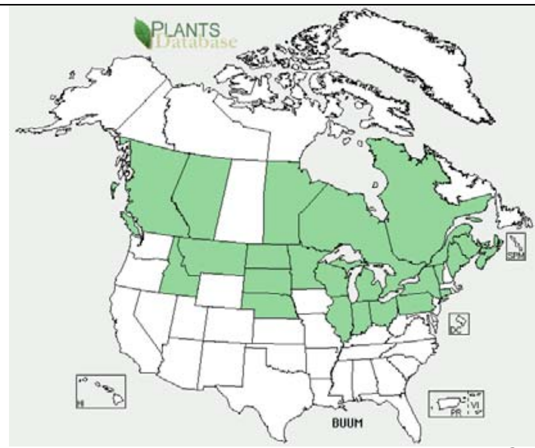
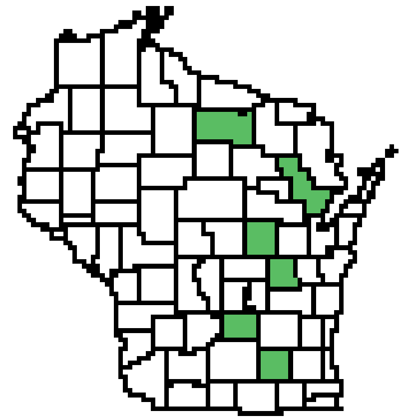
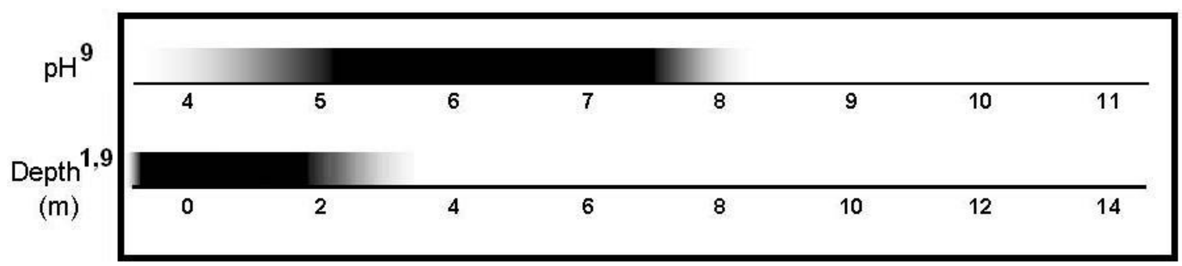
I. Current Status and Distribution — *Butomus umbellatus*

a. Range	Global/Continental	Wisconsin
Native Range Africa, Asia, Europe[1]	 *Figure 1: U.S and Canada Distribution Map*[2]	 *Figure 2: WI Distribution Map*[3]
Abundance/Range		
Widespread:	Northeastern U.S.; Great Lakes region	Not widespread
Locally Abundant:	Northern U.S.	Several Wisconsin populations
Sparse:	Western U.S.	Oneida County[4]
Range Expansion		
Date Introduced:	St. Lawrence River, Quebec, 1897[5]	Oconto County, 1958[3]
Rate of Spread:	Slow, locally rapid	Slow, locally rapid
Density		
Risk of Monoculture:	Medium[5]	High
Facilitated By:	Diploid populations[6,7]; drawdown or drought[8]	Unknown

b. Habitat	Lakes, ponds, reservoirs, wetlands, wadeable streams, rivers, ditches, riparian zones, high and low energy systems[1]
Tolerance	Chart of tolerances: Increasingly dark color indicates increasingly optimal range



Preferences	Fluctuating water levels; diploids prefer acidic soils with low nutrients, triploids prefer alkaline soils[9]; non-shaded areas[1]

c. Regulation	
Noxious/Regulated[2]:	CT, VT, WA
Minnesota Regulations:	*Prohibited*; One may not possess, import, purchase, propagate, or transport
Michigan Regulations:	*Restricted*; One may not knowingly possess or introduce
Washington Regulations:	*Secondary Species of Concern*; Class A Noxious Weed; State Wetland and Aquatic or Noxious Weed Quarantine List

II. Establishment Potential and Life History Traits	
a. Life History	Emergent, perennial, monocotyledonous forb[2]
Fecundity	Medium
Reproduction	Sexual; Asexual 2 cytotypes: diploid more fertile than sexually sterile triploid[6,10,11]; diploid is the most prominent cytotype of the Great Lakes region[6,7]
Importance of Seeds:	Low *in situ*[8]; low to medium in laboratory[11,12]; seeds are long-lived[5]
Vegetative:	Most important; 95% of 38 populations have the same genotype, indicating clonal reproduction[7]
Hybridization	Undocumented
Overwintering	
Winter Tolerance:	High; hardy in zones 3-10[1]
Phenology:	Emerges early relative to natives[12]; flowers from July to September and seeds ripen from August to September (in U.S.)[1]
b. Establishment	
Climate	
Weather:	Fluctuating water levels (particularly decreases) spur germination
Wisconsin-Adapted:	Yes
Climate Change:	Undocumented effect on growth and distribution
Taxonomic Similarity	
Wisconsin Natives:	Low
Other US Exotics:	Low
Competition	
Natural Predators:	Ducks, muskrats[1,8]
Natural Pathogens:	Undocumented
Competitive Strategy:	Rapid colonization following drop in water levels; long lived mobile propagules[13]
Known Interactions:	Documentation of competition with *Salix* sp. (willows) and *Typha* sp. (cattails)[5]
Reproduction	
Rate of Spread:	High
Adaptive Strategies:	Rhizomes allow for local dispersal; bulbils from root and umbel and long lived seeds disperse over long distances[1]; can extend distribution to depth ranges which are intolerant to other emergent species[1]
Timeframe	13 years from introduction to geographic saturation in St. Lawrence River[14]
c. Dispersal	
Intentional:	Ornamental cultivation[13]
Unintentional:	Water flow, muskrat activity, boating, ballast water[1,13]; water birds[9]
Propagule Pressure:	High; seeds and bulbils can be accidentally transported

Figure 3: Courtesy of Gary Fewless, University of Wisconsin-Green Bay[15]
Figure 4: Courtesy of Emmet Judziewicz, University of Wisconsin-Stevens Point[16]

III. Damage Potential	
a. Ecosystem Impacts	
Composition	Native plant richness and abundance decreases[1]
Structure	Monocultures
Function	Undocumented
Allelopathic Effects	Undocumented
Keystone Species	Undocumented
Ecosystem Engineer	Undocumented
Sustainability	Undocumented
Biodiversity	Decreases
Biotic Effects	Undocumented
Abiotic Effects	Undocumented
Benefits	Muskrat habitat
b. Socio-Economic Effects	
Benefits	Ornamental plant, edible plant[1]
Caveats	Risk of release and population expansion outweighs benefits of use
Impacts of Restriction	Increase in monitoring, education, and research costs
Negatives	Thick stands can hinder boat traffic and recreation[1]; may threaten economically important species such as wild rice [6,7]; decreases native diversity and abundance
Expectations	More negative impacts can be expected in systems with fluctuating water levels
Cost of Impacts	Decreased recreational and aesthetic value; decline in ecological integrity; increased research expenses
“Eradication” Cost	Quite expensive
IV. Control and Prevention	
a. Detection	
Crypsis:	High; confused with *Sparganium* spp. (bur-reeds) when sterile[1,13] but unique when flowering
Benefits of Early Response:	High; may limit local spread, individual pioneers could be removed by hand-digging[1]

b. Control	
Management Goal 1	Nuisance relief
Tool:	Chemical
Caveat:	Ineffective due to herbicide washing off narrow-leaves[1]
Cost:	Undocumented
Efficacy, Time Frame:	Most effective on dry banks or in very shallow water; herbicide may affect other emergent plants such as cattails[1]
Tool:	Mechanical
Caveat:	Repeat cuttings below water will reduce density but not kill plant[1]; disturbance to roots will promote release of bulbils, thus all of cut material needs to be removed
Cost:	Affordable to expensive depending on scale
Efficacy, Time Frame:	Multiple times per summer every year
Tool:	Combination approach
Caveat:	Labor intensive and expensive, but can be effective
Cost:	Expensive
Efficacy, Time Frame:	Effective control combines herbicide to kill vegetative parts and mechanical harvest to remove bulbils

[1] Global Invasive Species Database. 2005. *Butomus umbellatus*. Retrieved December 21, 2010 from: http://www.invasivespecies.net/database/species/ecology.asp?si=610&fr=1&sts=sss

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[3] University of Wisconsin – Madison. 2005. Family Butomaceae. Wisconsin Botanical Information System, Wisflora. Retrieved December 21, 2010 from: http://www.botany.wisc.edu/cgi-bin/detail.cgi?SpCode=BUTUMB

[4] Herman, L. 2007. Personal communication.

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[12] Hroudová, Z. and P. Zákravský. 2003. Germination responses of diploid *Butomus umbellatus* to light, temperature and flooding. Flora 198(1):37-44.

[13] Les, D.H. and L.J. Mehrhoff. 1999. Introduction of nonindigenous aquatic vascular plants in southern New England: a historical perspective. Biological Invasions 1:281-300.

[14] Delisle, F., C. Lavoie, M. Jean and D. Lachance. 2003. Reconstructing the spread of invasive plants: taking into account biases associated with herbarium specimens. Journal of Biogeography 30:1033-1042.

[15] Fewless, G. University of Wisconsin-Green Bay. Retrieved December 21, 2010 from: http://www.uwgb.edu/BIODIVERSITY/herbarium/invasive_species/butumb_aspect01.jpg

[16]Judziewicz, E. University of Wisconsin-Stevens Point. 2007. Family Butomaceae. Retrieved December 21, 2010 from: http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=BUTUMB