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Ecology and Management of Flowering Rush (*Butomus umbellatus* L.)

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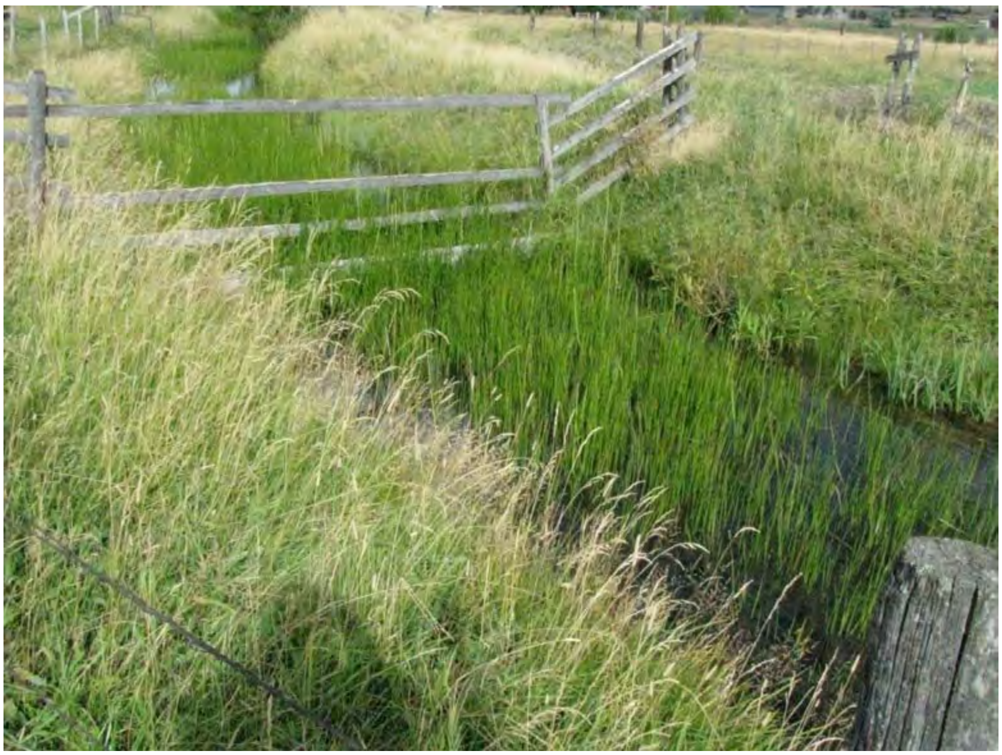

Figure 1. Flowering rush restricting flow in an irrigation ditch in Lake County, Montana. Photo by Alvin Mitchell, Salish Kootenai College, Pablo, Montana.

Abstract

Flowering Rush is an invasive Eurasian aquatic plant resembling a large sedge with emerged and fully submerged forms and umbrella-shaped clusters of 20 to 50 light-pink to rose-colored flowers. The fleshy rhizomatous roots fragment by minor disturbances and spread populations long distance by floating on water currents. It grows along lake shores and slow moving bodies of water. In Montana it is currently reported along the shores of Flathead Lake, portions of the Flathead River, Thompson Falls Reservoir, Noxon Reservoir, Cabinet Gorge and the Clark Fork River. Dense populations growing within irrigation ditches reduce water availability and flow (see Figure 1), and dense populations along lake shores inhibit boating, fishing, and swimming. Control methods are currently limited to hand and mechanical digging and herbicide application after water drawdown (check local regulations before applying these managements). Chemical control method studies are ongoing. Prevention, early detection and rapid response to eradicate new populations are the management priorities for Montana. Consult your county weed coordinator for the best management

options for your area. New populations should be reported to county Extension agents or weed coordinators.

Plant Biology

Figure 2. Rhizomes of flowering rush. Photo by Peter Rice, University of Montana, Missoula, Montana.

Identification

Flowering rush has triangular leaves like a sedge (Cyperaceae) and round flowering stems like a rush (Juncaceae), but it is neither. It is a Butomaceae, and it is the only representative species of this taxonomic family. It may grow either in shallow waters up to 10 feet deep (3 meters) as an emergent plant with upright foliage, or in deeper waters from 10 to 20 feet deep (3 to 6.1 meters) as a submerged plant with flexible leaves suspended in the water column. Both forms have fleshy, rhizomatous roots (see Figure 2). The narrow leaves are triangular in cross section (see Figure 3); spongy and compressible, and emerged leaves are twisted spirally toward the leaf tip.

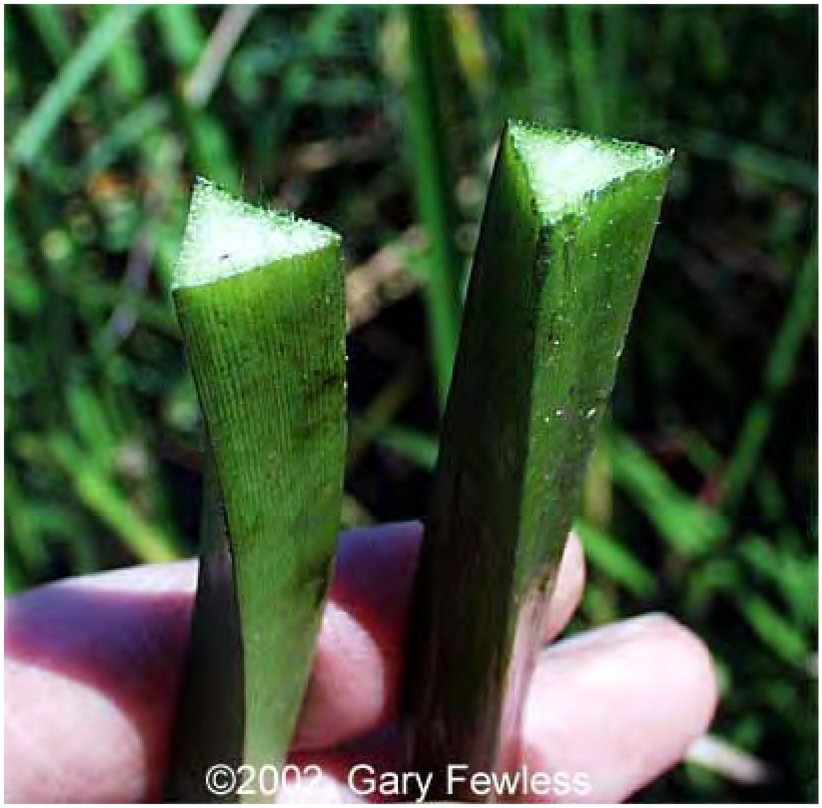

Figure 3. Cross sections of flowering rush leaves. Photo by Gary Fewless, University of Wisconsin, Green Bay, Wisconsin.

The flowers (see Figure 4) are three-quarters to one inch wide (2.0 to 2.5 centimeters) with three small, slightly-greenish sepals, six pink to rose-colored petals, nine stamens in two whorls (the outer whorl has six and the inner whorl has three), and six pistils that can produce about 200 seeds each. Twenty to 50 flowers are clustered in a round, umbrella-shaped inflorescence (see Figure 4) atop a stalk that is round in cross section. There are two flowering types; one that flowers regularly and produces viable seed, and the other that flowers occasionally but produces sterile flowers. The two reproductive types are distinguished also by their genetics, the fertile type is diploid (two sets of chromosomes) and the sterile type is triploid (three sets of chromosomes). A study of one population in Montana found only one plant in 1,000 flowered. Another population flowered profusely but produced no viable seed and very few bulbils (a small bulb-like vegetative reproductive structure similar to a bulblet). Thus, populations in Montana are believed to be the sterile type and do not reproduce sexually.

Figure 4. A flowering rush inflorescence and flower. Photo by Alvin Mitchell, Salish Kootenai College, Pablo, Montana.

Life History

Flowering rush is a perennial growing from a reproductive rhizome. Rhizomes develop structurally weak constrictions between vegetative buds formed along the rhizome. Minor disturbances such as moving water, waves, passing boats, or waterfowl break the rhizomes at the constrictions. The rhizome fragments disperse to form new populations. For the sterile type of flowering rush found in Montana, this is the only means of reproduction. The fertile type can reproduce by rhizome fragments as well as seed and small bulb-like structures (bulbils) formed on the rhizomes and on flowers.

Initiation of vegetative growth from rhizomes is somewhat variable. On Flathead Lake in northwestern Montana, emergence dates ranged from February 26 to April 15 over a three-year period. This is typically earlier in the spring than most native aquatic plants. Vegetative growth is continuous throughout the season and into fall. Plants flower from early summer to mid-fall. Fall frosts cause leaves to collapse as opposed to remaining upright through the winter like cattails.

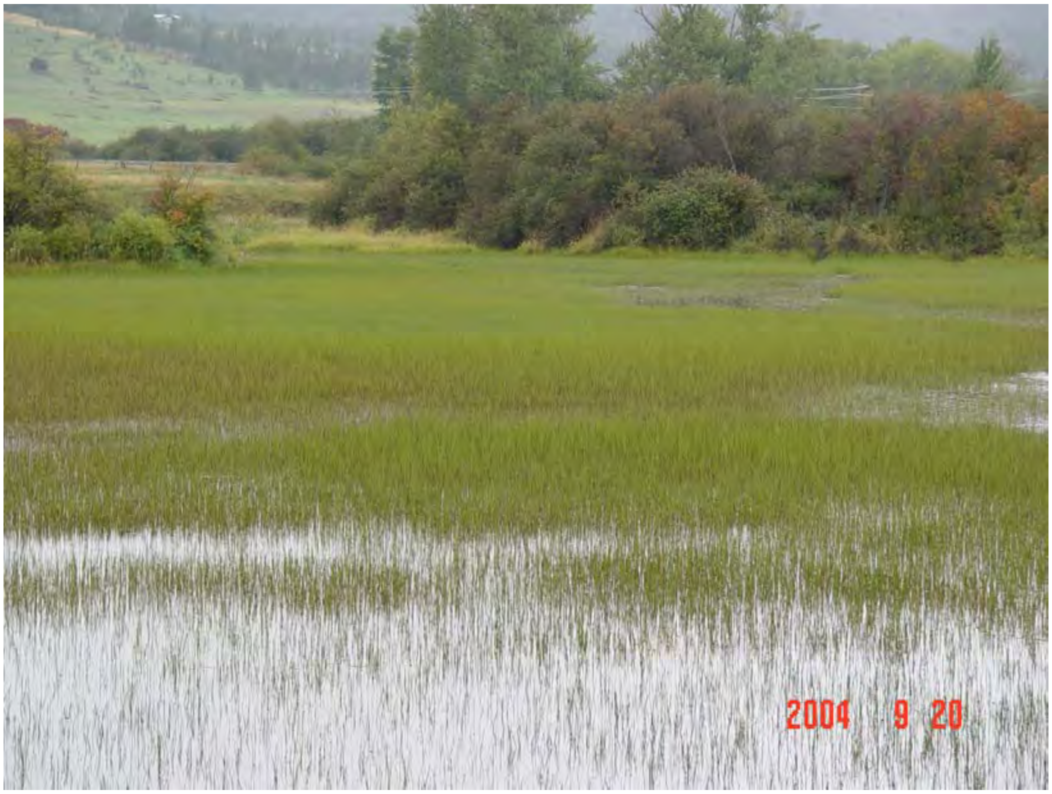

Figure 5. The shallow and slow moving waters of the mouth of Dayton Creek provide optimum habitat for flowering rush. Photo by Alvin Mitchell, Salish Kootenai College, Pablo, Montana.

Habitat

Flowering rush habitat includes lake shores, slow moving waterways, irrigation ditches, and wetlands. It is typically found in shallow waters, but can survive and grow across a range of water depths. It has been observed in very clear water at depths up to 20 feet (6.1 meters) in Flathead Lake. At depths of about 10 feet (3 meters) or greater, submersed leaves persist, but become limp and more ribbon-like than triangular in shape.

Fluctuating water levels promote flowering rush establishment and population expansion. As water levels decrease, un-vegetated or sparsely-vegetated substrata are exposed to rhizome establishment and the shallow waters or exposed sediments warm quickly promoting vegetative sprouting and accelerated growth. On the Flathead Lake before water levels were regulated by Kerr Dam, low water levels were typically during mid- to late summer and native emergent vegetation dominated low water zones. Since dam operations began, lake levels have been held at full pool through the summer and are at low pool in the late winter to early spring. This favors flowering rush because it is adapted to emerge and grow during this time, whereas the native plant species are not.

Competitive plants provide a barrier to flowering rush establishment. In the Czech Republic under stable water levels, flowering rush established in a band around reeds but did not advance into the reed patch. Currently, it is not known how North American native plants interact with flowering rush, but they may prevent population establishment and growth.

Spread

The sterile type of flowering rush found in Montana only spreads by rhizome fragments which are buoyant and a storehouse of carbohydrates. The floating fragments disperse on water currents, sometimes over long distances. Sparsely vegetated or un-vegetated silty substrata where water is shallow and currents have slowed to less than two miles per hour (mph) are ideal for rhizomatous establishment and vegetative growth fueled by the carbohydrate reserves.

First reported in Peaceful Bay on the northwest shore of Flathead Lake in 1964, flowering rush has spread through the Kerr Dam, along the lower Flathead river, and down the Clark Fork River to the delta and through Lake Pend Oreille, Idaho into the Pend Oreille River in Washington by 2010. Populations are in Flathead Lake (2,000 acres), Thompson Falls Reservoir (28 acres) and Noxon Reservoir (46 acres), and the Cabinet Gorge Reservoir. It occurs in sloughs, backwater eddies, low flow areas, and near boat launches along the Flathead and Clark Fork Rivers.

Flowering rush has been used ornamentally in water gardens. To avoid accidentally introducing non-native or invasive plants to surrounding water bodies, water gardens should never be placed near or allowed to overflow into wetlands, streams, or rivers. Non-native water garden plants should never be dumped into natural water bodies.

Impacts

Flowering rush growing prolifically in irrigation ditches reduces water flow and distribution, and increases ditch maintenance costs (see Figure 1). Plants interfere with boat propellers, swimming, and fishing thus reducing recreational opportunities along rivers and lake shores. Flowering rush supports habitat for the great pond snail that hosts parasites that cause swimmers' itch.

Fish habitat is affected where flowering rush forms dense stands in previously un-vegetated or sparsely-vegetated aquatic environments. This is a disadvantage for native cutthroat and bull trout that require open water to spawn, and an advantage to introduced fish like largemouth bass, yellow perch, and northern pike that spawn in vegetated substrata. Ambush piscivors (fish-eating fish) such as largemouth bass and northern pike hide in flowering rush vegetation. Northern pike are significantly depredating cutthroat and bull trout in the Flathead Lake and impairing their recovery.

Management Alternatives

Prevention

Prevention is the most important management option for flowering rush in Montana. Mapping, monitoring, early detection and eradication are critical to prevention. If a new infestation is found, a specimen should be saved, and the infestation reported to your county Extension Agent or the Montana Department of Fish, Wildlife and Parks at http://fwp.mt.gov/fishing/fishingmontana/ans/default.html. Inspection and sanitation of recreational equipment will prevent spread to un-infested water bodies. Any aquatic plant debris on boats, trailers, live wells, boat bilges, and fishing equipment should be disposed of away from lakes, ponds and rivers. Establishing washing stations with sanitation instructions at water-based recreational sites is recommended.

Mechanical Control

Methods of mechanical control include hand digging, raking, cutting, and bottom barriers. Hand digging may be a feasible management for very small infestations, especially when water levels are low. However, at a boat mooring on Flathead Lake, hand digging increased flowering rush density, most likely because of an increased number of rhizome fragments after digging. For hand digging to be successful, rhizome fragments will need to be diligently removed and repeated digging will probably be required. Raking is commonly used to remove aquatic vegetation from ponds. However, raking is not recommended for management of flowering rush because it has little effect on the population and it may disturb the root system and creates rhizome fragments. Similarly, cutting flowering rush below the water surface is not recommended because it will not kill the plant and the disturbance may fragment rhizomes. Bottom barriers are like underwater weed cloth used below boat moorings and ramps, and when properly installed and maintained according to recommendations and regulations, they can effectively restrict flowering rush growth in these small areas. It is advisable to check with state and tribal permitting authorities before applying any disturbance or bottom barriers in water bodies.

Ten years of mechanical harvesting in the Detroit Lakes (Minnesota) system only made the problem worse and at great expense. Mechanical control methods that disturb lake or river beds, and bottom barriers, may require permits from state, tribal, or federal agencies.

Cultural Control

Observational information suggests flowering rush establishes and quickly fills in areas devoid of aquatic vegetation, but it appears to invade areas with existing vegetation more slowly. It stands to reason that culturing desirable aquatic vegetation will retard flowering rush invasion and spread. Native sedges, rushes and reeds can be planted in areas susceptible to flowering rush invasion. In addition, managing water levels where possible to reduce winter and early spring draw downs that favor flowering rush, to more natural late summer draw downs, may favor native species over flowering rush.

Chemical Control

Application of herbicides directly to waters in Montana requires a 308 permit from the Montana Department of Environmental Quality. This includes private ponds and lakes that drain into irrigation ditches, creeks, rivers or other public waterways. Waters on tribal land are under the jurisdiction of the tribe. In addition, exposure of aquatic and riparian habitats to herbicides has high environmental risks. Contact you county weed coordinator prior to managing flowering rush with herbicides.

Herbicidal[1/] management of flowering rush is being developed. Research at the University of Montana and the Salish Kootenai College has investigated a number of herbicides applied at high and low water levels of Flathead Lake. Preliminary results suggest spraying during the spring draw-down period on Flathead Lake after five to seven inches (12.7 to 17.8 centimeters) of leaves had emerged from the exposed lake bed was most effective. Imazapyr (Habitat®) and imazomox (Clearcast®) suppressed flowering rush for one season but did not kill rhizomes. The effect on rhizomes of injecting herbicides in the water column is being tested.

[1/] Herbicides mentioned here are still being researched and are not listed as recommendations. Check www.greenbook.net for herbicide label updates. When herbicides do become available, note that a 308 permit from Montana Department of Environmental Quality is required before applying aquatic herbicides to water.

Biological Control

No biological control agents are currently available for the management of flowering rush.

Integrated Pest Management (IPM)

Prevention of further spread and education are the main priorities for flowering rush. Thoroughly wash all water recreational equipment. Dispose of plant material away from shores. Learn to identify flowering rush and report any findings to the Montana Department of Agriculture; Montana

Fish Wildlife and Parks; or your county Extension Agent or weed coordinator. Map and monitor current infestations and scout for new populations. Remove small populations by digging and follow-up with monitoring and repeated removal. Use bottom barriers in high use recreational areas with flowering rush. Develop a herbicide management strategy to target high priority areas and to minimize environmental consequences.

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