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Oak Savanna Restoration at Myre-Big Island State Park

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INTRODUCTION

An oak savanna restoration was initiated in 1995 on a 30 acre site in Myre-Big Island State Park three miles southeast of Albert Lea in Freeborn County in south-central Minnesota. Myre-Big Island State Park encompasses 16,000 acres of oak savanna, prairie, deciduous forest, and wetlands primarily surrounded by an agricultural matrix. This particular restoration site is located on a unique geologic feature formed by the deposition of gravely glacial till known as an esker. The esker lays in an east-west orientation and ranges in elevation from 30-35 feet. Forty acres surrounding the esker to the north and south are also scheduled for restoration in the near future.

The esker property was acquired by the Department of Natural Resources in 1976. Prior to that time, the site had been intensively grazed but never cultivated due to the steep slope. The restoration was attempted on the esker as it is a unique landscape feature with clearly defined boundaries. Interventions began on the least impacted areas progressing to the most damaged areas, of which 10 acres remain to be treated in the spring of 1996.

In conjunction with the 50th anniversary of the park, a campaign has been designed to educate the public about this restoration project and the importance of the disappearing oak savanna ecosystem. Increasing awareness of the loss of oak savanna at a national scale prompted the park manager, Jerry Casamire, to re-examine the classification of the esker site which had initially been considered an oak woods. Although the esker site resembled a native savanna, as there are many mature oak trees over 100 years old, the site lacked many of the native grasses and forbs of an ungrazed savanna, thus, was mistakenly classified as an oak woodlands. The original plant community that would have occurred on the esker is technically classified as a sand-gravel dry oak savanna. The motivation for undertaking this restoration came with the realization that traditional management practices were focused at too small a scale and only treating part of a larger ecosystem. Prescribed burning was already being used as a tool for managing prairie openings around the esker but had not been allowed to spread into the remnant oak stands on the esker.

ECOLOGY OF OAK SAVANNAS

The oak savanna ecosystem occurs along the interface of the eastern deciduous forest biome and the western prairie biome. The boundary between the prairie-forest border is dynamic, shifting as climatic conditions change to favor prairie encroachment in hot, dry years and forest encroachment in cool, wetter years. Fire frequency is an important determinant of savannas in terms of interrupting the successional sequence and as a natural regenerative agent (Tester, 1989).

Oak savanna is characterized by an extreme aggregation of trees in groves or fingers jutting into open grasslands with a canopy cover of less than fifty percent. Bur oak (*Quercus macrocarpa*) is the dominant tree species in this community interspersed with an occasional black oak (*Q. velutina*) or northern pin oak (*Q. ellipsoidalis*). Brush is either absent from oak savanna communities or locally abundant, while prairie openings are always present (DNR publication, 1993). The understory vegetation of savanna is a mixture of both prairie and forest species, with prairie forbs and grasses more abundant in areas of high light, and forest forbs and woody species in areas of low light (Bray, 1958). No species is known to be endemic to oak savannas and relatively few species are modal (Nuzzo, 1986).

INTERVENTIONS

The 30 acre esker site was nearly unrecognizable as a remnant of dry oak savanna because it had become infested with European buckthorn (*Rhamnus cathartica*), Tartarian honeysuckle (*Lonicera tatarica*) and black cherry (Prunus serotina) which had grown 10-15 feet tall, creating a nearly closed understory. Beneath this was a dense shrub layer of smooth sumac (*Rhus glabra*), prickly ash (*Zanthoxylum americanum*), and box elder (*Acer negundo*) which had been able to thrive in the partial sunlight created by the understory and overstory.

A particularly pernicious plant is European buckthorn which is an exotic species that has run rampant throughout the restoration site. Buckthorn is able to resprout from the stump after a fire and is a prolific seed producer which are then dispersed by birds. The goal of the treatment for buckthorn is to manage the species as part of the shrub layer as eliminating the species is extremely difficult and cost prohibitive. The treatments proposed to remove buckthorn and to clear the forest floor include burning, mechanical removal and herbicide applications.

The project manager has been careful to vary the timing of and methods of treatments employed on each plot so as to minimize plant resistance to the treatments. Repeated application of herbicide may artificially select for chemical resistance to the herbicide and render this management tool useless. It is hoped that a combination of an aggressive burn regime and herbicide application in the spring before the growth period will weaken the invasive species and destroy the root system. While annual fires have the positive effect of increased utilization of such nutrients as phosphorous, they also result in a net loss of nitrogen to the system (Tester, 1989). As plant diversity and competition for resources increases, prescribed burning can be scheduled at longer intervals to lessen the impact on soil microbes and invertebrates which are killed by frequent burnings.

After burning and clearing a site of the shrubby plants, forb and grass re-establishment will depend on the condition of the seed bank and the proximity to remnant populations of native forbs and grasses for seed rain. Revegetation will be required if some of the common species of an dry oak savanna ecosystem, such as prairie rose (*Rosa arkansana*) and big bluestem (*Andropogon gerardii*) do not appear after a few years. If seeding and planting becomes necessary only local genotypes will be used. Possible locations to find remnant oak savanna species include forest openings and borders, cutover areas, road cuts, abandoned fields, and railroad right-of-ways. These places all create the conditions of partial sunlight in which savanna species grow. There is a railroad right-of-way 300 feet from the base of the esker where some remnant oak savanna species have been found that will be used as a seed source.

EVALUATION

This restoration project will take many years of labor intensive management before the exotic species can be controlled enough to permit the plant community to function properly and to be self-sustaining. Furthermore, the rate at which restoration interventions can proceed is constrained by available funds and labor. In the interim, the success of the project can be evaluated on the basis of the number of oak savanna species that have recolonized the esker site and by the reduction in percent cover of European buckthorn.

Many of the plant species found in an oak savanna are common prairie species, but the species characteristic of an oak savanna do not occur at high densities or are rare. The mere appearance of characteristic rare plant species such as, round-stemmed false foxglove (*Agalinis gattingeri*), small-leaved pussytoes (*Antennaria parvifolia*), sea-beach needlegrass (*Aristida tuberculosa*), kitten-tails (*Besseya bullii*), Hill's thistle (*Cirsium hillii*) and Illinois tick-trefoil (*Desmodium illinoense*) would indicate the site has returned to a more natural community. The presence of common animal species, such as the Mourning dove, Blue jay, Chipping sparrow, White-footed mouse, Red fox and White-tailed deer is not indicative of a quality dry oak savanna. Rather, the degree of ecological integrity should be measured by the reappearance of rare animal species such as the Karner blue, Loggerhead shrike, Eastern spotted skunk and Bullsnake which require a functioning ecosystem.

CRITIQUE

As the area under restoration is a small patch of oak savanna, I believe that the long-term sustainability of this site will be greatly influenced by the land use practices of the matrix. It will be difficult to create a self-sustaining community with the structure and function of the original community without constant intervention to control the invasive species and to keep the canopy open. Since natural fires have been suppressed, and are likely to continue to be suppressed, frequent prescribed burnings will be an important management tool to control the exotic understory species and allow for regeneration of native fire-adapted species.

Oak seedlings cannot survive a fire until they have reached a certain size and height yet will be out-competed by the faster growing invasive plants if fire is artificially suppressed for too long. If an aggressive fire regime can prevent the invasive species from dominating the site, the oak seedlings can reach a height where they can survive periodic maintenance fires. Therefore, the site should be burned aggressively in the first few years of restoration, then less frequently as a natural fire would occur, e.g. during hot, dry years. Fuel load is another important factor in a burn regime as it determines the temperature of the fire and the effectiveness of the burn. Burns cannot be scheduled too close together as the temperature will be insufficient to kill the invasive plants and may result in damage to the native plants and soil structure. It is difficult to determine how many years to burn aggressively and how often to burn during those years. The results of a long-term study of fire frequency on oak savanna vegetation at Cedar Creek Natural History Area suggest that the best prescribed burning pattern to maximize species richness is a pattern of burning for two consecutive years followed by two years with no fire (Tester, 1989).

Other potential obstacles to the successful restoration of this site include deposition of wind-blown sediments and pollutants from the agricultural matrix into the soil which may preclude the re-establishment of native species by changing the soil pH or by killing symbiotic microbes. The recolonization of this site by associated animal species may also attract undesirable species such as the brood parasite Brown-headed Cowbird.

A very important shortcoming of this project is the failure to have identified a reference community to model the restoration after. There are many classifications of dry oak savanna delineated on the basis of topographic and soil characteristics, each with a slightly different assemblage of plants. The project manager may be attempting to restore plant species that would not naturally occur on the site.

CONCLUSION

Of the original 11-13 million hectares of oak savanna that spanned the Midwest prior to European settlement, less than .02% of this ecosystem remained in 1985 in small, degraded patches. A small scale restoration of oak savanna has been attempted on a 30 acre site in south central Minnesota. The clearly delineated boundaries and the relatively high-quality condition of the site made it feasible to attempt a restoration. It is hoped that a successful restoration in Myre-Big Island State Park will serves as an inspiration and a model for other land managers to restore oak savanna since it is one of the most endangered ecosystems in Minnesota.

REFERENCES

Bray in Nuzzo, V.A. 1986. Minnesota's Native Vegetation: A key to Natural Communities. 1993. Minnesota Department of Natural Resources. Nuzzo, V.A. 1986. Extent and Status of Midwest Oak Savanna: Presettlement and 1985. Natural Areas Journal. 6: 6-36.

Tester, J. 1989. Effects of fire frequency on oak savanna in east-central Minnesota. Bulletin of the Torrey Botanical Club. 116(2): 134-144. Wovcha, D., Delaney, B., & Nordquist, G. 1995. Minnesota's St.

Croix River Valley and Anoka Sandplain: A Guide to Native Habitats. University of Minnesota Press, Minneapolis.