

A STATEWIDE ASSESSMENT OF *EX SITU* STATUS, CAPACITY AND NEEDS FOR THE CONSERVATION OF HAWAIIAN PLANTS

Introduction: The flora of the Hawaiian Islands has one of the highest rates of endemism in the world (89% for angiosperms, 71% for pteridophytes), with over half of all taxa at risk (Palmer 2003; Sakai et al. 2002; Wagner et al. 1999). Approximately ten percent of the flora is extinct (Wagner et al. 1999), and over thirty percent of the flora is federally listed as threatened or endangered (out of 1352 species; USFWS 2010). The conservation of Hawai‘i’s flora is necessary and challenging. The first step toward preventing extinction is to secure and maintain viable propagules in a “genetic safety net” using *ex situ* or “off-site” storage techniques (Havens et al. 2004). These techniques include micropropagation, seed banking, nurseries, and gardens; all of which are necessary and available in Hawai‘i. Genetic storage collections can be used for research and propagation for recovery efforts once habitats are secured and appropriate for restoration. Collections with the highest conservation value are genetically diverse, representative of the naturally occurring populations, and have been managed to ensure documentation of the provenance data and history in cultivation. These can then be relied upon as a backup to prevent extinction as natural populations decline. We aimed to determine which species of conservation concern are represented *ex situ* (secured taxa), establish a list of unrepresented and underrepresented species (unsecured taxa), determine the optimal *ex situ* method for unsecured taxa, and evaluate *ex situ* facilities and techniques to learn what limits their ability to increase capacity.

Methods and Results: These data included 1) definitions of taxa of conservation concern, 2) estimates of the number of naturally occurring individuals and populations for these taxa, 3) inventories of *ex situ* facilities across the state, 4) the optimal *ex situ* method for each taxa and 5) interviews with botanists, conservation agencies, and *ex situ* facility managers. There are 724 taxa of conservation concern. Collections of 528 taxa of concern exist in the inventories of *ex situ* collections across the state. Twenty-seven percent of the taxa of concern are unsecured. Sixty-four percent of the secured taxa are represented by collections from only ten percent or less of the remaining naturally occurring individuals (Fig. 1). Collections of plants are secured in micropropagation, seed banks, nurseries and gardens. Seed banks in Hawai‘i have secured more collections of taxa of concern than other *ex situ* types. These collections are also more representative of naturally occurring populations than collections in other types of *ex situ* storage. Seventy-eight percent of the taxa of concern have the potential to be secured for several decades or longer in seed banks. We interviewed twenty-eight *ex situ* facilities and fifteen conservation agencies to determine their limiting factors. Increased funding

would be used to expand facilities, increase staffing and research, conduct botanical surveys (including helicopter support), and create and improve database usage, capabilities, and their ability to interact/share with others' databases.

Recommendations: The conservation of the Hawaiian flora requires the services of micropropagation facilities, seed banks, nurseries, and botanical gardens to secure the genetic diversity of the remaining plants until habitats can be restored for outplantings. Because seventy-eight percent of the taxa of concern have the long-term storage potential in seed banks, this method represents the greatest opportunity for efficient *ex situ* representation. Seed storage is ideal to secure collections that are genetically diverse and representative of the naturally occurring populations to prevent extinction and allow for future reintroductions. Existing seed storage facilities are currently inadequate for meeting this need and should be expanded. All other *ex situ* methods, including micropropagation, nursery, and garden facilities, are necessary for species not currently suited for seed storage and to be used in conjunction with seed storage for recovery efforts and regeneration of aging seed storage collections. A working group that represents the shared interests of all conservation organizations and agencies should be identified or established to implement the recommendations developed here. Recommendations include:

1. Network: Coordinate collections of underrepresented species, help initiate improved data recording and sharing capabilities among conservation agencies, organize standardized transportation of propagules, draft conservation plans with *ex situ* goals for taxa of concern
2. Seed Banks: Standardize storage and processing protocols; share collections and training information, invest funds and support to increase capabilities at the Seed Conservation Lab at Lyon Arboretum, establish collection of commons for restoration, identify research needs in collaboration with USDA-ARS NCGRP
3. Micropropagation: Investigate expansion of research efforts for taxa that are difficult to establish in micropropagation with UH-Hilo laboratory, identify research needs for taxa that are currently unable to be established in seed banks
4. Nurseries & Gardens: Develop a mid-elevation nursery on Moloka'i, standardize sanitation protocols to aid in exchange of plants, increase support for improving irrigation and facilities

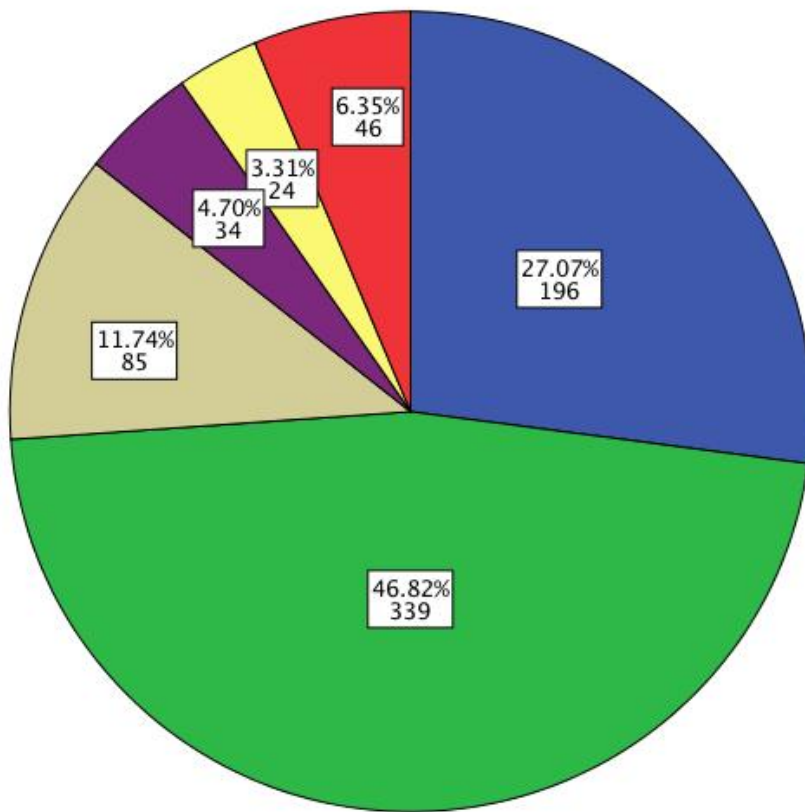


Fig. 1. *Ex situ* representation of all taxa of concern by conservation status. Blue is unsecured taxa, green has 10% or less founders represented, tan = 11-50%, purple = 51-84%, yellow = 85-100% with low replication of founder representation, red = 85-100% founders represented with high replication of founder representation.

Literature Cited:

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