Plant Assessment Form

For use with the "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association (Warner et al. 2003)

Printable version, February 28, 2003
(Modified for use in Arizona, 07/02/04)

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Salvinia molesta* Mitchell (USDA 2005)
Synonyms:	None identified in USDA (2005).
Common names:	Giant salvinia, salvinia, water fern, kariba-weed, African paval
Evaluation date (mm/dd/yy)**:**	09/18/03
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Committee review date:	09/19/03 and 03/26/04
List date:	03/26/04
Re-evaluation date(s):	

Table 2. Scores, Designations, and Documentation Levels

Question		Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	**A**	Other published material	**"Impact"** **Section 1 Score:** **A**	**"Plant Score"** **Overall Score:** **High** **Alert Status:** **Alert**
1.2	Impact on plant community	**A**	Other published material		
1.3	Impact on higher trophic levels	**A**	Other published material		
1.4	Impact on genetic integrity	**D**	Other published material		
2.1	Role of anthropogenic and natural disturbance	**B**	Observational	**"Invasiveness"** *For questions at left, an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Sum total of all points for Q2.1-2.7:* **15 pts** **Section 2 Score:** **B**	
2.2	Local rate of spread with no management	**A**	Observational		
2.3	Recent trend in total area infested within state	**B**	Observational		
2.4	Innate reproductive potential	**B**	Other published material		
2.5	Potential for human-caused dispersal	**A**	Other published material		
2.6	Potential for natural long-distance dispersal	**B**	Observational		
2.7	Other regions invaded	**C**	Other published material		RED FLAG **NO** Something you should know.
3.1	Ecological amplitude	**C**	Observational	**"Distribution"** **Section 3 Score:** **C**	
3.2	Distribution	**D**	Observational		

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **A** *Doc'n Level:* **Other pub.**
Identify ecosystem processes impacted: Reduces availability of light and dissolved oxygen.
Rationale: Under favorable conditions can form dense mats more than 0.5m thick completely covering water surface (DiTomaso and Healy 2003). Thereby decreasing light availability and dissolved oxygen while increasing dead plant material. Where *Salvinia molesta* is carefully managed, it can remove excess nutrients and other pollutants from water (DiTomaso and Healy 2003). It can also diminish water quality (unspecified type of impact; DiTomaso and Healy 2003). But if left in the water, these excess nutrients and other pollutants will not be removed. Giant salvinia has the potential to alter aquatic ecosystems in several ways. Rapidly expanding populations can overgrow and replace native plants. Resulting dense surface cover prevents light and atmospheric oxygen from entering the water. Meanwhile, decomposing material drops to the bottom, greatly consuming dissolved oxygen needed by fish and other aquatic life (Thomas and Room 1986 in Jacono 2003).
Sources of information: See cited literature.

Question 1.2 Impact on plant community composition, structure, and interactions *Score:* **A** *Doc'n Level:* **Other pub.**
Identify type of impact or alteration: Dense shade resulting from thick *S. molesta* mats removes an essential component to photosynthesis (sunlight) and jeopardizes survival of submerged plant communities (including algae).
Rationale: Without adequate sunlight, plants can not produce the biochemical materials necessary to exist. Rapidly growing *S. molesta* colonies produce mats up to 0.5 m thick including deep foliage layers and dead plant material; these submerged layers block the energy (sunlight) needed to sustain plant life. Experimental evidence suggests submersed leaves may sometimes associate with nitrogen-fixing blue-green algae (DiTomaso and Healy 2003). Giant salvinia has the potential to alter aquatic ecosystems in several ways. Rapidly expanding populations can overgrow and replace native plants. Resulting dense surface cover prevents light and atmospheric oxygen from entering the water. Meanwhile, decomposing material drops to the bottom, greatly consuming dissolved oxygen needed by fish and other aquatic life (Thomas and Room 1986 in Jacono 2003).
Sources of information: See cited literature; see also Jacono and Pitman (2001).

Question 1.3 Impact on higher trophic levels *Score:* **A** *Doc'n Level:* **Other pub.**
Identify type of impact or alteration: Extensive growth of *S. molesta* produces biomass that eventually decomposes in aquatic habitats and removes dissolved oxygen form the water and renders the water unsuitable for non-plant aquatic organisms (fish, mollusks and arthropods).
Rationale: Decomposition of mats formed by *S. molesta* creates an oxygen deficient (anaerobic conditions) in water bodies where *S. molesta* infestations cover large areas of water surfaces. Oxygen is an essential element that aquatic heterotrophic organism must have to survive. Giant *Salvinia* has the potential to alter aquatic ecosystems in several ways. Rapidly expanding populations can overgrow and replace native plants. Resulting dense surface cover prevents light and atmospheric oxygen from entering the water. Meanwhile, decomposing material drops to the bottom, greatly consuming dissolved oxygen needed by fish and other aquatic life (Thomas and Room 1986 in Jacono 2003).

Sources of information: See cited literature; also see Jacono and Pitman (2001) and DiTomaso and Healy (2003).

Question 1.4 Impact on genetic integrity	*Score:* **D** *Doc'n Level:* **Other pub.**
Identify impacts: No known hybridization.	
Rationale: In Arizona, there are no known native congeners (Kearney and Peebles 1960).	
Sources of information: See cited literature.	

Question 2.1 Role of anthropogenic and natural disturbance in establishment	*Score:* **B** *Doc'n Level:* **Obs.**
Describe role of disturbance: Requires humans (not necessarily a disturbance) to move into other streams or water sources, but it can move down stream and establish with normal natural disturbance processes.	
Rationale: Once established in North American fresh water habitats, its innate rapid vegetative reproduction makes it possible for *S. molesta* to be disseminated downstream by water currents. Escaped cultivation and spreading throughout southern U.S. (DiTomaso and Healy 2003).	
Sources of information: See cited literature; also see Jacono (2003). Score based on observations of Working Group members and inference drawn from the literature.	

Question 2.2 Local rate of spread with no management	*Score:* **A** *Doc'n Level:* **Obs.**
Describe rate of spread: Rapid, population densities can double in a few days.	
Rationale: One locality of *S. molesta* was documented in an irrigation canal near Blythe, California in 1999. Now this plant is a common contaminant of Colorado River still-water habitats from Cibola National Wildlife Refuge south of Ehrenberg, Arizona to Morelos Dam west of Yuma, Arizona. This means *S. molesta* has moved >50 miles down stream and become well-established in dozens of sites within a four-year period. As of September 2003, hundreds of thousands of square meters of *S. molesta* mats are present within the infested portion of Colorado River (F. Northam, personal observation, 2003; T. Olson, personal communication, 2003). From Jacono (2003): under optimal conditions (light, temperature and nutrient) in the laboratory, plant populations have been found to double in size every 2 to 4 days (Gaudet 1973). Under favorable natural conditions, biomass doubled in about one week to 10 days (Mitchell and Tur 1975, Mitchell and Rose 1979).	
Sources of information: See cited literature. Also considered observations by F. Northam (at the time Noxious Weed Program Coordinator for the Arizona Department of Agriculture, 2003) and personal communication with T. Olson (Wildlife Biologist, Bureau of Reclamation, Boulder City, Nevada, 2003). Score based on observations and inference drawn from the literature.	

Question 2.3 Recent trend in total area infested within state	*Score:* **B** *Doc'n Level:* **Obs.**
Describe trend: Rapid increase, but less than doubling in area infested in <10 years.	
Rationale: Although *S. molesta* has spread rapidly and aggressively in the lower Colorado River, on a state-wide basis, this invader's spread has been negligible. At this time, it has not moved into other aquatic habitats (requires humans to move it from one stream system to another).	
Sources of information: Observations by F. Northam (at the time Noxious Weed Program Coordinator for the Arizona Department of Agriculture, 2003) and personal communication with T. Olson (Wildlife Biologist, Bureau of Reclamation, Boulder City, Nevada, 2003).	

Question 2.4 Innate reproductive potential	*Score:* **B** *Doc'n Level:* **Other pub.**
Describe key reproductive characteristics: *Salvinia* molesta reproduction is strictly by vegetative (clonal) growth. It is an extremely efficient converter of nutrients, sunlight, and carbon dioxide into new plants.	
Rationale: As water temperatures warm through spring, new growth resumes in April or May and by June exponential population growth occurs until temperature and light intensity declines in late summer. *Salvinia molesta* effectively reproduces through vegetative means. Stems fragment spontaneously as plants mature. New branches develop from apical and lateral buds. Each node harbors up to five serial lateral buds, adding to the high potential for growth and dormancy (Jacono 2003).	
Sources of information: See cited literature; also see Mitchell and Tur (1975).	

Question 2.5 Potential for human-caused dispersal	*Score:* **A** *Doc'n Level:* **Other pub.**
Identify dispersal mechanisms: (1) Water recreation craft and vehicles, (2) aquatic plant markets—aquarium or pond ornamental, (3) recreation (fishing, water activities, etc.), and (4) irrigation delivery systems.	
Rationale: This plant is sold as an ornamental, may be released with other aquarium species, and it can be moved on aquatic recreational vehicles and equipment (DiTomaso and Healy 2003). Other observed forms of human dispersal observed include in bait buckets and in irrigation diversion systems into and out of rivers and streams along the Colorado River. *Salvinia molesta* requires humans to move it from one freshwater system to another; no naturally means to move from one system to another.	
Sources of information: See cited literature. Also considered Working Group member observations of dispersal.	

Question 2.6 Potential for natural long-distance dispersal	*Score:* **B** *Doc'n Level:* **Obs.**
Identify dispersal mechanisms: Fragments can disperse downstream in the water.	
Rationale: Occasional dispersal >1 km within infested habitats as the result of flowing water and can only go in one direction, downstream. Although it is extremely efficient at downstream dispersal, it will not spread upstream without human intervention. *Salvinia molesta* tends to infest down stream areas within 1km but there is occasional dispersal greater than 1 km.	
Sources of information: Observations by F. Northam (Consulting Weed Biologist, Tempe, Arizona, 2004).	

Question 2.7 Other regions invaded	*Score:* **C** *Doc'n Level:* **Other pub.**
Identify other regions: Aquatic habitats in California, Texas, Louisiana, Alabama, Georgia, Florida, South Carolina, Florida are invaded; however, similar habitats are already invaded in Arizona.	
Rationale: *Salvinia molesta* is strictly a freshwater species and does not tolerate brackish or marine environments. Typical habitat is still and slow-moving waters of lakes, ponds, reservoirs, rivers, marshes, ditches, and rice fields, with water temperature >60°F. Tolerates mild temperate conditions and occasional frost but not prolonged periods of freezing. Dense mats do not develop at temperatures below 10°C (DiTomaso and Healy 2003). *Salvinia molesta* will withstand periods of stress, both low temperature and dewatering, through latent buds (Jacono 2003). Found in lakes and marshes in Texas (Jacono 2003).	
Sources of information: See cited literature.	

Question 3.1 Ecological amplitude	*Score:* **C** *Doc'n Level:* **Obs.**
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Limited. Establishment and persistence requires permanent fresh (i.e., non-saline) aquatic environment that is an extremely limited ecological type in Arizona. First	

Arizona records of *S. molesta* were reported in 1999 (Arizona Department of Agriculture, Noxious Weed/Invasive Plant Distribution Database: *Salvinia molesta*). Colorado River populations reproduce extremely quickly during June through September. Small mats usually less than 2 m^2 each survive winter in protected areas such as the interior of large cattail and common reed patches (F. Northam, personal observation, 2004).
Rationale: An extremely small portion of Arizona's natural areas are susceptible to invasion by *S. molesta.* Limited to one major (Freshwater Systems) and two minor ecological type: rivers (Colorado) and lakes (Martinez and Squaw).
Sources of information: Arizona Department of Agriculture, Noxious Weed/Invasive Plant Distribution Database: *Salvinia molesta*. Also considered observations by F. Northam (Consulting Weed Biologist, Tempe, Arizona, 2004) and personal communication with T. Olson (Wildlife Biologist, Bureau of Reclamation, Boulder City, Nevada, 2003).

Question 3.2 Distribution	*Score:* **D** *Doc'n Level:* **Obs.**
Describe distribution: Limited	
Rationale: Only a small portion of each of two minor ecological types, which occupy a small portion of Arizona's ecological landscapes.	
Sources of information: Arizona Department of Agriculture, Noxious Weed/Invasive Plant Distribution Database: *Salvinia molesta*. Also considered observations by F. Northam (Consulting Weed Biologist, Tempe, Arizona, 2004) and personal communication with T. Olson (Wildlife Biologist, Bureau of Reclamation, Boulder City, Nevada, 2003).	

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**Yes**	**No**	**1 pt.**
Dense infestations produce >1,000 viable seed per square meter	**Yes**	**No**	**2 pt.**
Populations of this species produce seeds every year.	**Yes**	**No**	**1 pt.**
Seed production sustained for 3 or more months within a population annually	**Yes**	**No**	**1 pt.**
Seeds remain viable in soil for three or more years	**Yes**	**No**	**2 pt.**
Viable seed produced with *both* self-pollination and cross-pollination	**Yes**	**No**	**1 pt.**
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	**Yes**	**No**	**1 pt.**
Fragments easily and fragments can become established elsewhere	**Yes**	**No**	**2 pt.**
Resprouts readily when cut, grazed, or burned	**Yes**	**No**	**1 pt.**

Total pts: 5 Total unknowns: 0

Note any related traits:

Worksheet B. Arizona Ecological Types

(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	dunes	
Scrublands	Great Basin montane scrub	
	southwestern interior chaparral scrub	
Desertlands	Great Basin desertscrub	
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	
	semi-desert grassland	
Freshwater Systems	lakes, ponds, reservoirs	**D**
	rivers, streams	**D**
Non-Riparian Wetlands	Sonoran wetlands	
	southwestern interior wetlands	
	montane wetlands	
	playas	
Riparian	Sonoran riparian	
	southwestern interior riparian	
	montane riparian	
Woodlands	Great Basin conifer woodland	
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	
	montane conifer forest	
Tundra (alpine)	tundra (alpine)	

*A means >50% of type occurrences are invaded; B means >20% to 50%; C means >5% to 20%; D means present but ≤5%; U means unknown (unable to estimate percentage of occurrences invaded).

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