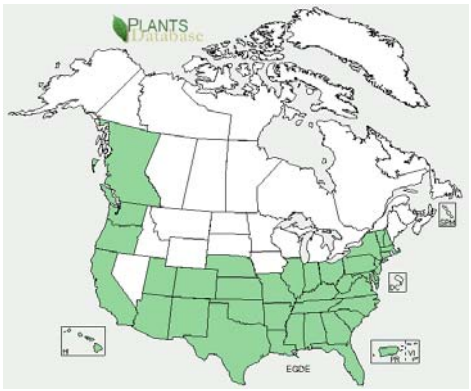
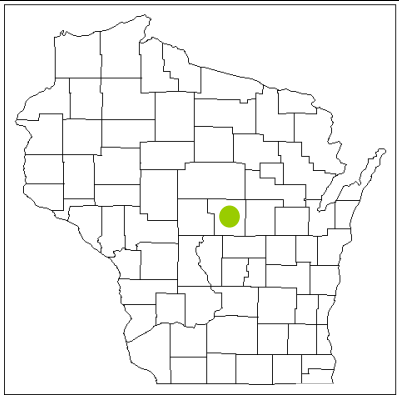
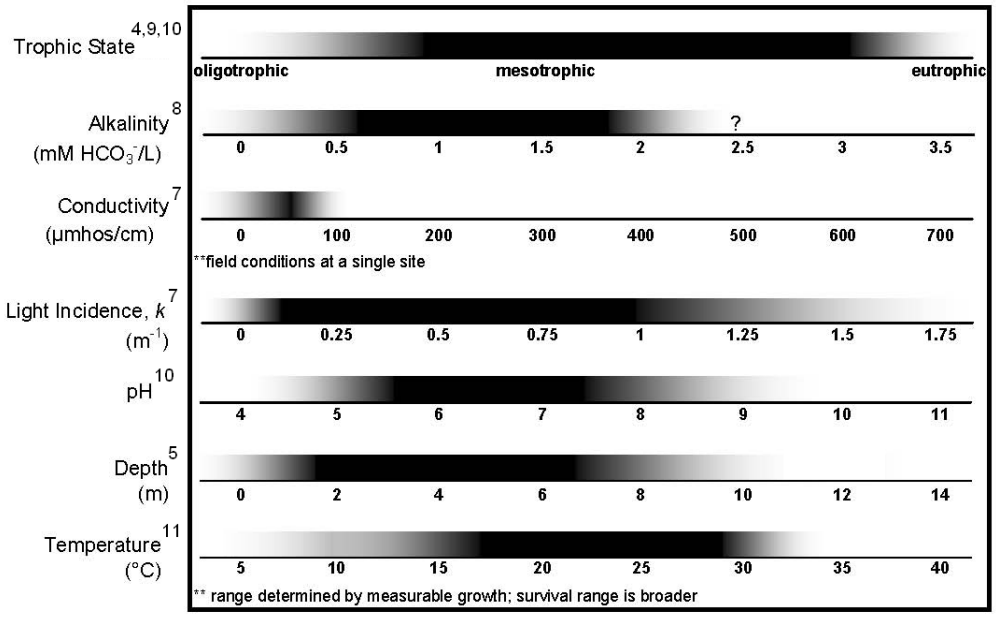
Aquatic Plant	Brazilian Waterweed; Brazilian Elodea
I. Current Status and Distribution	***Egeria densa***

a. Range	**Global/Continental**	**Wisconsin**
Native Range South America (Brazil, Argentina, Uruguay)[1]	 *Figure 1: U.S. and Canada Distribution Map*[2]	 *Figure 2: WI Distribution Map*[3]
Abundance/Range Widespread: Locally Abundant: Sparse:	 Eastern U.S. between 33° N and 35°N[4] Turbid, meso-eutrophic, still water High-energy systems	 Not applicable Not applicable Small Portage Co. fish pond[3]
Range Expansion Date Introduced: Rate of Spread:	 Long Island, New York, 1893[5] Population can double in one year[6]; low frequency to dominance in one year[5]	 Discovered 2009[3] Undocumented
Density Risk of Monoculture: Facilitated By:	 High[5,7,8] Moderately acidic meso-eutrophic waters[4,6,9,10]	 Widespread in pond Undocumented
b. Habitat	Lakes, streams, reservoirs, rivers, ponds, sloughs, ditches, wetlands	
Tolerance	Chart of tolerances: Increasingly dark color indicates increasingly optimal range	



Preferences	Shallow, still waters[1]; low light[7], slightly acidic, meso-eutrophic waters[4]
c. Regulation	
Noxious/Regulated[2]:	AL, CT, MA, ME, OR, SC, VT, WA
Minnesota Regulations:	*Regulated*; One may not introduce without a permit
Michigan Regulations:	*Prohibited*; One may not knowingly possess or introduce
Washington Regulations:	*Priority Species of Concern*; Class B Noxious Weed; State Wetland and Aquatic or Noxious Weed Quarantine List
II. Establishment Potential and Life History Traits	
a. Life History	Submersed, perennial, herbaceous, monocotyledonous angiosperm
Fecundity	High
Reproduction	Sexual; Asexual[8,9]
Importance of Seeds:	Seeds not produced outside native range[8]
Vegetative:	Very important: by root crowns, double nodes
Hybridization	Undocumented
Overwintering	
Winter Tolerance:	Medium; about 25% of biomass overwinters in Washington[5]
Phenology:	Emerges early relative to natives; two periods of growth (spring and fall) each followed by periods of senescence and decay[5]
b. Establishment	
Climate	
Weather:	Environmental disturbance facilitates growth[9]
Wisconsin-Adapted:	Yes
Climate Change:	May facilitate growth and distribution
Taxonomic Similarity	
Wisconsin Natives:	Medium; family Hydrocharitaceae
Other US Exotics:	Medium; family Hydrocharitaceae
Competition	
Natural Predators:	Eaten by many herbivores, but apparently not a preferred food[4]
Natural Pathogens:	Undocumented
Competitive Strategy:	Canopy formation[10,11]; shade tolerance[6,11]; decrease in native seed bank[8];
Known Interactions:	may out compete *Elodea canadensis*, *Lagarosiphon major*[6] and *Myriophyllum spicatum*[5]
Reproduction	
Rate of Spread:	High
Adaptive Strategies:	Increased lateral spread in low light; high rate of vegetative reproduction; fragments
Timeframe	Can double extensive population in one year (from 39% to 86% of sample sites)[6]; biomass increased over 10-fold within 2 years[5]
c. Dispersal	
Intentional:	Aquaculture trade (sold as oxygenator for ponds and aquaria, often as "Anacharis")
Unintentional:	Wind, water, animals, humans
Propagule Pressure:	High; fragments easily accidentally introduced, source populations near Wisconsin

Figure 3: Courtesy of Virginia Polytechnic Institute and State University, Bugwood.org[12]
Figure 4: Courtesy of Washington State Department of Ecology[5]

III. Damage Potential	
a. Ecosystem Impacts	
Composition	Reduced occurrence of native species[8]; has affected the status of certain threatened species[13]; native seed bank lower in diversity and density under *E. densa* canopies[8]; provides poor habitat for fish[5]; changes in biotic and abiotic conditions cause a response on multiple trophic levels[8]
Structure	Monocultures, subsurface canopy[8]; changes in community architecture; fish assemblage respond to change in architecture[13]
Function	Changes in biotic and abiotic factors affect higher trophic interactions; decreased light penetration, changes in nutrient regime[9]
Allelopathic Effects	Undocumented
Keystone Species	Undocumented
Ecosystem Engineer	Yes; dense canopy decreases light penetration
Sustainability	Undocumented
Biodiversity	Decreases[8]
Biotic Effects	Impacts native species at multiple trophic levels
Abiotic Effects	Increased oxygen and alkalinity (spring), total suspended solids, total phosphorous, total nitrogen (in beds over time) and temperature (though difference generally less than 1ºC)[9] Depletes sedimentary phosphorus; anoxia in benthic zone; decreased oxygen and alkalinity in summer[9]
Benefits	Can increase water clarity; may provide habitat for invertebrates and fish
b. Socio-Economic Effects	
Benefits	Used heavily as an aquarium and submerged pond plant; preferred in physiology studies, often used in high school science labs[13]
Caveats	Many potential introductions from aquarium water disposal[5]
Impacts of Restriction	Increase in monitoring, education, and research costs
Negatives	High growth rates may impede hydroelectric power generation[5,7]; impedes recreation; decreases aesthetic and ecological value of the ecosystem[5]; restricts water movement; traps sediments; fluctuations in water quality[5]
Expectations	Undocumented

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 native *Elodea* spp., and non-native Hydrilla[5]
Benefits of Early Response:	Undocumented
b. Control	
Management Goal 1	Eradication
Tool:	Various herbicides (diquat, endothall, fluridone, copper-based products)
Caveat:	Eradication possible but very difficult and costly; non-target plant species are negatively impacted
Cost:	Expensive
Efficacy, Time Frame:	Yearly effort needed to move towards eradication
Management Goal 2	Nuisance relief
Tool:	Small-scale chemical, mechanical harvest
Caveat:	Harvesting causes fragmentation which increases distribution and density[5]; negative impacts on non-target species
Cost:	Undocumented
Efficacy, Time Frame:	Undocumented
Tool:	Drawdown
Caveat:	Only feasible in certain situations
Cost:	Undocumented
Efficacy, Time Frame:	Consecutive drawdowns may be more effective than an individual drawdown; success dependent on degree of desiccation, substrate, air temperature, and presence of snow[5]
Tool:	Triploid grass carp[13]
Caveat:	Carp are non selective grazers, though grass carp (older than fingerlings) will eat it in preference to other plants[5]; stocking is often illegal due to occasional fertility
Cost:	Undocumented
Efficacy, Time Frame:	Undocumented
Tool:	Biological control (8 isolates of *Fusarium* sp., fungus)
Caveat:	Use of *Fusarium* sp. is underexplored
Cost:	Undocumented
Efficacy, Time Frame:	May have potential as a biological control agent
Documented Cost:	Over $1 million on Silver Lake, Washington; $2 million in Sacramento-Delta area[5]

[1] US Forest Service, Pacific Island Ecosystems at Risk (PIER). 2010. *Egeria densa* Planch., Hydrocharitaceae. Retrieved December 22, 2010 from: http://www.hear.org/pier/species/egeria_densa.htm

[2] United States Department of Agriculture, Natural Resource Conservation Service. 2010. The PLANTS Database. National Plant Data Center, Baton Rouge, LA, USA. Retrieved December 22, 2010 from: http://plants.usda.gov/java/profile?symbol=EGDE

[3] Provost, S. 2010. Personal communication.

[4] Cook, C.D.K. and K. Urmi-König. 1984. A revision of the genus *Egeria* (Hydrocharitaceae). Aquatic Botany 19:73-96.

[5] Washington State Department of Ecology Water Quality Program. 2010. Non-native Freshwater Plants Brazilian Elodea. Retrieved December 22, 2010 from: http://www.ecy.wa.gov/programs/wq/plants/weeds/egeria.html

[6] Tanner, C.C., J.S. Clayton and B.T. Coffey. 1990. Submerged-vegetation changes in Lake Rotoroa (Hamilton, New Zealand) related to herbicide treatment and invasion by *Egeria densa*. New Zealand Journal of Marine and Freshwater Research 24:45-57.

[7] Bini, L.M. and S.M. Thomaz. 2005. Prediction of *Egeria najas* and *Egeria densa* occurrence in a large subtropical reservoir (Itaipu Reservoir, Brazil-Paraguay). Aquatic Botany 83(3):227-238.

[8] de Winton, M.D. and J.S. Clayton. 1996. The impact of invasive submerged weed species on seed banks in lake sediments. Aquatic Botany 53(1-2):31-45.

[9] Mazzeo, N., L. Rodríguez-Gallego, C. Kruk, M. Meerhoff, J. Gorga, G. Lacerot, F. Quintans, M. Loureiro, D. Larrea and F. García-Rodríguez. 2003. Effects of *Egeria densa* Planch. beds on a shallow lake without piscivorous fish. Hydrobiologia 506-509:591-602.

[10] Mony, C., T.J. Koschnick, W.T. Haller and S. Muller. 2007. Competition between two invasive Hydrocharitaceae (*Hydrilla verticillata* (L.f.) (Royle) and *Egeria densa* (Planch)) as influenced by sediment fertility and season. Aquatic Botany 86(3):236-242.

[11] Barko, J.W. and R.M. Smart. 1981. Comparative influences of light and temperature on the growth and metabolism of selected submersed freshwater macrophytes. Ecological Monographs 51(2):219-235.

[12] Virginia Tech Weed Identification Guide Archive, Virginia Polytechnic Institute and State University. Retrieved December 22, 2010 from: Bugwood.org

[13] Global Invasive Species Database. 2006. *Egeria densa*. Retrieved December 22, 2010 from: http://www.invasivespecies.net/database/species/ecology.asp?si=289&fr=1&sts=sss&lang=EN