Establishing climate change vulnerability rankings for Hawaiian native plants

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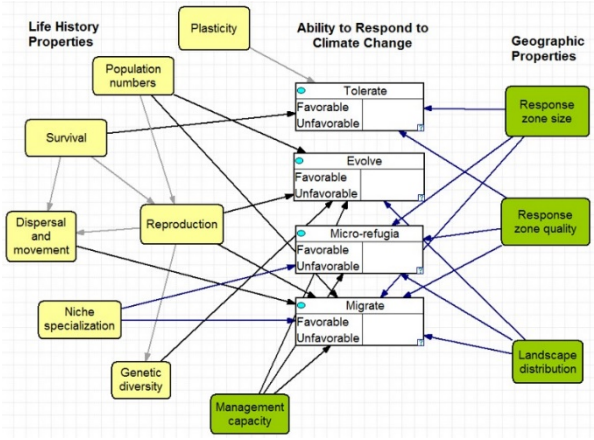
Loulu lelo, a threatened endemic Hawaiian tree. Photo courtesy Forest and Kim Starr/ CC BY 3.0

The Hawaiian Islands are some of the most isolated islands on earth, located nearly 2500 miles from the nearest continent. They are also considered a worldwide biodiversity hotspot, and nearly 90% of the plants native to Hawai‘i are endemic- found nowhere else on earth. However, Hawaii is also often known as the “extinction capital of the world” due to the rate at which endemic species are being lost. It is estimated that nearly half the native plants in Hawai‘i are threatened or otherwise of conservation concern. The threats to these plants have traditionally come from development, grazing or seed destruction by introduced species, and competition from introduced plants. In addition, global climate change is expected to increase temperature and alter patterns of precipitation in Hawaii. Although all plants will be exposed to these changes, species will respond differently based on their physical and genetic traits. We gathered information for over 1000 species from scientific literature, surveys sent to organizations working with Hawaiian plant conservation, and a panel of expert botanists.

Our models integrate this information to determine the relative vulnerability of native plant species under several climate change scenarios. We found that, for most native species, future range loss is proportional to amount of potential future regional warming.

Surprisingly, the relative vulnerability of a species tended to be similar across scenarios considered, suggesting our relative vulnerability scores will be useful regardless of the level of future warming. Our model also allows us to determine which factors are the strongest drivers of vulnerability for each species. A database of native plants with their relative vulnerability and contributing vulnerability factors, and maps of projected species habitat under different climate change scenarios are available. This information has been of great interest to resource managers and other plant protection groups and agencies. Given the large number of Hawaiian plant species that require conservation protection a certain amount of triage must be performed. Our species vulnerability scores will allow managers to make informed decisions on the prioritization of effort and allocation of resources.



Model schema showing the species-level properties used to estimate vulnerability. Image courtesy of author.

Quick Summary:

- Hawai‘i has a relatively large number of native plants which are under threat from human activity including habitat loss due to development, damage from introduced species, and climate change
- Our modelling combined large amounts of geographic and life-history information with future climate scenarios to determine the relative vulnerability of over 1000 native plants to climate change.
- Through extensive consultation with resource managers, we have determined that vulnerability scores and associated information will be extremely valuable to plant conservation management groups so that they can focus scarce time and resources on the most vulnerable species. This model framework may be adapted for similar assessments in other Pacific Island locations.

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