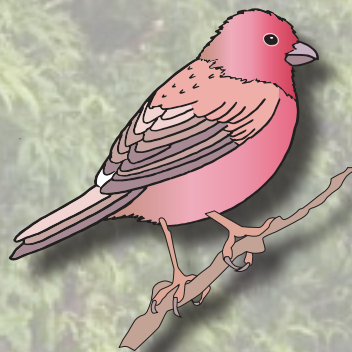
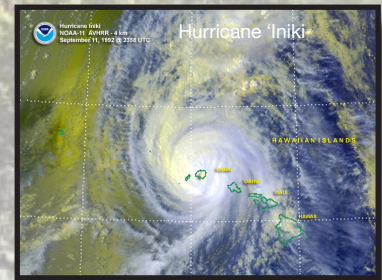
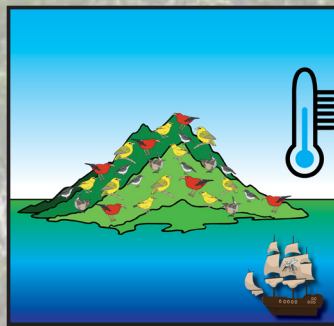
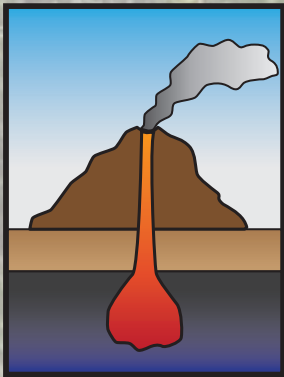


Kaua'i Forest Bird Recovery Project

Extinction Crisis Timeline

ACTIVITY



Symphony of the Hawaiian Birds

Lesson 12 Materials

EXTINCTION CRISIS TIMELINE ACTIVITY

Overview of Outcomes:

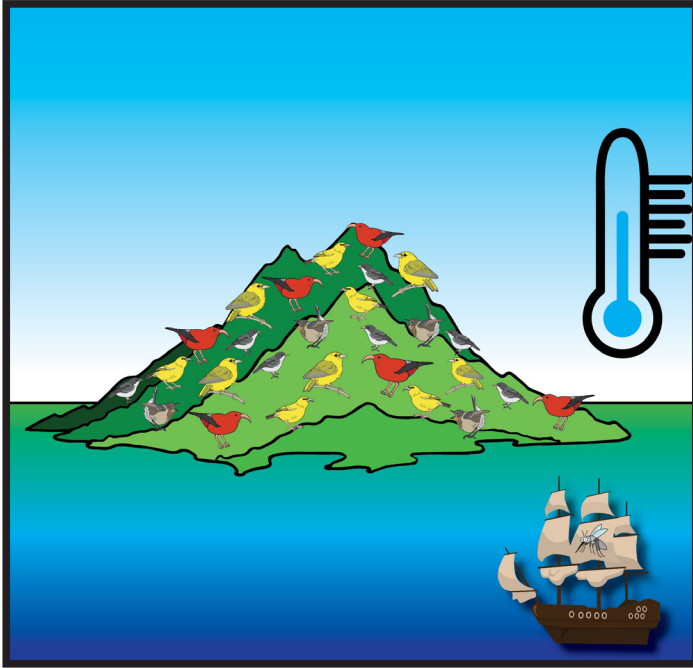
This activity will reprise themes from the previous activity on invasive, introduced, and indigenous/native species. Classes will be split into groups that will be given the packets (see below) containing images of specific events (initial species arrivals, Western contact, invasive establishment, etc.) and approximate dates, and tasked with matching these elements and creating a timeline for these events. Please note that some dates will overlap (e.g., arrival of birds and emergence of islands), and that some events are dateless but can still be placed in sequence.

This activity is designed to help students think about the temporal scale of Hawaiian natural history and to make connections between the increase of invasive species and diseases and the decline of our native species. A key component of this lesson will be communicating the rapid pace of habitat degradation in the Hawaiian Islands.

Events include (in order):

- Volcanic eruption/ emergence of main Hawaiian Islands from Hawaiian hotspot ~6 MYA, with Oahu emerging ~4 MYA
- Finch ancestor arrives in Hawai'i by chance, most likely blown off course. ~7.2-5.8 MYA ([https://www.cell.com/current-biology/fulltext/S0960-9822\(11\)01078-5](https://www.cell.com/current-biology/fulltext/S0960-9822(11)01078-5))
- Ancestors of Hawai'i's forest birds start to adapt and fill niches almost as soon as the islands formed, based on food sources and habitat types, further evolving as other islands ('O'ahu, Maui, and Hawai'i) begin to form and new habitats and food sources are created. Based on this article (<https://insider.si.edu/2011/10/smithsonian-scientists-collaborators-determine-the-evolutionary-family-tree-for-the-hawaiian-honeycreepers/>) the largest burst of evolution into new species occurred between ~4-2.5 mya. (adaptive radiation)
- Polynesians arrive and begin to change the landscape. They also bring with them many other species some begin to compete with the existing species. As many as 35 species of birds go extinct. (~1000 ad)
- Pacific rats and Pigs arrive with the Polynesians ~900 years ago
- Westerners (Cooke and his men) arrive bringing European rodents with them, and further change the landscape. Birds retreat as their habitat is changed or destroyed -(1778)
- Mosquitos arrive on whaling ships, bringing avian diseases (avian malaria) with them (1826). As we move forward in time, the birds retreat to high elevation forested areas where it is too cool for mosquitos to breed.
- Hawai'i becomes a state- (1959)
- Hurricane Iniki (last time Kama'o ever seen)-(1992)
- Birds placed on the endangered species list (Puaiohi-1967, 'akikiki & 'akeke'e -2010, 'i'iwi listed as threatened -2017)
- Rapid 'Ōhi'a Death threatens native forest which the birds depend on for their habitat (2014).
- Climate change alters weather patterns and increases the elevation which mosquitos can breed. Birds are forced to retreat to the even smaller areas of the forest still free from mosquitos and avian malaria. (present day)
- Some birds begin to develop resistance to avian diseases, others continue to decline in number as the temperature and breeding elevation continue to increase. In the near FUTURE, it is possible that only the most disease resistant species will remain.

Native birds found from the forest to the sea.



Adaptive Radiation

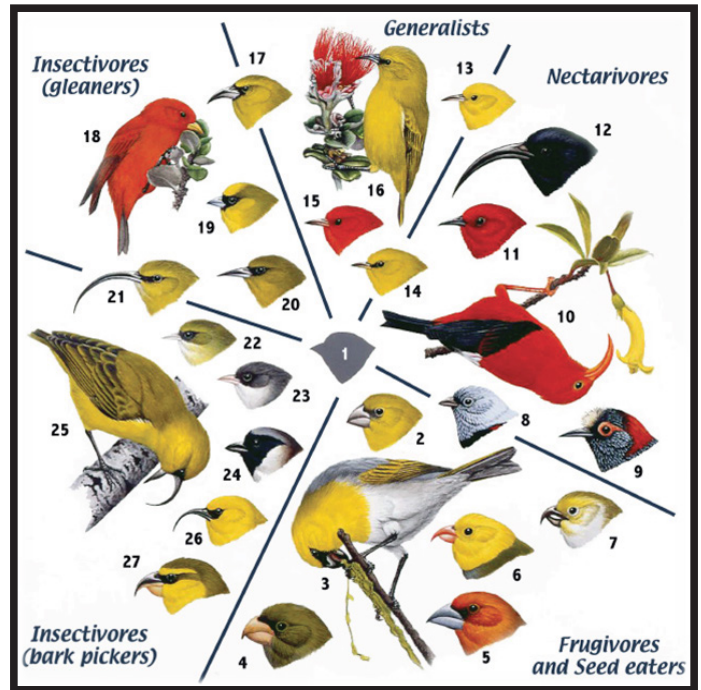
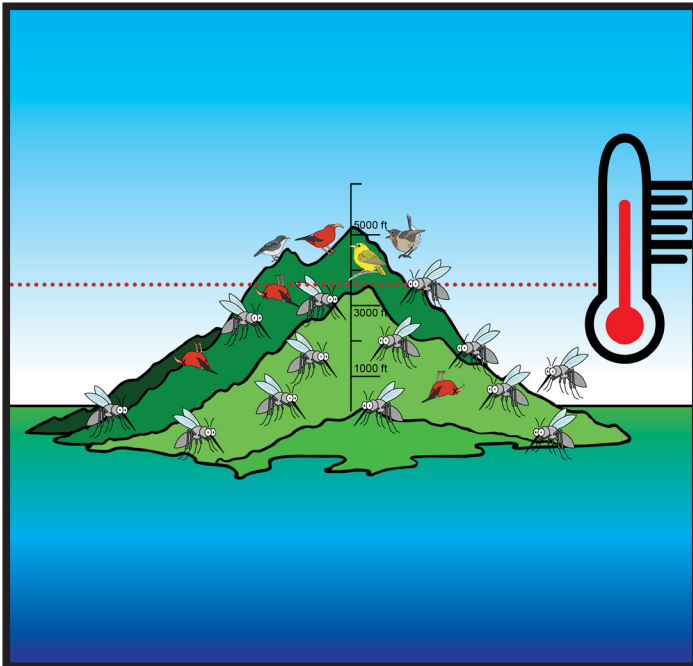
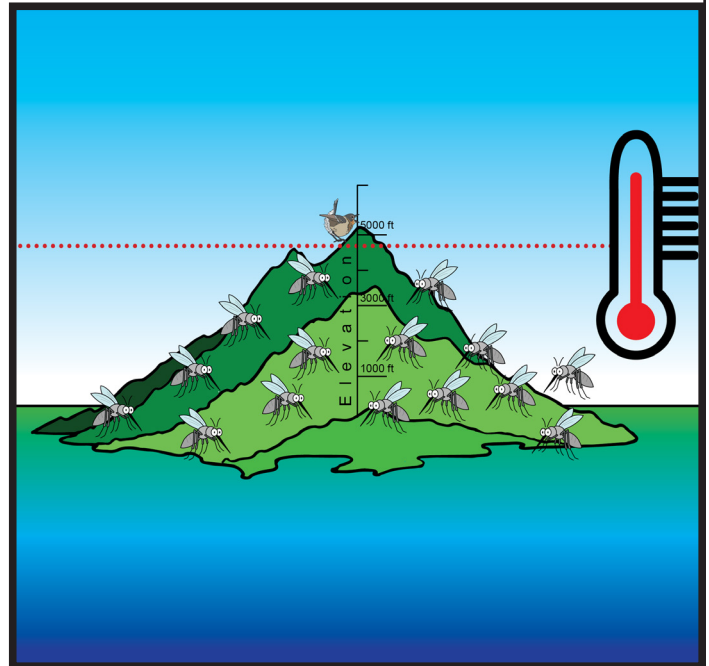


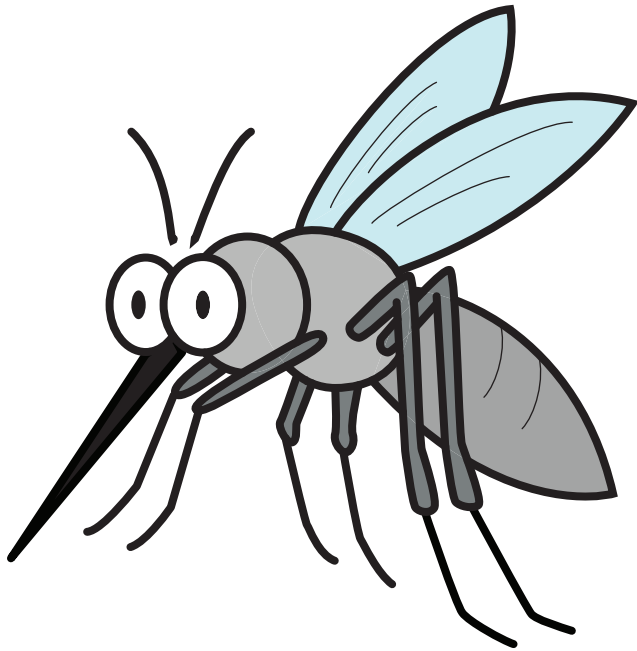
Image by H. Douglas Pratt



Climate begins to change.

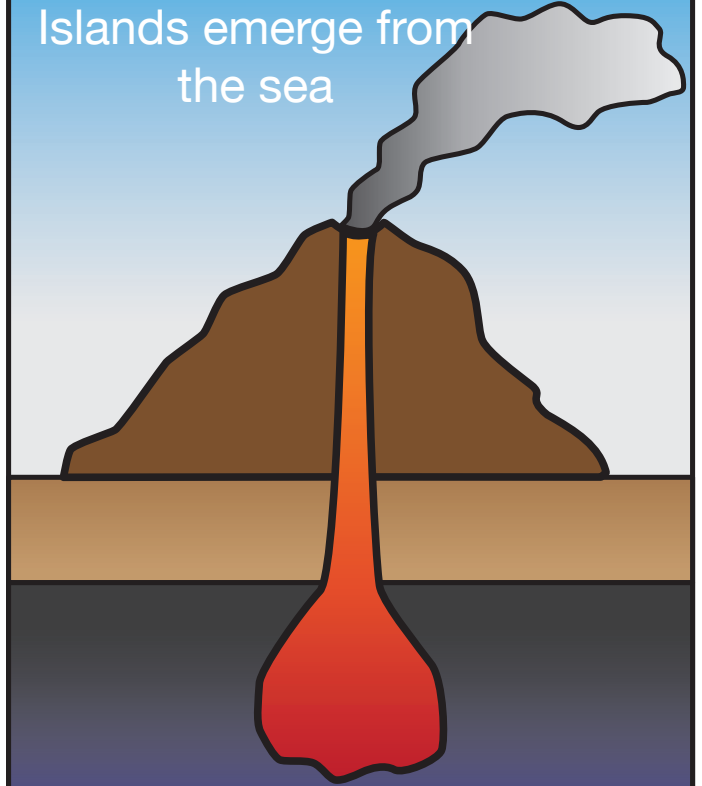


Only the most resilient birds remain.

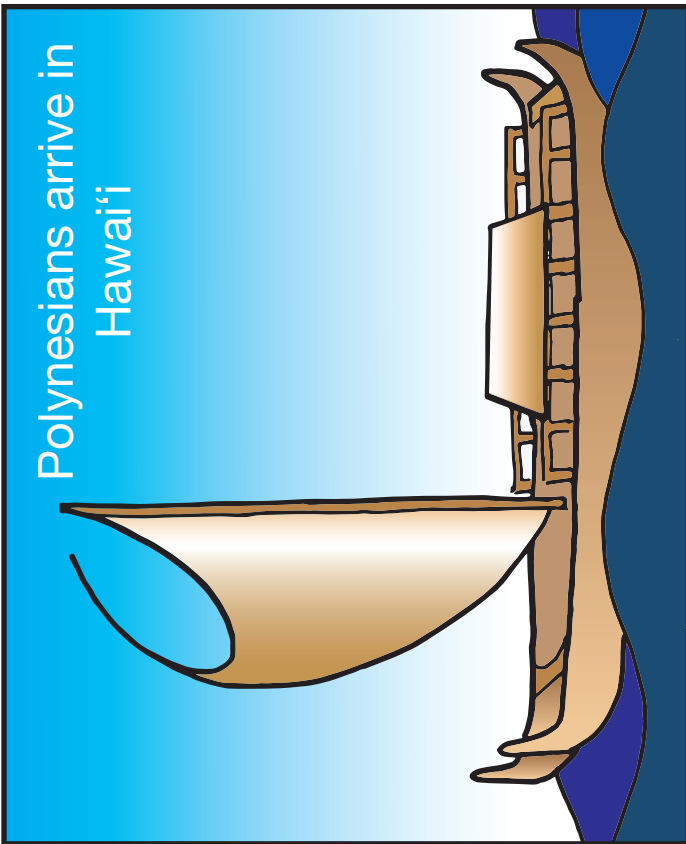


Mosquitoes arrive in Hawai'i

Main Hawaiian
Islands emerge from
the sea

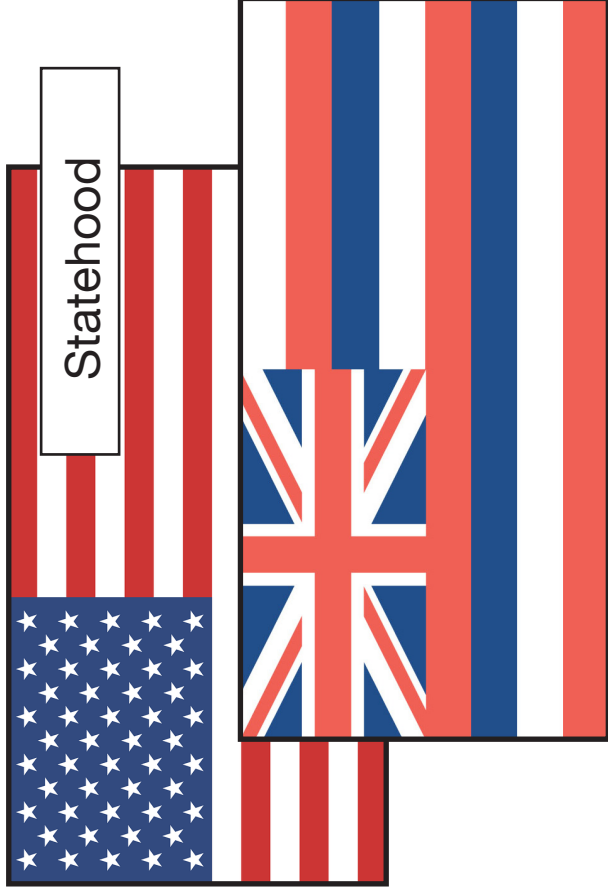


Polynesians arrive in
Hawai'i



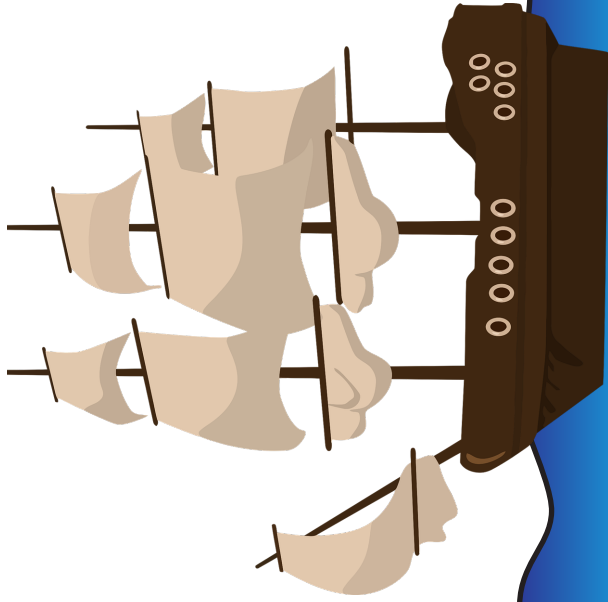
European rats arrive in Hawai'i

Statehood



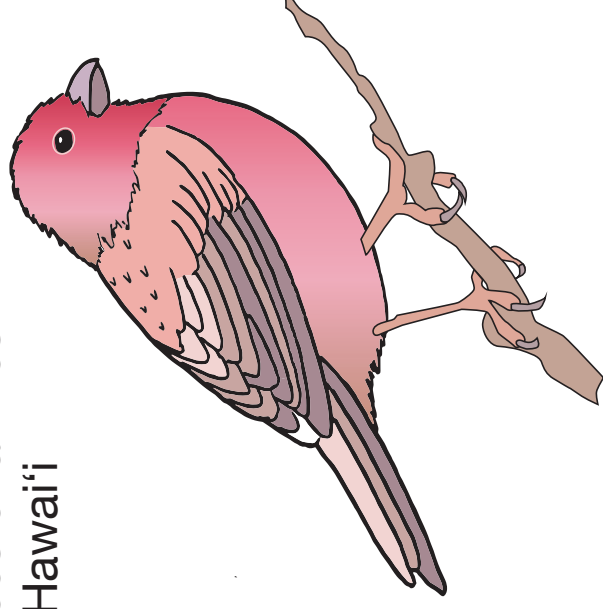
Images by Flags-to-Print.com

Pigs arrive in Hawai'i



Westerners arrive in Hawai'i

Finch ancestor arrives
in Hawai'i





Endangered



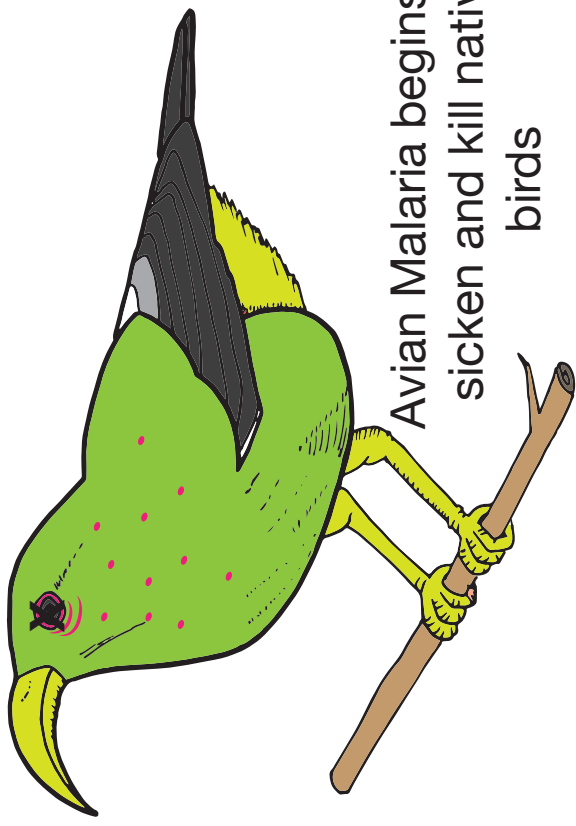
Endangered



Threatened



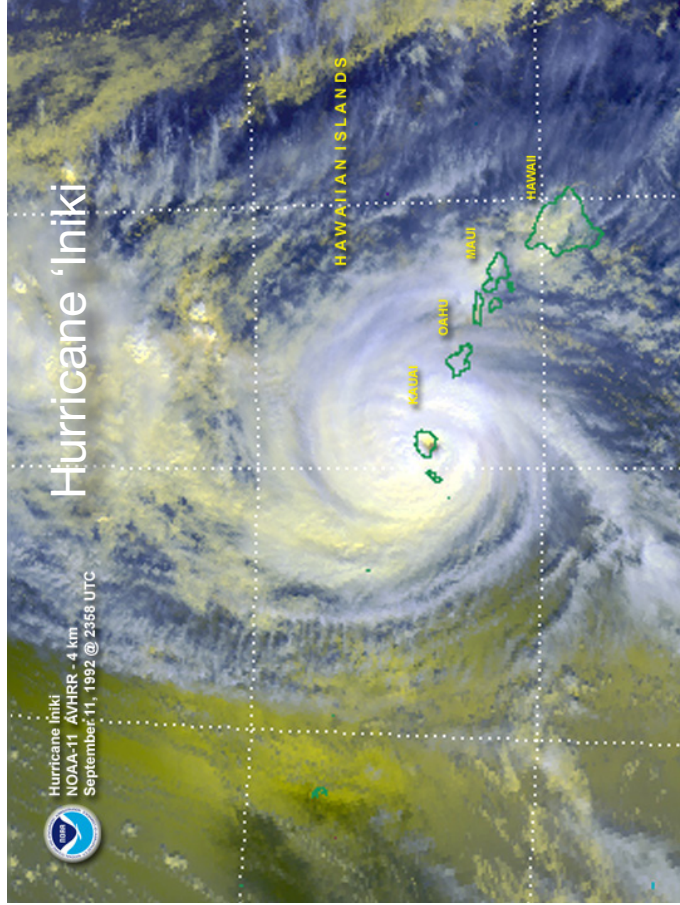
Endangered



Avian Malaria begins to
sicken and kill native
birds



Hurricane 'Iniki



Rapid 'Ōhi'a Death

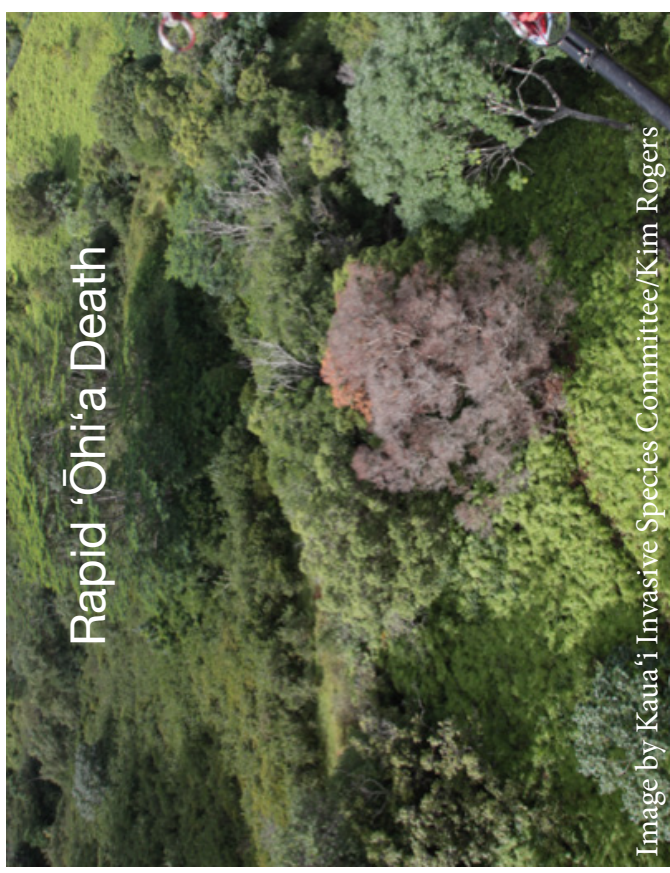


Image by Kaua'i Invasive Species Committee/Kim Rogers

6 million years ago

1967-2017

1000 a.d.

1778

1826

900 years ago

4-2.5 million
years ago

1959

1992

2014

present day

future