Collecting rare species in Florida

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Introduction

Rare plant destruction in tropical rain forests and other developing areas of the world has been the focus of much conservation attention, but the same development pressures and destructive phenomena are also at work in the relatively wealthy and developed (some would say too developed) state of Florida in the USA. Because of its unique geological history, during which ridges of high ground became isolated islands during interglacial periods, Florida is home to one of the highest concentrations of endemic species anywhere in the world. Although the numbers vary with the taxonomist doing the counting, there are about 2500 native plant species in Florida, of which 275 are endemic. In the last 60 years, citrus and cattle production, road building, residential development and a booming tourist industry have destroyed much of the natural habitat, leaving many of the rarest endemics close to extinction. The Florida Natural Areas Inventory records 385 species as rare, threatened or endangered; 169 of these are endemics.

Today many rare plants remain as remnant populations along roadsides and on private land near developments, sites too expensive to buy and too small to protect. Bok Tower Gardens' Endangered Plant Program was begun in 1986 in response to this critical situation. Genetically representative collections of the most severely endangered species are being grown in the protected setting of the garden, where they can be studied and propagated.

Collecting strategies

Working closely with other private conservation organizations and government agencies, the programme began with a reasonably accurate (though by no means complete) assessment of which plants are at risk and where they grow. Species were ranked using several factors: the number and size of the populations, the vigour and longevity of the plants, the number of protected sites and the degree of threat to unprotected sites. Species with fewer than five populations and no protected sites were deemed the highest priority. The development of good field inventories is an essential first step in understanding and meeting each species' individual needs.

After a population has been located and the necessary collecting permits and landowner permission obtained, the site is monitored until the most propitious time to collect propagules. If several populations are available, the one most seriously at risk is selected first. Unless the conservation situation is desperate, for example if bulldozers are about to destroy the site, only what it is thought that the population can reasonably afford to give up is taken, in order to have as little impact as possible on its persistence. How much material to take without having an adverse impact on the individual plants (in the case of cuttings) or the population as a whole (especially in the case of annuals) is a difficult judgement to make. When working with a population about which very little is known, but for which time is very short, the risk of making the species' already precarious existence even more doubtful is great.

Fortunately, experience can help with this decision, but ultimately it is as much a matter of intuition as of science. The methods used at Bok Tower tend to be very conservative, looking first at the size and overall vigour of the population, natural seedling generation, if any, and the likelihood of success with the material taken. One dares take very little from small populations of plants that are slow-growing or produce few seeds and which are known to be difficult to propagate. For example, *Lupinus aridorum* is known from only 15 sites, consisting of from one to 200 plants, of which fewer than half produced seeds in 1990. This species has never been grown to maturity in cultivation, so the chances are that all or nearly all the seeds collected will die. However, none of the natural sites is protected; the species has no long-term future on any of them. There are also rare species that seem to be limited more by habitat destruction than by biology. Often, these species set abundant viable seeds which can be collected with little danger to the persistence of the population. *Chrysopsis floridana* is a small, weedy composite with a very restricted geographic distribution on the edge of an expanding metropolitan area. Each plant produces hundreds of seeds which are readily cultivated.

One factor that can mitigate the removal of seeds from a rare plant population is the enhancement of the on-site germination of the remaining seeds. In the hot, dry, sandy scrub areas where most of Florida's rare

plants grow, many seeds dry out or are eaten before they can germinate. Their chances are considerably improved if the collector simply pushes some of the remaining seeds into the soil.

Knowing whether a plant is better propagated vegetatively or by seeds takes some experience and often some experimentation. At Bok Tower both methods are generally tried when beginning work on an unfamiliar species, before deciding which is best. Several mint species whose seeds are either short-lived (*Dicerandra* spp.) or very time-consuming to collect (*Conradina* spp.) are included in the programme. Fortunately, both root readily from tip cuttings, but only at certain times of the year. None of the endangered woody shrubs roots well from cuttings (three Annonaceae, one *Chionanthus* and one *Prunus* species), and yet all grow readily from seed. One of Florida's rarest plants, *Ziziphus celata*, known from only five clones, will not root from tip cuttings and does not set seed. Fortunately, it sprouts readily from root cuttings.

Having decided what to collect, there is the question of how to collect. A lot has been written about random sampling methods, but unfortunately much of the theory is irrelevant under the pressure of very practical considerations in the field. Often, the best that can be done is to document the known faults in the sampling method used, in the hope that they can be rectified later. Time constraints often preclude visiting a population more than once in a season even if individual plants ripen seeds over a long period of time. The best seeds ever collected of *Chionanthus pygmaeus* were from a late-blooming plant whose flowers had escaped damage by the weevils which frequently decimate seed crops produced in mid-season. By making this additional late-season collecting trip, genetic material was probably collected which was not represented in the earlier sample.

Rattlesnakes, cactus plants, wild hogs and boundary fences can also limit the sample, as can the collector's own aesthetic sense. The natural inclination is to take from the largest, healthiest, best-looking plants while small, weak plants (those least able to give up seeds or cuttings) may be under-represented. If scrawniness is a survival mechanism (e.g. against herbivores), then these plants may be genetically significant.

Germplasm conservation

There are limitations inherent in *ex situ* conservation in living collections. It is very expensive in labour, land, laboratory and greenhouse equipment and other institutional resources. Especially considering the long-term costs, over many generations, conservation in living collections is often a poor substitute for preserving a species in its own habitat. It works spectacularly well for some species, less well for others and not at all for a few. Long-lived woody species are the easiest to preserve, even if they take more space, since whole collections can live

and prosper with little care. Long-lived perennials with predictable life cycles may require periodic propagation, but with good care there should be few losses over time. Annuals and short-lived perennials, whose survival strategies rely more on numbers than longevity, often have high attrition rates; whole collections may die suddenly. These problematic species require more comprehensive solutions. Serious conservation efforts over sustained periods of time will require far larger numbers than have been dealt with so far. To really preserve a species it is necessary to think on a much larger scale, perhaps in terms of thousands of individuals.

Seed storage appears to be a low-cost alternative to garden cultivation, but experience at Bok Tower suggests several caveats. Often, very little is known about natural regeneration in these wild plants or how long seeds remain viable in storage. Many species appear to have low germination rates and high attrition rates over the life of the individual plants. Only by growing the species for several generations in numbers large enough to reflect natural systems is it possible to determine how many seeds will be necessary to reproduce a genetically representative, self-sustaining population. Merely putting seeds in storage without a comprehensive research programme is inadequate. A packet of frozen seeds is useless if no one knows how to grow them out.

Certainly, increased knowledge of these rare species is the greatest benefit of the Endangered Plant Program. By observing the plants in all stages of growth it is possible to learn to identify them in the wild when they are not in flower, which is often difficult to do with annual species and perennials which sprout from a dormant stage. Drawings of the plants in their infant and juvenile stages make it much easier to find and inventory them during other seasons of the year. Daily observations over a period of years provide continuous phenological data, much better than one-time observations in the field. It is possible to document a range of dates for flowering, seed set, dormancy and sprouting, which will assist in preparing long-term management schedules.

The successes, and also the failures, of trying to grow the plants in cultivation have yielded new information not only about the individual species but also about the systems in which they grow. Having so many rare plants together in one easily accessible place has been a powerful tool in educating the land managers who must care for the plants and the public policy makers who will ultimately make their preservation possible.

Strategies for the future

Ideally, the inclusion of a rare species in the Endangered Plant Program collection will be only the first step towards its recovery as naturally reproducing wild populations on protected land. The emphasis now is less on the long-term maintenance of the species in cultivation and more

on developing the technology to enhance wild populations and to introduce new populations on to protected sites. Four such introductions have already taken place with some success, although it may be years before it will be certain that the plants will prosper and reproduce on the new sites.

Ironically, it has been easier to develop the techniques for introducing a plant than it has been to find suitable land. There is enough information now to begin introduction projects for most of the species in the collection and Bok Tower Gardens is actively soliciting the cooperation of land managers of appropriate sites. Unfortunately, rapid habitat destruction means that there are fewer and fewer such sites, meeting both the biological and administrative criteria to make them suitable for the introduction of rare plants.

It has been argued that garden cultivation of rare species can too readily be used as an excuse for the destruction of their natural habitats. In fact, the Bok Tower Gardens Endangered Plant Program makes a compelling case for preserving natural habitats. The limitations inherent in *ex situ* conservation (both practical and philosophical) argue forcefully for habitat preservation. What good are our conservation collections if they have no future beyond being a botanical curiosity in a flowerpot on a greenhouse bench?