of flora presumed extinct
- 235 taxa with <50 individuals remaining in the wild

'Ōhi'a Lehua (*Metrosideros polymorpha*)



- Endemic to the Hawaiian Islands
- Dominant forest tree covering nearly 1 million acres statewide, from sea level to >9000' (2700m) elevation
- Among first plants to colonize new lava flows

'Ōhi'a Lehua (*Metrosideros polymorpha*)



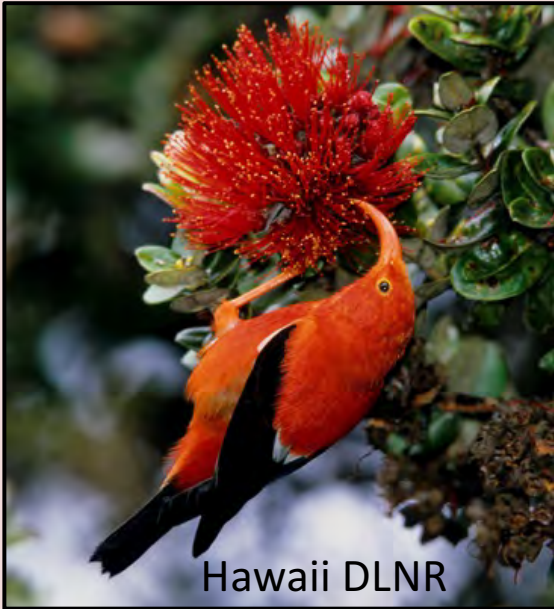
'Ōhi'a Lehua (*Metrosideros polymorpha*)



'Ōhi'a Lehua (*Metrosideros polymorpha*)



'Ōhi'a Lehua (*Metrosideros polymorpha*)



O`ahu Endemic *Metrosideros*



*Metrosideros
macropus*



*Metrosideros
tremuloides*



*Metrosideros
rugosa*

Rapid 'Ōhi'a Death



- Fungal pathogen *Ceratocystis fimbriata* (likely undescribed species)
- Kills trees within days or weeks of first symptoms

Rapid 'Ōhi'a Death



- Affecting >47,000 acres
- Some tolerance or resistance, but mortality increased with repeated surveys in some areas
- For more info: rapidohiadeath.org

Rapid 'Ōhi'a Death

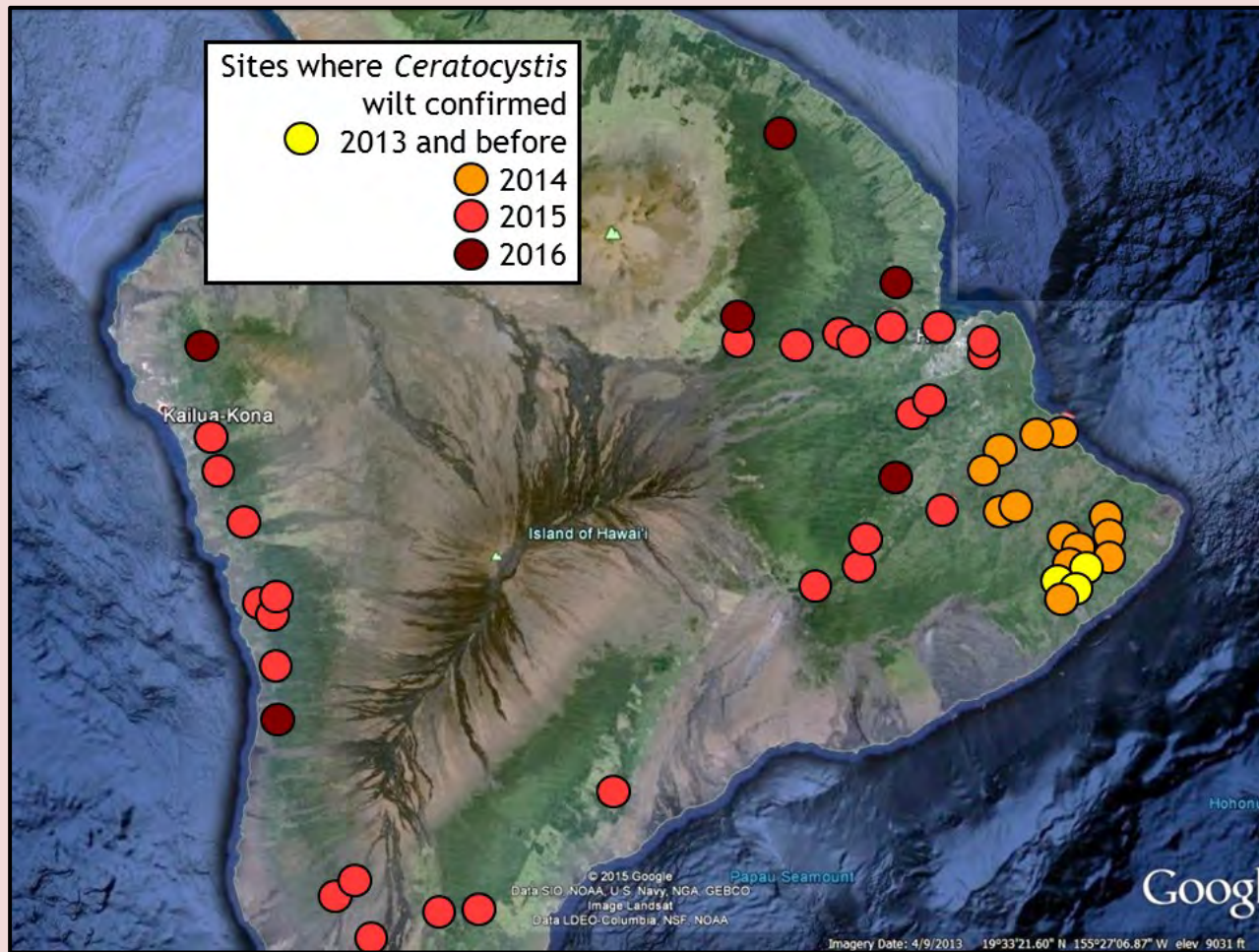
Kaua'i

O'ahu

Hawai'i
Island



Rapid 'Ōhi'a Death



Rapid 'Ōhi'a Death



Vectors

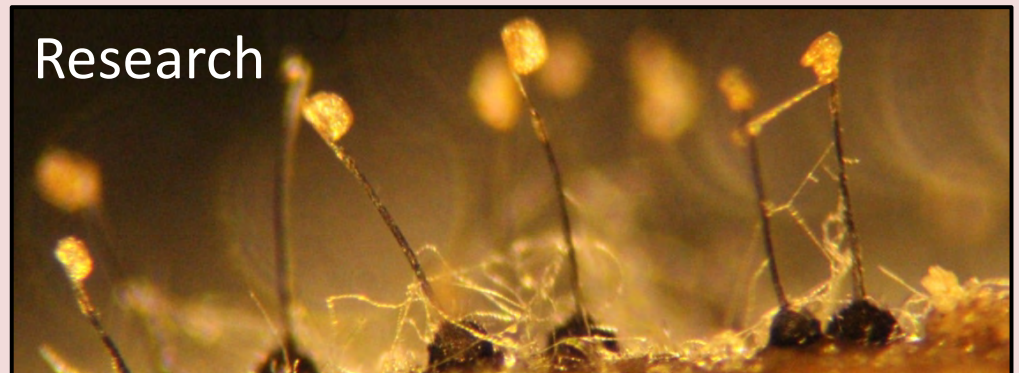
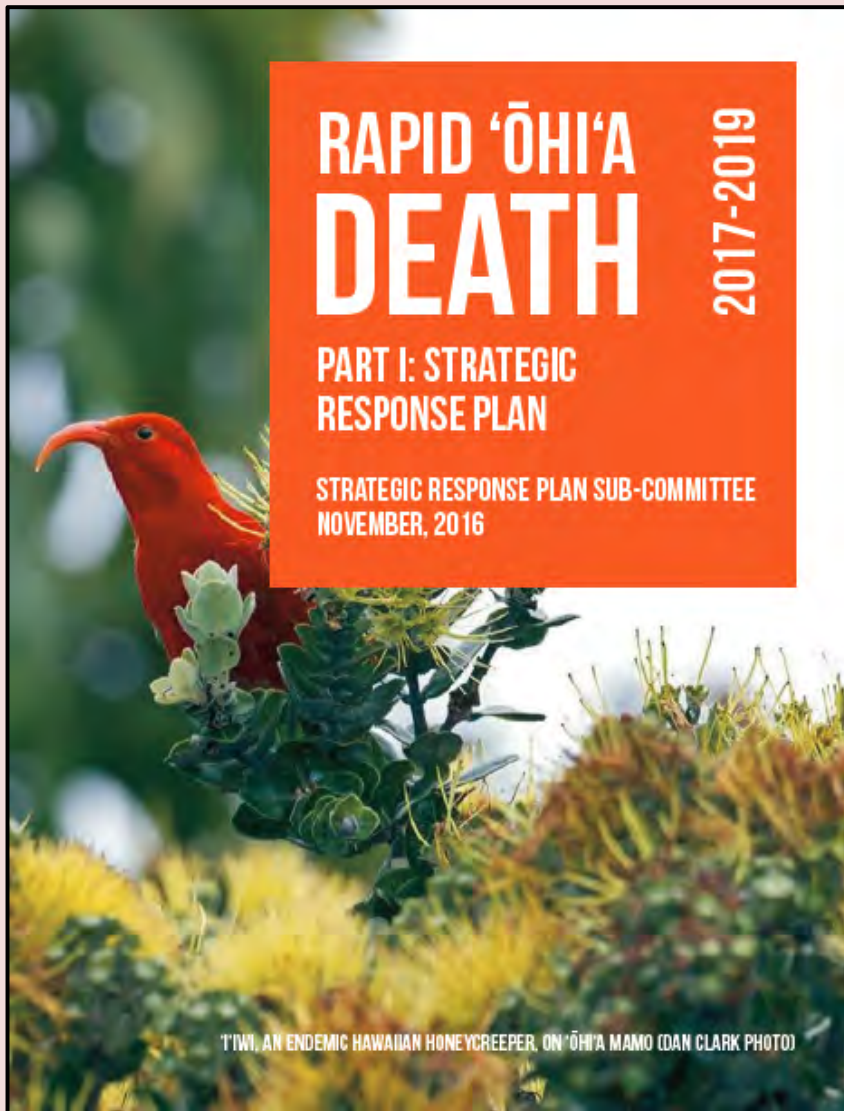
- Airborne sawdust from bark-boring beetles
- Humans & their gear, equipment, vehicles

Preventive Actions

- Quarantine on inter-island movement
- Outreach to reduce spread of ROD via sanitation protocols



Rapid 'Ōhi'a Death

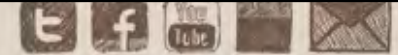


Seed Banking in Response to ROD



Lyon Arboretum

University of Hawai'i at Mānoa



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SEARCH

Seed Conservation Laboratory – Hawaiian Rare Plant Program



haha (*Cyanea magnicalyx*) fruit with seeds

In the Seed Lab, over 13 million seeds are banked, representing more than 550 taxa of native Hawaiian plants, or about 40% of the flora. Of these, over half are federally listed as endangered. The Seed Lab partners with Lyon's Micropropagation Lab, the Plant Extinction Prevention Program (PEPP), the Department of Forestry and Wildlife (DOFAW), and other agencies to provide for both long-term storage – preservation of genetic diversity – and propagation of plants for restoration efforts. We also conduct original research on seed characteristics such as storage behavior, longevity, dormancy, and germination.

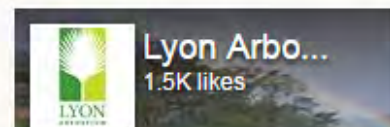
Contact Information



Telephone

(808) 988-0456

Lyon on Facebook

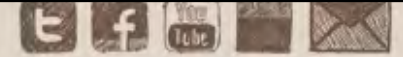


Seed Banking in Response to ROD



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Seed Conservation Laboratory – Ha



CYANEA MAGNICALYX
090204001-01

haha (*Cyanea magnicalyx*) fruit with seeds

In the Seed
banked, repl
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Seed Banking in Response to ROD



Erythrina sandwicensis



Metrosideros polymorpha


Seed Banking in Response to ROD



- Lisa Keith at USDA Pacific Basin Agricultural Research Service conducting ROD pathology research
- Trials showed seeds are unlikely to carry *Ceratocystis* and seed drying protocols likely kill fungal spores

#OhiaLove Crowdfunding Campaign

gofundme Search Help Start a Fundraiser [Share](#) [Tweet](#) [Donate](#)



Seeding the future of the 'ōhi'a forest
from University of Hawai'i System [PLUS](#)

445

02:05 HD vimeo

#OhiaLove Help Save Hawai'i Forests

[Share](#) [Tweet](#) [4.0K shares](#)


\$50,030 of \$50k goal

Raised by 457 people in 4 months

[Donate Now](#)

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Created February 3, 2016


 Marian Chau [✉](#)
Emergencies
HONOLULU, HI

Reward Levels

#OhiaLove Crowdfunding Campaign

gofundme Search Help Start a Fundraiser

Share Tweet Donate

 **Seeding the future of the 'ōhi'a forest**
from University of Hawai'i System PLUS

445

\$50,030 of \$50k goal

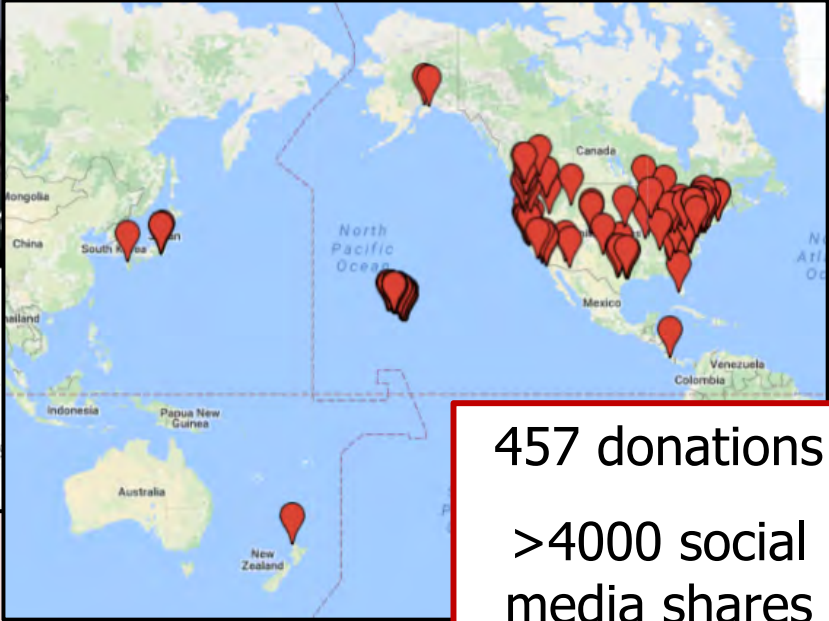
Raised by 457 people in 4 months

Donate Now

02:05 HD vir

#OhiaLove Help Save Hawai'i Forests

Share Tweet 4.0K shares



457 donations
>4000 social media shares

Hawai'i Seed Bank Partnership

Laukahi – Hawai'i Plant Conservation Network



- Created to coordinate seed banking efforts statewide
- Administered by Laukahi, which facilitates collaboration in plant conservation efforts statewide
- Began in 2013 with four active seed banks

Hawai'i Seed Bank Partnership

Laukahi – Hawai'i Plant Conservation Network



Plant Extinction Prevention
Program of Hawai'i



Hawai'i Island Seed Bank



NLGRP



Pu'u Kukui
Watershed



Hawai'i Island Seed Bank



- Established in 2008 by Jill Wagner, HSBP founding member
- Now a critical partner in the #OhiaLove Project – funds helped purchase dedicated equipment for 'ōhi'a seeds to reduce risk of spreading ROD from Hawai'i Island

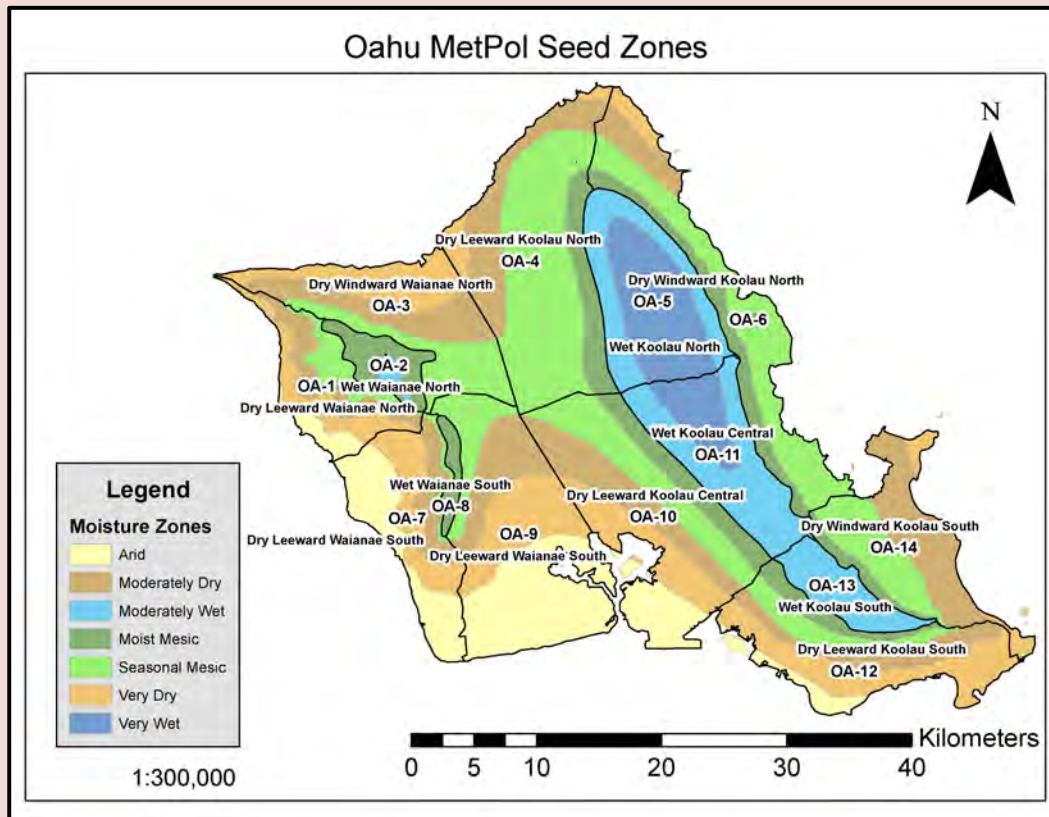


State of Hawai'i Division of Forestry & Wildlife Kaua'i Seed Bank



- Established in 2014 by Adam Williams, Kaua'i Botanist
- Collection partner in the #OhiaLove Project – funds supported backup storage of 'ōhi'a seeds from Kaua'i at Lyon Arboretum, including 2 island-endemic taxa

'Ōhi'a Collection Strategy



- HSBP partners developing provisional seed zones on each island
- Laukahi developing seed collection targets, statewide goals, and data management
- Lyon Arboretum developing standardized seed collection and post harvest handling protocols

'Ōhi'a Collection Protocols

HAWAII SEED BANK PARTNERSHIP #OhiaLove COLLECTION FORM

This section for *Seed Bank Use Only* HSBP Accession Code Received From Date Received

Receiving SeedBank [] [] [] []

OWNERSHIP AND PERMISSIONS Collector Name Collector Number Collection Date

Collector Agency [] [] [] []

Private or Public Land [] Landowner Authorized Collection Permit# []

PERMISSION TO RELEASE COLLECTION []

List Landowner/Manager, Collector authorized for release []

TAXON & LOCATION INFORMATION CHECK THIS BOX IF RAPID OHIA DEATH IS KNOWN FROM THIS AREA

TAXON []

Latitude Longitude UTM Location Notes

Island Code PopulationCode SiteCode link to map link to list

Degrees [] Degrees [] North []

Minutes [] Minutes [] East []

Seconds [] Seconds []

HABITAT INFORMATION

For Phenology, Condition, Light Level: enter .5 for 50% Moisture Class, Max Canopy: Select One Select Any that Apply

Phenology	Condition	Light Level	Moisture	Slope
Vegetative <input type="checkbox"/>	Healthy <input type="checkbox"/>	FullSun >95% <input type="checkbox"/>	Moisture []	Flat 0-10
Bud <input type="checkbox"/>	Moderate <input type="checkbox"/>	PartialSun 50-95% <input type="checkbox"/>	Max Canopy []	Moderate 10-45
Flower <input type="checkbox"/>	Poor <input type="checkbox"/>	PartialShade 5-50% <input type="checkbox"/>	Aspect []	Steep 45-70
Immature Fruit <input type="checkbox"/>	Dead <input type="checkbox"/>	Deep Shade 0-5% <input type="checkbox"/>	North	Vertical 70-90
Mature Fruit <input type="checkbox"/>			NorthEast	
			NorthWest	
			East	
			South	

SEED COLLECTION INFORMATION

FRUIT MATURITY [] POST-HARVEST PROCESSING []

BULK COLLECTION INFORMATION # trees observed [] # trees collected []

If seed collections must be made from multiple trees and combined into a *BULK* sample, please fill out these fields. Bulk collections must be made from the same taxon within the same Seed Transfer Zone. area covered (sq.km.) [] voucher code []

For Collections made and held from separate **individual plants**, please complete the [Google #OhiaLove Collection Form](#), or attach a spreadsheet with the fields shown in this **sample** below and submit with this form.

Plant #	Tag (y/n)	Ht. (m)	Latitude (Degrees/Minutes/Seconds)			Longitude (Degrees/Minutes/Seconds)			Elevation	# Mature Fruit	Notes
1	Y	20	21	19	57.4	157	48	07.5	152	50	

- Seed maturity guidelines
- Post-harvest ripening & handling protocols
- Standardized data required (e.g. variety, GPS, # capsules)



#OhiaLove Collection Summary

2016

- Over 2 million seeds from over 85 trees
- 10 seed zones on O`ahu and Hawai`i Island
- Taxa collected:

Metrosideros polymorpha

var. *incana*, *glaberrima*, *newellii*, *polymorpha*

hybrids *incana* x *glaberrima*, *incana* x *polymorpha*

Metrosideros macropus

Metrosideros rugosa

Metrosideros tremuloides

- Over 700,000 seeds banked at Lyon as backup for Kaua`i collections, including taxa:

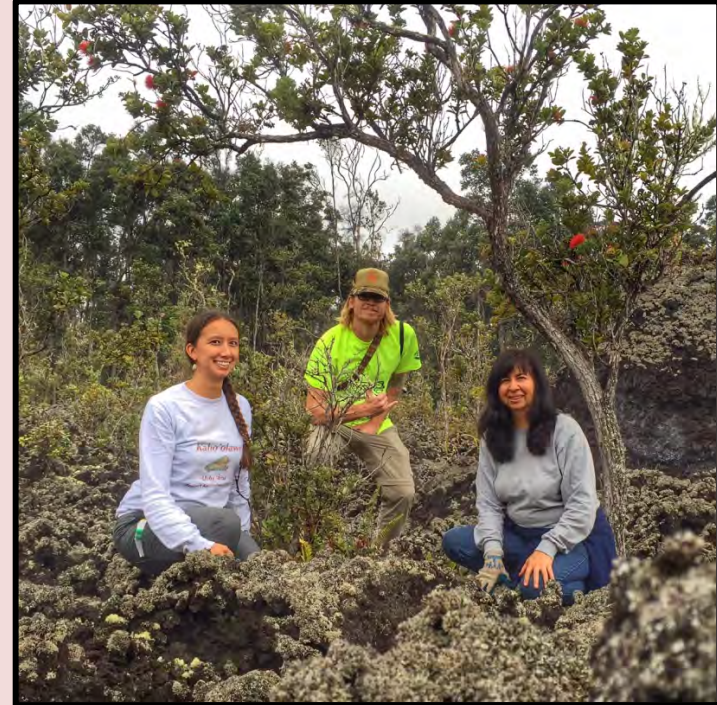
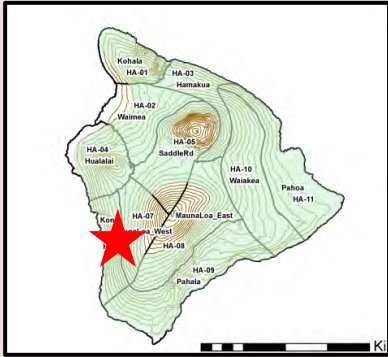
M. polymorpha var. *glaberrima*, *polymorpha*, *pumila*

Metrosideros waialealae



#OhiaLove Collection – Hawai'i

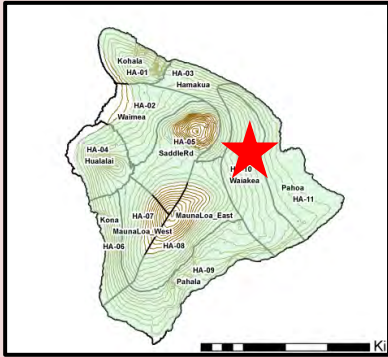
South Kona – May 2016



Taxa collected this trip: *Metrosideros polymorpha*
varieties *incana*, *glaberrima*, *polymorpha*
hybrid *incana* x *glaberrima*

#OhiaLove Collection – Hawai'i

Wailuku Stream – May 2016

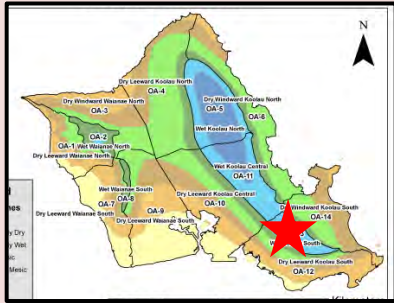


Taxa collected this trip:
Metrosideros polymorpha
variety *newellii*



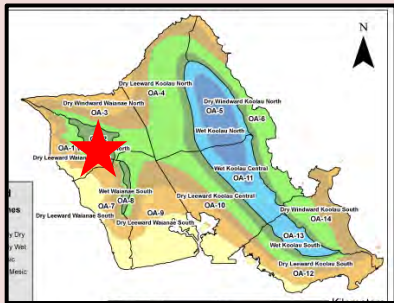
#OhiaLove Collection – O'ahu

Ko'olau Summit – June 2016



Taxa collected this trip:
Metrosideros rugosa





#OhiaLove Collection – O'ahu

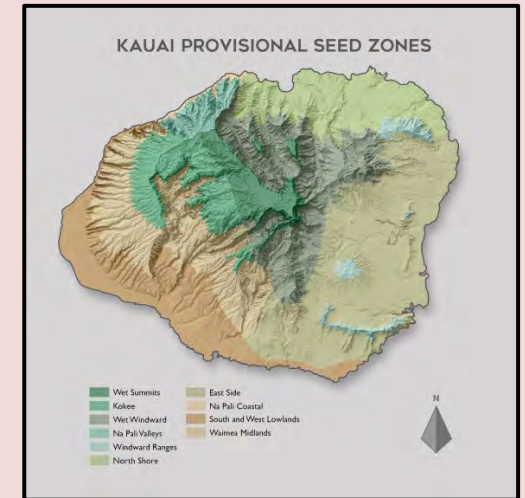
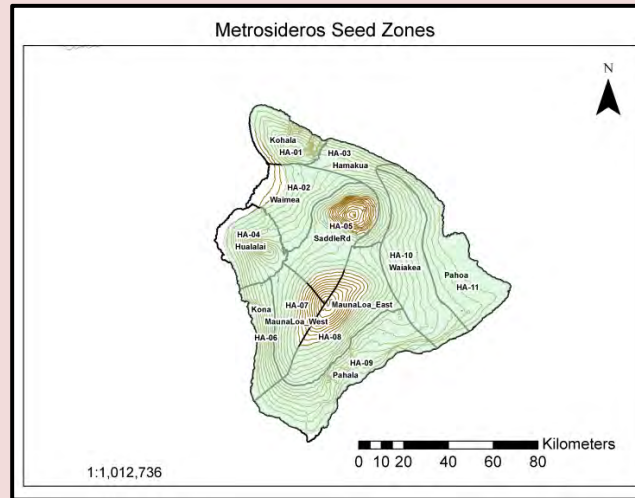
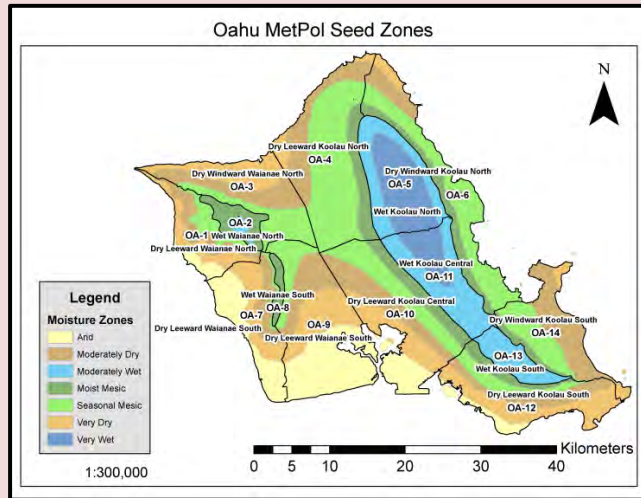
Wai'anae Mountains – August 2016



Taxa collected this trip:
Metrosideros polymorpha
variety *polymorpha*
hybrid *incana* x *glaberrima*



'Ōhi'a Collection Strategy



# 'Ōhi'a TAXA	# TREES	# CAPSULES
14 Including varieties	10,000 trees per taxon Representing all populations statewide	Minimum: 25 (5,000 seeds) Maximum: 75 (15,000 seeds)
TOTAL	140,000 trees	700 Million – 2.1 Billion Seeds!

laukahi.org

Laukahi: The Hawai'i Plant Conservation Network

[Hawai'i Strategy for Plant Conservation](#)

[Hawai'i Seed Bank Partnership](#)

[Hawai'i Rare Plant Restoration Group](#)

['Ōhi'a Seed Collections](#)

[PROTOCOL](#)

[FORM](#)

[MAPS](#)

[NEEDS](#)

[Ōhi'a
TAXA](#)

[Partners](#)

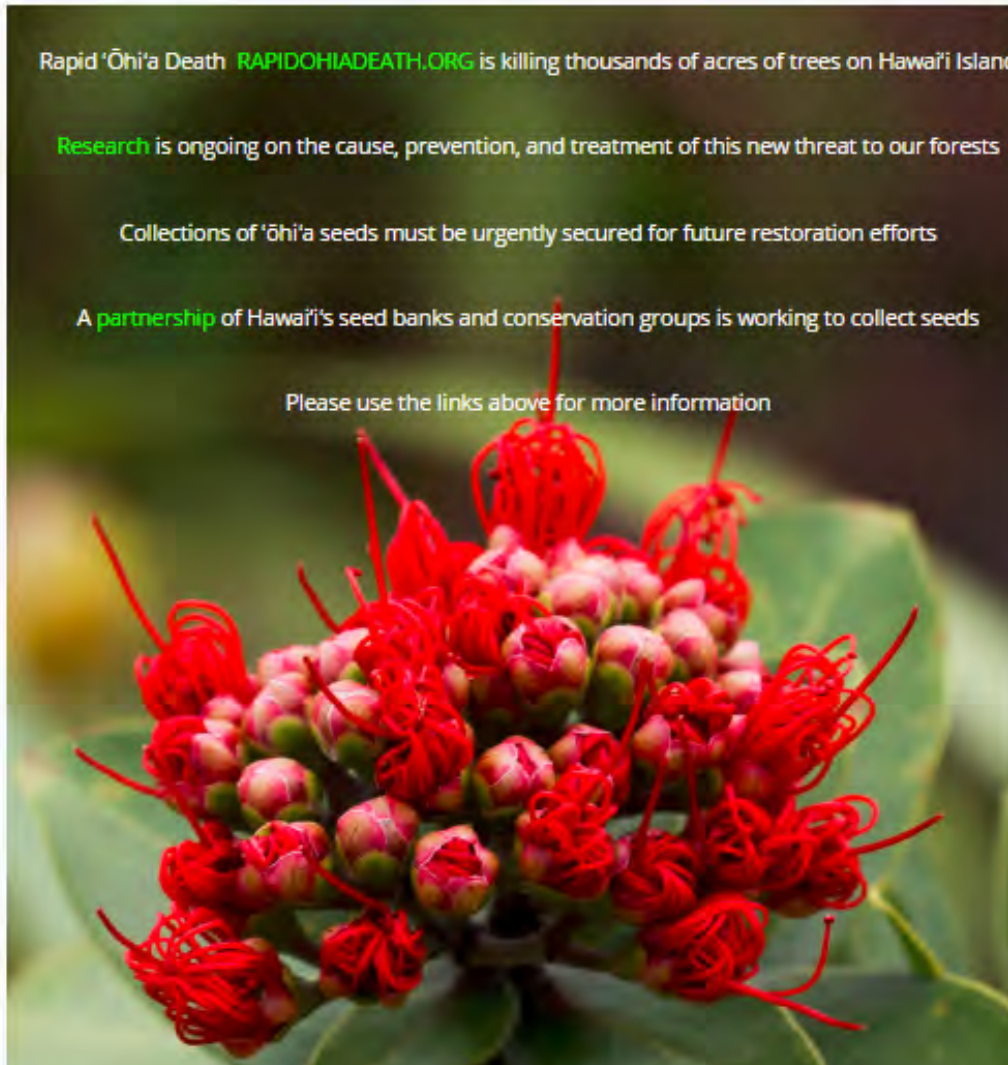
Rapid 'Ōhi'a Death [RAPIDOHIADEATH.ORG](#) is killing thousands of acres of trees on Hawai'i Island

[Research](#) is ongoing on the cause, prevention, and treatment of this new threat to our forests

Collections of 'ōhi'a seeds must be urgently secured for future restoration efforts

A [partnership](#) of Hawai'i's seed banks and conservation groups is working to collect seeds

Please use the links above for more information

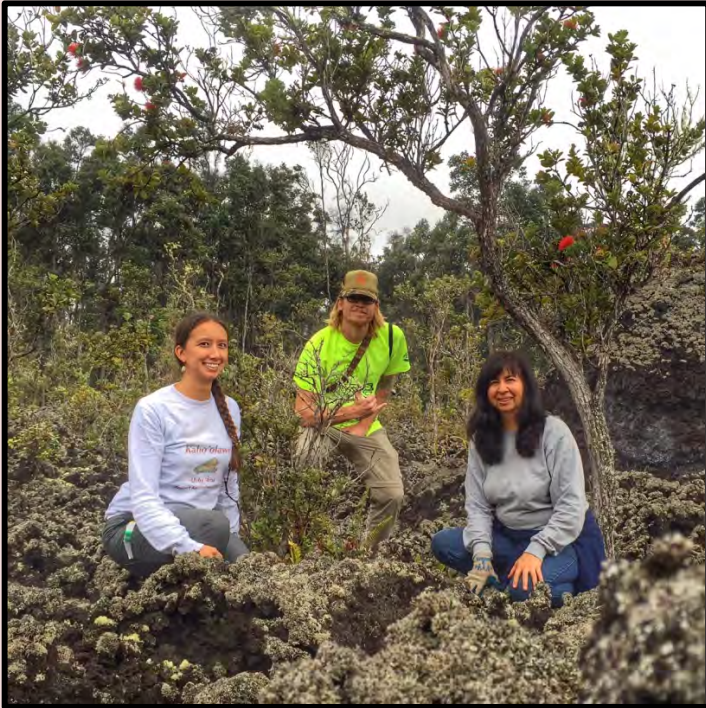




Next Steps: ROD Seed Banking Initiative 2017-2018

- Expand by offering 'ōhi'a seed collection workshops on each island, asking for help from conservation agencies and the local community
- Funding secured for Hawai'i Seed Bank Partnership facilities to accept 'ōhi'a seeds from many sources
- Provide material for USDA and University of Hawai'i research into ROD resistance
- Bank seeds of rare species affected by ROD

Mahalo! (Thank You)



Tim Kroessig
Jill Wagner
Matt Keir
Keoni Kikala
Hawai'i Seed Bank Partners

Funding Sources

#OhiaLove Supporters
UH President David Lassner
Hawai'i Tourism Authority

UH Mānoa Office of Communications, Nellie Sugii, Lyon Arboretum Staff,
Friends of Lyon Arboretum, UH Foundation

JB Friday, Flint Hughes, Lisa Keith, Ardena Saarinen, Kainana Francisco,
Adam Williams, Pu'u Wa'awa'a Staff, and the ROD Working Group

'Ōhi'a Lehua (*Metrosideros polymorpha*)



variety
incana



variety
polymorpha



hybrid

Guidelines for Landowners



Landowner's Guide to Storing 'Ōhi'a Seeds

Please do not collect 'ōhi'a seeds in the forest!
It could be harmful to these natural populations of trees, and even worse, it increases the likelihood that you will spread Rapid 'Ōhi'a Death.

How to store 'ōhi'a seeds from your own land:



1. Collect ripe, healthy seeds
2. Extract and clean the seeds
3. Germinate some seeds



4. Dry the seeds for storage
5. Package the seeds for storage
6. Store the seeds
7. Test seeds from time to time
8. Prepare stored seeds for sowing
9. Sow the seeds & grow 'ōhi'a!

[Read on for details on each step](#)

PDF posted at laukahi.org and shared on Lyon Arboretum's Facebook page



The preceding presentation was delivered at the

2017 National Native Seed Conference

Washington, D.C. February 13-16, 2017

This and additional presentations available at <http://nativeseed.info>

