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Version 1

Weed Risk Assessment for *Myriophyllum mattogrossensis* Hoehne (Haloragaceae)

Myriophyllum mattogrossensis Hoehne. Photo obtained with permission (Tran, 2017) from Han Aquatics' website (Han Aquatics, 2017).

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1. 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 the PPQ weed risk assessment (WRA) process (PPQ, 2015) 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.

The PPQ WRA process includes three analytical components that together describe the risk profile of a plant species (risk potential, uncertainty, and geographic potential; PPQ, 2015). At the core of the process is the predictive risk model that evaluates the baseline invasive/weed potential of a plant species using information related to its ability to establish, spread, and cause harm in natural, anthropogenic, and production systems (Koop et al., 2012). Because the predictive model is geographically and climatically neutral, it can be used to evaluate the risk of any plant species for the entire United States or for any area within it. We then use a stochastic simulation to evaluate how much the uncertainty associated with the risk analysis affects the outcomes from the predictive model. The simulation essentially evaluates what other risk scores might result if any answers in the predictive model might change. Finally, we use Geographic Information System (GIS) overlays to evaluate those areas of the United States that may be suitable for the establishment of the species. For a detailed description of the PPQ WRA process, please refer to the *PPQ Weed Risk Assessment Guidelines* (PPQ, 2015), which is available upon request.

We emphasize that our WRA process is designed to estimate the baseline—or unmitigated—risk associated with a plant species. We use evidence from anywhere in the world and in any type of system (production, anthropogenic, or natural) for the assessment, which makes our process a very broad evaluation. This is appropriate for the types of actions considered by our agency (e.g., Federal regulation). Furthermore, risk assessment and risk management are distinctly different phases of pest risk analysis (e.g., IPPC, 2015). Although we may use evidence about existing or proposed control programs in the assessment, the ease or difficulty of control has no bearing on the risk potential for a species. That information could be considered during the risk management (decision-making) process, which is not addressed in this document.

2. Plant Information and Background

SPECIES: *Myriophyllum mattogrossensis* Hoehne (The Plant List, 2013).

FAMILY: Haloragaceae

SYNONYMS: None. Numerous sources misspell the specific epithet as *mattogrossense*; however, The Plant List (2013) considers *mattogrossense* an unresolved name. *Myriophyllum mattogrossensis* is sometimes mislabeled in the aquatic plant trade as *M. tuberculatum*, which has red leaves (Aquatic Plant Central, 2016; Crow and Ritter, 1999).

COMMON NAMES: None.

BOTANICAL DESCRIPTION: *Myriophyllum mattogrossensis* is a mostly aquatic herb that can grow to 60 cm in length (Hoehne, 1915; Orchard, 1981; Orchard and Kasselmann, 1992). It is found in marshes, ephemeral ponds, fast-moving streams, or fully emergent on banks in mud (Crow and Ritter, 1999; Orchard, 1981). Emergent plants have different leaf morphology than submerged plants (Crow and Ritter, 1999) and appear to be less fecund (Orchard and Kasselmann, 1992). For a full botanical description see Orchard (1981).

INITIATION: PPQ received a market access request for *M. mattogrossensis* for propagation from the Ministry of Food, Agriculture and Fisheries, the Danish Plant Directorate (MFAF, 2009). Because this species is not native to the United States (Kartesz, 2015) and has some weedy congeners that are invasive in the United States (Anderson, 2003; Schultz and Dibble, 2012), the PPQ Weeds Cross-Functional Working Group recommended that we evaluate this species to assess its risk potential.

WRA AREA[1]: Entire United States, including territories.

FOREIGN DISTRIBUTION: *Myriophyllum mattogrossensis* is native to Brazil, Peru, Ecuador (Orchard and Kasselmann, 1992), and Bolivia (Crow and Ritter, 1999). It is not well studied and may be more widespread in South America than is currently known (Moody and Les, 2010). We found no evidence that *M. mattogrossensis* has established outside its native range. It was introduced into the global aquarium trade in 1990 (Florida Aquatic Nurseries, 2008) and is becoming more popular for planted tanks (Aquatic Plant Central, 2016).

U.S. DISTRIBUTION AND STATUS: *Myriophyllum mattogrossensis* is not known to be naturalized in the United States (Kartesz, 2015). It was introduced into the U.S. aquarium trade sometime after 1990 (Florida Aquatic Nurseries, 2008) and appears to be uncommon but is available for sale and trade (e.g., Amazon, 2017; Florida Aquatic Nurseries, 2008; Han Aquatics, 2017; The Planted Tank, 2013).

[1] "WRA area" is the area in relation to which the weed risk assessment is conducted [definition modified from that for "PRA area"] (IPPC, 2012).

3. Analysis

ESTABLISHMENT/SPREAD POTENTIAL

Myriophyllum mattogrossensis is not known to have naturalized outside its native range. However, several other members of the genus *Myriophyllum* have spread significantly in the United States and other countries (e.g., Anderson, 2003; ISSG, 2015; Schultz and Dibble, 2012), and the ability of *M. mattogrossensis* to reproduce vegetatively may allow it to similarly establish and spread if it escapes from aquatic plant hobbyists (Aquatic Plant Central, 2016). We could not answer six of the questions and had a very high level of uncertainty for this risk element, due to lack of information about its biology and behavior in its native range and because it has not established elsewhere.

Risk score = 6.0 Uncertainty index = 0.38

IMPACT POTENTIAL

We found no evidence that *Myriophyllum mattogrossensis* currently causes negative impacts anywhere in the world, resulting in a low risk score. However, invasive congeners such as *M. spicatum* and *M. aquaticum* are known to cause significant impacts where introduced; they grow quickly, outcompete other aquatic plants, reduce food and habitat for fish, and alter water chemistry (Anderson, 2003; Schultz and Dibble, 2012). *Myriophyllum mattogrossensis* is not well studied and may pose similar risks if it were to establish outside its native range. We had a very high level of uncertainty for this risk element due to lack of information about its impacts elsewhere.

Risk score = 1.2 Uncertainty index = 0.26

GEOGRAPHIC POTENTIAL

Based on three climatic variables, we estimate that about one percent of the United States is suitable for the establishment of *Myriophyllum mattogrossensis* (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 *Myriophyllum mattogrossensis* represents the joint distribution of Plant Hardiness Zones 8-12, areas with 20-100+ inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical rainforest, tropical savanna, and steppe. The area of the United States shown to be climatically suitable for species establishment considered only three climatic variables. Other variables, for example, soil and habitat type, novel climatic conditions, or plant genotypes, may alter the areas in which this species is likely to establish. *Myriophyllum mattogrossensis* occurs in marshes and temporary lakes (Orchard, 1981), as well as in fast-moving water (Crow and Ritter, 1999) and on muddy ground (Orchard and Kasselmann, 1992).

Because *M. mattogrossensis* is an aquatic species known to occur in plant hardiness zones 8 through 12, it is reasonable to assume that this species could survive in a humid subtropical climate, although we have no data points for this climate class. Additionally, one georeferenced point shows an occurrence on the edge of the climate class corresponding to marine west coast (GBIF, 2017). We believe that the geographic potential shown in Figure 1 underestimates the area of the United States that may be climatically suitable for this species because of the lack of geographic data and limited introduction outside its native range. Therefore, although we have no data points in the subtropical or marine west coast climate classes, we included these in an additional map (Fig. 2). When these additional climate classes are included, the area suitable for the establishment of *M. mattogrossensis* increased to 16 percent.

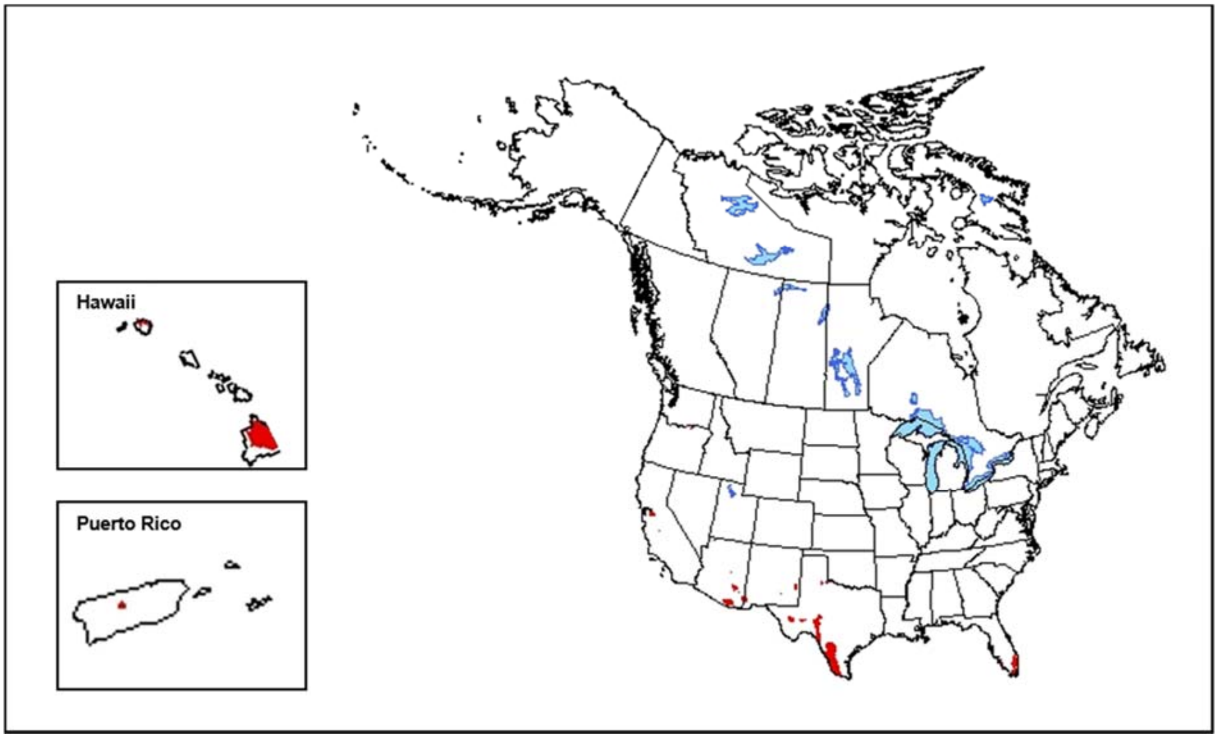

Figure 1. Potential geographic distribution of *Myriophyllum mattogrossensis* in the United States and Canada. Map insets for Hawaii and Puerto Rico are not to scale.

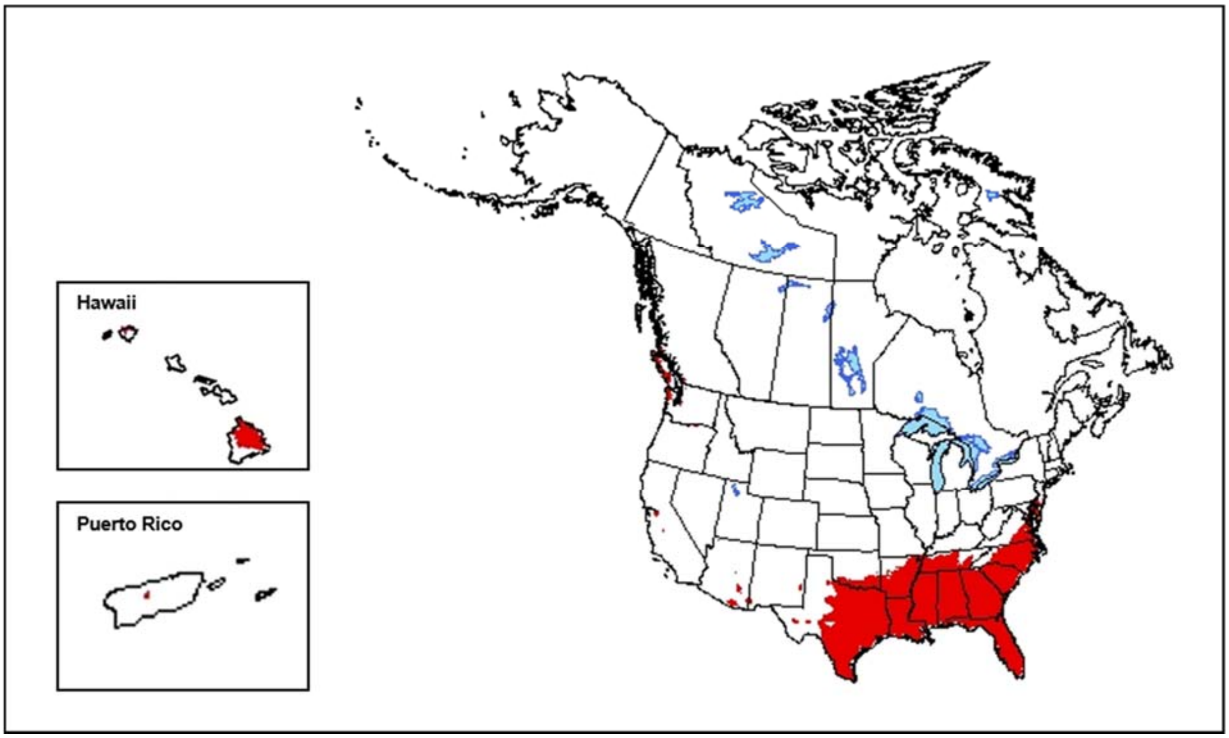

Figure 2. Potential geographic distribution of *Myriophyllum mattogrossensis* in the United States and Canada including humid subtropical and marine west coast climate classes. Map insets for Hawaii and Puerto Rico are not to scale.

ENTRY POTENTIAL

We did not assess the entry potential of *Myriophyllum mattogrossensis* because it is already present in the United States as an aquatic ornamental (Florida Aquatic Nurseries, 2008; The Planted Tank, 2013). Furthermore, if approved by APHIS, additional material is guaranteed entry since Denmark would like to export these plants to the United States.

4. Predictive Risk Model Results

Model Probabilities: P(Major Invader) = 11.9%
P(Minor Invader) = 69.8%
P(Non-Invader) = 18.3%
Risk Result = Evaluate Further
Secondary Screening = Evaluate Further

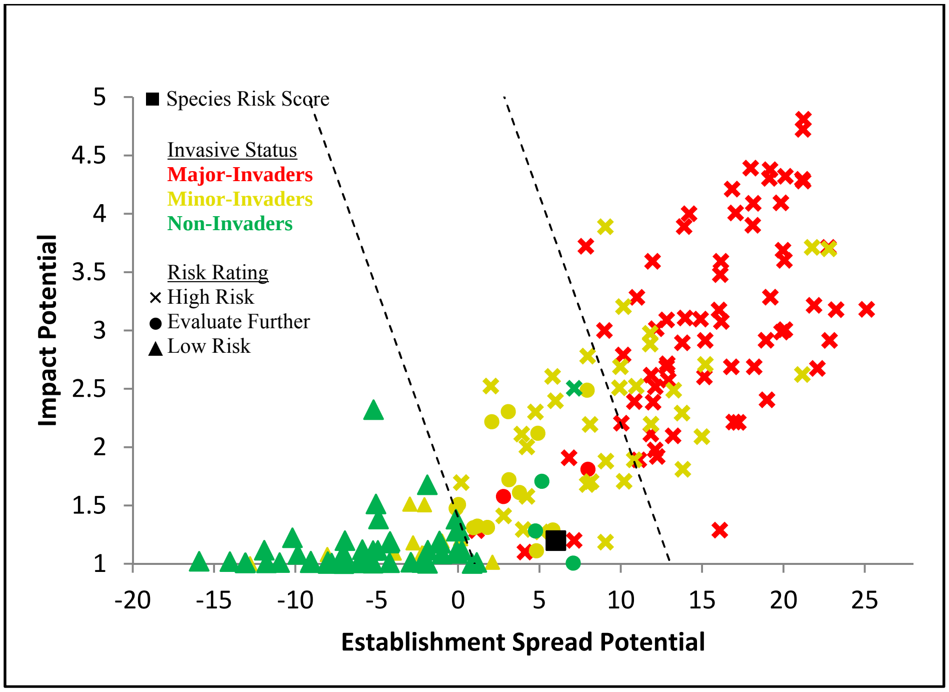

Figure 3. *Myriophyllum mattogrossensis* risk score (black box) relative to the risk scores of species used to develop and validate the PPQ WRA model (other symbols). See Appendix A for the complete assessment.

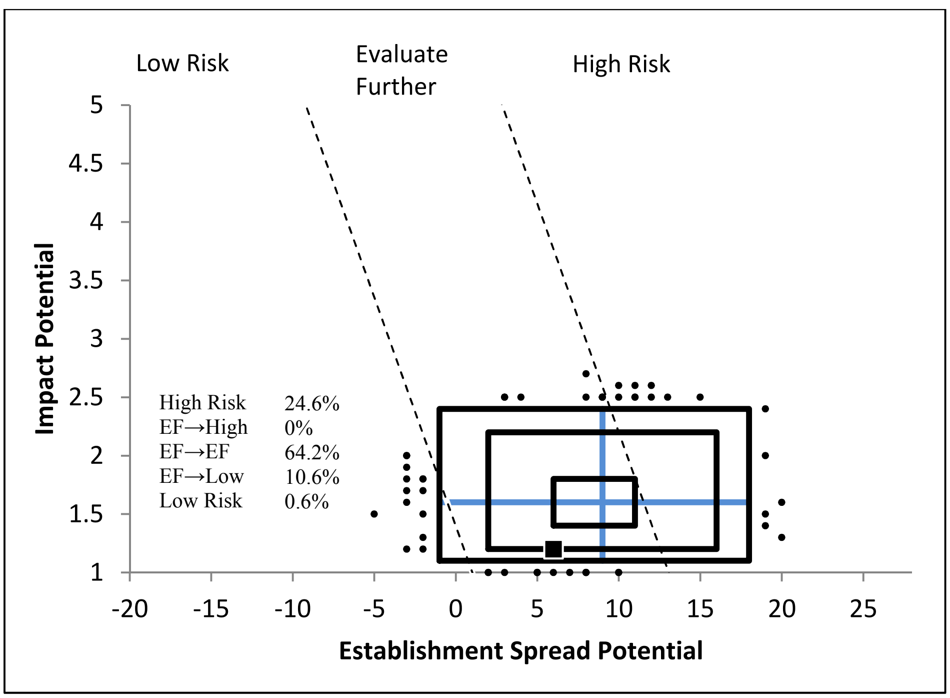

Figure 4. Model simulation results (N=5,000) for uncertainty around the risk score for *Myriophyllum mattogrossensis*. The blue "+" symbol represents the medians of the simulated outcomes. The smallest box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

5. Discussion

The result of the weed risk assessment for *Myriophyllum mattogrossensis* is Evaluate Further, even after secondary screening (Fig. 3). Because this species has not established outside its native range and has only recently been introduced in trade, very little information is available regarding its behavior or potential for invasiveness in other locations. It may be more widespread and may tolerate a wider range of temperatures and climate types in South America than is currently known (Orchard, 1981), and our predicted potential distribution (Fig. 1) using only the few known data points may not reflect its ability to invade U.S. areas. Figure 2, which includes two additional climate zones that are likely suitable for this species, may more correctly indicate the potential suitable habitats in the United States. Similarly, because *M. mattogrossensis* is not problematic in its native range and does not occur elsewhere, the risk score for impact was low and may be misleading (Fig. 3). Simulated risk scores ranged between the Low Risk and High Risk areas in our risk space (Fig. 4), emphasizing our lack of knowledge of how this species may behave if introduced. Other members of *Myriophyllum* are important and costly aquatic weed species of concern in the United States (e. g., Anderson, 2003; Schultz and Dibble, 2012), and introduced *Myriophyllum* species have hybridized with native members of the genus to create aggressive populations (Moody and Les, 2002). For these reasons, *M. mattogrossensis* may be more problematic than is predicted if it establishes here.

6. Acknowledgements

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SUGGESTED CITATION

PPQ. 2017. Weed risk assessment for *Myriophyllum mattogrossensis* Hoehne (Haloragaceae). United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (PPQ), Raleigh, NC. 17 pp.

DOCUMENT HISTORY

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Appendix A. Weed risk assessment for *Myriophyllum mattogrossensis* Hoehne (Haloragaceae)

Below is all of the evidence and associated references used to evaluate the risk potential of this taxon. We also include the answer, uncertainty rating, and score for each question. The Excel file, where this assessment was conducted, is available upon request.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 [What is the taxon's establishment and spread status outside its native range? (a) Introduced elsewhere =>75 years ago but not escaped; (b) Introduced <75 years ago but not escaped; (c) Never moved beyond its native range; (d) Escaped/Casual; (e) Naturalized; (f) Invasive; (?) Unknown]	b - mod	-2	*Myriophyllum mattogrossensis* is native to Brazil, Peru, Ecuador (Orchard and Kasselmann, 1992), and Bolivia (Crow and Ritter, 1999). Moody (Moody and Les, 2010) states that it is "known to range widely across South America and is likely more common than currently known". We found no evidence that *M. mattogrossensis* has established outside its native range. In the description of this species in 1915, Hoehne recommended this plant for small aquaria (Hoehne, 1915). One source states that it was introduced into the global aquarium trade in 1990 and later into the U.S. trade (Florida Aquatic Nurseries, 2008). Alternate answers for the uncertainty simulation were "a" and "d".
ES-2 (Is the species highly domesticated)	n - negl	0	We found no evidence that *Myriophyllum mattogrossensis* is domesticated.
ES-3 (Weedy congeners)	y - negl	1	Several members of *Myriophyllum* are noxious weeds. *Myriophyllum aquaticum*, *M. heterophyllum*, and *M. spicatum* are fast-growing, aggressive aquatic weeds that form dense stands that shade other vegetation, reduce oxygen in water, and impede recreational use of waterways (Anderson, 2003; ISSG, 2015; NSW DPI, 2014; Schultz and Dibble, 2012). Additionally, some members of the genus hybridize, resulting in aggressive hybrid populations (Moody and Les, 2002). *Myriophyllum aquaticum* and *M. spicatum* are state-listed noxious weeds in the United States (NRCS, 2017). *Myriophyllum aquaticum* is regulated in New Zealand (MPI, 2012), and *M. spicatum* is regulated in Australia (NSW DPI, 2014).
ES-4 (Shade tolerant at some stage of its life cycle)	y - mod	1	We found no information regarding light levels needed by *Myriophyllum mattogrossensis*. However, it is a submersed aquatic plant (Orchard, 1981).
ES-5 (Plant a vine or scrambling plant, or forms tightly appressed basal rosettes)	n - negl	0	*Myriophyllum mattogrossensis* is a "weak aquatic herb" that may be submerged with floating stems, partially emergent, or growing in mud (Orchard, 1981).
ES-6 (Forms dense thickets, patches, or populations)	n - high	0	We found no evidence that *Myriophyllum mattogrossensis* forms dense stands. However, it exhibits dense, leafy foliage (Hoehne, 1915),

Question ID	Answer - Uncertainty	Score	Notes (and references)
			and in high light aquaria, the stems recline and root along the substrate, forming a colony (Florida Aquatic Nurseries, 2008). Additionally, several well-known congeners do exhibit these behaviors (ISSG, 2015; NSW DPI, 2014). For these reasons, we used high uncertainty.
ES-7 (Aquatic)	y - negl	1	*Myriophyllum mattogrossensis* is an aquatic herb that may be completely submerged with floating stems, partially emergent, or growing in mud (Orchard, 1981).
ES-8 (Grass)	n - negl	0	*Myriophyllum mattogrossensis* is not a grass. It is an herb in the Haloragaceae (Hoehne, 1915).
ES-9 (Nitrogen-fixing woody plant)	n - negl	0	We found no evidence that this species fixes nitrogen. *Myriophyllum mattogrossensis* is an herbaceous member of the Haloragaceae (Hoehne, 1915).
ES-10 (Does it produce viable seeds or spores)	y - high	1	We found no direct evidence that seeds are viable, but several sources describe fruit and seed of this species from wild plants in various locations (Crow and Ritter, 1999; Hoehne, 1915; Orchard, 1981). For this reason we answered yes with high uncertainty.
ES-11 (Self-compatible or apomictic)	? - max	0	Unknown. Flowers are typically hermaphroditic (Hoehne, 1915). Specimens from Ecuador appear to lack normal flower and pollen development and are thought to be parthenogenic (Orchard and Kasselmann, 1992), but we found no other direct evidence of self-compatibility.
ES-12 (Requires specialist pollinators)	n - mod	0	*Myriophyllum mattogrossensis* is an aquatic herb that may bear its flowers and fruit submerged with floating stems, partially emergent, or growing in mud (Orchard, 1981), and it is unlikely that specialist pollinators would be required for each of these environmental conditions.
ES-13 [What is the taxon's minimum generation time? (a) less than a year with multiple generations per year; (b) 1 year, usually annuals; (c) 2 or 3 years; (d) more than 3 years; or (?) unknown]	b - high	1	We found no specific information about generation time. As with other members of *Myriophyllum*, it is able to reproduce from cuttings (AquaticPlantCentral.com, 2016), but we found no additional information about vegetative propagation. For this reason we answered "b." Flowers and fruits of *M. mattogrossensis* have been observed in March and November (Orchard, 1981). Alternate answers for the uncertainty simulation were "a" and "c." We chose "a" as our first alternate answer because there may be multiple generations per year produced through vegetative fragmentation.
ES-14 (Prolific seed producer)	? - max	0	Unknown.
ES-15 (Propagules likely to be dispersed unintentionally by people)	y - mod	1	We found no direct evidence that *M. mattogrossensis* is dispersed unintentionally by

Question ID	Answer - Uncertainty	Score	Notes (and references)
			people. However, other aquatic species, including other members of *Myriophyllum*, are known to be dispersed between bodies of water by boats and trailers (Anderson, 2003; Les and Mehrhoff, 1999). It is likely that *M. mattogrossensis* could be spread in a similar manner, as it propagates vegetatively from fragments (AquaticPlantCentral.com, 2016).
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	? - max	0	Unknown.
ES-17 (Number of natural dispersal vectors)	2	0	Propagule traits for questions ES-17a through ES-17e: This species is an aquatic plant that can reproduce through vegetative fragments. Fruit is a schizocarp, 0.7 mm in length, globular. Fruit has four mericarps which each contain one seed (Orchard, 1981).
ES-17a (Wind dispersal)	y - high		We found no specific evidence that *M. mattogrossensis* seed is wind dispersed. However, we answered yes with high uncertainty because the fruits are extremely small, at 0.7 x 0.9 mm, and the seed would naturally be blown by wind from emergent or terrestrial plants (Crow and Ritter, 1999; Orchard, 1981).
ES-17b (Water dispersal)	y - negl		This aquatic species often flowers and develops fruit underwater (Orchard, 1981).
ES-17c (Bird dispersal)	? - max		Unknown.
ES-17d (Animal external dispersal)	n - high		We found no evidence. *Myriophyllum mattogrossensis* fruit is 0.8mm and globular and we found no description of the seed (Orchard, 1981).
ES-17e (Animal internal dispersal)	? - max		Unknown.
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 - high	1	This species is known to root from cuttings in cultivation (AquaticPlantCentral.com, 2016), so it is likely that it would benefit from mechanical harvesting in the wild, as do some other members of the genus (Anderson, 2003; ISSG, 2015).
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	n - low	0	We found no evidence that *Myriophyllum mattogrossensis* exhibits herbicide resistance. It is not a weed and is not likely to be under herbicidal control in its native range. Additionally, no members of the genus *Myriophyllum* are listed as herbicide resistant by Heap (Heap, 2017).
ES-21 (Number of cold hardiness zones suitable for its survival)	5	0	
ES-22 (Number of climate types suitable for its survival)	3	0	
ES-23 (Number of precipitation bands suitable for its survival)	9	1	

Question ID	Answer - Uncertainty	Score	Notes (and references)
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	? - max		We found no evidence that *Myriophyllum mattogrossensis* is allelopathic. However, other members of *Myriophyllum* appear to use allelopathy to inhibit algae (e.g., Hilt et al., 2006; Nakai et al., 2000; Schultz and Dibble, 2012).
Imp-G2 (Parasitic)	n - negl	0	We found no evidence that *Myriophyllum mattogrossensis* is parasitic. It does not belong to a family known to contain parasitic plants (Heide-Jorgensen, 2008; Nickrent, 2009).
Impacts to Natural Systems			
Imp-N1 (Changes ecosystem processes and parameters that affect other species)	n - high	0	We found no evidence that *Myriophyllum mattogrossensis* changes ecosystem processes. We answered "no" with high uncertainty because of a lack of information about how this species might behave if introduced elsewhere. Additionally, other members of the genus are known to cause these changes (Anderson, 2003; ISSG, 2015).
Imp-N2 (Changes habitat structure)	n - high	0	We found no evidence that *Myriophyllum mattogrossensis* changes habitat structure. We answered "no" with high uncertainty because of a lack of information about how this species might behave if introduced elsewhere. Other members of the genus are known to change habitat structure (Aiken et al., 1979; ISSG, 2015; Schultz and Dibble, 2012).
Imp-N3 (Changes species diversity)	n - high	0	We found no evidence that *Myriophyllum mattogrossensis* changes species diversity. We answered "no" with high uncertainty because of a lack of information about how this species might behave if introduced elsewhere. Other members of the genus are known to impact aquatic species diversity (Aiken et al., 1979; ISSG, 2015; Schultz and Dibble, 2012).
Imp-N4 (Is it likely to affect federal Threatened and Endangered species?)	y - high	0.1	In its native habitat, *Myriophyllum mattogrossensis* has not been observed to cause negative impacts to other species. However, it has not been well studied. Based on the likelihood that this species can survive in humid subtropical climate, and based on congeneric evidence, it seems likely that *M. mattogrossensis* could affect threatened and endangered species. We answered yes with high uncertainty due to these assumptions.
Imp-N5 (Is it likely to affect any globally outstanding ecoregions?)	y - high	0.1	We found no evidence that *Myriophyllum mattogrossensis* causes impacts in its native range. However, based on the likelihood that this species can survive in humid subtropical climate, and based on congeneric evidence, it seems likely that it could affect globally

Question ID	Answer - Uncertainty	Score	Notes (and references)
			outstanding ecoregions such as the Hawaiian islands, the Everglades, and Gulf Coast wetlands. We answered yes with high uncertainty due to these assumptions.
Imp-N6 [What is the taxon's weed status in natural systems? (a) Taxon not a weed; (b) taxon a weed but no evidence of control; (c) taxon a weed and evidence of control efforts]	a - mod	0	*Myriophyllum mattogrossensis* has not been observed to cause impacts in its native range and is not known to be established outside its native range. We answered "a" with moderate uncertainty because the species has not been well studied. Alternate answers for the uncertainty simulation were both "b."
Impact to Anthropogenic Systems (e.g., cities, suburbs, roadways)			
Imp-A1 (Negatively impacts personal property, human safety, or public infrastructure)	n - low	0	We found no evidence.
Imp-A2 (Changes or limits recreational use of an area)	n - mod	0	We found no evidence. Although other members of the genus are known to clog waterways and inhibit their use (ISSG, 2015; NSW DPI, 2014), *Myriophyllum mattogrossensis* has not been noted to cause these kinds of impacts to waterways.
Imp-A3 (Affects desirable and ornamental plants, and vegetation)	n - negl	0	*Myriophyllum mattogrossensis* is an aquatic plant that is becoming more popular for aquaria (AquaticPlantCentral.com, 2016; Florida Aquatic Nurseries, 2008). We found no evidence that it causes negative impacts in these environments.
Imp-A4 [What is the taxon's weed status in anthropogenic systems? (a) Taxon not a weed; (b) Taxon a weed but no evidence of control; (c) Taxon a weed and evidence of control efforts]	a - low	0	We found no evidence that *Myriophyllum mattogrossensis* is a weed of anthropogenic systems. Alternate answers for the uncertainty simulation were both "b."
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	n - low	0	We found no evidence. *Myriophyllum mattogrossensis* grows in clear, swiftly flowing waters, marshes, and in mud (Crow and Ritter, 1999; Hoehne, 1915). Other members of *Myriophyllum* are weeds in rice (e.g., McIntyre et al., 1991; Nguyen et al., 2000), but we found no information about their impacts.
Imp-P2 (Lowers commodity value)	n - mod	0	We found no evidence.
Imp-P3 (Is it likely to impact trade?)	n - mod	0	We found no evidence.
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	? - max		Unknown. This is an aquatic species and some of its congeners are known to block ditches, canals, and irrigation equipment (e.g., Eiswerth et al., 2000; Piccoli and Gerdol, 1981).
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	? - max		Unknown. We found no information regarding toxicity. The congener *M. quitense* is used to feed cattle (Crow and Ritter, 1999).
Imp-P6 [What is the taxon's weed status in production systems? (a) Taxon not a weed; (b) Taxon a weed but no evidence of control;	a - low	0	We found no evidence that *M. mattogrossensis* is a weed of production systems. Alternate

Question ID	Answer - Uncertainty	Score	Notes (and references)
(c) Taxon a weed and evidence of control efforts]			answers for the uncertainty simulation were both "b".
GEOGRAPHIC POTENTIAL			Unless otherwise indicated, the following evidence represents geographically referenced points obtained from the Global Biodiversity Information Facility (GBIF, 2017).
Plant hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z2 (Zone 2)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z3 (Zone 3)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z4 (Zone 4)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z5 (Zone 5)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z6 (Zone 6)	n - negl	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z7 (Zone 7)	n - low	N/A	We found no evidence that it occurs in this hardiness zone.
Geo-Z8 (Zone 8)	y - high	N/A	One point in Bolivia. This point is close to zone 9 and may be in a microclimate or may be an artifact.
Geo-Z9 (Zone 9)	y - high	N/A	No observations were made in this zone, but one point occurs in zone 8 in Bolivia.
Geo-Z10 (Zone 10)	y - negl	N/A	One point in Peru and two points in Bolivia.
Geo-Z11 (Zone 11)	y - negl	N/A	Two points in Peru. Found in Cuyaba, Matto Grosso, Brazil (Orchard, 1981).
Geo-Z12 (Zone 12)	y - negl	N/A	One point each in Peru, Brazil, and Ecuador.
Geo-Z13 (Zone 13)	n - high	N/A	We found no evidence that it occurs in this hardiness zone.
Köppen -Geiger climate classes			
Geo-C1 (Tropical rainforest)	y - negl	N/A	Two points each in Peru and Bolivia.
Geo-C2 (Tropical savanna)	y - mod	N/A	Observed in Cuyaba, Matto Grosso, Brazil (Orchard, 1981).
Geo-C3 (Steppe)	y - high	N/A	One point in Bolivia. We used high uncertainty because this point may be an anomaly or in a microclimate.
Geo-C4 (Desert)	n - negl	N/A	We found no evidence that it occurs in this climate class.
Geo-C5 (Mediterranean)	n - negl	N/A	We found no evidence that it occurs in this climate class.
Geo-C6 (Humid subtropical)	n - high	N/A	We found no evidence that it occurs in this climate class; however, it seems likely that an aquatic species that occurs in plant hardiness zones 8 to 12 would survive here.
Geo-C7 (Marine west coast)	n - negl	N/A	We found no evidence that it occurs in this climate class.
Geo-C8 (Humid cont. warm sum.)	n - negl	N/A	We found no evidence that it occurs in this climate class.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-C9 (Humid cont. cool sum.)	n - negl	N/A	We found no evidence that it occurs in this climate class.
Geo-C10 (Subarctic)	n - negl	N/A	We found no evidence that it occurs in this climate class.
Geo-C11 (Tundra)	n - negl	N/A	We found no evidence that it occurs in this climate class.
Geo-C12 (Icecap)	n - negl	N/A	We found no evidence that it occurs in this climate class.
10-inch precipitation bands			
Geo-R1 (0-10 inches; 0-25 cm)	n - negl	N/A	We found no evidence that it occurs in this precipitation band.
Geo-R2 (10-20 inches; 25-51 cm)	n - negl	N/A	We found no evidence that it occurs in this precipitation band.
Geo-R3 (20-30 inches; 51-76 cm)	y - mod	N/A	One point in Bolivia. This point may be an outlier or in a microclimate, but because this is an aquatic species, it is likely to be found in most areas receiving adequate rainfall.
Geo-R4 (30-40 inches; 76-102 cm)	y - low	N/A	Because this is an aquatic species, it is likely to be found in most areas receiving adequate rainfall.
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	Because this is an aquatic species, it is likely to be found in most areas receiving adequate rainfall.
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	Because this is an aquatic species, it is likely to be found in most areas receiving adequate rainfall.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	Observed in Tocache, Peru (Crow and Ritter, 1999) and Cuyaba, Matto Grosso, Brazil (Orchard, 1981).
Geo-R8 (70-80 inches; 178-203 cm)	y - negl	N/A	Two points in Bolivia.
Geo-R9 (80-90 inches; 203-229 cm)	y - negl	N/A	One point in Peru.
Geo-R10 (90-100 inches; 229-254 cm)	y - negl	N/A	One point in Peru.
Geo-R11 (100+ inches; 254+ cm)	y - negl	N/A	Because this is an aquatic species, it is likely to be found in most areas receiving adequate rainfall.
ENTRY POTENTIAL			
Ent-1 (Plant already here)	y - low	1	*Myriophyllum mattogrossensis* is cultivated in the United States and is available for sale from a small number of distributors (e.g., Amazon, 2017; Florida Aquatic Nurseries, 2008), and it is traded among aquatic plant enthusiasts (The Planted Tank, 2013).
Ent-2 (Plant proposed for entry, or entry is imminent)	-	N/A	If approved by APHIS, additional material is guaranteed entry since Denmark would like to export these plants to the United States.
Ent-3 (Human value & cultivation/trade status)	-	N/A	
Ent-4 (Entry as a contaminant)			
Ent-4a (Plant present in Canada, Mexico, Central America, the Caribbean or China)	-	N/A	
Ent-4b (Contaminant of plant propagative material (except seeds))	-	N/A	

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Ent-4c (Contaminant of seeds for planting)	-	N/A	
Ent-4d (Contaminant of ballast water)	-	N/A	
Ent-4e (Contaminant of aquarium plants or other aquarium products)	-	N/A	
Ent-4f (Contaminant of landscape products)	-	N/A	
Ent-4g (Contaminant of containers, packing materials, trade goods, equipment or conveyances)	-	N/A	
Ent-4h (Contaminants of fruit, vegetables, or other products for consumption or processing)	-	N/A	
Ent-4i (Contaminant of some other pathway)	-	N/A	
Ent-5 (Likely to enter through natural dispersal)	-	N/A	