

**STATE OF ILLINOIS
SWG'05
GRANT PROPOSAL**

PROJECT NUMBER: T- 34 I-1

PROJECT TITLE: Hennepin and Hopper Lakes Wetland Restoration and Research Project

PURPOSE:

The Hennepin and Hopper Lakes site covers more than 2,600 acres and is comprised of at least 16 distinct plant communities – a mosaic of different wetland, prairie, savanna, forest, and backwater lake habitat. This proposal focuses on a 48-acre subset of the 360 acres of mixed wetlands found across the site. Seep, marsh and sedge meadow habitat are representative of the wetland communities surrounding Hennepin and Hopper Lakes, an area of mixed hydrologic conditions that has been partially restored, but is currently being threatened by a number of invasive species.

The purpose of this project is to conduct research on how best to manage wetland invasive species *in the early stages of large-scale wetland restorations*. Native wetland flora that is establishing in the early stages of restoration, but has yet to develop sufficient cover and/or dense fibrous roots, is particularly vulnerable to aggressive species invasions (Levine 2000). Such restorations often develop into cattail monotypes or low diversity communities dominated by a few invasives (Wilson and Mitsch 1996, Kentula 2000). We hypothesize that early in development, such systems are at a tipping point between alternative stable states: one where the system is dominated by invasive species and one where the system is dominated by a diverse community of relatively conservative native species. Assembly rules theory as applied to restoration ecology suggests that it is critically important to develop community establishment trajectories that will achieve the desired restoration target (Temperton et. al. 2004). Although much work has been done in the past on wetland invasive management, and in particular on cattail control, no single or simple strategy has emerged to protect wetlands from being overrun by invasives short of ongoing, massive applications of herbicides or through a program of cutting and drowning by manipulating water levels for up to three years time (Harris and Marshal 1963, Newman et.al. 1996, Ailstock et.al. 2001, Foster and Wetzel 2005). However, these strategies provide impractical solutions for large acreage sites where invasives are interspersed with conservative native species.

Ultimately, the overall goal of invasive management is eradication coupled with conservative native establishment. Our goal is to determine effective strategies to put large-scale restorations on a trajectory leading to the development of a biologically diverse native wetland. We will evaluate different strategies for controlling the spread of seven invasive species: cattails (*Typha latifolia*, *T. angustifolia*, and *T. x* hybrid), common reed grass (*Phragmites australis*), sandbar willow (*Salix interior*), purple loosestrife (*Lythrum salicaria*), and reed canary grass (*Phalaris arundinacea*). The results of this investigation can then be applied to the remaining 312 acres of wetlands on the Hennepin site. The results will also be published in a peer-reviewed journal.

NEED

Although large-scale wetland restorations are uncommon due to a number of factors, not the least of which is cost, they are increasingly being attempted across the nation, e.g. in the northern Florida Everglades and at Emiquon on the Illinois River. These projects present significant challenges that do not apply to smaller scale projects, and in particular that of invasive species management. Such projects are particularly vulnerable to invasion in the early stages of development, and standard management practices can prove as lethal to the developing natives as they do to the invasive targets (Moore et.al. 1999, Levine 2000). The challenge of managing such systems to promote the development of biologically diverse, native dominated wetlands is exemplified at the Hennepin and Hopper Lakes Restoration in north central Illinois.

In only its fourth year, the 2,600-acre Hennepin and Hopper Lakes site has been recognized as one of the most important restorations in the Midwest. It was recently recognized as an Important Bird Area by Audubon, part of a global program recognizing exceptional bird habitat based on the occurrence of key bird species that are vulnerable to global extinction or whose populations are otherwise irreplaceable. For migratory waterfowl and a host of other wetland dependent species, there is no other comparable area in the State of Illinois. The late Frank Belrose, a leading authority on the Illinois River Basin, in writing about the quality of food resources for migratory waterfowl at Hennepin, said in the *Peroia Journal Star* on November 18, 2001: "The emergence of the aquatic plants alone has been no less than phenomenal. I have seen more Sago pondweed in the Hennepin and Hopper Lakes than I have seen throughout and alongside the entire Illinois River". Barbara Pardo, Joint Venture Coordinator for the US Fish and Wildlife Service, said at the October 2005 dedication of the Sue and Wes Dixon Wildlife Refuge, that the \$500,000 NAWCA grant to the Hennepin restoration was "the best \$500,000 we've spent". Several endangered species can be found in the seeps and springs bordering the eastern shore of the lake, part of which has now been dedicated as an Illinois Nature Preserve.

Although a species rich native community has been restored on much of this site, the wetlands surrounding the lakes are now sharing space with an aggressive mixture of invasive species. In much of this developing wetland that has yet to develop the dense fibrous root mat typical of more mature communities, these invasives are quickly establishing in open space and threaten to outcompete the more conservative natives species. We believe that much of the Hennepin wetland complex is now at a tipping point between two alternatives – one that leads to a biologically diverse wetland supporting a diversity of wildlife, and one leading to dense mixture of exotic and invasive species with little wildlife habitat value. It is critical that these invasive species be managed to insure that these developing wetlands fulfill their extraordinary potential as pristine wildlife habitat.

With the loss of over 90% of its original wetlands and 99.9% of its original prairie, it has become critical that Illinois not only conserve what remains, but attempt to restore high quality habitat whenever possible and practical. The Illinois Wildlife Action Plan was developed in large part to address our need to protect those species in greatest need of conservation, including game species, and the plants that comprise the habitats necessary for their survival. The need to develop effective management strategies for large-scale restorations is strongly consistent with this overall objective. The need to protect what has been restored so far is reflected in the 240 bird species that have been observed onsite, many of which are exceedingly rare, threatened or endangered in Illinois (see Attachment 1). Twenty one federal or state listed bird species have been identified on the site. Twenty of these are among the 30 species that should directly benefit from this project on the Illinois Conservation Priority species list, including American Bitterns,

Northern Harriers, Piping Plovers, Yellow-headed Blackbirds and Black Terns. Fifty four species of butterflies (Attachment 2) and 30 mammal species (Attachment 3) have been identified on the site. Nineteen plant species with federal and/or state endangered or threatened status have been identified on site, many occurring in the wetlands, which includes one of the largest contiguous seeps in the Illinois River Valley. Moreover, 106 of the 498 plant species identified onsite are listed with a state conservation ranking (Attachment 4). This project will potentially benefit up to 51 of these plant species.

OBJECTIVES

We propose to test the efficacy of different treatment strategies to control the spread of selected invasive species and promote the establishment of native species on approximately 48 acres of wetland at the north end of Hennepin and Hopper Lakes, a hydrologically and topographically heterogeneous area that is in the process of being restored with a diverse mix of native species. Specifically, between 8/15/06 and 8/14/08, we will examine differences in response among plots to

1. the timing of herbicide application in spring vs. summer vs. fall.
2. the number and timing of within year herbicide applications: early vs. late vs. early plus late.
3. the application of herbicide vs. herbicide plus native plants in summer vs. herbicide plus seed in fall.
4. the application of broadcast herbicide plus native plants vs. hand application herbicide plus native plants.
5. the application of herbicide in year 1 vs. herbicide in years 1 and 2.

Timing is a key question in regard to determining the most susceptible application period, preventing invasives from going to seed, and the potential to kill seedlings (both desirable and undesirable) germinating in response to an earlier kill. Once a kill has been implemented, new germinations may be averted by establishing native plants to monopolize available space. All herbicide applications involve spot treating target plants except where broadcast spraying is indicated. Since broadcast spraying will kill target and non-target plants, it is important to determine if introducing natives can avert recolonization by invasives. Lastly, treating in multiple years may be required under circumstances where an invasive seed bank exists.

EXPECTED RESULTS OR BENEFITS

The Illinois River once supported an extensive system of highly productive and diverse backwater lakes nested within a complex mosaic of floodplain forest, marsh, sedge meadow, seep and prairie. After 150 years of agricultural development and hydrologic modifications, these systems are essentially extinct, having been replaced with corn and soybeans. The few remaining areas are highly degraded; many are functionally equivalent to an aquatic desert. The loss to resident and migratory wildlife over the past 100 years has been catastrophic. This project offers a unique opportunity to examine different ways in which to restore critical elements of a system that no longer exists on large scales within this region.

The treatments are designed to evaluate differences in the response of invasive and native species to 1) the number and timing of herbicide treatments; 2) post-treatment community development with and without installing native plants; 3) spot treatments vs. broadcast

treatments; and 4) herbicide treatments in a single year vs. treatments in consecutive years. Although not part of the scope of this project, this work will also afford us an opportunity to evaluate the response of wildlife to conditions within the treatment areas. Successful management may provide additional nesting and loafing habitat for several wetland dependent species, such as King Rail or Sedge Wrens.

The results will be used to develop a treatment strategy for managing the remaining complex of wetlands in the untreated areas surrounding Hennepin Lake and Hopper Lakes. Since very little work has been documented on how to manage this problem on large-scale wetland restorations, this project will become the basis of a peer-reviewed publication on invasive species management in large-scale wetland restorations.

APPROACH

This project will be completed by staff of the Wetlands Initiative, with oversight from Michelle Simone, a District Heritage Biologist with the Illinois Department of Natural Resources. We will use a multi-tiered approach of different herbicide application strategies coupled with the focused installation of native plants and seed to alter the developmental trajectory of treatment plots. The strategies will be implemented across a range of initial conditions relating to the hydrology and the balance between native and invasive species density.

The 48-acre area will be divided into seven experimental units that have been delineated based upon differences in wetland vegetation, hydrology, invasive species density, and the density of desirable species (see attached map: experimental units with treatment plots). Each unit is subdivided into either 4 or 8 treatment plots. Each of the questions outlined above will be assigned to one or more of these experimental units, with each plot assigned a treatment to be evaluated, one of which will be a control.

Vegetation at plot borders will be cut to demarcate treatment boundaries. Herbicide applications will be conducted by licensed summer interns working under the direction of the project manager (Gary Sullivan) and/or the site manager (Rick Seibert). Replicated plots will be monitored with presence/absence data collected from randomly selected 1m² plots four times annually the first year and twice the second year, and once the third year. Treatments effects will be determined with a repeated measures analysis of variance examining effects on species cover data through time and among treatments.

Success will be determined by the extent to which the invasive threat is eliminated and the native plant community is established. The results of the experiment will be published and will be used to guide invasive management throughout the remaining 312 acres of wetland at Hennepin and Hopper Lakes.

Personnel

The IL DNR project manager will be Michelle Simone, District Heritage Biologist, Jubilee College State Park, 13921 W. Route 150, Brimfield, IL 61517, 309/446-9181; fax 309/446-3183. She will oversee the project and review the final report. Gary Sullivan, PhD, will manage All research activities, including layout of treatment areas, choosing plants species and acquiring plants and seed, and all data collection and analysis activities will be conducted by Gary Sullivan, Ph.D. of The Wetlands Initiative, 53 West Jackson Boulevard, Suite 1015, Chicago, IL 60604. Dr. Sullivan is a wetlands ecologist with over 10 years experience in wetland restoration and research on restoration techniques (Attachment 5). Rick Seibert, the Hennepin and Hopper Lakes site manager, will be responsible for directing all herbicide applications and planting

activities by hourly employees. Rick, a graduate of the University of Debuque, Iowa, grew up on the Illinois River and has worked in its backwaters for over 20 years.

The Wetland Initiative

The Wetland Initiative is a nonprofit organization dedicated to restoring the wetland resources of the Midwest to reduce flood damages, improve water quality, enhance biodiversity and increase wildlife habitat. They have a dedicated, professional staff and independent Board of Directors who share this mission and who are committed to ensuring the financial and human resources are available to carry out this mission. Incorporated in 1994, TWI has developed a number of large-scale restorations in the Chicago Region on its own and in partnership with other organizations, e.g. the Spunky Bottoms Restoration (with The Nature Conservancy), The Midewin National Tallgrass Prairie restoration (with the U.S. Forest Service), and the Hennepin and Hopper Lakes Restoration (solo). TWI is currently developing a 1600-acre restoration project at Sawmill Lake, and a 1200-acre restoration project on Goose Pond, both backwaters of the Illinois River south of Hennepin.

Hennepin Project Ownership and Management

TWI was solely responsible for raising funds to acquire the 2,746-acre Hennepin property and implementing all restoration activities. In 2001, 2,254 project acres were subdivided into seven individual foundations (non-profit 501(c)(3) corporations) and enrolled in the Conservation Reserve Enhancement Program under a permanent conservation easement (see Attachment 6). TWI owns 246 project acres, purchased with \$500,000 from the USFWS under the North American Waterfowl Conservation Act. The remaining acreage is owned by the Hennepin Drainage and Levee District. Each of the seven foundations has given TWI authority to manage all restoration activities and to make all management decisions. All of the work being proposed here will be conducted on three of the seven foundations (Green-winged Teal, Mallard, and Wood Duck).

COMPLIANCE

The IDNR will use its CERP (Comprehensive Environmental Review Process) as a tool to aid the Department in meeting NEPA compliance for the projects outlined under this grant proposal. It is the Department's policy to require CERP applications for all land disturbing activities unless those activities are covered by CERP exemptions.

All work identified in this proposal is believed to be addressed by several categorical exclusions 1.4B(1) and (3), 516 DM 6 Appendix 1) with no known exceptions to those categorical exclusions. If exceptions are identified or the scope of the work changes during the execution of the proposed projects, the Federal Aid Division of the USFWS will be contacted to determine if additional NEPA compliance actions are needed.

All planned activities will also be in compliance with the Endangered Species Act. All determinations and documentation will in accordance with the current established U.S. Fish and Wildlife Service protocols for Section 7.

All planned activities will be in compliance with the National Historic Preservation Act and the Council on Historic Preservation Act. All determinations and documentation will be in accordance with the terms of the Programmatic Agreement, as amended, effective September 23, 2002.

When applicable, those planned activities which involve programs and/or site improvements will be done in accordance with section 504 of the Rehabilitation act and the Americans with Disabilities Act.

When applicable, those planned activities which involve the use of pesticides, herbicides or other comparable chemicals will be done in accordance with current state and federal regulations to assure the safe and legal application of those chemicals. All chemicals will be applied in accordance with the manufacturer's label instructions. All persons applying chemicals will be licensed by the Illinois Department of Agriculture as a chemical operator along with a licensed applicator, in accordance with Illinois state law.

PROJECT LOCATION:

The proposed 51-acre project area is located within the 2,746-acre Hennepin and Hopper Lakes Restoration Site on three parcels of land owned by separate, 501(c)(3) non-profit conservation foundations: the Green-winged Teal Foundation (2.9 acres), the Wood Duck Foundation (30.9 acres), and the Mallard Foundation (17.3 acres) (Attachment 6). The treatment plots are found in portions of the NE and SE quarters of Section 21, and in portions of the NW and SW quarters of Section 22, T32N; R2W. The project area is located just south of the Village of Hennepin in Putnam County, IL, on the shores of Hennepin and Hopper Lakes (Attachment 7).

REFERENCES

- Ailstock, M.S., C.M. Norman, and P.J. Bushman. 2001. Common reed *Phragmites australis*: control and effects upon biodiversity in freshwater nontidal wetlands. *Restoration Ecology* 9: 49-59.
- Foster, R.D. and P.R. Wetzel. 2005. Invading monotypic stands of *Phalaris arundinaceae*: a test of fire, herbicide, and woody and herbaceous native plant groups. *Restoration Ecology* 13: 318-324.
- Harris, S.W., and W.H. Marshall. 1963. Ecology of Water-Level Manipulations on a Northern Marsh. *Ecology* 44: 331-343.
- Kentula, M.E. 2000. Perspectives on setting success criteria for wetland restoration. *Ecological Engineering*. 15:199-209.
- Levine, J.M. 2000. Species diversity and biological invasions: relating local process to community pattern. *Science* 288:852-854.
- Moore, H.H., W.A. Niering, L.J. Marsicano, M. Dowdell. 1999. Vegetation change in created emergent wetlands (1988-1996) in Connecticut (USA). *Wetlands Ecology and Management* 4: 177-191.
- Newman, S., J.B. Grace, and J.W. Koebel. 1996. Effects of nutrients and hydroperiod on *Typha*, *Cladium*, and *Eleocharis*: implications for Everglades restoration. *Ecological Applications*. 6: 774-783.
- Temperton, V.M., R.J. Hobbs, T. Nuttle, and S. Halle, editors. 2004. *Assembly rules and restoration ecology: bridging the gap between theory and practice*. Island Press. Washington, D.C., 439 pages.
- Wilson, R.F. and W.J. Mitsch. 1996. Functional assessment of five wetlands constructed to mitigate wetland loss in Ohio, USA. *Wetlands*. 16: 436-451.

Appendix 1. Bird Observations at Hennepin and Hopper Lakes Restoration Project 2001 - 2005

| # | common name | species | abundance and season | breeding status | T & E status | conservation priority |
|----|-----------------------------|---------------------------|----------------------|-----------------|--------------|-----------------------|
| 1 | Trumpeter Swan | Cygnus buccinator | RM | | | IL, P |
| 2 | Tundra Swan | Cygnus columbianus | RM | | | |
| 3 | White-fronted Goose | Anser albifrons | CM | | | |
| 4 | Snow Goose (blue + white) | Chen caerulescens | UM | | | |
| 5 | Ross's Goose (blue + white) | Chen rossi | RM | | | |
| 6 | Canada Goose | Branta canadensis | AM,CS,UW | C | | P |
| 7 | Cackling Goose | Branta hutchinsii | CM, RW | | | |
| 8 | Wood Duck | Aix sponsa | AM,AS | C | | P |
| 9 | Green-winged Teal | Anas crecca | AM,RS | P | | |
| 10 | Black Duck | Anas rubripes | UM,RW | | | IL |
| 11 | Mallard | Anas platyrhynchos | AM,CS,UW | C | | P |
| 12 | Northern Pintail | Anas acuta | AM,RS,RW | C | | |
| 13 | Blue-winged Teal | Anas discors | AM,CS | C | | P |
| 14 | Northern Shoveler | Anas clypeata | AM,RS | P | | |
| 15 | Gadwall | Anas strepera | AM,RS | C | | |
| 16 | American Wigeon | Anas americana | AM,RS | | | |
| 17 | Canvasback | Aythya valisineria | CM | | | IL, P |
| 18 | Redhead | Aythya americana | FM,RS | C | | |
| 19 | Ring-necked Duck | Aythya collaris | AM,RS | | | |
| 20 | Greater Scaup | Aythya marila | RM | | | |
| 21 | Lesser Scaup | Aythya affinis | AM | | | IL, P |
| 22 | Long-tailed Duck | Clangula hyemalis | RM | | | |
| 23 | Common Goldeneye | Bucephala clangula | FM | | | |
| 24 | Bufflehead | Bucephala albeola | CM | | | |
| 25 | Hooded Merganser | Lophodytes cucullatus | CM,RS | L | | IL |
| 26 | Common Merganser | Mergus merganser | FM,UW | | | |
| 27 | Red-breasted Merganser | Mergus serrator | UM | | | |
| 28 | Ruddy Duck | Oxyura jamaicensis | AM,CS | C | | |
| 29 | Ring-necked Pheasant | Phasianus colchicus | RP | | | |
| 30 | Wild Turkey | Meleagris gallopavo | RP | | | |
| 31 | Northern Bobwhite | Colinus virginianus | RP | P | | IL |
| 32 | Common Loon | Gavia immer | RM | | | P |
| 33 | Pied-billed Grebe | Podilymbus podiceps | CM,CS | C | D 2004 | IL |
| 34 | Horned Grebe | Podiceps auritus | UM | | | |
| 35 | Eared Grebe | Podiceps nigricollis | RM | | | |
| 36 | White Pelican | Pelecanus erythrorhynchos | AM,RS | | | |
| 37 | Double-crested Cormorant | Phalacrocorax auritus | CM,US | | | P |
| 38 | American Bittern | Botaurus lentiginosus | RM | P | SE | IL, P |
| 39 | Least Bittern | Ixobrychus exilis | RS | C | ST | IL, P |
| 40 | Great Blue Heron | Ardea herodias | CM,CS,RW | | | |
| 41 | Great Egret | Ardea alba | CM,US | | | IL |
| 42 | Snowy Egret | Egretta thula | RM | | SE | IL |
| 43 | Little Blue Heron | Egretta caerulea | UM | | SE | IL |
| 44 | Tricolored Heron | Egretta tricolor | V | | | |
| 45 | Cattle Egret | Bubulcus ibis | RM | | | |
| 46 | Green Heron | Butorides virescens | US | L | | |
| 47 | Black-crowned Night-Heron | Nycticorax nycticorax | RM | | SE | IL |
| 48 | White-faced Ibis | Plegadis chihi | V | | | |

| # | common name | species | abundance and season | breeding status | T & E status | conservation priority |
|----|------------------------|-----------------------------|----------------------|-----------------|--------------|-----------------------|
| 49 | Turkey Vulture | Cathartes aura | FM,FS | | | |
| 50 | Osprey | Pandion haliaetus | RM | | SE | IL |
| 51 | Bald Eagle | Haliaeetus leucocephalus | CM,CW,RS | C | FT, ST | IL, P |
| 52 | Northern Harrier | Circus cyaneus | FM,UW | | SE | IL, P |
| 53 | Sharp-shinned Hawk | Accipiter striatus | UM,RW | | | |
| 54 | Cooper's Hawk | Accipiter cooperii | RP | P | | |
| 55 | Red-shouldered Hawk | Buteo lineatus | RM | | D 2004 | IL, P |
| 56 | Broad-winged Hawk | Buteo platypterus | RM | | | IL |
| 57 | Red-tailed Hawk | Buteo jamaicensis | FP | C | | |
| 58 | Rough-legged Hawk | Buteo lagopus | UW | | | |
| 59 | American Kestrel | Falco sparverius | UP | L | | |
| 60 | Peregrine Falcon | Falco peregrinus | RM | | SE | IL, P |
| 61 | King Rail | Rallus elegans | RM | L | | IL, P |
| 62 | Virginia Rail | Rallus limicola | US | L | WL | |
| 63 | Sora | Porzana carolina | FM,RS | L | WL | |
| 64 | Common Moorhen | Gallinula chloropus | US | C | ST | IL, P |
| 65 | American Coot | Fulica americana | AM,AS,RW | C | | |
| 66 | Whooping Crane | Grus americana | V | | FE | IL |
| 67 | Sandhill Crane | Grus canadensis | RM | L | ST | IL |
| 68 | Black-bellied Plover | Pluvialis squatarola | RM | | | |
| 69 | American Golden Plover | Pluvialis dominica | RM | | | IL |
| 70 | Semipalmated Plover | Charadrius semipalmatus | UM | | | |
| 71 | Piping Plover | Charadrius melodus | RM | | FE, SE | IL |
| 72 | Killdeer | Charadrius vociferus | FM,FS,RW | C | | |
| 73 | Greater Yellowlegs | Tringa melanoleuca | FM | | | IL, P |
| 74 | Lesser Yellowlegs | Tringa flavipes | AM | | | |
| 75 | Solitary Sandpiper | Tringa solitaria | FM | | | |
| 76 | Willet | Catoptrophorus semipalmatus | RM | | | |
| 77 | Spotted Sandpiper | Actitis macularia | UM,RS | L | | |
| 78 | Marbled Godwit | Limosa fedoa | RM | | | P |
| 79 | Hudsonian Godwit | Limosa haemastica | RM | | | P |
| 80 | Ruddy Turnstone | Arenaria interpres | RM | | | |
| 81 | Red Knot | Calidris canutus | RM | | | |
| 82 | Semipalmated Sandpiper | Calidris pusilla | FM | | | |
| 83 | Least Sandpiper | Calidris minutilla | FM | | | |
| 84 | White-rumped Sandpiper | Calidris fuscicollis | RM | | | |
| 85 | Baird's Sandpiper | Calidris bairdii | RM | | | |
| 86 | Pectoral Sandpiper | Calidris melanotos | CM | | | |
| 87 | Dunlin | Calidris alpina | UM | | | |
| 88 | Stilt Sandpiper | Calidris himantopus | UM | | | IL, P |
| 89 | Short-billed Dowitcher | Limnodromus griseus | UM | | | IL, P |
| 90 | Long-billed Dowitcher | Limnodromus scolopaceus | RM | | | |
| 91 | Wilson's Snipe | Gallinago delicata | FM,RW | | WL | IL |
| 92 | American Woodcock | Scolopax minor | RM,RS | | | IL, P |
| 93 | Wilson's Phalarope | Phalaropus tricolor | UM,RS | P | SE | IL, P |
| 94 | Laughing Gull | Larus atricilla | V | | | |
| 95 | Franklin's Gull | Larus pipixcan | UM | | | |
| 96 | Bonaparte's Gull | Larus philadelphia | FM | | | |
| 97 | Ring-billed Gull | Larus delawarensis | CP | | | |
| 98 | Herring Gull | Larus argentatus | FM,UW,RS | | | |

| # | common name | species | abundance and season | breeding status | T & E status | conservation priority |
|-----|---------------------------|-----------------------------------|----------------------|-----------------|--------------|-----------------------|
| 99 | Caspian Tern | <i>Sterna caspia</i> | FM | | | |
| 100 | Common Tern | <i>Sterna hirundo</i> | RM | | SE | IL |
| 101 | Forster's Tern | <i>Sterna forsteri</i> | UM | | SE | IL, P |
| 102 | Black Tern | <i>Chlidonias niger</i> | FM,RS | L | SE | IL, P |
| 103 | Rock Dove | <i>Columba livia</i> | FP | | | |
| 104 | Mourning Dove | <i>Zenaida macroura</i> | CP | L | | |
| 105 | Black-billed Cuckoo | <i>Coccyzus erythrophthalmus</i> | RS | P | | P |
| 106 | Yellow-billed Cuckoo | <i>Coccyzus americanus</i> | UM,US | L | | IL |
| 107 | Barn Owl | <i>Tyto alba</i> | RP | P | SE | IL |
| 108 | Great Horned Owl | <i>Bubo virginianus</i> | UP | C | | |
| 109 | Barred Owl | <i>Strix varia</i> | RP | P | | |
| 110 | Short-eared Owl | <i>Asio flammeus</i> | UW | | SE | IL |
| 111 | Common Nighthawk | <i>Chordeiles minor</i> | RM | | | |
| 112 | Chimney Swift | <i>Chaetura pelagica</i> | FM,FS | P | | |
| 113 | Ruby-throated Hummingbird | <i>Archilochus colubris</i> | FM,RS | L | | |
| 114 | Belted Kingfisher | <i>Ceryle alcyon</i> | UM,RS,RW | C | | |
| 115 | Red-headed Woodpecker | <i>Melanerpes erythrocephalus</i> | FS,RW | C | | IL, P |
| 116 | Red-bellied Woodpecker | <i>Melanerpes carolinus</i> | CP | C | | |
| 117 | Yellow-bellied Sapsucker | <i>Sphyrapicus varius</i> | UM | | | |
| 118 | Downy Woodpecker | <i>Picoides pubescens</i> | CP | C | | |
| 119 | Hairy Woodpecker | <i>Picoides villosus</i> | UP | L | | |
| 120 | Yellow-shafted Flicker | <i>Colaptes auratus</i> | CM,FS,RW | C | | IL, P |
| 121 | Pileated Woodpecker | <i>Dryocopus pileatus</i> | UP | L | | |
| 122 | Eastern Wood Pewee | <i>Contopus virens</i> | FM,FS | C | | |
| 123 | Willow Flycatcher | <i>Empidonax traillii</i> | UM,RS | L | | |
| 124 | Least Flycatcher | <i>Empidonax minimus</i> | UM | | | |
| 125 | Eastern Phoebe | <i>Sayornis phoebe</i> | FM,US | C | | |
| 126 | Great Crested Flycatcher | <i>Myiarchus crinitus</i> | FM,FS | C | | |
| 127 | Eastern Kingbird | <i>Tyrannus tyrannus</i> | FM,FS | L | | |
| 128 | White-eyed Vireo | <i>Vireo griseus</i> | RS | P | | |
| 129 | Blue-headed Vireo | <i>Vireo solitarius</i> | RM | | | |
| 130 | Yellow-throated Vireo | <i>Vireo flavifrons</i> | RM,RS | P | | |
| 131 | Warbling Vireo | <i>Vireo gilvus</i> | CM,CS | C | | |
| 132 | Philadelphia Vireo | <i>Vireo philadelphicus</i> | RM | | | |
| 133 | Red-eyed Vireo | <i>Vireo olivaceus</i> | UM,US | L | | |
| 134 | Blue Jay | <i>Cyanocitta cristata</i> | CP | L | | |
| 135 | American Crow | <i>Corvus brachyrhynchos</i> | FP | L | | |
| 136 | Horned Lark | <i>Eremophila alpestris</i> | UP | C | | |
| 137 | Purple Martin | <i>Progne subis</i> | UM,RS | | | |
| 138 | Tree Swallow | <i>Tachycineta bicolor</i> | AM,FS | C | | |
| 139 | N. Rough-winged Swallow | <i>Stelgidopteryx serripennis</i> | CM,CS | L | | |
| 140 | Bank Swallow | <i>Riparia riparia</i> | AM,FS | C | | |
| 141 | Cliff Swallow | <i>Petrochelidon pyrrhonota</i> | FM | | | |
| 142 | Barn Swallow | <i>Hirundo rustica</i> | AM,CS | C | | |
| 143 | Black-capped Chickadee | <i>Poecile atricapillus</i> | CP | C | | |
| 144 | Tufted Titmouse | <i>Baeolophus bicolor</i> | FP | C | | |
| 145 | Red-breasted Nuthatch | <i>Sitta canadensis</i> | RM | | | |
| 146 | White-breasted Nuthatch | <i>Sitta carolinensis</i> | FP | C | | |
| 147 | Brown Creeper | <i>Certhia americana</i> | UM,RW | | D 2004 | IL |
| 148 | Carolina Wren | <i>Thryothorus ludovicianus</i> | UP | L | | |

| # | common name | species | abundance and season | breeding status | T & E status | conservation priority |
|-----|------------------------------|------------------------------|----------------------|-----------------|--------------|-----------------------|
| 149 | House Wren | Troglodytes aedon | CM,CS | C | | |
| 150 | Winter Wren | Troglodytes troglodytes | UM,RW | | | |
| 151 | Sedge Wren | Cistothorus platensis | UM,RS | P | | |
| 152 | Marsh Wren | Cistothorus palustris | US | C | | IL |
| 153 | Golden-crowned Kinglet | Regulus satrapa | UM,UW | | | |
| 154 | Ruby-crowned Kinglet | Regulus calendula | FM | | | |
| 155 | Blue-gray Gnatcatcher | Poliophtila caerulea | FM,US | L | | |
| 156 | Eastern Bluebird | Sialia sialis | FM,RS,RW | C | | |
| 157 | Veery | Catharus fuscescens | RM,RS | P | | |
| 158 | Swainson's Thrush | Catharus ustulatus | UM | | | |
| 159 | Hermit Thrush | Catharus guttatus | UM | | | |
| 160 | Wood Thrush | Hylocichla mustelina | UM,US | L | | P |
| 161 | American Robin | Turdus migratorius | AM,CS,FW | C | | |
| 162 | Gray Catbird | Dumetella carolinensis | CM,CS | C | | |
| 163 | Northern Mockingbird | Mimus polyglottos | RM,RS | | | |
| 164 | Brown Thrasher | Toxostoma rufum | FM,FS | L | | |
| 165 | American Pipit | Anthus rubescens | UM | | | |
| 166 | Cedar Waxwing | Bombycilla cedrorum | FM,US | L | | |
| 167 | European Starling | Sturnus vulgaris | CR | C | | |
| 168 | Blue-winged Warbler | Vermivora pinus | RM | | | IL, P |
| 169 | Golden-winged Warbler | Vermivora chrysoptera | RM | | | |
| 170 | Tennessee Warbler | Vermivora peregrina | RM | | | |
| 171 | Orange-crowned Warbler | Vermivora celata | RM | | | |
| 172 | Nashville Warbler | Vermivora ruficapilla | UM | | | |
| 173 | Northern Parula | Parula americana | UM,RS | | | |
| 174 | Yellow Warbler | Dendroica (petechia) aestiva | CM,CS | C | | |
| 175 | Chestnut-sided Warbler | Dendroica pensylvanica | RM,RS | | | |
| 176 | Magnolia Warbler | Dendroica magnolia | RM | | | |
| 177 | Cape May Warbler | Dendroica tigrina | RM | | | |
| 178 | Black-throated Blue Warbler | Dendroica caerulescens | RM | | | |
| 179 | Yellow-rumped Warbler | Dendroica coronata | CM,RW | | | |
| 180 | Black-throated Green Warbler | Dendroica virens | UM | | | |
| 181 | Blackburnian Warbler | Dendroica fusca | RM | | | |
| 182 | Yellow-throated Warbler | Dendroica dominica | RM | | | |
| 183 | Prairie Warbler | Dendroica discolor | RM | | | |
| 184 | Pine Warbler | Dendroica pinus | RM | | | |
| 185 | Palm Warbler | Dendroica palmarum | UM | | | |
| 186 | Bay-breasted Warbler | Dendroica castanea | RM | | | |
| 187 | Blackpoll Warbler | Dendroica striata | RM | | | |
| 188 | Cerulean Warbler | Dendroica cerulea | RM | | | IL, P |
| 189 | Black-and-white Warbler | Mniotilta varia | RM | | | |
| 190 | American Redstart | Setophaga ruticilla | FM,US | L | | IL |
| 191 | Prothonotary Warbler | Protonotaria citrea | RM,RS | P | | P |
| 192 | Ovenbird | Seiurus aurocapillus | RM | | | IL |
| 193 | Northern Waterthrush | Seiurus noveboracensis | UM | | | |
| 194 | Louisiana Waterthrush | Seiurus motacilla | RM | | | P |
| 195 | Common Yellowthroat | Geothlypis trichas | CM,CS | C | | |
| 196 | Wilson's Warbler | Wilsonia pusilla | RM | | | |
| 197 | Canada Warbler | Wilsonia canadensis | RM | | | P |
| 198 | Yellow-breasted Chat | Icteria virens | RM | | | IL |

| # | common name | species | abundance and season | breeding status | T & E status | conservation priority |
|-----|-------------------------------|-------------------------------|----------------------|-----------------|--------------|-----------------------|
| 199 | Scarlet Tanager | Piranga olivacea | RM | | | |
| 200 | Summer Tanager | Piranga rubra | RM | | | |
| 201 | Eastern Towhee | Pipilo erythrophthalmus | UM,US | L | | |
| 202 | Spotted Towhee | Papilo maculatus | RM | | | |
| 203 | American Tree Sparrow | Spizella arborea | AM,CW | | | |
| 204 | Chipping Sparrow | Spizella passerina | CM,FS | C | | |
| 205 | Field Sparrow | Spizella pusilla | FM,US | C | | P |
| 206 | Vesper Sparrow | Poocetes gramineus | UM,US | C | | |
| 207 | Lark Sparrow | Chondestes grammacus | UM,RS | P | | |
| 208 | Savannah Sparrow | Ammodramus sandwichensis | FM,US | L | | IL |
| 209 | Grasshopper Sparrow | Ammodramus savannarum | CS | C | | IL, P |
| 210 | LeConte's Sparrow | Ammodramus leconteii | RM | | | IL, P |
| 211 | Nelson's Sharp-tailed Sparrow | Ammodramus nelsonii | RM | | | IL |
| 212 | Fox Sparrow | Passerella iliaca | UM,RW | | | |
| 213 | Song Sparrow | Melospiza melodia | AM,CS,FW | C | | |
| 214 | Lincoln's Sparrow | Melospiza lincolni | UM | | | |
| 215 | Swamp Sparrow | Melospiza georgiana | CM,US,UW | L | | |
| 216 | White-throated Sparrow | Zonotrichia albicollis | CM,RW | | | |
| 217 | White-crowned Sparrow | Zonotrichia leucophrys | CM,UW | | | |
| 218 | Dark-eyed Junco | Junco (hyemalis) hyemalis | CW | | | |
| 219 | Lapland Longspur | Calcarius lapponicus | RW | | | |
| 220 | Snow Bunting | Plectrophenax nivalis | RW | | | |
| 221 | Northern Cardinal | Cardinalis cardinalis | CP | C | | |
| 222 | Rose-breasted Grosbeak | Pheucticus ludovicianus | CM,FS | C | | |
| 223 | Blue Grosbeak | Passerina caerulea | RM | | | |
| 224 | Indigo Bunting | Passerina cyanea | CM,CS | C | | |
| 225 | Dickcissel | Spiza americana | CS | C | | IL, P |
| 226 | Bobolink | Dolichonyx oryzivorus | RM | | | IL, P |
| 227 | Red-winged Blackbird | Agelaius phoeniceus | AM,CS,UW | C | | |
| 228 | Eastern Meadowlark | Sturnella magna | UM,US | L | | P |
| 229 | Western Meadowlark | Sturnella neglecta | RS | P | | P |
| 230 | Yellow-headed Blackbird | Xanthocephalus xanthocephalus | US | C | SE | IL |
| 231 | Rusty Blackbird | Euphagus carolinus | FM,RW | | | IL, P |
| 232 | Brewer's Blackbird | Euphagus cyanocephalus | RM | | | |
| 233 | Common Grackle | Quiscalus quiscula | AM,CS,RW | C | | |
| 234 | Brown-headed Cowbird | Molothrus ater | CM,CS,UW | L | | |
| 235 | Orchard Oriole | Icterus spurius | RS | C | | P |
| 236 | Baltimore Oriole | Icterus galbula | CM,FS | C | | |
| 237 | Purple Finch | Carpodacus purpureus | FM,UW | | | |
| 238 | House Finch | Carpodacus mexicanus | UP | L | | |
| 239 | American Goldfinch | Carduelis tristis | FP | L | | |
| 240 | House Sparrow | Passer domesticus | FP | L | | |

| Appendix 1 Key | |
|-----------------------|---|
| A | Abundant |
| C | Common |
| F | Fairly Common |
| U | Uncommon |
| R | Rare |
| V | Vagrant (not in normal range) |
| | |
| M | Migrant |
| S | Summer |
| W | Winter |
| P | Resident (present year round) |
| | |
| C | Confirmed (nest or dependent young observed) |
| L | Likely (multiple pairs seen in multiple years; breeding behavior, but no nests or young observed) |
| P | Possible (in breeding range; observed in summer, appropriate conditions and habitat exist) |
| | |
| FE | Federal Endangered |
| FT | Federal Threatened |
| SE | State Endangered |
| ST | State Threatened |
| WL | Illinois Watch List |
| D | Delisted |
| | |
| IL | Illinois Conservation Priority List |
| P | USFWS Region 3 Conservation Priority List |

Appendix 2. Butterfly Observations at Hennepin and Hopper Lakes Restoration Project 2001 – 2005.

| # | Species | Common Name | Family | Breeding |
|----|---------------------------|---------------------------|-------------------|----------|
| 1 | Anatrytone logan | Delaware Skipper | Skipper | U |
| 2 | Ancyloxypha numitor | Least Skipper | Skipper | P |
| 3 | Asterocampa celtis | Hackberry Emperor | Brush-Footed | P |
| 4 | Atalopedes campestris | Sachem | Skipper | P |
| 5 | Battus philenor | Pipevine Swallowtail | Swallowtail | U |
| 6 | Boloria bellona | Meadow Fritillary | Brush-Footed | P |
| 7 | Callophrys gryneus | Juniper Hairstreak | Gossamer-Wing | U |
| 8 | Callophrys henrici | Henry's Elfin | Gossamer-Wing | C |
| 9 | Celastrina ladon | Spring Azure | Gossamer-Wing | P |
| 10 | Cercyonis pegala | Common Wood-Nymph | Brush-Footed | P |
| 11 | Chlosyne gorgone | Gorgone Checkerspot | Brush-Footed | U |
| 12 | Chlosyne nycteis | Silvery Checkerspot | Brush-Footed | U |
| 13 | Colias eurytheme | Orange Sulphur | White and Sulphur | P |
| 14 | Colias philodice | Clouded Sulphur | White and Sulphur | P |
| 15 | Danaus plexippus | Monarch | Brush-Footed | P |
| 16 | Enodia anthedon | Northern Pearly- Eye | Brush-Footed | P |
| 17 | Epargyreus clarus | Silver-Spotted Skipper | Skipper | P |
| 18 | Euphyes vestris | Dun Skipper | Skipper | P |
| 19 | Euptoieta claudia | Variegated Fritillary | Brush-Footed | C |
| 20 | Eurema lisa | Little Yellow | White and Sulphur | P |
| 21 | Everes comyntas | Eastern Tailed- Blue | Gossamer-Wing | P |
| 22 | Feniseca tarquinius | Harvester | Gossamer-Wing | U |
| 23 | Hylephila phyleus | Fiery Skipper | Skipper | C |
| 24 | Junonia coenia | Common Buckeye | Brush-Footed | P |
| 25 | Libytheana carinenta | American Snout | Brush-Footed | U |
| 26 | Limenitis archippus | Viceroy | Brush-Footed | P |
| 27 | Limenitis arthemis | Red-Spotted Purple | Brush-Footed | P |
| 28 | Lycaena hyllus | Bronze Copper | Gossamer-Wing | C |
| 29 | Megisto cymela | Little Wood- Satyr | Brush-Footed | P |
| 30 | Nathalis iole | Dainty Sulphur | White and Sulphur | U |
| 31 | Nymphalis antiopa | Mourning Cloak | Brush-Footed | U |
| 32 | Nymphalis milbert | Milbert's Tortoiseshell | Brush-Footed | U |
| 33 | Papilio cresphontes | Giant Swallowtail | Swallowtail | U |
| 34 | Papilio glaucus | Eastern Tiger Swallowtail | Swallowtail | P |
| 35 | Papilio polyxenes | Black Swallowtail | Swallowtail | P |
| 36 | Phoebis sennae | Cloudless Sulphur | White and Sulphur | U |
| 37 | Pholisora catallus | Common Sootywing | Skipper | P |
| 38 | Phyciodes tharos | Pearl Crescent | Brush-Footed | P |
| 39 | Pieris rapae | Cabbage White | White and Sulphur | C |
| 40 | Polites peckius | Peck's Skipper | Skipper | U |
| 41 | Polites themistocles | Tawney-Edged Skipper | Skipper | U |
| 42 | Polygonia comma | Eastern Comma | Brush-Footed | P |
| 43 | Polygonia interrogationis | Question Mark | Brush-Footed | P |
| 44 | Polygonia progne | Gray Comma | Brush-Footed | U |
| 45 | Pontia protodice | Checkered White | White and Sulphur | U |
| 46 | Pyrgus communis | Common Checkered-Skipper | Skipper | U |
| 47 | Satyrrium calanus | Banded Hairstreak | Gossamer-Wing | P |
| 48 | Speyeria cybele | Great Spangled Fritillary | Brush-Footed | C |

| # | Species | Common Name | Family | Breeding |
|----------------------|--|------------------------|---------------|----------|
| 49 | Staphylus hayhurstii | Hayhurst's Scallopwing | Skipper | C |
| 50 | Strymon melinus | Gray Hairstreak | Gossamer-Wing | U |
| 51 | Thorybes pylades | Northern Cloudywing | Skipper | U |
| 52 | Vanessa atlanta | Red Admiral | Brush-Footed | C |
| 53 | Vanessa cardui | Painted Lady | Brush-Footed | P |
| 54 | Vanessa virginiensis | American Lady | Brush-Footed | U |
| Butterfly Key | | | | |
| C | Breeding confirmed - copulation, eggs, larva or pupa observed | | | |
| P | Breeding possible - the number of individuals and the available habitat appear suitable for breeding | | | |
| U | Breeding uncertain - proper habitat and/or sufficient numbers to support breeding are uncertain | | | |

Appendix 3. Mammal Observations at Hennepin and Hopper Lakes Restoration Project 2001 – 2005.

| # | Species | # | Species |
|----------|----------------------------|----------|----------------------|
| 1 | 13-lined ground squirrel | 16 | least weasel |
| 2 | American mink | 17 | little brown bat |
| 3 | badger | 18 | marsh rabbit |
| 4 | beaver | 19 | meadow jumping mouse |
| 5 | coyote | 20 | meadow vole |
| 6 | deer mouse | 21 | muskrat |
| 7 | eastern chipmunk | 22 | northern river otter |
| 8 | eastern cottontail rabbit | 23 | prairie vole |
| 9 | eastern fox squirrel | 24 | raccoon |
| 10 | eastern gray squirrel | 25 | red fox |
| 11 | eastern mole | 26 | striped skunk |
| 12 | Franklin's ground squirrel | 27 | Virginia opossum |
| 13 | gray fox | 28 | white-tailed deer |
| 14 | house mouse | 29 | woodchuck |
| 15 | least shrew | 30 | woodland vole |

Appendix 4. Plant species at Hennepin with a state conservation ranking and with state or federal endangered or threatened species status.

| # | Species | common name | conservation rank | T E listing |
|----|---------------------------------|-------------------------------|-------------------|-------------|
| 1 | <i>Acorus americanus</i> | sweet flag | 3 | |
| 2 | <i>Alisma trivale</i> | large-flowered water plantain | 2 | |
| 3 | <i>Allium cernuum</i> | nodding wild onion | 2 | |
| 4 | <i>Allium stellatum</i> | prairie onion | 2 | |
| 5 | <i>Anemone canadense</i> | meadow anemone | 3 | |
| 6 | <i>Anemone cylindrica</i> | thimbleweed | 3 | |
| 7 | <i>Aster furcatus</i> | forked aster | 2 | T |
| 8 | <i>Boltonia decurrens</i> | decurren's false aster | 2 | FT, T |
| 9 | <i>Bouteloua curtipendula</i> | sideoats grama | 3 | |
| 10 | <i>Bromus kalmii</i> | prairie brome | 2 | |
| 11 | <i>Calamagrostis canadensis</i> | bluejoint grass | 3 | |
| 12 | <i>Caltha palustris</i> | marsh marigold | 3 | |
| 13 | <i>Carex bebbii</i> | bebb's oval sedge | 3 | |
| 14 | <i>Carex bicknellii</i> | prairie sedge | 3 | |
| 15 | <i>Carex comosa</i> | bristly sedge | 3 | |
| 16 | <i>Carex crinita</i> | fringed sedge | 3 | |
| 17 | <i>Carex cristatella</i> | crested sedge | 3 | |
| 18 | <i>Carex crus-corvi</i> | crowfoot fox sedge | 3 | |
| 19 | <i>Carex eburnea</i> | ivory sedge | 3 | |
| 20 | <i>Carex festucacea</i> | fescue oval sedge | 3 | |
| 21 | <i>Carex grayii</i> | bur sedge | 3 | |
| 22 | <i>Carex hystericina</i> | porcupine sedge | 3 | |
| 23 | <i>Carex interior</i> | prairie star sedge | 3 | |
| 24 | <i>Carex lacustris</i> | lake sedge | 3 | |
| 25 | <i>Carex lupulina</i> | common hop sedge | 3 | |
| 26 | <i>Carex lurida</i> | sallow sedge | 3 | |
| 27 | <i>Carex molesta</i> | field oval sedge | 1 | |
| 28 | <i>Carex muhlenbergii</i> | sand-bracted sedge | 3 | |
| 29 | <i>Carex pellita</i> | wooly sedge | 3 | |
| 30 | <i>Carex prairea</i> | fen panicled sedge | 1 | |
| 31 | <i>Carex projecta</i> | loose headed oval sedge | 3 | |
| 32 | <i>Carex sartwellii</i> | running marsh sedge | 2 | |
| 33 | <i>Carex scoparia</i> | broom sedge | 3 | |
| 34 | <i>Carex sterilis</i> | fen star sedge | 3 | |
| 35 | <i>Carex stipata</i> | awl-fruited sedge | 3 | |
| 36 | <i>Carex stricta</i> | tussock sedge | 3 | |
| 37 | <i>Carex tenera</i> | narrow-leaved oval sedge | 3 | |
| 38 | <i>Carex trichocarpa</i> | hairy-fruited lake sedge | 3 | |
| 39 | <i>Carex typhina</i> | common cattail sedge | 3 | |
| 40 | <i>Castilleja sessiliflora</i> | downy panicled cup | 2 | E |
| 41 | <i>Clematis viorna</i> | clematis | 1 | E |
| 42 | <i>Cyperus erythrorhizos</i> | red-rooted cyperus | 3 | |
| 43 | <i>Dalea foliosa</i> | leafy prairie clover | 1 | FE, E |
| 44 | <i>Eleocharis compressa</i> | flat-stem spike rush | 3 | |
| 45 | <i>Eleocharis elliptica</i> | oval-stem spike rush | 3 | |
| 46 | <i>Eleocharis quadrangulata</i> | square-stem spike rush | 1 | |
| 47 | <i>Elodea nutallii</i> | nutall's elodea | 3 | |

| # | species | common name | cons. rank | T E listing |
|----|---|-----------------------------|------------|-------------|
| 48 | <i>Elymus virginicus</i> | virginia wild rye | 3 | |
| 49 | <i>Filipendula rubra</i> | queen of the prairie | 1 | E |
| 50 | <i>Helianthus giganteus</i> | tall sunflower | 1 | E |
| 51 | <i>Hierochloa odorata</i> | sweet grass | 2 | |
| 52 | <i>Hypoxis hirsuta</i> | yellow stargrass | 3 | |
| 53 | <i>Juncus dudleyi</i> | dudley's rush | 3 | |
| 54 | <i>Koeleria cristata</i> | prairie june grass | 3 | |
| 55 | <i>Leersia oryzoides</i> | rice cut-grass | 3 | |
| 56 | <i>Liatris ligulistylis</i> | savanna blazing star | 2 | T |
| 57 | <i>Liatris scariosa</i> var. <i>nieuwlandii</i> | meadow blazing star | 3 | T |
| 58 | <i>Liparis loeselii</i> | green twayblade | 1 | |
| 59 | <i>Matelea decipiens</i> | climbing milkweed | 2 | E |
| 60 | <i>Mimulus glabratus</i> | yellow monkey flower | 1 | E |
| 61 | <i>Muhlenbergia cuspidata</i> | prairie satin grass | 2 | |
| 62 | <i>Muhlenbergia mexicana</i> | leafy satin grass | 3 | |
| 63 | <i>Muhlenbergia racemosa</i> | upland wild timothy | 3 | |
| 64 | <i>Najas flexilis</i> | northern naiad | 3 | |
| 65 | <i>Napaea dioica</i> | glade mallow | 3 | |
| 66 | <i>Nelumbo luteo</i> | lotus | 3 | |
| 67 | <i>Nymphaea odorata</i> | white water lily | 2 | |
| 68 | <i>Peltandra virginica</i> | arrow-arum | 3 | |
| 69 | <i>Penstemon grandiflorus</i> | large-flowered beard tongue | 2 | E |
| 70 | <i>Penstemon pallidus</i> | pale beard tongue | 1 | |
| 71 | <i>Polygonatum biflorum</i> | solomon's seal | 1 | |
| 72 | <i>Polygonum amphibium</i> | water knotweed | 3 | |
| 73 | <i>Polygonum pennsylvanicum</i> | pinkweed | 3 | |
| 74 | <i>Pontedaria cordata</i> | pickerel-weed | 3 | |
| 75 | <i>Potamogeton foliosus</i> | leafy pondweed | 3 | |
| 76 | <i>Potamogeton nodosus</i> | nodding longleaf | 3 | |
| 77 | <i>Potamogeton pusillus</i> | narrow leaf pondweed | 3 | |
| 78 | <i>Ranunculus pensylvanicus</i> | bristly buttercup | 2 | |
| 79 | <i>Ranunculus rhomboideus</i> | prairie buttercup | 2 | T |
| 80 | <i>Ranunculus sceleratus</i> | cursed crowfoot | 3 | |
| 81 | <i>Rumex orbiculatus</i> | great water dock | 3 | |
| 82 | <i>Salix discolor</i> | pussy willow | 3 | |
| 83 | <i>Sanguisorba canadensis</i> | American burnet | 2 | E |
| 84 | <i>Scirpus acutus</i> | hard-stem bulrush | 3 | |
| 85 | <i>Scirpus fluviatilis</i> | river bulrush | 3 | |
| 86 | <i>Scleria verticillata</i> | low nut rush | 2 | |
| 87 | <i>Silene nivea</i> | snowy campion | 3 | |
| 88 | <i>Silene regia</i> | royal catchfly | 1 | E |
| 89 | <i>Silene stellata</i> | starry campion | 3 | |
| 90 | <i>Sisyrinchium campestre</i> | prairie blue-eyed grass | 2 | |
| 91 | <i>Sporobolus heterolepis</i> | prairie dropseed | 2 | |
| 92 | <i>Stipa spartea</i> | porcupine grass | 3 | |
| 93 | <i>Stuckenia pectinata</i> | sago pondweed | 3 | |
| 94 | <i>Symplocarpus foetidus</i> | skunk cabbage | 3 | |
| 95 | <i>Thalictrum dasycarpum</i> | tall meadow-rue | 3 | |
| 96 | <i>Thalictrum dioicum</i> | early meadow rue | 3 | |
| 97 | <i>Thalictrum revolutum</i> | waxy meadow rue | 3 | |

| # | species | common name | cons. rank | T E listing |
|-----|----------------------------------|-------------------------|------------|-------------|
| 98 | <i>Tradescantia bracteata</i> | long-bracted spiderwort | 1 | T |
| 99 | <i>Trifolium reflexum</i> | buffalo clover | 3 | T |
| 100 | <i>Trillium sessile</i> | red trillium | 3 | |
| 101 | <i>Valeriana edulis ciliata</i> | hairy valarian | 3 | |
| 102 | <i>Vallisneria americana</i> | wild celery | 3 | |
| 103 | <i>Viola blanda</i> | hairy white vioolet | 2 | E |
| 104 | <i>Zanichellia palustris</i> | horned pondweed | 3 | |
| 105 | <i>Zigadenus elegans glaucus</i> | white camas | 1 | E |
| 106 | <i>Zizania aquatica</i> | wild rice | 3 | |

Attachment 5. Gary Sullivan Curriculum Vitae:

Gary Sullivan

Wetlands Restoration Ecologist

The Wetlands Initiative

53 West Jackson Boulevard, Suite 1015, Chicago IL 60604

(312) 922-0777 x115 gsullivan@wetlands-initiative.org

EDUCATION

| | | | |
|------|-------|---------------|--|
| 1995 | Ph.D. | Plant Ecology | Binghamton University, Binghamton, NY |
| 1988 | B.S. | Biology | Elmira College, Elmira, NY |
| 1975 | B.A. | Anthropology | St. John Fisher College, Rochester, NY |

PROFESSIONAL EXPERIENCE

| | | |
|-----------|--|--------------------------------|
| 2001-2005 | Restoration Ecologist | The Wetlands Initiative |
| 1996-2002 | Adjunct Assistant Professor | San Diego State University |
| 1999-2001 | NRC Postdoctoral Fellow | US EPA Coastal Ecology Branch |
| 1995-1999 | Research Ecologist | Pacific Estuarine Research Lab |
| 1994-1995 | Postdoctoral Research; Adjunct Professor | Binghamton University |
| 1989-1994 | Dissertation Research | Binghamton University |
| 1988 | Research Assistant; Lab Instructor | Elmira College |

PUBLICATIONS

- Titus, J. E., D. Gris , G. Sullivan, M. D. Stephens. 2004. Monitoring submersed vegetation in a mesotrophic: correlation of two spatio-temporal scales of change. *Aquatic Botany*. 79:33-50.
- Morzaria-Luna, H., J.C. Callaway, G. Sullivan, and J.B. Zedler. 2004. Relationship between topographic heterogeneity and vegetation patterns in a Californian salt marsh. *Journal of Vegetation Science*. In press.
- Callaway, J. C., Sullivan, G., and Zedler, J. B. 2003. Species-rich plantings increase biomass and nitrogen accumulation in a wetland restoration experiment. *Ecological Applications*. 13:1626-1639.
- Sullivan, G. 2002. Restoring a complex of backwater lakes, wetlands, and prairie on the Illinois River. *Ecological Restoration*. 20:134-135.
- Zedler, J. B., Callaway, J. C., & Sullivan, G. 2001. Declining biodiversity: Why species matter and how their functions might be restored in Californian tidal marshes. *Bioscience*, 51, 1005-1017.
- Titus, J. T. and G. Sullivan. 2001. Heterophylly in the yellow water lily *Nuphar variegata* (Nymphaeaceae): effects of [CO₂], natural sediment type, and depth. *American Journal of Botany*. 88:1469-1478.
- Sullivan, G. 2000. Establishing vegetation in restored and created coastal wetlands. *in*: J. B. Zedler (ed.), *Handbook of restoring coastal wetlands*. CRC Marine Science Series. CRC Press, Boca Raton, FL.
- Sullivan, G. and G. B. Noe. 2000. Coastal wetland plant species of southern California. *in*: J. B. Zedler (ed.), *Handbook of restoring coastal wetlands*. CRC Marine Science Series. CRC Press, Boca Raton, FL.

- Callaway, J. C. and G. Sullivan. 2000. Sustaining restored wetlands: Identifying and solving management problems. *in*: J. B. Zedler (ed.), Handbook of restoring coastal wetlands. CRC Marine Science Series. CRC Press, Boca Raton, FL.
- Callaway, J. C., G. Sullivan, G. D. Williams, J. S. Desmond and J. B. Zedler. 2000. Assessment and monitoring of restored wetlands. *in*: J. B. Zedler (ed.), Handbook of restoring coastal wetlands. CRC Marine Science Series. CRC Press, Boca Raton, FL.
- Sullivan, G. and J. B. Zedler. 1999. Functional redundancy among tidal marsh halophytes: a test. *Oikos*. 84: 246-260.
- Zedler, J. B., J. C. Callaway, J. S. Desmond, G. Vivian-Smith, G. D. Williams, G. Sullivan, A. E. Brewster, and B. K. Bradshaw. 1999. Californian salt marsh vegetation: An improved model of spatial pattern. *Ecosystems* 2:19-35.
- Zedler, J. B., J. Desmond, S. Phinn, B. Nyden, G. Sullivan, G. D. Williams, J. Callaway, K. E. Boyer, A. Powell. 1997. New tools for assessing coastal habitats. *in*: O. T. Magoon, H. Converse, B. Baird, and M. Miller-Henderson (ed.), California and the World Ocean '97. Vol. 1. American Society of Civil Engineers, Reston, VA. 1016-1027.
- Sullivan, G., and J. E. Titus. 1996. Physical site characteristics limit pollination and fruit set in the dioecious hydrophilous species, *Vallisneria americana*. *Oecologia*. 108: 285-292.
- Pueschel, C. M., G. Sullivan, and J. E. Titus. 1995. Occurrence of the red alga *Thorea violacea* (Batrachospermales: Thoreaceae) in the Hudson River, New York State. *Rhodora*. 97: 328-338.
- Sullivan, G. 1995. A tradeoff between sexual and asexual reproduction in the dioecious clonal macrophyte *Vallisneria americana*: environmental and genetic influences. Ph.D. Dissertation, Binghamton University, Binghamton, NY.

In preparation

- Sullivan, G., J. C. Callaway and J. B. Zedler. Biodiversity vs. species identity effects on salt marsh ecosystem functioning in experimental microcosms.
- Sullivan, G., and J. E. Titus. A physiological tradeoff between sexual and asexual reproduction in the dioecious clonal macrophyte *Vallisneria americana* Michx.
- Sullivan, G. A genetically determined cost of reproduction in the dioecious clonal macrophyte *Vallisneria americana* Michx.

CONTRIBUTED PAPERS AT PROFESSIONAL SOCIETY MEETINGS

- Sullivan, G., J. C. Callaway and J. B. Zedler. 2001. Species richness and system function in experimental salt marsh microcosms. Ecological Society of America Annual Meeting. Madison, WI.
- Sullivan, G., J. C. Callaway and J. B. Zedler. 1999. Diversity affects function in experimental salt marsh plant assemblages. Ecological Society of America Annual Meeting. Spokane, WA.
- Sullivan, G. and J. B. Zedler. 1997. Biodiversity and system function in experimental salt marsh assemblages. Ecological Society of America Annual Meeting. Albuquerque, NM.
- Sullivan, G., J. Callaway and J. B. Zedler. 1997. Poster: Salt marsh establishment from seedlings: an alternative to transplantation. Estuarine Research Federation Biannual Meeting. Providence, RI.
- Sullivan, G. 1995. The genetic basis to the relationship between sexual and asexual reproduction in the dioecious clonal macrophyte *Vallisneria americana* Michx. Society for the Study of Evolution Annual Meeting. Montreal, Quebec, Canada.

- Sullivan, G., and J. Titus. 1995. Site-specific pollen limitation in a submersed hydrophilous macrophyte. Ecological Society of America Annual Meeting. Snowbird, UT.
- Sullivan, G. 1994. Genetic variation in the tradeoff between sexual and asexual reproduction in a dioecious clonal plant. Ecological Society of American Annual Meeting. Knoxville, TN.
- Sullivan, G., and J. Titus. 1992. Balancing sexual and asexual reproduction in a submersed dioecious clonal plant. Ecological Society of America Annual Meeting Honolulu, HA.
- Sullivan, G., and J. Titus. 1990. Relating asexual reproduction to growth and fruit production in a submersed plant. Ecological Society of America Annual Meeting. Snowbird, UT.

RESEARCH GRANTS

1999. NRC Research Associateship Award. Impacts of green macroalgae on seagrass and mudflat habitats within Pacific Northwest estuaries.
1996. NSF award # DEB96-19875. The role of diversity in ecosystem function. Co-PI with J. B. Zedler and J. Callaway.

PROJECT GRANTS

2006. PSPG / US Fish and Wildlife Service. \$40,500 to Hennepin and Hopper Lakes: Wetland Restoration.
2006. National Fish and Wildlife Foundation / US Fish and Wildlife Service. \$80,000 to Midewin National Tallgrass Prairie: Prairie Wetland Restoration Project.
2006. Illinois Conservation Fund. \$40,000 to Midewin National Tallgrass Prairie: Prairie Wetland Restoration Project.
2005. Grand Victoria Foundation. \$250,000 to Hennepin and Hopper Lakes: Wetland and Prairie Restoration.
2004. Illinois Conservation Fund. \$50,000 to Midewin National Tallgrass Prairie: Prairie Wetland Restoration Project.
2003. C-2000 / Illinois Department of Natural Resources. \$50,000 to Midewin National Tallgrass Prairie: Blodgett Road Restoration Project.
2003. NAWCA / US Fish and Wildlife Service. \$50,000 to Midewin National Tallgrass Prairie: Dolomitic Wetland and Prairie Restoration Project.
2003. Mark Morton Foundation. \$100,000 to Hennepin and Hopper Lakes: Infrastructure for Public Access and Interpretive Signage.
2003. British Petroleum. \$25,000 to Midewin National Tallgrass Prairie: Prairie Wetland Restoration.
2002. Illinois Clean Energy. \$70,000 to Hennepin and Hopper Lakes: Backwater Lakes – Prairie Restoration.
2002. Oberweiler Foundation. \$14,500 to Midewin National Tallgrass Prairie: Dolomitic Prairie Restoration.
2002. British Petroleum. \$90,000 to Midewin National Tallgrass Prairie: Prairie Wetland Restoration.
2002. National Fish and Wildlife Foundation / US Fish and Wildlife Service. \$70,000 to Illinois River Valley Restoration Project.

RESEARCH EXPERIENCE

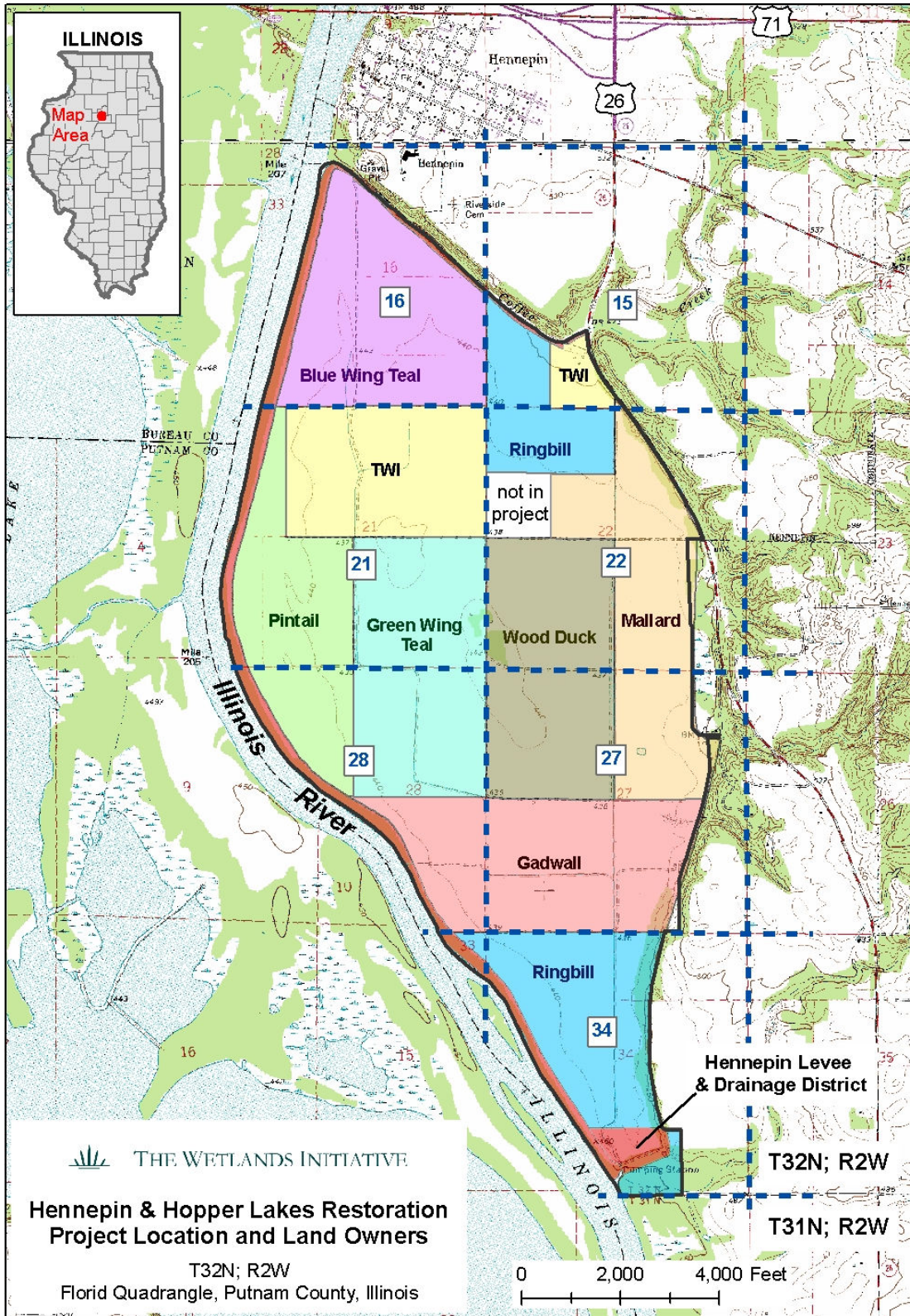
- 2001-2006: Conducting field experiments 1) evaluating the role of biodiversity in establishing ecosystem functions in a backwater lake – prairie complex on the Illinois River; 2)

- evaluating different restoration strategies for large-scale restorations characterized by a heterogeneous landscape: hydrology, topography, soils, and the resulting plant communities.
- 2000 – 2001: Field study examining the establishment of annual *Zostera marina* populations along hydrology gradients in Pacific Northwest estuaries.
- 2000 – 2001: Field study on the contribution of *Alnus rubra* (red alder) to stream nitrogen in Pacific Northwest coastal streams.
- 1999 – 2001: Manipulative field experiments examining seagrass and macroalgae interactions in Pacific Northwest Estuaries.
- 1995-2001: Manipulative field experiments in Southern California intertidal salt marsh systems: 1) design and implementation of experiments examining biodiversity and ecosystem function; 2) experimentation and design of salt marsh restoration techniques; 3) establishment and growth of seedlings and transplants under intertidal field conditions; 4) mesocosm growth experiments.
- 1996-1999: Design and implementation of field studies in the salt marshes of Southern California and Baja California, Mexico.
- 1995-1999: Manipulative greenhouse experiments: 1) design and implementation of intertidal microcosm experiments; 2) establishing techniques for seed germination and growth of halophytes in greenhouse experiments.
- 1990-1995: Greenhouse aquatic mesocosm experiments: 1) manipulative growth and allocation experiments; 2) examining genetic variation in plant breeding experiments; 3) germination and establishment of seeds and tubers in physiological response studies.
- 1989-1995: Field experiments in aquatic ecosystems: 1) submersed pot experiments in lakes using SCUBA; 2) lake and river pollination studies; 3) underwater transect sampling and data collection with SCUBA; 4) design of collection methods for aquatic plants and sediments with SCUBA.

CONSULTING EXPERIENCE

- 2004: Republic of Bulgaria. Developing strategies for large-scale restoration of wetlands on the Danube River floodplain in Bulgaria.
- 2001: US Forest Service, Midewin National Tallgrass Prairie, Joliet IL. Developing strategies to restore rare wet- and mesic dolomitic and wet deep soil prairies at the Midewin National Tallgrass Prairie Restoration.
- 1999: US Navy, South Western Division; Camp Pendelton Marine Corps Base, Camp Pendelton, CA. Analysis on the impacts to coastal wetland habitats of secondarily treated sewage effluent at the Santa Margarita River Estuary, CA. 1999.

Attachment 6. Map of seven 501(c)(3) non-profit foundations “ducks”. Property purchased under NAWCA is labeled TWI.



Attachment 7. Location map of the Hennepin and Hopper Lakes project site.

