United States Department of Agriculture

Weed Risk Assessment for *Alternanthera reineckii* Briquet (Amaranthaceae) – Temple plant

United States Department of Agriculture

Animal and Plant Health Inspection Service

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Version 1

Left: *Alternanthera reineckii* (source: Extraplant, 2016). Right top: *Alternanthera reineckii* flowers. Right bottom: *Alternanthera reineckii* growing with other plants (source: APPW, 2016).

Agency Contact:

Plant Epidemiology and Risk Analysis Laboratory
Center for Plant Health Science and Technology

Plant Protection and Quarantine
Animal and Plant Health Inspection Service
United States Department of Agriculture
1730 Varsity Drive, Suite 300
Raleigh, NC 27606

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.

	***Alternanthera reineckii* Briquet. – Temple plant**
Species Information	Family: Amaranthaceae Synonyms: *Achyranthes reineckii* (Briq.) Standl., *Alternanthera pilosa* var. *microphylla* Chodat, *Alternanthera pilosa* f. *petiolata* Chodat (The Plant List, 2016). Common names: Temple plant (Winterton and Scher, 2007), red hygrophila (Dave's Garden, 2016). Botanical description: *Alternanthera reineckii* is an amphibious herbaceous perennial that grows along river courses, in seepage areas, and in wet depressions (rain pools) in its native South America (Vogt et al., 1979). It has the capacity to grow completely submerged as well as emerged (Rataj and Horeman, 1977). It grows to 15-50 cm in height and 10-15 cm in width (Windeløv, 2004). Initiation: The government of Denmark requested market access for commercially produced live plants of *Alternanthera reineckii* in approved growing media for propagation into the continental United States and Alaska (MFAF, 2009). This weed risk assessment was initiated in response to this request. Foreign distribution and status: *Alternanthera reineckii* is native to South America (Brazil, Paraguay, and Argentina; Vogt et al., 1979) and has naturalized in Taiwan (Wu et al., 2010). It is commonly found in the ornamental aquatic plant trade in Germany and Australia, but has not naturalized in German freshwaters (Hussner et al., 2014) or in Australia (Randall, 2007). U.S. distribution and status: This species is available from at least three online nurseries (two retail and one wholesale) in the United States (Plant Information Online, 2016). It is listed on a popular gardening website (Dave's Garden, 2016), but we found no evidence that it has naturalized in the United States or that it is causing any negative impacts for aquatic plant enthusiasts. WRA area[1]: Continental United States and Alaska.

1. *Alternanthera reineckii* analysis

Establishment/Spread Potential

This species has naturalized in Taiwan (Wu et al., 2010) and has close relatives within the genus that are significant invaders (Tanveer et al., 2013). It can grow submersed in water and also on land. In its native range, it produces seeds that may be dispersed by wind and water. It is propagated through vegetative reproduction in the nursery trade (aquaticmag.com, n.d.; Windeløv, 2004). There was relatively little information available on the

[1] "WRA area" is the area in relation to which the weed risk assessment is conducted (definition modified from that for "PRA area") (IPPC, 2015).

biology or ecology of *A. reineckii* and we answered five questions as unknown. We had a high amount of uncertainty for this risk element.
Risk score = 4 Uncertainty index = 0.31

Impact Potential We found no evidence of impact on the part of *A. reineckii*. This species is very popular in the aquatic plant trade and is mentioned in numerous articles and countless aquatic online nurseries. The only evidence we found that *A. reineckii* could be considered a weed is its naturalization in Taiwan (Wu et al., 2010). In fact, it is recommended by New Zealand as a "low risk" plant for aquaria and water ponds (Clayton et al., n.d.) We had a high amount of uncertainty for this risk element.
Risk score = 1.2 Uncertainty index = 0.24

Geographic Potential Based on three climatic variables, we estimate that about 15.3 percent of the United States is suitable for the establishment of *Alternanthera reineckii* (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 *Alternanthera reineckii* represents the joint distribution of Plant Hardiness Zones 8-13, areas with greater than 20 inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical savannah and humid subtropical.

The area of the United States shown to be climatically suitable (Fig. 1) is likely overestimated since our analysis considered only three climatic variables. However, *Alternanthera reineckii* is an amphibious species and can live both in water and on land (Vogt et al., 1979), so it may be able to find suitable habitat in microhabitats outside of the predicted area as well.

Entry Potential We did not assess the entry potential of *Alternanthera reineckii* because it is already present in the United States (Rataj and Horeman, 1977).

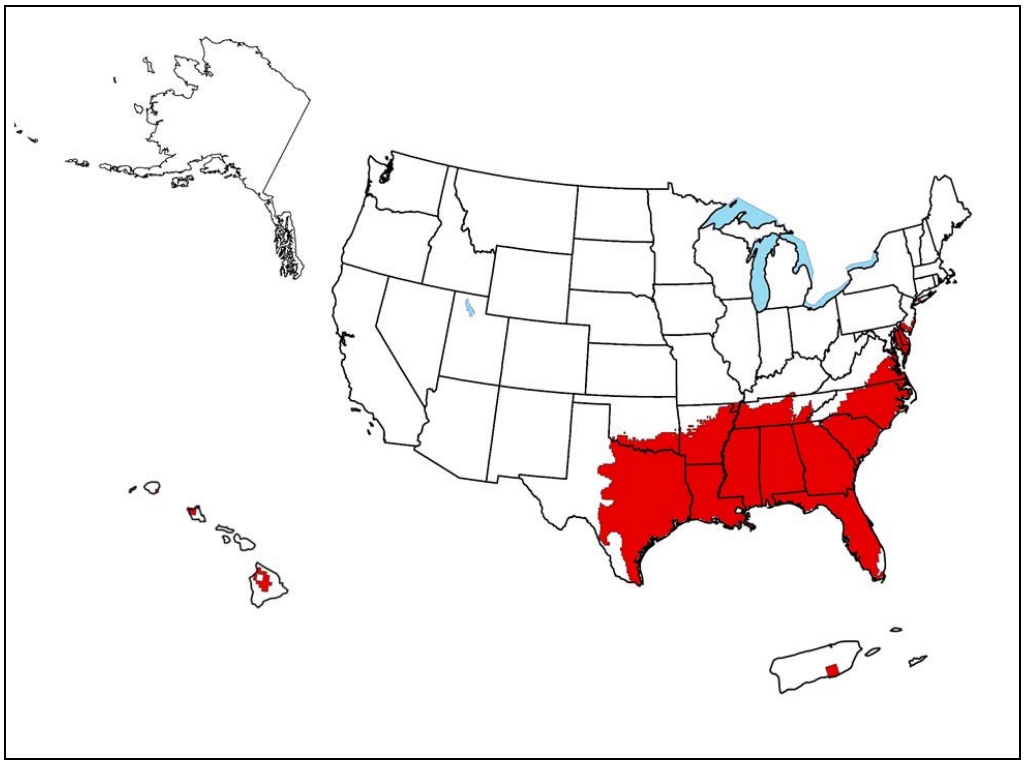

Figure 1. Predicted distribution of *Alternanthera reineckii* in the United States. Map insets for Alaska, Hawaii, and Puerto Rico are not to scale.

2. Results

Model Probabilities: P(Major Invader) = 7.8%
P(Minor Invader) = 65.9%
P(Non-Invader) = 26.3%
Risk Result = Evaluate Further
Secondary Screening = Evaluate Further

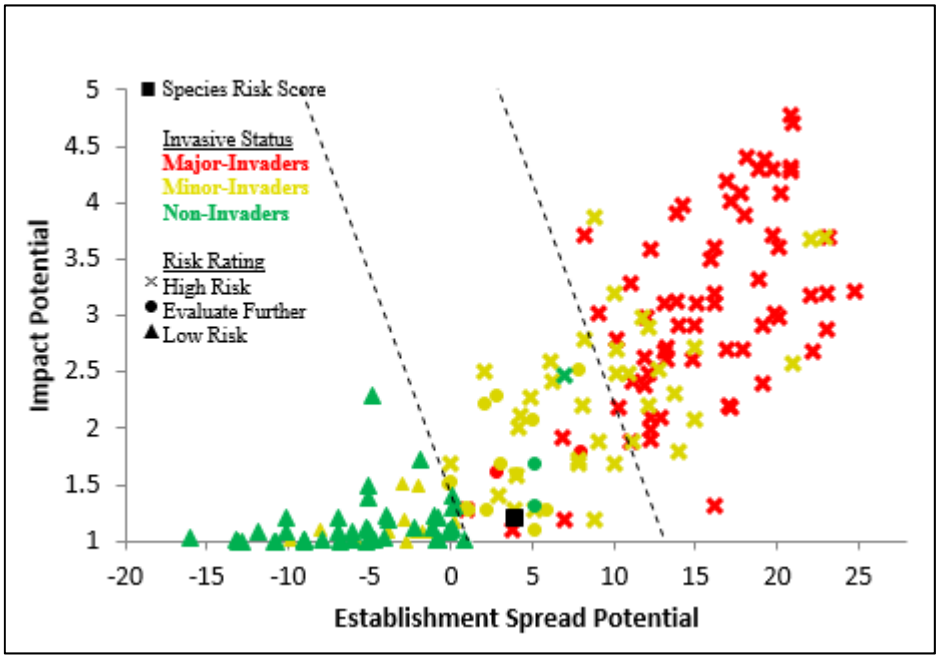

Figure 2. *Alternanthera reineckii* risk score (black box) relative to the risk scores of species used to develop and validate the PPQ WRA model (other symbols). See Appendix A for the complete assessment.

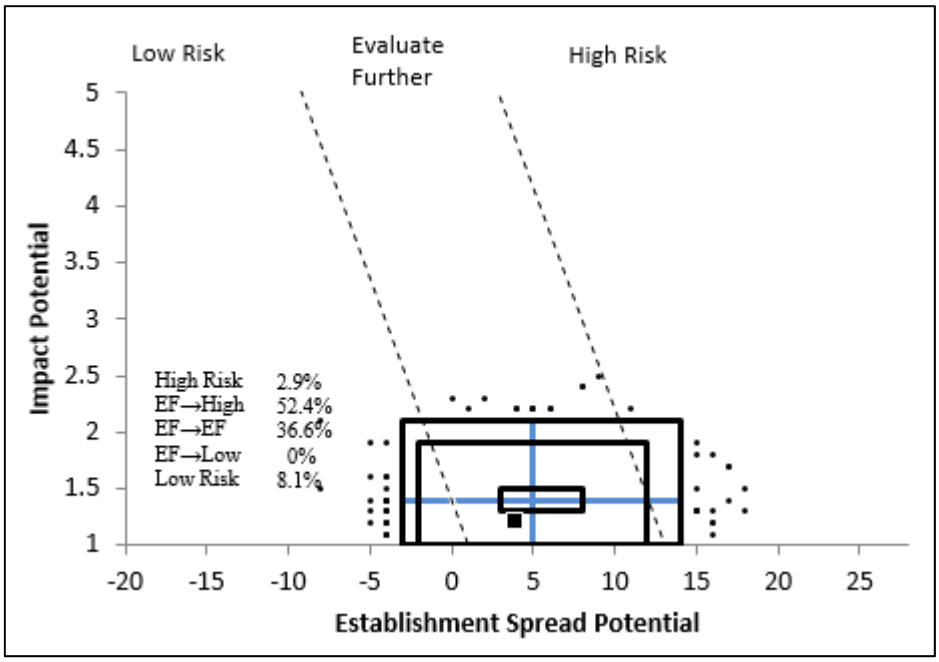

Figure 3. Model simulation results (N=5,000) for uncertainty around the risk score for *Alternanthera reineckii*. The blue "+" symbol represents the medians of the simulated outcomes. The smallest box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

3. Discussion

The result of the weed risk assessment for *Alternanthera reineckii* is Evaluate Further (Fig. 2). This species is an amphibious plant with the ability to survive in water and in terrestrial soils along river courses, in seepage areas, and in wet depressions. It has naturalized in Taiwan, but we did not find any information on its behavior or impact there. This is something that could be researched. This species has weedy congeners, some of which are serious invaders (e.g., *A. philoxeroides* and *A. sessilis*). This species is popular in the aquatic plant trade because its red foliage compliments the greenery found in most aquaria, and varieties with varying shades of red, dwarf varieties, etc. have been developed. Although *A. reineckii* is mentioned in many papers on invasive alternantheras, we found very little evidence for negative impacts caused by this plant. Along with the lack of certain specific biological data, this resulted in a relatively high number of "unknowns" within the assessment, and thus we had a high amount of uncertainty for both the establishment and spread and the impact sections of the assessment (Fig. 3). Presumably because it is associated with weedy congeners, other countries (e.g., Germany) have been monitoring it; despite being commonly found in the ornamental aquatic plant trade in Germany, it has not naturalized in German freshwaters (Hussner et al., 2014). Finally, a New Zealand plant guide recommends *A. reineckii* as a "low risk" plant for aquaria and water ponds (Clayton et al., n.d.).

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Appendix A. Weed risk assessment for *Alternanthera reineckii* Briquet (Amaranthaceae). 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]	e - low	2	Native to South America (Eliasson, 1988). In Brazil, it is considered vulnerable (populations diminishing) in savannah (Cerrado) habitats (Fank-de-Carvalho et al., 2012). It has naturalized in Taiwan (Wu et al., 2010). Although commonly found in the ornamental aquatic plant trade in Germany, it has not naturalized in German freshwaters (Hussner et al., 2014). It is listed in Randall (Randall, 2007) but has not naturalized in Australia, nor is it considered a weed there. Randall (Randall, 2012) has one reference (Jiang et al., 2011) for naturalization in China, but this may be in error. It is naturalized in Taiwan, as stated above. Our alternate answers for the uncertainty simulation are "d" and "f."
ES-2 (Is the species highly domesticated)	n - low	0	Mears (Mears, 1977) states that *Alternanthera reineckii* is very rarely found in cultivation. Randall (Randall, 2012) states that it is cultivated, providing one reference. However, there are countless websites on the internet selling multiple varieties of *A. reineckii*, indicating that it is widely cultivated for aquaria. There are dwarf varieties and "bushier" varieties, but the species does not appear to have been bred specifically to reduce weedy characteristics.
ES-3 (Weedy congeners)	y - negl	1	The genus *Alternanthera* has as many as 170 species and a relatively high number are invasive weeds (Tanveer et al., 2013). *Alternanthera philoxeroides* (alligator weed) is an invasive plant in much of its distributed range; it has been in the United States since the late 1800s and has been a significant weed since the 1960s (EPPO, 2016). *Alternanthera sessilis* is classified as a Federal Noxious Weed in the United States (7 CFR § 360, 2016). *Alternanthera sessilis* is the most widespread species of *Alternanthera* (Mears, 1977); it is a weed of rice and other cereal crops, sugarcane, and bananas in tropical areas (Singh et al., 2009) and is invasive in South Africa and Australia (Mabberley, 2008). Other invasive *Alternanthera* species include *A. angustifolia*, *A. denticulata*, *A. nana*, *A. nodiflora*, *A. paronychioides*, *A. pungens*, *A. tenella*, and *A. triandra* (Tanveer et al., 2013).
ES-4 (Shade tolerant at some stage of its life cycle)	y - high	0	In its native range, it occurs as a marsh plant accustomed to submersed life; it is described as growing well in the shade as an aquarium plant (Rataj and Horeman, 1977). Other sources say that light requirements in aquaria are "high to very high"

Question ID	Answer - Uncertainty	Score	Notes (and references)
			and that it requires high light to form dark red leaves (Windeløv, 2004).
ES-5 (Plant a vine or scrambling plant, or forms tightly appressed basal rosettes)	n - low	0	It is not described as a vine or scrambling plant, with tightly appressed basal rosettes. It is described as a stem plant (aquaticmag.com, n.d.) reaching 15-50 cm in height, 10-15 cm in width (Windeløv, 2004) and an herb (Wu et al., 2010).
ES-6 (Forms dense thickets, patches, or populations)	n - mod	0	We found no evidence that *A. reineckii* forms dense patches, either in descriptions from its native range or in descriptions of growth habits under cultivation. Descriptions of the different varieties range from being difficult to grow to being relatively undemanding (Windeløv, 2004). *Alternanthera reineckii* 'Lilacina' is described as a difficult plant (for aquarium use) requiring CO_2 for growth (Windeløv, 2004), while *A. reineckii* 'Roseafolia' is less demanding and easy to propagate by nipping the terminal bud and planting it on the bottom (of the aquarium); this makes the mother plant more bushy, because more side shoots are formed (Windeløv, 2004).
ES-7 (Aquatic)	y - mod	1	*Alternanthera reineckii* is amphibious (grows in water and in terrestrial soils); it grows along river courses, in seepage areas, and in wet depressions (rain pools) over much of southern South America (Vogt et al., 1979). In its native range, it occurs as a marsh plant accustomed to submersed life (Rataj and Horeman, 1977).
ES-8 (Grass)	n - negl	0	*Alternanthera reineckii* is not a grass. It is in the family Amaranthaceae (Windeløv, 2004).
ES-9 (Nitrogen-fixing woody plant)	n - negl	0	*Alternanthera reineckii* is in the family Amaranthaceae, which is not among those families known to contain nitrogen-fixing species (Martin and Dowd, 1990; Santi et al., 2013). Additionally, *A. reineckii* is herbaceous (Vogt et al., 1979) and not a woody species.
ES-10 (Does it produce viable seeds or spores)	y - low	1	In its native range, *A. reineckii* normally produces abundant seed and occurs as a terrestrial plant above the reach of fluvial floods (Vogt et al., 1979). For the aquarium trade, grower requirements provided by those selling or recommending the plant state that some varieties are "very easy to propagate" by nipping the terminal bud and planting it in the bottom of the aquarium (e.g., aquaticmag.com, n.d.).
ES-11 (Self-compatible or apomictic)	? - max	-1	We found no evidence of apomixis in *A. reineckii* or any other *Alternanthera* species.
ES-12 (Requires specialist pollinators)	n - mod	0	We found no evidence of the necessity of specialized pollinators. The genus is fairly well known.
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	c - high	0	*Alternanthera reineckii* is a perennial (Wu et al., 2010), so we are answering "c." However, because this species reproduces vegetatively and because it is acclimated to warm climates, we are assuming it

Question ID	Answer - Uncertainty	Score	Notes (and references)
years; (d) more than 3 years; or (?) unknown]			can grow enough in one year to produce enough vegetative matter to start a new plant. Our alternate answers for the uncertainty simulation are both "b".
ES-14 (Prolific seed producer)	? - max	0	We found no evidence on the amount of seed produced, other than a statement that it produces "abundant seed" in its native range in Brazil (Vogt et al., 1979).
ES-15 (Propagules likely to be dispersed unintentionally by people)	? - max	1	The variety *A. reineckii* 'Roseafolia' is said to be very easy to propagate by nipping off the terminal bud and planting it in the bottom of the aquarium (Windeløv, 2004). However, we found no direct evidence that this would lead to accidental dispersal by humans, so we answered unknown.
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	n - high	-1	We found no evidence specific to *A. reineckii*. The seeds of invasive congener *A. philoxeroides* are contaminants in birdseed coming into the European Union, and seedlings of *A. philoxeroides* have been found in the European Union associated with bonsai from China (EPPO, 2016). However, *A. reineckii* and *A. philoxeroides*, although in the same genus, are not in the same subgenus (Vogt et al., 1979) and thus may not behave the same way.
ES-17 (Number of natural dispersal vectors)	2	0	We did not find specific information on propagule traits for *A. reineckii*.
ES-17a (Wind dispersal)	y - high		In its native range, the closely related congener *A. sessilis* spreads by seeds, which are wind dispersed (Singh et al., 2009). *Alternanthera reineckii* is very closely related to *A. sessilis* (more so than to *A. philoxeroides*) (Vogt et al., 1979).
ES-17b (Water dispersal)	y - high		In its native range, the closely related congener *A. sessilis* spreads by seeds, which are water dispersed (Singh et al., 2009). *Alternanthera reineckii* is very closely related to *A. sessilis* (more so than to *A. philoxeroides*) (Vogt et al., 1979).
ES-17c (Bird dispersal)	n - high		We found no evidence suggesting that seeds of *A. reineckii* are dispersed by birds.
ES-17d (Animal external dispersal)	n - mod		We found no evidence suggesting that seeds of *A. reineckii* are dispersed externally by animals.
ES-17e (Animal internal dispersal)	n - mod		We found no evidence suggesting that seeds of *A. reineckii* are dispersed internally by animals.
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	? - max	0	We found no evidence specific to *A. reineckii* on a persistent seed bank; however, because many aquatic or amphibious plant species do possess long-lived seeds (McFarland and Shafer, 2011), we answered unknown rather than no.
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	? - max	0	We found no evidence specific to *A. reineckii*. However, this species can easily be propagated by breaking off terminal buds (Windeløv, 2004), and its similarly amphibious relatives propagate through stem fragments, so we answered unknown since this species may benefit from mutilation.
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	n - low	0	We found no evidence of herbicide resistance (or evidence of any use of herbicide on this species).

Question ID	Answer - Uncertainty	Score	Notes (and references)
			Furthermore, this species is not listed by Heap (Heap, 2016) as being resistant to herbicides.
ES-21 (Number of cold hardiness zones suitable for its survival)	4	0	
ES-22 (Number of climate types suitable for its survival)	2	-2	
ES-23 (Number of precipitation bands suitable for its survival)	9	1	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	? - max		We found no evidence specific to *A. reineckii*; however, there are other species within the genus *Alternanthera* that are allelopathic Tanveer et al., 2013), so we answered unknown.
Imp-G2 (Parasitic)	n - negl	0	We found no evidence that *A. reineckii* is parasitic, nor does it belong to a family known to contain parasitic plants (Heide-Jorgensen, 2008; Nickrent, 2016).
Impacts to Natural Systems			
Imp-N1 (Changes ecosystem processes and parameters that affect other species)	n - mod	0	We found no evidence that *A. reineckii* changes ecosystem processes and parameters.
Imp-N2 (Changes habitat structure)	n - mod	0	We found no evidence that *A. reineckii* changes habitat structure.
Imp-N3 (Changes species diversity)	n - mod	0	We found no evidence that *A. reineckii* changes species diversity.
Imp-N4 (Is it likely to affect federal Threatened and Endangered species?)	n - low	0	We found no evidence that would lead us to believe that *A. reineckii* is likely to affect any Federal Threatened and Endangered species.
Imp-N5 (Is it likely to affect any globally outstanding ecoregions?)	n - mod	0	We found no evidence that this species is likely to affect any U.S. globally outstanding ecoregion.
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]	b - high	0.2	The only evidence that *A. reineckii* is considered a weed is its naturalization in Taiwan (Wu et al., 2010). However, there is no evidence of negative impacts or of any type of control there. Our alternate answers for the uncertainty simulation were both "a."
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 of impact on personal property, human safety, or public infrastructure. Moreover, we found no evidence suggesting this is likely given that this is a small-statured plant.
Imp-A2 (Changes or limits recreational use of an area)	n - mod	0	We found no evidence that it changes or limits recreation.
Imp-A3 (Affects desirable and ornamental plants, and vegetation)	n - mod	0	We found no evidence of any effect on desirable and ornamental plants and vegetation.
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 - mod	0	We found no evidence that *A. reineckii* is a weed in anthropogenic systems. In fact, a New Zealand plant guide recommends *A. reineckii* as a "low risk" plant for aquaria and water ponds (Clayton et al., n.d.). Our alternate answers for the uncertainty simulation were both "b."

Question ID	Answer - Uncertainty	Score	Notes (and references)
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	n - low	0	We found no evidence of *A. reineckii* as a pest of agriculture or any type of production system.
Imp-P2 (Lowers commodity value)	n - low	0	We found no evidence of *A. reineckii* lowering commodity value.
Imp-P3 (Is it likely to impact trade?)	n - mod	0	We found no evidence that would suggest *A. reineckii* may impact trade.
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	n - low	0	Although it is an amphibious species, capable of living submersed and emersed, we found no evidence of competition with other plants for water. It is primarily marketed as a colorful aquatic plant for aquarium uses.
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	? - max		We found no evidence specific to *A. reineckii* and conflicting information on congeners; for example, *A. philoxeroides* was introduced into North America partly as fodder for crayfish but *A. pungens* is harmful to stock in Australia (Mabberley, 2008).
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; (c) Taxon a weed and evidence of control efforts]	a - mod	0	We found no evidence suggesting that *A. reineckii* is a weed in production systems. Our alternate 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, 2016).
Plant hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	We found no evidence that this species could survive in Zone 1.
Geo-Z2 (Zone 2)	n - negl	N/A	We found no evidence that this species could survive in Zone 2.
Geo-Z3 (Zone 3)	n - negl	N/A	We found no evidence that this species could survive in Zone 3.
Geo-Z4 (Zone 4)	n - negl	N/A	We found no evidence that this species could survive in Zone 4.
Geo-Z5 (Zone 5)	n - negl	N/A	We found no evidence that this species could survive in Zone 5.
Geo-Z6 (Zone 6)	n - negl	N/A	We found no evidence that this species could survive in Zone 6.
Geo-Z7 (Zone 7)	n - negl	N/A	We found no evidence that this species could survive in Zone 7.
Geo-Z8 (Zone 8)	y - high	N/A	Taiwan.
Geo-Z9 (Zone 9)	y - negl	N/A	Brazil.
Geo-Z10 (Zone 10)	y - negl	N/A	Brazil.
Geo-Z11 (Zone 11)	y - negl	N/A	Brazil.
Geo-Z12 (Zone 12)	y - negl	N/A	Brazil.
Geo-Z13 (Zone 13)	y - mod	N/A	Taiwan.
Köppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - mod	N/A	We found no evidence that this species could survive in this climate class.

Question ID	Answer - Uncertainty	Score	Notes (and references)
Geo-C2 (Tropical savanna)	y - negl	N/A	Brazil.
Geo-C3 (Steppe)	n - low	N/A	We found no evidence that this species could survive in this climate class.
Geo-C4 (Desert)	n - negl	N/A	We found no evidence that this species could survive in this climate class.
Geo-C5 (Mediterranean)	n - low	N/A	We found no evidence that this species could survive in this climate class.
Geo-C6 (Humid subtropical)	y - negl	N/A	Brazil and Taiwan.
Geo-C7 (Marine west coast)	n - low	N/A	We found no evidence that this species could survive in this climate class.
Geo-C8 (Humid cont. warm sum.)	n - low	N/A	We found no evidence that this species could survive in this climate class.
Geo-C9 (Humid cont. cool sum.)	n - negl	N/A	We found no evidence that this species could survive in this climate class.
Geo-C10 (Subarctic)	n - negl	N/A	We found no evidence that this species could survive in this climate class.
Geo-C11 (Tundra)	n - negl	N/A	We found no evidence that this species could survive in this climate class.
Geo-C12 (Icecap)	n - negl	N/A	We found no evidence that this species could survive 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 this species could survive in this rainfall band.
Geo-R2 (10-20 inches; 25-51 cm)	n - low	N/A	We found no evidence that this species could survive in this rainfall band.
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	Brazil.
Geo-R4 (30-40 inches; 76-102 cm)	y - negl	N/A	Brazil.
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	Brazil.
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	Brazil.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	Brazil.
Geo-R8 (70-80 inches; 178-203 cm)	y - negl	N/A	Brazil.
Geo-R9 (80-90 inches; 203-229 cm)	y - negl	N/A	Taiwan.
Geo-R10 (90-100 inches; 229-254 cm)	y - negl	N/A	Taiwan.
Geo-R11 (100+ inches; 254+ cm)	y - negl	N/A	Taiwan.
ENTRY POTENTIAL			
Ent-1 (Plant already here)	y - negl	1	*Alternanthera reineckii* is available from at least three online nurseries (two retail, one wholesale) in the United States (Plant Information Online, 2016) It has been grown in aquaria in the United States since at least 1977 (Rataj and Horeman, 1977).
Ent-2 (Plant proposed for entry, or entry is imminent)	y - negl	N/A	The European Union (Denmark) has requested market access for a number of aquatic plants, including *A. reineckii* (MFAF, 2009).
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	

Question ID	Answer - Uncertainty	Score	Notes (and references)
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	