

## Native Species Enhancement

The development of Wisconsin's shorelands has increased dramatically over the last century and with this increase in development a decrease in water quality and wildlife habitat has occurred. Many people that move to or build in shoreland areas attempt to replicate the suburban landscapes they are accustomed to by converting natural shoreland areas to the "neat and clean" appearance of manicured lawns and flowerbeds. The conversion of these areas immediately leads to destruction of habitat utilized by birds, mammals, reptiles, amphibians, and insects (Jennings et al. 2003). The maintenance of the newly created area helps to decrease water quality by considerably increasing inputs of phosphorus and sediments into the lake. The negative impact of human development does not stop at the shoreline. Removal of native plants and dead, fallen timbers from shallow, near-shore areas for boating and swimming activities destroys habitat used by fish, mammals, birds, insects, and amphibians, while leaving bottom and shoreline sediments vulnerable to wave action caused by boating and wind (Jennings et al. 2003, Radomski and Goeman 2001, and Elias & Meyer 2003). Many homeowners significantly decrease the number of trees and shrubs along the water's edge in an effort to increase their view of the lake (. However, this has been shown to locally increase water temperatures, and decrease infiltration rates of potentially harmful nutrients and pollutants. Furthermore, the dumping of sand to create beach areas destroys spawning, cover and feeding areas utilized by aquatic wildlife (Scheuerell and Schindler 2004).



In recent years, many lakefront property owners have realized increased aesthetics, fisheries, property values, and water quality by restoring portions of their shoreland to mimic its unaltered state. An area of shore restored to its natural condition, both in the water and on shore, is commonly called a *shoreland buffer zone*. The shoreland buffer zone creates or restores the ecological habitat and benefits lost by traditional suburban landscaping. Simply not mowing within the buffer zone does wonders to restore some of the shoreland's natural function.

Enhancement activities also include additions of *submergent*, *emergent*, and *floating-leaf* plants within the lake itself. These additions can provide greater species diversity and may compete against exotic species.

### Cost

The cost of native, aquatic and shoreland plant restorations is highly variable and depend on the size of the restoration area, planting densities, the species planted, and the type of planting (e.g. seeds, bare-roots, plugs, live-stakes) being conducted. Other factors may include extensive grading requirements, removal of shoreland stabilization (e.g., rip-rap, seawall), and protective measures used to guard the newly planted area from wildlife predation, wave-action, and erosion. In general, a restoration project with the characteristics described below would have an estimated materials and supplies cost of approximately \$4,200.

- The single site used for the estimate indicated above has the following characteristics:
  - An upland buffer zone measuring 35' x 100'.
  - An aquatic zone with shallow-water and deep-water areas of 10' x 100' each.
  - Site is assumed to need little invasive species removal prior to restoration.
  - Site has a moderate slope.
  - Trees and shrubs would be planted at a density of 435 plants/acre and 1210 plants/acre, respectively.
  - Plant spacing for the aquatic zone would be 3 feet.
  - Each site would need 100' of biolog to protect the bank toe and each site would need 100' of wavebreak and goose netting to protect aquatic plantings.
  - Each site would need 100' of erosion control fabric to protect plants and sediment near the shoreline (the remainder of the site would be mulched).
  - There is no hard-armor (rip-rap or seawall) that would need to be removed.
  - The property owner would maintain the site for weed control and watering.

***Advantages***

- Improves the aquatic ecosystem through species diversification and habitat enhancement.
- Assists native plant populations to compete with exotic species.
- Increases natural aesthetics sought by many lake users.
- Decreases sediment and nutrient loads entering the lake from developed properties.
- Reduces bottom sediment re-suspension and shoreline erosion.
- Lower cost when compared to rip-rap and seawalls.
- Restoration projects can be completed in phases to spread out costs.
- Many educational and volunteer opportunities are available with each project.

***Disadvantages***

- Property owners need to be educated on the benefits of native plant restoration before they are willing to participate.
- Stakeholders must be willing to wait 3-4 years for restoration areas to mature and fill-in.
- Monitoring and maintenance are required to assure that newly planted areas will thrive.
- Harsh environmental conditions (e.g., drought, intense storms) may partially or completely destroy project plantings before they become well established.

## Manual Removal

Manual removal methods include hand-pulling, raking, and hand-cutting. Hand-pulling involves the manual removal of whole plants, including roots, from the area of concern and disposing them out of the waterbody. Raking entails the removal of partial and whole plants from the lake by dragging a rake with a rope tied to it through plant beds. Specially designed rakes are available from commercial sources or an asphalt rake can be used. Hand-cutting differs from the other two manual methods because the entire plant is not removed, rather the plants are cut similar to mowing a lawn; however Wisconsin law states that all plant fragments must be removed. One manual cutting technique involves throwing a specialized “V” shaped cutter into the plant bed and retrieving it with a rope. The raking method entails the use of a two-sided straight blade on a telescoping pole that is swiped back and forth at the base of the undesired plants.



In addition to the hand-cutting methods described above, powered cutters are now available for mounting on boats. Some are mounted in a similar fashion to electric trolling motors and offer a 4-foot cutting width, while larger models require complicated mounting procedures, but offer an 8-foot cutting width. Please note that the use of powered cutters may require a mechanical harvesting permit to be issued by the WDNR.

When using the methods outlined above, it is very important to remove all plant fragments from the lake to prevent re-rooting and drifting onshore followed by decomposition. It is also important to preserve fish spawning habitat by timing the treatment activities after spawning. In Wisconsin, a general rule would be to not start these activities until after June 15<sup>th</sup>.

### Cost

Commercially available hand-cutters and rakes range in cost from \$85 to \$150. Power-cutters range in cost from \$1,200 to \$11,000.

### Advantages

- Very cost effective for clearing areas around docks, piers, and swimming areas.
- Relatively environmentally safe if treatment is conducted after June 15<sup>th</sup>.
- Allows for selective removal of undesirable plant species.
- Provides immediate relief in localized area.
- Plant biomass is removed from waterbody.

### Disadvantages

- Labor intensive.
- Impractical for larger areas or dense plant beds.
- Subsequent treatments may be needed as plants recolonize and/or continue to grow.
- Uprooting of plants stirs bottom sediments making it difficult to conduct action.
- May disturb *benthic* organisms and fish-spawning areas.
- Risk of spreading invasive species if fragments are not removed.

## Bottom Screens

Bottom screens are very much like landscaping fabric used to block weed growth in flowerbeds. The gas-permeable screen is placed over the plant bed and anchored to the lake bottom by staking or weights. Only gas-permeable screen can be used or large pockets of gas will form under the mat as the result of plant decomposition. This could lead to portions of the screen becoming detached from the lake bottom, creating a navigational hazard. Normally the screens are removed and cleaned at the end of the growing season and then placed back in the lake the following spring. If they are not removed, sediments may build up on them and allow for plant colonization on top of the screen.

### Cost

Material costs range between \$.20 and \$1.25 per square-foot. Installation cost can vary largely, but may roughly cost \$750 to have 1,000 square feet of bottom screen installed. Maintenance costs can also vary, but an estimate for a waterfront lot is about \$120 each year.

### Advantages

- Immediate and sustainable control.
- Long-term costs are low.
- Excellent for small areas and around obstructions.
- Materials are reusable.
- Prevents fragmentation and subsequent spread of plants to other areas.

### Disadvantages

- Installation may be difficult over dense plant beds and in deep water.
- Not species specific.
- Disrupts benthic fauna.
- May be navigational hazard in shallow water.
- Initial costs are high.
- Labor intensive due to the seasonal removal and reinstallation requirements.
- Does not remove plant biomass from lake.
- Not practical in large-scale situations.

## Water Level Drawdown

The primary manner of plant control through water level drawdown is the exposure of sediments and plant roots/tubers to desiccation and either heating or freezing depending on the timing of the treatment. Winter drawdowns are more common in temperate climates like that of Wisconsin and usually occur in reservoirs because of the ease of water removal through the outlet structure. An important fact to remember when considering the use of this technique is that only certain species are controlled and that some species may even be enhanced. Furthermore, the process will likely need to be repeated every two or three years to keep target species in check.

### Cost

The cost of this alternative is highly variable. If an outlet structure exists, the cost of lowering the water level would be minimal; however, if there is not an outlet, the cost of pumping water to the desirable level could be very expensive. If a hydro-electric facility is operating on the system, the costs associated with loss of production during the drawdown also need to be considered, as they are likely cost prohibitive to conducting the management action.

<b>Advantages</b>	<b>Disadvantages</b>
<ul style="list-style-type: none"> <li>• Inexpensive if outlet structure exists.</li> <li>• May control populations of certain species, like Eurasian water-milfoil for a few years.</li> <li>• Allows some loose sediment to consolidate, increasing water depth.</li> <li>• May enhance growth of desirable emergent species.</li> <li>• Other work, like dock and pier repair may be completed more easily and at a lower cost while water levels are down.</li> </ul>	<ul style="list-style-type: none"> <li>• May be cost prohibitive if pumping is required to lower water levels.</li> <li>• Has the potential to upset the lake ecosystem and have significant effects on fish and other aquatic wildlife.</li> <li>• Adjacent wetlands may be altered due to lower water levels.</li> <li>• Disrupts recreational, hydroelectric, irrigation and water supply uses.</li> <li>• May enhance the spread of certain undesirable species, like common reed (<i>Phragmites australis</i>) and reed canary grass (<i>Phalaris arundinacea</i>).</li> <li>• Permitting process may require an environmental assessment that may take months to prepare.</li> <li>• Unselective.</li> </ul>

### Mechanical Harvesting

Aquatic plant harvesting is frequently used in Wisconsin and involves the cutting and removal of plants much like mowing and bagging a lawn. Harvesters are produced in many sizes that can cut to depths ranging from 3 to 6 feet with cutting widths of 4 to 10 feet. Plant harvesting speeds vary with the size of the harvester, density and types of plants, and the distance to the off-loading area. Equipment requirements do not end with the harvester. In addition to the harvester, a shore-conveyor would be required to transfer plant material from the harvester to a dump truck for transport to a landfill or compost site. Furthermore, if off-loading sites are limited and/or the lake is large, a transport barge may be needed to move the harvested plants from the harvester to the shore in order to cut back on the time that the harvester spends traveling to the shore conveyor. Some lake organizations contract to have nuisance plants harvested, while others choose to purchase their own equipment. If the latter route is chosen, it is especially important for the lake group to be very organized and realize that there is a great deal of work and expense involved with the purchase, operation, maintenance, and storage of an aquatic plant harvester. In either case, planning is very important to minimize environmental effects and maximize benefits.



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### Costs

Equipment costs vary with the size and features of the harvester, but in general, standard harvesters range between \$45,000 and \$100,000. Larger harvesters or stainless steel models may

cost as much as \$200,000. Shore conveyors cost approximately \$20,000 and trailers range from \$7,000 to \$20,000. Storage, maintenance, insurance, and operator salaries vary greatly.

<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• Immediate results.</li> <li>• Plant biomass and associated nutrients are removed from the lake.</li> <li>• Select areas can be treated, leaving sensitive areas intact.</li> <li>• Plants are not completely removed and can still provide some habitat benefits.</li> <li>• Opening of cruise lanes can increase predator pressure and reduce stunted fish populations.</li> <li>• Removal of plant biomass can improve the oxygen balance in the littoral zone.</li> <li>• Harvested plant materials produce excellent compost.</li> </ul>	<ul style="list-style-type: none"> <li>• Initial costs and maintenance are high if the lake organization intends to own and operate the equipment.</li> <li>• Multiple treatments are likely required.</li> <li>• Many small fish, amphibians and invertebrates may be harvested along with plants.</li> <li>• There is little or no reduction in plant density with harvesting.</li> <li>• Invasive and exotic species may spread because of plant fragmentation associated with harvester operation.</li> <li>• Bottom sediments may be re-suspended leading to increased turbidity and water column nutrient levels.</li> </ul>

## Chemical Treatment

There are many herbicides available for controlling aquatic macrophytes and each compound is sold under many brand names. Aquatic herbicides fall into two general classifications:

1. *Contact herbicides* act by causing extensive cellular damage, but usually do not affect the areas that were not in contact with the chemical. This allows them to work much faster, but does not result in a sustained effect because the root crowns, roots, or rhizomes are not killed.
2. *Systemic herbicides* spread throughout the entire plant and often result in complete mortality if applied at the right time of the year.



Both types are commonly used throughout Wisconsin with varying degrees of success. The use of herbicides is potentially hazardous to both the applicator and the environment, so all lake organizations should seek consultation and/or services from professional applicators with training and experience in aquatic herbicide use.

Applying herbicides in the aquatic environment requires special considerations compared with terrestrial applications. WDNR administrative code states that a permit is required if “you are standing in socks and they get wet.” In these situations, the herbicide application needs to be completed by an applicator licensed with the Wisconsin Department of Agriculture, Trade and Consumer Protection. All herbicide applications conducted under the ordinary high water mark require herbicides specifically labeled by the United States Environmental Protection Agency.

Herbicides that target submersed plant species are directly applied to the water, either as a liquid or an encapsulated granular formulation. Factors such as water depth, water flow, treatment area size, and plant density work to reduce herbicide concentration within aquatic systems. Understanding concentration exposure times are important considerations for aquatic herbicides. Successful control of the target plant is achieved when it is exposed to a lethal concentration of the herbicide for a specific duration of time. Some herbicides are applied at a high dose with the anticipation that the exposure time will be short. Granular herbicides are usually applied at a lower dose, but the release of the herbicide from the clay carrier is slower and increases the exposure time.

Below are brief descriptions of the aquatic herbicides currently registered for use in Wisconsin.

Fluridone (Sonar<sup>®</sup>, Avast!<sup>®</sup>) Broad spectrum, systemic herbicide that is effective on most submersed and emergent macrophytes. It is also effective on duckweed and at low concentrations has been shown to selectively remove Eurasian water-milfoil. Fluridone slowly kills macrophytes over a 30-90 day period and is only applicable in whole lake treatments or in bays and backwaters where dilution can be controlled. Required length of contact time makes this chemical inapplicable for use in flowages and impoundments. Irrigation restrictions apply.

Diquat (Reward<sup>®</sup>, Weedtrine-D<sup>®</sup>) Broad spectrum, contact herbicide that is effective on all aquatic plants and can be sprayed directly on foliage (with surfactant) or injected in the water. It is very fast acting, requiring only 12-36 hours of exposure time. Diquat readily binds with clay particles, so it is not appropriate for use in turbid waters. Consumption restrictions apply.

Endothal (Hydrothol<sup>®</sup>, Aquathol<sup>®</sup>) Broad spectrum, contact herbicides used for spot treatments of submersed plants. The mono-salt form of Endothal (Hydrothol<sup>®</sup>) is more toxic to fish and aquatic invertebrates, so the dipotassium salt (Aquathol<sup>®</sup>) is most often used. Fish consumption, drinking, and irrigation restrictions apply.

2,4-D (Navigate<sup>®</sup>, DMA IV<sup>®</sup>, etc.) Selective, systemic herbicide that only works on broad-leaf plants. The selectivity of 2,4-D towards broad-leaved plants (dicots) allows it to be used for Eurasian water-milfoil without affecting many of our native plants, which are monocots. Drinking and irrigation restrictions may apply.

Triclopyr (Renovate<sup>®</sup>) Selective, systemic herbicide that is effective on broad leaf plants and, similar to 2,4 D, will not harm native monocots. Triclopyr is available in liquid or granular form, and can be combined with Endothal in small concentrations (<1.0 ppm) to effectively treat Eurasian water-milfoil. Triclopyr has been used in this way in Minnesota and Washington with some success.

Glyphosate (Rodeo<sup>®</sup>) Broad spectrum, systemic herbicide used in conjunction with a *surfactant* to control emergent and floating-leaved macrophytes. It acts in 7-10 days and is not used for submergent species. This chemical is commonly used for controlling purple loosestrife (*Lythrum salicaria*). Glyphosate is also marketed under the name Roundup<sup>®</sup>; this formulation is not permitted for use near aquatic environments because of its harmful effects on fish, amphibians, and other aquatic organisms.

Imazapyr (Habitat®) Broad spectrum, system herbicide, slow-acting liquid herbicide used to control emergent species. This relatively new herbicide is largely used for controlling common reed (giant reed, *Phragmites*) where plant stalks are cut and the herbicide is directly applied to the exposed vascular tissue.

### Cost

Herbicide application charges vary greatly between \$400 and \$1000 per acre depending on the chemical used, who applies it, permitting procedures, and the size of the treatment area.

<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• Herbicides are easily applied in restricted areas, like around docks and boatlifts.</li> <li>• If certain chemicals are applied at the correct dosages and at the right time of year, they can selectively control certain invasive species, such as Eurasian water-milfoil.</li> <li>• Some herbicides can be used effectively in spot treatments.</li> </ul>	<ul style="list-style-type: none"> <li>• Fast-acting herbicides may cause fishkills due to rapid plant decomposition if not applied correctly.</li> <li>• Many people adamantly object to the use of herbicides in the aquatic environment; therefore, all stakeholders should be included in the decision to use them.</li> <li>• Many herbicides are nonselective.</li> <li>• Most herbicides have a combination of use restrictions that must be followed after their application.</li> <li>• Many herbicides are slow-acting and may require multiple treatments throughout the growing season.</li> <li>• Overuse may lead to plant resistance to herbicides</li> </ul>

### Biological Controls

There are many insects, fish and pathogens within the United States that are used as biological controls for aquatic macrophytes. For instance, the herbivorous grass carp has been used for years in many states to control aquatic plants with some success and some failures. However, it is illegal to possess grass carp within Wisconsin because their use can create problems worse than the plants that they were used to control. Other states have also used insects to battle invasive plants, such as waterhyacinth weevils (*Neochetina spp.*) and hydrilla stem weevil (*Bagous spp.*) to control waterhyacinth (*Eichhornia crassipes*) and hydrilla (*Hydrilla verticillata*), respectively. Fortunately, it is assumed that Wisconsin's climate is a bit harsh for these two invasive plants, so there is no need for either biocontrol insect.

However, Wisconsin, along with many other states, is currently experiencing the expansion of lakes infested with Eurasian water-milfoil and as a result has supported the experimentation and use of the milfoil weevil (*Euhrychiopsis lecontei*) within its lakes. The milfoil weevil is a native weevil that has shown promise in reducing Eurasian water-milfoil stands in Wisconsin, Washington, Vermont, and other states. Research is currently being conducted to discover the best situations for the use of the insect in battling Eurasian water milfoil. Currently the milfoil weevil is not a WDNR grant-eligible method of controlling Eurasian water milfoil.



**Cost**

Stocking with adult weevils costs about \$1.20/weevil and they are usually stocked in lots of 1000 or more.

<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• Milfoil weevils occur naturally in Wisconsin.</li> <li>• Likely environmentally safe and little risk of unintended consequences.</li> </ul>	<ul style="list-style-type: none"> <li>• Stocking and monitoring costs are high.</li> <li>• This is an unproven and experimental treatment.</li> <li>• There is a chance that a large amount of money could be spent with little or no change in Eurasian water-milfoil density.</li> </ul>

Wisconsin has approved the use of two species of leaf-eating beetles (*Galerucella californiensis* and *G. pusilla*) to battle purple loosestrife. These beetles were imported from Europe and used as a biological control method for purple loosestrife. Many cooperators, such as county conservation departments or local UW-Extension locations, currently support large beetle rearing operations. Beetles are reared on live purple loosestrife plants growing in kiddie pools surrounded by insect netting. Beetles are collected with aspirators and then released onto the target wild population. For more information on beetle rearing, contact your local UW-Extension location.

In some instances, beetles may be collected from known locations (*cella* insectaries) or purchased through private sellers. Although no permits are required to purchase or release beetles within Wisconsin, application/authorization and release forms are required by the WDNR for tracking and monitoring purposes.

**Cost**

The cost of beetle release is very inexpensive, and in many cases is free.

<i>Advantages</i>	<i>Disadvantages</i>
<ul style="list-style-type: none"> <li>• Extremely inexpensive control method.</li> <li>• Once released, considerably less effort than other control methods is required.</li> <li>• Augmenting populations many lead to long-term control.</li> </ul>	<ul style="list-style-type: none"> <li>• Although considered “safe,” reservations about introducing one non-native species to control another exist.</li> <li>• Long range studies have not been completed on this technique.</li> </ul>