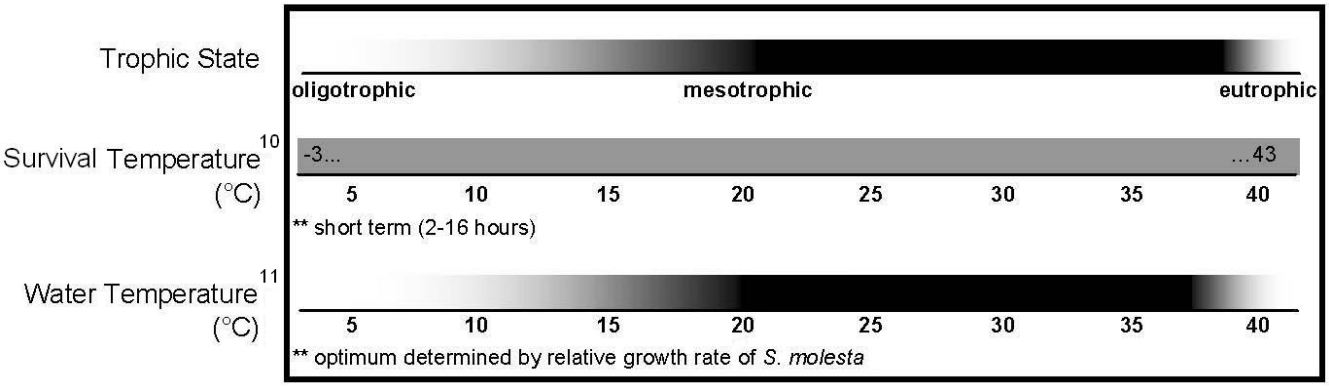
| Aquatic Plant | | Salvinia spp. |
|---|---|---|
| **I. Current Status and Distribution** | | ***Salvinia molesta, S. minima, S. herzogii, S. natans*** |
| **a. Range** | **Global/Continental** | **Wisconsin** |
| **Native Range**<br>*S. molesta*: South America (Southern Brazil)[1]<br>*S. minima*: Central and South America[2]<br>*S. herzogii*: South America[3]<br>*S. natans*: Eurasia[4] |  <br>*Figure 1: U.S and Canada Distribution Map*[5] (*S. molesta, S. minima, S. herzogii, and S. natans* ) | Not recorded in Wisconsin |
| **Abundance/Range**<br>Widespread:<br>Locally Abundant:<br>Sparse: | <br>Tropics, subtropics<br>Warm temperatures, high nutrients[6]<br>Frost-limited | <br>Not applicable<br>Not applicable<br>Not applicable |
| **Range Expansion**<br>Date Introduced:<br><br>Rate of Spread: | <br>Late 19th century[7]; 1930s[2]; late 1970s to early 1980s[8]<br>Extremely rapid; doubling time of 2.9 days (*S. herzogii*)[9] | <br>Not applicable<br><br>Not applicable |
| **Density**<br>Risk of Monoculture:<br><br>Facilitated By: | <br>High; capable of 30,000 plants/m$^2$; can result in mats 3 feet thick[8]<br>High temperatures, nutrients | <br>Unknown<br><br>Unknown |
| **b. Habitat** | Lakes, reservoirs, wetlands, low energy systems | |
| **Tolerance** | Chart of tolerances: Increasingly dark color indicates increasingly optimal range | |
|  | | |
| **Preferences** | Low energy freshwater systems; high nutrient input (nitrogen) and high temperatures[9,12]; intolerant of salinity[7] | |

| | |
|---|---|
| **c. Regulation** | |
| Noxious/Regulated[5]: | Federal Noxious Weed List; AL, AZ, CA, CO, CT, FL, MA, MS, NV, NC, OR, SC, TX, VT |
| Minnesota Regulations: | *Prohibited*; One may not possess, import, purchase, propagate, or transport |
| Michigan Regulations: | *Prohibited*; One may not knowingly possess or introduce |
| Washington Regulations: | *Secondary Species of Concern* |
| **II. Establishment Potential and Life History Traits** | |
| **a. Life History** | Floating leaf aquatic fern; subtle differences exist between species but in general they are very closely related[12]; *S. molesta* can act as an annual or perennial (depending on climate)[6] |
| **Fecundity** | Very high |
| **Reproduction** | Asexual |
| Importance of Spores: | Sporocarps of low reproductive importance |
| Vegetative: | Very important: autofragmentation, ramets |
| **Hybridization** | Undocumented |
| **Overwintering** | |
| Winter Tolerance: | Medium: will survive mild winters when frost is slight[12,13] |
| Phenology: | Starts growing later than most native plants |
| **b. Establishment** | |
| **Climate** | |
| Weather: | Warm temperatures stimulate growth |
| Wisconsin-Adapted: | Uncertain; plants can act as an annual and still achieve nuisance-level growth during summer[6]; *S. natans* has a temperate zone distribution |
| Climate Change: | Likely to facilitate growth and distribution |
| **Taxonomic Similarity** | |
| Wisconsin Natives: | Low |
| Other US Exotics: | High; several *Salvinia* spp. are considered exotic in the United States |
| **Competition** | |
| Natural Predators: | *Cyrtobagous salviniae* (beetle)[9] |
| Natural Pathogens: | Undocumented |
| Competitive Strategy: | Very prolific; rapid growth rate; dense canopy shades competition[6,12] |
| Known Interactions: | *S. herzogii* replaced by *Eichhornia crassipes* in 103 days[10] |
| **Reproduction** | |
| Rate of Spread: | High; can cover 40 $mi^2$ in three months[12]; relative growth rate positively correlated with nitrogen[9] |
| Adaptive Strategies: | Prolific vegetative growth |
| **Timeframe** | Can dominate a community in one season |
| **c. Dispersal** | |
| Intentional: | Aquarium trade, ornamental use, wastewater treatment[6] |
| Unintentional: | Wind, water, animals, humans |
| Propagule Pressure: | Medium; fragments easily accidentally introduced but source populations not near Wisconsin |


*Figure 2: S. natans; Courtesy of Kurt Stueber*[14]
*Figure 3: S. molesta; Courtesy of Wikimedia Commons*[15]

| **III. Damage Potential** | |
|---|---|
| **a. Ecosystem Impacts** | |
| **Composition** | Migrating birds find it difficult to access water in areas covered by *Salvinia* spp.[6]; mats pose risk for native species at multiple trophic levels; displaces native vegetation and provides very little habitat for native fauna[12,16] |
| **Structure** | High risk of monocultures; drastic architectural changes[6]; decrease in light penetration (affects structure of plant and microbial community)[17]; increase in siltation and reduction in water flow |
| **Function** | Depletes dissolved oxygen[12]; increases $CO_2$; increases siltation and reduces water flow[6] |
| **Allelopathic Effects** | Undocumented |
| **Keystone Species** | Undocumented |
| **Ecosystem Engineer** | Yes; habitat altered by dense canopy; increased siltation |
| **Sustainability** | Undocumented |
| **Biodiversity** | Causes decrease in biodiversity[6] |
| **Biotic Effects** | Impacts native species at multiple trophic levels[6,12] |
| **Abiotic Effects** | Decrease in dissolved oxygen concentration and pH; increase in siltation and nutrient pulses |
| **Benefits** | Undocumented |
| **b. Socio-Economic Effects** | |
| **Benefits**<br>Caveats | Used as mulch, compost and fodder; used in paper making, handcrafts, bio-gas generation[6]<br>Risk of release and population expansion outweighs benefits of use |
| **Impacts of Restriction** | Increase in monitoring, education, and research costs |
| **Negatives** | Clogs waterways, (entire villages have been abandoned when navigation becomes impossible)[6,11,12]; can cause drowning of livestock[11]; angling becomes impossible[12]; increases level and spread of human diseases (elephantiasis, encephalitis, dengue fever, malaria)[6]; can ruin electrical and agricultural industries[6] |
| **Expectations** | More negative impacts in tropical, eutrophic, slow moving, shallow, water-limited areas[6] |
| **Cost of Impacts** | Decreased recreational and aesthetic value; decline in ecological integrity; increased research expenses |
| **"Eradication" Cost** | Undocumented |

| IV. Control and Prevention | |
|---|---|
| **a. Detection** | |
| Crypsis: | Low |
| Benefits of Early Response: | High; restricting size of population improves prospect of successful control |
| **b. Control** | |
| **Management Goal 1** | Nuisance relief |
| Tool: | *Cyrtobagous salviniae* (beetle)[9] |
| Caveat: | Eradication is impossible, suppression is realistic goal |
| Cost: | Comparatively cheap |
| Efficacy, Time Frame: | 2 years for 90% control in Louisiana[18] |
| | |
| Tool: | Diquat, fluridone, glyphosate and manual removal |
| Caveat: | Labor intensive; results last for only a few weeks |
| Cost: | Very expensive |
| Efficacy, Time Frame: | Multiple times per year |

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