EURASIAN WATERMILFOIL

An Invasive Plant heading towards Manitoba: *Hydrilla Verticillata* L.

Eurasian watermilfoil is native to Europe, Asia, and Northern Africa (Couch and Nelson 1985). The genus *Myriophyllum* is cosmopolitan comprised of some 40 species belonging to the Watermilfoil Family (Haloragidaceae) (White and Haber 1992). *Myriophyllum spicatum* was introduced into North America in the 1940's causing ecological damage to rivers, lakes, wetlands, and estuaries (Creed 1998). It is considered the most widely managed aquatic weed in the United States.

Eurasian watermilfoil is the most important waterweed in the continental United States and considered to be most widely managed aquatic weed in the United States.

Eurasian watermilfoil threatens human health, as infestations create ideal habitat for mosquitoes including *Culex spp*. which has been implicated in the spread of West Nile Virus in Manitoba.

BIOLOGY

Eurasian watermilfoil is an invasive, submersed aquatic perennial with smooth stems that branch near the surface. It grows from 1.8 to 2.7 m in length with vine like stems and featherlike leaves that are whorled about the stem in fours (Eiswert et al. 2000). Reed (1977) described Eurasian watermilfoil as an aquatic-rooted herb with long, branching stems and whorled leaves in 3's or 4's growing to 35 mm long. Leaves on the primary

stem are in 14-21 pairs, rigid, linear, and are kidney shaped. The terminal spike is about 2 to 10 cm long often standing above the water (Reed 1977). Stems and leaves are a dark to medium green.

Eurasian watermilfoil produces seeds, however spreads primarily by plant fragments that grow roots, stems and leaves as they float (Eiswert et al. 2000). Stems can reach the waters surface from up to 7 meters of water growing in any type of aquatic substrate including silt, sand or rocks. Reed (1977) reported Eurasian watermilfoil will root in varying depths of water to 3 meters but rarely to 5 meters never extending beyond the water level.

In winter, upper portions of the stems break off and are capable of starting new populations in new habitats. Lower portions of the plant remain alive and green throughout the winter and send up new shoots in the spring and summer growing 5-7 cm per day (Reed 1977).

Of management concern is the finding that the invasive *M. spicatum* may be able to hybridize with the native *M. sibiricum* (Moody and Les 2002). Hybridization between native and invasive alien plants can result in introgression (causing extirpation of native species through gene contamination) and heterosis or hybrid vigor resulting in superior competitive phenotypes (Moody and Les 2002). Moody and Les (2002) found that hybrids were more aggressive in forming dense, monospecific stands. Hybrid milfoils may also show resistance to biological control agents.

ECOLOGICAL IMPACTS

Eurasian watermilfoil will out-compete or eliminate native aquatic and wetland plants reducing overall biological diversity. Eurasian watermilfoil establishes in dense bands along riparian areas making fishing, boating and swimming impossible. The plant has replaced the native northern watermilfoil (*M. sibiricum*) over much of the North American range (Johnson and Blossey 2002).

Johnson and Blossey (2002) reported ecological impacts include suppression of macrophytes, macroinvertebrates, fish spawning and growth, and that waterfowl avoid aquatic areas infested by plant. Dick et al. (2004) found that waterfowl prefer wetlands dominated by native vegetation over those dominated by invasive plants such as hydrilla and Eurasian watermilfoil. Eurasian watermilfoil can reduce water quality by increasing nutrient loading, reducing dissolved oxygen and changing water temperature (Eiswerth et al. 2000). Madsen et al. (1991) found that the plant significantly reduced native plant numbers and cover.

Eurasian watermilfoil threatens human health, as Eiswerth et al. (2000) reported that infestations create ideal habitat for mosquitoes including *Culex spp*. which has been implicated in the spread of West Nile Virus.

In British Columbia, the ecological impacts from Eurasian watermilfoil invasions have included replacing native plant communities; obstructing swimming, boating, waterskiing and fishing; reducing the appeal of beach areas due to the accumulation of plant debris; impeding flood control, water conservation, drainage and irrigation works; and reducing the economic benefits of tourism where dense growth limits recreation (Province of British Columbia 1976). Aquatic plant management programs have been discontinued in British Columbia however it is believed the distribution of Eurasian watermilfoil has since expanded.

ECONOMIC IMPACTS

According to Johnson and Blossey (2002), overall financial impacts have yet to be assessed.and that the state of New York alone, $500,000 is spent annually on control.

Eiswerth et al. (2000) concluded the impacts on recreation value in a watershed from Eurasian watermilfoil can range between $30 to $45 million dollars annually. Eiswerth et al. (2000) reported that economic damages of Eurasian watermilfoil infestations can be attributed to decreases in quantity and quality of recreational activities such as angling, boating and swimming; decreased profitability of agricultural production by clogging ditches, canal, and irrigation equipment; increases in the costs of electricity generation by clogging power plant intakes and municipal water supplies; and degraded passive land use values (values individuals place on a resource they do not personally use, for example, the existence of a pristine environmental resource with no anticipated future use).

To the south of Manitoba, Minnesota spent $140,000 to manage Eurasian watermilfoil in 26 lakes in 2004 (Minnesota Invasive Species Program, 2005). Minnesota reported that Eurasian watermilfoil is the invasive species that received the most focus in 2005 targeting $165,000 towards it control (Minnesota Invasive Species Program 2006).

DISPERSAL MECHANISMS

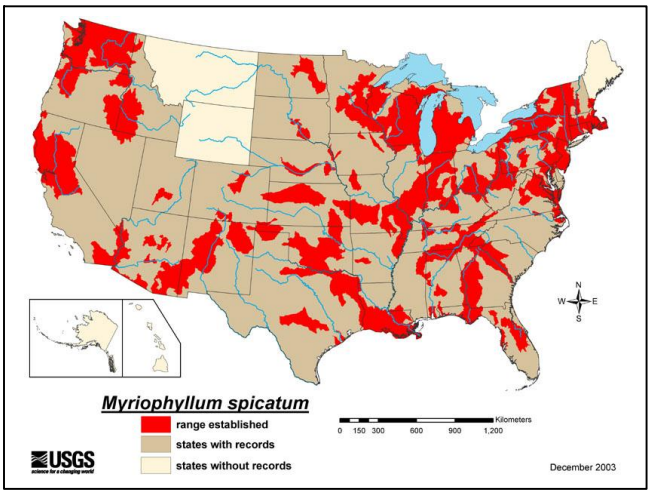
Human recreational activities are thought to be the major introduction vector. Plant materials caught upon boat motors, trailers, nets, boat propellers, and fishing gear are most likely transported between waterbodies (Eiswerth et al. 2000; Reed 1977). Madsen (1999) identified cross boundary boat traffic as a significant dispersal mechanism in the further spread of invasive plants in general into new watersheds.

Johnson and Blossey (2002) indicated that dispersal is linked to the aquarium and aquatic nursery trade. Eurasian watermilfoil is a popular aquarium plant and humans commonly discard unwanted aquarium contents into various water sources including wetlands, lakes, streams and rivers (Reed 1977). Reed (1997) suggested that the disconnected spatial distribution of Eurasian watermilfoil indicates many independent introductions probably from aquarium sources.

Reed (1977) suggested that hurricanes, tropical storms, and flood events further contribute to dispersal.

GEOGRAPHICAL DISTRIBUTION

Here is the USGS Eurasian watermilfoil distributional map.



Eurasian watermilfoil has spread to 45 states within the United States and into three Canadian provinces from the initial introduction in the Northeast region of the United States (Johnson and Blossey 2002; Moody and Les 2002). It was first found in Minnesota in Lake Minnetonka in 1987 and has since spread to 140 waterbodies (Newman and Herb 2004). The geographic centre of Eurasian watermilfoil in Minnesota is the metropolitan Lakes (Madsen 1999), further indicating the influence of human dispersal mechanisms. It is classified as a prohibited invasive species in Minnesota meaning that it cannot be bought, sold, or possessed in Minnesota (Minnesota Invasive Species Program 2004).

The closest established populations of Eurasian watermilfoil to Manitoba are found in Minnesota in the counties of Itasca and Cass. In 2004, Eurasian watermilfoil was

discovered in seven new lakes and on one new river in Minnesota (Minnesota Invasive Species Program 2005). In 2005, thirteen new populations were discovered in Minnesota resulting in 177 established populations (Minnesota Invasive Species Program 2006). It would seem only a matter of time before the plant establishes in Manitoba.

Eurasian watermilfoil invaded Wisconsin in the 1960s and has since spread throughout the state (Jester et al. 2000, Madsen 1999). Madsen (1999) examined Eurasian watermilfoil in eight Wisconsin lakes reporting that Beaver Dam Lake, Big Sand Lake, Nancy Lake, and Yellow Birch Lake all had dense mats of watermilfoil, all of these lakes are in the northern portion of Wisconsin with Nancy Lake being geographically closest to Manitoba.

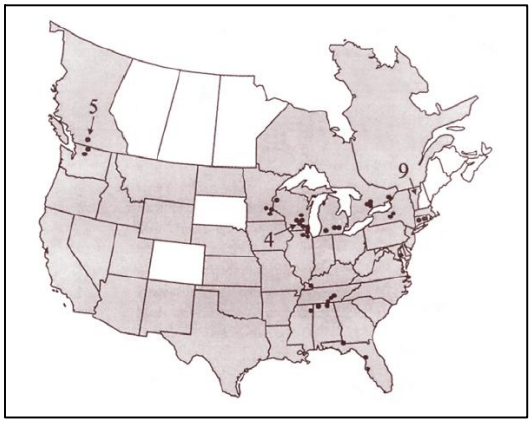
In the state of Vermont Eurasian watermilfoil was first detected in 1962 in Lake Champlain, and by September 2003, the plant had spread to 57 lakes and 15 rivers including the Connecticut River (Vermont Aquatic Nuisance Species Program, 2004).

Manitoba and Canada

Eurasian watermilfoil has been reported however not confirmed in Manitoba. It was reported in 1998 and again in 2001 in a channel portion of Souris River in southwestern Manitoba. Of concern to Manitoba is the general northward spread of the plant and established populations in Minnesota (i.e. Leech Lake in the northern half of Minnesota) and in Wisconsin. Leech Lake is a popular recreational lake with nine public water access points and numerous harbors and resorts (Minnesota Invasive Species Program 2005). The potential that recreational boaters will serve as a primary vector for further introductions from these public boat launches is extremely high.

It was first observed in British Columbia in 1970 in Okanagan Lake. The plant has spread since to Shuswap and Mara Lakes, to Christina and Champion Lakes in the Kootenays, to all the main lakes in the Okanagan Valley and to numerous water bodies in the Lower Mainland. Also, isolated populations were discovered on Vancouver Island in 1985, and in Nicola Lake in 1991 (Province of British Columbia 1976).

Eurasian watermilfoil distribution and watermilfoil declines (black dots) (adapted from Creed 1998). The areas with declines are thought to be the result of the herbivorous native weevil *Euhrychiopsis lecontei.*



MANAGEMENT

Once established there is no management tool currently available to eradicate Eurasian watermilfoil.

The State of Vermont suggests bottom barriers, suction harvesting, hydrorakes, pulling, mechanical harvesters and rotavating as mechanical control option (Vermont Aquatic Nuisance Species Program 2004). These methods are very costly and labour intensive. Jester et al. (2000) reported that mechanical harvesting and chemical herbicides provide only short-term control and have negative impacts on non-target vegetation.

Hybridization between Eurasian and northern watermilfoil (*Myriophyllum sibiricum*) also has management implications on any herbicide or biological control strategies (Moody and Les 2002).

Chemicals have been used throughout the United States to control and contain Eurasian watermilfoil. Minnesota has used whole-lake treatments with fluridone to management Eurasian watermilfoil in Lake McKinney and Ice Lake in northern Minnesota to achieve short-term control. In 2004, Minnesota spent $140,000 to manage Eurasian watermilfoil in 26 lakes (Minnesota Invasive Species Program 2005). Chemical control would not be a management option in Manitoba or Canada. There is also the concern that chemical controls may harm non-target organisms.

Eurasian watermilfoil is a prohibited invasive species in Minnesota which means it cannot be bought, sold or possessed.

Management tools may also include boat inspections, public education and surveys at boat launches or highway access point.

BIOLOGICAL CONTROL

Research suggests that the native herbivorous weevil may provide control of Eurasian watermilfoil (Creed 1998). The biological control agent *Euhrychiopsis lecontei (*Dietz) is being examined as a potential control agent for Eurasian watermilfoil in Wisconsin (Jester et al. 2000). The weevil is native to North America and known to exist in northern United States and southern Canada (Jester et al. 2000). The agent has been found in 49 Wisconsin Lakes and weevil herbivory has been shown to significantly reduce standing biomass (Jester et al. 2000). Johnson and Blossey (2002) add the native aquatic moth (*Acentria ephemerella*) is a generalist herbivore that feeds on Eurasian watermilfoil and that declines in Eurasian watermilfoil populations in Ontario have been attributed to this moth.

Grass carp have been released throughout some regions of North America (not permitted in Minnesota but have been released in Washington) to control aquatic invasive species including Eurasian watermilfoil however releases have greatly reduced native plant biomass and choice-tests revealed *M. spicatum* was the least preferred food for grass carp (Johnson and Blossey 2002).

Efforts in Minnesota are focused on the native milfoil weevil (*Euhrychiopsis lecontei*) which is a specialist herbivore of watermilfoils. The weevil has been successful at some sites and not effective at others.

Moody and Les (2002) reported that hybrid populations of *M. spicatum* are resistant to the biological control agent *Euhrychiopsis lecontei* (an aquatic weevil that consumes shoot apical tissue). Biological control agents are selected based on target species (parent species), however if the target species hybridizes to form new species resistant to the agent this poses new significant management challenges

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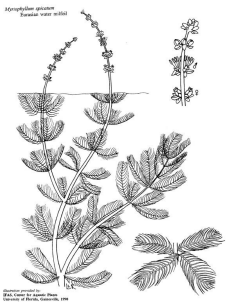
PICTURE GALLERIES

	Organization: University of Florida Center for Aquatic and Invasive Plants. Link: http://aquat1.ifas.ufl.edu/myrspi.html
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