

Haleakala Silversword: An Optimistic Note

By Lloyd Loope

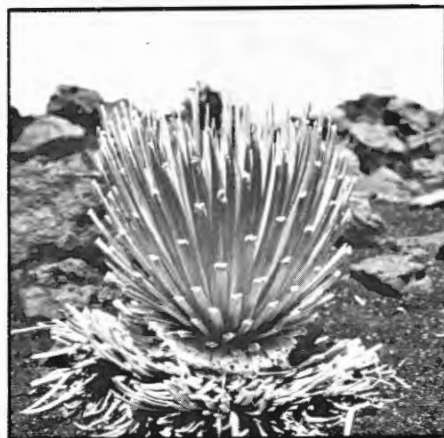
Our research group at Haleakala is investigating the population biology of a number of the park's endemic plant species as part of a program to develop long-term management strategies. The prognosis for many native species is not good unless management efforts by the NPS succeed in drastically reducing feral pig and goat populations. Hawaii is an exciting place for a biologist to work only if one can avoid depression and despair at the continuing precipitous decline of one of the world's most remarkable biotas.

Not all species are declining, however, and we are pleased to report that despite reports to the contrary (e.g., S. Carlquist, *Bioscience* 32(5):350, 1982), the Haleakala silversword (*Argyroxiphium sandwicense*) is doing just fine - at least for now. We have initiated a long-term investigation involving silversword population monitoring and biology in view of the importance of preserving this species. The silversword receives more attention from visitors to Haleakala than any other species because of its bizarre and beautiful appearance and its uniqueness. Scientific interest in this and closely related taxa is substantial. The *Argyroxiphium-Dubautia* group, consisting of about two dozen species, is one of the best existing examples of the evolutionary phenomenon known as adaptive radiation. Detailed studies of the evolution and physiological ecology of this group, underway by Dr. Gerald Carr of the University of Hawaii and Dr. Robert Robichaux of the University of California at Berkeley, will yield much basic information regarding evolutionary processes.

The Haleakala silversword has historically received considerable attention from park managers because it has, in the past, appeared in danger of extinction. The long-term survival of the silversword is clearly somewhat precarious because of its restricted habitat, moderate numbers, its monocarpic habit (it grows for 7-20 years in a rosette stage, then flowers and dies), and its dependence on establishment of seedlings (virtually no vegetative reproduction). Flowering is sporadic, with heavy flowering in some years and no flowering in other years. Preliminary indications are that cross-pollination by endemic insects is essential for adequate production of viable seeds. Loss of pollinators (for example, perhaps due to predation by some introduced predatory insect, such as the ground-nesting yellow-jacket, *Vespula pennsylvanica*) could be disastrous. In the past, much concern has been focused on the seemingly precarious relationship between the silversword and its



#2 - Larvae of *Plagithmysus terryi*, a long-horned (*Cerambycidae*) beetle endemic to Haleakala, feed in the pith of silversword roots (show here) and stems of flowering plants. About a dozen endemic insects are associated with the silversword.



#3 - Goat-damaged silversword. Fortunately, browsed plants are the exception rather than the rule for the remaining silversword population.

native seed predators. Concern was certainly warranted, since by the late-1920's goat and cattle browsing and human vandalism had reduced the once abundant



#1 - One of the 2200+ silverswords that flowered in 1982.

Haleakala silversword to a few thousand plants occupying only a fraction of its former range.

By the 1930's, it was determined that a dozen or so species of endemic insects are associated with the silversword. Some of these seem to be dependent on the silversword for carrying out their life cycles. Several insects are seed predators, and in some years these were observed to consume most of the seed produced. Some experimentation was carried out involving burning of dead silversword plants to destroy larvae of predatory insects. As late as the 1960's, consideration was given to use of insecticides to protect silverswords from their native insect predators.

Fortunately, the silversword population has been building up for the past 50 years. Numbers have increased from a few thousand to about 50,000 as shown by our 1982

census. The summer of 1982 was the best flowering season for silverswords yet recorded in Haleakala, with over 2,200 plants in bloom. The increase seems to be the result of removal of cattle and near elimination of human vandalism. Goats continue to impact silverswords, especially at the periphery of their present range, and prevent them from reoccupying former range.

Still, little is known regarding silversword population dynamics and silversword-insect relationships. Our project hopes to remedy this situation. In preliminary work last summer, we established plots for long-term monitoring of silversword populations. We also examined insect damage to seeds and seed viability in a year of heavy flowering. With the help of Betsy and Wayne Gagne of the B.P. Bishop Museum, we are trying to quantify the impact of various insects on the silversword population.

We found that both insect damage and seed viability were high in early-flowering plants, whereas insect damage and seed viability were very low in late-flowering plants. It is too early to say, but it seems possible that pollination and seed consumption may result from different stages of the life cycle of the same insect. The hazards of tinkering with a biological system of which we know little are becoming obvious. Successful control of the seed predators by management could have resulted in elimination of the plant species management was hoping to protect.

I personally find the silversword-insect relationship one of the most interesting phenomena I have encountered in 20 years as a biologist. It seems clearly appropriate for the NPS to regard the endemic insects as a resource comparable in value to the silversword. I find it very encouraging that such a finely-tuned relationship has survived so far, in spite of feral animal and human impacts which have proved devastating to other Hawaiian biota. We are fortunate that the silversword has not met the fate of its close relative, the Haleakala greensword. (*Argyroxiphium virescens* var. *virescens*), which became extinct in the 1930's - presumably along with an associated complex of native insects.