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Endangered Plant Mitigation

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As more plants become rare and endangered the need to save these plants from extinction becomes greater. The mitigation policy is available for guidelines on how to go about saving endangered plant species. Mitigation is a term used to describe a wide variety of actions taken to avoid, reduce, or compensate for adverse impacts of development (Falk et al. 1996). This often means that sites with endangered species must be designed carefully so as not to disturb the endangered species located on that site. Transplanting is usually the last precaution taken when endangered species are located on a site involved in construction. Any movement of endangered species could be detrimental. The most favorable way of dealing with endangered species is to avoid locations where these populations grow.

If the rare plant habitat must be removed, a technique or term used for removal is transplanting. Transplanting includes two different methods, whole plants and plant parts. Transplanting can be done with or without soil. Transplanting plant parts involves four methods. These four methods are cuttings, transplanting through specialized stems and roots, grafting, and *in vitro* micropropagation.

Transplanting by means of the whole plant is the most common form of reintroduction which involves the transplanting of seedlings of older, more developed plants. Transplanting with associated soil is often successful while transplanting without soil is assumed to have a higher failure rate. A unsuccessful example of transplanting without associated soil is listed along with a successful example. A project in New Hampshire involved 150 plants of *Isotria medeoloides* (orchids) that were placed in a protected environment when the original habitat was being disturbed in 1986 (Brumback and Fyler). Each year the plants were monitored for growth and reproduction. It was discovered that there were fewer plants each year and no progress had been made in the growth or reproduction of the plants. In 1992 less than 10 percent of the plants moved were sending up shoots for reproduction. (Falk et al 1996). In other words, transplanting the whole plant without associated soil, was a failure. The project was a failure because the plants were not able to adjust to their new environment.

Transplanting without associated soil was also done by Bob Jacobson, Natural Resource Program Coordinator, at the Minnesota Department of Transportation (MN/DOT). Plants protected under the Minnesota law, for instance orchids, can be transplanted, but only to other Minnesota state land. If a suitable transplant location is unavailable or the population is too large to be completely salvaged, the Minnesota Department of Agriculture issues a permit that allows plants to be removed from the public. In these cases MN/DOT can issue a permit for the public to salvage excess plants. These permits are controlled and restrictions are often placed on how many plants are to be taken per person.

Jacobson has been involved with transplanting orchids (Orchidaceae family) on two different projects. Orchids are perennials and prefer a semishaded area for excellent growth. In order to transplant without associated soil, a suitable place must be found for the endangered species to

grow. Jacobson's transplanting efforts of whole plant orchids without associated soil had an 80% success rate. The success rate was measured by marking the plants and placing them in a specific area so that Jacobson and his crew could go back and look to see how many plants were still there. Jacobson found that the other 20% of the plants were stolen from their new area by discovering holes in the ground where the orchids had been originally placed.

Another form of whole plant transplanting involves moving the associated soil in order to keep the existing seedbank. Associated soil is the original soil the plant is growing in. In 1989 the first part of a road side construction near Baudette, MN was completed and over 20,000 *Cypripedium calceolus* (Lady Slipper orchids) were moved back to their original habitat (Jacobson). Not only were the plants moved during the construction, the topsoil was also salvaged to keep the natural seedbank intact. Salvaging the seedbank was done by removing the topsoil and spreading it out over a new area. The topsoil was spread out instead of being left in a pile so the microbial activity would remain alive. A native seed mix of grass and flowers was also added to the topsoil to enhance regrowth. The following year Jacobson reported seeing new orchid seedlings coming up.

The use of plant parts as a way to transplant involves four methods. Cuttings, specialized stems and roots, grafting, and *in vitro* micropropagation are the four methods of transplanting plant parts. Taking cuttings has been used for many years by horticulturists. The use of cuttings as a way to transplant involves the loss of the parent plant's survival techniques. A plant's survival techniques are defined as the ability to withstand natural environmental cicumstances. Drought, heavy rain, or cool temperatures are examples of some natural environmental circumstances.

The first project involving cuttings deals with the perennial grass *Penstemon barrettiae* (Foxglove). *P. barrettiae* is located along the Columbia River in Oregon and had multiple cuttings taken from several plants by J. Kierstead (Nelson). Cuttings were first placed in the Berry Botanic Garden, Oregon, where they were allowed to root (Falk et al.1996). After rooting, several plants were taken back to the area originally collected from and placed on a hill away from the parent plants. Other rooted cuttings were left at the garden and monitored there for growth. After six years of careful observations, more plants had survived on the hill away from the parent plants than at the gardens (Falk et al.).

The plant *Presidio manzanita* (represented by one remaining individual) was declared endangered in 1978 by the California Department of Fish and Game. Within a year this plant was added to the federal endangered list by the US Fish and Wildlife Service (USFWS). In 1984 a protection plan was finally evolved to preserve the *Presidio manzanita*. The plan was finalized by USFWS and a year later the US Army began transplanting. The Army began to enhance the remaining habitat available to the one remaining plant. In 1994, the *Presidio manzanita* was handed over to the National Park Service. Although the one remaining plant was surviving, *P. manzanita* was unable to produce any seed via cross-pollination (Heinrich). Despite this problem, the park staff revised the recovery plan to expand the current population and restore its habitat. The removal of non-native plants and four other exotic Monterey Pines was done to give the *Presidio manzanita* more light and optimum growing conditions. The main goal of the recovery plan was to not disturb the only remaining *Presidio manzanita*. As well as habitat improvement, 180 cuttings of the plant were taken in 1987. Between 1987 and 1989, sixty-five

cuttings were taken and rooted, then they were placed in the same area as their parent plant. During the summer of 1996, a field survey showed twenty-one clones survived. The surviving clones are identical to their parents which means that they were also susceptible to pests and diseases, but their survival was an asset to genetic records (Heinrich). Even though living clones of *Presidio manzanita* remain, this plant will be considered extinct in the wild when the parent plant dies.

The second type of transplanting with plant parts involves specialized stems and roots. The seeds and corms of *Brodiaea filifolia* (thread-leaf brodiaea) were collected from a site ready for destruction in California. After three years the researchers were not able to establish the plants. The experiment was determined to be unsuccessful.

Grafting plant parts as a way of transplanting is the third method. Grafting is usually done from one root stock to another. In Hawaii grafting was done with the tropical perennial *Kokia cookei* (Wooliams and Gerum, 1992). Although many different varieties of techniques were tried on *Kokia cookei* it only now exists on the stock of *K. kauaiensis* and *K. dryarioides* as grafted scions.

Micropropagation (*in vitro* micropropagation) is the fourth and last type of transplanting with plant parts. This type of transplanting can have many plants developed from limited parent material. The limitation of micropropagation is the new plants are almost identical genetically to the parent plants. There are two problems associated with the use of micropropagation. Narrow genetic base and inherent risk of inducing genetic damage are the two problems associated with the use of micropropagation (Falk et al. 1996).

Synopsis

The different methods of transplanting have been used across the country by many people to help preserve endangered populations. Transplanting by means of the whole plant with the associated soil is the most successful way to save an endangered population. This method has been proven very successful in many books and is recommended by horticulturists. Whole plant transplanting with associated soil is the most effective way to transplant. It involves removing the endangered population with the original soil and placing the population in an undisturbed location. The original soil is there for easy establishment, for an intact seedbank, and the population is not harmed from cuttings or grafting. Taking cuttings from an endangered population could reduce the original population more by removing viable branches for growth. Grafting involves taking a branch or small portion of the original plant and placing it on a stock plant that is compatible in order to fuse the two vascular tissues together. Transplanting with cuttings or grafting are the other two most popular ways to salvage an endangered population, but when compared to whole transplanting with associated soil they are not popular.

Mitigation is an existing policy available to help guide the many people involved in saving endangered and rare plant species. The method of transplanting is one technique covered in this paper that expresses some of the best ways under mitigation to save endangered species. All of these methods of transplanting are there to save plants from being gone totally from this world. We, as a society, need to be more careful of the environment so as not to disturb the natural

beauty around us. Being more aware can reduce the risks of endangering a plant population and lower the chances of loosing that population through transplanting techniques.

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