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Version 1

Weed Risk Assessment for *Echinochloa pyramidalis* (Lam.) Hitch. & Chase (Poaceae) – Antelope grass

A researcher studying a population of *Echinochloa pyramidalis* in a constructed wetland in Africa (source: https://people.ifm.liu.se/inuita/pictures.html).

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Introduction Plant Protection and Quarantine (PPQ) regulates noxious weeds under the authority of the Plant Protection Act (7 U.S.C. § 7701-7786, 2000) and the Federal Seed Act (7 U.S.C. § 1581-1610, 1939). A noxious weed is defined as "any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment" (7 U.S.C. § 7701-7786, 2000). We use weed risk assessment (WRA) - specifically, the PPQ WRA model (Koop et al., 2012) - to evaluate the risk potential of plants, including those newly detected in the United States, those proposed for import, and those emerging as weeds elsewhere in the world.

Because the PPQ WRA model is geographically and climatically neutral, it can be used to evaluate the baseline invasive/weed potential of any plant species for the entire United States or for any area within it. As part of this analysis, we use a stochastic simulation to evaluate how much the uncertainty associated with the analysis affects the model outcomes. We also use GIS overlays to evaluate those areas of the United States that may be suitable for the establishment of the plant. For more information on the PPQ WRA process, please refer to the document, *Background information on the PPQ Weed Risk Assessment*, which is available upon request.

Echinochloa pyramidalis **(Lam.) Hitch. & Chase – Antelope grass**

Species Information

Family: Poaceae

Initiation: On July 26, 2011, APHIS published a notice in the Federal Register announcing that *Echinochloa pyramidalis* has been proposed for APHIS' Not Allowed Pending Pest Risk Analysis (NAPPRA) list (APHIS, 2011). Plants in the NAPPRA category are potential quarantine pests that cannot be imported as propagative material until they have been evaluated with a weed risk assessment (WRA). Depending on the results of the WRA, assessed NAPPRA species may either be allowed entry or they may be denied entry and regulated as Federal noxious weeds. The Plant Epidemiology and Risk Analysis Laboratory (PERAL) initiated this WRA to evaluate the risk potential of *E. pyramidalis*.

Foreign distribution: *Echinochloa pyramidalis* is native to Africa (Benin, Botswana, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Ethiopia; French Guinea, Gabon, the Gambia, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Senegal, Somalia, South Africa, Sudan, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe) and has been introduced elsewhere in tropical America, southeastern Asia, and Australia (FloraBase, 2011; GBIF, 2011; Michael, 1983; NGRP, 2012).

U.S. distribution & status: *Echinochloa pyramidalis* has been introduced into the United States for experimental purposes (Gainesville, FL; Barkworth et al., 2011). We found no evidence that it has naturalized (e.g., Kartesz, 2012).

WRA area: Entire United States, including territories

1. *Echinochloa pyramidalis* analysis

Establishment/Spread Potential *Echinochloa pyramidalis* is a grass that grows well in a variety of environments including swampy areas, alongside bodies of water, and open floating meadows, but it also grows on dry lands, and can withstand long periods of drought and tolerate grazing (Heuzé et al., 2011). On land plant stems grow upright, while on water they lie flat and float on the water surface. In this assessment, we considered this species as an aquatic plant because it appears to be adapted to aquatic habitats: stems have numerous intercellular cavities that help them to float (Catling, 1992). *Echinochloa pyramidalis* has invaded sensitive wetland habitats in Mexico, and efforts to control or eradicate it are ongoing (López Rosas et al., 2010). It forms extensive, homogenous, dense stands over large areas (Dean, 1968). Seeds and plants are dispersed by water (Catling, 1992; FAO, 2011), and stem fragments readily form adventitious roots to form new plants (Heuzé et al., 2011). Because we could not answer several questions (see Appendix A), the uncertainty was above-average.

Risk score = 13 Uncertainty index= 0.26

Impact Potential In Mexico, *E. pyramidalis* has invaded wetlands. It reduces biodiversity by replacing native species (Heuzé et al., 2011) and impedes their recovery by blocking the sunlight they need for germination (e.g., *Cyperus digitatus*, *C. humilis*, and *C. lanceolata*, *Eleocharis geniculata*, and *Fuirena simplex*) (López Rosas et al., 2006). Where restoration efforts reduced *E. pyramidalis* populations in wetlands, both plant and animal species richness increased over time (López Rosas et al., 2010). *Echinochloa pyramidalis* is a weed of rice and sugarcane (Bishundial et al., 1997; López Rosas et al., 2006; Michael, 1983) to the extent that it is actively controlled in both crops (Bishundial et al., 1997; Bruyere and Rakotomanana, 1964; Jauffret, 1954; Rochecouste, 1965). In sugarcane it hinders irrigation and transport in canals. This risk element had an average amount of uncertainty.

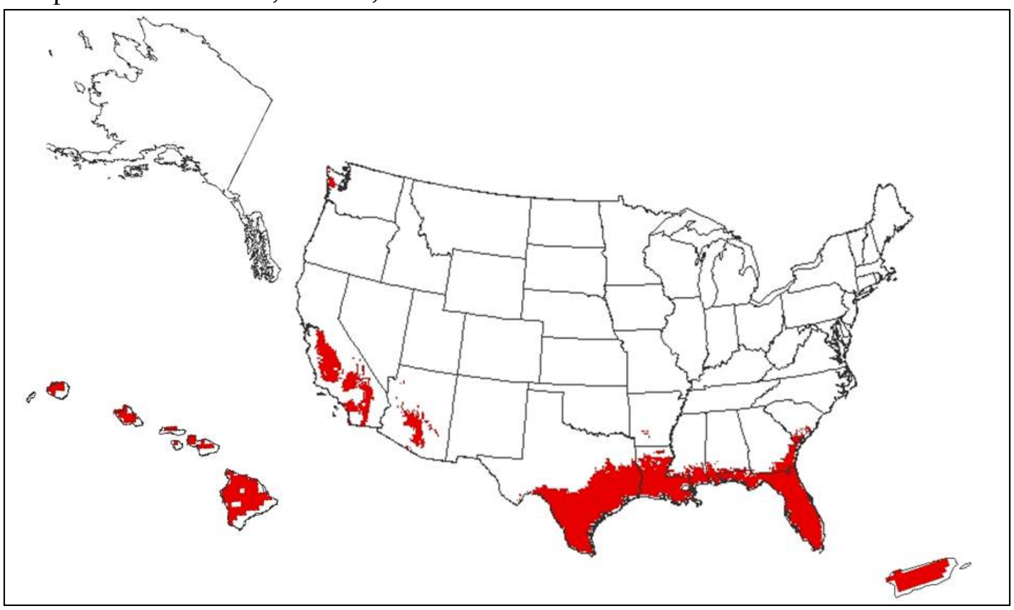
Risk score = 3.5 Uncertainty index = 0.18

Geographic Potential We estimate that about 7 percent of the United States is suitable for the establishment of *E. pyramidalis* (Fig. 1). This predicted distribution is based on the species' known distribution elsewhere in the world and includes point-referenced localities and areas of occurrence. The map for *E. pyramidalis* represents the joint distribution of Plant Hardiness Zones 9-13, areas with 10-100+ inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical rainforest, tropical savanna, steppe, desert, humid subtropical, and marine west coast.

The area estimated in Fig. 1 likely represents a conservative estimate as it uses three climatic variables to estimate the area of the United States that is suitable for establishment of the species. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish. Because of its affinity for aquatic and seasonally inundated habitats (Burkill, 1985; López Rosas et al., 2010), *E. pyramidalis* is likely to be restricted to rivers, canals, lakes, estuaries, and wetlands of the southern United States, and any other similar areas (e.g., production sites for wetland rice and sugarcane).

Entry Potential *Echinochloa pyramidalis* has been grown experimentally in Florida (Barkworth et al., 2011), but we found no other evidence that this species is present in the United States. We also found no evidence of trade or resale on the internet, but this species is cultivated in Africa as both a cereal and a feed for livestock (Barkworth et al., 2011; FAO, 2011). Thus, because of its potential economic importance, it may be introduced to the United States again in the future. This risk factor contributed 0.25 points of this risk element's score. We found no evidence that this species is likely to enter as a hitchhiker or a trade contaminant. However, because it grows in wetlands and riverine habitats, and because it is present in Mexico (López Rosas et al., 2010), it may be present in the Mexican portion of the Rio Grande watershed. If it is present in the watershed, then it may eventually disperse down the watershed and into the Rio Grande River, which forms part of Texas' border. In its native range, this species forms mats of vegetation that float down the Nile River (Anonymous, 2012). This risk factor contributed another 0.06 points to the score for this risk element.
Risk score = 0.31 Uncertainty index = 0.20

Figure 1. Predicted distribution of *Echinochloa pyramidalis* in the United States. Map insets for Alaska, Hawaii, and Puerto Rico are not to scale.



2. Results and Conclusion

Model Probabilities: P(Major Invader) = 73.8%
P(Minor Invader) = 25.2%
P(Non-Invader) = 1.1%

Risk Result = High Risk
Secondary Screening = Not Applicable

Figure 2. *Echinochloa pyramidalis* risk score (black box) relative to the risk scores of species used to develop and validate the PPQ WRA model (other symbols). See Appendix A for the complete assessment.

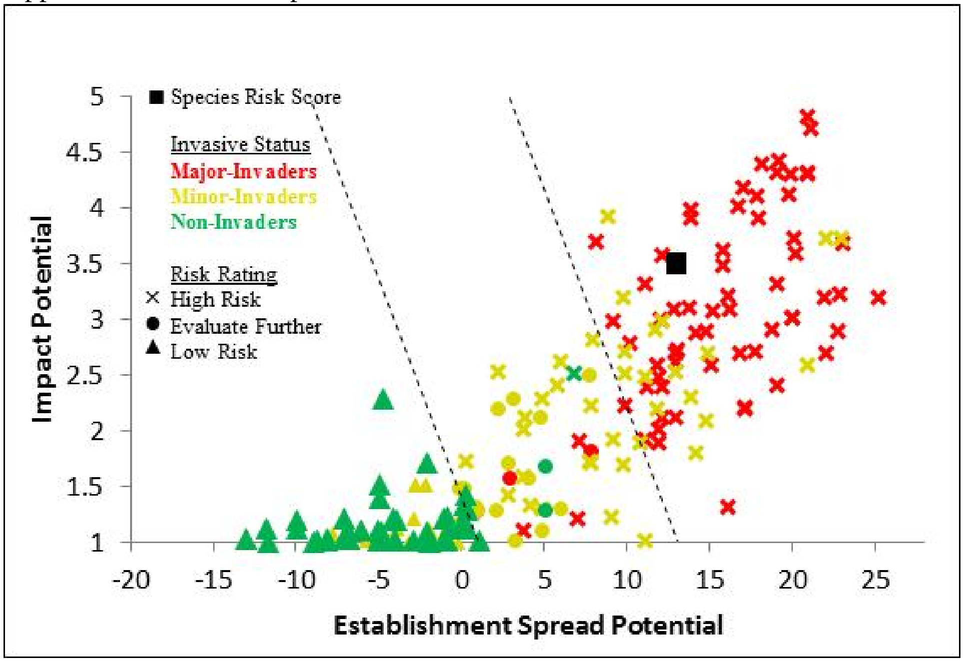
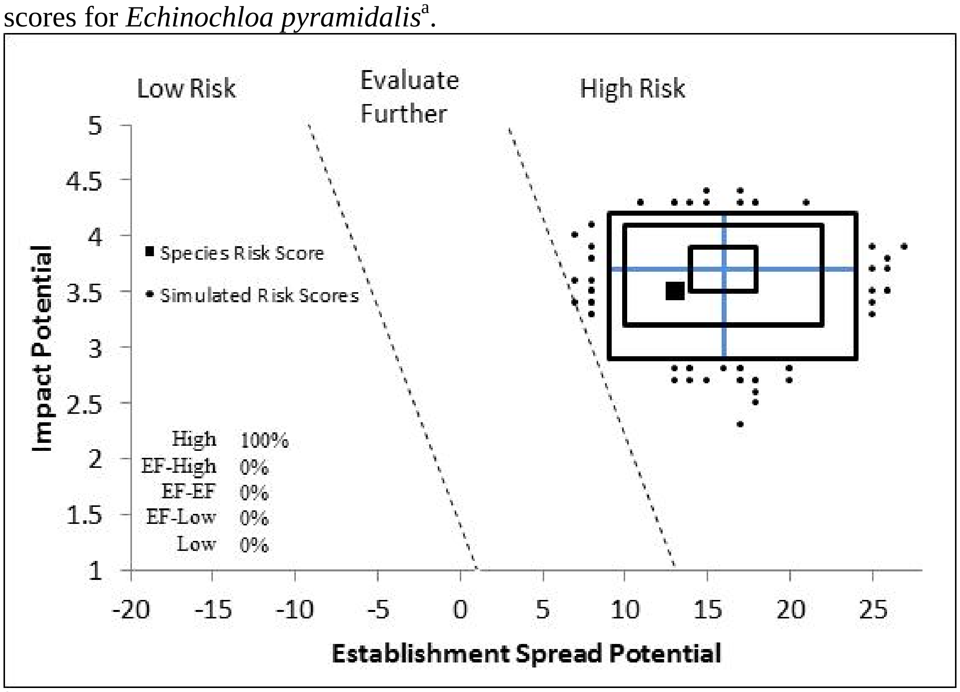


Figure 3. Monte Carlo simulation results (N=5,000) for uncertainty around the risk scores for *Echinochloa pyramidalis*[a].



[a] The blue "+" symbol represents the medians of the simulated outcomes. The smallest box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

3. Discussion

The result of the weed risk assessment for *E. pyramidalis* is High Risk (Fig. 2). Because *E. pyramidalis* is a tropical species, it will only be able to establish in the southern tier of the United States (Fig. 1). Its impact potential in this region may be high because these zones also coincide with areas where rice and sugarcane are commercially produced. *Echinochloa pyramidalis* is a troublesome weed in these crops in some parts of the world (Catling, 1992; IRRI and IWSS, 1983). Its impacts in wetland and riparian ecosystems have been well-documented (Heuzé et al., 2011; López-Rosas and Moreno-Casasola, 2012). Because this species obstructs water flow in irrigation canals (Bushundial, 1991), it is likely to cause similar problems in U.S. canals and slow-flowing river systems, blocking either recreational access or perhaps clogging storm water runoff.

We could not answer five of the questions in this assessment. More information about *E. pyramidalis*' potential impacts in population centers and production systems, as well as detailed information about seed production, longevity, and dispersal, would probably reduce uncertainty associated with the risk ratings. Still, the uncertainty analysis (Fig. 3) indicated that the outcome was robust.

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Appendix A. Weed risk assessment for *Echinochloa pyramidalis* (Lam.) Hitch. & Chase (Poaceae). The following information was obtained from the species' risk assessment, which was conducted using Microsoft Excel. The information shown in this appendix was modified to fit on the page. The original Excel file, the full questions, and the guidance to answer the questions are available upon request.

Question ID	**Answer - Uncertainty**	**Score**	**Notes (and references)**
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 (Status/invasiveness outside its native range)	f - negl	5	*Echinochloa pyramidalis* is native to tropical Africa, Southern Africa, and Madagascar (Heuzé et al., 2011). It has been introduced to southeastern Asia and tropical America, and is abundant in the floating rice areas of tropical Africa (Michael, 1983). *Echinochloa pyramidalis* has been introduced for cattle grazing in Mexican wetlands because of its tolerance to flooding and is now a widespread invader in freshwater marshes (López Rosas et al., 2010). Naturalized in Nepal (Tiwari et al., 2005). It is abundant [suggesting invasive] in rice fields in the Philippines (Baker and Terry, 1991). Naturalized in Western Australia, but does not appear to be spreading (FloraBase, 2011). It is a major constituent of the Sudd in the Niger and Nile Rivers, and is invading some parts of the Volta Lake (Burkill, 1985). It is an invader of irrigation in Nigeria (Burkill, 1985). Randall (2007) classifies this plant as "invasive", which are species that spread rapidly and often create monocultures (Randall, 2007). Alternate answers for the Monte Carlo simulation were both "E".
ES-2 (Is the species highly domesticated)	n - negl	0	Yield studies in Malawi on several varieties of *E. pyramidalis* for use as hay, silage, and other types of feed, as well as descriptions of different types (glabrous vs. smooth vs. hairy leaf sheaths) indicate some degree of domestication, but not directly related to invasive or weedy habit. Some cultivars differ in their growth form (cv. Chirundu is upright while cv. Parfuri is creeping), which may impact the plant's competitive ability (FAO, 2011).
ES-3 (Weedy congeners)	y - negl	1	*Echinochloa crus-galli* can be a very serious weed in rice, maize, soy bean, lucerne (alfalfa), vegetables, root crops, orchards, and vineyards, and is reported to be a serious weed of 36 crops, particularly rice, where its similar habit and appearance make it difficult to distinguish from other rice plants when young (CABI, 2011). Of 340 ranked weeds, *E. crus-galli* (ranked 96), and *E. polystachya* (ranked 227) were identified to pose a threat and likely impact biodiversity in New South Wales (Downey et al., 2010). Among the ten worst weeds of the ten major crop plants are *Echinochloa crus-galli* (weed of *Zea mays*) and *Echinochloa colona* (weed of *Solanum tuberosum*) (IRRI and IWSS, 1983).
ES-4 (Shade tolerant at some stage of its life cycle)	n - negl	0	It grows in swampy areas, alongside water, and in open floating meadows (Heuzé et al., 2011), all of which tend to be sunny habitats. Freshwater marshes invaded by this species are now being restored using several techniques including shading (López Rosas et al., 2010), which suggests that it does not tolerate shade well.
ES-5 (Climbing or smothering growth form)	n - negl	0	It neither is a vine nor forms a rosette (Burkill, 1985).
ES-6 (Forms dense thickets)	y - negl	2	The tall grass *Echinochloa pyramidalis* forms extensive,

Question ID	Answer - Uncertainty	Score	Notes (and references)
			homogenous, dense stands over large areas (Dean, 1968). It forms dense, tangled, floating stems that root at the nodes, dense enough to reduce erosion and protect against wave action (Heuzé et al., 2011). "*Echinochloa pyramidalis* is important in the central floodplains, in the south and east of Africa, where it originated and where it grows in dense, pure stands" (López Rosas et al., 2010).
ES-7 (Aquatic)	y - high	1	Evidence for this species as an aquatic is mixed. Even though this species is a rooted emergent plant, because it grows primarily in aquatic environments that flood seasonally, and because its culms are adapted to float on water, answering "yes," but with "high" uncertainty. Evidence for being aquatic: This species grows in seasonally flooded grassland and lake shores, and floating meadows (FAO, 2011). It has a floating habit in Africa (Yabuno, 1983). Because culms have numerous intercellular cavities, allowing flotation, the species forms massive floating islands in lakes in Africa (Catling, 1992). "A reed-like rhizomatous perennial grass, culms robust, erect to 3½ m high, or creeping or floating to 4½ m long; of river-banks, marshes, open water and riverine meadows" (Burkill, 1985). Evidence for not being an aquatic: It withstands long periods of drought and grows in dry lands with satisfactory production (Heuzé et al., 2011). Flooding reduces the competitive ability of the invading *E. pyramidalis*, as shown by López Rosas (2007). All five restoration sites were flooded and antelope grass decreased even in those quadrats without clipping. When the grass is cut and then inundated, the newly opened space is quickly taken over by native species, but flooding alone also seems to weaken the grass in the long term (López Rosas et al., 2010).
ES-8 (Grass)	y - negl	1	Family: Poaceae (Burkill, 1985).
ES-9 (Nitrogen-fixing woody plant)	n - negl	0	Not a member of a plant family known to be nitrogen fixers (Martin and Dowd, 1990).
ES-10 (Does it produce viable seeds or spores)	y - negl	1	This species produces seed, as several bird species in Africa rely on it as a food source (Douthwaite, 1974). It is a heavy seed producer, but sometimes there is low seed germination (FAO, 2011). *Echinochloa pyramidalis* is partially self-incompatible, so propagation through seed is doubtful. It depends more on rhizomes and corms (Raju, 1999). Because it is partially self-incompatible, it probably depends more on vegetative reproduction by rhizomes or corms than on seed reproduction (IRRI and IWSS, 1983). Gunn and Ritchie (1988) show the structure of the seed of *E. pyramidalis*. Kew Gardens' Seed Information Database (RBGK, 2008) reports 85-96% germination rates if seed are scarified and showed that seed stored up to 3 years, remained viable. So, for this question, the answer is yes, although seed production is not the only mode, and possibly not the primary mode, of reproduction for the plant.
ES-11 (Self-compatible or apomictic)	y - mod	1	This species has been reported as being partially self-incompatible (Raju, 1999; Yabuno, 1983), indicating that some genotypes or under certain environmental conditions, it is self-compatible. Consequently answering yes, but with mod uncertainty. Note, many other species of *Echinochloa* are self-

Question ID	Answer - Uncertainty	Score	Notes (and references)
			fertile (Yabuno, 1983).
ES-12 (Requires special pollinators)	n - negl	0	We found no evidence this species requires specialist pollinators. Generally, grasses (Poaceae) are wind pollinated (Zomlefer, 1994).
ES-13 (Minimum generation time)	? - max		Unknown. This species is "characteristic of flood plain grasslands in Tanzania and Zimbabwe. Growth starts at the onset of the rains, depending on the extent of flooding. Flowering occurs about half way through the wet season and seeds are shed before the end of the rains. Translocation of nutrients below ground then starts and the subaerial parts dry off although the site may still be flooded. However, node shoots remain green and there is some secondary flowering later. Early fires may not penetrate the *Echinochloa* stand. However, later in the season the whole stand becomes straw, and fierce fires, resulting in a clean burn, occur. Subsequently vigorous growth from ground level occurs without the incidence of rain, and this provides a green dry- season pasture which may remain available until the commencement of the next rainy season." (FAO, 2011). It can also reproduce vegetatively—antelope grass has dense, tangled, floating stems that root at the nodes (Heuzé et al., 2011), and is characterized by ease of budding and by rooting from culm nodes. Strains with rhizomes and those with corms have been discovered (IRRI and IWSS, 1983). There is insufficient information to determine the minimum generative time for culms produced via seeds or rhizomes.
ES-14 (Prolific reproduction)	n - high	-1	There is insufficient data to answer this question with little uncertainty. However, the weight of the evidence suggests it is not a prolific seeder due to low seed germination (FAO, 2011). Another author says "Because it is partially self-incompatible, it probably depends more on vegetative reproduction by rhizomes or corms than on seed reproduction" (Yabuno, 1983). Seed produced in spikelets of 4-6 rows (see photo in: Informed Farmers, 2011); it is not clear how many spikes there are per plant.
ES-15 (Propagules likely to be dispersed unintentionally by people)	n - mod	-1	No evidence.
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	? - max	0	Unknown. The congener, *Echinochloa crus-galli* contaminates rice seed (Moody et al., 1997). *Echinochloa pyramidalis* is abundant in floating rice areas of tropical Africa and often occurs as a weed of rice there (IRRI and IWSS, 1983), suggesting that it too may be a seed contaminant.
ES-17 (Number of natural dispersal vectors)	1	-2	
ES-17a (Wind dispersal)	n - low		No evidence, but botanically seeds do not appear to have an appropriate structure for wind dispersal (NRCS, 2012).
ES-17b (Water dispersal)	y - negl		*Echinochloa pyramidalis* is a semi-aquatic species (see ES-7 section above). Seed is shed during the rains (FAO, 2011). Because culms have numerous intercellular cavities, allowing flotation, the species forms massive floating islands in lakes in Africa (Catling, 1992). Furthermore, this species is a component of a swamp area in Africa called the Sudd on the White Nile.

Question ID	Answer - Uncertainty	Score	Notes (and references)
			Here, sometimes the matted vegetation breaks free of its moorings, building up into floating islands of vegetation up to 30 km in length. Such islands, in varying stages of decomposition, eventually break up (Anonymous, 2012).
ES-17c (Bird dispersal)	? - max		Unknown. Wattled cranes in their four main habitats eat seed of *E. pyramidalis* and *E. colona* (Douthwaite, 1974). But it is unknown whether seeds pass intact. Field collections of duck feces at five locations in the prairie pothole region of North America indicate that some birds can disperse intact seeds of common wetland species (including *Echinochloa crus-galli*) (Mueller and van der Valk, 2002).
ES-17d (Animal external dispersal)	? - max		Unknown. Seed are covered with prickly spines or hairs which may allow them to stick in animal fur or coats. It is also a common forage crop, so animals (wild and domesticated) eat it and may pick up and disperse the seeds while grazing (Anonymous, 2011).
ES-17e (Animal internal dispersal)	n - mod		No evidence. Did not find any direct evidence about viability of consumed seeds.
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	? - max	0	Unknown.
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	y - negl	1	Soil disking reduced the dominance of *E. pyramidalis* and increased the diversity of native species, but this was not enough to eliminate the grass. After nine months, *E. pyramidalis* recovered in all the treatments and again became the dominant species (López Rosas et al., 2006). It forms dense, tangled, floating stems that root at the nodes (Heuzé et al., 2011). *Echinochloa pyramidalis* tolerates drought and other stress conditions such as intensive grazing (López Rosas et al., 2005). Late season fires can result in a clean burn, followed by vigorous re-growth from the ground (FAO, 2011).
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	y - high	1	*Echinochloa pyramidalis* is managed with herbicides in a few different systems (Bishundial et al., 1997). In Madagascar, 2, 4-D (ester) is applied to rice 5 weeks after sowing, and while other weeds eventually succumb to the herbicide, it is ineffectual against *Echinochloa pyramidalis* and *E. colona* (Jauffret, 1954). Also, it is possible *E. pyramidalis* may pick up resistance to atrazine from its congener, which expresses some resistance to herbicides *Echinochloa crus-galli* (Cejudo-Espinosa et al., 2009).
ES-21 (Number of cold hardiness zones suitable for its survival)	5	0	
ES-22 (Number of climate types suitable for its survival)	6	2	
ES-23 (Number of precipitation bands suitable for its survival)	10	1	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	n - mod	0	No evidence.
Imp-G2 (Parasitic)	n - negl	0	Plant not in a family known to contain parasitic plants (Nickrent, 2009).

Question ID	Answer - Uncertainty	Score	Notes (and references)
Impacts to Natural Systems			
Imp-N1 (Change ecosystem processes and parameters that affect other species)	y - low	0.4	In a study comparing the competitive interaction between *E. pyramidalis* and two native species in three different hydrological regimes, high productivity by *E. pyramidalis* led to the accretion of organic soils underneath plants, thus increasing the microtopography of the habitat; in contrast, the two native species did not result in soil accretion (López-Rosas and Moreno-Casasola, 2012). The authors hypothesize that by increasing the height of the soil *E. pyramidalis* changes habitat conditions (soil depth, length of hydroperiod), making it more favorable for its own growth (López-Rosas and Moreno-Casasola, 2012).
Imp-N2 (Change community structure)	y - low	0.2	Species forms extensive, homogenous, dense stands over large areas (Dean, 1968) that eliminate structural diversity of communities.
Imp-N3 (Change community composition)	y - negl	0.2	*Echinochloa pyramidalis* reduces biodiversity by replacing native species (Heuzé et al., 2011). Both plant and animal species richness increased over time as *E. pyramidalis* declined (López Rosas et al., 2010). López-Rosas suggests that *E. pyramidalis* impedes the recovery of native species by diminishing the degree of insolation on the soil, thus reducing the germination capacity of these species; *Eleocharis geniculata*, *Fuirena simplex*, *Cyperus humilis*, *C. digitatus*, and *C. lanceolata*, germinated in response to light stimulation when the *E. pyramidalis* canopy was removed (López Rosas et al., 2006).
Imp-N4 (Is it likely to affect federal Threatened and Endangered species)	y - low	0.1	Based on the impacts documented above for natural systems, *E. pyramidalis*, which colonizes wetlands and riparian zones, could impact T & E plants. There are many state-listed threatened and endangered species of *Cyperus* and *Eleocharis* (NRCS, 2012) that occur in the same habitats that *E. pyramidalis* would invade if introduced.
Imp-N5 (Is it likely to affect any globally outstanding ecoregions)	y - low	0.1	*Echinochloa pyramidalis* can establish in U.S. regions containing globally outstanding ecoregions (e.g., in FL, AL, MS, LA, TX, CA; Ricketts et al., 1999). Based on its documented impacts above, it could threaten these regions.
Imp-N6 (Weed status in natural systems)	c - negl	0.6	In some humid contexts, *Echinochloa pyramidalis* is considered one of the most troublesome weeds, e.g., in the freshwater wetlands of the Mexican tropics (Heuzé et al., 2011). Several studies have evaluated the feasibility of various control techniques, including manual extraction, clipping, and inundation (López Rosas et al., 2010; López Rosas et al., 2006). Both alternate answers for the Monte Carlo simulation are "B".
Impact to Anthropogenic Systems (cities, suburbs, roadways)			
Imp-A1 (Impacts human property, processes, civilization, or safety)	n - mod	0	No evidence.
Imp-A2 (Changes or limits recreational use of an area)	n - mod	0	No evidence.
Imp-A3 (Outcompetes, replaces, or otherwise affects desirable plants and vegetation)	n - mod	0	No evidence.
Imp-A4 (Weed status in	a - mod	0	No evidence. Both alternate answers for the Monte Carlo

Question ID	Answer - Uncertainty	Score	Notes (and references)
anthropogenic systems)			simulation are "B".
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	? - max		Unknown. *Echinochloa pyramidalis* is an alternate host for several sugarcane pests, including stem borers (Sampson and Kumar, 1986).
Imp-P2 (Lowers commodity value)	y - high	0.2	This species is controlled in rice in Madagascar (Bruyere and Rakotomanana, 1964). Cutting of the rice and weed with a sickle, before rice tillering, gave good control of *E. pyramidalis* in 2 years (Bruyere and Rakotomanana, 1964). Intensive manual control is expected to lower the value of the commodity.
Imp-P3 (Is it likely to impact trade)	n - mod	0	There is no evidence that this species can follow a trade pathway or that it is regulated.
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	y - low	0.1	This species hinders irrigation and transport in sugarcane canals in Guyana (Bushundial, 1991).
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	n - negl	0	This species is excellent for fodder (FAO, 2011). It makes useful hay and silage in South Africa. The types with glabrous or smooth leaf sheaths should be used for hay: those with hairy leaf-sheaths are unpleasant to handle. No toxicity has been reported (FAO, 2011).
Imp-P6 (Weed status in production systems)	c - low	0.6	*Echinochloa pyramidalis* is abundant in the floating rice areas of tropical Africa and often occurs with *E. stagnina* as a weed in rice. *Echinochloa pyramidalis* is considered a weed in the rice fields of Australia, India, the Philippines, and Tropical America (López Rosas et al., 2006). It has been introduced to India and tropical America, but apparently is not a significant weed in rice outside Africa (Michael, 1983). Controlled in rice in Madagascar (Bruyere and Rakotomanana, 1964). This species is considered a troublesome weed in irrigation canals of the Guyana Sugar Corporation and is controlled with herbicides (Bishundial et al., 1997). Along with other weeds, herbicides are used to control it in rice (Jauffret, 1954). It is recommended that *E. pyramidalis* be replaced with another grass species along sugarcane irrigation canals in Madagascar (Rochecouste, 1965). Both alternate answers for the Monte Carlo simulation are "B".
GEOGRAPHIC POTENTIAL			Unless otherwise stated all geographic information used below was obtained from GBIF (2012). PS = point-source data (latitude/longitude geo-referenced data points, or other). Occ = presence within a region.
Plant cold hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	No evidence.
Geo-Z2 (Zone 2)	n - negl	N/A	No evidence.
Geo-Z3 (Zone 3)	n - negl	N/A	No evidence.
Geo-Z4 (Zone 4)	n - negl	N/A	No evidence.
Geo-Z5 (Zone 5)	n - negl	N/A	No evidence.
Geo-Z6 (Zone 6)	n - negl	N/A	No evidence.
Geo-Z7 (Zone 7)	n - low	N/A	No evidence.
Geo-Z8 (Zone 8)	n - high	N/A	No evidence.
Geo-Z9 (Zone 9)	y - mod	N/A	PS: Mexico.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-Z10 (Zone 10)	y - negl	N/A	PS: Australia, Botswana.
Geo-Z11 (Zone 11)	y - negl	N/A	PS: Madagascar, Mexico.
Geo-Z12 (Zone 12)	y - negl	N/A	PS: Burkina Faso, Costa Rica.
Geo-Z13 (Zone 13)	y - negl	N/A	PS: Benin, Suriname.
Koppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	y - negl	N/A	PS: Mexico, Cameroon; Occ: French Guinea, Guadeloupe, Trinidad & Tobago.
Geo-C2 (Tropical savanna)	y - negl	N/A	PS: Mexico, Gabon.
Geo-C3 (Steppe)	y - negl	N/A	PS: Botswana, Cameroon.
Geo-C4 (Desert)	y - negl	N/A	PS: Mali, Chad.
Geo-C5 (Mediterranean)	n - low	N/A	No evidence.
Geo-C6 (Humid subtropical)	y - negl	N/A	PS: Mexico, Malawi.
Geo-C7 (Marine west coast)	y - negl	N/A	PS: Mexico, Madagascar.
Geo-C8 (Humid cont. warm sum.)	n - low	N/A	No evidence.
Geo-C9 (Humid cont. cool sum.)	n - negl	N/A	No evidence.
Geo-C10 (Subarctic)	n - negl	N/A	No evidence.
Geo-C11 (Tundra)	n - negl	N/A	No evidence.
Geo-C12 (Icecap)	n - negl	N/A	No evidence.
10-inch precipitation bands			
Geo-R1 (0-10 inches; 0-25 cm)	n - high	N/A	No evidence.
Geo-R2 (10-20 inches; 25-51 cm)	y - negl	N/A	PS: Botswana, Mali.
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	PS: Botswana, Mali.
Geo-R4 (30-40 inches; 76-102 cm)	y - negl	N/A	PS: Australia, Tanzania, Malawi.
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	PS: Australia, Cote d'Ivoire.
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	PS: Kenya, Uganda.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	PS: Cameroon, Mexico.
Geo-R8 (70-80 inches; 178-203 cm)	y - negl	N/A	PS: Cameroon, Mexico.
Geo-R9 (80-90 inches; 203-229 cm)	y - negl	N/A	PS: Madagascar, Mexico.
Geo-R10 (90-100 inches; 229-254 cm)	y - negl	N/A	PS: Mexico, Costa Rica.
Geo-R11 (100+ inches; 254+ cm))	y - negl	N/A	PS: Cameroon, Venezuela; Occ: French Guinea.
ENTRY POTENTIAL			
Ent-1 (Plant already here)	n - high	0	It has been grown experimentally in Gainesville, Florida, but it is not established in North America (Barkworth et al., 2011). Assuming that all introduced plants were destroyed after the experiment was completed, we will assume that it is not present in the United States and proceed with the evaluation of its entry potential.

Question ID	**Answer - Uncertainty**	**Score**	**Notes (and references)**
Ent-2 (Plant proposed for entry, or entry is imminent)	n - mod	0	No evidence.
Ent-3 (Human value & cultivation/trade status)	c - mod	0.25	This species is grown as a cereal and an animal feed in Africa, with several described cultivars and types (Barkworth et al., 2011; FAO, 2011). It was introduced to Mexico for cattle grazing (López Rosas et al., 2010). No evidence of resale on the internet.
Ent-4 (Entry as a contaminant)			
Ent-4a (Plant present in Canada, Mexico, Central America, the Caribbean or China)	y - negl		Present in Mexico (GBIF, 2011; López Rosas et al., 2010).
Ent-4b (Contaminant of plant propagative material (except seeds))	n - mod	0	No evidence.
Ent-4c (Contaminant of seeds for planting)	? - max		Unknown. The congener, *Echinochloa crus-galli* contaminates rice seed (Moody et al., 1997). *Echinochloa pyramidalis* is abundant in floating rice areas of tropical Africa and often occurs as a weed of rice there (IRRI and IWSS, 1983), suggesting that it too may be a seed contaminant.
Ent-4d (Contaminant of ballast water)	n - mod	0	No evidence.
Ent-4e (Contaminant of aquarium plants or other aquarium products)	n - low	0	No evidence. Seems unlikely.
Ent-4f (Contaminant of landscape products)	n - mod	0	No evidence.
Ent-4g (Contaminant of containers, packing materials, trade goods, equipment or conveyances)	n - mod	0	No evidence.
Ent-4h (Contaminants of fruit, vegetables, or other products for consumption or processing)	n - low	0	No evidence. Seems unlikely.
Ent-4i (Contaminant of some other pathway)	a - mod	0	No evidence.
Ent-5 (Likely to enter through natural dispersal)	y - high	0.06	Because this species grows in wetlands and riverine habitats, and because it is present in Mexico (López Rosas et al., 2010), it is likely that it may disperse naturally down the Rio Grande watershed and establish along Texas' border. In its native range, this species forms mats of vegetation that float down the Nile (Anonymous, 2012). However, because we don't have any data on its distribution in Mexico and whether it is present in the watershed region of Mexico, using "high" uncertainty.