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# Ex situ seed conservation of Hawaiian ‘exceptional species’ as a case study for tropical island floras

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## Abstract

The Hawai‘i Seed Bank Partnership conducts research on *ex situ* storage protocols for Hawai‘i’s native flora, and has gathered real-time data from hundreds of species for more than two decades. Seed storage behavior has been investigated, and 197 species have been assessed for seed freeze-sensitivity, a loss of viability in frozen storage (-18°C) when compared to refrigerated storage (5°C). A new index of Relative Performance was calculated with paired storage experiments at -18 and 5°C. Four Hawaiian families and 10 genera showed freeze-sensitivity or likely freeze-sensitivity. Additionally, we assessed 295 species for *ex situ* storage longevity. We recommend re-collection intervals, before viability falls below 70% of maximum germination, which range from > 20 to < 5 years, depending on the species. The largest family in the Hawaiian flora, Campanulaceae, is a spectacular example of adaptive radiation, with 159 endemic species in 6 genera from a single colonization, and over half are assessed as threatened on the IUCN Red List. The Hawaiian Campanulaceae is highlighted as a characteristic example of *ex situ* seed freeze-sensitivity and variation in longevity. This is the most comprehensive, long-term study to date on seed storage behavior and *ex situ* longevity for a regional flora. A high incidence of seed freeze-sensitivity is not yet known in any other region, so we present a protocol for testing seed freeze-sensitivity that can be utilized or adapted globally. Seed banking is now a critical tool for Hawaiian plant conservation, including these ‘exceptional species’ with freeze-sensitive seeds. Therefore, the Hawaiian flora can serve as a model for other tropical, subtropical, and island regions that might utilize seed banking to preserve species of conservation importance, now or in the future.

**Keywords:** Campanulaceae, freeze sensitivity, genebank, Hawaii, seed banking

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