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)**:**	Spartina alterniflora x foliosa hybrids, S. alterniflora Lois.
Synonyms:	
Common names:	Hybrid cordgrass, smooth cordgrass
Evaluation date (mm/dd/yy)**:**	March 4, 2004
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Section below for list committee use—please leave blank

List committee members:	Carla Bossard, Joe DiTomaso, John Randall, Cynthia Roye, Jake Sigg, Alison Stanton, Peter Warner
Committee review date:	03/19/04
List date:	enter text here
Re-evaluation date(s):	enter text here

Table 2. Criteria, Section, and Overall Scores

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

"Impact"

Enter four characters from Q1.1-1.4 below:

ABAA

Use matrix determine the score; enter below:

A

2.1	Role of anthropogenic and natural disturbance	**A 3**	**Rev'd, Sci. Pub'n**
2.2	Local rate of spread with no management	**A 3**	**Rev'd, Sci. Pub'n**
2.3	Recent trend in total area infested within state	**A 3**	**Rev'd, Sci. Pub'n**
2.4	Innate reproductive potential	**A 3**	**Rev'd, Sci. Pub'n**
2.5	Potential for human-caused dispersal	**C 1**	**Anecdotal**
2.6	Potential for natural long-distance dispersal	**A 3**	**Observational**
2.7	Other regions invaded	**C 1**	**Rev'd, Sci. Pub'n**

"Invasiveness"

For questions at left, recall that an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Enter the sum total of all points for Q2.1-2.7 below:

17

Use matrix to determine score and enter below:

A

3.1	Ecological amplitude	**B**	**Rev'd, Sci. Pub'n**
3.2	Distribution	**D**	**Rev'd, Sci. Pub'n**

"Distribution"

Use matrix determine the score; enter below:

C

"Plant Score"

Using matrix, determine the Overall Score and Alert Status from the three section scores and enter them below:

High

Red Alert

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes
Identify ecosystem processes impacted: Sediment accretion
Rationale: S. alterniflora (and S. anglica) accrete sediments and elevate marsh surfaces transforming naturally open tidal mudflats into meadows
Sources of information: Observational information for San Francisco Bay; sediment accretion has been observed in other estuaries (including within native East Coast range); sediment accretion has been documented for S. anglica another maritime cordgrass: Pringle , A. W. 1993. Spartina anglica colonisation and physical effects in the Tamar Estuary, Tasmania 1971-91. Papers and Proceedings of the Royal Society of Tasmania 127: 1-10
Question 1.2 Impact on plant community composition, structure, and interactions
Identify type of impact or alteration: Hybrid cordgrass is invading marshes dominated by native cordgrass. Hybrid cordgrass has shown increased tolerance to salinity and co-occurs with Salicornia virginica in the higher marsh of restoration sites.
Rationale: The main impacts of hybrid cordgrass are the replacement of native cordgrass in existing marshes, the potential replacement of Salicornia virginica dominated marshes, and the invasion and dominance of restored marshes
Sources of information: Ayres DR, Smith DL, Zaremba K, Klohr S, Strong DR. 2004. Spread of exotic cordgrasses and hybrids (Spartina sp.) in the tidal marshes of San Francisco Bay. Biological Invasions. 6: 221-231 Pakenham, M. R. 2003. Variation in salinity tolerance and competitive ability of invasive Spartina hybrids in San Francisco Bay. Master of Science thesis. University of California Davis.
Question 1.3 Impact on higher trophic levels
Identify type of impact or alteration: Removal of bird foraging habitat though cordgrass overgrowth of open mud flat habitat
Rationale: Open mudflat is valuable forage ground for migratory and residential shorebirds
Sources of information: The Pt. Reyes Bird Observatory has assembled a bibliography on maritime cordgrass impacts to shorebirds. An example (for S. anglica): Goss-Custard, J. D., Clarke, R. T., Dit Durell, S. V., Caldow, R. W., and B. J. Ens. 1995. Population consequences of winter habitat loss in a migratory shorebird. II. Model predictions. Journal of Applied Ecology 32: 337-351.

Question 1.4 Impact on genetic integrity
Identify impacts: Hybrid cordgrass freely interbreeds with native S. foliosa. This is predicted to result in the extirpation of the native species.
Rationale: Hybrid cordgrass is a superior sire on the native and out competes it
Sources of information: Ayres, D. R., D. R. Strong, and P. Baye. 2003. Spartina foliosa - a common species on the road to rarity? Madrono 50: 209-213.
Question 2.1 Role of anthropogenic and natural disturbance in establishment
Describe role of disturbance: Hybrid colonize the open mud of restoration sites, intertidal foreshores, and naturally caused bare patches in established marshes. The latter 2 occur naturally.
Rationale: Continuing restoration of salt ponds into tidal marsh create ideal recruitment sites for cordgrass seed. Some highly fit hybrids are able to establish in intertidal foreshores and within existing native marshes.
Sources of information: Ayres DR, Smith DL, Zaremba K, Klohr S, Strong DR. 2004. Spread of exotic cordgrasses and hybrids (Spartina sp.) in the tidal marshes of San Francisco Bay. Biological Invasions. 6: 221-231. Ayres and Strong, unpublished data.
Question 2.2 Local rate of spread with no management
Describe rate of spread: Exponential to super-exponential
Rationale: Selection on invasive genotypes is leading to the evolution of more invasive genotypes, we hypothesize. This increases the rate of spread to greater-than-exponential.
Sources of information: Ayres DR, Smith DL, Zaremba K, Klohr S, Strong DR. 2004. Spread of exotic cordgrasses and hybrids (Spartina sp.) in the tidal marshes of San Francisco Bay. Biological Invasions. 6: 221-231.
Question 2.3 Recent trend in total area infested within state
Describe trend: see above
Rationale: enter text here
Sources of information: enter text here

Question 2.4 Innate reproductive potential
Describe key reproductive characteristics: Some hybrids produce inflorescence with 4-fold the number of florets as the native. Some of these are highly fertile and some are highly self-fertile. Some hybrids have high rates of lateral expansion through clonal growth. Some hybrids can sire abundant seed on surrounding S. foliosa plants
Rationale: Long-lived clones, plus high seed set and siring abilities confer high persistance and high reproductive potential on cordgrass hybrids.
Sources of information: Ayres DR, Smith DL, Zaremba K, Klohr S, Strong DR. 2004. Spread of exotic cordgrasses and hybrids (Spartina sp.) in the tidal marshes of San Francisco Bay. Biological Invasions. 6: 221-231. Ayres, D. R., D. R. Strong, and P. Baye. 2003. Spartina foliosa - a common species on the road to rarity? Madro o 50: 209-213. Zaremba K (2001) Hybridization and Control of a Native-Non Native Spartina Complex in San Francisco Bay. Master of Arts thesis, San Francisco State University, San Francisco, California
Question 2.5 Potential for human-caused dispersal
Identify dispersal mechanisms: limited - restricted to restoration that plants S. alternifllora and hybrid plants
Rationale: early in the invasion the above contributed to long distance dispersal and establishment of hybrids. Widespread attention has curtailed this introduction route.
Sources of information: U. S. Army Corps of Engineers (USACE) (1978) Shoreline erosion control demonstration program. Alameda, California: Preconstruction Report. U. S. Army Engineer District, San Francisco Corps of Engineers, San Francisco, CA Faber, P. 2000. Good intentions gone awry. Why would anyone bring and alien cordgrass to San Francisco Bay? Coast and Ocean 16 (2).
Question 2.6 Potential for natural long-distance dispersal
Identify dispersal mechanisms: seed floating on the tides; seed contained in rafts of cordgrass wrack
Rationale: Cordgrass seed is able to float for long periods; seed-containing wrack is able to move long distances. Long distance dispersal on tidal currents is feasible.
Sources of information: Huiskes AHL, Koutstaal BP, Herman PMJ, Beeftink WG, Markusse MM and De Munck W (1995) Seed dispersal of halophytes in tidal salt marshes. Journal of Ecology 83: 559-567; Kathleen Sayce, personal communication on dispersal of S. alterniflora from Willapa Bay to Greys Harbour, WA
Question 2.7 Other regions invaded
Identify other regions: S. alterniflora has invaded many estuaries worldwide, most notably, estuaries in Washington State.

Rationale: Open mud flat habitat is natural to the Pacific coast of north America and vulnerable to S. alterniflora invasion
Sources of information: Janie Civille, PhD research
Question 3.1 Ecological amplitude
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: S. alterniflora and hybrids grow lower and higher in the marsh than native vegetation. Some hybrids have higher salinity tolerance than native. S. alterniflora was introduced into San Francisco Bay in the mid-1970s - hybrids arisen since this time.
Rationale: Native habitat will be altered due to the wider ecological amplitude of the invader.
Sources of information: Pakenham, M. R. 2003. Variation in salinity tolerance and competitive ability of invasive Spartina hybrids in San Francisco Bay. Master of Science thesis. University of California Davis. Callaway, J. C. and M. N. Josselyn. 1992. The introduction and spread of smooth cordgrass (Spartina alterniflora) in South San Francisco Bay. Estuaries 15:218-226. Zaremba K (2001) Hybridization and Control of a Native-Non Native Spartina Complex in San Francisco Bay. Master of Arts thesis, San Francisco State University, San Francisco, California Faber, P. 2000. Good intentions gone awry. Why would anyone bring and alien cordgrass to San Francisco Bay? Coast and Ocean 16 (2). Ayres and Strong, unpublished data.
Question 3.2 Distribution
Describe distribution: Hybrids have radiated from points of deliberate introduction.
Rationale: Marshes neighboring invaded marshes are especially vulnerable to invasion; restoration sites near invaded marshes have been heavily colonized by hybrids.
Sources of information: Ayres DR, Smith DL, Zaremba K, Klohr S, Strong DR. 2004. Spread of exotic cordgrasses and hybrids (Spartina sp.) in the tidal marshes of San Francisco Bay. Biological Invasions. 6: 221-231.

Worksheet A

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**No: 0 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	**Unknown: 0 pts**
Seeds remain viable in soil for three or more years	**No: 0 pts**
Viable seed produced with *both* 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	**Yes: 1 pt**
	6 pts **1 unknown**
	Score

Note any related traits: Seed production almost doubles in an El Nino year.

Worksheet C - California Ecological Types

(*sensu* Holland 1986)

Major Ecological Types	Minor Ecological Types	Code*
Marine Systems	marine systems	**score**
Freshwater and Estuarine Aquatic Systems	lakes, ponds, reservoirs	**score**
	rivers, streams, canals	**score**
	estuaries	**D. presen**
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**
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	**D. presen**
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).