13.4.12. Control of Phragmites or Common Reed

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Phragmites, or common reed, is a perennial grass often associated with wetlands. When phragmites is interspersed with open water or with other vegetation, waterbirds and small mammals find cover among the stems. Its dense root systems strengthen dikes and roads. On many sites, however, this robust emergent forms monotypic, impenetrable stands having little value for waterfowl. Ducks occasionally nest on the edges of large stands, but avoid the dense interior.

Phragmites is native to North America and is found worldwide, primarily in lowland temperate regions. Phragmites can occupy upland sites with seeps, or grow in brackish or fresh water several feet deep. Large monocultures are usually associated with impounded areas and resultant stabilized water regimes. Such sites, having levees or water-control structures that keep large areas moist for long periods, create ideal situations for phragmites to become a problem. The plants are less competitive when there is variation in water levels among wet and dry seasons and years. Growth is often stunted where soil fertility is extremely high or low or where salinity is high. Phragmites usually establishes itself on dry borders of marshes, but frequently invades shallow water foraging sites by outcompeting and subsequently replacing more desirable emergent plants.

Because waterfowl benefit from interspersion of phragmites with other plant species and water, we do not recommend eradication of this plant from wetlands. Instead, phragmites should be controlled only to the degree necessary to achieve management objectives. By understanding the ecology and life history of phragmites, such control is more easily achieved.

Ecology and Life History

Phragmites has a thick stalk that can reach 13 ft (4 m) under optimal conditions. This height is usually not seen until 5–8 years after establishment. The long, flat leaves spread out widely from the stem and are relatively broad, gradually narrowing to a fine tip (Figure). The very high transpiration rate of phragmites is achieved primarily through these leaves. The terminal flower cluster consists of numerous perfect flowers. These flowers, purplish at first, gain long, white silky hairs around them by maturity, creating the large, plumelike flower cluster that persists through winter.

Phragmites most often spreads vegetatively by stout, creeping rhizomes. Fragments of these rhizomes are viable if they have at least two or three nodes and are 8 in. (20 cm) long. All stands have horizontal and vertical rhizomes, and young stands also have long surface runners that aid rapid expansion of the colony. Mature clones normally have a balance of vertical and horizontal rhizomes, while colonizing clones have predominantly horizontal rhizomes. Although these rhizomes are usually 8–39 in. (20–100 cm) below the substrate surface, they can penetrate to twice that distance. Thick

Figure. *Phragmites australis* plant (× ⅓), spikelet and floret (× 3), and rhizome. *Illustration from Hitchcock (1950).*

mud roots with small lateral roots that reach down 3 ft (1 m) or more grow from the horizontal rhizomes.

Vertical rhizomes arise from buds at nodes of horizontal rhizomes. Each upright rhizome bears only one shoot the first year, up to six the second year, and more thereafter. Vertical rhizomes also bear roots that branch and form dense mats.

Although germination from seed does occur, it is not common. Seedling survival is low because sites must remain wet, but not flooded, until seedlings are well established. Furthermore, until rhizomes develop, seedlings are highly susceptible to frost.

Mature stands of phragmites are normally composed of about 8–20 shoots per square foot (80–200 shoots per square meter). In Utah, shoot growth occurs from April to June with little growth occurring in undisturbed plants after June. Stems usually tassel in late summer but may begin to flower as early as mid-July. Plants begin flowering at 3–4 years; in most mature stands, about half of the shoots will bear flower clusters. Shoots die after flowering but most remain standing throughout winter. Seeds generally ripen in late September.

The horizontal rhizomes, which are responsible for the perpetuation of the stand, are where most of the nutrient reserves and plant hormones are stored. Rhizomes grow most rapidly from late summer to early winter. Buds are formed in fall and normally remain dormant in winter. These first buds that emerge, formed when food was abundant the previous summer, are large. The average size of emerging buds decreases through the spring emergent period, which lasts 1–3 months. Buds are also very vulnerable to frost damage. Other spring-formed buds remain below the soil surface, ready to emerge as a replacement crop. These are generally smaller and will form a shorter, denser crop of stems. During the growing season, buds will emerge within a month of any activity that breaks the internal dormancy. Fire and discing are examples of activities that may break this dormancy and stimulate new shoot growth.

Control

Control of phragmites is more easily achieved in areas where growing seasons are short and plant growth is less vigorous. The period of vulnerability will vary with the site and treatment. Control treatments may include spraying herbicides, mowing, discing, bulldozing, crushing, shading, dredging, flooding, draining, burning, and grazing. In many areas, a combination of treatments is most effective. Managers should consider control objectives (i.e., containment, reduction, or elimination) and then choose the most suitable treatment.

After successful treatment other plants will become established in areas formerly dominated by phragmites. These may include many plants attractive as waterfowl food, such as wild millet, smartweeds, rice cutgrass, and wild rice.

Chemical Control

Several herbicides have been used on phragmites with varying degrees of effectiveness. Local conditions and regulations will influence the choice

Table. *Reduction of phragmites effected by three herbicides (data obtained from the literature; citations available upon request).*[a]

Herbicide[b]	Dosage	Time of application	Comments
Amitrole	12 lb/a	summer	increase dosage on wet sites
Amitrole and dalapon	2 lb and 10 lb/a	summer	increase dosage on wet sites
Dalapon	15-30 lb/a	throughout growing season	burned 7–19 weeks before treatment, longer interval more effective
Dalapon	20 lb/a	throughout growing season	most effective in August and September
Dalapon	22.3 lb/a and 10.7 lb/a	September and following May	
Dalapon	12 lb/a and 12 lb/a	May and June	effective through two growing seasons
Dalapon	15 lb/a and 15 lb/a	May and June	effective to third growing season
Glyphosate	4-6 lb/a	June	equally effective applied at 2 lb/a 2 successive years
Glyphosate (Rodeo)	4-6 lb/a	September	lower dosage equally effective
Glyphosate (Rodeo)	4 lb/a	September	applied by helicopter
Glyphosate	10.7 lb/a	late fall	

[a] All treatments considered successful by investigators. Percent reductions are not provided because post-treatment evaluations were not performed at comparable intervals.
[b] Mention of trade names does not imply U.S. Government endorsement.

of herbicides. Systemic herbicides are most effective if applied to actively growing plants, when sugars are being translocated from the leaves to the rhizomes. On moderately wet sites, the period of optimal control occurs from full growth to early fruiting. Aerial application of chemicals should never be undertaken until after waterfowl have completed nesting activities because of possible overdrift. In areas with long, hot summers, spraying may be done as late as mid-September.

Chemical control of phragmites has been achieved most frequently with amitrole, dalapon, and glyphosate (Table). These herbicides are absorbed by the foliage and are translocated to the rhizomes. If the dosage is too concentrated, top kill may occur before the herbicide can be translocated to the rhizome and treatment will not be effective. Care should be taken not to break stems during treatment, as this would also prevent the herbicide from reaching the rhizomes.

Amitrole may be used to effectively control phragmites on flooded and dry sites. Neither dalapon nor glyphosate (as Rodeo, the formulation approved in most States for use in wetlands) are as effective on flooded sites, but they will produce results on moist or dry sites. Rodeo can also be effective when sprayed on senescing shoots during late fall. Several researchers have found that split applications (at 1/2 the dosage) work better than a single, full-strength application. This treatment method is likely to be less stressful to the environment, as well. The second dose should be applied 15–30 days after the first.

Size, accessibility, and proximity of phragmites stands to other vegetation or wetlands dictates the most appropriate application technique. Regardless of method, herbicides must be applied at the dosage prescribed on the label for maximum effectiveness. On smaller beds, backpack spray equipment is sufficient. If areas are very large or are inaccessible from the ground, aerial spraying by an experienced helicopter pilot is suggested. A marker system should be in place before flying transects to maintain a reference point when the tank is refilled. For best results, the same area should be sprayed in 2 successive years, then spot-treated as necessary thereafter. Infrared photographs of treated areas are helpful in locating any missed spots. Equipment used for aerial spraying must be free of leaks and have complete cut-off capabilities to prevent treatment of nontarget areas. The cost of aerial spraying in the late 1980's varied from $30 to $50 per acre; some refuges have taken advantage of State cost-sharing programs or made agreements with the highway department to reduce costs.

Mechanical Control

Mechanical control is difficult, but possible on sites that are flooded or consistently moist. A "cookie cutter" or rotary ditch digger can be used in flooded areas to chop through rhizome-packed substrates, creating openings in dense stands. On

drier sites, bulldozers, brushcutters, discs, rototillers, mowers, crushers, and plows can be practical and effective. On unflooded areas, discing is often the most practical method, but crushing repeatedly with rollers also may contribute significantly to phragmites control. Dredging is effective in some situations, but potential effects on wetlands and aesthetic considerations limit its use.

On areas that are dry in late summer, phragmites may be mowed with sicklebar mowers or rotary brush cutters. After 3 consecutive years of summer mowing in Canada, phragmites was replaced by short grass-sedge-sowthistle meadow. Phragmites stands mowed in spring will recover with shorter but more dense growth than the original crop, and will almost always develop fully within the same season. Thus, mowing is most effective in August and September. When beds are too large for annual mowing, wide strips cut through the stands create more edge and make stands more attractive to waterfowl.

Discing in summer or fall reduces stem density, but discing from late winter to midsummer stimulates bud production and results in stands with greater stem density. Discing is more effective than plowing because the chopped rhizome pieces that result are too small to be viable. The most effective time for cutting rhizomes is late in the growing season. Furthermore, in dry areas, rhizome fragments remaining above ground may dry out or freeze, while fragments buried deeply will deplete energy sources before buds reach the surface. Like discing, bulldozing is destructive to phragmites under certain conditions. A latesummer treatment may expose rhizomes to killing winter frosts, provided the area remains unflooded. Dredging removes phragmites from flooded areas, but unless the horizontal rhizomes are removed or the area remains deeply flooded (more than 5 ft or 1.5 m) following dredging, regrowth will almost certainly occur.

Water-level manipulation, where it can be used, is a useful tool for controlling phragmites. Flooding will not alter established stands, but if water levels greater than 12 in. (30 cm) are maintained, colonies will not expand. At these depths, runners are unable to anchor and will float to the surface. Seedlings are easily killed by raising water levels, but timing of water-level manipulations must be carefully determined to be effective and to avoid conflicts with other management objectives.

Draining water from established stands often reduces plant vigor and allows more desirable species to compete, but drying may require several years to degrade a stand. The potential benefits of severe frosts are more likely to be achieved on drained areas. On many wetland areas, however, drainage is neither practical nor desirable.

Abrupt alteration of salinity (e.g., by allowing salt-water intrusion into a coastal impoundment) can be effective if used before stands are well established. However, because phragmites is more salt-tolerant than many other emergents, the saltwater challenge is more likely to hurt competing plants and the freshwater biota than it will phragmites.

Fire used alone as a control measure has variable results depending on intensity of the burn, but is generally most effective in late summer. Generally, winter burning affords no control and often increases densities of spring crops unless a latespring freeze kills new buds. Spring burning without other control treatments is ineffective because the original stand is simply replaced with a more vigorous growth. In fact, burning in spring removes all dead stems and litter and scorches buds, stimulating multiple buds to develop and emerge. Early to midsummer burns are also ineffective because regrowth still replaces the original stand. Burning phragmites late in the growing season reduces stand vigor temporarily because few replacement buds are available. Furthermore, reserve energy is in the rhizomes by then and cannot be used for winter bud production. In dry, peaty areas, late-summer burns kill phragmites roots and rhizomes, creating depressions that may subsequently fill with spring run-off water and be useful to waterfowl.

Biological Control

Biological control is rarely a practical option for controlling phragmites because those organisms known to feed on this plant (moth larvae, aphids, leaf miners, gall midges, rodents, and birds) cause only incidental damage, with a few rare exceptions. American coots consume young shoots in the immediate area of their nests. Considerable damage to phragmites shoots occurs locally by such species as muskrats and nutria, but like coot grazing, this is not an activity under the manager's control.

Controlled grazing has little effect on shoot density, but rhizomes that are repeatedly trampled will bear few shoots and recover slowly when grazing has ceased. If phragmites stands are grazed for 2 years or more, vigor is reduced considerably. Because the amount of grazing required to reduce these stands would be detrimental to desirable plant species as well, grazing is not a recommended control measure on wildlife management areas.

Combining Treatments

On many areas, control of phragmites is achieved most effectively if control treatments are combined. For example, after an area is drained, chemical or mechanical treatments are more easily applied. If an area is drained and then plowed, the resultant short growth is easily treated with chemical sprays. Stands that are drained and then either cut or treated with chemicals may again be flooded to prevent survival of the replacement buds.

Some of the more labor-intensive treatment combinations are even more effective for control. Stands that are mowed, burned, and then disced at least twice will be almost completely removed. The green material from the new growth can be turned under with a heavy disc (32-in. blade) using a 400-hp tractor. This treatment method would likely cost about $35 per acre. The spread of phragmites can be contained by burning in mid- to late summer and then treating the second growth with chemicals. Herbicides must be translocated to the rhizomes to achieve more than a partial kill; therefore, the longer the interval between burning and spraying, the more effective the application.

Phragmites can be controlled, but expansion of stands and vigor returning to treated sites must be monitored closely. Repeated treatments over several years will be necessary. In some situations, it may be more reasonable to prevent stand expansion rather than expect to achieve complete control. Effective control requires an understanding of the plant's growth cycle and the local growing season in order to schedule effective treatments.

Suggested Reading

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van der Toorn, J., and J. H. Mook. 1982. The influence of environmental factors and management on stands of *Phragmites australis*. I. Effects of burning, frost, and insect damage on shoot density and shoot size. J. Appl. Ecol. 19:477–499.

Appendix. Common and Scientific Names of Plants and Animals Named in Text.

Plants

Sedge	*Carex* sp.
Coast barnyard grasss or wild millet	*Echinochloa walteri*
Rice cutgrass	*Leersia oryzoides*
Phragmites or common reed	*Phragmites australis* (syn *P. communis*)
Smartweed	*Polygonum* sp.
Sowthistle	*Sonchus* sp.
Wild rice	*Zizania aquatica*

Birds and Mammals

American coot	*Fulica americana*
Nutria	*Myocaster coypus*
Muskrat	*Ondatra zibethicus*

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