
Name of Organization: Indiana Dunes National Lakeshore

Type of Organization: Federal Agency

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Resource Management

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Project Title: Evaluation of Techniques for Restoration of Graminoid Fens

Project Category: Habitat (Ecological) Protection and Rest

Rank by Organization (if applicable): 0

Total Funding Requested (\$): 84,112 **Project Duration:** 2 Years

Abstract:

Graminoid fens are wetlands with unique artesian hydrology that provides minerlized water to the soil's surface allowing for a mix of wet and mesic prairie species as well as calciphilic species. The number of graminoid fens in the watersheds of the Great Lakes has declined and those remaining continue to be imperiled by biological and anthropogenic stressors. Graminoid fens have been placed on the highest tier of conservation targets for recovery by the Chicago Wilderness Biodiversity recovery plan.

Cowles Bog is a world reknown graminoid fen. Cowles Bog's aretesian hydrology remains intact, however, due to anthropogenic stressors, its unique floristic attributes have been compromised. And today, based on its vegetation, dense stands of Cattail pocketed with Phagmites and shrubs, Cowles bog would not be classified a graminoid fen. The restoration literature provides little guidance on how to implement extinction of a stable Cattail community followed by installation of a graminoid fen community.

The proposed work would evaluate management techniques for eradication of Cattail dominated plant communities. The existing biological resource will be documented and the cumulative effects of Cattail on development of system resistance to colonization by graminoid fen species along a chronosequence will be investigated. The anticipated products are scientific information that will be made available to the restoration community and a positive physical impact on Cowles Bog. In the first case, scientific papers documenting the interrelations among the graminoid fen's abiotic and biotic components and best management practices will be submitted to scientific journals for publication. Also, a design manual for restoration of graminoid fens will be developed and made available to the public. In the second case, management treatments will initiate destabilization of the Cattail community and replacement of it by fen species.

Geographic Areas Affected by the Project

States:

<input checked="" type="checkbox"/>	Illinois	<input type="checkbox"/>	New York
<input checked="" type="checkbox"/>	Indiana	<input type="checkbox"/>	Pennsylvania
<input checked="" type="checkbox"/>	Michigan	<input checked="" type="checkbox"/>	Wisconsin
<input checked="" type="checkbox"/>	Minnesota	<input checked="" type="checkbox"/>	Ohio

Lakes:

<input type="checkbox"/>	Superior	<input checked="" type="checkbox"/>	Erie
<input checked="" type="checkbox"/>	Huron	<input type="checkbox"/>	Ontario
<input checked="" type="checkbox"/>	Michigan	<input type="checkbox"/>	All Lakes

Geographic Initiatives:

<input checked="" type="checkbox"/>	Greater Chicago	<input type="checkbox"/>	NE Ohio	<input checked="" type="checkbox"/>	NW Indiana	<input type="checkbox"/>	SE Michigan	<input type="checkbox"/>	Lake St. Clair
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Primary Affected Area of Concern: Grand Calumet River/IHC, IN

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area: Chicago Wilderness

Other Affected Biodiversity Investment Areas:

Problem Statement:

Graminoid fens have been placed on the highest tier of conservation targets for recovery by the Chicago Wilderness Biodiversity recovery plan. Recently, the number of graminoid fens in the watersheds of the Great Lake's has declined and those remaining continue to be imperiled by biological and anthropogenic stressors. Graminoid fens are of importance because of their unique hydrology and plant communities. Upwelling of calcium and magnesium laden groundwater allows for a mix of wet and mesic prairie species as well as calciphilic species.

The hydrology of graminoid fens has been compromised by mining and landscape scale activities such as increases in non-pervious surfaces resulting in altered ground water dynamics. Biological stresses such as grazing and invasion of the plant community by Cattail, Phragmites, shrubs and other species have resulted in the demise of the graminoid fen's botanical resource.

If a graminoid fen loses its unique hydrology, it is certain that its species composition will change and over time the system will no longer exhibit the outward manifestations of a graminoid fen. Successful restoration of graminoid fen hydrology is unlikely, therefore, the fen will cease to exist. Conversely, if due to biological stressors, the graminoid fen loses its outward manifestations i.e. the plant community, but hydrological forcing functions remain intact, then restoration of the botanical resource is hypothetically possible.

If hydrological forcing functions remain intact, then restoration of the botanical resource is a two step process. Step one involves the removal of the invasive plant community and step two the establishment of the graminoid fen community. The required activities, the sequence of them, the necessary time requirement and costs to successfully execute the above two steps are not clear. We propose to conduct studies and management activities on a world renowned graminoid fen in the Lake Michigan basin in order to evaluate techniques for restoration of graminoid fens.

Cowles Bog, which, regardless of its name is a graminoid fen, and its adjacent wetlands were a natural wonder known world wide for their unique botanical diversity and waterfowl utilization. Cowles Bog was declared a National Natural Landmark on December 2, 1965. Prior to recognition by the federal government, the unique floristic, geologic and hydrologic features of Cowles Bog won it international recognition. As early as the 1910's, European ecologists ranked Cowles Bog on par with famous North American natural features such as Yellowstone, Yosemite, and the Grand Canyon. In recent times, Cowles bog provided habitat for 16 Indiana state listed species, including the only known state population of Northern White Cedar.

During the past 100 years, the Cowles Bog Wetland Complex(CBWC) was exposed to anthropogenic activities of fire suppression, landscape alterations, chemical inputs, lumbering, hydrological alterations and haying of the graminoid

resource. And, today CBWC's floristic resource is comprised largely of dense Cattail(*Typha* spp.) with intermittent patches of Phragmites. Its significance to waterfowl and wading birds has declined.

Fortunately, Cowles Bog's artesian hydrology carrying mineralized water to the surface remains intact and stresses which thrust the CBWC into an anthropogenically induced successional endpoint have been largely removed. However, the invasion community of Cattail, Phragmites and shrubs exhibit every indication of a stable climax community and will likely remain intact until anthropogenic activities designed to replace it are implemented.

The restoration literature provides little guidance on how to implement extinction of a stable Cattail community followed by replacement of it by a pre-existing community of unique floristic composition. There is little known concerning the cumulative impacts of Cattail on soil chemistry and structure and the potential consequences of altered soils on re-establishment of previously occurring species. The required activities, the sequence of them, the necessary time require and the cost in dollars remains the domain of artful speculation by the restoration community.

Proposed Work Outcome:

STUDY SITE

The CBWC occupies approximately 80 ha of the interdunal basin between the Tolleston and Calumet dunes on the southern shore of Lake Michigan. The study site encompasses the westernmost portion of wetland within the Dune Creek watershed. Dune Creek meanders through the site west to east. As it exits the site, Dune Creek continues east, eventually swinging north and then terminating at Lake Michigan.

STUDIES

Management Activity-

Two management questions will be investigated, 1) what is the response of Cattail when mowed or clipped under naturally fluctuating water levels; and 2) what is the best way to handle Cattail biomass following death due to herbicide applications. In the first case, the death of Cattail following cutting and submergence is well documented. However, in natural systems where water level control is usually absent, cutting of Cattail followed by its submergence is not a viable management tool. But, cutting of cattail may be desirable when Cattail occurs mixed with high quality remnant vegetation. A series of treatments will be implemented to determine Cattail response to multiple cuttings and season of cutting under naturally fluctuating water levels.

In the second case, spraying dense stands of Cattail with herbicide results in a dense layer of dead biomass. This dense layer of dead biomass may be deleterious to follow up restoration activities such as plant installation for two reasons 1) the dead biomass may prevent light penetration to the wetland surface and 2) decomposition of the biomass may result in anoxic soil conditions. In both cases, the conditions are detrimental to plant growth and establishment. A series of treatments, in which following herbicide applications, plants will be installed and dead Cattail biomass will be handled differently, for example burned, physically removed or allowed to remain, will be implemented.

The response of the system to the above treatments will be monitored. Measured parameters will include light intensity at the wetlands surface, soil oxygen concentrations, germination from the seed bank, and growth of the installed plants.

Biotic and Abiotic Resources-

In order to develop restoration guidelines, knowledge of the existing site conditions, soils, vegetaton and hydrology, are necessary. In the case of the CBWC, in the 1980's a study involving photographic interrpretation documented the progression of the Cattail invasion. Therefore site conditions can be investigated in context of a chronosequence of cumulative impacts of Cattail on the system. This is important because Cattail modifies the physical environment and restoration activities required for a system occupied for a long time by Cattail may differ from restoration activites required for a system occupied for a short time by Cattail. It is critical that the restoration community understands the cumulative impacts of Cattail on graminoid fens and how it effects restoraton of the fen vegetation.

Vegetation- The realized flora will be documented using standard vegetation anaysis methods. Transects will extend south to north across the system. Herbaceous vegetation will be evaluated in 1m square quadrats, shrubs in 5m square quadrats and trees in 10 m square quadrats. Species list will be compiled and dominance of them determined using cover estimates and measurement of diameter at breast height. Approximately 1000 quadrats will be evaluated.

The potential flora will be evaluated by the seedling assay method. Ten germination units will be constructed. Approximately 100 sample points will be evaluated. At each sample point, 15 soil cores will be extracted using a golf hole cutter. The cores will be homogenized and 6 sub-samples selected for germination. Three of the subsamples will be exposed to saturated soil conditions and three subsamples will be exposed to inundation by approximately 10 cm of water. The study site will be sampled in early April and samples germinated from Mid-April through September. In order to estimate the mortality rate and longevity of the Cattail seedbank, a subset of samples will be maintained over winter and monitored throughout the second year of the study.

Hydrology- Hydrological studies will focus on determining the distribution of surface water depths. Five staff gauges will be strategically position throughout the study site. Water levels at these staff gauges will be measured on a weekly bases. Monthly, water levels at each vegetation sample point will be measured. Water depths at vegetation sample points will be regressed on water depths at the staff gauges providing a set of equations. These equations will allow the prediction of water level at each vegetation sample point using staff gauge data. These data will allow for development of isopleths depicting areas of similar water depths.

Soils- Soil at a subset of vegetation sample points, approximately 100, will be sampled to a depth of 15cm and their chemistry determined. Soils will be analyzed for the following constituents: total nitrogen, ammonium, nitrate, available phosphorus, pH, exchangeable potassium, exchangeable magnesium, exchangeable calcium, exchangeable hydrogen, cation exchange capacity, base saturation, sodium, carbon and organic matter. In addition, 50 one meter soil cores will be extracted from a subset of the above 100 sample points. This core will be describe using standard soil taxonomic methods.

Products:

Cowles Bog cannot be restored in a two year period. Estimates pertaining to the restoration of this graminoid fen range from 10 to 20 years at a cost of 2 to 3 million dollars.

However, the activities conducted here are critical first steps required to initiate the process. The studies will provide a blueprint for future restoration activites. The management activities will begin the process of destablization of the Cattail community and hopefully colonization of it by desirable vegetation.

Management studies, studies on Cattail impacts and evaluation of the CBWC's existing resource will provide information

necessary for planning the restoration of the CBWC. This information will also prove useful for others conducting restoration activities on graminoid fens throughout the Great Lake area. The information will be distributed via several publications in scientific journals that publish restoration subject matter. Potential journals include Restoration Ecology, Wetlands and Natural Areas.

In addition to the above scientific papers, a design manual providing a blue print for restoration of the CBWC will be produced. The design manual will provide advice on best practices for eradicating Cattail, location of potential post-restoration plant assemblages, methods to ensure development of the desired plant assemblages, for example seedbank recruitment, seeding, installation of vegetative propagules or potted material, and best management practices to decrease the systems resistance to colonization by desirable species while increasing its resistance to colonization to non-desirable species. The design manual will include an estimated cost to restore the CBWC. Several hundred copies of the design manual will be printed and made available to interested restorationist in the Great Lake area.

Project Milestones:	Dates:
Project Start	10/2000
Seed bank sampling completed	05/2001
Soil, Veg., Hydrology surveys completed	10/2001
All management treatments implemented	11/2001
Draft of abiotic/biotic resources report	05/2002
Management study completed	09/2002
Draft report/design manual	11/2002
Project End-Final products	01/2003

Project Addresses Environmental Justice

If So, Description of How:

Project Addresses Education/Outreach

If So, Description of How:

Cowles Bog is a well known National Natural Landmark with international visitors as well as visitors from throughout the United States. Restoration work at Cowles Bog will provide an excellent opportunity to educate Indiana Dunes Natural Lakeshore visitors about biodiversity of the Great Lakes and the threat of invasives to it.

The Indiana Dunes National Lakeshore's interpretive staff will be invited for visits to observe the restoration effort to understand the negative impact of invasives on graminoid fen diversity. The interpretive staff will be able to pass the information to school groups, clubs and other organized groups of nature enthusiasts.

Funding from local supporters, for example Friends of the Dunes, Save the Dunes, Shirley Heinze Fund, NIPSCO, will be sought for signage and interpretive materials. These materials will be used to educate the casual visitor concerning restoration activities, habitat issues and Great Lake biodiversity.

Project Budget:

	Federal Share Requested (\$)	Applicant's Share (\$)
Personnel:	22,800	24,000
Fringe:	1,710	7,200
Travel:	1,500	0
Equipment:	750	0
Supplies:	4,500	0
Contracts:	48,752	0
Construction:	0	0
Other:	4,100	0
Total Direct Costs:	84,112	31,200
Indirect Costs:	0	0
Total:	84,112	31,200
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

There exist two firm commitments of other funding. The project is a collaborative effort among the United States Geological Survey (USGS), The Nature Conservancy and the National Park Service (9, collaboration). The USGS will contribute approximately \$20,000 of personnel time (Dr. Noel Pavlovic). The Nature conservancy will contribute approximately \$10,000 of personnel time (Mr. Paul Labus). In total the collaborators will contribute approximately \$61,000

The seedbank shelters will be constructed through the work of Boy Scouts. The government estimates volunteer time at approximately \$13.00 per hour. Construction of the seedbank shelters will require approximately 150 hours. Therefore, volunteer contributions in this effort is approximately \$1,950.00.

As indicated under Education Applicability,(6) funding for signage, educational and interpretive materials will be sought from organizations that have a long standing with Indian Dunes National Lakeshore. We anticipate support of approximately \$500 to \$750. However, to date no funding has been secured.

Description of Collaboration/Community Based Support:

As indicated under "Other Sources of Funding" the project will be a collaborative effort involving the National Park Service, United States Geological Survey and the Nature Conservancy.

The National Park Service at Indiana Dunes National Lakeshore has a long standing relationship with youth organizations such as the Boy Scouts that participate in small construction and stewardship projects. While no firm commitment is in hand, there have been several inquiries of interest from the Boy Scout organization for projects such as building of seedbank germination shelters.

Recently, organizations such as Friends of the Dunes and Save the Dunes, and local nature enthusiasts have lamented the decline of the graminoid fen community at Cowles bog. These groups have been supportive of efforts taken by the National Park Service to implement a search for funding to initiate work at Cowles Bog. Save the Dunes has expressed an interest in sponsoring fund raisers for Cowles Bog restoration work. The work proposed here could provide a public relations boost for fund raising by Save the Dunes.