

NATIVE PLANT PROPAGATION AND HABITAT RESTORATION AT HAKALAU FOREST NATIONAL WILDLIFE REFUGE, HAWAII

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Horiuchi, B.; Jeffrey, J. 2002. Native Plant Propagation and Habitat Restoration at Hakalau Forest NWR, Hawaii. In: Dumroese, R.K.; Riley, L.E.; Landis, T.D., technical coordinators. National Proceedings: Forest and Conservation Nursery Associations- 1999, 2000, and 2001. Proceedings RMRS-P-24. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station: 233. Available at: <http://www.fcnanett.org/proceedings/2000/horiuchi.pdf>

Hakalau Forest NWR was established in 1985 under the authority of the Endangered Species Act to preserve and protect five species of endangered forest birds and their rain forest habitat. While most of the 32,730 acre refuge is closed canopy forest, over one hundred years of cattle grazing, logging and burning have converted about 5,000 acres (2,023 ha) of upper elevation forest into open woodland and pasture dominated by introduced grasses. Other portions of the refuge encompass relatively intact native forest including some of the last montane, mesic koa 'hi'a (*Acacia koa-Metrosideros polymorpha*) forests in the world. These areas contain some of the highest densities of native forest birds in the State of Hawai'i as well as 29 rare and endangered plant species and the endangered Hawaiian Hoary Bat.

A primary goal for this refuge is to restore native forest in pasture areas enhancing and increasing native forest bird habitat and aiding in the recovery of endangered flora and fauna. The first crucial steps toward restoration have already been taken by eliminating domestic cattle grazing, fencing management units, and controlling weeds and feral ungulates, halting destruction of the forest, and allowing the process of natural recovery to begin. Natural forest regeneration in open pasture areas is very slow and is inhibited by

lack of a native tree seed bank, exotic grass competition, lack of protective tree canopy, changes in soil conditions, and harsh microclimates. Although Hawaii may seem like a tropical paradise, at Hakalau Forest NWR, propagation and out-planting programs have been fraught with many of the same problems found at other sites around the world, including frost, drought, insect pests, power and water limitations, weeds, and remote, high elevation constraints.

The refuge, with assistance from other federal and state agencies, has experimented with propagation and reforestation techniques. Since 1989, the refuge has had an extensive native tree planting program in which, with the help of many volunteers, over 175,000 koa trees have been planted within the upper elevation, most heavily disturbed, portions of the refuge. In 1996, a 30 X 96 foot greenhouse was constructed at the 6,400 ft elevation on the refuge and a horticulturist hired to manage and supervise the seed collection, propagation, and out-planting of native plants. To date, almost 40,000 native plants of 20 species, including 6 endangered species, have been propagated at the greenhouse and out-planted at the refuge. Prior to this, many of these species had never been propagated outside of the wild or outplanted for forest restoration programs.