Eurasian water milfoil (*Myriophyllum spicatum*) Bed Mapping Survey Sand Lake Barron County, Wisconsin WBIC: 2661100

Project Sponsored by:

Sand Lake Management District, Short Elliot Hendrickson Inc., and the Wisconsin Department of Natural Resources

Survey Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin

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TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

INTRODUCTION:

Sand Lake (WBIC 2661100) is a 322 acre, drainage lake in northwestern Barron County, Wisconsin in the Town of Maple Plain (T36N R14W S17 NW NE). It achieves a maximum depth of 57ft in the south basin, and has an average depth of approximately 30ft. Sand Lake is oligotrophic in nature with good water clarity. From 1988 to 2009, summer Secchi readings have ranged from 10-18ft with an average of 13.9ft (WDNR 2009). The bottom substrate is predominately sand and sandy muck with scattered gravel primarily along the shoreline. Some areas of thick organic muck occur in scattered bays on the west side of the lake and at the far north and south ends.

Figure 1: Sand Lake Aerial Photo

In 2002, the Wisconsin Department of Natural Resources (WDNR) and the Sand Lake Management District (SLMD) confirmed the presence of Eurasian water milfoil (*Myriophyllum spicatum*) in the lake. Since this time, EWM has been managed by regular spot chemical applications. In the summer of 2009, the SLMD decided to begin working on updating their Aquatic Plant Management Plan. The first step to doing this was to complete a fall EWM bed mapping survey prior to any chemical treatments in 2010. The goals of this survey were to determine the extent of the EWM infestation, delineate the total acreage covered by EWM, and use these data to develop an initial management plan for 2010.

METHODS:

On October 4th, 11th and 24th, we mapped all known beds of EWM on Sand Lake. A "bed" was determined to be any area where we visually estimated that EWM made up >50% of the area's plants and was continuous with clearly defined borders. After we located a bed, we motored around the perimeter of the area, took GPS coordinates at regular intervals, and estimated the average rakefull rating of EWM within the bed. In addition to beds, we logged a GPS coordinate for each plant or cluster of plants that had the potential to become beds in 2010 if not treated. These data were then mapped and total acreage was determined using ArcMap 9.3.

As this was our first time working on the lake, we also compiled a species list by identifying all plants seen (Voss 1996; Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2006). From the total species found, we calculated a tentative Floristic Quality Index (FQI): This index measures the impact of human development on a lake's aquatic plants. Species in the index are assigned Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and often exploit these changes to the point where they crowd out other more sensitive species. The FQI is calculated by averaging the conservatism value for each species found in the lake. In general, the higher the index value, the healthier the lake's macrophyte community. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain, and recommended comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Sand Lake is in the Northern Central Hardwood Forests.

RESULTS:

Fall Eurasian Water Milfoil Bed Mapping:

On our October 4th, we found very little EWM and were concerned that we had missed something as it was our first time on the lake and we didn't know what to expect. We contacted the chemical applicator, got copies of his treatment maps and resurveyed the lake on October 11th. During this survey, cloudy conditions made for poor surveying so we did extensive rake sampling in areas the applicator had identified as having had EWM in the past and in buoy marked areas. We again found very little EWM. On October 24th, conditions were ideal and we opted to resurvey the lake. All total, we found only five beds covering just over 0.22 acres that met the criteria of a true bed. One additional 0.21 acre area had a high number of pioneer clusters so we mapped it as well (Figure 2) (Table 1) (Appendix I). Of these five beds, three were so small (approximately 5ft X ft) that the margin of error on the GPS was greater than the diameter of the bed forcing us to simply log a point at the center of the bed. We also located 52 other points that had either a single or small handful of EWM plants. Most of these plants were found interspersed with the lake's abundant population of Northern water milfoil (*Myriophyllum sibiricum*) over areas organic/sandy muck in 4-10ft of water.

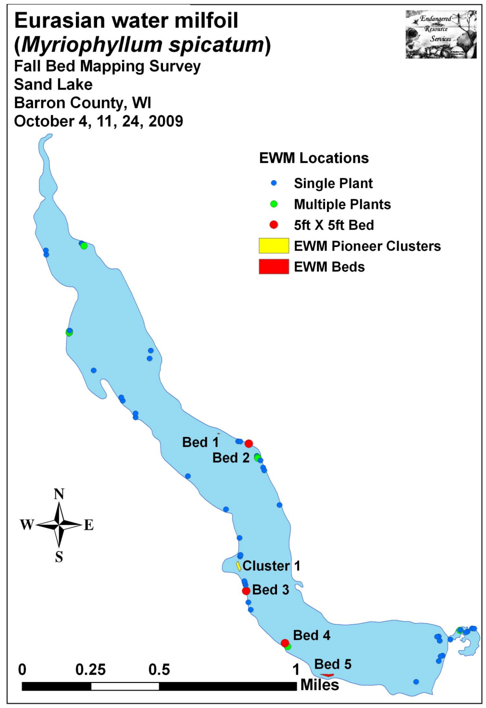

Figure 2: Sand Lake Fall Eurasian Water Milfoil Distribution

Table 1: Fall Eurasian water-milfoil Beds
Sand Lake, Barron County
October 4, 11, 24, 2009

Area	Area in Acres	Estimated Mean Rakefull	Bed Characteristics
Bed 1	0.01	2-3	Very small area, but had a solid bed of EWM
Bed 2	<0.01	2-3	5ft. X 5ft. solid EWM bed
Bed 3	<0.01	2-3	5ft. X 5ft. solid EWM bed
Bed 4	<0.01	2-3	5ft. X 5ft. solid EWM bed
Bed 5	0.21	2-3	Small area, but has solid bed of EWM
Cluster 1	0.18	<1	Clusters of EWM among NWM; especially on S end of area
Total	0.40		

We identified a total of 33 native plants to species in and immediately adjacent to Sand Lake. They produced a mean Coefficient of Conservation of 6.0 and a Floristic Index of 34.5 (Table 2). Nichols (1999) reported Average Mean C for the North Central Hardwood Forests Region of 5.6 putting Sand Lake slightly above average for this part of the state. The FQI was also well above the mean FQI of 20.9 for the North Central Hardwood Forests Region (Nichols 1999). This very high FQI is likely a result of the lake's variable substrate/habitats, good clarity and patches of undeveloped shoreline. All of these factors create a variety of microhabitats which offer a wide variety of plants suitable growing conditions.

Table 2: Tentative Floristic Quality Index of Aquatic Macrophytes
Sand Lake, Barron County
October 4, 2009

Species	Common Name	C
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Elodea canadensis	Common waterweed	3
Equisetum fluviatile	Water horsetail	7
Eriocaulon aquaticum	Pipewort	9
Heteranthera dubia	Water star-grass	6
Lemna minor	Small duckweed	5
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water milfoil	7
Najas flexilis	Bushy pondweed	6
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Polygonum amphibium	Water smartweed	5
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton gramineus	Variable pondweed	7
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton nodosus	Long-leaf pondweed	7
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Robbins (fern) pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Sagittaria cristata	Crested arrowhead	9
Schoenoplectus acutus	Hardstem bulrush	5
Schoenoplectus tabernaemontani	Softstem bulrush	4
Sparganium eurycarpum	Common bur-reed	5
Stuckenia pectinata	Sago pondweed	3
Typha latifolia	Broad-leaved cattail	1
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
N		33
mean C		6.0
FQI		34.5

DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:

Sand Lake has an abundant and diverse plant community. Unfortunately, Eurasian water-milfoil will pose a continued threat to that diversity and the resource as a whole moving forward as it is unlikely that EWM will ever be totally eliminated from the lake.

The lake's native plant communities are the base of the aquatic food pyramid, provide habitat for fish and other aquatic organisms, are important food sources for waterfowl and other wildlife, stabilize the shoreline, and work to improve water clarity by absorbing excess nutrients from the water. To minimize EWM's impact on the lake's native plants, every effort should be made to maintain it at or further reduce it from its current low levels.

The current management of controlling EWM using spot herbicide application appears to be highly effective at controlling the infestation. The lake's good water clarity coupled with EWM's tendency to establish in a narrow depth range of 4-10ft make it relatively easy to find. Using low doses of herbicide in small areas is also likely minimally harmful to sensitive native vegetation, has less of an impact on water quality and is more cost effective.

Lakeshore owners can help prevent the spread of EWM by refraining from unnecessary removal of native plants (either manually or with herbicide) from the lake as these patches of barren substrate provide an easy place for invasive plants like EWM to take root and become established. Reducing or eliminating fertilizer applications near the water will not only contribute to improved water quality, but also deny minerals to plants like EWM that thrive in nutrient rich waters. Where possible, shoreline restoration and buffer strips of native vegetation would also enhance water quality by preventing erosion and nutrient runoff as well as improve the natural aesthetic value of highly developed shoreline areas.

Completing the updated Aquatic Plant Management Plan (APMP) will help the lake clarify a management plan moving forward. A team approach that uses all available data from this report and the lake usership surveys coupled with open and frank communication between the WDNR, SEH Inc., lakeshore owners and interested citizens will be critical in formulating the best APMP possible for the lake.

MANAGEMENT RECOMMENDATIONS SUMMARY:

- Preserve the lake's diverse and rare plant community by continuing to maintain/reduce Eurasian water milfoil at/from its current low rates.
- Continue spot herbicide applications to control EWM – especially in low density areas and in areas with sensitive native species.
- Whenever possible, refrain from unnecessary removal of native plants from the lake manually or with herbicides as this provides a place for exotic species like EWM to more easily establish and colonize.
- Reduce and, wherever possible, eliminate fertilizer applications as their runoff encourages excessive plant growth.
- Encourage shoreline restoration that establishes native vegetation buffer strips along the lakeshore to help prevent erosion and nutrient runoff.
- Complete an updated Aquatic Plant Management Plan (APMP) to guide the management of EWM and the lake's native plants moving forward.

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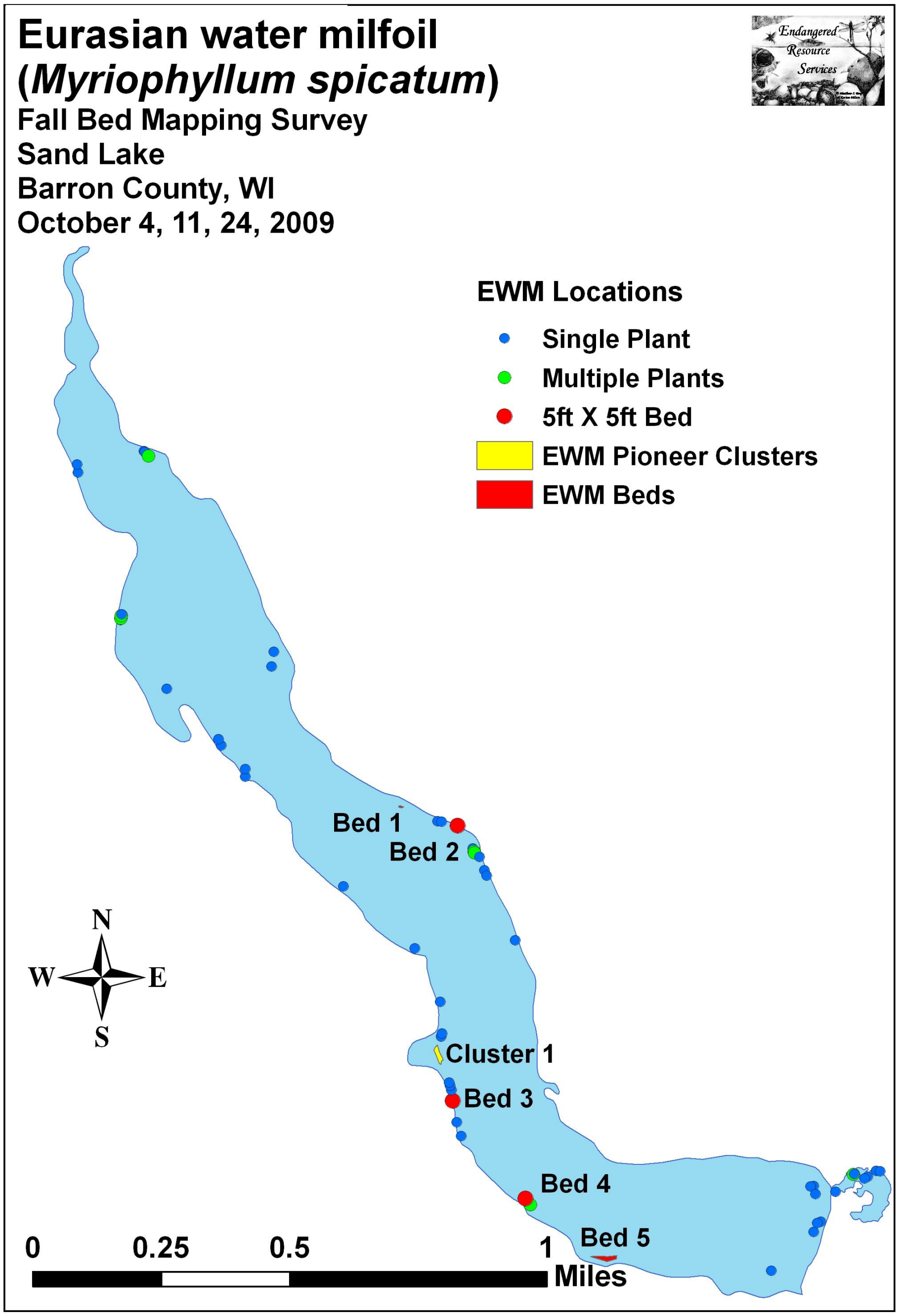
Appendix I: Fall Eurasian Water Milfoil Distribution Maps


Eurasian water milfoil
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Sand Lake
Barron County, WI
October 4, 11, 24, 2009
Endangered Resource Services
EWM Locations
Single Plant
Multiple Plants
5ft X 5ft Bed
EWM Pioneer Clusters
EWM Beds
Bed 1
Bed 2
Cluster 1
Bed 3
Bed 4
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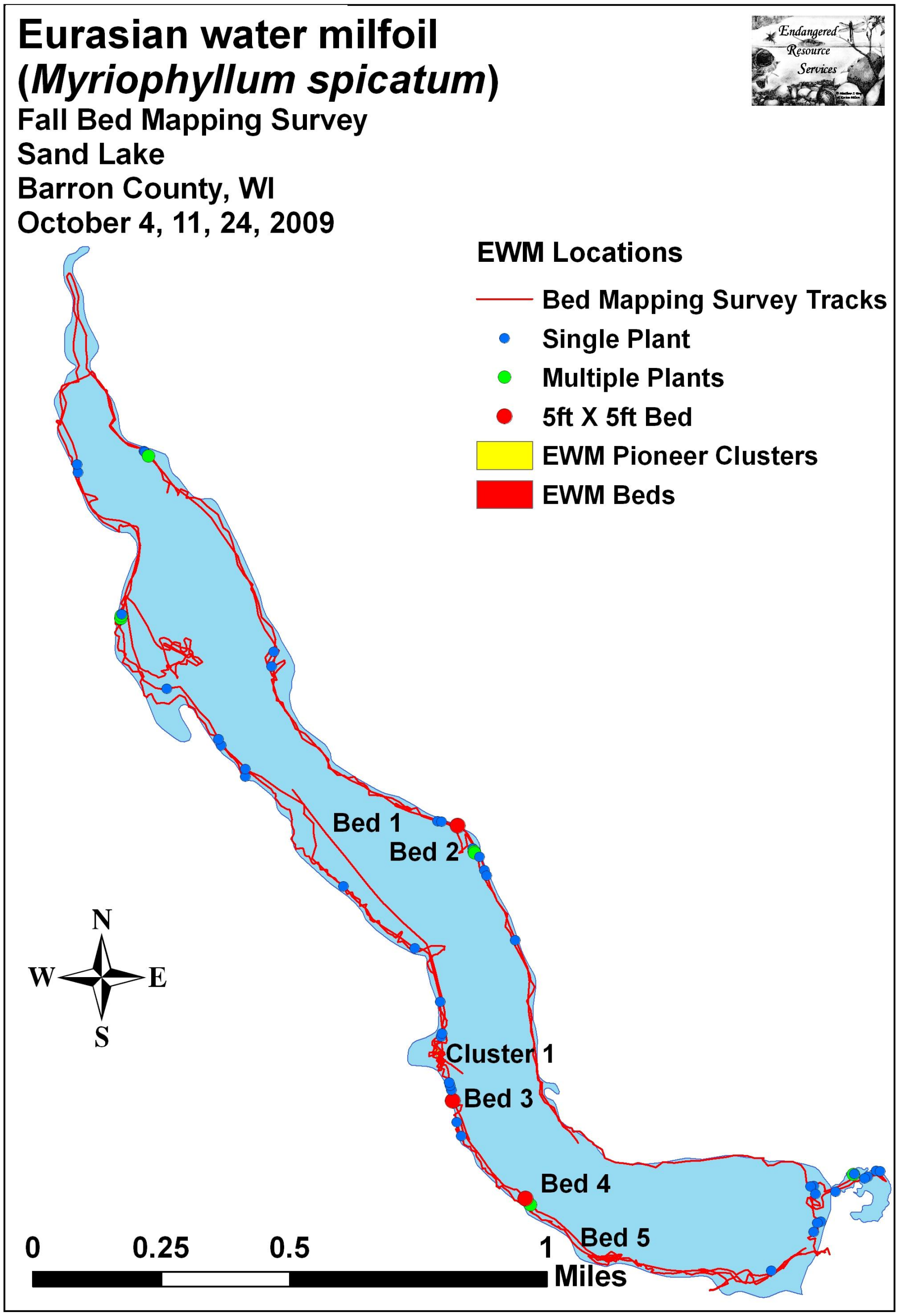
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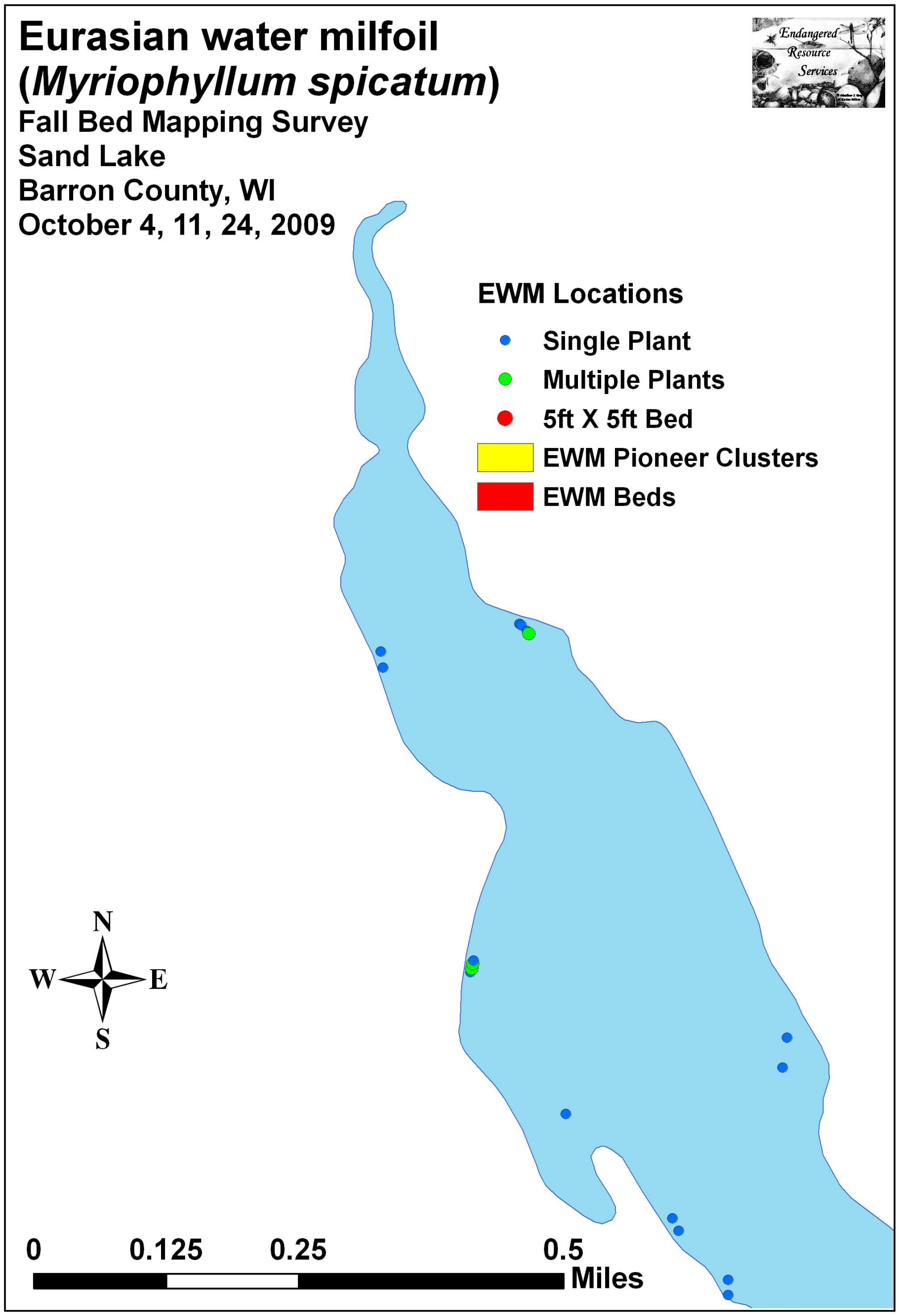

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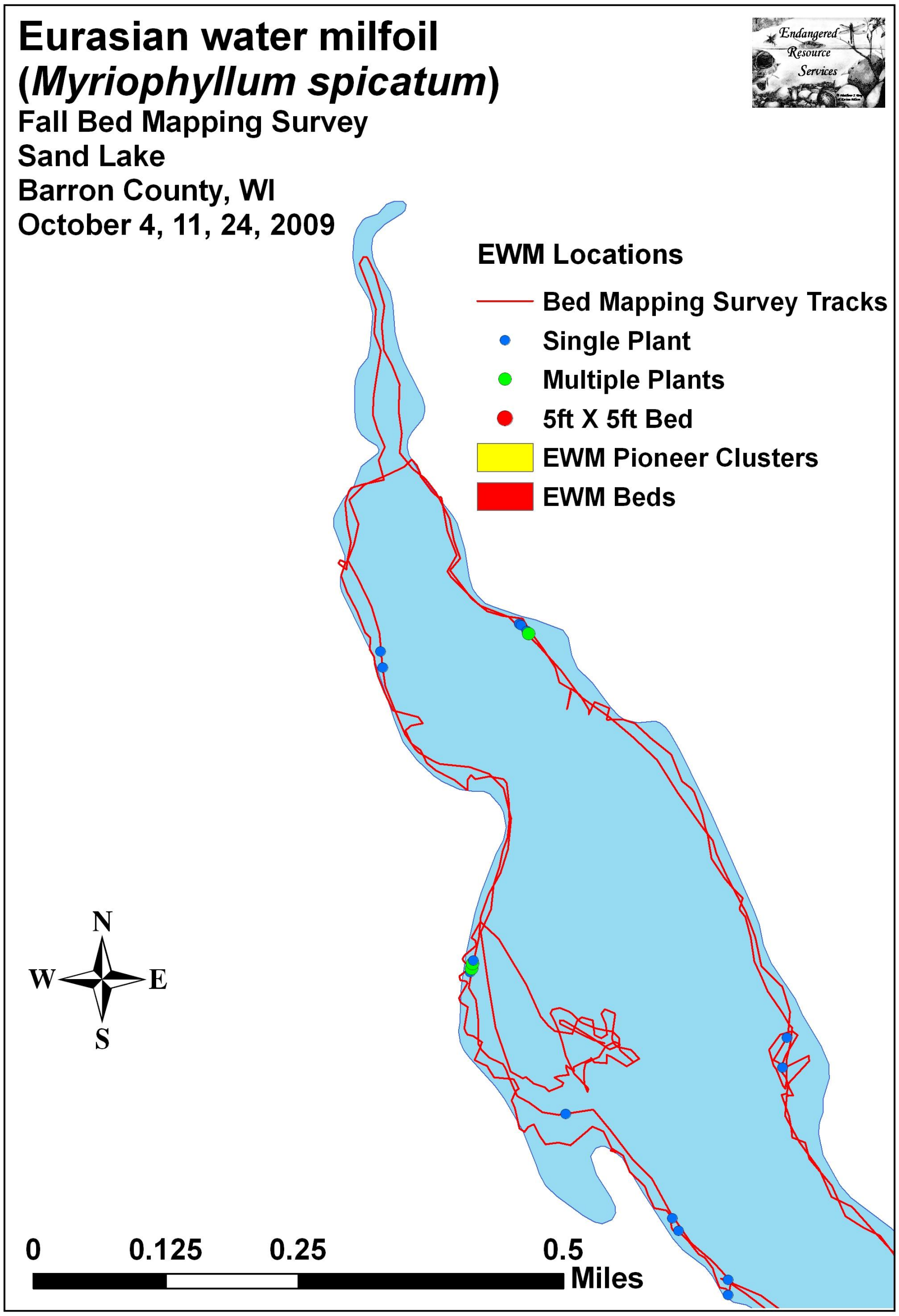
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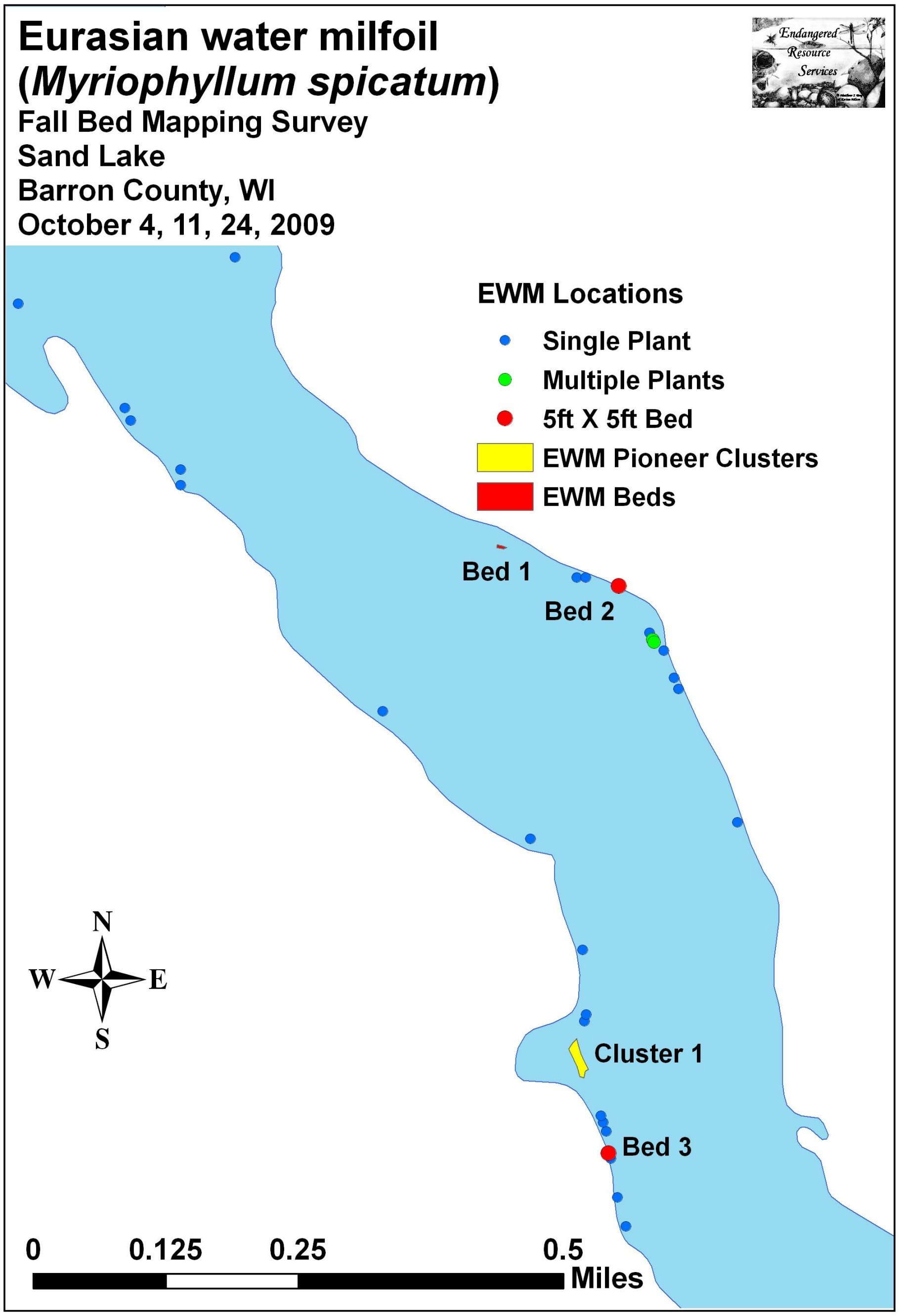
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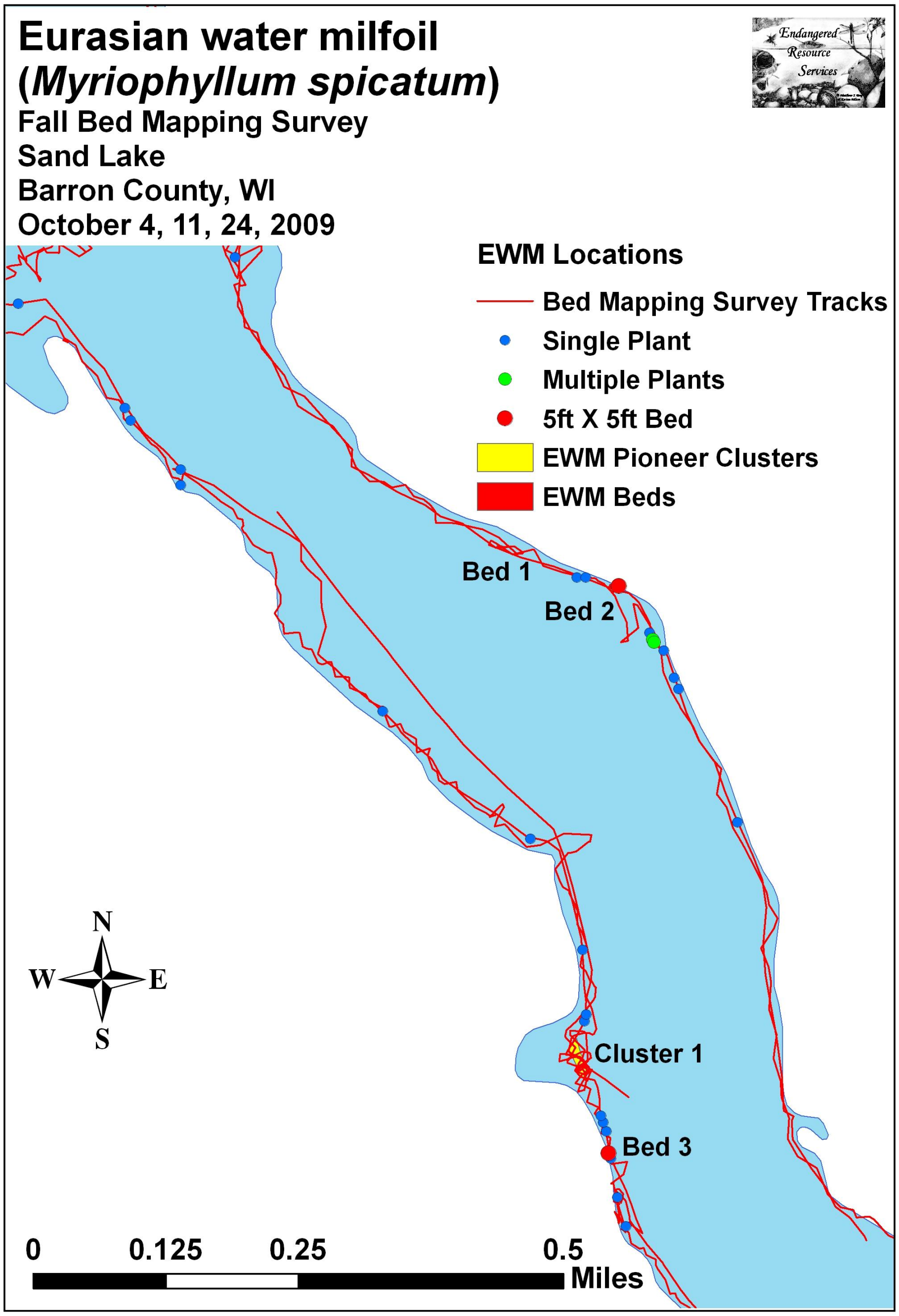
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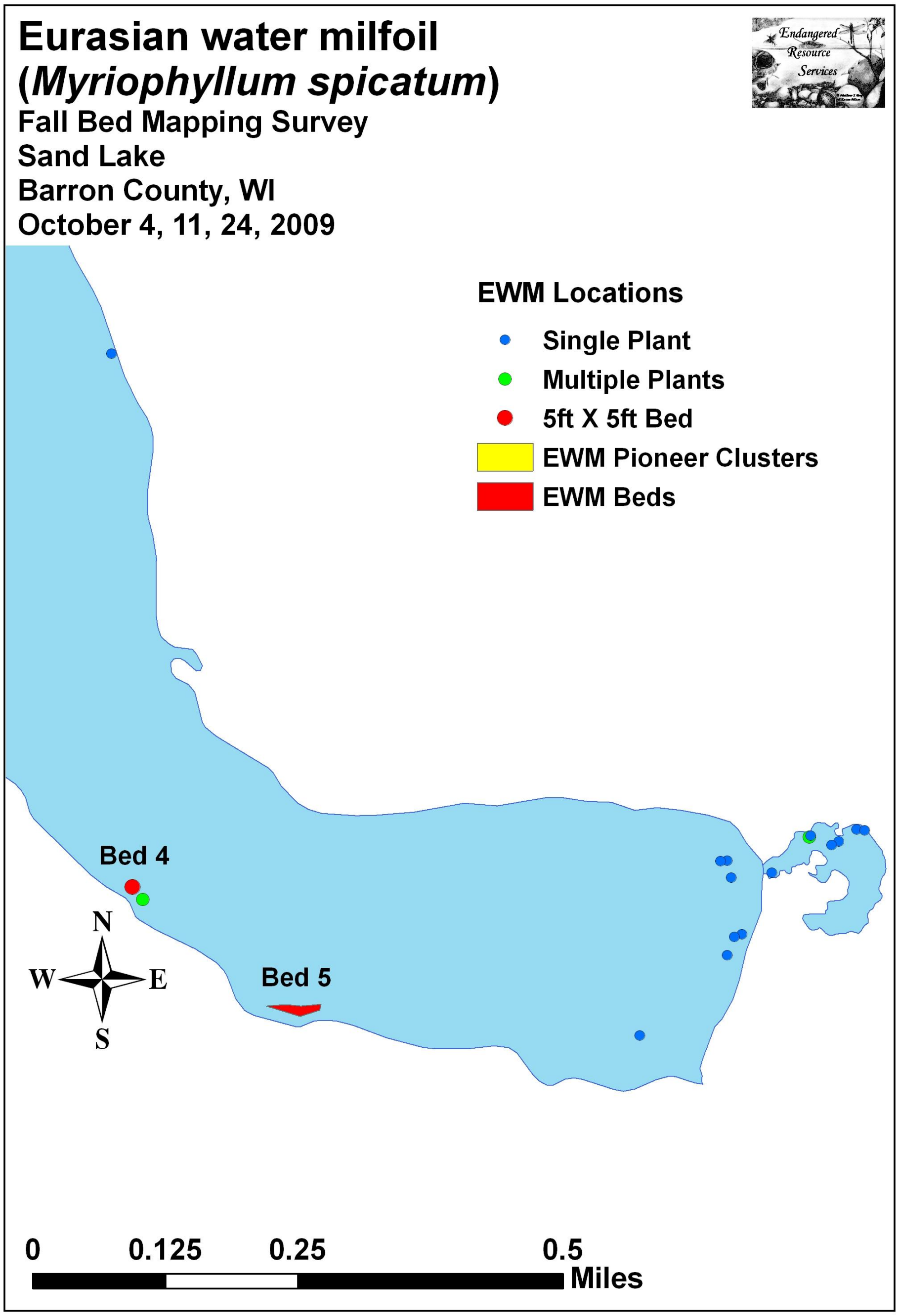
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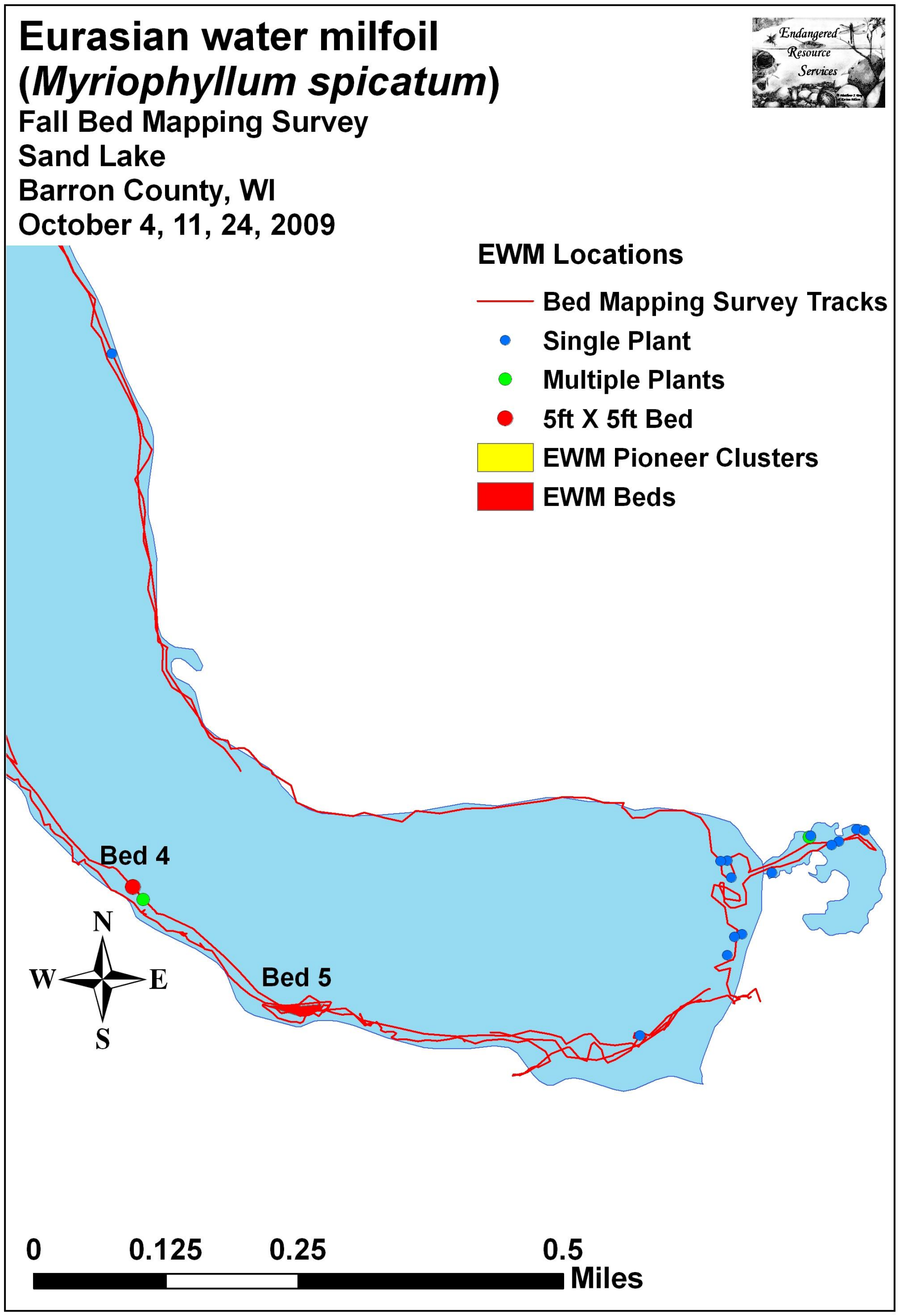
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Appendix II: Milfoil Identification Guide

Eurasian water milfoil vs. Northern water milfoil

EWM Leaflets >26 NWM Leaflets < 22

EWM Leaflets Limp out of Water   NWM Leaflets Stiff Out of Water

Appendix III: Glossary of Biological Terms

Aquatic:
organisms that live in or frequent water.

Cultural Eutrophication:
accelerated eutrophication that occurs as a result of human activities in the watershed that increase nutrient loads in runoff water that drains into lakes.

Dissolved Oxygen (DO):
the amount of free oxygen absorbed by the water and available to aquatic organisms for respiration; amount of oxygen dissolved in a certain amount of water at a particular temperature and pressure, often expressed as a concentration in parts of oxygen per million parts of water.

Diversity:
number and evenness of species in a particular community or habitat.

Drainage lakes:
Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

Ecosystem:
a system formed by the interaction of a community of organisms with each other and with the chemical and physical factors making up their environment.

Eutrophication:
the process by which lakes and streams are enriched by nutrients, and the resulting increase in plant and algae growth. This process includes physical, chemical, and biological changes that take place after a lake receives inputs for plant nutrients--mostly nitrates and phosphates--from natural erosion and runoff from the surrounding land basin. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Exotic:
a non-native species of plant or animal that has been introduced.

Habitat:
the place where an organism lives that provides an organism's needs for water, food, and shelter. It includes all living and non-living components with which the organism interacts.

Limnology:
the study of inland lakes and waters.

Littoral:

the near shore shallow water zone of a lake, where aquatic plants grow.

Macrophytes:

Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Nutrients:

elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances can become a nuisance by promoting excessive aquatic plant growth.

Organic Matter:

elements or material containing carbon, a basic component of all living matter.

Photosynthesis:

the process by which green plants convert carbon dioxide (CO2) dissolved in water to sugar and oxygen using sunlight for energy. Photosynthesis is essential in producing a lake's food base, and is an important source of oxygen for many lakes.

Phytoplankton:

microscopic plants found in the water. Algae or one-celled (phytoplankton) or multicellular plants either suspended in water (Plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short.

Plankton:

small plant organisms (phytoplankton and nanoplankton) and animal organisms (zooplankton) that float or swim weakly though the water.

ppm:

parts per million; units per equivalent million units; equal to milligrams per liter (mg/l)

Richness:

Number of species in a particular community or habitat.

Rooted Aquatic Plants:

(macrophytes) Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Runoff:

water that flows over the surface of the land because the ground surface is impermeable or unable to absorb the water.

Secchi Disc:

An 8-inch diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days.

Seepage lakes:

Lakes without a significant inlet or outlet, fed by rainfall and groundwater. Seepage lakes lose water through evaporation and groundwater moving on a down gradient. Lakes with little groundwater inflow tend to be naturally acidic and most susceptible to the effects of acid rain. Seepage lakes often have long ,residence times. and lake levels fluctuate with local groundwater levels. Water quality is affected by groundwater quality and the use of land on the shoreline.

Turbidity:

degree to which light is blocked because water is muddy or cloudy.

Watershed:

the land area draining into a specific stream, river, lake or other body of water. These areas are divided by ridges of high land.

Zooplankton:

Microscopic or barely visible animals that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. For many fish, they are the primary source of food.

Appendix IV: Aquatic Invasive Species Information

Curly-leaf pondweed

DESCRIPTION: Curly-leaf pondweed is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early July

DISTRIBUTION AND HABITAT: Curly-leaf pondweed is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all states but Maine

LIFE HISTORY AND EFFECTS OF INVASION: Curly-leaf pondweed spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring.

It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out compete native plants in the spring. In mid-summer, when most aquatic plants are growing, curly-leaf pondweed plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches. Curly-leaf pondweed forms surface mats that interfere with aquatic recreation. (Taken in its entirety from WDNR, 2009 http://www.dnr.state.wi.us/invasives/fact/curlyleaf_pondweed.htm)

Eurasian water milfoil

DESCRIPTION: Eurasian water milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian water milfoil is nearly impossible to distinguish from Northern water milfoil. Eurasian water milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

DISTRIBUTION AND HABITAT: Eurasian milfoil first arrived in Wisconsin in the 1960's. During the 1980's, it began to move from several counties in southern Wisconsin to lakes and waterways in the northern half of the state. As of 1993, Eurasian milfoil was common in 39 Wisconsin counties (54%) and at least 75 of its lakes, including shallow bays in Lakes Michigan and Superior and Mississippi River pools.

Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

LIFE HISTORY AND EFFECTS OF INVASION: Unlike many other plants, Eurasian water milfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms of infested lakes. (Taken in its entirety from WDNR, 2009 http://www.dnr.state.wi.us/invasives/fact/milfoil.htm)

Reed canary grass

DESCRIPTION: Reed canary grass is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The lead ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass also resembles non-native orchard grass (*Dactylis glomerata*), but can be distinguished by its wider blades, narrower, more pointed inflorescence, and the lack of hairs on glumes and lemmas (the spikelet scales). Additionally, bluejoint grass (*Calamagrostis canadensis*) may be mistaken for reed canary in areas where orchard grass is rare, especially in the spring. The highly transparent ligule on reed canary grass is helpful in distinguishing it from the others. Ensure positive identification before attempting control.

DISTRIBUTION AND HABITAT: Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as bergs and spoil piles.

LIFE HISTORY AND EFFECTS OF INVASION: Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in less than twelve years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites. (Taken in its entirety from WDNR, 2009 http://www.dnr.state.wi.us/invasives/fact/reed_canary.htm)

Purple loosestrife

DESCRIPTION: Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

This species may be confused with the native wing-angled loosestrife (*Lythrum alatum*) found in moist prairies or wet meadows. The latter has a winged, square stem and solitary paired flowers in the leaf axils. It is generally a smaller plant than the Eurasian loosestrife.

By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Distribution and Habitat: Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Life History and Effects of Invasion: Purple loosestrife can germinate successfully on substrates with a wide range of pH. Optimum substrates for growth are moist soils of neutral to slightly acidic pH, but it can exist in a wide range of soil types. Most seedling establishment occurs in late spring and early summer when temperatures are high.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. (Taken in its entirety from WDNR, 2009 http://www.dnr.state.wi.us/invasives/fact/loosestrife.htm)