

Part IV. Plant Assessment Form

For use with “Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands”
by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association

Table 1. Species and Evaluator Information

Species name (Latin binomial):	Eichhornia crassipes
Synonyms:	Eichhornia speciosa, Heteranthera formosa, Piaropus crassipes, Pontederia crassipes
Common names:	water hyacinth,
Evaluation date (mm/dd/yy):	8/20/2004
Evaluator #1 Name/Title:	Brianna Richardson, Project Manager
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Evaluator #2 Name/Title:	enter text here
Affiliation:	enter text here
Phone numbers:	enter text here
Email address:	enter text here
Address:	enter text here

Section below for list committee use—please leave blank

List committee members:	Alison Stanton, Cynthia Roye, Jake Sigg, John Randall, Joe DiTomaso, Peter Warner
Committee review date:	8/27/2004
List date:	enter text here
Re-evaluation date(s):	enter text here

General comments on this assessment:

Water hyacinth has both economically beneficial uses and causes significant economic damage, neither of which is considered in this assessment.

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	A	Rev'd, Sci. Pub'n
1.2	Impact on plant community	A	Rev'd, Sci. Pub'n
1.3	Impact on higher trophic levels	A	Rev'd, Sci. Pub'n
1.4	Impact on genetic integrity	D	Other Pub. Mat'l

<p>Impact</p> <p><i>Enter four characters from Q1.1-1.4 below:</i></p> <p>AAAD</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>A</p>

2.1	Role of anthropogenic and natural disturbance	A (3 pts)	Other Pub. Mat'l
2.2	Local rate of spread with no management	A (3 pts)	Other Pub. Mat'l
2.3	Recent trend in total area infested within state	C (1 pt)	Other Pub. Mat'l
2.4	Innate reproductive potential Wksht A	A (3 pts)	Other Pub. Mat'l
2.5	Potential for human-caused dispersal	A (3 pts)	Other Pub. Mat'l
2.6	Potential for natural long-distance dispersal	A (3 pts)	Other Pub. Mat'l
2.7	Other regions invaded	C (1 pt)	Other Pub. Mat'l

<p>Invasiveness</p> <p><i>Enter the sum total of all points for Q2.1-2.7 below:</i></p> <p>17</p> <p><i>Use matrix to determine score and enter below:</i></p> <p>A</p>
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<p>Plant Score</p> <p><i>Using matrix, determine Overall Score and Alert Status from the three section scores and enter below:</i></p> <p>High Red Alert</p>
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3.1	Ecological amplitude/Range	C	Other Pub. Mat'l
3.2	Distribution/Peak frequency Wksht C	D	Other Pub. Mat'l

<p>Distribution</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>C</p>

Table 3. Documentation

<p>Question 1.1 Impact on abiotic ecosystem processes</p>	<p>A Rev'd, Sci. Pub'n back</p>
<p>Identify ecosystem processes impacted: Forms dense mats that block sunlight. Mats clog waterways, and alter water oxygen levels, temperature, and pH. Increases suspended and dissolved organic matter, nitrogen, and phosphorous. Decreases nitrate nitrogen. Increases sulphate content. Increases biological oxygen demand and chemical oxygen demand. Removes pollutants from water. Increases water losses from lakes and rivers due to its high transpiration rate (almost 8x that of evaporation from open water). Increases carbon-dioxide tension and turbidity. Adds suspended particulate matter to water. Lowers water temperature. Increases free carbon-dioxide, and decreases dissolved oxygen. Increases calcium hardness. Increases water conductivity. Decreases water transparency.</p>	
<p>Rationale: Changes chemistry, light availability, water temperature, and water evaporation rates of infested waterways.</p>	
<p>Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421.</p> <p>Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175.</p> <p>Aneja, KR, K Singh. 1992. Effect of waterhyacinth (Eichhornia crassipes) on the physico-chemical environment of a shallow pond. Proceeding of the Indian National Science Academy. B58(6): 357-364.</p> <p>Rommens, W., J Maes, N Dekeza, P Inghelbrecht, T Nhiwatiwa, E Holsters, F Ollevier, B Marshall, L Brendock. 2003. The impact of water hyacinth (Eichhornia crassipes) in a eutrophic subtropical impoundment (Lake Chivero, Zimbabwe). I. Water quality. Archive Fuer Hydrobiologie. 158(3): 373-388.</p>	
<p>Question 1.2 Impact on plant community composition, structure, and interactions</p>	<p>A Rev'd, Sci. Pub'n back</p>
<p>Identify type of impact or alteration: Forms dense mats that produce a large amount of dry matter. Displace native aquatic vegetation. Causes extreme hypoxic and hypercarbic conditions harmful to native plants. In the Brendock et. al. study, hyacinth decreased planktonic and macrophyte diversity, while blue-green algae abundance increased. Can provide shelter for snakes in some areas. On Lake Okeechobee (in FL) hyacinth was allowed to grow in 1986 and between Aug and Nov had "destroyed native plant communities." On Lake Okeechobee (in FL) hyacinth was allowed to grow in 1986 and between Aug and Nov had "destroyed native plant communities."</p>	
<p>Rationale: Forms large, dense monocultures. Occludes water surface. Decreases aquatic plant diversity and abundance. Creates increased structural layer (in canopy).</p>	
<p>Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421.</p> <p>Aneja, KR, K Singh. 1992. Effect of waterhyacinth (Eichhornia crassipes) on the physico-chemical environment of a shallow pond. Proceeding of the Indian National Science Academy. B58(6): 357-364.</p> <p>Brendonck, L, J Maes, W Rommens, N Dekeza, T Nhiwatiwa, M Barson, V Callebaut, C Phiri, K Moreau, B Gratwicke, M Stevens, N Alyn, E Holsters, F Ollevier, B Marshall. 2003. The impact of water hyacinth (Eichhornia crassipes) in a eutrophic subtropical impoundment (Lake Chivero, Zimbabwe). II. Species diversity. Archive Fuer Hydrobiologie. 158(3): 389-405.</p> <p>Parsons, WT, EG Cuthbertson. 1992. Noxious Weeds of Australia. Inkata Press, Melbourne. P. 139-144.</p>	

<p>Joyce, JC. 1992. Impac of Eichhornia and Hydrilla in the United States. ICES Marine Science Symposium: 106-109.</p> <p>Observational, Joe DiTomaso, John Randall, 2004.</p>	
<p>Question 1.3 Impact on higher trophic levels</p>	<p>A Rev'd, Sci. Pub'n back</p>
<p>Identify type of impact or alteration: Provides mosquito habitat. Displace native wildlife. European honey bee main pollinator in CA. Degrades water fowl habitat by reducing open water. When decomposing, makes water unfit for consumption by wildlife. Displaces native plants used as food and shelter by wildlife. Changes to water chemistry and light levels affect the health of fish. Causes extreme hypoxic and hypercarbic conditions harmful to wildlife. In the Brendock et. al. study, hyacinth decreased planktonic and macrophyte diversity, while increasing macro-invertabrate and fish diversity in some areas. Can provide shelter for snakes in some areas.</p>	
<p>Rationale: Reduces water, shelter, and food sources for wildlife. Can negatively impact migratory birds. Decreases planktonic diversity. Can increase fish diversity (one study). Can provide shelter for some animals. The negative effects on wildlife appear to outweigh any benefits some species may accrue.</p>	
<p>Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421.</p> <p>Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175.</p> <p>Aneja, KR, K Singh. 1992. Effect of waterhyacinth (Eichhornia crassipes) on the physico-chemical environment of a shallow pond. Proceeding of the Indian National Science Academy. B58(6): 357-364.</p> <p>Brendonck, L, J Maes, W Rommens, N Dekeza, T Nhiwatiwa, M Barson, V Callebaut, C Phiri, K Moreau, B Gratwicke, M Stevens, N Alyn, E Holsters, F Ollevier, B Marshall. 2003. The impact of water hyacinth (Eichhornia crassipes) in a eutrophic subtropical impoundment (Lake Chivero, Zimbabwe). II. Species diversity. Archive Fuer Hydrobiologie. 158(3): 389-405.</p>	
<p>Question 1.4 Impact on genetic integrity</p>	<p>D Other Pub. Mat'l back</p>
<p>Identify impacts: There are no closely related CA natives.</p>	
<p>Rationale: enter text here</p>	
<p>Sources of information: Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175.</p>	
<p>Question 2.1 Role of anthropogenic and natural disturbance in establishment</p>	<p>A Other Pub. Mat'l back</p>
<p>Describe role of disturbance: Dams can create still water conducive to establishment.</p>	
<p>Rationale: Disturbance is unnecessary for establishment.</p>	
<p>Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421.</p>	

Parsons, WT, EG Cuthbertson. 1992. Noxious Weeds of Australia. Inkata Press, Melbourne. P. 139-144.	
Question 2.2 Local rate of spread with no management	A Other Pub. Mat'l back
Describe rate of spread: Extremely high rate of growth. Plant numbers can double in ~5 days. One plant can cover 600 square meters in one year.	
Rationale: Without management, hyacinth can easily double in less than 10 years.	
Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421. Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175.	
Question 2.3 Recent trend in total area infested within state	C Other Pub. Mat'l back
Describe trend: Populations have declined in LA and other SE states, but the agents have not become established in CA.	
Rationale:	
Sources of information: Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175. Personal knowledge, Joe DiTomaso. 2004.	
Question 2.4 Innate reproductive potential	A Other Pub. Mat'l back
Describe key reproductive characteristics: Flowers June-October. Plants linked by stolons from stem. Insect pollinated. Each seed capsule can contain up to 300 seeds. Stems can survive foliage death (by frost) and grow new foliage. Reproduces vegetatively from stolons and by seed. In temperate regions, seeds may survive up to 20 yrs in dried mud, survive for several years in sediment. Fragments as small as 1.5 cm and rhizomes can establish new plants. Believed to be self-pollinated. Bunches of plants break off and float to establish elsewhere. A single plant can produce new infestations. Reaches reproductive maturity within a few weeks.	
Rationale: 11 points.	
Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421. Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175. Forno, IW, AD Wright. 1993. The biology of Australian weeds. 5. Eichhornia crassipes. The Journal of the Australian Institute of Agricultural Science (v/n unknown): 21-28.	

Question 2.5 Potential for human-caused dispersal	A Other Pub. Mat'l back
Identify dispersal mechanisms: Vegetative parts and seed dispersed by human activity. Actively transported by people both for ornamental establishment in natural waterways and by dumping. Used as a packing material and as cushions in boats. Sold horticulturally for water gardens. Increasingly used for sewage treatment in the US. Vegetative fragments can be carried by boats from one place to another.	
Rationale: Most dispersal is human caused. Sold horticulturally. Many opportunities for both intentional and accidental dispersal by humans.	
Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421. Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175. Parsons, WT, EG Cuthbertson. 1992. Noxious Weeds of Australia. Inkata Press, Melbourne. P. 139-144.	
Question 2.6 Potential for natural long-distance dispersal	A Other Pub. Mat'l back
Identify dispersal mechanisms: Vegetative parts and seed dispersed along waterways. Seeds can cling to the feet and feathers of birds. Migratory birds may be an important mechanism.	
Rationale: Frequent long-distance dispersal by the flow of waterways. Occasional long-distance dispersal by birds.	
Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421. Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175.	
Question 2.7 Other regions invaded	C Other Pub. Mat'l back
Identify other regions: Occurs almost worldwide in tropical and warm temperate regions. AZ, southern and eastern US. Dominates waterways in 50 countries.	
Rationale: Invades many other places, but is restricted to the same habitat already invaded in CA.	
Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421. Parsons, WT, EG Cuthbertson. 1992. Noxious Weeds of Australia. Inkata Press, Melbourne. P. 139-144.	
Question 3.1 Ecological amplitude/Range	C Other Pub. Mat'l back
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Introduced from Brazil in 1884 as an ornamental. First found in CA in 1904. Ponds, sloughs, channels, streams, lakes, other still or slow-moving water.	

Rationale: Invades only one major and two minor ecological types in CA.	
Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421. Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175.	
Question 3.2 Distribution/Peak frequency	D Other Pub. Mat'l back
Describe distribution: Central Valley, San Francisco Bay region, South Coast, Peninsular Ranges. Sacramento-San Joaquin Delta heavily infested.	
Rationale: Exists in less than 5% of freshwater systems in CA.	
Sources of information: DiTomaso, JM, EA Healy. 2003. Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources publication 3421. Godfrey, K. 2000. Eichhornia crassipes. In: Invasive Plants of California's Wildlands. Bossard, CC., JM Randall, MC Hoshovsky (eds.) University of California Press, Berkeley: 171-175. Observational, Joe DiTomaso, John Randall, 2004.	

Worksheet A

[back](#)

Reaches reproductive maturity in 2 years or less	Yes: 1 pt
Dense infestations produce >1,000 viable seed per square meter	Yes: 2 pts
Populations of this species produce seeds every year.	Yes: 1 pt
Seed production sustained over 3 or more months within a population annually	No: 0 pt
Seeds remain viable in soil for three or more years	Yes: 2 pts
Viable seed produced with <i>both</i> self-pollination and cross-pollination	Yes: 1 pt
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	Yes: 1 pt
Fragments easily and fragments can become established elsewhere	Yes: 2 pts
Resprouts readily when cut, grazed, or burned	Yes: 1 pt
	11 pts Total Unknowns
	A (6+ pts)

Note any related traits: enter text here

Worksheet C - California Ecological Types

[back](#)

(*sensu* Holland 1986)

Major Ecological Types	Minor Ecological Types	Code*
Marine Systems	marine systems	score
Freshwater and Estuarine Aquatic Systems	lakes, ponds, reservoirs	D. present
	rivers, streams, canals	D. present
	estuaries	score
Dunes	coastal	score
	desert	score
	interior	score
Scrub and Chaparral	coastal bluff scrub	score
	coastal scrub	score
	Sonoran desert scrub	score
	Mojavean desert scrub (incl. Joshua tree woodland)	score
	Great Basin scrub	score
	chenopod scrub	score
	montane dwarf scrub	score
	Upper Sonoran subshrub scrub	score
	chaparral	score
Grasslands, Vernal Pools, Meadows, and other Herb Communities	coastal prairie	score
	valley and foothill grassland	score
	Great Basin grassland	score
	vernal pool	score
	meadow and seep	score
	alkali playa	score
	pebble plain	score
Bog and Marsh	bog and fen	score
	marsh and swamp	score
Riparian and Bottomland	riparian forest	score
	riparian woodland	score
	riparian scrub (incl. desert washes)	score
Woodland	cismontane woodland	score
	piñon and juniper woodland	score
	Sonoran thorn woodland	score
Forest	broadleaved upland forest	score
	North Coast coniferous forest	score
	closed cone coniferous forest	score
	lower montane coniferous forest	score
	upper montane coniferous forest	score
	subalpine coniferous forest	score
Alpine Habitats	alpine boulder and rock field	score
	alpine dwarf scrub	score

* 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).