

Forest Health

2020 highlights

◀ HAWAII
◀ MARCH 2021

Disease Activity 2

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Additional Information 4

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2020 Summary

- **Rapid 'Ōhi'a Death (ROD)** continued spreading on Hawai'i Island, and both *Ceratocystis* species are now established at many sites on Kauai. The aggressive *C. lukuohia* has not been found on O'ahu, Maui, Molokai, or Lanai.
- **Coconut rhinoceros beetle (CRB)** (*Oryctes rhinoceros*) eradication efforts continue on O'ahu where increases in trapped beetles were seen in 2020, and the area of the infestation also increased. The beetles have not been detected on any other island where early detection traps have been deployed.
- The Hawaii Agriculture Research Center (HARC), in collaboration with DOFAW, conducted **disease resistance screening** of koa (*Acacia koa*) and continued establishing seed orchards to provide koa seed for commercial and restoration plantings.
- A new plant pest was detected in forests on O'ahu. The **passion-vine hopper** (*Scolypopa australis*) is known to be invasive in New Zealand, and this was the first detection of the pest in the U.S.

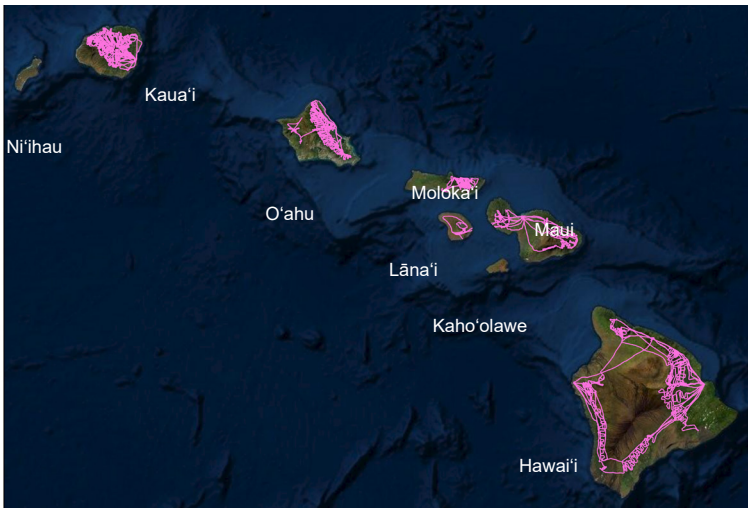
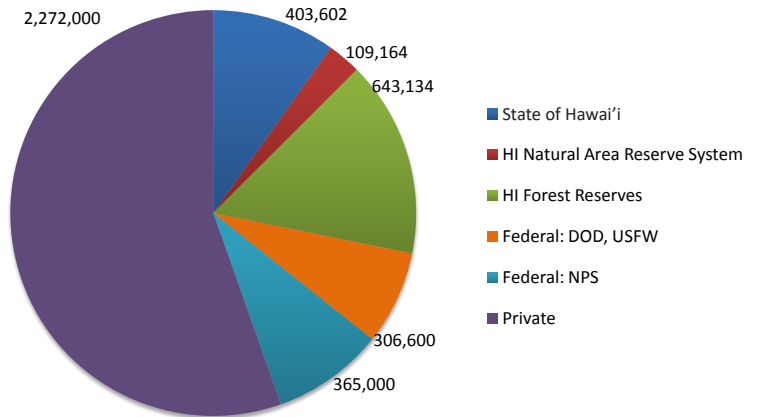


Figure 1. Aerial Survey flight lines in Hawaii, October 2019–October 2020. Map credit: Brian Tucker, University of Hawai'i at Mānoa - Pacific Cooperative Studies Unit

Land Ownership in Hawai'i



Forest Resources

This report is for the State of Hawai'i, which includes eight main islands (Kauai, O'ahu, Molokai, Lanai, Kaho'olawe, Maui, Hawai'i, and Ni'hau) totaling 4.1 million acres. Approximately 1.4 million acres of the state are considered forested.

Forest Health Monitoring in Hawai'i

Forest health monitoring occurs throughout the state on private, state, and federal lands. The spread and impact of invasive plants, invertebrate pests, diseases, ungulates, and biological control agents are monitored using ground surveys, transect monitoring, helicopter surveys, road surveys, photo points, and remote sensing techniques.

The Hawaii Division of Forestry and Wildlife is working with partners to utilize new technologies to collect forest health data at varying scales. UAS surveys for small areas, high resolution cameras mounted on helicopters and fixed wing aircraft, satellite imagery coupled with computer learning technology, and lidar combined with spectroscopy are examples of different technologies being used in Hawai'i to collect data on pest damage. In addition, the US Forest Service Forest Inventory and Analysis program has installed plots through Hawaii's forest and is currently conducting the second measurement.

Rapid 'Ōhi'a Death or *Ceratocystis* Wilt of 'Ōhi'a

Ceratocystis spp.

'Ōhi'a (*Metrosideros polymorpha*) is the most common tree species in Hawaii's native forests, growing from sea level to nearly 8,000 feet in dry, mesic, and wet forests. 'Ōhi'a-dominated forests cover 350,000 ha statewide, with 250,000 ha occurring on Hawai'i Island. 'Ōhi'a trees account for 50% of all forest trees in the state. This abundant tree provides habitat to much of the native flora and fauna and also has significant cultural importance. The name 'ōhi'a means 'to gather' in the Hawaiian language, referring to the tree's ability to collect water from the rain and mist, feeding the aquifers that sustain life on this remote archipelago.

Rapid 'Ōhi'a Death was first observed in 2010 in the Puna District of Hawai'i island. Molecular analysis resulted in identification of two distinct but related fungal species of *Ceratocystis* which were described as *C. huliohia* and *C. lukuohia* in 2018, the former a slow spreading canker disease and the latter an aggressive wilt disease causing most of the mortality seen on Hawaii island (Barnes et al. 2018).

In 2020, Rapid 'Ōhi'a Death (ROD) continued to spread on Hawai'i Island, mostly filling in areas where only scattered mortality occurred. Semi-annual aerial surveys of the state's 'ōhi'a forests using the US Forest Service Digital Mobile Sketch Mapping (DMSM) tablet-based app were used to identify new disease outbreaks. On Kauai, both *Ceratocystis* species have been detected in multiple areas. However, the disease is limited to fragmented, invaded forests in lowland areas, and managers are working to prevent spread into the island's interior 'ōhi'a forests.

Early detection surveys continued on the islands of Oahu, Maui, Molokai, and Lanai. Only *C. huliohia* has been detected – one tree on Maui and five on Oahu. Updated information and disease maps can be found on the Rapid Ohia Death website at www.rapidohiadeath.org.

'Ōhi'a Disease Resistance Program

<https://akakaforests.org/projects/ohia-disease-resistance-program>

The Akaka Foundation for Tropical Forests, US Forest Service Pacific Southwest Research Station, and various partners are working on identifying and developing genetic disease resistance in 'ōhi'a (*Metrosideros polymorpha*). In 2020, the program accomplished various goals including:

- Collected over 4,300 'ōhi'a cuttings and countless seeds representing 175 mother 'ōhi'a trees on Hawai'i Island.
- Produced seedlings from *Metrosideros* species and varieties from O'ahu (*M. polymorpha* var. *incana*, var. *polymorpha*, var. *glaberrima*, *M. tremuloides*, *M. macropus*, and *M. rugosa*) and Kaua'i (*M. polymorpha* var. *dieteri* and *M. waialeale* var. *waialealae*).
- Established the Leilani Estates 'ōhi'a community partnership in the Moku of Puna, a community-based ROD resistance effort to collaboratively identify surviving, and potentially ROD-resistant, 'ōhi'a individuals for seed collections.
- Produced two peer-reviewed journal articles describing improved culturing techniques for *Ceratocystis lukuohia* and the promising results of our initial *C. lukuohia* screening work, and an outreach piece about 'ōhi'a disease resistance work in a special 'ōhi'a issue of Hawai'i Landscape magazine.
- Created a physical brochure and online content for Akaka Foundation for Tropical Forests website to support community outreach and engagement.

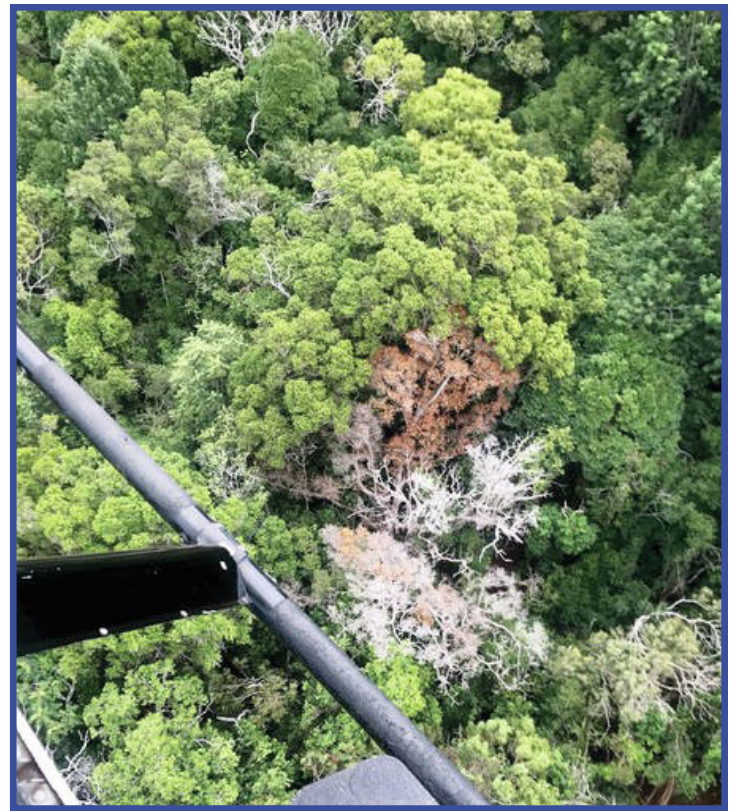


Figure 2. This 'ōhi'a tree, showing symptoms of ROD, was detected during the DMSM survey on Kauai. The tree was tested and was positive for *C. lukuohia*. Photo credit: Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife



Figure 3. Successfully rooted cuttings collected from 'ōhi'a trees in nature being grown at the Institute of Pacific Islands Forestry for ROD-resistance screening. Photo credit: 'Ōhi'a Disease Resistance Program



Figure 4. Several 'ōhi'a have survived preliminary inoculation experiments with *Ceratocystis lukuohia*. These survivors will be outplanted and monitored to validate the results of the short-term greenhouse inoculation experiments. Photo credit: 'Ōhi'a Disease Resistance Program

Myrtaceae Rust

Austropuccinia psidii

A rust disease on 'ōhi'a lehua (*Metrosideros polymorpha*) seedlings was first detected in a nursery on O'ahu in 2005. The disease was identified as *Austropuccinia psidii*, commonly known as "guava rust" in Florida and as "eucalyptus rust" in Brazil. It is considered to be a serious threat to several hosts in the Myrtaceae family in numerous tropical and subtropical countries. The disease is referred to locally as "'ōhi'a rust" because of the importance of this native tree, but it infects many species in Myrtaceae present in Hawai'i. The disease is present on all major islands and can cause severe injury to 'ōhi'a seedlings growing in nurseries.

Multiple strains of *Austropuccinia psidii* have been found to be associated with different hosts in Brazil (Graca et al. 2011). Fortunately, only a single strain referred to as the pandemic strain of *Austropuccinia psidii* is known to occur in Hawai'i, and it has not caused excessive injury to 'ōhi'a trees. A study conducted in Brazil found 'ōhi'a families to be more susceptible to several of the strains isolated in Brazil (da Silva et al., 2014). This information is being used by quarantine officials at state and federal levels to protect Hawaii from accidental introduction of additional, more harmful strains of the disease. In 2020, the Hawaii Department of Agriculture enacted a rule restricting imports of Myrtaceae plant material into Hawaii, helping protect *Metrosideros* spp. from additional rust strains and other pests. Monitoring for rust outbreaks on *Metrosideros* has also been incorporated into the Rapid 'Ōhi'a Death aerial surveys.

Koa Wilt

Over the past decade, the Division of Forestry and Wildlife has worked with the Hawaii Agriculture Research Center in developing disease-resistant koa (*Acacia koa*) for both commercial plantations and forest restoration. *F. oxysporum* causes a wilt disease in koa that can cause widespread mortality in planted koa, especially at lower elevations. Screening koa families for disease resistance by ecoregion has been conducted by HARC, and seed orchards have been established throughout the state for providing seed to DOFAW and private landowners.

Areas of focus in 2020 include: South Kona on Hawai'i Island, where seed was collected for screening; Helemano on O'ahu, where the state recently acquired land for experimental forestry and seed was collected for screening; and distribution of seed to growers on Hawai'i island and Molokai for forestry use. Existing seed orchards on O'ahu, Kauai, and Maui were maintained and monitored.

Coconut Rhinoceros Beetle

Oryctes rhinoceros

<https://www.crbhawaii.org/coconut-rhinoceros-beetle>

The coconut rhinoceros beetle (CRB) is a pest of coconut trees and other palms and is native to South and Southeast Asia. The adult beetles damage trees by boring into tree crowns where they injure young, growing tissue to feed on sap. The subsequent damage can cause tree death. The beetles breed in moist, decomposing organic matter, especially dead coconut material, leading to a destructive cycle if left unmanaged. Although the beetles can fly up to 2 miles regularly feeding on coconut palms and returning to the breeding site, spread is primarily through human movement of infested breeding material (e.g., green waste, dead trees, etc.).

The first detection of CRB in Hawai'i occurred on Joint Base Pearl Harbor – Hickam on O'ahu in December 2013 in a USDA trap. The amount and location of the infested mulch made destruction of the breeding population extremely challenging and required developing new tools. Currently infested material is being treated through composting or incineration in air curtain burners.

In cooperation with the U.S. Navy and the University of Hawai'i, the project which is housed by Hawaii Department of Agriculture (HDOA) is using pheromone detection traps around the island to delineate the infestation and detect new satellite populations. Crews also survey coconut palms for signs of CRB damage and mulch piles for breeding sites. No beetles have been detected on other islands in the archipelago, and eradication on O'ahu is still the project goal. While site-specific eradication has occurred at the original infestation, several infested areas remain. HDOA is utilizing USDA-trained canine teams to detect breeding locations.

The infestation area expanded into agriculture lands in central O'ahu in 2020, and there are now populations abutting natural forests. As the population expands, there is growing concern about impacts to native *Pritchardia* palms, which are known to be susceptible to CRB feeding damage. In particular, the endangered *Pritchardia kaalae*, endemic to the Waianae Mountains on O'ahu, could be threatened by CRB establishing in natural areas.



Figure 5. Koa seed collection. Photo credit: Hawaii Agriculture Research Center

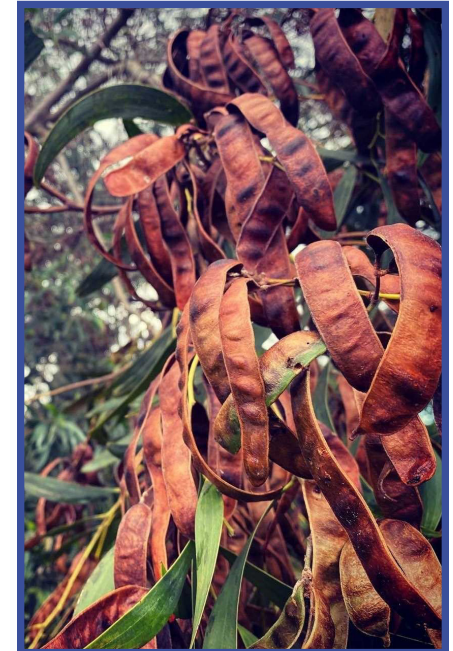


Figure 6. Koa seed pods. Photo credit: Hawaii Agriculture Research Center

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Data Sources

The data sources used for this report include the Division of Forestry and Wildlife, US Forest Service Region 5, Hawai'i Department of Agriculture, University of Hawai'i College of Tropical Agriculture and Human Resources, Hawai'i Agriculture Research Center and other partner organizations.

Hawaii's Watershed Partnerships, the National Park Service, The Nature Conservancy of Hawaii, and DOFAW's Natural Area Partnership System also conduct monitoring of invasive plants and ungulates to improve the effectiveness of their management activities, but those data are not the focus of this report. The USDA Forest Service's Forest Health Forest Inventory and Analysis Program was recently introduced to Hawai'i, but results from the survey are not yet available.

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