

Reintroducing Hawaii's Silverswords

by Robert Robichaux, Steven Bergfeld, Marie Bruegmann, Joan Canfield, Patrice Moriyasu, Tanya Rubenstein, Timothy Tunison, and Frederick Warshauer



A Mauna Loa silversword being planted at Kulani Correctional Facility. Inmates from the facility have participated in an innovative volunteer program to help with silversword reintroduction.

All photos by Joan Canfield

(Opposite page, bottom) Members of the sunflower family (Asteraceae), silverswords have a rosette form, with dagger-shaped leaves that are densely covered by silvery hairs. Most silverswords flower only once, after growing for 30-50 years, with the majestic flowering stalks of large rosettes often exceeding 1.5 meters in height.

Of the many endangered plant species in the Hawaiian Islands, silverswords have the highest profile due to their radiant beauty and the severity of the threats confronting them. The large-scale reintroduction of greenhouse-grown seedlings is raising hopes for the recovery of these spectacular endemic species, although serious challenges remain.

The Mauna Kea silversword (*Argyroxiphium sandwicense* ssp. *sandwicense*) had an historical range that encircled Mauna Kea volcano at 8,500-12,500 feet (2,600-3,800 meters) elevation on the Island of Hawai'i. Based on the records of early naturalists, this silversword grew in abundance and was a dominant plant of the subalpine and alpine ecosystems. In the late 1700s, European voyagers introduced sheep and other alien (non-native) ungulates to the island. The alien animals spread rapidly, with the sheep population on Mauna Kea eventually exceeding 40,000. As alien ungulate populations increased, silverswords declined severely in distribution and abundance, presumably due to heavy browsing. The small natural population of silverswords that persists on Mauna Kea now contains only 42 plants, all of them confined to cliffs and rock faces that are inaccessible to ungulates.

The Mauna Loa silversword (*Argyroxiphium kauense*) suffered a similar fate. Historically, this species was common in moist to wet ecosystems between 5,000 and 8,900 feet (1,500 and 2,700 m) on Mauna Loa and Hualalai volcanoes. Following the introduction and spread of pigs, mouflon sheep, and other alien ungu-

lates, however, the Mauna Loa silversword suffered a severe decline. The surviving individuals, numbering fewer than 1,000 plants, are confined to three small natural populations widely scattered across Mauna Loa.

In addition to direct threats from alien ungulates, Mauna Kea and Mauna Loa silverswords may face serious indirect threats from alien insects, especially ants and wasps. These alien predators have the potential to decimate populations of native bees and moths that serve as pollinators, thereby greatly limiting seed set in silverswords.

Partnership for Recovery

Though the threats are daunting, the outlook for recovery of Mauna Kea and Mauna Loa silverswords has brightened considerably in recent years. Key to this reversal of fortune has been a public/private partnership between the Volcano Rare Plant Facility, Hawaii Division of Forestry and Wildlife, Fish and Wildlife Service, National Park Service, Biological Resources Division of the U.S. Geological Survey, and Hawaiian Silversword Foundation. The Rare Plant Facility has grown the large number of silversword seedlings destined for reintroduction, closely tracking the pedigree (or parentage) of each one. Different agencies in the partnership have then overseen the outplanting effort in different parts of the historical ranges. The non-profit Silversword Foundation has worked closely with all of the partners to facilitate the collaborative initiative. By sharing expertise, resources, and enthusiasm, and by emphasizing on-the-ground actions, the partnership has made major strides recently with silversword reintroduction.

In 1999, we outplanted more than 2,500 silverswords on Mauna Kea, bringing the total reintroduced population to about 4,000. (About 1,500 Mauna Kea silverswords were successfully outplanted by the Division of Forestry and Wildlife between 1973 and 1998.) We planted the seedlings at multiple sites in the State Forest Reserve. Survivorship has varied among the sites and with the time of planting, but has been exceptionally high in some cases. Of the 1,200 seedlings planted in late fall on the east slopes of Mauna Kea, for example, more than 99 percent have survived their critical first 9 months on the volcano.

We also outplanted more than 1,000 silversword seedlings on Mauna Loa and Hualalai in 1999. They went to protected sites in Hawaii Volcanoes National Park, Kulani Correctional Facility, and State Forest Reserves. Again, survivorship has varied among the sites, but has exceeded 90 percent at some locations.

To ensure high genetic diversity in the reintroduced silversword populations, we have implemented a controlled crossing program in which we hand-pollinate flowering silverswords in both the field and greenhouse to produce seeds (see *Bulletin* Vol. XXIII, No. 2-3). Although hand-pollinating the plants can be challenging at times, especially on Mauna Kea, where we must perch precariously on steep cliffs and rock faces, the program has enabled us to significantly increase the number of founders (or parents) for the reintroduction effort, and to balance their genetic representation among the seedlings that are outplanted.

Over the next year, we plan to outplant another 2,000 silverswords on Mauna Kea and 8,000 silverswords on Mauna Loa and Hualalai. Thus, we will soon be about 40-60 percent of the way towards achieving our long-term goal of reintroducing more than 15,000 Mauna Kea and Mauna Loa silverswords throughout their historical ranges.

The major threat to the recovery of silverswords (and many other endangered plant species in Hawaii) continues to be alien ungulates. Even at low numbers, these animals can have severe impacts. On the upper slopes of Mauna Kea, for example, where alien ungulate populations have been greatly reduced by a court-ordered removal program, browsing still caused significant seedling mortality, and serious damage to adult silverswords, at some of the outplanting sites in 1999. Because alien ungulates are still abundant on Mauna Loa and Hualalai, all of our outplanting sites for Mauna Loa silverswords must be protected by fencing, which ultimately constrains the scope of the reintroduction effort. Alien insects may also continue to pose a significant threat to the health of native pollinator populations.

The large-scale reintroduction strategy for silverswords, implemented through our public/private partnership, highlights both the opportunities and challenges for recovery of other endangered plant species in Hawaii.

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The Volcano Rare Plant Facility is part of the Center for Conservation Research and Training of the University of Hawaii. In addition to growing thousands of silversword seedlings for reintroduction each year, the facility has successfully propagated more than 70 other endangered and threatened plant species from the Island of Hawai'i.

