13.4.13. Management and Control of Cattails

Richard S. Sojda
U.S. Fish and Wildlife Service
Office of Information Transfer
1201 Oak Ridge Drive, Suite 200
Fort Collins, Colorado 80525–5589

and

Kent L. Solberg
Minnesota Department of Natural Resources
306 Power Avenue North
Hinckley, Minnesota 55037

The response of wetland vegetation to management can only be interpreted by considering an intricate mix of physiological, ecological, and temporal factors. Because cattail management is important for many freshwater marshes, the purpose of this leaflet is to present autecological principles for such management.

A 50:50 ratio of open water and vegetation is a frequent objective when managing cattail marshes in North America. When a particular marsh has been extensively flooded for some time and few cattails remain, managers may wish to foster more cattails to develop such hemi-marsh conditions. The reverse is followed when a marsh is dominated by cattails. Hemi-marsh conditions are optimal for breeding migratory birds, including most waterfowl, black and Forster's terns, American coots, and yellow-headed blackbirds. During the nonbreeding season, the life history requirements of migratory birds are not as closely tied to the hemi-marsh conditions. However, such wetlands still provide excellent habitat.

Cattails are prolific and can quickly dominate a wetland plant community. Monotypic stands of cattails have reduced overall habitat value but do benefit some species of wildlife. They provide excellent habitat for wintering white-tailed deer and ring-necked pheasants and habitat for breeding marsh wrens, least bitterns, and various species of blackbirds. However, hemi-marshes also are habitat for these species, too.

Cattails also provide excellent roosting habitat for blackbirds that can severely damage adjacent crops, especially sunflowers in the prairie states. Elimination of the cattail stand removes roosting habitat and can reduce local damage, but the damage is often simply shifted to other areas where the displaced birds create new roosts.

Although the vegetation cycle in prairie marshes is based on the cycle of wet and dry years on the prairies, its basic principles apply to cattail management elsewhere. The cycle of a semipermanent marsh has four stages: dry, regenerating, degenerating, or lake marsh. Identifying the existing stage of a wetland is the first step toward determining the appropriate direction of subsequent management. Generally, all wetlands with cattails in their flora mimic aspects of this prairie marsh cycle. However, certain hydrologic conditions can lengthen the duration of any stage to such an extreme that no cycle is apparent.

There are four species of cattails in North America: the broad-leaved cattail (*Typha latifolia*), common cattail (*T. glauca*), narrow-leaved cattail (*T. angustifolia*), and southern or Dominican cattail (*T. domingensis)*. The common cattail is widespread and is thought to be a hybrid between the broad-leaved and the narrow-leaved species. Whether the narrow-leaved cattail is a native, an exotic from Europe, or a hybrid is unclear. The autecological principles for the management of cattails are identical for all species, and minor differences among species are not addressed here. However, in deeper water and in periods of longer inundation, the common cattail has slightly greater vigor than the other species. The acreage of cattail-dominated wetlands in the north-central United States has increased drastically since the early twentieth century. Among the reasons are the increased prevalence of common cattail, sedimentation of wetland basins, and changes in hydrology and land use.

Cattail Autecology and Management Principles

Plant Structures

The cattail rhizome (Fig. 1) supports the plant, stores carbohydrates, and allows the plant to reproduce asexually. The rhizomes begin to elongate in early summer, and annual growth can be 2 feet (0.6 m) or longer under ideal conditions. The next year's stems begin as shoots (Fig. 1) that form on the rhizomes during midsummer. Subsequent shoot growth begins in late winter or early spring and can start even while ice cover remains on the marsh.

The aerenchyma (Fig. 2) provides air passage from the leaves to the rhizomes in cattails and other emergent plants. The structure is functional not only in living leaves but also in standing dead leaves as long as the leaves penetrate the water column and reach air. It is thought that a single leaf can provide oxygen to underground rhizomes for a radius of a few feet from that leaf. Interrupting the function of the aerenchyma is the key to the most effective nonchemical means of controlling cattails.

Germination

Cattails can produce seeds and contribute to the seed bank at all marsh stages, but recruitment occurs only during the dry stage. A single cattail head can contain as many as 250,000 seeds, and almost 1,000 seeds / m^2 may exist in the upper few inches of soil. Viability can approach 100% in the year after production, and seeds in the seed bank can remain viable for as long as 100 years. Cattail seeds, like those of almost all other emergent plants, do not germinate under more than 0.5 inch (1.3 cm) deep water. Light in combination with other environmental factors is critical to germination, and deeper water or shading in dense stands filters out enough light to prevent germination. One of the primary reasons cattails

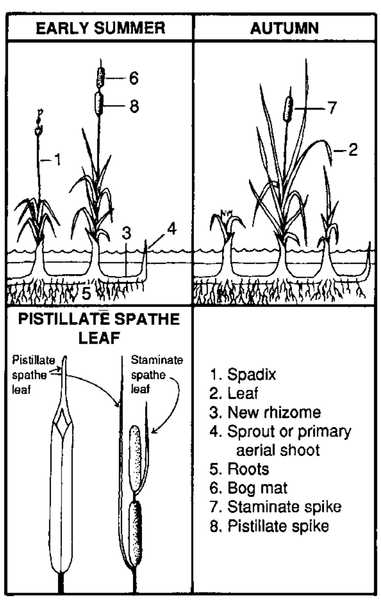

Fig. 1. The structure of a cattail plant: 1. spadix; 2. leaf; 3. new rhizome; 4. shoot or sprout; 5. roots; 6. staminate spike; 7. pistillate spike.

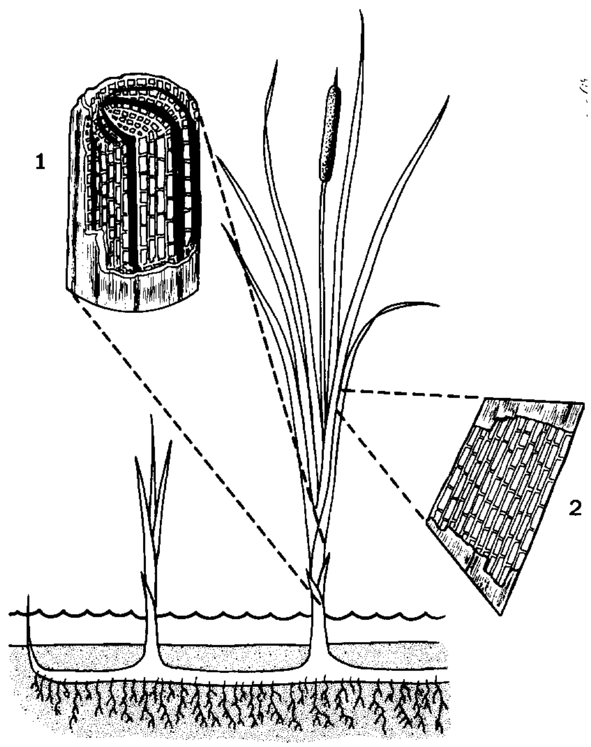

Fig. 2. Aerenchyma provides air passage from leaves to rhizomes. 1. Cross-section of a stem; 2. Longitudinal section of a leaf.

are so prolific is that seeds germinate under a wide range of temperatures if the soil is nearly saturated. The optimum soil–surface temperatures are 77–86^{o} F (25–30^{o} C) and usually occur in the northern United States from early summer to midsummer.

Depending on the successional stage of the marsh, a manager may either foster or obstruct germination of seeds from the seed bank. Because keeping areas flooded with 1 inch (2.5 cm) of water essentially prevents germination, a greater depth is not necessary. Shallow flooding is quick and usually inexpensive. However, shallow flooding of a portion of a wetland can leave a significant expanse of unflooded, saturated soils nearby where cattail germination may flourish. Shallowly flooded areas can become mud flats quickly when rates of evapotranspiration are high. This transition can easily happen in just a few days during warm weather. Knowledge of the bottom contours of a wetland basin allows the judicious use of water to prevent germination.

Carbohydrate Conversion

The control of cattails has to be timed to the annual cycle of carbohydrate storage (Fig. 3). During early spring, the shoots receive their energy for growth primarily from starches stored in the rhizomes. When the conversion of the starches is aerobic, the energy for initiating shoot growth is greatest. Aerobic conditions exist either when the marsh is dry or when standing dead leaves can supply rhizomes with oxygen via the aerenchyma. The depth of water that the shoot can penetrate is not limited in typical semipermanent wetlands when starch conversion is aerobic. If energy reserves are insufficient for the shoot to penetrate the water column, however, the plant dies.

When the conversion of starches is anaerobic, available energy may be limited and the shoot is not able to penetrate the water column. Conditions become anaerobic for the cattail when soils are flooded and the aerenchyma link between leaves and rhizomes is broken. This happens, for example, when a marsh is burned during winter and the remaining stalks are then flooded. The depth of water through which the shoot must grow in spring before it reaches air determines whether the plant has sufficient starch reserves in the rhizomes to survive.

Carbohydrate Storage

In summer when the pistillate spike is lime green and the staminate spike is dark green,

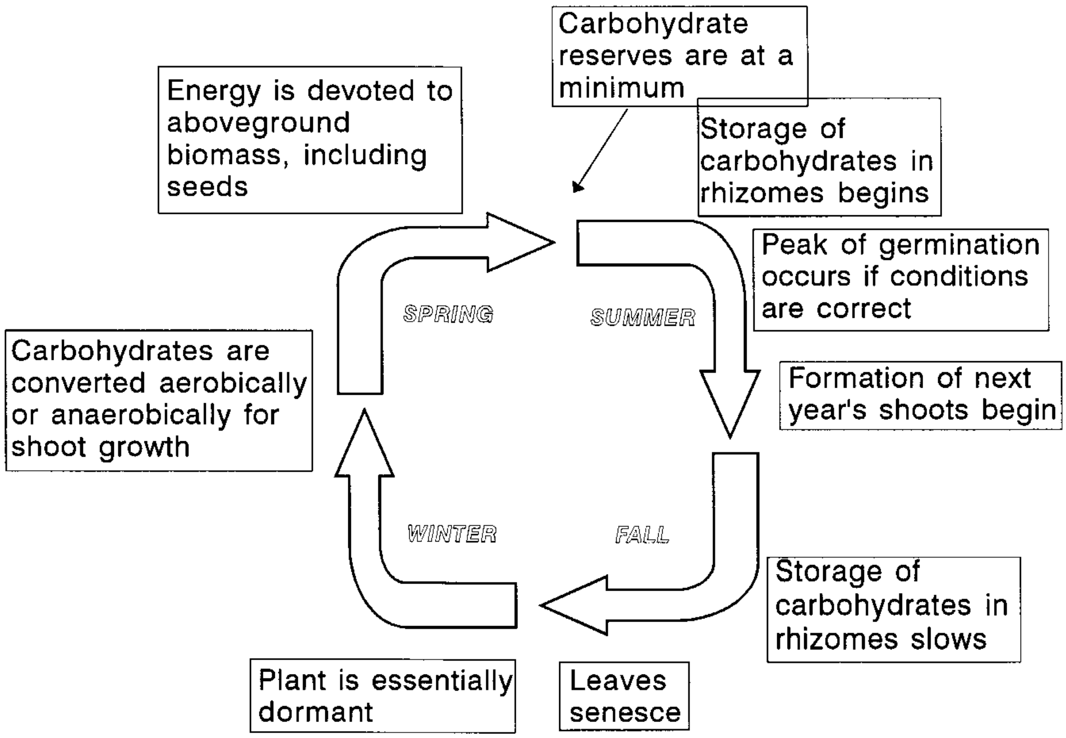

Fig. 3. The annual cycle of growth and carbohydrate storage in cattails.

starch reserves in the rhizomes are at their minimum (Fig. 2). Until this time, the plant has been committing its energy to leaf growth and flower development. Starting in midsummer, the energy is redirected toward building carbohydrate reserves for shoot growth in the following spring. Carbohydrate storage continues until the leaves are senescent. (Linde et al. [1976] provide the most comprehensive documentation of the annual cycle of growth and carbohydrate storage in cattails.)

Control techniques such as grazing and mowing are most effective when the starch reserves of the plant are lowest. Shortening the time during which carbohydrates are stored in the rhizomes does not immediately kill the plant but increases its vulnerability to stress during the subsequent spring.

The vigor of the plant depends principally on its efficient storage of carbohydrates in the rhizomes. Because cattails are adapted to semipermanent water regimes, either deep water or drying of the marsh stresses starch storage. However, cattails are also adapted to a wide range of environmental conditions, and the effects of the stress are subtle.

Effect of Herbivores

Direct mortality of mature cattail plants from muskrats, cattle, and other herbivores is rare. The season of grazing and the water levels in subsequent seasons determine to what degree the removal of the growing plant parts affects plant vigor. Grazing on the mature plant parts impedes carbohydrate storage or conversion. In contrast, grazing can kill seedlings, particularly grazing by Canada geese and greater snow geese that eat nearly the entire seedling. The removal of only aboveground parts can stunt the plant so much it does not survive to reproduce and contribute to the seed bank. When germination of seedlings has created a dense stand, geese may not remove all plants and the combined effects on stand development can be variable.

Hydrologic Changes

Long-term changes in water regimes in a marsh can have either subtle or drastic effects on plant species composition. Because they are best adapted to semipermanent water regimes, cattails can be eliminated by deeper and more permanent water levels. Likewise, a conversion to a drier water regime (e.g., a seasonal marsh) can shift the competitive ecological edge to other species. If drier conditions coincide with soil disturbance, wetlands in many areas of North America can change to being temporarily dominated by annual plants such as smartweeds and wild millets. Concurrent germination of more cattails should be prevented. Long-term plant communities of a drier regime may include *Carex* spp., *Scirpus* spp., perennial smartweeds, and some of the aquatic grasses.

Control Techniques: Why and When They Work

Water Level Control

Water levels should mimic long-term (10- to 20-year) drought cycles of the local area, particularly if the objective is the hemi-marsh stage. The resultant cycle of the marsh will follow the previously mentioned four-stage model.

Drawdowns in summer enhance cattail stem densities by stimulating germination. When cattails are absent, drawdowns in early spring stimulate germination of aquatic annuals such as smartweeds and millet. Then, shallow flooding during summer stimulates the growth of annuals while eliminating germination of cattails.

If indeed the aerenchyma link between rhizome and leaf is broken, high water levels that are above the tops of cattail shoots in spring extend the period during which the plant must anaerobically convert the stored starches to sugars for shoot growth. The depth of water necessary to kill the plant depends on temperatures, the quantity of starch the plant stored the previous year, and the general vigor of the plant. Therefore, no minimum water depth can be prescribed, but a rule of thumb would be to maintain 3–4 feet (0.9–1.2 m) of water over the tops of existing shoots in spring. It is critical to remember that, even if standing dead leaves from last year were completely removed, aerobic conditions are restored to the rhizome as soon as the new growing shoot penetrates the water surface. Cattails are well adapted to growing in anaerobic soil conditions.

If the leaves from the previous years were removed (e.g., by cutting or burning) and water control is effective, cattails can be controlled even if the actual quantity of available water is limited. If water remains only a few inches above the top of the growing shoots and standing dead leaves, oxygen is prevented from reaching the rhizomes. The use of water is efficient if the water level is raised progressively, so that all plant parts remain submerged by no more than a few inches.

Extremely high water levels—in excess of 4 feet (1.2 m)—in late spring and summer, even after the cattails reach their full height, sufficiently stress the plants by reducing the quantities of the stored carbohydrates for subsequent spring growth. However, the physiological mechanism that causes this reduction is poorly understood.

High water levels favor the survival of muskrats in winter. The ideal water depths are probably 4–5 feet (1.2–1.5 m) in most areas. The current marsh stage relative to the desired stage determines the manager's decision to foster or retard muskrat survival with water levels in winter. Population levels of 10 muskrats / acre (10/0.4 ha) can nearly eliminate cattails in 2 years if combined with high water levels in spring to stress starch conversion in the rhizome. The effect of muskrats on cattail-dominated wetlands can be explained with the described autecological principles. In isolated marshes of the arid West, muskrats can be eliminated by drought, and recolonization can take many years irrespective of subsequent water conditions.

Salinity Alteration

Seawater is used locally to kill cattails in coastal areas in the southeastern United States where historic salt marshes have been impounded and managed as freshwater wetlands. Flooding a marsh during most of the growing season with water of 10 ppt salinity kills cattails. Flooding with sea-strength water for 2 months also kills plants. Water depth is not critical because the salinity directly affects plant physiology. In North America drought or purposeful drawdown can sufficiently increase water or soil salinities, mature plants can be killed, plant growth can be retarded, and germination can be prevented.

Cutting, Crushing, Shearing, and Disking

Cattails can be controlled by cutting, crushing, shearing, or disking. Details about effective water levels relative to shoot height, timing of shoot growth, and timing of control in relation to starch reserves are rarely provided in the literature. Almost no experimental work has been reported.

Cutting, crushing, shearing, and disking during the growing season can be used to impede starch storage. These treatments are effective if done during a 3-week window from 1 week before to 1 week after the pistillate spike is lime green and the staminate spike is dark green. However, the treatments are most effective during the 3–4 days when the spikes are so colored.

Deep disking can retard shoot formation and can damage the rhizomes, but the effect on plant survival is variable. The overall effect on the entire stand is minimal if water conditions are favorable for cattail survival. Control of water levels and of recruitment from the seed bank are necessary to prevent reestablishment of the cattails. Deep disking combined with continued drying and freezing in fall decreases plant survival. If the wetland can be kept sufficiently dry to repetitively disk in any two to three successive seasons, cattails can be eliminated or their stem densities severely reduced. For example, plant survival is significantly reduced if the marsh is disked in fall and again in the following spring and summer. In contrast, little effect is realized from disking alone in three successive falls. The cost of the equipment and personnel for these operations can be extreme. Airborne seeds released during these operations clog the equipment and irritate the operator.

When the plants are dormant, cutting, crushing, shearing, or disking is extremely effective for severing the aerenchyma link between the rhizomes and the leaves. To reduce plant survival, however, these techniques must be combined with high water levels in spring to induce stress from anaerobic starch conversion. Cattails can be cut with a rotary mower or sheared with a front-end loader on a tractor when equipment can be driven on ice, but airborne seeds are a nuisance. Subsequent water levels in spring must still inundate the cut stalks.

Bulldozer and Cookie Cutter

Bulldozers and cookie cutters remove plants from the local area of the marsh and can—sometimes inadvertently—alter wetland basin morphology. The desirability of the potential effect depends on the management objectives, permits, and other legal requirements. The control of cattails with a bulldozer or cookie cutter is the most expensive option. However, floating cattail mats cannot be removed with any other equipment.

The seed bank and the conditions for germination determine the floristic composition of the marsh after the next drawdown, whether dewatering is natural or controlled. If the seed bank is dominated by cattails, the effect of a bulldozer or cookie cutter may be short-lived. Alternatively, a depauperate seed bank may also result in an undesirable plant community. The domino effect of this may be a reduction of the diversity and abundance of invertebrates and a consequent lack of food for shorebirds, ducks, and other species. Creating deeper and possibly permanent water areas also creates better habitat for muskrats and minks.

Grazing

Grazing by cows, geese, muskrats, and other animals on seedling and young cattails without extensive rhizomes can remove entire plants, reducing stem densities or eliminating stands. Grazing on mature plants in association with proper water-level management reduces the survival of cattails through the combined effects of severing the aerenchyma link between the rhizomes and leaves and stressing the storage and conversion of starches. To minimize starch storage, cattails should be heavily grazed by cattle during the 3-week period centered on the time when the pistillate spike is lime green and the staminate spike is dark green.

Prescribed Burning

Burning cattails is difficult during the growing season, except during extreme low-water conditions. Dry residual cattail litter provides enough fuel to carry a fire through growing plants. The fire usually does not kill the plants but can stress starch storage. Fires in cattail marshes rarely are hot enough at ground level for heat penetration to impede rhizome function or shoot viability.

Most cattail marshes must be burned in winter or before significant growth has occurred in spring when fuels are dry enough to carry a fire. However, frozen or saturated soils can hamper the progress of the fire through cattail duff. When combined with high water levels in spring to smother the residual stalks, fire can be used to control cattails.

Prescribed burning can be used for cattail control even in wetlands where control of water levels is not always possible and the manager must rely on precipitation in spring for flooding. Cattails can be burned when water levels are naturally low in fall and winter. If water levels are high during the next spring, they force anaerobic conversion of starches in the rhizomes. Spring weather obviously is not known during the preceding fall, but dry falls followed by ample rain and high water levels in spring are not unusual in many parts of North America.

In wetlands with well developed peat soils, fires during drought conditions can destroy the entire cattail plant including the rhizomes. Such fires actually burn the peat, and the ability to smother the fire by reflooding the marsh must exist before prescribing such fires. Peat fires can also eliminate the existing seed bank and, if sufficiently severe, lower the relative bottom of a marsh. Local concern with the effects of peat fires on air quality can be substantial. In some locations (e.g., Minnesota), regulations prohibit the purposeful ignition of peat.

Fire prescriptions for cattail marshes should not solely address fire control but the ecological effects of fires at different intensities, at different seasons, and under different environmental conditions. Moreover, planned fires must be combined with water management that ultimately controls the cattails.

Herbicides

Herbicides, especially glyphosate, interrupt metabolic pathways and have been used successfully to kill cattails. Herbicides that are translocated to the rhizomes are most effective for cattail control. Application in mid- to late summer when carbohydrates are stored enhances the effectiveness of translocated herbicides. Therefore, herbicides have little effect on seed production during the year of application. If not all cattails are killed, a hemi-marsh is created, but surviving cattails can spread quickly and eliminate this effect if water levels cannot be manipulated. As with other techniques, the duration of the effect of herbicides depends on subsequent water-level control and recruitment from the seed bank.

The public and natural resource agencies are concerned about the use of herbicides in aquatic systems. Herbicides for the control of cattails should readily degrade in water, soil, or substrate. Glyphosate applied at label rates seems relatively safe for waterfowl and aquatic invertebrates. Habitat alteration from herbicide application, as from other cattail removal techniques, may reduce the distribution and abundance of invertebrates.

Herbicides can be expensive, although the cost of the application is a minor portion of the total cost. Aerial application can be the most efficient technique for managing cattails over a large area or over several smaller, inaccessible locations. Boom or wick applications are useful for small areas accessible by ground or airboat and when pesticide drift is a concern.

Permits

Many of the described control techniques require permits from local, state, or federal authorities.

Suggested Reading

Ball, J. P. 1990. Influence of subsequent flooding depth on cattail control by burning and mowing. Journal of Aquatic Plant Management 28:32–36.

Kadlec, J. A. 1992. Habitat management for breeding areas. Pages 590–610 *in* B. D. J. Batt, A. D. Afton, M. G. Anderson, C. D. Ankeny, D. H. Johnson, J. A. Kadlec, and G. L. Krapu, editors. Ecology and management of breeding waterfowl. University of Minnesota Press, Minneapolis.

Kantrud, H. A., J. B. Millar, and A. G. van der Valk. 1989. Vegetation of wetlands of the prairie pothole region. Pages 132–187 *in* A. G. van der Valk. Northern prairie wetlands. Iowa State University Press, Ames.

Linde, A. F., T. Janisch, and D. Smith. 1976. Cattail—the significance of its growth, phenology and carbohydrate storage to its control and management. Wisconsin Department of Natural Resources Technical Bulletin 94. 27 pp.

van der Valk, A. G. 1981. Succession in wetlands: a Gleasonian approach. Ecology 62:688–696.

Weller, M. W., and L. H. Fredrickson. 1974. Avian ecology of a managed glacial marsh. Living Bird 12:269–291.

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

Plants

Sedges	*Carex* spp.
Wild millets	*Echinochloa* spp.
Smartweeds	*Polygonum* spp.
Bulrushes	*Scirpus* spp.
Cattails	*Typha* spp.

Animals

Canada goose	*Branta canadensis*
Greater snow goose	*Chen caerulescens atlantica*
Black tern	*Chlidonias niger*
Marsh wren	*Cistothorus palustris*
American coot	*Fulica americana*
Least bittern	*Ixobrychus exilis*
Mink	*Mustela vison*
White-tailed deer	*Odocoileus virginianus*
Muskrat	*Ondatra zibethicus*
Ring-necked pheasant	*Phasianus colchicus*
Forster's tern	*Sterna forsteri*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*

Note: Use of trade names does not imply U.S. Government endorsement of commercial products.

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
***Fish and Wildlife Leaflet* 13**
Washington, D.C. • 1993