

NORTH CAROLINA PLANT CONSERVATION PROGRAM RARE PLANT REINTRODUCTION, AUGMENTATION, AND TRANSPLANTATION GUIDELINES

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This document was prepared by the North Carolina Plant Conservation Program Scientific Committee. This Committee contains representatives from the NC Natural Heritage Program, NC Botanical Garden, University of North Carolina at Chapel Hill Herbarium, NC State University Herbarium, NC Museum of Natural Sciences, The Nature Conservancy, NC Nurseryman's Association, and a NC citizen group.

For conserving rare plant species, there is no substitute for *in situ* ecosystem protection coupled with a thorough status survey and careful review of rarity, rank, and threats. Reintroduction, augmentation, or transplantation should only be considered if habitat protection is not possible or if the taxon is critically imperiled and appropriate sites and propagule source material are available. (Reintroduction is the appropriate recreation of a population, augmentation adds conspecific individuals to an existing population, and transplantation is the relocation of individuals from one site to another.)

It is important to have a good reason for attempting a rare plant reintroduction, as this action is time consuming and requires considerable resources. Any manipulation of a rare plant population should be viewed as an experimental process and meaningful results can only be determined through careful monitoring and evaluation. Reintroduction, augmentation, or transplantation is a three-step process of planning, implementing and monitoring. Each step must be carefully documented, approved by the appropriate state and federal agencies, and discussed with the Fish and Wildlife Service species lead biologist.

The following reintroduction guidelines and checklist are based on information from numerous sources listed in Resources and Literature Cited. **The purpose of this document is to help in the preparation of a reintroduction plan and as a guide for addressing some of the critical points in a successful rare plant reintroduction, augmentation or transplantation.** As the rare plant regulatory agency within the state, the NC Plant Conservation Program requests and evaluates completed checklists as part of the permitting process.

Transplantation Considerations

In recent years, the transplantation of rare plant species from threatened to apparently non-threatened sites has become increasingly favored by some land owners and land use agencies. For several biological and ecological reasons, it is strongly advised to not transplant rare plants unless all other options have been exhausted and reduction or extirpation is inevitable. Instead, it is far better to protect rare plant populations where they currently occur. Every existing population resides in a unique environment that cannot be duplicated or fully understood.

Transplantation increases the risks for both the relocated taxon and for the site where it is introduced. Any movement of individuals (whether whole plants or seeds) to another site is an introduction of off-site genotypes, and may result in new interspecies dynamics, such as competition for resources (e.g., pollinators, soil nutrients, moisture,

and light). It is also likely that such transplantations will result in the unwitting introduction of other taxa associated with the relocated species as soil contaminants.

If transplantation occurs as a last resort, it is essential to make a thorough ecological assessment of the original site prior to moving the plants. Once the site is disrupted, this information may be forever lost. All information is relevant for protecting, managing, and restoring the species itself and the ecosystem to which it belongs. Relocated plants risk, for example, not being able to establish essential relationships at a site, such as with a specific pollinator or soil organism. And only years of careful study can show if the transplantation was successful.

GUIDELINES AND CHECKSHEET

Goal(s)

Indicate the goals of the reintroduction/augmentation/transplant project. In most rare plant reintroductions, it is probably unrealistic to state that the goal is to create a viable population in a self-sustaining habitat. A more appropriate goal is: "To establish and maintain a viable population that requires a minimal amount of management intervention" (NEPCoP, 1992). Anticipate site management needs (e.g., prescribed fire, invasive exotic plant control, herbivory protection, watering during drought, etc.). Create a budget, determine time requirements, and ensure the availability of needed personnel.

Objectives

Develop objectives that are specific, measurable, and attainable (NEPCoP, 1992). Consult the species recovery plan if one exists and follow all appropriate recommendations. Pay careful attention to the results of both successful and unsuccessful attempts at rare plant reintroduction. Most unsuccessful reintroduction attempts, however, remain unpublished. It is therefore important to search the 'gray literature' and seek out the experiences of others.

Investigator(s) name(s) and contact information

Reason(s) for reintroduction

Documentation of reintroduction need

Provide, on a separate sheet, a narrative that provides a justification for the reintroduction, the recovery objective, and show evidence of a thorough literature review.

Species Biology and Plant Material

Species Identification:

Scientific name _____

Synonymy _____

Common name(s) _____

Species Status:

Natural Heritage: Global ____ State ____

Federal: _____ State: _____

Other states in which taxon occurs and S-ranks if available:

Reason(s) for rarity: Habitat loss or degradation ____ Specialized habitat ____

Reduced reproduction ____ Pathogen(s) ____ Herbivory ____

Other _____ Unknown ____

Previous known reintroductions or reintroduction attempts

General Life History Traits:

- Duration - Annual ____ Perennial ____ Obligate biennial ____ Facultative biennial ____ “Intermitent vegetative dormancy” _____ Other ____
- Habit - Herb ____ Shrub ____ Tree ____ Vine ____ Epiphyte ____ Other ____
- If hemi- or obligately parasitic, list host(s) _____
- Saprophytic ____
- Clonal ____
- Role in ecosystem (e.g., keystone species, host plant, nectar plant, etc.) _____

Reproductive Biology:

- Phenology
 - vegetative emergence _____
 - vegetative duration _____
 - duration of: anthesis _____ stigma receptivity _____
 - fruit maturation time and duration _____
- Self-pollinating ____ Outbreeding ____ Mixed-Mating ____ Apomictic ____
Other _____ Unknown ____
- Self-incompatible ____ Self-compatible ____
- Monecious ____ Dioecious ____ Other _____
- Vegetative reproduction: importance (rate 0-5, unimportant to very important) ____
and mechanism _____
- Are pollinators present at reintroduction site? ____ (Document possible pollinators from extant sites. If not present, then make pollinator establishment part of reintroduction methodology or consider relocating reintroduction site where these pollinators occur.)
 - Flower visitors _____
 - Pollinators _____

- Propagule dispersal mechanism(s)
 - Primary - Wind ___ Water ___ Animal(s) (list) ___ Gravity ___ Other
 - Secondary - Wind ___ Water ___ Animal(s) (list) ___ Gravity ___ Other
- If propagules animal dispersed, are these present ___ (If not, include animal disperser establishment in the reintroduction methodology.)
- Effective population size ___. (Determine from extant populations if possible. If this is not known, include this analysis in the reintroduction methodology.)

Taxon Site Requirements:

- Edaphic conditions -
 - Soil type and series _____ pH _____
 - Solid texture _____
- Hydrology – Aquatic ___ Seasonally flooded ___ Mesic ___ Xeric ___
Other _____
- Aspect and Slope -
- Exposure –
- Special requirements _____

Seed/Propagule Collection and Seed Banking (*Ex situ* conservation):

- See attached Center for Plant Conservation seed collection guidelines.
- Extent of natural seed bank and means of evaluation _____

- Determination and arrangements made with the appropriate CPC Participating Institution for germplasm reposition _____

Plant Material and Source:

- Are all required permits and landowner permission granted? ___
- Whole plants ___ Seeds/Spores ___ Vegetative part(s) _____
- Number of individuals planted ___ If dioecious, sex ratio _____
- Propagule source (use attached Center for Plant Conservation seed collection guidelines)
 - From existing population at reintroduction site ___ Collection date _____
 - From other population ___ Distance from reintroduction site _____
 - Is propagule source from stored germplasm? ___ Collection date _____
 - Proportion of seed collection accession used _____
 - Element occurrence #(s) _____
 - Voucher citation and location _____
 - Propagule source sample size and representativeness of source material

 - Was the entire population removed from the donor site (Is the donor population expected to be extirpated or remain extant)?
 - Other information _____
- Propagation protocols
 - Germination protocols (e.g., stratification, dormancy, etc.) established ___
 - Vegetative reproduction protocols (if necessary) established ___

- Propagation procedure _____
- Have mycorrhizal associations been determined? ____
- Number of maternal families represented _____
- Plan for using or disposing of surplus plant material ____

Donor Site Information

- Demography of donor population:
 - # or % Adult nonreproductive
 - # or % Adultreproductive
 - # or % Juvenile
- Population density (indicate units used for counting plants, stems, clumps, etc. as well as area. Eg: Clumps per square meter)
- Population distribution (clumped, random, uniform, etc)
- Edaphic conditions -
 - Soil type and series _____ pH _____
 - Solid texture _____
- Hydrology – Aquatic ____ Seasonally flooded ____ Mesic ____ Xeric ____
Other _____
- Aspect and Slope -
- Exposure –
- Fire Prescription –
- Plant community classification and dominate species in herb, shrub, and canopy layers-

Population genetic analysis and method(s) of evaluation (e.g., allozymes, DNA, morphometric analysis)

- Existing individuals (if present) genetic characterization ____
- Source material genetic characterization ____
- Nearby population(s) genetic characterization ____
- Is there evidence of inbreeding in any of the above ____
- Is there evidence of inbreeding or outbreeding depression ____

Reintroduction Location

Ranked Site Preference:

- Immediately adjacent habitat containing the same ecological characteristics ____
- Documented extant population on protected site ____
- Documented historic location on a protected site ____
- Not a known historic location, but within historic geographic range, and with similar physical and biological features ____

Reintroduction Site Ownership and Security:

- Public land: Protected ____ Protection mechanism _____ Unprotected ____
 - Private land: Protected ____ Protection mechanism and by whom _____
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- Potential threats after reintroduction (e.g., trail building or maintenance, fire rotation schedule, structures, etc.) _____
- Adjacent land disruption or threats _____
- Acquire all required permits and/or landowner permission _____
- Landowner kept fully apprised of reintroduction status _____

Reintroduction / Transplant Site Characteristics:

- Location _____ Longitude & Latitude _____
GPS coordinates and system _____
- Site disturbance history _____
- Land management practices _____
- Geologic parent material _____
- Edaphic conditions
 - Soil type and series _____ pH _____
 - Soil texture _____
- Organic material composition _____
- Hydrology – Aquatic ____ Seasonally flooded ____ Mesic ____ Xeric ____
Other _____
- Aspect and Slope _____
- Exposure _____
- Special requirements _____
- Plant community type and composition _____

- Invasive exotic plants _____
- What congeners are present with which rare plant introduction might hybridize

Reintroduction Methods:

- Use an experimental design approach, as all reintroductions should be thought of as experiments (Guerrant, 1996).
- Establish a monitoring protocol and schedule for both short- and long-term objectives. (See attached Monitoring report outline from Elizinga, et al., 1996, **Measuring and Monitoring Plant Populations**, p. 302.)
- Information on species biology and site requirements is often available from Natural Heritage Program **Element Occurrence Status Report** and from the US Fish & Wildlife Service.

Resources and Literature Cited

Elizinga, Cary L, et al. 1998. **Measuring and Monitoring Plant Populations**. United States Bureau of Land Management, Technical Reference 1730-1.

Falk, Donald A., et al., eds. 1996. **Restoring Diversity: Strategies for Reintroduction of Endangered Plants**. Center for Plant Conservation, Island Press.

- Falk, Donald A. and Kent E. Holsinger, eds. 1991. **Genetics and Conservation of Rare Plants**. Center for Plant Conservation, Oxford University Press.
- Givin, David R. 1994. **Principles and Practice of Plant Conservation**. IUCN, The World Conservation Union, Timber Press.
- Guerrant, Edward. 1996. **Designing populations: Demographic, genetic, and horticultural dimensions**. In Faulk, Donald A., et al., eds. 1996. **Restoring Diversity: Strategies for Reintroduction of Endangered Plants**. Center for Plant Conservation, Island Press.
- Guerrant, Edward, Kayri Havens, and Michael Maunder, eds. 2003. **Saving All The Pieces**. Center for Plant Conservation, Island Press (in press).
- Havens, Kayri. 1998. **The genetics of plant restoration**. Restoration and Management Notes, 16:1.
- Maryland Department of Natural Resources, Wildlife and Heritage Division, Guidelines for Rare. 1999. **Threatened, and Endangered Plant Reintroductions in Maryland**.
- Morris, William, et al. 1999. **A Practical Handbook for Population Viability Analysis**. The Nature Conservancy.
- NEPCoP (New England Plant Conservation Program). 1992. New England Wild Flower Society, Inc. Vol. 7, No. 1.

Monitoring Reports

Executive Summary

- I. Introduction.
- II. Description of ecological model.
- III. Monitoring objective.
- IV. Monitoring design.
- V. Data sheet example.
- VI. Management implications of potential results.
- VII. Summary of results.
Include tables and figures communicating the results as well as general natural history information.
- VIII. Interpretation of results.
Describe potential causes for the results observed, sources of uncertainty in the data, and implications of the results for the resource.
- IX. Assessment of the monitoring project.
Describe time and resource requirements, efficiency of the methods, and suggestions for improvement.
- X. Management recommendations.

A. Change in management.

Recommended changes based on results and the management implications identified in Section VI.

B. Change in monitoring.

Analysis of costs vs. information gain, effectiveness of current monitoring system, and recommended changes in monitoring.

XI. References.

Includes grey literature and personal communications.

XII. Reviewers.

List those who have reviewed drafts of the report.