

Part IV. Plant Assessment Form

For use with “Criteria for Categorizing Invasive Non-Native Plants that Threaten Colorado’s Wildlands and Agriculture”
By the Colorado Noxious Weed Advisory Committee

Electronic version: December 4, 2008

Table 1. Species and Evaluator Information

Species name (Latin binomial):	Sagittaria sagittifolia
Synonyms:	enter text here
Common names:	Arrowhead, Hawaii arrowhead, giant arrowhead, old world arrowhead, wapato
Evaluation date (mm/dd/yy):	04/29/2010
Evaluator #1 Name/Title:	Joseph Vassios, Graduate Research Assistant
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Section below for list committee use—please leave blank

List committee members:	enter text here
Committee review date:	enter text here
List date:	enter text here
Re-evaluation date(s):	enter text here

General comments on this assessment:

enter text here

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	C	Other Pub. Mat'l	<p>Impact</p> <p><i>Enter four characters from Q1.1-1.4 below:</i></p> <p>CCDB</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>C</p>	<p>Wildlands Plant Score</p> <p><i>Using matrix, determine Overall Score and Alert Status from the first, second, and third section scores and enter below:</i></p> <p>Limited No Alert</p>
1.2	Impact on plant community	C	Rev'd, Sci. Pub'n		
1.3	Impact on higher trophic levels	D	Rev'd, Sci. Pub'n		
1.4	Impact on genetic integrity	B	Rev'd, Sci. Pub'n		
2.1	Role of anthropogenic and natural disturbance	A (3 pts)	Rev'd, Sci. Pub'n	<p>Invasiveness</p> <p><i>Enter the sum total of all points for Q2.1-2.7 below:</i></p> <p>12</p> <p><i>Use matrix to determine score and enter below:</i></p> <p>B</p>	
2.2	Local rate of spread with no management	B (2 pts)	Rev'd, Sci. Pub'n		
2.3	Recent trend in total area infested within state	U (0 pts)	Other Pub. Mat'l		
2.4	Innate reproductive potential Wksht A	B (2 pts)	Rev'd, Sci. Pub'n		
2.5	Potential for human-caused dispersal	C (1 pt)	Observational		
2.6	Potential for natural long-distance dispersal	B (2 pts)	Rev'd, Sci. Pub'n		
2.7	Other regions invaded	B (2 pts)	Rev'd, Sci. Pub'n		
3.1	Ecological amplitude/Range	U	Other Pub. Mat'l	<p>Distribution</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>U</p>	
3.2	Distribution/Peak frequency Wrksht B	U	Other Pub. Mat'l		

<u>4.1</u>	Poisonous to livestock	D (0 pts)	Rev'd, Sci. Pub'n
<u>4.2</u>	Detrimental to economic crops	C (1 pt)	Rev'd, Sci. Pub'n
<u>4.3</u>	Detrimental to management of agricultural system, rangeland and pasture	C (1 pt)	Rev'd, Sci. Pub'n
<u>4.4</u>	Human impacts <u>Wrksht C</u>	D (0 pts)	Anecdotal

Agricultural / Human Impact

Enter the sum total of all points for Q4.1-4.4 below:

2

Use matrix to determine score and enter below:

C

Agricultural Plant Score

Using matrix, determine Overall Score and Alert Status from the second, third and fourth section scores and enter below:

Moderate

No Alert

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes	C Other Pub. Mat'l back
Identify ecosystem processes impacted: Decomposing plants may alter water quality when present.	
Rationale: For California arrowhead, decomposing plants may alter water quality, but usually occurs quickly. This would likely be the same with other Sagittaria species.	
Sources of information: DiTomaso, JM, EA Healy. 2003 Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources.	
Question 1.2 Impact on plant community composition, structure, and interactions	C Rev'd, Sci. Pub'n back
Identify type of impact or alteration: Grows in shallower waters and saturated sediments, often in the same areas in which reeds are established. May also displace native Sagittaria species.	
Rationale: Growth is primarily in shallow waters and saturated sediments. Growth is limited in deeper waters. In the areas it does occur, it may compete with reed species. Also, there are currently six other species of Sagittaria that exist in Colorado, some of which are threatened or endangered in parts of the US. If this species was present, it could displace other native or already established species.	
Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of Sagittaria sagittifolia L. In Czechoslovakia. Folia Geobotanica and Phytotaxonomica. Vol. 23, 4:337-373. USDA Plants Database. 2010. Sagittaria L.. Accessed online Apr. 27. http://plants.usda.gov/java/profile?symbol=SAGIT DiTomaso, JM, EA Healy. 2003 Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources.	
Question 1.3 Impact on higher trophic levels	D Rev'd, Sci. Pub'n back
Identify type of impact or alteration: Fruits and leaves may provide a good food source for waterfowl. Also, roots and leaves are edible to humans.	
Rationale: Both the fruits and leaves of Sagittaria species may provide a food source for waterfowl. Others have also mentioned that the leaves and roots (rhizomes) are could provide a food source for humans.	
Sources of information: DiTomaso, JM, EA Healy. 2003 Aquatic and Riparian Weeds of the West. University of California Agriculture and Natural Resources. Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of Sagittaria sagittifolia L. In Czechoslovakia. Folia Geobotanica and Phytotaxonomica. 23:337-373.	

Question 1.4 Impact on genetic integrity	B Rev'd, Sci. Pub'n back
Identify impacts: There is a possibility that this species may form hybrids with other Sagittaria species already present in Colorado	
Rationale: Hybrids of <i>S. sagittifolia</i> and <i>S. natans</i> have been confirmed in Europe, confirming that it is possible for the species to successfully form hybrids with other Sagittaria species. Since other species of Sagittaria are already present in Colorado, there would be other species for it to hybridize with.	
Sources of information: Preston, CD, P Uotila. 2009. <i>Sagittaria x lunata</i> , a binomial for the widespread North European hybrid between <i>S. natans</i> and <i>S. Sagittifolia</i> (Alismataceae) <i>Ann. Bot. Fennici</i> .46: 215-230.	
Question 2.1 Role of anthropogenic and natural disturbance in establishment	A Rev'd, Sci. Pub'n back
Describe role of disturbance: Does not require disturbance for establishment, but anthropogenic alterations may allow for further establishment.	
Rationale: Will become established in slow moving and still waters that are shallow, wetland margins, and mud. Anthropogenic disturbance, such as the building of dams, may slow water flow and increase possible habitat for this species.	
Sources of information: DiTomaso, JM, EA Healy. 2003 <i>Aquatic and Riparian Weeds of the West</i> . University of California Agriculture and Natural Resources. Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. <i>Ecobiology and Distribution of Sagittaria sagittifolia L. In Czechoslovakia</i> . <i>Folia Geobotanica and Phytotaxonomica</i> . 23:337-373.	
Question 2.2 Local rate of spread with no management	B Rev'd, Sci. Pub'n back
Describe rate of spread: Seed production can be relatively high, but germination rate is low. Rate of spread would be relatively slow.	
Rationale: Although plants may produce thousands of seeds, germination is usually less than 20%.	
Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. <i>Ecobiology and Distribution of Sagittaria sagittifolia L. In Czechoslovakia</i> . <i>Folia Geobotanica and Phytotaxonomica</i> . 23:337-373.	
Question 2.3 Recent trend in total area infested within state	U Other Pub. Mat'l back
Describe trend: Not currently known to exist in Colorado.	
Rationale: Not currently known to exist in Colorado. Is currently on the Federal Noxious Weed List. Other Sagittaria species currently present in Colorado include the following: <i>S. brevirostra</i> , <i>S. calycina</i> , <i>S. cuneata</i> , <i>S. graminea</i> , <i>S. latifolia</i> , and <i>S. longiloba</i> .	

Sources of information: USDA Plants Database. 2010. <i>Sagittaria</i> L.. Accessed online Apr. 27. http://plants.usda.gov/java/profile?symbol=SAGIT	
Question 2.4 Innate reproductive potential	B Rev'd, Sci. Pub'n back
Describe key reproductive characteristics: Species can reach reproductive maturity within one year. Populations may produce significantly more than 1,000 seeds per square meter. Most of the seeds will germinate the following spring. Flowers remain viable for only ~8 days. If water levels are too high, plants will not flower. Also reproduces through tubers. Is both self-pollinated as well as cross-pollinated.	
Rationale: enter text here	
Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of <i>Sagittaria sagittifolia</i> L. In Czechoslovakia. <i>Folia Geobotanica and Phytotaxonomica</i> . 23:337-373. Dorken, ME, SCH Barrett. 2003. Gender plasticity in <i>Sagittaria sagittifolia</i> (Alismataceae), a monoecious aquatic species. <i>Plant Syst. Evol.</i> 237: 99-106.	
Question 2.5 Potential for human-caused dispersal	C Observational back
Identify dispersal mechanisms: Human dispersal of seeds may occur, but would be limited.	
Rationale: Seeds may be transported between water bodies on recreational equipment (boats, fishing equipment).	
Sources of information: Joseph Vassios, Personal Observation, 2010.	
Question 2.6 Potential for natural long-distance dispersal	B Rev'd, Sci. Pub'n back
Identify dispersal mechanisms: Water flow could facilitate long-distance dispersal of seeds.	
Rationale: Tubers may be responsible for local spread and surviving dry conditions, but seeds will float and flowing water would likely spread them downstream.	
Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of <i>Sagittaria sagittifolia</i> L. In Czechoslovakia. <i>Folia Geobotanica and Phytotaxonomica</i> . 23:337-373.	
Question 2.7 Other regions invaded	B Rev'd, Sci. Pub'n back
Identify other regions: This species is not currently known to exist in the US, but can grow in freshwater aquatic systems and riparian/wetland areas.	
Rationale: Not currently in the US, and is listed as a Federal Noxious Weed. In other regions grows anywhere there is sufficient moisture and slow moving to still water including: lakes, ponds, rivers, streams, reservoirs, wetlands, and canals.	

Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of Sagittaria sagittifolia L. In Czechoslovakia. Folia Geobotanica and Phytotaxonomica. 23:337-373.	
USDA Plants Database. 2010. Sagittaria L.. Accessed online Apr. 27. http://plants.usda.gov/java/profile?symbol=SAGIT	
Question 3.1 Ecological amplitude/Range	U Other Pub. Mat'l back
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Not currently known to exist in Colorado.	
Rationale: enter text here	
Sources of information: USDA Plants Database. 2010. Sagittaria L.. Accessed online Apr. 27. http://plants.usda.gov/java/profile?symbol=SAGIT	
Question 3.2 Distribution/Peak frequency	U Other Pub. Mat'l back
Describe distribution: Not currently known to exist in Colorado.	
Rationale: enter text here	
Sources of information: USDA Plants Database. 2010. Sagittaria L.. Accessed online Apr. 27. http://plants.usda.gov/java/profile?symbol=SAGIT	
Question 4.1 Poisonous to Livestock	D Rev'd, Sci. Pub'n back
Describe impacts in terms of high probability of death, long-term health impacts, or short-term health impacts: Not known to be toxic to livestock, and has been suggested for use as a livestock feed.	
Rationale: Can be eaten by waterfowl, wildlife, and use as a livestock feed has been suggested.	
Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of Sagittaria sagittifolia L. In Czechoslovakia. Folia Geobotanica and Phytotaxonomica. 23:337-373.	
Question 4.2 Detrimental to Economic Crops	C Rev'd, Sci. Pub'n back
Describe impacts to all aspects of cropping systems (see guidelines): May impact water delivery in canals, so may indirectly impact cropping systems.	
Rationale: In other parts of the world may interfere in fish ponds and rice fields, but the only way it would impact crops in Colorado would be through negative impacts on water delivery systems.	

Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of <i>Sagittaria sagittifolia</i> L. In Czechoslovakia. <i>Folia Geobotanica and Phytotaxonomica</i> . 23:337-373. Joseph Vassios. Personal Observation. 2010.	
Question 4.3 Detrimental to Mgmt of Agricultural System, Rangeland and Pasture C Rev'd, Sci. Pub'n back	
Describe impacts to water diversion systems, increased water use, reduced forage for livestock: Infestations in canals could interfere with water delivery.	
Rationale: enter text here	
Sources of information: Hroudova, Z., L. Hrouda, P. Zakravsky, I. Ostry. 1988. Ecobiology and Distribution of <i>Sagittaria sagittifolia</i> L. In Czechoslovakia. <i>Folia Geobotanica and Phytotaxonomica</i> . 23:337-373.	
Question 4.4 Human Health Impacts D Anecdotal back	
Describe key human impacts such as; irritants, property values, recreational values, and industry impacts: Would not likely impact human health or property values.	
Rationale: Property values would likely not be effected by this species, and it is limited to shallow waters. Since it can be used as a food source, it is unlikely that it would pose any health hazards.	
Sources of information:	

Worksheet A

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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.	No: 0 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	No: 0 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	No: 0 pts
Resprouts readily when cut, grazed, or burned	Unknown: 0 pts
	5 pts 1 unknown
	B (4-5 pts)

Note any related traits: May not produce seed depending on the depth of water. Most seeds will germinate in Spring of the year after they are produced.

Worksheet B - Colorado Ecological Types and Land Use

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Major Ecological and Land Use Types	Minor Ecological and Land Use Types	Code*
Freshwater and Aquatic Systems	lakes, ponds, reservoirs	score
	rivers, streams, canals	score
Riparian and wetlands	Riparian forest	score
	Riparian shrublands	score
	Wet meadows	score
Grasslands	Shortgrass prairie	score
	Tallgrass prairie	score
	Sandsage prairie	score
	Montane meadows	score
Irrigated Agriculture	Hay meadows	score
	Irrigated crops (alfalfa, corn, sugar beets)	score
Dryland Agriculture	Dryland crops (wheat, corn, millet, dryland grass hay, sunflowers, mustard for biodiesel)	score
Developed Lands	Urban, exurban, industrial	score
Arid Shrublands	Sagebrush shrublands	score
	Foothills shrublands	score
	Gambel oak shrublands	score
Woodlands	Pinyon - juniper	score
	Ponderosa pine	score
	Limber pine	score
Forest	Lodgepole pine	score
	Spruce-fir	score
Alpine	Boulder and rock fields	score
	Dwarf shrublands	score
	Tundra	score
Barrens (lower elevation)	Dunes	score
	Rock outcrops	score
	Canyonlands	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).

Worksheet C – Human Impacts

Human health impacts; irritants (sap), spines, poisonous, and/or smoke impacts	No: 0 pt
Property values are decreased due to increased risk of fire	No: 0 pts
Decreased property value due to moderate to heavy infestations	No: 0 pts
Decreased land value for recreational use; boating, fishing, camping, etc.	No: 0 pts
Impact of listing detrimental to industry; agriculture, horticulture, nursery, and/or seed	No: 0 pt

	Total Pts	Total Unknowns
	D (0 pts)	

Note any related traits: enter text here