

Conserving Genetic Diversity *ex situ*: Updates on Practical Advice

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Overview: Conserving rare or threatened plants with limited conservation resources requires data-driven, effective, and efficient strategies. At the Morton Arboretum, we assess genetic diversity safeguarded in *ex situ* collections (left column), test sampling approaches using simulations (middle), and scale up our work across species (right). Our results indicate how multiple avenues of work combine together to contribute *practical advice for seed collectors!*

Assessing the Outcome of an Intensive Collection

Goal: Quantify genetic diversity in a large *ex situ* collection of a desert oak *Q. havardii* (photo at right, showing its small stature) across multiple botanic gardens (a meta-collection).

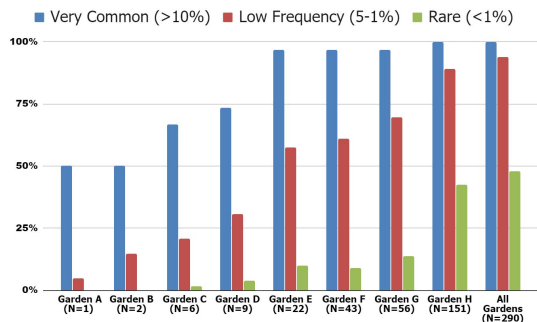
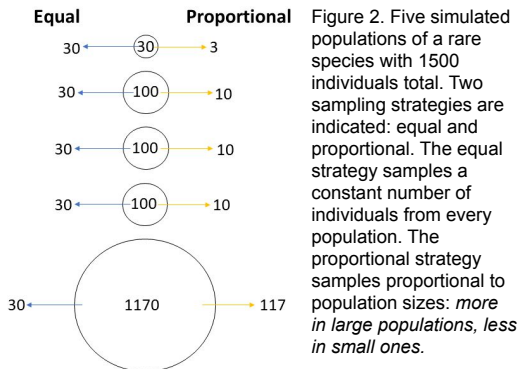


Figure 1. Alleles conserved *ex situ* of wild populations of *Q. havardii*.

Key finding: We conserved *Q. havardii* by sampling >1000 seed, from >20 locations via USFS/APGA funding in 2016. We quantified wild genetic diversity conserved in gardens with different numbers of seedlings. **25 plants conserve common alleles (Fig 1, blue) but >100 are needed for conserving rare but valuable genetic variation (red).**

Using Simulations to Test Sampling

Goal: Determine practical sampling guidelines for rare species with unequal sized populations.



Key finding: Sampling proportional to population size captures significantly more genetic diversity than sampling equally across all populations when population sizes vary. **Seed samplers should allocate more effort in larger populations to efficiently collect genetic diversity, when feasible.**

Looking Forward - Gene Conservation in 10 Oaks

Goal: Build on recent work showing that we can quantify genetic diversity conserved *ex situ*. Most botanic garden collections do not yet capture enough genetic diversity and we need better seed sourcing guidance for each genus.

Table 1. Allele capture *ex situ* from wild populations of three species of oaks (from Hoban et al. (2020), Proceedings B).

Species	N <i>in situ</i>	N <i>ex situ</i>	Common	Low Frequency	Rare
<i>Quercus boyntonii</i>	244	77	100	66	29
<i>Quercus georgiana</i>	223	36	92	66	39
<i>Quercus oglethorpensis</i>	187	145	100	97	67



Ongoing work, *Q. acerifolia*
Image: Morton Arboretum

Key Plans: We will test seed sampling guidelines that can apply to all threatened oaks. We are examining 7 additional IUCN Red List threatened oaks from the US (*pacifica*, *hinckleyi*, *tomentella*, *acerifolia*, *ajoensis*, *graciliformis*, *havardii*). We will see how these oaks are safeguarded *ex situ* and design better guidelines for this important genus.

Suggested reading: BGJournal issue 17.2, pg 23, Hoban, Cavender and Griffith
See also: BGCI publication "Towards the Metacollection" Griffith et al 2019 (bgci.org/resources/)