

Understanding the response of native and non-native forests to climate variability and change to support resource management in Hawai'i

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'Ōhi'a Lehua blossoms. Photo by University of Hawai'i News/ [CC BY-NC-ND 2.0](#)

Hawai'i Island is by far the largest island in the Hawaiian archipelago, and it also has the largest forests, which combined cover nearly half of the island's area. These varied forests are extremely important ecologically and culturally. Many of the native species found in these forests exist nowhere else on earth. However, Hawaiian forests are threatened by habitat loss, disease, and the spread of invasive non-native species. Changes in climate add another level of complication to the already difficult process of planning forest protection and restoration. Better information about the future effects of climate change on plant growth can allow landowners to anticipate and manage possible shifts in plant community function and composition.

We used field data from two long-term monitoring sites in Hawai'i Volcanoes National Park (HAVO) to model the effects of projected climate change on two forest ecosystems, one dominated by the native tree 'Ōhi'a (*Metrosideros polymorpha*) and the other by the invasive non-native tree Strawberry Guava (*Psidium cattleianum*). Both species are projected to significantly increase their evapotranspiration rates in the future, which means that forests may use more water. Our work indicates that growth rates for both species may decrease.

Although a slower growth rate of invasive species could be considered a benefit, the predicted decrease in 'Ōhi'a growth is troubling because this may suggest a decrease in vigor generally, which could reduce resilience to disease, invasion, drought, or wildfire.

Future research on the mechanism underlying slower plant growth can help to determine if there are effects on plant vigor and resilience. In addition, water resources managers should take the predicted increase in forest water use into consideration when developing future plans, as this may result in changes to groundwater recharge rates and stream flows.



A fluxnet micrometeorological monitoring station located in HAVO collects long-term environmental data.

Quick Summary

- The native forests of Hawai'i are of vital importance ecologically as well as culturally. However, even protected forests are threatened by the spread of invasive species and the effects of changing climate. Information about projected changes in forest ecosystems can allow resource managers to plan restoration and monitoring strategies more effectively.
- Our environmental data and climate change models project that both native and invaded forests will show higher water consumption but slower growth for much of the year. This may suggest reduced vigor overall, which could have a disastrous impact on native 'Ōhi'a forests.
- The possibility of increased water use by invasive forest plant species may have an effect on future water groundwater recharge and streamflow. In the future, in areas where cloudiness is projected to decrease (roughly the same as areas where rainfall is projected to decrease), managing to limit invasion might have beneficial consequences regarding water.



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