Restoration of Oak Island Sandscape, Apostle Islands National Lakeshore

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Introduction

Apostle Islands National Lakeshore, located in far northwestern Wisconsin, includes 21 islands and a mainland strip set in a matrix of Lake Superior. The islands range in size from 3 to 10,000 acres. The lakeshore is 42,000 acres in land area. Oak Island is 5,000 acres in size and has the highest elevation of the Apostle Islands.

Apostle Island sandscapes include a wide diversity of coastal features and are among the highest quality in the Great Lakes. Sandscapes within the lakeshore include sandspits, cuspate forelands, tombolos, a barrier spit, and numerous beaches. Four of the lakeshore's sandscapes comprise Wisconsin's Sandscape State Natural Area. These areas include the Outer Island sandspit, Stockton Island tombolo, and Rocky and Raspberry islands' cuspate forelands. The sandscapes within the national lakeshore are very popular visitor-use areas for both day and overnight use and are among the few places available for boats to access the islands. Sandscape vegetation is, however, very sensitive to trampling.

Sandscape monitoring, part of the park's long-term monitoring program, began in 1988. All seventeen of the park's significant sandscapes are regularly monitored. Monitoring of each sandscape is done every three to five years, depending on visitor-use levels at each site. Monitoring includes vegetation monitoring using the point step method and mapping of the sandscape and trails using a GPS (global positioning system). Vegetation monitoring enables the park to determine trends in basal cover and species composition of individual species, as well as percent bare ground, percent vegetative litter, percent total vegetation, and percentage of exotic species. Mapping of the sandscape and trails enables the park to determine trends in informal trail length and width, a measure of direct visitor impact, and long-term trends in sandscape geomorphology.

The Oak Island sandscape is a cuspate foreland 1.6 acres in size. It has had a long history of human use, dating back to the 1850s. It was the location of the earliest settlement in the Apostle Islands and one of the earliest episodes of logging. Oak Island's sandscape is currently a very popular visitor-use area for both camping and day-use and is on a popular kayak route. There is both an individual and group campsite adjacent to the sandscape.

Monitoring results over a ten-year period (1988–1998) indicated that Oak Island's sandscape was the most threatened of the park's sandscapes and in need of restoration. Over the ten-year period, there was a steady decrease in vegetative cover, an increase in vegetative litter, and an increase in exotic species abundance. The abundance of exotic species, already very high compared with other park sandscapes, increased from 15% to over 30%. Exotic species composition on most of the sandscapes is less than 5%, and some of the sandscapes have less than 1%. The Oak Island sandscape also offered an excellent opportunity as a pilot location to test methods and restoration techniques due to its level of historic and current disturbances and small size.

Objectives of the restoration effort included: (1) determining the best techniques for restoring native species, including determining the feasibility of gathering, propagating,

and establishing site-specific plant materials; (2) restoring vegetative species composition, diversity, and cover; (3) reducing the total percentage and cover of exotic species; and (4) developing protocols to guide future restoration efforts.

Methods

In 2000, funding was obtained from both the National Park Service's (NPS's) disturbed-lands restoration program and the U.S. Fish and Wildlife Service's (USFWS) Great Lakes Coastal Program. An interagency agreement was developed with the Natural Resource Conservation Service's (NRCS's) Rose Lake Plant Materials Center in Rose Lake, Michigan, to utilize NRCS's technical expertise in restoration. NRCS gathered native plant materials and began to propagate fifteen species.

During 2001, additional floating boardwalk was installed. Floating boardwalks are made of wooden boards drilled through their ends and connected with a stringer of cable. The boardwalk lies directly on the sand, following natural contours, and can be laid straight or curved. These boardwalks have been very effective in directing visitor traffic on sandscapes. Restoration signs were also installed to minimize visitor traffic on the sandscape and to inform visitors of the restoration effort.

Eighteen plots were established to determine how well propagated plants could be established and the effect of various lighting conditions. A set number of plants of nine different species were planted. Seven of the plots were in sun, seven in partial sun, and four in shady conditions. The plots were monitored during the fall of 2001 and in spring, summer, and fall of 2002. Data collected for each plot included survival, colonization, and vigor.

During 2002, on-site restoration occurred, with the primary effort coming in late May. More than 3,200 propagated plants of fifteen species were planted. The restoration was very much a cooperative effort between park staff, NRCS (which provided plants and technical guidance), and a Northland College field ecology class. As many as eighteen people at any one time assisted with the planting, enabling a large number of plants to be planted quickly. Although restoration occurred throughout the sandscape, most of the planting focused on bare areas. Distance between plants in these areas ranged from one to two feet. In ten of the heavily planted areas, 20 randomly placed 1x1-m monitoring plots were established. Data collected for each plot included the number of plants, aerial cover by species, and percent of bare ground and vegetative litter.

In addition to planting native species, the most abundant exotic species on the sandscape, orange hawkweed *(Hieracium aurantiacum),* was treated using both manual and chemical control. Plots (20x20 ft) were established to determine the effectiveness of both techniques. The sandscape and all monitoring were also mapped utilizing a global positioning system (GPS).

Some of the challenges included harsh planting conditions and inaccessibility. The impacted areas were nearly pure sand, having lost the thin layer of vegetative litter that provides some protection to plants in non-impacted areas of the sandscape. Although the plants were well watered during planting, it was not feasible to water after planting. Logistics are always a challenge in the Apostle Islands. Weather conditions on Lake Superior are the determining factor as to whether or not work can be accomplished. Oak Island is 5.5 miles from the mainland. The number of plants and people involved required numerous trips, and the sandscape is only accessible during fairly calm conditions and favorable wind directions.

Results

The plots established in 2001 were used to determine how well propagated plants had become established on the sandscape and the effect of various lighting conditions on survival. Under ideal conditions, planting would have been done in late May or early June to take advantage of cooler, moister conditions. Because of schedule conflicts, the 2001 plots were not established until early July. Even under these harsher conditions, plant survival

rate during the first season was 85% under shady conditions and 50% under conditions of partial or full sun. During 2002, the survival rate remained similar in plots exposed to partial or fall sun. However, plants under shady conditions dramatically increased, especially common horsetail *(Equisetum arvense).* Of the nine species planted, six increased during the second (2002) season; these were *Equisetum arvense, Vaccinium angustifolium, Rosa blanda, Carex pensylvanica, Anaphalis margaritacea,* and *Elymus canadensis*. Both *Equisetum arvense* and *Vaccinium angustifolium* began spreading. Two species, *Juniperus communis* and *Fragaria virginiana*, decreased. The only species that did not become established was *Aristida dichotoma*.

Some species that were somewhat difficult to grow in the greenhouse, such as *Vaccinium angustifolium* and *Rosa blanda*, did well on-site. Other species, such as *Fragaria virginiana* and *Anaphalis margaritacea*, were easy to growth in the greenhouse, but had a lower success rate after transplanting.

The 2002 plots were established to determine the effectiveness of the restoration effort. Current results are preliminary, since they can only provide information on how well plants had become established by the end of the first growing season. To enable the park to determine how well this restoration effort worked over the longer term, future monitoring will be critical.

The 2002 plot data were analyzed by grouping results using the following components: planted natives (greenhouse-propagated material), non-planted natives, and non-native. By the end of the first growing season, results were encouraging and indicated that native species, especially planted natives, were filling in at a higher rate than non-natives. When analyzing changes in plant count, non-native species increased 43%, as compared with an increase of 108% for non-planted natives, and 241% for planted natives. Changes in percent aerial cover showed a decrease in non-natives, as well as bare ground, compared with increases in both planted and non-planted native species.

The response of each plant component under various light conditions was also analyzed. Results based on both plant count and percent aerial cover indicate that the planted native species had the best competitive advantage under partially sunny conditions, non-planted natives under sunny conditions, and non-natives under sunny conditions. Overall, planted native species did better than non-native species under all lighting conditions. This information will be useful in planning restoration projects on sites with a similar species composition by helping to determine which areas may have a greater problem with non-native species. The species which most influenced these results were non-native *Poa compressa* and *Agropyron repens*, non-planted native *Ammophila breviligulata* and *Carex pensylvanica*, and planted native *Ammophila breviligulata* and *Anaphalis margaritacea*.

Discussion

Preliminary results from both sets of monitoring plots were encouraging and indicate that plants propagated from local plant material could be established successfully and were effective in increasing the native plant population. Results also showed a greater increase in both number of plants and aerial coverage of native species as compared with non-native species. On plots established to determine the effectiveness of hand-pulling hawkweed compared with chemical treatment, preliminary results indicate that hand-pulling is more effective. In an area as small as the Oak Island sandscape (1.6 acres), hand-pulling may be feasible; however, that may not be the case in larger areas due to the amount of labor involved. As discussed above, future monitoring will be important to determine the overall success of restoration.

Lessons learned were: (1) late May or early June are better planting times, because of cooler, moister conditions; (2) watering plants at the time of planting is important; (3) plants in peat pots tended to pop up when planted in sand; and (4) deer seemed to be attracted to perlite, pulling out the plants, but not eating them. This project was an excellent example of one that greatly benefited from having a large number of people working together over

a short period of time, enabling plants to be put in the ground quickly.

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