Assessing viability of the Haleakala Silversword to uncover the effects of climate change on Hawai‘i's high-elevation ecosystems

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Haleakalā silversword with inflorescence. Image from Forest and Kim Starr /CC BY 3.0.

The summit of Haleakalā volcano on the Hawaiian island of Maui is austere but spectacular. The volcano‘s mostly barren crater, rim, and multicolored cinder cones are home to the striking Haleakalā silversword. A distant relative of the daisy, each silver-green plant lives for decades before producing a tall spike with multiple flowers, and then dying. This federally threatened species is one of the most dominant components of the alpine Haleakalā ecosystem but is found nowhere else. The silversword was until recently considered a conservation success story. From a low point of less than twenty thousand individuals in 1935, plant numbers had rebounded to over seventy thousand in 1991 after being protected from grazing and vandalism. However, changing climate now imperils the silversword. Over the past 20 years the population has dwindled by more than 60%. Decreasing rainfall trends over the same period have resulted in substantial silversword mortality of both young and old plants, as well as a decrease in new plant germination.

We developed population predictions based on long-term plant censuses and data from climate monitoring stations on Haleakalā. The results show that much of the silversword population is likely to face extinction within the next 100 years if populations continue to decline. To attempt to mitigate the decline in numbers, conservation workers may need to increase silversword propagation efforts, involving greenhouse germination of collected seeds and subsequent outplanting of seedlings in suitable locations. Our recent work indicates that plants grown under drier greenhouse conditions are likely to be slightly more drought-resistant after outplanting. However, seeds collected from different areas did not appear to produce seedlings that differed strongly in survival after outplanting, as long as they were grown under similar conditions. This suggests that there may be no specific 'best' locations or plants to harvest seeds from. Future silversword outplanting success may be increased by targeting parts of Haleakalā National Park and surrounding areas which are projected to remain wetter in the future. The Haleakalā silversword is a good example of how changes in environmental conditions are affecting species that are in other ways carefully protected. Perhaps with adaptive management and intervention the silversword will continue to exist, serving as an important part of the alpine Haleakalā ecosystem as well as allowing visitors and residents to enjoy its unusual beauty.

Silverswords in greenhouse. Image from P. Krushelnycky.

Quick Summary:

- Haleakalā silversword is a culturally and ecologically important plant that exists only on Haleakalā volcano and is currently experiencing population decline related to changing climate patterns, specifically lower rainfall.
- Research suggests that this species is likely to disappear from most of its range in the next 100 years if current weather and population trends continue. Interventions such as greenhouse rearing of seedlings may be more successful if plants are grown with a lower-watering regimen before eventual outplanting.
- It may be valuable to continue efforts to greenhouse raise plants and outplant them to areas with slightly wetter conditions, including parts of the silverswords' historical range where plants do not currently exist.

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