A Guide to the Control and Management *of* INVASIVE PHRAGMITES

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Introduction

An aggressive, nonnative variety of phragmites *(Phragmites australis)*, also known as common reed, is threatening the ecological health of Michigan wetlands and coastal shorelines.

Because this guide discusses tools that are not readily applied by the average landowner, it is intended primarily for land or resource managers from agencies, organizations, and businesses and extension agents or others in a similar position.

This invasive variety of phragmites is becoming widespread throughout the Great Lakes and is displacing the native variety of the same species, as well as many other native plants. Near-monotypic stands of this phragmites have replaced high-quality, complex communities of native plants over thousands of acres of Michigan wetlands and coastal areas. The rapid expansion of this variety of phragmites has resulted in adverse ecological, economic and social impacts on the natural resources and people of the Great Lakes.

The goal of this guide is to provide information about effective methods to control and manage phragmites. This guide presents a compilation of techniques, based on four years of research and more than 10 years of land managers' on-the-ground experience, to control the nonnative variety of phragmites, hereafter referred to simply as phragmites. Control of phragmites is one step toward a greater goal of restoring native wetland plant communities and protecting fish and wildlife habitat. The easiest way to control phragmites is to begin a control program as soon as it is observed on your property, before the plants become well established. In many areas, especially those with established phragmites, complete eradication may not be achievable. However, through periodic management, it is possible to maintain phragmites infestations at levels that allow for regeneration of native wetland plant communities and protection of fish and wildlife habitat.

left: Dense stand of phragmites that has displaced native vegetation. B. Avers

The Problem

Once phragmites invades, it causes adverse ecological, economic and social impacts including:

* *Threats to coastal and interior wetlands, which are Michigan's most biologically diverse and productive ecosystems.*
* *Domination of native vegetation, displacing desirable native plant species such as sedges, rushes and cattails, and reduction of plant diversity.*
* *Reduction of wildlife habitat diversity resulting in loss of food and shelter.*
* *Alteration of water regime, causing "drying" of marsh soils through increased evaporation and trapping of sediments.*
* *Reduction of property values due to use impairment.*
* *Restriction of shoreline views due to tall, dense stands.*
* *Reduction of access for swimming, fishing and hunting.*
* *Creation of potentially serious fire hazard to structures due to dry biomass during the dormant season.*

Understanding Phragmites

To better control and manage phragmites it is helpful to understand the physical characteristics of the plant, as well as how and when it reproduces and spreads.

In Michigan, phragmites is found growing in coastal and interior marshes, bogs, fens, swamps, lake margins, roadside ditches and other low wet areas. Typically it prefers the wetland-upland interface, though it can be found in dry uplands.

Phragmites continues to expand within Michigan, in part because it reproduces through wind dispersal of seeds and vigorous vegetative reproduction through rhizomes. Rhizomes broken by natural actions, such as waves, or man-made actions, such as dredging or disking, readily reroot in new locations. Rapid expansion also is facilitated by other disturbances that give phragmites a competitive edge, such as discharge of nutrients, wetland drainage, fire and road salt.

on page 2: Tall, dense stand of phragmites restricting views and access to water, and creating potential fire danger. J. Schafer

Illustration of the nonnative phragmites plant

[USDA NRCS PLANTS DATABASE]

Nonnative (background, left; dark leaves) and native phragmites (front, right; light green leaves) at Montezuma National Wildlife Refuge, NY. B. Blossey, Cornell University

Native Phragmites

typically has the following distinguishing traits:

* *Stems are reddish in the spring and summer and are smooth, shiny and flexible, while nonnative phragmites stems are tan and rough, dull and rigid.*
* *Leaves of native phragmites are lighter yellow-green, as opposed to dark blue-green.*
* *Rhizomes rarely exceed 15 millimeters in diameter and are yellow, as opposed to white to light yellow.*
* *Co-occurs with other plants, while nonnative phragmites typically grows as a monoculture.*

Plant Description

Phragmites is a perennial, warm season grass that can grow in dense stands and is long living.

Plants can reach 15 feet in height, yet more than 80 percent of the yearly biomass is contained below ground in a dense mass of roots and rhizomes. Stalks support flat, stiff leaves that are 0.5–2.0 inches wide near the base, tapering to a point at the end. Phragmites has gray-green foliage during the growing season, with distinctive purple-brown-silver seed head plumes appearing by late July. These plumes form at the end of stalks, are 6-20 inches long and up to 8 inches broad, and have many branches. Phragmites turns tan in the fall and most leaves drop off, leaving only the stalk and plume-topped shoot throughout winter.

Before attempting to control phragmites it is important to be able to identify the native phragmites and other native plants that grow under similar conditions in Michigan's coastal and interior wetlands. Field guides and other resources can be used to identify other wetland plants, and a website through Cornell University **(http://www.invasiveplants.net/phragmites/phrag/morph.htm)** can be used to identify native and nonnative phragmites.

Dormant
Germination
Primary Vegetative Growth
Flowering & Seed Set
Food to Rhizomes & Seed Shed
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Life Cycle

Phragmites reproduces through rhizomes, horizontal stems growing under the ground.

Rhizomes generate roots and stalks at regularly spaced nodes. An individual plant can multiply into a large stand through its rhizomes. Rhizomes may exceed 60 feet in length, grow more than 6 feet per year and readily grow into new plants when fragmented.

In addition to facilitating reproduction, phragmites rhizomes can penetrate the soil to a depth of more than 6 feet. This allows the plant to reach low-lying groundwater and tolerate a variety of conditions, including dry upland sites and wetlands with water depths exceeding 2 feet.

Mature plants produce as many as 2,000 seeds annually. Germination occurs in the spring, generally on exposed moist soils. Although seed viability is considered low and germination is a slower process than spreading by rhizome fragments, new stands of phragmites will develop from seed. Water depths greater than 2 inches typically prevent germination of seeds.

Effective control of phragmites hinges upon attacking the right portion of the plant at the proper times within the life cycle to slow or stop current and future growth.

left:
Approximate timing of the life cycle stages of phragmites throughout the year.
Photos: D. Avers.

Control Methods

This section will provide an overview of four broad control methods and recommendations based on field experience. Prior to implementation of any control methods, safety factors and permit requirements must be taken into consideration. Many control actions require permits from local, state and/or federal agencies.

Control programs can result in significant reduction of phragmites, but this requires commitment to an integrated approach and a long-term management strategy.

Few techniques are fully effective when used alone, and reinvasion by phragmites is likely when the management strategy is not maintained. The methods to be used for a particular site will depend upon existing conditions and management goals. Effective control of phragmites, particularly larger well-established stands, is likely to require multiple treatments using a combination of methods.

The use of herbicide treatment(s) (initial and spot treatments) is recommended as the primary control method and the first step toward effective control. After the initial herbicide treatment, one or more follow-up methods at each site will be required, such as: prescribed fire, mechanical treatment, or water level management. These follow-up methods will not only help provide multiple stresses on the plants, but also will prepare the site for subsequent years' herbicide treatments. Creating stresses through a regime of multiple treatments on the plants is the most effective way to control phragmites.

left: Aerial phragmites herbicide application at Nayanquing Point State Wildlife Area, Saginaw Bay, MI. D. Avers

Herbicides

Two broad-spectrum herbicides, glyphosate and imazapyr, are commercially available and known to control phragmites effectively when used properly.

These chemicals are nonselective and will enter any plant species through contact with the leaves or stems. Therefore, impacts on other native plants may occur if the product is applied incorrectly. Both herbicides are available in separate formulas for application either on aquatic (wet) or terrestrial (dry) sites. Improper use of the terrestrial formulations in an aquatic habitat may harm fish and macroinvertebrates and is a violation of federal and state laws.

Glyphosate and imazapyr can be used individually or combined to control phragmites (Table 1). While the cost per

left: Spot treating phragmites with a backpack sprayer. L. Esman

below: Table 1. Herbicide Application Information

		Imazapyr	Glyphosate	Combination
Treatment Timing		Apply to actively growing green foliage after full leaf elongation and up to first killing frost (i.e., June up to first killing frost)	Apply after plants are in full bloom in late summer up to the first killing frost (i.e., late August up to first killing frost)	Apply after plants are in full bloom in late summer up to the first killing frost (i.e., late August up to first killing frost)
Herbicide Rate	High Volume	Six pints per acre	Six pints per acre	Three pints glyphosate and three pints imazapyr per acre
	Low Volume	1 - 1.5% solution	1 - 1.5% solution	No recommended rate is available
Cost		High	Low	Medium
Effectiveness		High Allows treatment earlier in the growing season	Medium Good results where water level management is available	High Recommended for most sites

Table 2. Herbicide Application Methods

Method	Phragmites Stand Characteristics	Site Conditions	Treatment Technique	Precautions
Injecting Stems	Scattered or isolated	Effective in areas where impacts to desirable, native plant species must be avoided.	Cut plants to waist height. Add one drop of herbicide to hollow stems with a squirt bottle or syringe.	Seed heads should be removed from the site after cutting to prevent seed spread.
Hand Swiping	Scattered or isolated	Effective in areas where impacts to desirable, native plant species must be avoided.	Cover (wipe) each individual stem using a cotton wicking glove worn over a chemical resistant glove.	Use care not to over-saturate or drip herbicides on native vegetation.
Backpack Sprayer	Scattered to moderately dense stands	Use on low-wind days to prevent drift outside the treatment area. Use carefully to avoid native plants.	Spray close to leaves using low pressure.	Utilize flat fan nozzles to minimize non-target exposure.
Wick or Dauber	Moderately dense to dense stands greater than 1 acre	Targets phragmites without impacting shorter plant species. Useful when complete eradication of all plants is not desired.	Saturate absorbent material with low pressure sprayers attached to an ATV or tractor. The area must be covered twice, in opposite directions.	Herbicide will not be effective on stems broken or damaged by the equipment.
Boom Sprayer	Dense stands greater than 1 acre	Use on low-wind days to prevent drift outside the treatment area. Use carefully to avoid native plants.	Attach low pressure boom sprayers to an ATV or tractor.	Herbicide will not be effective on stems broken or damaged by the equipment.
Aerial Application	Dense stands greater than 5 acres	Use on low-wind days to prevent drift outside the treatment area. Use carefully to avoid native plants.	Spray area from helicopter booms using proper droplet size, boom length and nozzle type.	Large scale application may affect adjacent plant communities. Using a skilled pilot is imperative.

–Herbicides–

gallon of imazapyr can be significantly higher than glyphosate, results from recent studies suggest that imazapyr used alone or in combination with glyphosate can control phragmites for a longer period of time (Getsinger et al., 2007). In most cases, herbicides should be used in conjunction with burning or mechanical methods, and reapplied in subsequent years to spot-treat individual plants or patches of plants that were not eliminated completely in the first application.

Numerous methods may be used to apply these herbicides depending on the size of the phragmites stand and existing site conditions, as identified in Table 2. Application rates for low-volume spot treatment methods, such as injecting stems, hand swiping, wicks and backpack spraying, are calculated by percent of solution (e.g., 2 ounces of herbicide in 1 gallon of water yields a 1.5-percent solution). Application rates for high-volume treatment methods, such as boom sprayers, hand gun and aerial applications, are calculated on a per-acre rate.

To ensure the herbicide is taken up by the plants, a state-approved nonionic surfactant must be used in conjunction with the herbicide(s) at the rate recommended on the label. Spray should be applied to wet the leaves and, when present, the flower plumes of the target plants. Excessive application, such that the chemicals are dripping off the plants, should be avoided because it is more costly, can cause increased injury to desirable nontarget species and often decreases the success of control. Visual effects, such as browning or withering of the plants, may not occur for several weeks. If the herbicide is applied close to the first killing frost, symptoms may not have time to appear before the plant dies back for the year. In this case, control effectiveness may not be determined until the following growing season.

When using herbicides, always read and follow directions on the manufacturer's label. These directions must be followed in order to achieve legal, safe and effective treatment of phragmites. Only trained individuals should apply herbicides. Pesticide use certification, which can be obtained in Michigan through the Department of Agriculture, is required prior to the use of imazapyr and recommended prior to the use of glyphosate. Permits are required in Michigan when applying herbicide to phragmites in standing water or below the ordinary high-water mark of the Great Lakes and Lake St. Clair.

Consult the Michigan Department of Environmental Quality (MDEQ) website at **http://www.michigan.gov/deqinlandlakes** *or contact the MDEQ Environmental Assistance Center (EAC) at 1-800-662-9278 for more information about Aquatic Nuisance Control Permits. Contact local municipal offices for information on city or township requirements.*

Because phragmites stands burn hot and fast, safety is paramount when using prescribed fire and a burn plan should be prepared prior to initiating any work. Preparation of a burn plan will help prevent unintended spot-fires and minimize adverse impacts to wildlife, sensitive plant species and adjacent property owners. Prescribed fire must be handled carefully and should be conducted only by properly trained individuals. More information can be found on the Michigan Prescribed Fire Council website at **http://www.firecouncil.org.** *Approval from the local municipality and fire department will likely be required prior to the prescribed fire.*

left: Using prescribed fire after an initial herbicide treatment, Erie Marsh Preserve, MI. H. Braun

Prescribed Fire

Prescribed fire is a tool that can be used after an herbicide treatment to remove excess biomass, potentially kill any living rhizomes and promote native plant growth.

In situations where prescribed fire can be implemented it is easier to locate phragmites regrowth and spot-treat those plants with herbicides once a site has been cleared of the thick, dead stems. In situations where it can be implemented safely and effectively, prescribed fire is a cost-effective and ecologically sound tool to help control phragmites. Prescribed fire is recommended where phragmites exists in large dense stands. Use of prescribed fire without first treating with herbicides does not control phragmites, and instead may encourage rhizome growth and cause phragmites populations to become more vigorous.

Prescribed fire should be conducted the year following herbicide treatment, either in late summer (mid-July through August) or winter (January until prior to spring green-up). Both options are very effective in controlling phragmites and encouraging native plant growth.

Prescribed fire conducted in late summer as a second-year treatment following an herbicide treatment is preferred. A prescribed fire in late summer destroys seed heads, removes dead stems, and helps kill any phragmites plants that survived the initial herbicide treatment. Burning during this time frame also will provide for green-up of native plants before first frost. Late summer prescribed fires should be conducted when conditions are as dry as possible to achieve a complete burn of plants.

If it is anticipated that a prescribed fire cannot be accomplished during the summer period, then an earlier burn in the winter (January until prior to spring green-up) following an herbicide treatment is recommended. A winter burn can prepare the site for subsequent herbicide treatments and removes dead stems, allowing sunlight to stimulate new growth of many plant species. Once a site has been cleared of the thick, dead stems, it will be easier to locate phragmites regrowth and spot-treat those plants with herbicides. Be aware, however, that burning during this time frame can also stimulate growth of phragmites plants that survived the initial herbicide treatment (Getsinger et al., 2007).

Mechanical Treatment

Mechanical treatments are used most effectively following an herbicide treatment to remove dead stems and promote native plant growth. This also aids in the identification of new phragmites growth for subsequent herbicide spot treatments. When burning is not feasible, mechanical treatment is recommended.

Mechanical treatment should be limited to only those areas where phragmites is present, and should not include broad-scale mowing of other wetland vegetation.

Mechanical control of phragmites includes the use of weed whips, small mowers, brush hogs, and flail mowers or hand-cutting of stems and seed heads. The use of mechanical equipment is highly dependent on the size and wetness of the site and the density of phragmites. Weed whips or handheld cutting tools are ideal for use on wet or dry sites with low plant densities. Small mowers can be used effectively on low density sites. Larger mowers can be used on sites with a higher density of plants, but the site must be dry enough to support the weight of the mower in order to avoid soil disturbance.

If mechanical treatment methods are chosen as part of a phragmites management plan, it is critical to adhere to the following timing recommendations. Mechanical treatments should not occur until at least 2 weeks after herbicide treatment to allow plant absorption of the herbicide. To remove dead stems on dry sites after an herbicide treatment, mechanically cut the treated plants once within a period from late summer or fall until prior to spring green-up. On wet sites, mechanically cut the treated plants once when the ground is frozen to minimize soil disruption. Mowing/cutting should occur only during time frames that will avoid soil disturbance.

Once an area has been mowed or cut, thatch should be raked, bagged and disposed of in an appropriate location to prevent seed spread and to allow sunlight

In Michigan, mowing and cutting phragmites below the ordinary high-water mark of the Great Lakes and Lake St. Clair requires a permit from the MDEQ, Land and Water Management Division. Permit applications can be obtained from the MDEQ website at **http://www.michigan.gov/deqwetlands.** *Mowing stands of phragmites in inland wetlands may also require a permit. Before initiating any cutting or mowing regimen, contact the MDEQ EAC at 1-800-662-9278 for more information about Land and Water Management permits.*

left: Using a brush hog to mechanically remove dead phragmites stems after an herbicide treatment; St. Clair Flats Wildlife Area, MI. J. Schafer

-Mechanical Treatment-

to reach the soil surface. This ensures that the native seed bank will have an advantage during the subsequent growing season. Use of a flail-type mower can eliminate the need for thatch removal, since it will destroy most plant parts adequately.

Under limited circumstances, for example, when isolated plants or low density stands of phragmites exist and herbicide treatment is not feasible, mechanical treatments alone may be used to reduce phragmites and encourage native plants. In these situations, cutting individual plants or mowing small areas of phragmites once during late summer/fall (September to first killing frost) appears to have the best results because it eliminates the surface biomass of the plant when it is using most of its energy for flower and seed production. Cutting/mowing in late summer also eliminates potential disruption to the breeding and nesting seasons for most birds. If a mower is used instead of handheld tools, then the mower deck should be set to a mowing height greater than 4 inches to minimize impact on small animals and native plants. Mechanical treatments are not intended to create the appearance of a manicured lawn, but to allow reestablishment of native wetland vegetation. Cutting/mowing should occur only in those areas where phragmites is present.

Mechanical methods must be used carefully to avoid stimulating growth of phragmites. Mowing alone leaves the plants' rhizomes behind. Regeneration from those rhizomes may cause an increase in stand density. Improper use of mechanical methods, such as cutting during the wrong time of year, cutting too frequently, too short, or where native plants are present, can disrupt wildlife and destroy existing native plants. Disking soil is not recommended as a mechanical control method for phragmites, since it results in the spread of rhizomes and the production of new plants. Equipment used to manage phragmites must be cleaned properly of all debris before it is removed from the treatment site to prevent the unintended spread of seeds or rhizomes to other areas.

left: Using a weed whip to mechanically treat a small stand of phragmites; Nayanquing Point State Wildlife Area, MI. D. Avers

Water Level Management "FLOODING"

In impounded sites where water levels can be readily manipulated, phragmites can be controlled effectively through an herbicide treatment followed by prescribed burning and flooding.

Although phragmites is intolerant of persistent flooding, increasing water level alone is not effective in controlling it.

Traditional moist soil management, in which impoundments are drawn down to produce mud flats in early summer, may encourage growth of phragmites.

If phragmites is on site or in the surrounding landscape, managers should use caution when timing drawdowns. Drawdowns should be conducted in late summer (late July) to maintain and promote native vegetation and to avoid reestablishment of phragmites.

In Michigan, a permit from the MDEQ, Land and Water Management Division, is required prior to manipulating water levels in impoundments. The permit application can be found at **http://www.michigan.gov/deqwetlands.**

left: Pumping station used for controlling water levels in a wetland impoundment; St. Clair Flats Wildlife Area, MI. J. Schafer

Recommended Management Strategies

Because of the physiology of phragmites, well-established stands are difficult to control with only one herbicide treatment.

An initial herbicide treatment stresses the plants, making them particularly vulnerable to subsequent treatments. Creating multiple stresses on the plants is the most effective way to control phragmites. Herbicide treatment in conjunction with prescribed fire, mechanical treatment or flooding have proven to be effective in controlling phragmites and allowing native plants to reestablish.

Before control methods are implemented, it is important to evaluate the site properly to determine the density of phragmites within the overall stand of plants, the wetness of the site and the size of the area infested by phragmites. Using this information and recognizing that control of phragmites likely will require a long-term commitment, a comprehensive management plan can be formulated and implemented.

The following three management strategies have been developed based on past efforts to control phragmites. The three strategies provide information and steps in controlling phragmites under certain conditions. These strategies basically follow one of the three general approaches in table 3. Together these strategies and approaches to managing phragmites can be used to develop more comprehensive management plans.

left: Dead stems of phragmites the summer after an aerial herbicide treatment and natural vegetation regrowth; St. Clair Flats Wildlife Area, MI. J. Schafer

Management Strategy

for **large, dense stands** of phragmites *on a wet or dry site*

1. *Treat phragmites stands with herbicide in early summer or late summer, depending upon the type of herbicide used (see Herbicides section). Wait at least two weeks to allow plant exposure to the herbicide.*
2. *Conduct the prescribed fire in the year following herbicide treatment either in (a) late summer (mid-July through August) or (b) winter (January until prior to spring green-up), if prescribed fire cannot be accomplished during the summer.*
3. *Check site the following growing season for phragmites regrowth and spot-treat with herbicide if needed.*

If prescribed fire is not possible, mechanically treat wet sites when ground is frozen to minimize soil disturbance. On dry sites, mechanically cut treated plants once after an herbicide treatment beginning in late summer or fall until prior to spring green-up. Herbicide spot treatment will be needed during the next growing season.

left: Large, dense stand of phragmites.
B. Avers

Management Strategy

for **large, dense stands** of phragmites *in impoundments*

Note:

For small, scattered stands of phragmites within an impoundment, steps 1–5 may not all be necessary. In these cases, treat with herbicide and maintain water levels throughout the next growing season. Spot treatment with herbicide may be needed the following year.

1. *Treat phragmites stands with herbicide in late summer (late August and September), followed immediately by flooding to a minimum water depth of 6 inches. (It is not necessary to dewater the site prior to herbicide application.)*
2. *Allow the site to remain flooded until the next summer, and then dewater in late July.*
3. *Keep the site as dry as possible until mid-August, at which time use prescribed fire.*
4. *Immediately following the burn, flood the site to a minimum water depth of 6 inches and maintain this water depth for at least one year.*
5. *Check site the following growing season for phragmites regrowth and spot-treat with herbicide if needed.*

If prescribed fire is not feasible for a site, it is recommended that the site be mechanically treated during the winter in a frozen condition to remove the dead plants that have persisted from the herbicide treatment.

Management Strategy

for **low-density stands** of phragmites *on a wet or dry site*

1. *Treat phragmites stands with herbicide in early summer or late summer, depending upon the type of herbicide used (see Herbicides section). Wait at least 2 weeks to allow plant exposure to the herbicide.*
2. *Mechanically treat site beginning in late summer or fall until prior to spring green-up, or when the ground is frozen for wet sites with hand tools, weed whips or small mowers where dense stands of phragmites are present.*
3. *Check site the following growing season for phragmites regrowth and spot-treat with herbicide if needed.*

left: Low-density stand of phragmites at St. Clair Flats State Wildlife Area, MI. J. Schafer

Table 3. Three integrated multi-year approaches to managing phragmites.

		APPROACH 1	APPROACH 2	APPROACH 3
Year 1	Jan			
	Feb			
	Mar			
	April			
	May			
	June	herbicide treatment with imazapyr		
	July		OR	
	Aug			
	Sep	herbicide treatment with glyphosate or imazapyr/glyphosate combo		
	Oct			mechanical treatment
	Nov			
	Dec			
Year 2	Jan		prescribed burn	
	Feb			
	Mar			
	April			
	May			
	June		spot treat with imazapyr (if necessary)	
	July	prescribed burn	OR	
	Aug			
	Sep		spot treat with glyphosate (if necessary)	
	Oct			
	Nov			
	Dec			
Year 3	Jan			
	Feb			
	Mar			
	April			
	May			
	June		spot treat with imazapyr	
	July		OR	
	Aug			
	Sep		spot treat with glyphosate	
	Oct			
	Nov			
	Dec			

Long-Term Management *and* Monitoring

MANAGEMENT OF A SITE TO CONTROL PHRAGMITES DOES NOT END WITH THE SUCCESSFUL IMPLEMENTATION OF ONE OR MORE OF THE CONTROL METHODS DESCRIBED ABOVE, BUT RATHER BEGINS WITH THESE INITIAL STEPS.

Because of the pervasiveness of this species and its ability to aggressively recolonize through seed or rhizomes, long-term management and monitoring are necessary.

The control methods described above are likely to be successful in controlling phragmites for one to two years without additional action. However, phragmites typically begins to recover three years after treatment and will become reestablished if follow-up management is not implemented. After removal from a site, phragmites will continue to recolonize from remnant and neighboring populations and the existing seed bank in the soil.

Annual maintenance is essential to the success of any habitat restoration plan and should focus on selectively removing pioneer colonies of phragmites. Once areas of phragmites have been controlled (e.g., greater than 85-percent reduction), it is recommended that an annual maintenance control program be implemented. Successful long-term management plans should incorporate one or more of the control methods, including spot treatment with herbicide, mowing during the recommended time and/or use of prescribed fire. For example, annual spot treatments of pioneer colonies of phragmites with herbicides can provide up to 100-percent control of phragmites and discourage its spread, while enhancing the recovery and growth of native plants.

left: Restoration site in year three of a phragmites control plan, Bay City State Recreation Area, MI. Note dead stands of phragmites and native vegetation that has reestablished. B. Avers

-Long-Term Management and Monitoring-

To reach the goal of reestablishing and restoring native wetland plant communities, controlling invasive species is a necessary step. Implementing selective control, as needed, will not only keep phragmites from reestablishing dominance, but also will pave the way for the recovery of beneficial native species of wetland vegetation. Seeding an area after phragmites control to restore native wetland communities typically is not necessary since native seeds normally are present in the soil. It is recommended that native vegetation be allowed to reestablish naturally. However, if monitoring determines that native plants are not responding, some sites may require seeding or planting using native genotypes to reach restoration goals.

Monitoring and adaptive management are integral components of a successful phragmites control plan. A detailed monitoring plan should be developed prior to implementation of control measures. Monitoring provides the data needed to determine the effectiveness of initial control efforts and the types of follow-up control methods that are necessary. Monitoring may be as simple as establishing and using fixed photo points on the site to record changes over time, or more involved, such as comparison of aerial photographs taken over time or the use of quantitative measurements and inventories of vegetation using sampling grids or transects. At a minimum, each treated site should be inspected annually during the growing season.

In the future there may be an effective biological control for phragmites, just as beetles can now be used to control purple loosestrife in certain situations. Currently there are no commercially available biological methods for the control of phragmites; however, several insects and microorganisms native to Europe are known to attack phragmites. Ongoing research at Cornell University is exploring the possibility of using these species as a means of biological control (**http://invasiveplants.net**).

left: Great Lakes coastal wetland at St. Clair Flats State Wildlife Area, MI. J. Schafer

A Call to Action

Whether the goals are to restore native plant communities and wildlife habitat or improve a lakeside view and recreational opportunities, the charge is the same—to control phragmites in coastal and interior wetlands of Michigan.

Before an agency or organization engages in efforts to control phragmites, it is important to establish realistic goals and realize that achievement of these goals will involve an ongoing commitment and an annual investment of time and resources. Agencies and organizations have the opportunity to work together and may be much more effective by pooling resources to achieve control in targeted geographic areas.

While phragmites control can involve a significant expenditure of resources, the environmental and social benefits derived from restoring native wetland communities to the coastal and interior wetlands of Michigan are even greater.

Many species—and people—benefit from wetlands: (top to bottom) recreational bird watcher; black tern, J. Schafer; fox snake, J. Schafer; king rail, endangered, USFWS. far left (page 32): Mallard ducklings, Al & Elaine Wilson

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Reference Information

More information on phragmites control can also be found in the following:

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