Cattail (*Typha* spp.) Management

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ABSTRACT: Cattails generally occur as scattered sterile plants in high-quality natural areas. Disruptions of hydrology, wildfire suppression, or system enrichment may favor cattail growth. System disruption is often followed by the growth of dense monocultures of cattails that may reduce habitat heterogeneity and eliminate other plants. Mechanical, chemical, prescribed burning, and several other methods of cattail control have been attempted. Reliable control is achieved by any method reducing and maintaining the stature of live and dead cattail stems below water levels for a period of one to three years. A bibliography of related works is also included.

INTRODUCTION

Cattails commonly occur in freshwater wetlands throughout North America. Cattail management may be desirable where ecosystem disruptions favor cattails, and where they often respond by growing in dense monocultures. Cattails can behave like aggressive introduced weeds, but are native elements found in a variety of natural communities. In high-quality natural communities, cattails usually occur as scattered sterile plants. Cattails have wide ecological amplitude, compared to species with greater niche specificity (Pianka 1973). With disruptions, shallow wetlands, ponds, and slow-moving streams may become vulnerable to cattail growths that can eliminate open water, habitat diversity, and other plant species. Cattails are considered serious weeds in some countries (Holm et al.1979, Morton 1975), but not in North America. Cattails often stabilize shorelines and channels from wave action erosion, or ice heaving, and have been used to reduce salinity in rice fields (Marsh 1962).

This paper summarizes important aspects of the ecology of cattails pertinent to their control. The cattail family, represented worldwide by the genus Typha, is a perennial aquatic herb with cosmopolitan distribution in freshwater habitats. About fifteen species, up to seventy-eight inches (two meters) in height, with linear, thick, and spongy leaves from subterranean stems, have been described (Heywood 1978). The plants have unisexual wind pollinated flowers that are condensed into thickened terminal spadix structures. North American cattails have male flowers located close to the terminus of the spadix. Achenes are produced from female florets and have an elongated embryo and a stalk covered with fine, unmatted hairs that aid in wind dispersal.

Three species of cattail and several hybrids occur in North America (Smith 1962, Hotchkiss and Dozier 1949). This includes broad-leaved (Typha latifolia), narrow-leaved (T. angustifolia) (Figure 1), and tall cattails (Typha domingensis). Except for the far north, broad-leaved cattail occurs throughout North America from sea level to 2134 m (7000 ft), but most commonly inland. This is the only species usually found in relatively undisturbed habitats (Smith 1967) and also occurs in areas with widely fluctuating water levels such as roadside ditches, reservoirs, or estuaries. Narrow-leaved cattail is widely distributed in the eastern and southern states, and is generally restricted to unstable environments, often with basic, calcareous, or somewhat salty soils (Fassett and Calhoun 1952). Narrow-leaved cattail can grow in deeper water, although both species reach maximum growth at a water depth 50 cm (20 in) (Grace and Wetzel 1981). A robust hybrid between narrow- and broad-leaved cattail

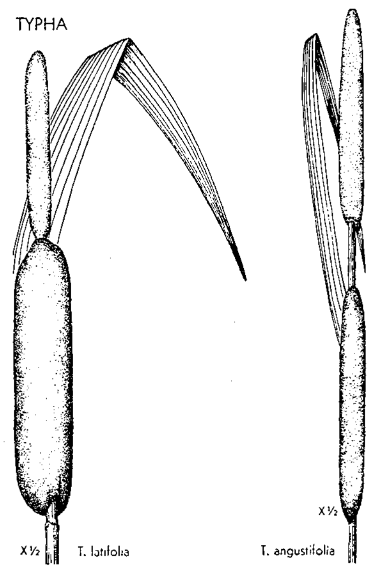

Figure 1. Typha latifolia and T. angustifolia. From The New Britton and Brown Illustrated Flora by H.A. Gleason. Reprinted with permission of The New York Botanical Garden.

has often been given species status as Typha glauca. Tall cattail's range includes the coastal areas of the southwest states, southern California, and east to southeastern Virginia. Tall cattail's distribution in the eastern United States is not well understood. Although difficult to separate from narrow-leaved cattail, this taller species has flattened, and usually several more leaves. Cattail's worldwide distribution is summarized by Morton (1975).

In Indiana, we believe modified surface hydrology, wildfire suppression, and wetland enrichment, perhaps operating synergistically, preceed growth of cattail monocultures (Wilcox, Apfelbaum, and Hiebert 1984). Claims that hybrid cattails are responsible for monoculture growths have not been confirmed in field or laboratory. We have also observed several years of thick cattail growth associated with enriched runoff from burned forests (Ahlgren and Ahlgren 1960) in the Quetico-Superior Wilderness (Apfelbaum and Haney 1981). Lake levels and substrates did not vary, suggesting this was a response to enrichment. Similar reasons have been used to explain cattail proliferation in wetlands with historically small cattail populations before being subject to disruption (U.S. EPA 1983 a. and 1983 b.)

Cattail productivity and growth rates have been quantified in Indiana (Apfelbaum et al. 1983, Wilcox, Apfelbaum, and Hiebert 1984). Based on dry weight, cattails contributed 700 kilograms (1543 pounds) of biomass per hectare (approx. 600 lbs/acre) where it grew in monocultures. Aerial photographs showed cattail growth increased from 2 to 37.5 hectares (5-93 acres) from 1938 to 1982. Growth seemed to occur by establishment of disjunct colonies, perhaps by seed reproduction, and by expansion of existing colonies. This study also confirmed declines in sedge-grass and prairie meadow vegetation as cattail increased. At Horicon Marsh monotypic growths of cattail increased from 30 to 80 percent cover from 1947 to 1971 and associated vegetation declined (Linde 1963, Bedford, Zimmerman, and Zimmerman 1974, Wisconsin DNR 1971). Within two growing seasons, broad- and narrow-leaved cattail seedlings grew to cover fifty-eight and forty square meters (15.86 and 10.9 square feet), respectively (Grace and Wetzel 1981). Vegetative growth by broad-leaved cattails of 518 cm (17 ft) annually have been recorded (McDonald 1951), and plants grown from seed flowered the second year (Smith 1967, Yeo 1964). Cattails can produce 20,000-700,000 fruits per inflorescence (Prunster 1941, Marsh 1962, Yeo 1964); sexual reproduction is important for colonization (McNaughton 1968), but colonies are maintained by vegetative reproduction. Ninety-eight vegetative shoots and 104 crown buds were produced on a single greenhouse grown cattail seedling the first year (Timmons et al. 1963). Cattail's high growth rate underscores the concern and the potential reason that management may be necessary in some areas, especially in nature preserves.

Cattail produces a dense rhizome mat and the clustered leaves cause litter. Dense cattail growth and litter may reduce the opportunity for other plants to establish or survive (Wesson and Waring 1969). Mineralized substrates necessary for many plants to germinate are buried by this litter. Beneath the litter, substrates are cool and moist, optimal conditions for survival of a seed bank (Van der Valk and Davis 1976) but not for seed germination. Seed longevity and dormancy may be affected by soil moisture, temperature, and soil atmosphere (Schafer and Chilcote 1970, Roberts

1972, Meyer and Poljakoff-Mayber 1963, Morinaga 1926). Allelopathy has not been confirmed for cattails, although declines by other species with increasing cattail, and an observed natural degeneration that often produces small open areas in cattail colonies, may be related to a toxin produced by cattail plants (Van der Valk and Davis 1976, Szczepanska 1971, McNaughton 1968, Bonasera and Leck 1978). However, self-thinning has also been related to effective utilization of space and resources (Hutchings 1979).

The effects of shading, day length, or varying light intensity on cattail's sexual or asexual reproduction are largely unknown. Cattail pollination ecology, seed production, seed viability, conditions for seedling establishment and growth rates, mortality, and seed longevity have been explored. Cattail seed germination rates as high as 100 percent under a slightly flooded condition have been reported for all three species (Smith 1967) from some localities, while samples from montane areas showed appreciably lower rates, suggesting differing dormancy requirements. Dormancy has been reported from field and greenhouse experiments (Smith 1967, Yeo 1964, Bedish 1967). Sifton (1959) showed light and low oxygen tensions affected germination of broad-leaved cattail. Other studies have confirmed flooding requirements to a depth of 2.54 cm (1 inch) for germination (Bedish 1967, Penfound et al. 1945, Uhler 1944, Bellrose and Brown 1941, Laing 1940, Dane 1956, Giltz and Myser 1954). Germination of dried seed at room temperature was found to decrease from an original 48 percent to 20 percent (Bedish 1967). The optimal temperature for germination was 25-30° C (Sifton 1959). Broad-leaved cattail seeds were found to be especially sensitive to white light and to require seed coat degradation for germination to occur. Broad-leaved cattail was found to account for 27 percent of the total soil seed bank in tidal marsh cattail stands (Leck and Graveline 1979).

Vegetative reproduction by rhizomes creates characteristic cattail colonies. Survival of rooted aquatic plant rhizomes does not occur for more than several growing seasons without the gas exchange supported by live and dead stems reaching above the water's surface (Whigham and Simpson 1978). Minimal carbohydrate reserves occur immediately prior to flowering (Linde et al. 1976, Gustafson 1976). Reserves in the rhizomes decline with emergence until flowering and then increase or may stabilize for several months prior to senescence. Cattail emergence time varies regionally, but usually occurs by early April in the Midwest. Flowering generally occurs July-September; senescence of above ground biomass occurs before late October. Seeds often remain on the plant through winter and disperse in spring. We have observed submerged spadix structures during the spring and fall with hundreds of emerging seedlings; these were washed ashore or found floating in wetlands. Dispersal can occur by seeds, rhizomes, corms, and by the movement of parts of colonies torn by wind, water, ice, or animals.

Cattail control or reduction may be desirable where noticeable increases threaten natural plant diversity and habitat heterogeneity. Management may be necessary to:

(1) Control the spread and domination of potential habitat by cattail in and perhaps adjacent to natural areas.

(2) Circumvent declines in other plant species with cattail proliferation.

(3) Prevent development of monotypic cattail growth and loss of habitat heterogeneity (Patton 1975, Martin et al. 1957).

MANAGEMENT

Most cattail control efforts have been by wildlife managers interested in waterfowl production. Some methods would not be considered for use in designated nature preserves or natural areas. These applications may be considered for adjacent lands or for areas that are being restored and could be helpful to natural area land stewards. These methods include chemical and physical control, plus prescribed fire, shading, and water level modification. Biological cattail control has not been documented but the other methods are reviewed.

CHEMICAL CONTOL

For designated preserves or natural areas, especially where system-oriented stewardship is used, chemical applications may not be appropriate. This is particularly true because cattail is an element of certain natural communities. However, use of chemicals to control an overabundance of cattail may have certain applications. Spraying Dalpan (Nelson and Dietz 1966) at 8.8-35.3 kg/acre (4-16 lb/acre) produced 74 to 97 percent reductions in cattails ten months after a mowed area was sprayed. Cattail regrowth was sprayed at 58-90 cm (24-36 in) height in September. Control was most effective when treated areas could be flooded to 10-15 cm (4-5 in) or deeper. Dalpan spray achieved varied success but greatest control occurred where cattail stems were cut below water depths regardless of the herbicide quantity used. Poorest results were attained in areas with shallow fluctuating water levels. Spraying mature cattails rather than regrowth after cutting gave better results. Weller (1975) had similar results with spraying where Amitrol, Rodopan, and Doupon herbicides were effective in creating and maintaining openings for at least three years after spraying, but areas were quickly invaded by peripheral cattail. High doses of MCPA or 2,4D in diesel oil (2.2-4.5 kg per acre) were effective if applied during flowering. Dalpan (9 kg/acre) and Amino-triazole (.91-1.36 kg active ingred./acre) were also effective and economical cattail control. Use of Erbon (18.14 kg/acre) gave good control results in Montana (Timmons et al. 1963). Herbicide applications were found necessary for up to three years in some areas. Similiar results were found by Grigsby et al. (1955), Heath and Lewis (1957), Krolikowska (1976), Pahuja et al. (1980), Singh and Moolani (1973), and Wisconsin Department of Natural Resources (1969).

PHYSICAL CONTROL

Hand or mechanical cutting of cattails followed by submergence of all cattail stems results in high control. Up to 100 percent of cattail control was measured two growing seasons after treatment. No visible cattail regrowth occurred in one year and cattail rhizomes were dead. The highest cattail control of any method tested (Nelson and Dietz 1966) was achieved by two clippings followed by stem submergence to at least 7.5 cm (3 in). Control was best if plants were cut in late summer or early fall.

In Iowa (Weller 1975), cutting cattail and reflooding with at least 8 cm (3.1 in) of standing water over plant stems was effective. This author also found clipping cattails too early in the growing season (e.g., May) stimulated their growth and resulted in a 25 percent increase in stem counts the following year, with an eventual decline to preclip levels. August clipping controlled up to 80 percent of cattail only if followed by submergence. It was important to remove all dead and live cattail stems to achieve this control. Cutting shoots below the water surface two or three times in one growing season before flower production reduced a cattail stand by 95-99 percent in Montana and Utah (Stodola 1967). Similiar results were demonstrated by Shekhov (1974).

Cattail control by injuring developing rhizomes and shoots was investigated (Weller 1975). Crushing and reflooding showed that cattails injured after June had poor recoveries. Success of crushing depended on the load used, number of times an area was crushed, and standing water depths after treatment. Spring and early summer treatments generally created favorable seedbeds for cattail that required a fall crushing to control seedlings. Crushing involved pulling a 55 gallon water filled drum behind a tractor. Deeper water areas showed highest control (up to 100 percent) while regrowth occurred in shallow areas.

Although not practical for natural areas management, discing (Weller 1975) and blasting (Nelson and Dietz 1966) have also been investigated as methods of cattail control.

PRESCRIBED FIRE

Fire was found to provide little or no cattail control (Nelson and Dietz 1966). Fires that destroyed cattail roots offered control; however, most fires only burned above-ground biomass and did little to control cattail. Drying in readiness for burning was effective cattail control when done for two years in arid Utah.

Water level drawdown, burning, and reflooding to 20-35 cm (8-18 in) water depth or deeper controlled cattail. Fire was found useful for cattail litter cleanup and assisted access for mowing or hand clipping (Nelson and Dietz 1966, Weller 1975).

SHADING

Black polyethylene tarps were used to cover cattails in an attempted control measure (Nelson and Dietz 1966). Actively growing cattail tips were killed when completely covered for at least sixty days. Greatest control was achieved in July when food resources of cattail were presumed to be lowest (Linde et al. 1976). Problems with holding tarps down and their degradation confounded this investigation.

WATER LEVEL MODIFICATION

Two years of 65 cm (26 in) deep flooding was required before established cattail began to die and open water conditions were created at Sinnissippi Marsh. Cattail initially survived flooding from 1973-77 and became the dominant emergent plant. A light green color, noticeably narrower leaves, and absence of fruiting heads indicated stress in 1976. Cattail stem densities declined 57 percent with all emergent plants dead in 1977. Horicon Marsh, flooded to a depth of 40 cm (16 in), showed declines in emergent and aquatic plants. Cattail required two years before it declined (Wisconsin DNR 1969 and 1971).

Mature T. latifolia and seedlings less than one year old are killed by water depths of 63.5 cm (25 in) and 45 cm (18 in) or more, respectively. Narrow-leaved cattail was unaffected by this degree of flooding. Narrow-leaved cattail establishment was prevented when water levels were maintained at 1.2 m (47 in) or deeper (Steenis et al. 1958).

Because cattails can transpire (Fletcher and Elmendorf 1955, Zohary 1962) significant quantities of water (2-3 m of water/acre/year), their establishment may serve to exacerbate water level instability and further contribute to disruptive influences supporting increased cattail. Flooding must account for evapotranspirational losses of water to maintain a level effective in cattail control.

DISCUSSION

Most efforts to control cattail have given little attention to the natural community, although this is the most important consideration for natural areas. Control techniques of fire, flooding, and physical removal are most appropriate.

For example, there is no data to test concerns that a fire used to control or destroy Typha rhizomes would have catastrophic effects on other vegetation, either plants or seed banks. Implementation of a regular burning program, including spring and fall burns, should gradually reduce Typha vigor, mineralize substrates, and promote regrowth by seed bank plants and invading species. Periodic fires, while not instantly controlling cattails, may reduce their overall vigor. In conjunction with the restoration of a naturally dynamic water level and quality, use of fire may help promote maintenance of the natural quality of a site.

The effects of flooding seem to support a recovery dominated by those plants represented in the soil seed bank. At Horicon Marsh, after three years of flooding that eliminated cattail, followed by drawdown, seeds of soft stem bulrush, cattail, nut grass, canary grass, sedges, and blue vervain germinated. The viable seeds present in newly exposed soils largely determined plant species that appeared during recovery in the few available studies. Submerged aquatic plants reappeared at Horicon Marsh even under flooded cattail overstories in areas with open water. Submerged plants increased once cattail stem densities were reduced. The paucity of case studies and data related to recovery after cattail control suggests a focus and need for future studies and monitoring research.

The effectiveness of cattail control by all mechanical means was more a function of the relationship between water depth and height at which cattails were cut than the methodology that was used. Methods that reduced the cattail's stature, followed by flooding to cover the cattail stems, offered reliable cattail control within several growing seasons. Chemical methods have also worked but should be less desirable in preserves. The potential for use of fire should be determined in each preserve since substrates need to be dried to affect cattail rhizomes. If fire is prescribed during a drawdown followed by reflooding, it could eliminate standing cattail stems and reduce the need for clipping. Hand clipping was as effective, in conjunction with flooding, as any cattail control method. This may be the most desirable cattail control method in nature preserves.

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