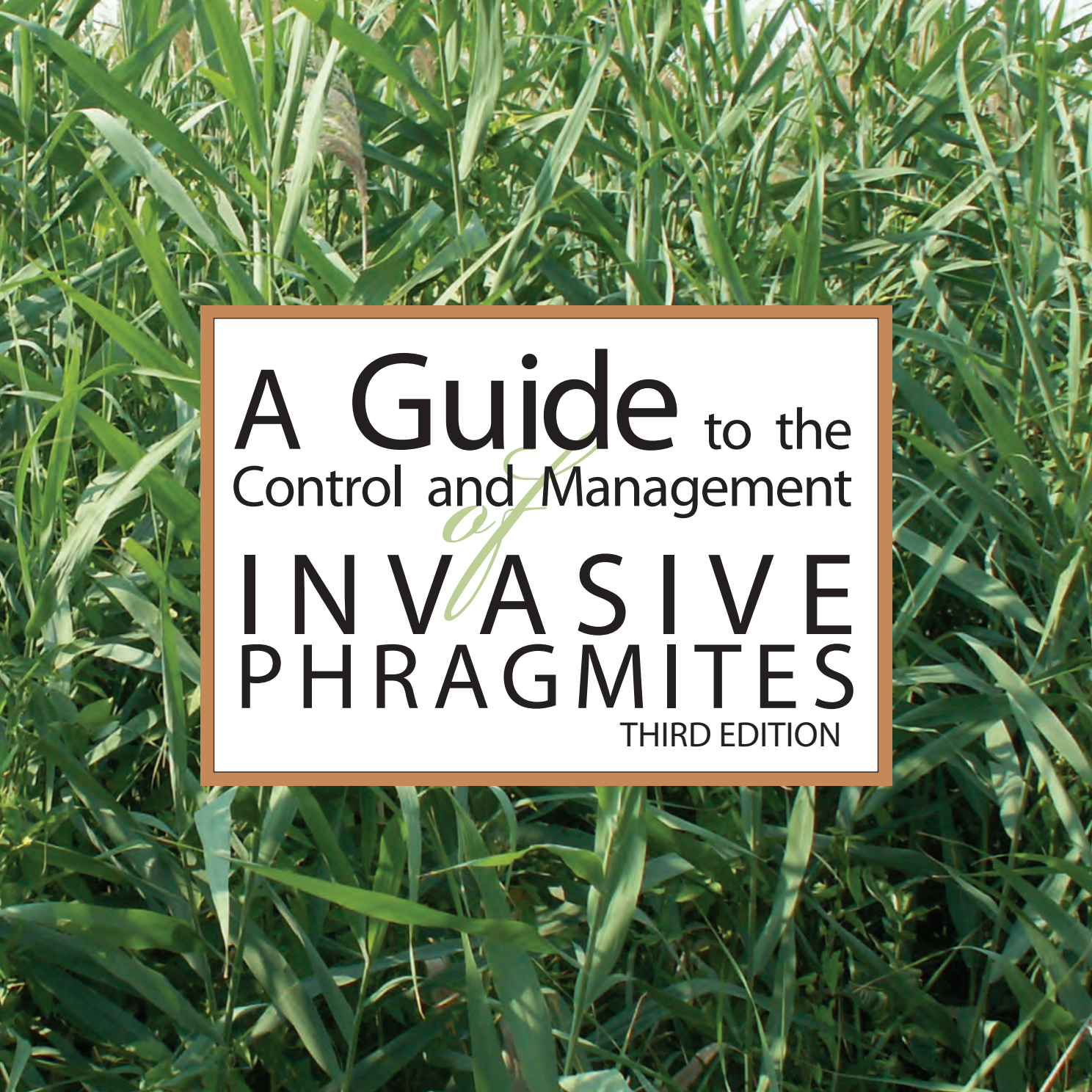

A Guide to the Control and Management of INVASIVE PHRAGMITES

THIRD EDITION

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Third Edition 2014

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Table of Contents

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; 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 aggressive grass 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 4 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

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 is also facilitated by physical and chemical disturbances that give Phragmites a competitive edge, such as discharge of nutrients, wetland drainage, fire, and road salt.

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.*

left: 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]

seed head plumes

purple-brown-silver;
6-20 inches long and up to 8 inches broad

flat, stiff leaves/blades

0.5-2.0 inches wide near the base,
tapering to a point at the end

ligules

narrow and sturdy, 0.1-0.4 mm

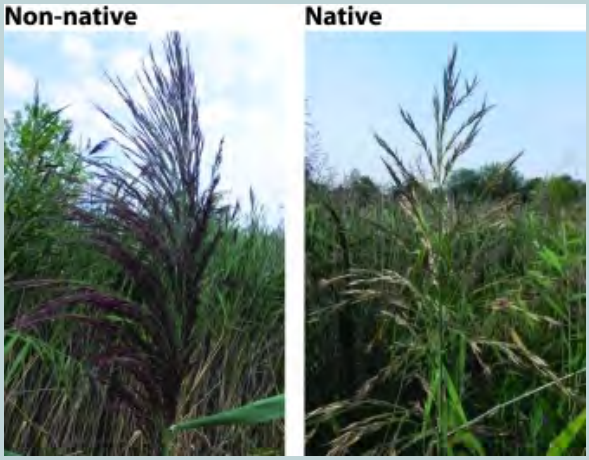
glumes

short, 2.6-4.2 mm

rhizomes

horizontal, underground stem;
sends out roots and shoots
from nodes;

Photos: Michigan Natural Features Inventory



Plant Description

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

Plants can reach 20 feet in height, yet more than 80% 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.

Before attempting to control Phragmites, it is important to be able to distinguish the native Phragmites subspecies (*americanus*) from the invasive subspecies (*australis*). The following table can be used to help distinguish native and invasive Phragmites.

Characteristic	Native	Nonnative (Invasive)
Density	Sparse or co-occuring with other plants. Stems often break down each season and allow undergrowth to occur.	Dense, near monocultures. Young stands look similar to native, but lack seed heads Stems persist from year to year.
Size	Grows to 6.5 feet high.	Grows to 20 feet high.
Stems	Can be shiny and red near base. May have small black dots.	Dull and tan/green. Horizontal stems (stolons) can appear red.
Leaves	Pliant yellow-green with sheaths that readily fall away (absent in winter).	Bluish-green leaves that are flat and somewhat stiff with sheaths that remain close to the stem and persist through winter.
Ligules (membrane that connects leaf sheath to stem)	Frays and sheds by midsummer, measures 0.4-1.0 mm.	Narrow and sturdy measuing 0.1-0.4 mm.
Seed head plumes	Brown in color and appearing much less dense than nonnative.	Purple-brown or silver, appear early and develop more branching. Dense.
Glumes (bracts at base of spikelets)	Long lower glumes measuring 4-7 mm.	Shorter glumes measuring 2.6-4.2 mm.


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 seeds and 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 or soils exposed through disturbance. 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 optimal methods 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 treatments (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 is recommended, 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

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 experienced individuals should apply herbicides. Pesticide use certification, which can be obtained in Michigan through the Michigan Department of Agriculture and Rural Development, 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.

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 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 as a control strategy for Phragmites (Table 1). The cost per gallon of imazapyr can be significantly higher than glyphosate, though some studies suggest that imazapyr used alone or in combination with glyphosate can control Phragmites for a longer period of time. For best results, herbicides should be used in conjunction with burning or mechanical methods and, when necessary, reapplied in subsequent years to spot treat individual plants or patches that were not eliminated completely in the initial 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% solution). Application rates for high volume treatment methods, such as boom sprayers, hand gun, and aerial applications, are calculated on a per acre rate.

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.

left: Spot treating Phragmites with a backpack sprayer. J.F. New and Associates Inc.

Table 1. Herbicide Application Information

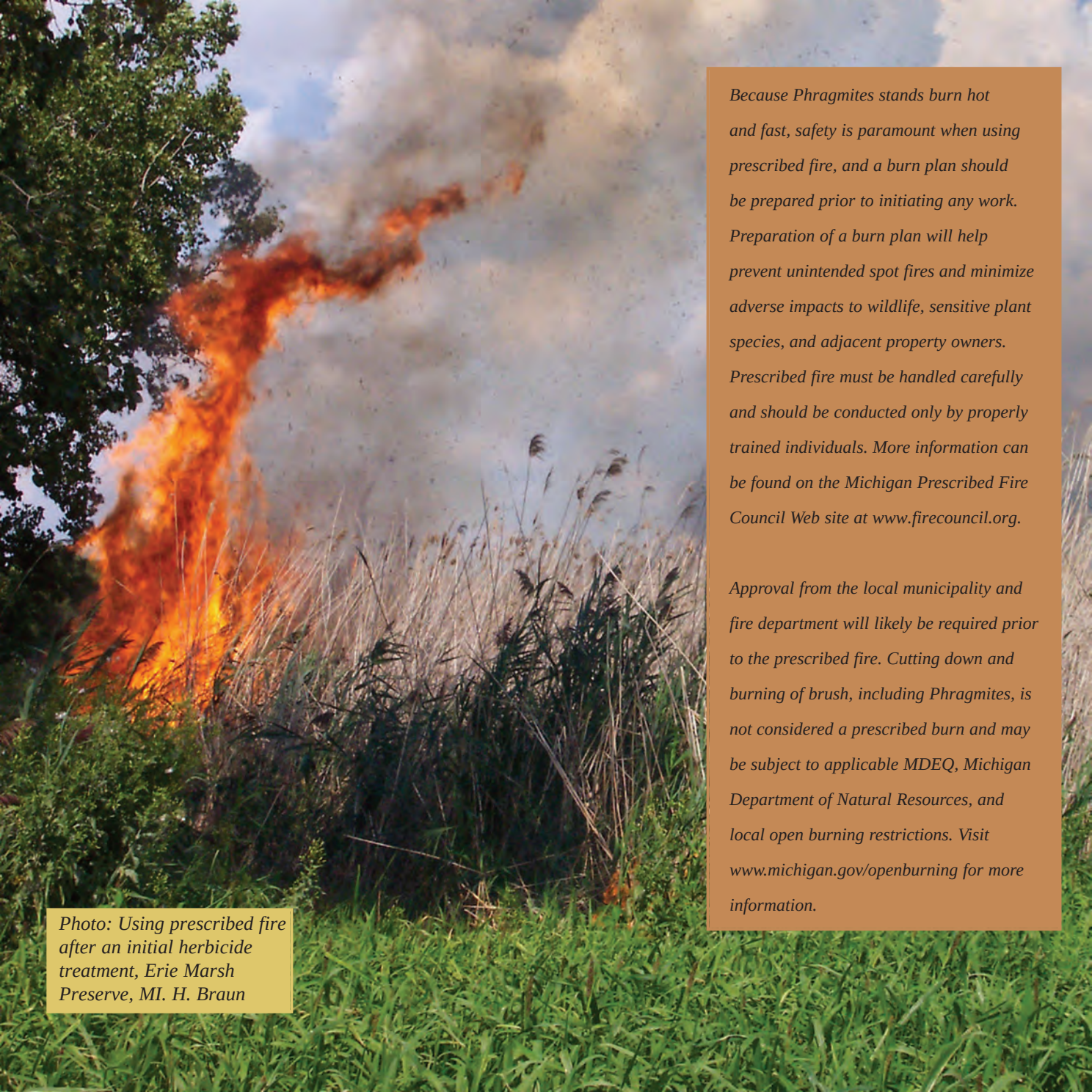
		Imazapyr	Glyphosate	Combination
Treatment Timing		Apply to actively growing green foliage after full leaf elongation and up to first killing frost (i.e., August up to first killing frost). If stand has substantial amount of old stem tissue, allow to regrow to approximately 5 feet tall before treatment	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	4 to 6 pints per acre	6 pints per acre	3 pints glyphosate and 3 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 Acts slowly and can remain active in the soil during the following year or more	Medium Good results with follow-up treatment or where water level management is available	High Recommended for most dense Phragmites stands
Precautions		Non-seclective and may persist actively in the soil for multiple years. Can move along roots and kill non-target species including nearby woody species. Not recommended for treatment in high quality areas with diverse native vegetation.	Non-selective and can kill non-target species when sprayed on foliage. May not be thoroughly transferred to roots in the first year and typically requires subsequent treatment.	Non-selective and may persist actively in the soil for multiple years. Can move along roots and kill non-target species including nearby woody species. Not recommended for treatement in high quality with diverse native vegetation.

To ensure the herbicide is taken up by the plants, it is recommended that a state-approved nonionic surfactant be used in conjunction with the herbicide(s). The use of a state-approved colorant or tracer dye is also suggested to help identify plants that have already been treated and to avoid impacts to nontarget plants.

Consult the Michigan Department of Environmental Quality (MDEQ) Web site at www.michigan.gov/anc or contact the MDEQ's 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.

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. Also recommended for follow-up treatments where native vegetation is recovering.	Cover (wipe) each individual stem using a cotton wicking glove worn over a chemical resistant glove.	Use care not to oversaturate 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. Also recommended for follow-up treatments where native vegetation is recovering.	Saturate absorbent material with low pressure sprayers attached to an ATV or tractor. The area must be covered twice.	Herbicide may 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 may 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.



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 Web site at www.firecouncil.org.

Approval from the local municipality and fire department will likely be required prior to the prescribed fire. Cutting down and burning of brush, including Phragmites, is not considered a prescribed burn and may be subject to applicable MDEQ, Michigan Department of Natural Resources, and local open burning restrictions. Visit www.michigan.gov/openburning for more information.

Photo: 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. When done properly, prescribed fire may also promote native plant growth.

Using prescribed fire will clear the treatment area of thick, dead stems and make it easier to locate and spot treat Phragmites regrowth. 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. However, careful consideration must be given to nesting birds, amphibians, and reptiles before burning anytime other than during winter.

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 will also 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 spottreat 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 although the benefits of biomass removal and native plant regrowth may outweigh this risk.

In Michigan, mowing and cutting Phragmites below the ordinary high water mark in the St. Clair Flats requires a permit from the MDEQ Water Resources Division. The permit application can be obtained from the MDEQ website at www.michigan.gov/jointpermit. It is also important to note that mowing stands of Phragmites within other protected areas, such as conservation easements, environmental areas, ect. may also require a permit.

Photo: Using a brush hog to mechanically cut down dead Phragmites stems after an herbicide treatment; St. Clair Flats Wildlife Area, MI. J. Schafer

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 and opens up the canopy to promote the growth of native species. When burning is not feasible, mechanical treatment is recommended.

Mechanical methods must always be used carefully to avoid stimulating growth of Phragmites. Mowing alone leaves the plants' rhizomes behind, and 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 as well as the disruption of wetland soil needed for native plants and animals to thrive. 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.

Mechanical treatments are not intended to create the appearance of a manicured lawn, but to allow reestablishment of native wetland vegetation. Mechanical treatment should be limited to only those areas where Phragmites is present, and should not include broad-scale mowing of other wetland vegetation.

Post-herbicide Mowing

Mechanical control of Phragmites by conducting postherbicide mowing 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. Mower decks should always be set to a mowing height of 4 inches or greater to minimize impact on small animals and native plants.

When conducting postherbicide mowing as part of a Phragmites management plan, it is critical to adhere to the following timing recommendations. Postherbicide mowing should not occur until at least 2 weeks after herbicide application, 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 fall until March 1. For the best results, mechanically cut the treated plants once when the ground is frozen to avoid soil disruption.

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

Once an area has been mowed or cut, thatch can be raked, bagged, and disposed of in an appropriate location to prevent seed spread and to allow sunlight 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. When thatch removal is not feasible, it can be left in place; however, this could somewhat slow the rate of revegetation by native plant species.

Under limited circumstances when herbicide treatment is not feasible, mechanical treatments alone may be used to reduce Phragmites and encourage growth of native plants. For example, when isolated plants or low density stands of Phragmites exist, cutting individual plants or mowing small areas of Phragmites once during late summer/fall (September to first killing frost) eliminates the surface biomass of the plant when it is using most of its energy for flower and seed production. In a situation where the Phragmites stand is dense but herbicide is not an option, mowing during the winter when the ground is frozen can remove the standing dead stems to improve native vegetation growth in the spring, while minimizing soil disturbance and impacts to nesting birds and wildlife.

Pre-herbicide Mowing

In some cases, where Phragmites stands are very dense and the plants are very tall, a preherbicide mow may improve the likelihood of success when done properly. Because standing dead stems in older dense stands of Phragmites can inhibit access to new Phragmites growth during herbicide application, mowing dead stems prior to herbicide application can be helpful. Preherbicide mowing should ideally reduce Phragmites stem height to 4-12 inches.

In order to minimize impacts to nesting birds and wildlife as well as allow sufficient time for new Phragmites stems to leaf out and develop the seed head, it's best to cut dead Phragmites stems in the winter prior to herbicide treatment (before March 1). If winter mowing is not possible, it may still be beneficial to conduct a pre-herbicide mow after July 15; however, it is critical that the mowing be conducted a minimum of 4 weeks prior to herbicide application in order to allow sufficient leaf and seed head growth.

No preherbicide mowing should occur between March 1 and July 15 to avoid impacts to nesting birds and animals.

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.

In Michigan, a permit from the MDEQ's Water Resources Division is required prior to manipulating water levels in impoundments. The permit application can be found at www.michigan.gov/jointpermit.

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.

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

Photo: Dead stems of Phragmites the summer after an aerial herbicide treatment and natural vegetation regrowth; 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.

Additionally, the MDEQ has developed a tool to help management groups prioritize the treatment and management of invasive Phragmites in Michigan. The tool was designed to help compare many potential treatment sites so that groups can strategically allocate limited resources. To view the tool, visit www.michigan.gov/aquaticinvasives and follow the links for Phragmites.

Management Strategy

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

1. Treat Phragmites stands with herbicide in midsummer 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. Conduct the prescribed fire in the year following herbicide treatment either in (a) late summer (mid-July through August)(Approach 1); or (b) winter (January until prior to spring green-up), if prescribed fire cannot be accomplished during the summer (Approach 2).

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 low density stands of Phragmites on a wet or dry site

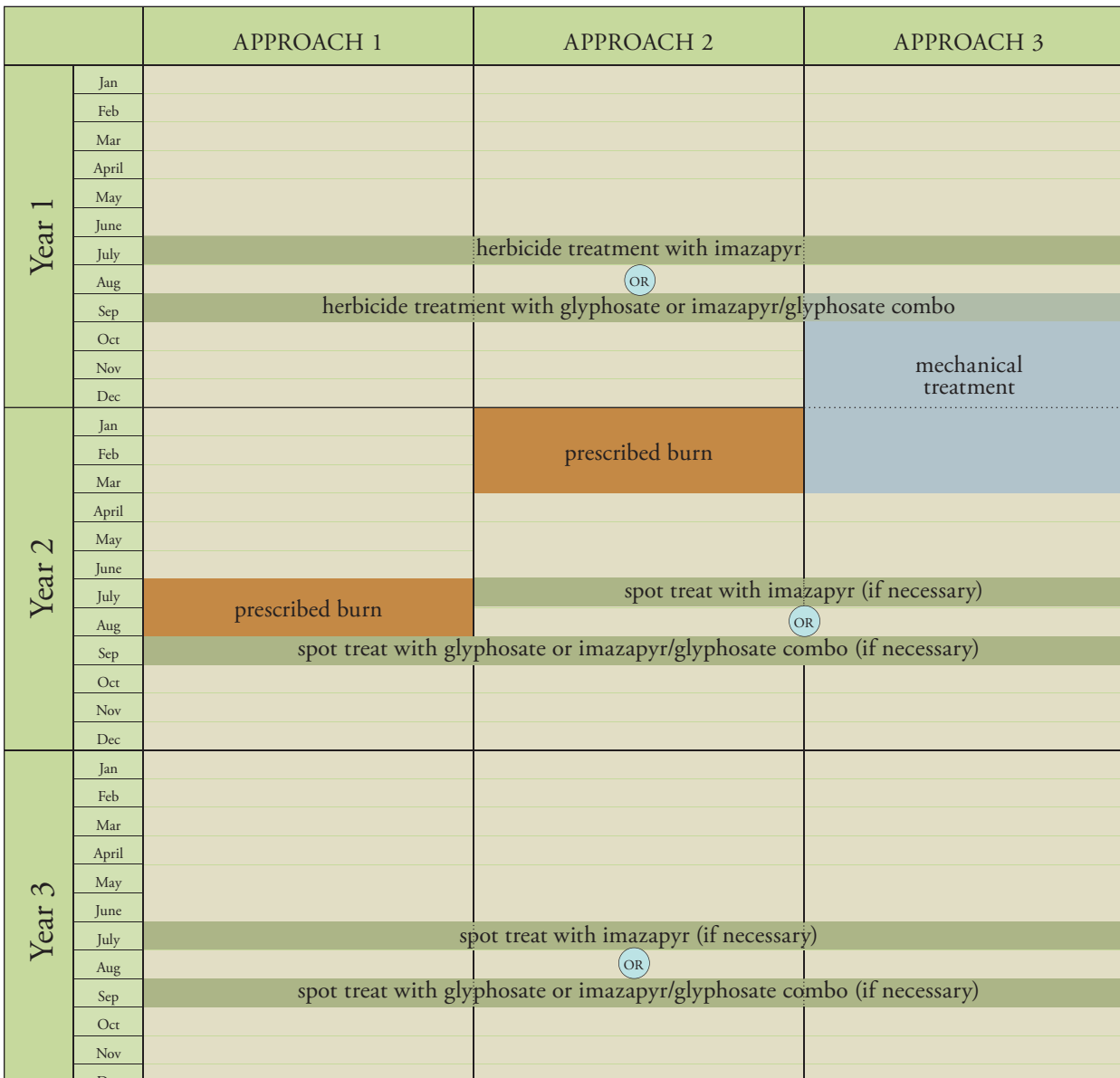
1. Treat Phragmites stands with herbicide in midsummer or late summer, depending upon the type of herbicide used (see Herbicides section). Wait at least 2 weeks to allow plant exposure to the herbicide.

2. Mechanically treat site beginning in late summer (September 1) or fall until prior to spring green-up. Treat wet sites when the ground is frozen. Approaches may include hand tools, weed whips, or small mowers (Approach 3).

3. Check site during the following several years 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 examples of integrated, multiyear approaches to managing Phragmites.



Management Strategy

for large, dense stands of Phragmites in impoundments

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 following 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 1 year.

5. Check site the following growing season for Phragmites regrowth and spot treat with herbicide if needed.

If prescribed fire is not feasible or chosen as a tool for a specific 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.

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.

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 the management process 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.

After removal from a site, Phragmites will continue to recolonize from remnant and neighboring populations and the existing seed bank in the soil. The control methods described above are likely to be successful in controlling Phragmites for 1-2 years without additional action. However, Phragmites typically begins to recover 3 years after treatment and will become reestablished if follow-up management is not implemented.

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% 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% control of Phragmites and discourage its spread, while enhancing the recovery and growth of native plants.

left: Restoration site in year 3 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

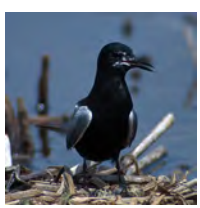
To reach the goal of reestablishing and restoring native wetland plant communities, controlling invasive species is a necessary step. Implementing selective control, as needed, will not only keep Phragmites from reestablishing dominance, but will also pave the way for the recovery of beneficial native 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.

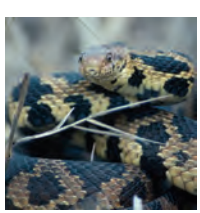
Monitoring and adaptive management are integral components of a successful Phragmites control plan. A detailed monitoring plan should be developed prior to implementation of control measures. Monitoring provides the data needed to determine the effectiveness of initial control efforts and the types of 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.

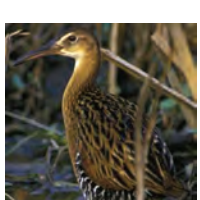
Management Strategies on the Horizon

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 (www.invasiveplants.net). Additionally, researchers at the U.S. Geological Survey are working to determine if there are other alternative methods of Phragmites control using gene silencing and disruption of the symbiotic relationship between Phragmites and microbial endophytes.

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

Reference Information

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

Getsinger, K.D., L.S. Nelson, L.A.M. Glomski, E. Kafcas, J. Schafer, S. Kogge, and M. Nurse. 2007. *Control of Phragmites in a Michigan Great Lakes Marsh–Final Report–Draft*, U.S. Army Engineer Research and Development Center, Vicksburg, MS, 120 pp.

Tu M., C. Hurd, and J.M. Randall. 2001. *Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas* available at www.invasive.org/gist/handbook.html

Great Lakes Phragmites Collaborative Web site: www.greatlakesphragmites.net

Michigan Invasive Species Coalition Web site: www.michiganinvasives.org

MDEQ Aquatic Invasive Species Web site: www.michigan.gov/aquaticinvasives

MDNR Invasive Species Web site: www.michigan.gov/invasivespecies

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