

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):	<i>Myriophyllum aquaticum</i> (Vell.) Verdc. (USDA 2005)
Synonyms:	<i>Enydria aquatica</i> Vell., <i>Myriophyllum brasiliense</i> Camb., <i>Myriophyllum proserpinacoides</i> Gillies ex Hook. & Arn. (USDA 2005)
Common names:	Parrot’s feather, parrot feather watermilfoil, Brazilian water milfoil
Evaluation date (mm/dd/yy):	02/15/05
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Committee review date:	03/2/05
List date:	03/2/05
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	Reviewed scientific publication	<p>“Impact”</p> <p>Section 1 Score:</p> <p>A</p>	<p>“Plant Score”</p> <p>Overall Score:</p> <p>High</p> <p>Alert Status:</p> <p>Alert</p>
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		
				<p>“Invasiveness”</p> <p><i>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:</i></p> <p>15 pts</p> <p>Section 2 Score:</p> <p>B</p>	
2.1	Role of anthropogenic and natural disturbance	B	Other published material		
2.2	Local rate of spread with no management	A	Other published material		
2.3	Recent trend in total area infested within state	B	Other published material		
2.4	Innate reproductive potential	B	Reviewed scientific publication		
2.5	Potential for human-caused dispersal	A	Other published material		
2.6	Potential for natural long-distance dispersal	B	Other published material		
2.7	Other regions invaded	C	Other published material		
				<p>“Distribution”</p> <p>Section 3 Score:</p> <p>C</p>	
3.1	Ecological amplitude	C	Other published material		
3.2	Distribution	D	Other published material		

Table 3. Documentation

<p>Question 1.1 Impact on abiotic ecosystem processes</p>	<p>Score: A Doc'n Level: Rev. sci. pub.</p>
<p>Identify ecosystem processes impacted: Uncontrolled growth of parrot's feather impacts abiotic ecosystems by: (1) restricting flow in streams, 2) increasing sediment and organic matter deposition, (3) depleting oxygen under dense mats, and 4) altering water quality and flooding regime.</p>	
<p>Rationale: Parrot's feather, a rhizomatous South American aquatic perennial in the water-milfoil family, colonizes in slow moving or still water, forming dense mats. This plant roots in the sediment and stems grow throughout the water column until they reach the water surface (Orchard 1981). These stands lower dissolved oxygen and increase acidity in aquatic systems (Evans et al. 2003), significantly altering both the physical and chemical characteristics of lakes and streams (WDOE 2003). Dense stands reduce stream flow, block water ways, and create water loss (evapotranspiration doubles when water surface is covered with parrot's feather; Cilliers 1999). In Washington dense infestations have caused flooding and drainage problems in shallow rivers and streams (WDOE 2003).</p>	
<p>Sources of information: See cited literature.</p>	
<p>Question 1.2 Impact on plant community composition, structure, and interactions</p>	<p>Score: A Doc'n</p>
<p>Level: Other pub.</p>	
<p>Identify type of impact or alteration: Uncontrolled growth of parrot's feather impacts plant communities by: (1) altering and possibly eliminating native plant communities, (2) decreasing algal growth, and (3) forming large monoculture mats.</p>	
<p>Rationale: Parrot feather forms dense mats which shade native vegetation, and deplete nutrients from water. Observations of the Palo Verde Westside Drain near Blythe, California (just across the Colorado River from Ehrenberg, Arizona), indicate plants cover 75% to 100% of water surface in 2002–2004 (T. Olson, personal observations, 2002–2004). Infestations can alter aquatic ecosystems by shading out algae in the water column (WDOE 2003). Large mats prevent the growth of native vegetation, competing with native aquatic plants, eliminating them or reducing their numbers in infested sites (Cal-IPC website). Parrot's feather infested irrigation water used for raising tobacco and caused discoloring of the tobacco (Cilliers 1999).</p>	
<p>Sources of information: See cited literature. Also considered personal observations of T. Olson (Wildlife Biologist, Bureau of Reclamation, Lower Colorado Regional Office, 2002–2004, observations at the Palo Verde Westside and Outfall Drains, Blythe, California and all along the Lower Colorado River from Blythe, California south to the international border) and information from the California Invasive Plant Council (Cal-IPC) website for <i>Myriophyllum aquaticum</i> (available online at: http://ucce.ucdavis.edu/datastore/detailreport.cfm?usernumber=64&surveynumber=182).</p>	
<p>Question 1.3 Impact on higher trophic levels</p>	<p>Score: A Doc'n Level: Other pub.</p>
<p>Identify type of impact or alteration: (1) Increases mosquito habitat. (2) Dense mats detrimental to fish. (3) Shades out algae, a food source for other animals.</p>	
<p>Rationale: Parrot's feather: provides choice mosquito larvae habitat (WDOE 2003); reduces dissolved oxygen and increases acidity, which may be detrimental to fish (Evans et al. 2003); and shades out algae changing the food chain for several higher organisms including waterfowl (Cal-IPC website). A bio-control agent has been located for this species. <i>Lysathia</i> n. sp. (Coleoptera: Chrysomelidae), a leaf beetle has been studied in South Africa and found to be effective there, but is not available in the U.S. Parrot's feather has a high tannin content to most grazers, including grass carp find it unpalatable. Although <i>M. aquaticum</i> may provide cover for some aquatic organisms, large infestations can alter aquatic ecosystems by shading out the algae in the water column that serve as the basis of the aquatic food web (WDOE 2003). According to the Environmental Media Services website, parrot's feather has colonized sloughs and backwaters of the Chehalis River in Washington. These areas are known to be important</p>	

for salmon habitat. Because this plant alters water chemistry, these sloughs are becoming lost as rearing areas for juvenile salmon.
Sources of information: See cited literature. Also considered information from the California Invasive Plant Council (Cal-IPC) website for <i>Myriophyllum aquaticum</i> (available online at: http://ucce.ucdavis.edu/datastore/detailreport.cfm?usernumber=64&surveynumber=182) and the Environmental Media Services website (available online at: http://www.ems.org/cgi-bin/GPrint2002.pl?file=salmon/threats.rx).

Question 1.4 Impact on genetic integrity	<i>Score: D Doc'n Level: Other pub.</i>
Identify impacts: None. Parrot's feather reproduces by fragmentation in the United States.	
Rationale: Reproduction of parrot's feather in the U.S. is believed to be entirely by vegetative means, resulting from stem fragmentation and/or regrowth from rhizomes. Even in South America, virtually all plants are female. Male plants are unknown outside South America so no seeds are produced in the U.S. Parrot's feather also lacks tubers or other specialized reproductive over-wintering structures like turions; as a result, it spreads exclusively by plant fragments outside of its native range. Only one native plant is closely to this species: <i>Myriophyllum sibiricum</i> Komarov (= <i>M. exalbescens</i> Fern.). This species exists in Arizona in Apache, Navajo, and Coconino Counties, but because this plant does not produce seed in the U.S. hybridization is unknown (Kearney and Peebles 1960).	
Sources of information: See cited literature. Also see USDA (2005).	

Question 2.1 Role of anthropogenic and natural disturbance in establishment	<i>Score: B Doc'n Level: Other pub.</i>
Describe role of disturbance: Fragmentation and/or rhizomes needed for spread.	
Rationale: Spread of parrot's feather is mainly by fragmentation through either natural stream flow or disturbance such as flooding, by animals such as waterfowl, and by human cultivation and/or disturbance through recreation and boating. Parrot's feather can also spread locally by rhizomes rooted in sediment. It tends to colonize slowly moving or still water rather than in areas with higher flow rates. While it grows best when rooted in shallow water, it has been known to occur as a floating plant in the deep water of nutrient-enriched lakes. The emergent stems can survive on wet banks of rivers and lake shores, so it is well adapted to moderate water level fluctuations.	
Sources of information: See WDOE (2003). Also considered information from the California Invasive Plant Council (Cal-IPC) website for <i>Myriophyllum aquaticum</i> (available online at: http://ucce.ucdavis.edu/datastore/detailreport.cfm?usernumber=64&surveynumber=182) and the Washington State Noxious Weed Control Board website for <i>Myriophyllum aquaticum</i> (available online at: http://www.nwcb.wa.gov/weed_info/Written_findings/Myriophyllum_aquaticum.html).	

Question 2.2 Local rate of spread with no management	<i>Score: A Doc'n Level: Other pub.</i>
Describe rate of spread: Increasing rapidly (doubling in <10 years).	
Rationale: In the lower Colorado River, south of Ehrenberg, Arizona and Blythe, California, parrot's feather has rapidly taken over small backwaters and canal systems. The area of spread has more than doubled in five years. Infestation was first found in the Palo Verde Irrigation Drain in 1999 along with <i>Salvinia molesta</i> . Since 1999 infestations of parrot's feather have now been found up to the Imperial Dam, just north of Yuma, Arizona, an approximate distance of 75 river miles (T. Olson, personal observations, 2002–2004).	
Sources of information: Personal observations of T. Olson (Wildlife Biologist, Bureau of Reclamation, Lower Colorado Regional Office, 2002–2004, observations at the Palo Verde Westside and Outfall Drains, Blythe, California and all along the Lower Colorado River from Blythe, California south to the international border).	

Question 2.3 Recent trend in total area infested within state	<i>Score: B Doc'n Level: Other pub.</i>
Describe trend: Increasing, but less rapidly than doubling in area in <10 years.	
Rationale: Since 1999 infestations of parrot's feather have now been found (2004) south to the Imperial Dam, just north of Yuma, Arizona, an approximate distance of 75 river miles (T. Olson, personal observations, 2002–2004). This is a localized rapid spread and is part of the same river system, and populations to date have not spread outside this watershed. Other areas infested in the state include Kiper Springs (1979), Pond in McClellan Wash, Gila Indian Reservation (1934), Artificial pond eight miles northwest of Benson (1955), and Kinsley's Ranch south of Tucson (1958) (Global Biodiversity Information Facility website). It is unknown at this time what the spread is of those populations.	
Sources of information: See cited literature. Also considered personal observations of T. Olson (Wildlife Biologist, Bureau of Reclamation, Lower Colorado Regional Office, 2002–2004, observations at the Palo Verde Westside and Outfall Drains, Blythe, California and all along the Lower Colorado River from Blythe, California south to the international border) and information from the Global Biodiversity Information Facility website (available online at: www.gbif.net/portal or http://www.gbif.net/portal/ecat_browser.jsp?taxonKey=291331&nextTask=digit_viewer.jsp).	

Question 2.4 Innate reproductive potential	<i>Score: B Doc'n Level: Rev. sci. pub.</i>
Describe key reproductive characteristics: Reproduces in the U.S. only by fragmentation and rhizomes.	
Rationale: Reproduction in the U.S. is believed to be entirely by vegetative means, resulting from stem fragmentation and/or regrowth from sections of rhizomes. Even in South America, most plants are female. Male plants are unknown outside of South America, so no seeds are produced in North American populations (Cilliers 1999, WDOE 2003) Parrot's feather also lacks tubers or other specialized reproductive over-wintering structures like turions. It spreads exclusively by plant fragmentation outside of its native range (Evans 2003). Unlike <i>Myriophyllum spicatum</i> , this plant does not form auto-fragments. However, fragments can be formed mechanically and through disturbance, and will readily root. With its tough rhizomes, parrot's feather can be transported long distances on boat trailers. Rhizomes stored under moist conditions can survive for over a year. Female plants do flower, but no male plants exist to pollinate. Plants flower in the spring, but some may flower in the fall. The inconspicuous flowers form where emergent leaves attach to the stem.	
Sources of information: See cited literature. Also considered information from the California Invasive Plant Council (Cal-IPC) website for <i>Myriophyllum aquaticum</i> (available online at: http://ucce.ucdavis.edu/datastore/detailreport.cfm?usernumber=64&surveynumber=182)	

Question 2.5 Potential for human-caused dispersal	<i>Score: A Doc'n Level: Other pub.</i>
Identify dispersal mechanisms: (1) Available for commercial sale, (2) spread along riverways that act as transportation corridors, and (3) transported on boats or by boat trailers.	
Rationale: Because of its attractiveness and ease of cultivation, parrot's feather has been introduced worldwide for use in indoor and outdoor aquaria. It is also a popular aquatic garden plant. It has escaped cultivation, however, and spread via plant fragments and intentional plantings. This plant is readily available for commercial sale on several internet sites and at nurseries. This plant has been used in several scientific studies for uptake of contaminants in the environment (Wilson et al. 2001), including phyto-remediation of explosive wastes in Tennessee (USAEC 1996, USEPA 1998, Project Oceanography 2000). This plant is readily transported by boat and boat trailers through fragments and its tough rhizomes. Parrot's feather is a great threat to irrigation canal and drainage systems, and its distribution through these systems is an inoculation source to wildlands.	
Sources of information: See cited literature.	

Question 2.6 Potential for natural long-distance dispersal	<i>Score: B Doc'n Level: Other pub.</i>
Identify dispersal mechanisms: Species can fragment and float long distances downstream of rivers. May be carried by waterfowl or other avian/animal species.	
Rationale: Parrot's feather easily fragments and may float and travel long distances in river systems where there is flowing water (Evans et al. 2003). For example, one infestation was first found in the Palo Verde Irrigation Drain in 1999 along with <i>Salvinia molesta</i> . Since 1999 infestations of parrot's feather have now been found (2004) up to the Imperial Dam, just north of Yuma, Arizona, an approximate distance of 75 river miles (T. Olson, personal observations, 2002–2004) This plant also spreads by floods and animals (Henderson and Cilliers 2002).	
Sources of information: See cited literature. Also considered personal observations of T. Olson (Wildlife Biologist, Bureau of Reclamation, Lower Colorado Regional Office, 2002–2004, observations at the Palo Verde Westside and Outfall Drains, Blythe, California and all along the Lower Colorado River from Blythe, California south to the international border).	

Question 2.7 Other regions invaded	<i>Score: C Doc'n Level: Other pub.</i>
Identify other regions: This plant has a distribution in several wetland and river systems worldwide including: Africa, Australia, Indonesia, New Zealand, South Africa, and the United States (including California and Washington).	
Rationale: This plant was first collected in the U.S. near Washington, DC in 1890. It was reported from South Africa in 1918 or 1919, Japan in 1920, New Zealand in 1929, Australia in the 1960s, and England in the 1970s. A population was reported in western Washington in 1944 (WDOE 2003) and now is in several lakes and coastal streams. In California this species is in several streams, coastal wetlands, irrigation, and drainage canals. A 1985 survey of irrigation, mosquito abatement, flood control, and reclamation agencies in California indicated that parrot feather infested nearly 600 miles of waterways and over 500 surface acres (WDOE 2003). Parrot's feather is a great threat to irrigation canal and drainage systems, and distribution through these systems is an inoculation source to wildlands. Currently in Arizona it has been located in the Lower Colorado River below Ehrenberg, Arizona and Blythe California, and has been in several small localized ponds. Although it has invaded other Non-Riparian Wetlands in other states in the U.S. (e.g., California and Washington), the potential to invade this ecological type in Arizona is slim because non-riparian wetland in Arizona tend to be ephemeral and intermittent in nature and also tend to be saline.	
Sources of information: See cited literature.	

Question 3.1 Ecological amplitude	<i>Score: C Doc'n Level: Other pub.</i>
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: This plant is currently know from freshwater systems in Arizona.	
Rationale: Since 1999 infestations of parrot's feather have now been found south to the Imperial Dam, just north of Yuma, Arizona, an approximate distance of 75 river miles (Lower Colorado River giant salvinia website; T. Olson, personal communication, 2002–2004). This is a localized rapid spread and is part of the same river system. Other areas infested in the state include Kiper Springs (1979), pond in McClellan Wash, Gila Indian Reservation (1934), artificial pond eight miles northwest of Benson (1955), and Kinsley's Ranch south of Tucson (1958) (Global Biodiversity Information Facility website). It is unknown at this time whether these populations have spread.	
Sources of information: Personal observations of T. Olson (Wildlife Biologist, Bureau of Reclamation, Lower Colorado Regional Office, 2002–2004, observations at the Palo Verde Westside and Outfall Drains, Blythe, California and all along the Lower Colorado River from Blythe, California south to the international border). Also considered information from the Lower Colorado River giant salvinia website (available online at: www.lcrsalvinia.org) and the Global Biodiversity Information	

Facility website (available online at: www.gbif.net/portal or http://www.gbif.net/portal/ecat_browser.jsp?taxonKey=291331&nextTask=digit_viewer.jsp).

Question 3.2 Distribution	<i>Score: D Doc'n Level: Other pub.</i>
Describe distribution: Only known in one river system (Lower Colorado River) and four small freshwater or man-made ponds.	
Rationale: Since 1999 infestations of parrot's feather have now been found south to the Imperial Dam, just north of Yuma, Arizona, an approximate distance of 75 river miles (Lower Colorado River giant salvinia website; T. Olson, personal communication, 2002–2004). This is a localized rapid spread and is part of the same river system. Other areas infested in the state include Kiper Springs (1979), pond in McClellan Wash, Gila Indian Reservation (1934), artificial pond eight miles northwest of Benson (1955), and Kinsley's Ranch south of Tucson (1958) (Global Biodiversity Information Facility website). It is unknown at this time whether these populations have spread.	
Sources of information: Personal observations of T. Olson (Wildlife Biologist, Bureau of Reclamation, Lower Colorado Regional Office, 2002–2004, observations at the Palo Verde Westside and Outfall Drains, Blythe, California and all along the Lower Colorado River from Blythe, California south to the international border). Also considered information from the Lower Colorado River giant salvinia website (available online at: www.lcrsalvinia.org) and the Global Biodiversity Information Facility website (available online at: www.gbif.net/portal or http://www.gbif.net/portal/ecat_browser.jsp?taxonKey=291331&nextTask=digit_viewer.jsp).	

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Dense infestations produce >1,000 viable seed per square meter	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Populations of this species produce seeds every year.	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Seed production sustained for 3 or more months within a population annually	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Seeds remain viable in soil for three or more years	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Viable seed produced with <i>both</i> self-pollination and cross-pollination	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Fragments easily and fragments can become established elsewhere	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Resprouts readily when cut, grazed, or burned	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
		Total pts: 5	Total unknowns: 0
		Score : B	
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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