REINTRODUCING NATIVE PLANTS INTO THE WILD

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Every year more rare plant populations and habitats disappear. From species extinctions to invisible depletion of numbers and loss of genetic diversity, these disappearances sound a warning bell: not only are we losing unique plants, but we may be witnessing deeper problems in our ecological environment.

Plant conservationists have developed important strategies to counter rare plant losses, including efforts to conserve habitat, protect remaining populations, store seeds, and propagate rare plants. Research and information management are also vital tools in the practice of conserving rare plants. One further technique is the reintroduction of rare native plants back into their wild habitat.

Establishing populations of disappearing species in their former habitat (or augmenting existing populations) through outplanting or translocations is the classic vision of reintroductions. But as the techniques of replacing lost populations or bolstering declining populations are refined, reintroductions are seen by many as a promising solution to a wider variety of problems.

Thus it happens that the young science of establishing new populations of rare and endangered plants in the wild is catching on. But is this always a good idea? Let's examine the ecological and social implications.

Why reintroduce?

Reintroduction projects may run the gamut from measures of last resort for critically endangered species to salvaging plants from development sites. In general, reintroductions have as a principal goal either conservation or mitigation, as described below.

***Conservation-oriented reintroductions**:* The goal of reintroductions conducted in response to a conservation imperative is two-fold: to ensure the long-term survival of a rare plant species and/or to restore elements of biological diversity. Besides reintroducing plants to formerly occupied habitat, reintroductions within the conservation context can include augmenting (supplementing) existing plant populations as well as introducing plants to suitable habitat that may not have necessarily supported the species in the past. Although plant conservationists are most concerned about endangered plant taxa, some reintroduction projects are aimed toward cushioning vulnerable species against attrition by introducing additional populations into the landscape. Other projects may be motivated by a desire to expand the distribution of plants in nature that have aesthetic, botanical, medicinal, economic, or symbolic values.

***Compensatory mitigation**:* In contrast, compensatory mitigation projects do not necessarily lead to enhanced biodiversity. These projects -- in which the loss of an existing population or natural community is compensated for by creating or establishing a replacement population -- are driven by the development imperative, which may result in partial or outright loss of plant

populations. The aim of mitigation is to hold losses down, although this is often applied only to replacing individual plants, without regard to conservation of habitat or other elements of biodiversity. So it can happen that mitigation may resemble conservation at the local scale yet result in loss of biodiversity in the larger landscape.

Very few would question the need for reintroductions driven by imminent extinction, but other rationales for reintroduction raise questions that need to be explored. We must keep in mind that it is *always* biologically preferable to conserve *existing* populations and their habitat.

Risks of reintroductions

The most well-intentioned reintroduction project, if poorly executed, can do more harm than good. Reintroductions are inherently experimental and complex, and we must remember that *all* reintroductions carry risks. Awareness of the risks described below is essential.

Genetic contamination: A primary concern of conservationists is maintenance of genetic variability within and among plant populations, and all reintroductions should be aimed toward establishing resilient, self-sustaining populations with the genetic resources necessary to undergo adaptive evolutionary change. Losing genetic uniqueness of local populations is another concern. Introducing -- either directly or by inappropriate siting -- non-local genes of the same species or highly related species to a native plant population may result in hybridization and, consequently, loss of the population's genetic uniqueness. It may also lead to the introduction of disadvantageous genes into the native population (e.g., genes that may enhance the survival of a species in one region of the country may actually have adverse effects in another). Even local germplasm grown for several generations in a nursery or botanical garden may be genetically different from the native local gene pools. And just as we want to minimize genetic problems in the reintroduced population, we also want to minimize adverse effects on existing populations.

Taxa acting as exotic invasive species: Without the restraints of former competitors, pests, and diseases, some native species may become sufficiently abundant to threaten other native species at a site. Any species that becomes established beyond its historic range through direct or indirect human intervention is considered an exotic species. If these plants are seen to have harmful effects, intensive procedures may be needed to remove or inhibit them. Careless siting of new populations may also elevate risks from invasive exotic species.

Impacts on donor populations: Although it makes genetic sense to choose plant materials from native populations that are geographically close and ecologically similar to the reintroduction site, we can deplete the donor population if we either overcollect or unsystematically collect propagules. The donor population(s) must be large enough to withstand initial, and possibly subsequent, collecting of source material for reintroductions.

Loss of community or ecological integrity: Certain communities represent an irreplaceable combination of ecological history and function; many also harbor populations of rare or habitat-restricted species. Introducing new biological elements into a community may impair its ecological integrity. With the barrage of environmental changes these days, we should refrain from gratuitously introducing new variables into the mix.

Spread of pathogens: Introducing whole plants from one area to another increases the chance of spreading disease and pest organisms. Also, whenever populations interact, pathogens may be spread in one or both directions. This must be considered when augmenting an existing population with whole plants, when siting one population near enough to another to allow interactions (dispersal, pollination, gene flow), and particularly when creating or augmenting clusters of populations. Risks are heightened if the pathogen is so exotic that local populations are not adapted to dealing with it effectively.

Loss of reproductive output due to absence of pollinators or dispersal agents: For many species, establishing an isolated population or siting a population in an area lacking pollinators, dispersal agents, or patches for colonization may subject the population to inbreeding depression.

***Maladaption of plants to particular microsites*:** While many species can adapt to a variety of habitat conditions, others are limited by specific environmental requirements (soil conditions, amount of light and moisture, periodic disturbances, ecological associates, etc.). Careful monitoring and experimental plantings may be necessary to determine if a site has the requisite conditions for allowing the plants to grow and reproduce.

Problems of public perception: Public expectations about plant conservation are a primary reason conservationists are concerned about creating populations in the wild. The overall success rate for reintroduction projects is low, so touting isolated successes may lead to a dangerous perception that natural populations are easily recreated -- and are, therefore, expendable. Conservation professionals are also concerned about mistaking created populations for native populations and the implications this may have for conserving existing populations. For instance, in some New England states, if the total number of wild populations exceeds a certain threshold, the entire species loses legal protection under the state endangered species law. Another concern revolves around possible restriction of private property rights if a rare plant population is established on private land. Finally, our understanding of the natural range of a species may become obscured if new populations are created in areas where the species hasn't been found before.

Lack of follow-through to ensure project success: By definition, reintroduction projects are experimental, and as such they require a commitment to see the project through to conclusion. With a little luck, the result may be a successfully established population, but even if the experiment fails, it is important to understand why. Unfortunately, for a variety of reasons (discontinued funding, discouragement with early results, presumptions about the ability of the population to become self-sustaining without ongoing management, changes in personnel, etc.), many reintroductions that are initially undertaken with enthusiasm receive decreasing attention as time goes on. When this happens, the potential long-term viability of the population may be compromised, and, at the very least, important scientific information is lost.

Diversion of scarce resources from high-priority conservation projects: Only limited money and time are available for meeting a whole panoply of competing plant conservation needs. The repercussions of diverting needed resources to high-profile or politically charged projects at the expense of declining native populations can be long-lasting and serious. Reintroduction projects that are undertaken outside the larger context of conserving biological diversity pose particular risks of inefficient use of resources.

Creation of management conflicts: Many rare species require disturbance regimes and other management interventions that favor certain plants at the expense of others. In fragmented or isolated habitats, it may become impossible to establish self-sustaining populations, and management may become a permanent undertaking. This could preclude other valuable ecological processes and result in loss of other plant or animal species from the area. These effects must be considered when planning a reintroduction.

Considerations for reintroductions

The general concern about using reintroduction as a conservation tool is that this will in some way undermine the imperative to conserve existing populations and communities. The challenge, therefore, is to unlock the creative potential of reintroduction while guarding against its possible misuse.

Recognizing that each situation is unique, let's explore what it takes to conduct a good reintroduction project. In doing this, we should remember that just as the science of reintroduction is young, so too is the development of guidance for using reintroduction as a conservation tool. The best first step is to ask two key sets of questions, followed by well-reasoned answers.

First, is the reintroduction appropriate?

- What guidance can be found in existing policies on rare species reintroduction?
- What legal or regulatory considerations are connected with the reintroduction?
- What criteria can be used to determine whether a species should be reintroduced?
- Is reintroduction occurring in a mitigation context involving the loss or alteration of a natural population or community?

Second, how will the reintroduction be conducted?

- What are the defined goals of this reintroduction, and how will the project be monitored and evaluated?
- Has available ecological knowledge regarding the species and its community been reviewed? What additional knowledge is needed to conduct the project well?
- Who owns the reintroduction site, and how will the site be managed over the long term?
- Where should the reintroduction occur?
- What is the genetic composition of the material to be reintroduced?
- How will the founding population be structured to favor demographic persistence and stability?
- Are essential ecological processes intact at the site? If not, how will they be established?

Take-home messages

In general, we should keep the following messages in mind as we consider initiating a reintroduction project:

- It is far better, where appropriate, to conserve existing populations and communities than to attempt the difficult and imperfect task of creating new ones.

- Reintroductions are fraught with uncertainty and difficulties and should be viewed as experiments. As such, it is unwise to presume a successful result, given that the risks of failure are significant (this is often the case with compensatory mitigation).

- Determining the outcome of reintroduction efforts takes time. It certainly takes years, and may take decades, depending on species and community characteristics.

- Learning opportunities exist throughout the reintroduction process. To reintroduce confidently, we need extensive and detailed knowledge about the species, its community, and the larger ecosystem. For most rare species, this knowledge base is minimal and unevenly distributed among species or communities. Most projects will thus have to incorporate uncertainty and adaptation into the project design.

- Documentation of outcomes of every reintroduction effort is extremely important. If a project is well-conceived and executed, any outcome will yield useful ecological information. Natural Heritage programs should be informed about all proposed and ongoing reintroduction projects.

- Planning and long-term commitment are of utmost importance to the success of a reintroduction project. It is generally agreed that reintroduction is best when it is part of a comprehensive conservation and recovery strategy for the species and its community. If such a plan is developed, then reintroduction can be better incorporated into the larger objectives.

- Finally, reintroduction efforts entail a real responsibility to coordinate with governmental and conservation organizations that are involved in rare plant conservation. Various federal, state, and local institutions have a stake in conserving rare and endangered plant species, and it is important to ensure that individual projects provide benefits that are in keeping with the broader conservation context for these species.

DEFINITIONS

Reintroduction*:* the process of placing native plants back into formerly occupied or suitable habitat within the plants' natural range. Generally, reintroduction involves replacing something recently lost or that remains present, whereas *introduction* involves putting something new into an ecosystem.

Augmentation (also called enhancement, reinforcement, and restocking): the addition of individuals to an existing population, with the aim of increasing population size or diversity and thereby improving its viability.

Translocation (also called transplantation): the act of moving plants from one on-site location to any other site. A special category of translocation is *rescue* (or salvage), where individual plants are ostensibly saved from destruction by being moved elsewhere (although not necessarily to a protected site or with safeguards to ensure long-term survival).

Outplanting: movement of plants from an off-site location (e.g., a propagation facility) to an on-site location, including restoration sites.

Compensatory mitigation: situations in which an existing population or natural community is destroyed in exchange for creating or establishing a replacement population.