



Lake Wingra Watershed Management Plan – Invasive Species

October 2003



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Friends of Lake Wingra – Invasive Species Committee

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Friends of Lake Wingra
Watershed Management Plan – Invasive Species
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Purpose of the Invasive Species Management Plan

This plan is submitted in partial fulfillment of a Wisconsin Department of Natural Resources (DNR) Lake Management Planning grant awarded to the Friends of Lake Wingra (FOLW) through Dane County and Edgewood College. The plan is intended to address a critical need for widespread participation of citizen and partner groups in the development of a comprehensive, integrated plan for the control of invasive species in the Lake Wingra watershed.

The plan recommends planning values and management principles for consideration by watershed residents, businesses and municipalities. The plan outlines a comprehensive, strategic approach to invasive species management in Lake Wingra and its surrounding watershed. The plan recommends a range of management actions and it provides land managers, neighborhood groups and citizens with tools for developing appropriate tactics to encourage native species and discourage pest species. The plan recommends short-term, mid-term and long-term management actions.

These recommendations were informed, in part, by the strategic weed management planning done by the UW-Madison Arboretum, the Wisconsin Department of Natural Resources, Bureau of Endangered Resources and the U.S. National Park Service. The Arboretum work provides a template for the site-specific invasive species management planning recommended in this document and includes a priority ranking of some of the most serious pest plant species in the watershed. We conducted a risk analysis of the 16 most widespread and troublesome terrestrial and wetland pest plants in the watershed. For each species, the risk analysis looked at the seriousness of the ecological impact of the species; the degree of threat posed to the watershed; the ease of control efforts and the likelihood of controlling the species.

These four factors were boiled down to a simple, two-variable scheme—low or high threat and easy or hard to control. Degree of threat combines measures of potential impact and significance of impact. Ease of control is a measure of feasibility of control and likelihood of reinvasion (abundance within and near to the resource). Such a simple scheme allows managers to rank-order priorities for immediate and long-term weed control. Thus, those species that pose the highest threat to the resource and are the easiest to control are tackled first, while those species that are of little threat and are hard to control are left for last (see Table 1 below.)

These 16 plant species are considered the most serious in the watershed and should be tackled first.

Invasive Plant Priority Ranking Matrix Friends of Lake Wingra

Results of a risk analysis of the most widespread and troublesome
terrestrial and wetland species in the Lake Wingra Watershed

	Relatively easy to control	Relatively hard to control
High threat to ecological communities of concern	First priority Garlic mustard (<i>Alliaria petiolata</i>) Dame's rocket (<i>Hesperis matronalis</i>) Buckthorn (<i>Rhamnus cathartica</i> and <i>frangula</i>) Purple loosestrife (<i>Lythrum salicaria</i>)	Second priority Oriental bittersweet (<i>Celastris orbiculatus</i>) Reed canary grass (<i>Phalaris arundinacea</i>) Honeysuckle (<i>Lonicera x bella</i>) Canada thistle (<i>Cirsium canadense</i>) Leafy spurge (<i>Euphorbia esula</i>)
Low threat to ecological communities of concern	Third priority Norway maple (<i>Acer platinoides</i>) Japanese barberry (<i>Berberis thunbergii</i>) Multiflora rose (<i>Rosa multiflora</i>) Sweet clover (<i>Melilotus officinalis</i>) Wild parsnip (<i>Pastinaca sativa</i>)	Fourth priority Burning bush (<i>Euonymus alatus</i>) Amur maple (<i>Acer ginnala</i>)

Degree of threat combines measures of potential impact and significance of impact.
 Ease of control is a measure of feasibility of control and abundance within the watershed.
 Adapted from UW-Madison Arboretum weed management planning.

Friends of Lake Wingra Values for Managing Invasive Species

To address these problems, FOLW recommends that the following planning values and management principles be adopted by watershed residents, businesses and municipalities.

Prevent, to the extent possible, the entry and establishment of invasive plants and animals into the watershed. FOLW supports the continued enforcement of City of Madison regulations that prohibit the sale and cultivation of the known invasive plant, purple loosestrife. FOLW supports educational and outreach programs that inform watershed residents of native alternatives to known invasive plants.

Control or eradicate invasive plant and animal species. Coordinated efforts with a watershed perspective should be made to develop site-specific invasive species management plans for public and private lands for the watershed's most troublesome invasive species. The heavily urbanized watershed is a continual source of pest plant seeds and re-infestation, confounding the best efforts of citizens and land managers to halt their spread. There are countless invasive plant species reproducing in the Lake Wingra watershed but only about two dozen are the target of active management by individuals, neighborhood organizations, friends groups and public land agencies. (Glass, 1997). Land managers are unable to focus on controlling more than a few pest species at one time—thus they continually loose ground against the advance of invasive species.

Native habitat restoration. Improve natural habit through increased planting of native species, restoration of degraded habitat and reversal of ecosystem damage and system alteration caused by storm water and invasive species. Because removal of invasive species is a necessary—but not sufficient—step towards ecosystem recovery, active efforts must be taken to restore ecosystem structure, function and diversity on both a site-specific and watershed-wide basis.



Breached storm water detention facility (Pond #4) in South East Marsh.

Improve storm water management practices in the watershed. Immediate steps should be made to: a) eliminate erosion caused by overland storm water flow; b) decrease overland

flows and increase infiltration of rainfall where it falls; and c) improve the management of impervious surfaces to capture nutrients and sediment before they flow into Lake Wingra, and d) repair existing storm water detention facilities. Seeds and other propagules of invasive plant species are transported by overland storm water flows. Storm water itself disturbs natural communities and creates openings for invasive species. The nutrients and sediment loads carried by storm water further create conditions that are favorable for invasive plant species.

Understanding the Lake Wingra Watershed

The Lake Wingra watershed has a total area of 5,000 acres (21 sq km) with about 75% of that area being urban. Although located in an urban setting with well-established residential and commercial development, almost all of the Lake Wingra shoreline is undeveloped. About 30% of the watershed area is green space, occupied by urban parks, golf courses, and the University of Wisconsin Arboretum. Nevertheless, the Lake Wingra watershed has been dramatically changed by urbanization. Dredging and filling associated with the construction of Vilas Park, Wingra Creek and Arboretum Drive have permanently altered the size and level of the lake and surrounding wetlands.

“The aquatic and wetland vegetation of the Lake Wingra watershed has also changed considerably since European settlement, both as a result of major hydrological changes and the introduction of aggressive exotics species. There has been a decrease in diversity of submerged aquatic vegetation; a reduction of the extent of emergent aquatic/shallow marsh vegetation (and extirpation of wild rice); a significant decline in sedge meadow area; decrease in area, altered hydrology, loss of organic soil, and decrease in species diversity of fens; and a complete loss of tamarack stands and associated bog flora. At least 13 plant species are known to have been extirpated from the watershed, and at least one state-threatened species, white lady slipper (*Cypripedium candidum*) is apparently increasingly rare.” (Institute for Environmental Studies, 1999).

Examples of existing invasive species management problems

In addition to the examples cited above, Lake Wingra and its watershed experience the following stresses:

- “Continued invasion of exotic plant species pose additional threats to habitat and water quality. Buckthorn (*Rhamnus sp*) and honeysuckle (*Lonicera x bella*) near the lake edge and in upland areas, reed canary grass (*Phalaris arundinacea*) in sedge meadows and marshes, and hybrid cattails (*Thypha x glauca*) in shallow marshes, all have large populations in or around Lake Wingra and are serious problems. Sedge meadows, formerly common, have been reduced to a few stands that are seriously threatened by invasion of these exotics.” (Institute of Environmental Studies, 1999).



A monotypic stand of reed canary grass that has overrun a former high-quality sedge meadow in South East Marsh. Viewed from the breached detention pond in previous photo and looking toward Carver St. and WHA radio tower.

- A population of purple loosestrife (*Lythrum salicaria*), apparently an escape from a neighborhood garden, has become well established in the Edgewood marsh. Since its discovery in the mid-1990's, Edgewood College has worked in collaboration with the UW Arboretum and the WDNR to control this population. This population continues to serve as a source of infection for the rest of the watershed
- Garlic mustard and dame's rocket continue to reproduce in the watershed and expand their ranges.
- Reed canary grass inhabits virtually every wetland in the watershed and is now invading dry upland woodlands throughout the watershed. Traditional management approaches such as prescribed fire only seem to encourage its spread.



Reed canary grass monoculture (light-colored vegetation on right) in a drainage swale running through the center of Curtis Prairie, looking west towards Curtis Pond.

- Several new plant invaders have entered the watershed recently, including: porcelain berry (*Ampelopsis brevipedunculata*) and castor-leafed aralia (*Calapanax* species).
- The veliger (or immature stage) of the zebra mussel, an invasive mollusk, was recently observed in a sample from Lake Wingra.
- Research has identified common carp (*Cyprinus carpio*) as contributing to the turbidity of Lake Wingra and the loss of its macrophytes.

Examples of Current Management Strategies and Actions

- Aggressive control efforts in the watershed are holding garlic mustard and dame's rocket invasions at bay; they are confined to discrete, disjunctive populations but the species remain unpredictable.
- Public awareness of the extent and nature of the invasive species problem is increasing. FOLW has established good working relationships with "friends" groups, neighborhood associations and healthy lawn teams
- Citizen participation in public and private efforts to remove invasive plants and cultivate natives is increasing.
- Public land agencies are increasingly using strategic approaches to pest plant control that are guided by comprehensive weed management plans. These plans prioritize actions and spell out strategies and tactics for weed control.
- University of Wisconsin researchers are trying to understand the dynamics and ecology of pest plant invasions and their impacts on plant communities.
- Applied research is developing new and improved control efforts.
- Edgewood College and UW-Madison researchers and educators conduct outreach efforts to educate watershed residents about the impacts of invasive exotics; conduct classes on control efforts; and promote native alternatives to invasive exotics.
- University staff provide opportunities for faculty, staff and students and other watershed residents to get on-the-job training in methods of pest plant control and restoration techniques.

Goals for improved invasive species management

1. Implement a comprehensive, watershed-wide invasive species management plan that results in control or eradication of the watershed's most serious invaders. Targeted species would include: purple loosestrife, buckthorn and reed canary grass; and reduction in distribution and density of other very troublesome species such as garlic mustard, dame's rocket, Japanese knotweed, and hybrid cattail. Integrate and coordinate, to the extent feasible, planning for storm water management and control of invasive species. Recommended objectives include improved vegetation management and invasive species control on neglected public rights-of-way, storm water drainage ways and storm water detention facilities.



Buckthorn (*Rhamnus cathartica*) forest typical of those in Lake Wingra Watershed. *Rhamnus* alters soil chemistry and microfauna and shades out native wildflowers.

2. Increased public, private and citizen participation in promoting a healthy Lake Wingra. Increased capacity for long-term collaboration and integration of planning and management among public, private and citizen partners on high leverage, site-specific invasive species infestations. This would result in implementation of best management practices at specific sites that represent particular invasive species problems and/or opportunities. These opportunities include, but are not limited to:
 - Eradication of purple loosestrife in Edgewood Marsh and elsewhere in the watershed.
 - Monitoring for evidence that zebra mussels have established a viable population in Lake Wingra.
 - If successful zebra mussel invasion has not yet occurred, implement public education and provide boat washes at infested Wisconsin lakes to prevent transport to Lake Wingra.
 - Control or eradication of reed canary grass in Lake Wingra wetlands.
 - Population suppression of carp (*Cyprinus carpio*) in Lake Wingra.
3. Develop a pilot neighborhood project for control of invasive plant species and restoration of native habitat in a community public space. Provide assistance in developing community plans for control of invasive species, restoration and management. Neighborhood segments along the SW Bike Pedestrian Path corridor provides numerous opportunities for such projects. Projects at a particular site may have a more or less informational and educational purpose but they will also result in significant reductions of invasive species infestations.



Honeysuckle (*Lonicera x bella*) thicket. Areas such as this harbor invasives like garlic mustard and dame's rocket, but support few native wildflowers and provide inferior wildlife habitat.

4. Educate and train watershed residents in the concepts and implementation techniques of environmental stewardship of the Lake Wingra watershed. New or heightened skills would include ecological literacy, and strategies and techniques for habitat conservation, preservation and restoration. A “backyard habitat audit” that would inventory, map and report on the status of invasive species is a good example. The idea aims to build the capacity of individuals and community groups to identify future environmental problems and craft solutions for them.

Obviously, a citizen stewardship pilot or demonstration project such as this could be combined with a physical demonstration project but with the desired outcome being to build the capacity of watershed residents to identify and address environmental problems in general in addition to addressing a particular site-specific problem—likely partners include neighborhood associations, healthy lawn teams, schools, and friends groups.

5. Increase public, private and citizen group partnerships to coordinate and expand outreach and education about invasive species management and native habitat restoration. There is a wealth of talent and expertise in the watershed and beyond already at work on invasive species management. Active groups and potential partners include, but are not limited to, the Invasive Plant Association of Wisconsin (IPAW), Wild Ones, Madison Area Weed Warriors, City of Madison Parks, Dane County Parks, Wisconsin DNR, etc.

Site-specific recommendations for possible actions

1. Odana Ponds/SW Bike Path drainage way (immediate action)

Purple loosestrife (and nearly a dozen other non-native invasive plants) grows in the drainage way that parallels the bike path from south west of Hammersley Road. Runoff associated with rainfall events and periodic discharges of industrial waste water from plants along the drainage way disperses seeds of these plants throughout the west watershed. There is potential for purple loosestrife seeds to be carried into Lake Wingra. It does not appear that the vegetation along this drainage way is managed.

Recommendation: All purple loosestrife plants should be eradicated. Public land management agencies should be encouraged to mow the swale at least once a year to prevent invasive plants from setting seed. A vegetation management plan for the drainage way should be written. The plan should include target population levels for the most troublesome invasive species and a strategic and tactical work plan for achieving the goals.

2. The Edgewood Marsh (immediate action)

A well-established population of purple loosestrife was discovered in the Edgewood Marsh (1 ha) in 1996, having apparently originated from seed transported on storm water from a neighboring garden, possibly a decade earlier. The distribution pattern is dense, with about 70% of the population found in a relatively small area (about 200 m²) near the north end of the marsh. There is reduced density of purple loosestrife toward the fringes of the marsh. The population has spread toward the shoreline, and there is imminent potential of spread throughout wetlands surrounding the lake. Isolated individual loosestrife plants of uncertain origin have been discovered in wetlands on Edgewood and Arboretum property.

Early control efforts from 1996 through 1998 consisted of cutting and application of a 50% solution of roundup to stems. These efforts resulted in temporarily reduced loosestrife densities. However, consistent resources were not available to adequately control the spreading population. Since 1999 purple loosestrife beetles have been released into the marsh with cooperation of the DNR purple loosestrife bio-control program. Beetle populations have been established and have resulted in damage to loosestrife plants in the area of densest growth. However, given the large seed bank and the absence of a supplemental and systematic mechanical control program, the loosestrife population has spread.

Suggested control strategy

Research has shown that generally within 4 to 5 years after initial release, purple loosestrife beetles bring a dense loosestrife population down to the point where seed production is so low that it no longer poses a threat to nearby un-infested areas (Woods, personal communication, 2002.)

However, on the margins of infested areas, where the loosestrife population is too low and scattered to support a predatory beetle population, mechanical and cultural control methods are required. This situation is found on the lake and shore sides of the Edgewood Marsh. These scattered, and hard-to-find plants pose the greatest threat of escape and infestation of nearby areas. In this area, systematic, routine and careful scouting and monitoring by trained volunteers and land care managers is required. Mechanical, cultural and chemical controls will be dictated by the extent of the population and the time, energy and resources available to the land care managers.

It is recommended that Edgewood, in cooperation with the DNR purple loosestrife bio-control program develop target purple loosestrife population levels, and a range of acceptable variation around these targets, for the marsh. Edgewood managers should continue to use predatory beetles in the main body of the densest loosestrife population. Within this containment zone, managers may choose to remove the flowers but leave the plants to support the beetle populations. A rigorous monitoring program should be established to evaluate the success of the control program and to inform management decisions.

A systematic, rigorous surveillance program, perhaps using watershed volunteers should be enough to keep tabs on the fringe areas. Here again, a set of target population levels should be established; fluctuations around this target level will trigger management action. The exact management action will depend upon the time, energy and resources available to managers and to the degree of threat posed by the population.

Precautions should be taken to ensure that as little harm as possible is done to the marsh during the efforts to control purple loosestrife. Steps should be taken to minimize walking in the marsh, soil disturbance, dispersal of seeds and trampling of native vegetation during monitoring and control. Managers might consider such things as temporary, “floating” walkways or small, portable lookout platforms as ways to avoid or lessen impact on the marsh.

3. SW Bike Path and Glenway (mid-term action)

The SW Bike/Pedestrian path has been identified as a potentially important demonstration area.

The SW bike path itself is a major environmental corridor for the movement of storm water and pest plants through the watershed and into Lake Wingra. Most of the invasive plant species in the watershed are also found along the path. The storm water management plan has identified a number of storm water erosion gullies intersecting the bike path that carry sediment and seeds of pest species to Lake Wingra. Trees and shrubs under public utility lines along the bike path are currently managed on a regular basis.

In addition to the bike path’s biological importance, it is a social and cultural corridor—a community even. The bike path connects most of the neighborhoods in the Lake Wingra watershed and is used for transportation, recreation and socializing by many of the watershed’s residents. The bike path has a friends group that is active in invasive

species control and planting of native species. FOLW has a good working relationship with members of the friends group.

Recommendation: Work with the Friends of the SW Bike/Pedestrian Path to help them build their organizational capacity; help the group develop habitat restoration and invasive species management plans; help organize community efforts to control pest plants and restore native habitat. Build on the already strong relationship with City agencies and develop partnerships with other land managers such as utility companies.

4. Lake Wingra Marshes (mid-term)

The FOLW storm water management plan recommends that “Maintenance and repair of storm water infrastructure in the UW Arboretum is needed to reduce habitat degradation and nutrient and sediment transport to the lake.” For example, unabated storm water (due to a by-pass channel around detention pond #3 and a breach in the berm of detention pond # 4) is a factor responsible for the spread of reed canary grass and hybrid cattail in South East Marsh. The advance of these two species threatens high quality marsh.



Reed canary grass and urban storm water detritus such as pop cans and golf balls, are now common in South East Marsh.

Recommendation: Support recommendations of FOLW storm water management plan. Encourage development of restoration plans for the marshes. Coordinate with UW-Madison Arboretum on development of a comprehensive storm water management plan and support efforts to develop innovative solutions such as infiltration to handling storm water flows.

Recommendations for Nuisance Waterfowl

Canada geese (*Branta canadensis*) (immediate action)

Urban populations of the giant Canada goose (*Branta Canadensis maxima*) have increased dramatically in recent decades throughout North America, creating frequent goose-human conflicts (Smith, et al, 1999). Geese have become increasingly adapted to urban and suburban environments, often breeding in cities. In 2002 in Vilas Park, there were 23 adult resident (locally nesting) giant Canada geese that produced 33 young (Lorman, 2003). In addition, there were 100 to 700 migrating geese during the same period. In Vilas Park in November of 2002, the 23 adult resident geese produced an average of 100 lbs dry-weight feces per acre.

Year-round resident populations of this species cause shoreline erosion, which sends sediment, and nutrient loads to the lake, and an accumulation of feces, which contributes nutrient and bacterial contamination to Lake Wingra. In addition, geese can transmit diseases to other animals and are known to attack people, especially during the nesting season.



Spring Trail Pond. Shoreline erosion caused by resident (non –migratory) Canada geese and mallards.

Current management actions—the Madison City Council has created an ad hoc committee on integrated waterfowl management. This committee has recommended various educational and outreach efforts; creation of scientific protocols to study the local situation and careful consideration of management strategies. Researchers at Edgewood College conduct population counts and document the effects of geese in Vilas Park.

Recommendation

FOLW recommends that the giant Canada goose populations in the watershed be managed to reduce their impact on the lake and watershed. These steps should be taken:

- Set desired population levels for Vilas Park and other locations in the watershed.
- Experiment with management/control strategies to reduce geese and mallard populations.
- Enforce existing regulations that prohibit the feeding of geese and mallards.
- Restore shoreline vegetation to stabilize banks, reduce erosion and discourage flocks of these two species.

Friends of Lake Wingra support the work of the Madison City Parks Department and its partners in their efforts to find an integrated approach to urban goose management.

Recommendations for In-lake Management

1. Zebra mussel (*Dreissena polymorpha*) (immediate action)

Zebra mussel veligers (immature stages) were observed in a sample from Lake Wingra in September 2003 (Wisconsin DNR, personal communication). “The zebra mussel is perhaps the most successful exotic invasive species that the world has ever known.” (Dane County Lakes and Watershed Commission, 2003b). It is not known whether or not Lake Wingra provides suitable habitat for a successful invasion. This very recent observation for Lake Wingra is disturbing and warrants immediate, continued monitoring. See the excellent new booklet by the Dane County Lakes and Watershed Commission (Dane County Lakes and Watershed Commission, 2003b) for an information and analysis of the threat to the Madison area lakes.

2. Common carp (long term action)

Evidence from research projects around the world suggests that the presence of common carp (*Cyprinus carpio*) is the primary cause of poor water clarity and loss of native macrophytes in shallow, eutrophic lakes such as Lake Wingra. “Introduction of the benthivorous common carp has been identified as one of the main causes of loss of biodiversity and water clarity in numerous shallow lakes worldwide” (Zambrano, et al 2001). The literature also shows that when carp are removed lake clarity improves (Meijer, et al, 1990.) However, other researchers (Zambrano and Hinojosa, 1999) have shown that there are many direct and indirect effects and complex interactions of carp removal on water turbidity, zooplankton and macrophyte and benthic communities.

Since introduction of the fish to Lake Wingra in the mid-1880’s, there have been repeated attempts to control this invasive species. Carp denude the lake bottom of aquatic plants and re-suspend sediments so that water clarity is constantly compromised. The last intensive removal effort took place in the 1950’s and carp quickly regained its place as one of the dominant fish species in the lake (Institute for Environmental Studies, 1999.)

The classic Lake Wingra case history (Baumann, et al 1974) indicates that carp removal is not benign to other aquatic life forms. These authors suggest that “to be effective, management plans must consider the entire fish community and the total ecosystem.”

Recommendations:

Friends of Lake Wingra support an integrated approach to reducing the impact of carp.

Outreach--The fact that carp are over-abundant in Lake Wingra and the specific consequences of this for water and habitat quality need to be effectively communicated to the public as part of ongoing outreach that identifies community goals for the lake. In the long run, the watershed community will have to weigh the alternatives and decide what control measures might be acceptable or desirable.

Research—We support proposals to study the recovery of native macrophytes and fish species through the use of carp-proof exclosures that are compatible with other lake uses. This might provide the community with a pilot demonstration of what the lake could be like without carp.

Eradication—At this point in time, maintaining a carp-free environment over the long term does not seem feasible because the occasional inundation of the Wingra dam provides access to the Lake by other carp populations. This view may change and in the future, with new information, eradication may become more feasible. Furthermore, the methods required for eradication -- wholesale poisoning of all fish species, with subsequent reintroduction of those deemed beneficial -- may not be compatible with the community's vision of lake stewardship. In addition, carp removal may be a necessary step but will not be sufficient to allow native aquatic plants to re colonize if they are not already present in the lake.

Population suppression--FOLW supports efforts to suppress the carp population through methods that do not threaten other fish and plant species. These methods might include:

- Periodic commercial seining to remove large numbers of carp. This can be timed for minimum impact on macrophyte populations and provide a way to monitor trends in carp population.
- An on-going cash bounty on carp taken from the lake by hook and line, or bow and arrow. This approach engages the community, provides incentive for sport fishing and maintains continued pressure on declining carp population with no damage to other fish species.
- Consideration of proposals to study the recovery of native macrophytes and fish species through the use of carp-proof exclosures that are compatible with recreational use of the lake. This approach might provide the community with a pilot demonstration of what the lake could be like without carp.
- Continued assessment of the obstacles to suppression or eradication. These include how to prevent reintroduction of carp from Wingra Creek and Lake Monona, and the complex controversy that any approach that involves poisoning would bring.
- Further study and community discussion and agreement on goals and actions.

3. Eurasian milfoil (*Myriophyllum spicatum*) (mid-term action – Vilas lagoons)

In addition to the terrestrial and wetland invasive species, there is also one in-lake aquatic plant species of concern in Lake Wingra. Eurasian milfoil (*Myriophyllum spicatum*), introduced to Lake Wingra in the early 1960s, rapidly became the dominant submerged plant, accounting for 68% of plant relative frequency in 1969. By the late 1970s milfoil began to decline, although still accounting for 52% of the plant frequency found in the lake (Trebitz et al, 1993). However, by the early 1990s, overall plant diversity had increased dramatically with milfoil accounting for only 23-29% of plant frequency whereas approximately 15 other species had frequencies >1%. During the 1960s and 1970s only five other plant species had frequencies >1%. Data from 1999-2001 indicate that while Eurasian milfoil is still the most frequent plant, other native plants including native milfoil are widespread in the lake.

While Eurasian milfoil has declined in Lake Wingra itself, it still forms massive monotypic stands in the Vilas Park lagoons that are connected by a narrow channel to the lake proper. In other area lakes, declines in milfoil have been linked to a native weevil that targets Eurasian milfoil. There is evidence that in systems where milfoil is not harvested, weevil populations build up especially if a buffer zone of natural vegetation surrounds the lake shoreline affording critical overwintering habitat for the weevil (Richard Lathrop, WDNR, personal communication). The Vilas lagoons currently have no such habitat since the park lawn is mowed right to the water's edge, and macrophytes in the lagoons are regularly harvested thus removing nascent weevil populations.

Current Management Actions

The Lakes Division of the Dane County Department of Public Works is responsible for the county's aquatic plant management program, with oversight provided by The Dane County Lakes and Watershed Commission, the Dane County Public Works Committee and elected county officials (Lakes & Watershed Commission, 2003a). Summertime aquatic plant harvesting in Lake Wingra focuses on the Vilas Park lagoons and Vilas Park beach area.

Recommendation

FOLW supports the development of an integrated approach to the control of Eurasian milfoil in Vilas lagoons. The development of a natural riparian zone around the shoreline of the lagoons, coupled with the elimination of routine harvesting, could establish natural biological control of the excessive milfoil growths.

Invasive species and human health in Lake Wingra

Until recently, it was believed that invasive species in the Lake Wingra watershed do not have direct effects on human health. This view changed when Long Term Ecological Research samples from Lake Wingra uncovered high concentrations of the toxic algae *Cylindrospermopsis raciborskii*.

“*Cylindrospermopsis raciborskii*, or Cylindro, is a sub-tropical species of blue-green algae that has been migrating northward from Brazil and in recent years has been found in several southern states as well as in Illinois, Little is known about Cylindro and its effects, although the available scientific literature suggests that it differs from other blue-greens in that it may produce more toxins more frequently than the blue-green algae species commonly found in Wisconsin lakes” (News Release, WDNR, August 6, 2003).

Scientists at DNR and the UW-Madison continue to study Cylindro’s ecology and its ability to produce toxins under different bloom conditions in Lake Wingra and other southern Wisconsin lakes.

Recommendation: Specific FOLW recommendations will follow the analysis and reporting on these studies.

General recommendations include the continued implementation of management practices that prevent blue-green algae blooms of all types in Lake Wingra:

- Reduced nutrient (especially phosphorus) inputs from stormwater runoff in the watershed
- Restoration of healthy populations of native aquatic plants which compete with algae for available nutrients

Steps to Implement FOLW Invasive Species Management Recommendations

- 1) Continue to inventory the watershed
 - Document all new outbreaks of invasive species.
 - Identify specific, high-leverage opportunities for controlling invasive species or reducing their impact.
 - Support efforts to develop site-specific invasive species management plans.
- 2) Develop an implementation strategy
 - Prioritize management recommendations to guide funding and implementation over the next five years.
 - Set objectives for each site that are specific, measurable and achievable over a specific period of time.
 - Work to manage invasive species at specific sites that have particular problems and/or opportunities and where such changes will have significant positive impacts on the watershed.
 - Encourage stakeholders to restore native habitat in areas degraded by invasive plants and animals.
- 3) Educate stakeholders
 - Help public and private partners build capacity for developing invasive species management and implementation plans.
 - Sponsor training sessions on pest species identification and control techniques.

- Create educational and outreach programs that help build ecological literacy.
- 4) Continue research on effective invasive species control techniques and impacts of invasive species on the watershed ecosystems.
- 5) Promote coordination of invasive species management planning among public agencies and private partners.
- 6) Evaluate impacts of efforts through monitoring of invasive populations and ecosystem recovery.

Expected Outcomes of Improved Invasive Species Management.

- 1 Prevention of the establishment of new invasive species such as porcelain berry through early detection. Swift elimination of new outbreaks of invasive species.
- 2 Halt to the spread of the highest priority invasive species and subsequent control or eradication of these species.
- 3 Reduction in the size, number and aerial extent of lower priority invasive species populations.
- 4 Improvement in quality of native habitat.
- 5 Restoration of native ecosystems like marshes, fens, prairie and savanna that have been degraded by invasive species.

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