



Cofrin Center for Biodiversity
UNIVERSITY of WISCONSIN-GREEN BAY

Pt. au Sable Nature Preserve Coastal Wetland Restoration Plan – Phase 1

ROBERT HOWE, AMY WOLF, JOSH MARTINEZ
Cofrin Center for Biodiversity, University of Wisconsin-Green Bay

BETSY GALBRAITH, GARY VAN VREEDE
U.S. Fish and Wildlife Service

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INTRODUCTION

Pt. au Sable is a prominent peninsula located on the east shore of lower Green Bay in Brown County, Wisconsin, approximately 4 miles north of the University of Wisconsin-Green Bay campus. The university-owned natural area consists of 181.6 acres of wetland, woodland, and shoreline habitats adjacent to approximately 70 acres of undeveloped private lands (Figure 1). Together these tracts encompass the largest coastal wetland along the eastern shore of Green Bay. An estuarine wetland mosaic extends inland from the mouth of Wequiock Creek, a locally confined waterway that drains a rapidly developing rural/suburban landscape north of the City of Green Bay.

Coastal wetlands at Point au Sable and the Wequiock Creek estuary are located within the Green Bay Area of Concern (AOC), a 55 km² area including Lower Green Bay and an adjacent portion of the Fox River. Among 14 beneficial use impairments in this ecosystem, at least two (degradation of fish and wildlife populations and loss of fish and wildlife habitat) are directly relevant to conservation objectives at the Pt. au Sable Nature Preserve. This site has long been recognized as a valuable wetland resource by duck hunters and naturalists; today it protects one of the few undeveloped estuarine wetlands in the entire Lake Michigan ecosystem. Most of Point au Sable was privately owned as a hunting area since the turn of the century. Because of its importance to hunters and migratory waterfowl, the property was left mostly unmodified by human activities. According to historical maps no public road has ever been built through the 250 acre peninsula, and limited vehicle access is possible only through a gated, private track along the far western border. Today, the University's primary management objective is to maintain Pt. Sable as a natural area for biodiversity conservation, ecological services (water quality improvement, fish spawning habitat, etc.), education, and recreation. Neighboring landowners have been very supportive of these conservation/preservation management goals.

Each spring and fall, thousands of migratory waterfowl, gulls, terns, shorebirds, and passerines pass through Point au Sable, and diverse assemblages of breeding birds occur in the site's wetland and forest habitats. Estuarine wetlands near the mouth of Wequiock Creek also provide breeding habitat for fish, including northern pike, bass, and other game species. Studies by UW-Green Bay students and staff have documented well over 200 bird species at Point au Sable, including 2 federally listed species (Bald Eagle, which now nests at the property and Peregrine Falcon) and 8 state threatened/endangered species.

The Pt. au Sable wetland complex is subject to dramatic changes in character due to fluctuating water levels in Lake Michigan and Green Bay. These changes strongly influence vegetation patterns and habitats for plant and animal species. During the past decade, historically low water levels have resulted in severe reduction in the extent of open wetlands at Pt. Sable (Figure 2), contributing to the invasion of *Phragmites australis* across much of the site. In addition, build-up of zebra mussel shells along the beaches has impeded flow of water into a large coastal wetland/lagoon at the western peninsula of the Point. Sediments from upstream farms and residential developments in the Wequiock Creek drainage also might have affected the extent of open water in wetlands in the estuarine mosaic.

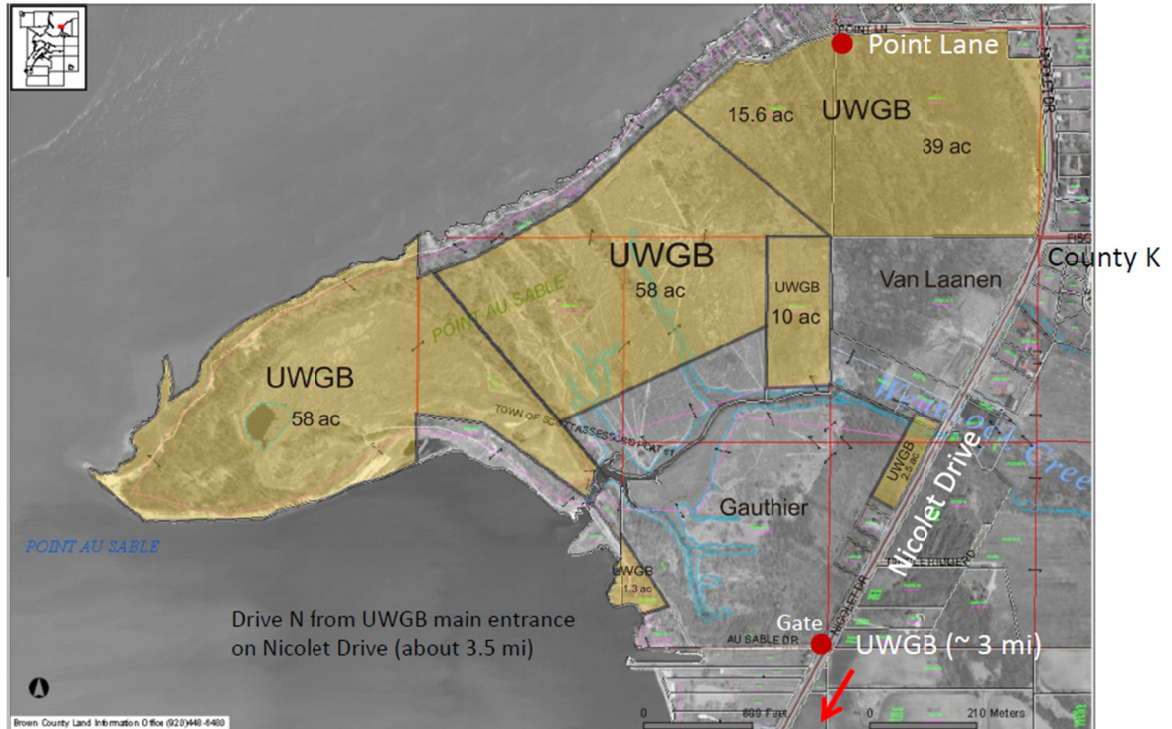


Figure 1. Map of Pt. Sable Nature Preserve. Tracts labeled Gauthier and Van Laanen are privately owned. Air photo was provided by Brown County Land Information Office.

OBJECTIVES

The primary goal of conservation management at Pt. au Sable is to maintain a healthy coastal ecosystem that maximizes native biodiversity and provides quality habitat for migratory birds and other species. Our specific objectives recognize the transient nature of the vegetation and wetland features at Pt. au Sable, but we seek to re-establish a diverse coastal wetland community in order to reverse historical damage caused by sediment pollution in the estuary and invasion of non-native species in the wetland complex. Wetland restoration will set the stage for a long term management strategy that inhibits highly invasive species like *Phragmites australis* and provides a seed source for native species in the dynamic coastal environment. In other words, eradication of invasive species in this system is unlikely, but we can compromise their status to the point that they can be sustainably controlled through vigilance and affordable ongoing management.

By restoring wetland and shoreline ecosystems at Pt. au Sable we hope to accelerate the delisting of two Beneficial Use Impairments (BUIs) within the Green Bay AOC including “loss of fish and wildlife habitat” and “degradation of fish and wildlife populations.” Restoration of coastal wetlands at Point au Sable was included as a priority project in the Stage II Green Bay Remedial Action Plan (RAP II) submitted in January 2012 to the US EPA by the WI DNR. The Green Bay AOC Habitat & Biota Committee has discussed this project and also has provided ongoing support. Control of aquatic invasive species like *Phragmites australis* benefits native biodiversity, including species of conservation concern; restores beneficial wetland functions such as nutrient and hydrologic buffering;

and provides a model of habitat management that can help motivate effective conservation efforts by private landowners in the lower Green Bay AOC.

In addition to its values as a natural area, Pt. au Sable provides outstanding educational opportunities for University of Wisconsin-Green Bay students and a variety of recreational uses for the general public, including birdwatching, hiking, and (controlled) hunting of white-tailed deer. A secondary goal of management at Pt. au Sable is to cultivate these opportunities while simultaneously sustaining the natural features and ecological services that make this area an important element of the lower Green Bay ecosystem.

ECOLOGICAL MANAGEMENT

Ecological management of the Pt. au Sable Preserve focuses on seven vegetation/habitat management units (Figure 2). The boundaries between these units are generally imprecise and two of the units are discontinuous. Nevertheless, the areas within each category share similar management challenges and opportunities. A brief description of each unit is given below.

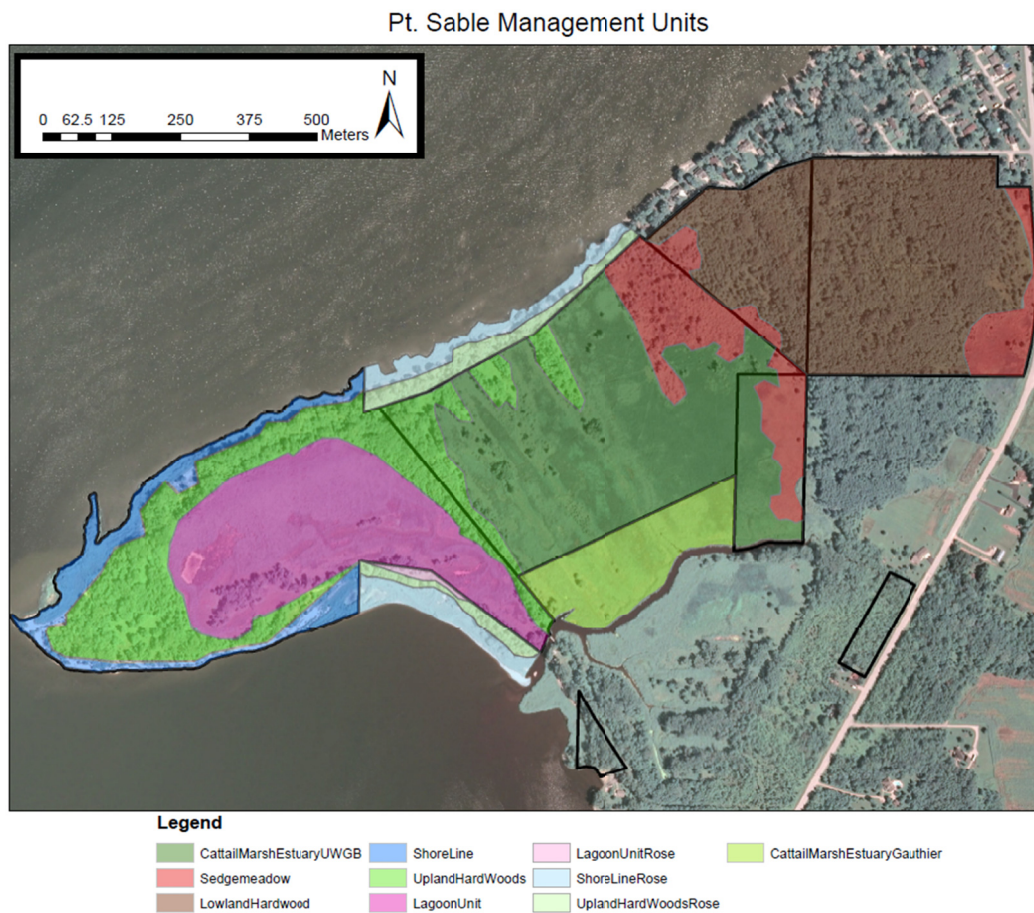


Figure 2. Boundaries of ecological management units at Point au Sable.

1. Green Bay Shoreline

The Pt. au Sable Nature Preserve includes approximately 1.3 km of shoreline/beach habitat, adjacent to 1.06 km of undeveloped shoreline owned by John P. Rose, a longtime friend of this natural area. The physical and ecological characteristics of the shorelines vary dramatically with fluctuations in water levels of Green Bay. In 1992, for example, historical air photos show that beach habitat covered about 1.89 ha; in the low water year of 2010, nearly 4 times as much beach area (7.55 ha) was present. Significant differences also exist between the exposed northern shoreline, which is today invaded by extensive areas of the invasive grass, *Phragmites australis*, and the more protected southeastern shoreline, which is narrower and less heavily invaded by *Phragmites*. The vegetation along these beaches has not been systematically surveyed, but native species like beach rocket (*Vitex rotundifolia*) and beach grass (*Ammophila breviligulata*) are present, along with invasive species like *Phragmites*, reed canary grass (*Phalaris arundenacea*, spotted knapweed (*Centaurea stoebe*) and others. Mounds of dreissenid (zebra and quagga) mussel shells cover much of the beach today. Despite its degraded character, the shoreline at Pt. au Sable is an important feeding area for migratory terns (Caspian Tern, Common Tern, and Forster's Tern), shore birds, waterfowl, and many other species.

2. Coastal Wetland/Lagoon

One of Pt. au Sable's most significant natural features is a coastal wetland covering about 25 acres (10.2 hectares) near the tip of the peninsula. The wetland has been connected to the bay historically at several places (Figure 3), including a now-obstructed channel leading to the north shore and two small channels formerly connecting to the south shore. Currently, none of these connections is functional, the last outlet (near the southeast corner) being closed during the late 1990's as water levels in Lake Michigan and Green Bay progressively dropped.



Figure 3. Coastal wetland near the tip of Point au Sable during high water year (May 1992). Yellow arrows indicate locations of connections with the bay of Green Bay.

The drop in lake/bay levels during the early 2000's led to drying of the coastal lagoon, coinciding with colonization of the lagoon bed by *Typha* and (especially) *Phragmites australis*. Within just a few years, nearly the entire lagoon was covered with *Phragmites*, with smaller patches of *Typha* near remaining pools of water. Today, ground elevations in the former coastal lagoon/wetland range from 578-583 ft. above sea level; water levels in the bay of Green Bay on April 3, 2013 were about 557-567 ft (<http://glakesonline.nos.noaa.gov/monitor.html>), well below this range.

The wetland's substrate consists of silty to organic soils over sandy outwash deposits (NRCS / USDA <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> accessed 28 April 2013). Exposed soils in the lagoon are classified as Markey Muck and Rosocommon Muck, both poorly drained, highly organic soils that retain water well.

Despite the presence of extensive native wetland vegetation as recently as 1999, the coastal wetland at Pt. au Sable has been rapidly colonized by invasive *Phragmites australis* and, to a lesser extent, *Typha* spp. Tulbure et al. (2007) suggested that the exposed mineral soils at Pt. au Sable contributed to the unusual rapidity with which *Phragmites* colonized this wetland, mainly by vegetative growth. The ecological consequences of this transformation have been severe. Black Tern (*Chlidonias niger*), Forster's Tern (*Sterna forsteri*), Virginia Rail (*Rallus limicola*), and large concentrations of migratory waterfowl once used this coastal wetland, but they are now absent. Open water is limited to just a small pond at the western end of the wetland, and even this had become seasonally ephemeral by 2012. Wood frog (*Lithobates sylvaticus*), leopard frog (*Lithobates pipiens*), green frog (*Lithobates clamitans*), and American toad (*Anaxyrus americanus*) are common at the coastal wetland today, and their populations would be expected to increase significantly with an increase in surface water area. These amphibians, in turn, would provide a prey base for use of the wetland by herons and other water birds.

A major objective of conservation management at Pt. au Sable is to restore biodiversity and ecological integrity of the 25 acre coastal wetland/lagoon. The first steps in this process have begun, initiated by a successful prescribed burn in May 2012 to remove the build-up of dead *Phragmites* stems. This was followed by aerial application of herbicide during September 2012. A follow-up burn is scheduled for May 2013, led (again) by students and faculty of the Wildland Firefighter Program at Fox Valley Technical College in Appleton, WI.

The next major step will be installation of a portable water pump system to flood the lagoon periodically, thereby preventing or at least inhibiting re-establishment of *Phragmites* in the open wetland and providing habitat for wetland animals and plants. If this initiative is successful local, periodic control of new *Phragmites* clones should be sustainable. A more detailed description of this project is described under the heading **Coastal Wetland Restoration Plan** below.

Pt. Sable Phragmites Aerial Spray 2012

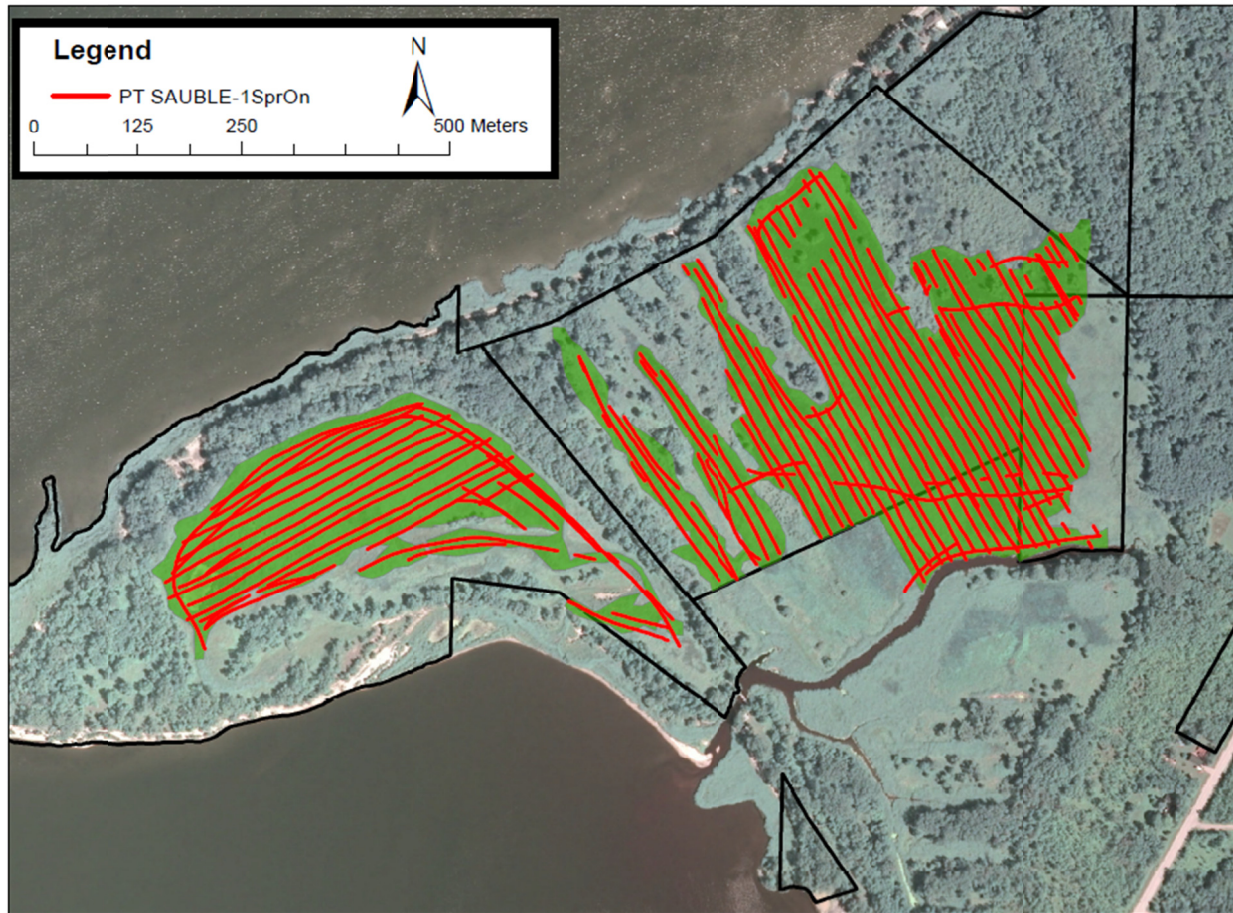


Figure 4. Paths (in red) of herbicide spraying by helicopter on September 26th, 2012.

3. Estuarine Wetland

A 50+ acre area of open wetland (labeled “Cattail Marsh Estuary” in Figure 2) east of the coastal lagoon is likewise covered by invasive *Phragmites* and, to a lesser extent, *Typha*. Historically, this area has been penetrated by channels from Wequiock Creek, especially during periods of high water such as in the early 1970’s (Figure 4). The earliest aerial image from 1938 (Figure 5) shows a treeless meadow, probably dominated by sedges (*Carex* spp.) and Canada bluejoint grass (*Calamagrostis canadensis*). Today, trees and shrubs occur the northern part of this area, extending in a series of narrow bands running NW-SE. Most of the open area today is covered by *Phragmites* and *Typha*.

An important issue underlying management strategies in the estuarine wetland is the fact that much of this habitat is privately owned. The Gauthier family owns most of the area adjacent to the creek (on both sides). Any management plan for the estuarine clearly must include their cooperation. Herbicide was applied during fall 2012 (Figure 3) on both UW-Green Bay land and a small portion of the Gauthier parcel. The Gauthier family has been supportive of conservation efforts at Pt. au Sable, and

they are likely to be partners in developing a plan to control invasive species and to improve fish and wildlife habitat.

The long range objectives for management of the estuarine wetland are similar to those of the coastal lagoon: 1) reduce invasive plant populations to levels that can be controlled sustainably, and 2) restore hydrologic regimes (e.g., periodic flooding) that will sustain native wetland and wet meadow species.



Figure 5. Aerial view of Pt. Sable facing northwest in summer 1973. Photograph by Tom Erdman. Bridge over Wequiock Creek is visible in lower left.

4. Wequiock Creek

Wequiock Creek drains an area of approximately 7,680 acres (Lamine et al. 2006) beginning in the Town of Humboldt east of the City of Green Bay (Figure 5). Channels from the upper watershed cross the Niagara Escarpment at Wequiock Falls County Park and at a second site on private land approximately 500 m to the north of the falls. Wequiock Creek is the only perennial (continuously running) stream in the Town of Scott, although upper stretches typically cease to flow during late summer.

Surface drainage into Wequiock Creek comes largely from agricultural land and the Highway 57 corridor. Sediments from soil erosion and road maintenance inevitably flow into the Wequiock Creek, affecting the flood dynamics and water regime of the estuarine environment at Pt. au Sable. During the past century, increased rates of sediment deposition might be partly responsible for reduced flooding of the estuarine/riparian wetlands at Pt. Au Sable. Reduction in forest and wetland cover in

the watershed also may have led to an increase in the “flashiness” of water flow into Pt. au Sable (Walsh et al. 2009), reducing the retention of water in the riparian wetlands. Consequences of watershed change are difficult to interpret due to simultaneous operation of multiple factors (Allan 2004), but many of these landscape effects are still occurring, so systematic monitoring of stream flow and water quality at will likely provide important insights into the hydrology and ecology of Wequiock Creek. These monitoring efforts are first steps in developing long term ecological restoration strategies for the Wequiock Creek Estuary at Point au Sable.



Figure 6. Aerial view of Pt. Sable in 1938. Photograph courtesy of Brown County Planning and Land Services Department. (Original photo from USDA / Soil Conservation Service.)

5. Sedge Meadow

Small patches of open meadow north of Wequiock Creek (labeled “Sedge meadow” in Figure 2) support native sedges (*Carex* spp.), Canada bluejoint grass (*Calamagrostis canadensis*) and other native species, probably remnants of the extensive wetland meadow that covered much of the area during the early 1900’s (Figure 5). Soils in the remnant sedge meadow are predominantly Ruse silt loam, contrasting with the wet organic Markey muck found closer to Wequiock Creek (NRCS). Sedge meadows in Wisconsin are defined by the presence of tussocks formed by *Carex stricta* (Peach and Zedler 2006). Tussock-forming sedges promote local biodiversity by creating an irregular substrate for nesting or feeding by birds, small mammals, and invertebrates. Like other native plant communities at Pt. au Sable, remnant sedge meadow patches are threatened by invasive species,

particularly reed canary grass (*Phalaris arundinacea*) and *Typha x glauca*, a hybrid between the native broad-leaf cattail (*Typha latifolia*) and the nonnative narrow-leaf cattail (*Typha angustifolia*) (Wisconsin Department of Natural Resources 2012).

Sedge meadows are significant habitats for declining bird species like sedge wren (*Cistothorus platensis*) and northern harrier (*Circus cyaneus*) (Mossman 1990) and wetland butterflies like Mulberry Wing (*Poanes massasoit*) and Dion Skipper (*Euphyes dion*) (Shuey 1985). The mosaic of native sedges and shrub-dominated meadows also provides breeding habitat for species like Alder Flycatcher (*Empidonax alnorum*) and Willow Flycatcher (*Empidonax traillii*) and seasonal habitat for many migrant bird species, especially during fall when native shrubs like red-osier dogwood (*Cornus sericea*) are in fruit.

The first step in conservation of the sedge meadow at Pt. au Sable is to aggressively protect the small remaining habitat from further invasion by *Phragmites* and *Typha*. Control of reed canary grass will be more challenging but might be initiated by spot treatment of stems in the small area of remaining sedge meadow. Longer term re-establishment of sedge meadow over a larger area will require future research and detailed mapping of existing substrate and hydrological conditions.

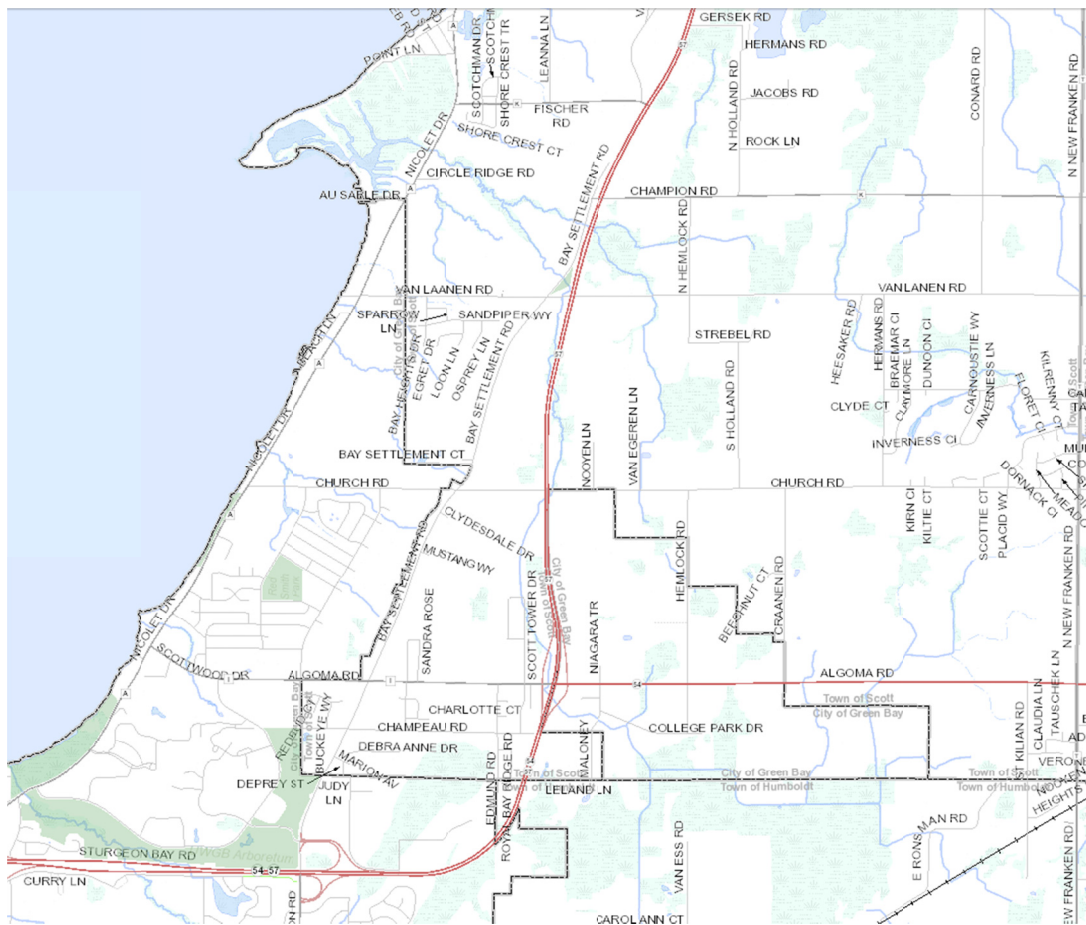


Figure 7. Map of Wequiock Creek watershed in eastern Brown County, Wisconsin. (Brown County Planning and Land Services web portal, http://www.co.brown.wi.us/departments/page_76605a5fe686/?department=85713eda4cdc&subdepartment=89ce08984445, accessed 4/29/13).

6. Upland forest

Like other habitats at Pt. au Sable, forests have changed significantly in extent and composition during the past century. Maps from the mid-1800's show forest cover on the peninsula, but the earliest air photo for 1938 (Figure 6) reveals very little forest cover, even in the northeastern part of the site that is now densely forested. Areas that are forested today at Point au Sable apparently were cleared by humans or disturbed through natural causes (fire, wind, or flooding) prior to 1938. Large oaks (mostly *Quercus macrocarpa*) from these savannas remain today, but the canopy has become closed in significant portions of the preserve.

Upland forests (Figure 2) cover about 34 acres on sandy well-drained soils surrounding the coastal lagoon near the tip of the Pt. au Sable peninsula. Tree species include white oak (*Quercus alba*), red oak (*Q. rubra*), black cherry (*Prunus serotina*), choke cherry (*Prunus virginiana*), box elder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), and aspen (*Populus tremuloides*), all consistent with the early successional status of this forest. Understory shrubs also include non-native honeysuckles and buckthorn (*Rhamnus cathartica*). Herrick (2005) noted that 1/3 of the plant species recorded at Pt. Sable were non-native or invasive, and the forest provides no exception to this pattern. The understory flora is poorly developed and likewise is vulnerable to invasion by garlic mustard and other non-native species.

Despite its limited extent and relatively low plant biodiversity, upland forest at Pt. au Sable is an important habitat for migratory birds, which can be extraordinarily abundant in the canopy at Pt. au Sable during peak migration periods. Control of invasive species is a high priority for maintaining a productive and diverse ecological community in upland forests at Pt. Sable. Plant inventories are needed to assess the current status of the forest community and to establish a baseline for future studies in the upland forest at Pt. Sable. In general, this habitat is poorly studied at Pt. au Sable and deserves future research on phenology, species composition, successional trends, and species interactions, especially involving migratory birds.

7. Lowland Forest

Lowland forest in the northeastern part of the Pt. au Sable Nature Preserve covers approximately 48 acres in the northeastern part of the preserve (Figure 2). In addition to remnant bur oaks, the lowlands are forested by black ash (*Fraxinus nigra*), green ash, cottonwood, American elm (*Ulmus americana*), white oak, black cherry, and box elder. Significant areas are flooded seasonally, resulting in hatches of midges and mosquitos that attract large numbers of migratory birds during late spring. Dead elms provide opportunities for cavity nesting birds, which are particularly diverse here. According to a study by UWGB undergraduate Jeffrey Bell in 2000, all but one of Wisconsin's breeding woodpecker species (Downy Woodpecker, *Picoides pubescens*; Hairy Woodpecker *Picoides villosus*; Red-bellied Woodpecker, *Melanerpes carolinus*; Red-headed Woodpecker, *Melanerpes erythrocephalus*; Yellow-bellied Sapsucker, *Sphyrapicus varius*; and Pileated Woodpecker, *Dryocopus pileatus*) occur at Pt. au Sable, and the density of nests is among the highest recorded in eastern North America. Red-headed Woodpeckers no longer breed at Pt. au Sable, and Yellow-bellied Sapsuckers nest irregularly, if at all, but all of the other species are established residents at Pt. Sable.

Invasive species (especially honeysuckle, buckthorn, and garlic mustard) control is a high priority for management of the lowland forest at Point au Sable. Dumping of yard waste by residents along Point lane also is an ongoing issue that needs to be addressed. Ongoing studies of bird migration patterns

and bat diversity will help guide management strategies for the lowland forest. Systematic investigations of understory plants and hydrology are needed.

WETLAND RESTORATION PLAN

Phase 1 of conservation management at Pt. au Sable includes restoration of standing water and native vegetation to the 25 acre coastal lagoon at the tip of the point. A proposed strategy for achieving this goal is to pump water from a relatively deep area near the Green Bay shoreline (Figure 8) approximately 150 ft. into the lagoon. The result will be restoration of a shallow wetland that will 1) provide habitat for amphibians, water birds, and other wetland species and 2) inhibit recolonization of the lagoon by *Phragmites australis*. Preparation of the site for flooding has included a controlled burn in spring 2012 to remove dead *Phragmites* stems, followed by aerial (helicopter) herbicide treatment of new *Phragmites* growth during September 2012. A follow-up prescribed burn is scheduled for May 2013 to remove dead stems from the herbicide application.

Before pumping water into the lagoon, two small earthen berms will be created at points where the water formerly entered the lagoon from Green Bay (Figure 9). These berms will help contain water in the lagoon, thereby minimizing the amount of water pumped from Green Bay. Each of the berms will include an inline water control structure (e.g., <http://www.agridrain.com/watercontrolproductsinline.asp>) that will permit lowering of water levels in the lagoon if needed or, if lake levels rise, allow natural flow of water into the lagoon. The bayside outlet from the water control structures will normally be (dry) above the bay levels. Flow will be prevented by built-in stoplogs.

Water will be pumped from the bay into the lagoon by a trailer mounted diesel powered pump with 6" diameter suction/discharge ports. A heavy duty pump of this size will transfer about 1000 gallons per minute. In order to flood a 25 acre area to a depth of 1 ft., we will need to transfer about 8,213,000 gallons of water, minus the amount contributed by rainfall. At a pumping rate of 1000 gal/minute, the water will fill the coastal lagoon to this depth in about 136 hours. A screen to exclude fish and aquatic macroinvertebrates will be installed at the intake pipe. On the long term, water lost from the lagoon through evaporation and transpiration will be replaced by periodic pumping during allowed periods. As requested by the Wisconsin Department of Natural Resources, no water will be pumped between March 1 and June 15th.

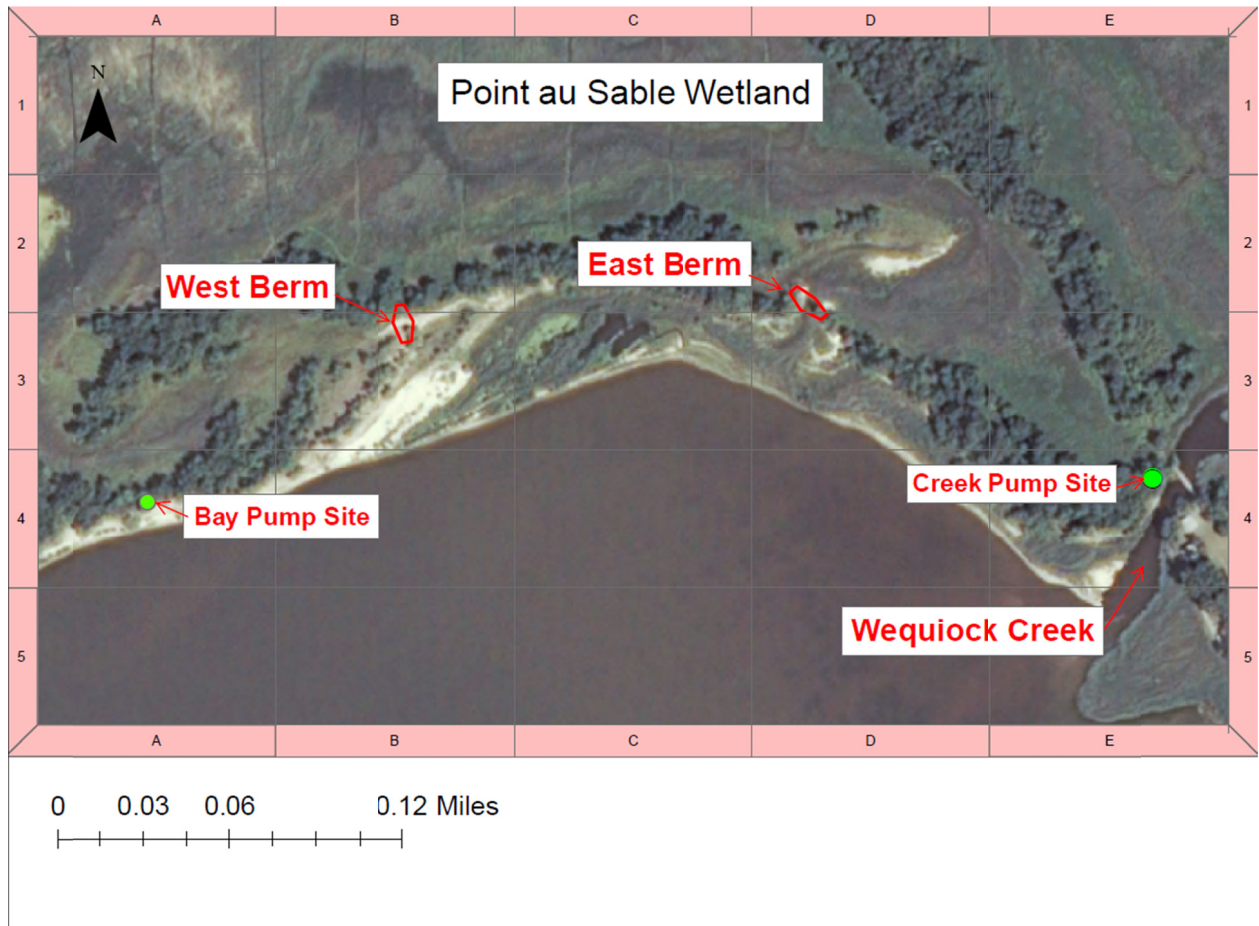


Figure 8. Locations of earthen berms (West Berm and East Berm) at Point au Sable coastal lagoon. Water will be pumped from the Bay Pump Site.

A research project by UW-Green Bay student Stephan Humpal in 2000 under the supervision of Dr. Kevin Fermanich demonstrated that changes in water level of the lagoon were much less pronounced than water level changes in the creek, where storm surges, seiches from the bay, and other watershed-related factors create a more dynamic hydrology. Depth gauges are currently being monitored to determine the loss of water from the lagoon through evaporation and infiltration. Periodic pumping will be needed to maintain 1-2 ft. water levels in the coastal lagoon. A very rough estimate based on preliminary data suggests that, in the absence of rain, the pump will need to operate approximately 1/10th of the time during the growing season. Fluctuations in water levels are common in naturally occurring wetlands, so a significant degree of variation (and even periodic drying) will be acceptable. Future studies will determine the optimal hydrologic regime to promote the following objectives: 1) inhibit re-invasion by *Phragmites*, 2) provide habitat for migratory waterfowl and other water birds, 3) provide optimal aquatic habitat for frogs and toads, and 4) sustain a healthy community of native aquatic plants and invertebrates.

According to Cross and Fleming (1989), flooding will not alter established stands of *Phragmites*, but water levels greater than 1 ft (30 cm) will inhibit establishment and survival of seedlings, and rhizomes of existing stands are unable to anchor and will float to the surface. Timing of water-level manipulations is important, so some degree of control will be necessary. This will be accomplished

by strategic operation of the pump and construction of a small water control structure near the south end of the lagoon.

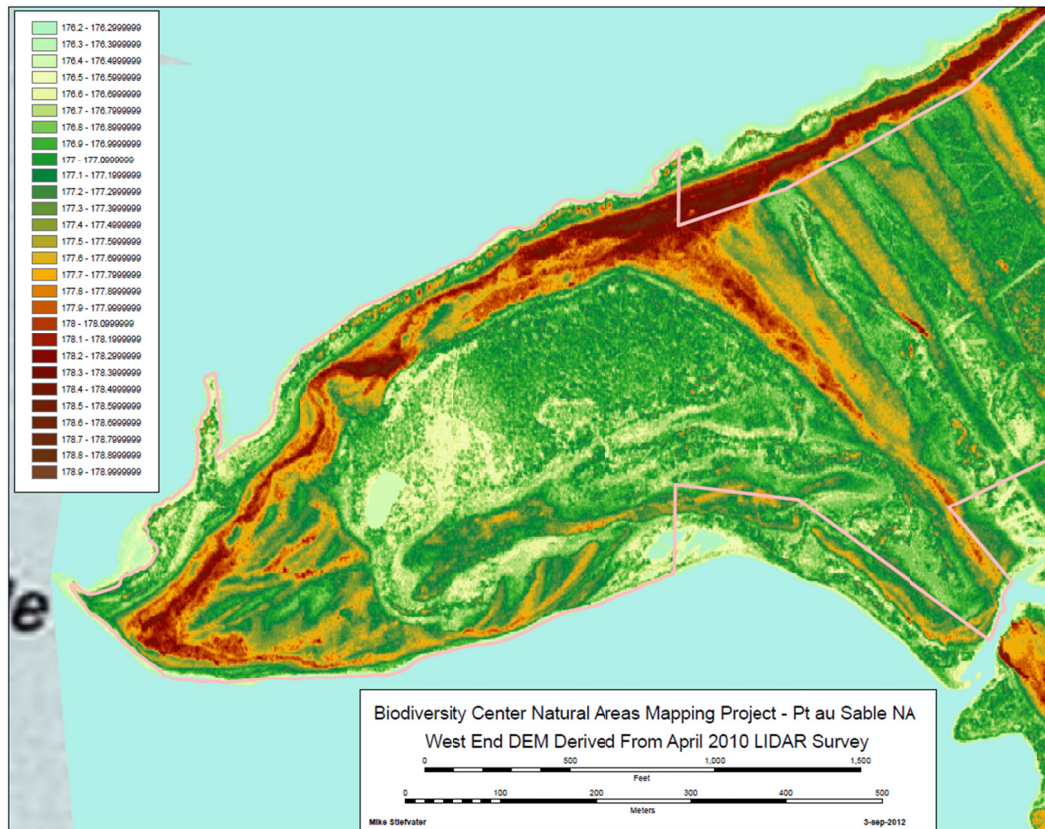


Figure 9. Substrate elevations at Point au Sable based on 2011 Brown County LiDAR survey. Elevation scale on left is in meters.

Historically, the coastal lagoon at Pt. au Sable has been recognized as an important habitat for migratory land birds, waterfowl and colonial water birds, amphibians (frogs and toads), and other wetland organisms. The wetland is a dynamic ecosystem with extensive open water when Green Bay water levels are high, alternating with an emergent marsh and sedge meadow during low water cycles. Until recently, the vegetation community within the marsh consisted of a rich variety of native wetland plants dominated by cattails (*Typha* spp) and native sedges or grasses. Unfortunately, low water levels since the late 1990's have contributed to invasion by the exotic common reed (*Phragmites australis*), which has replaced much of the native vegetation. The loss of open water and reduction in cover by native plant species has greatly reduced habitat for native wetland animals.

Restoration of the 28 acre wetland will be an important step toward sustaining native plant and animal assemblages at Point au Sable. If successful, this plan will provide productive wetland habitat for native wetland plants, breeding and migratory bird species, mammals, amphibians, and other species that have experienced significant regional declines in Lower Green Bay during the past century. Establishment of a healthy wetland ecosystem at Pt. au Sable will enhance recreational and educational opportunities in a region where public awareness of environmental degradation and its consequences is already well established. This project has the potential to become a widely appreciated success story.

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