Weed Risk Assessment for *Pistacia chinensis* Bunge (Anacardiaceae) – Chinese pistache

United States Department of Agriculture

Animal and Plant Health Inspection Service

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Version 1

Pistacia chinensis (source: D. Boufford, efloras.com)

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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.

***Pistacia chinensis* Bunge – Chinese pistache**

Species Information

Family: Anacardiaceae

Initiation: On January 5, 2012, the Exotic Pest Information Collection and Analysis group reported that *Pistacia chinensis* had naturalized in North Carolina (Krings, 2011). For that reason, the PERAL Weed Team initiated this assessment.

Foreign distribution: Native to China (Min and Barford, 2008), *P. chinensis* is distributed in Japan, Taiwan, Australia, and Ethiopia (Csurhes and Edwards, 1998; GBIF, 2012; Mulvaney, 1991; University of Queensland, 2011).

U.S. distribution and status: This species is naturalized in Alabama, California, Georgia, and Texas (NRCS, 2012), and is naturalized and spreading in North Carolina (Krings, 2011). It is also grown ornamentally in Arizona, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, Virginia, and West Virginia (Dave's Garden, 2012). Although this plant has been promoted by the nursery industry for at least 30 years, a new cultivar (male, seedless) is now being promoted as an alternative to female trees (Dave's Garden, 2012).

WRA area[1]: Entire United States, including territories

1. *Pistacia chinensis* analysis

Establishment/Spread Potential *Pistacia chinensis* is a deciduous large shrub or small tree that reproduces primarily by seed (Gilman and Watson, 1994). The species is dioecious (requiring both male and female trees to produce seed) (Smith et al., 2000) and wind pollinated (Yu and Lu, 2011). The fruits are drupes, dispersed by multiple species of birds (Smith et al., 2000) and possibly other animals, such as squirrels (Copeland, 1955). The trait

[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).

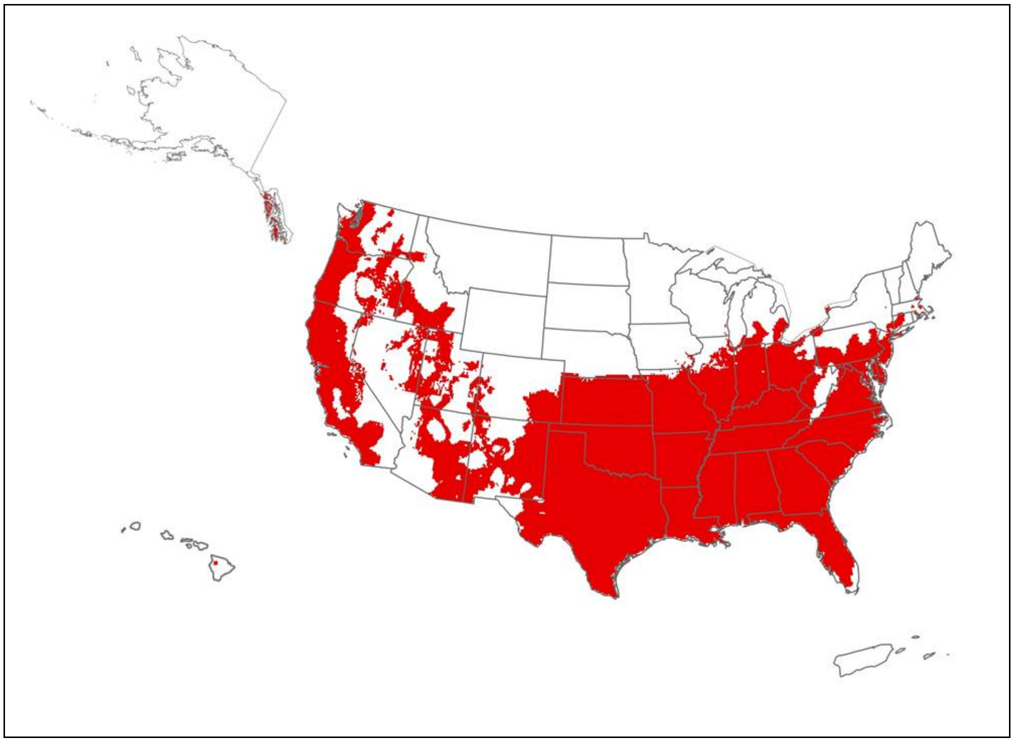
contributing most to the score for this risk element is its invasiveness elsewhere; it has naturalized and is spreading in Australia (Smith et al., 2000) and has naturalized in a number of U.S. states. Although trees may first flower at 6-10 years of age, wild trees appear to reach reproductive maturity more slowly, with one generation taking approximately 25 years (Smith et al., 2000). Uncertainty was low for this risk element.
Risk score = 1 Uncertainty index = 0.13

Impact Potential *Pistacia chinensis* may displace native trees (change community composition) in Texas (Dave's Garden, 2012), and is under control in Australian urban areas (Smith et al., 2000). It sends out horizontal roots that lift sidewalks and curbs, and handling it may cause skin irritation or allergic reaction (Dave's Garden, 2012). It is sometimes used as understock (rootstock) for the pistachio nut, *P. vera* L. (Dirr, 1998). Uncertainty was high for this risk element because much of the information came from comments on an online gardening site.
Risk score = 1.7 Uncertainty index = 0.33

Geographic Potential Based on three climatic variables, we estimate that about 45 percent of the United States is suitable for the establishment of *P. chinensis* (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 *P. chinensis* represents the joint distribution of Plant Hardiness Zones 6-11, areas with 10-90 inches of annual precipitation, and the following Köppen-Geiger climate classes: steppe, mediterranean, humid subtropical, marine west coast, and humid continental warm summer. The area estimated is likely conservative (i.e., expansive) because it is based on only three climatic variables. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish.

Entry Potential We did not assess the entry potential for *P. chinensis* because it is already present in the United States (Dave's Garden, 2012; Krings, 2011; NRCS, 2012).

Figure 1. Predicted distribution of *Pistacia chinensis* 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) = 0.053
P(Minor Invader) = 0.597
P(Non-Invader) = 0.349

Risk Result = Evaluate Further

Secondary Screening = High Risk

Figure 2. *Pistacia chinensis* 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.

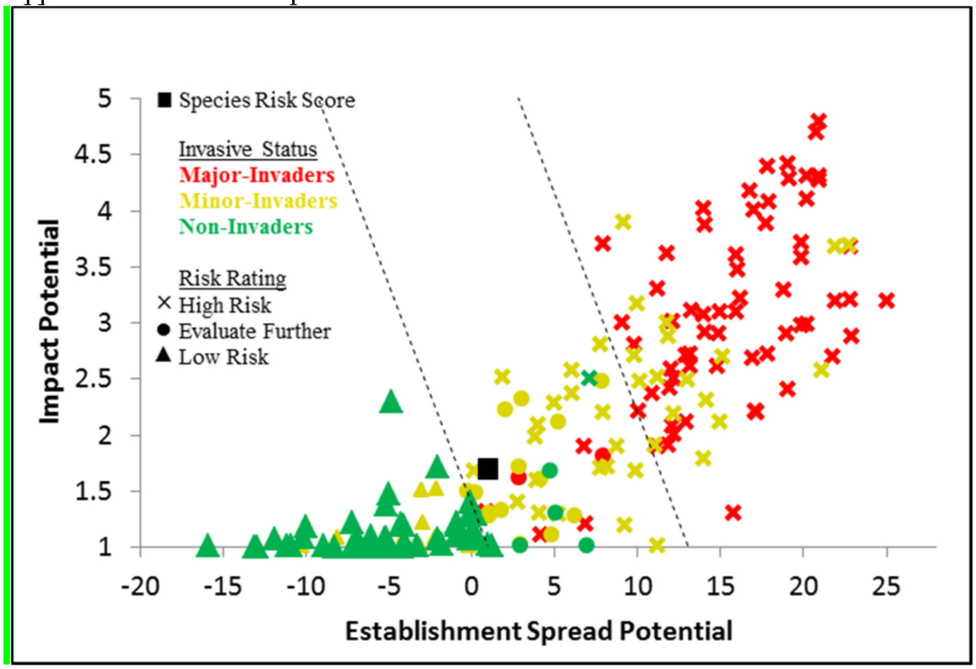
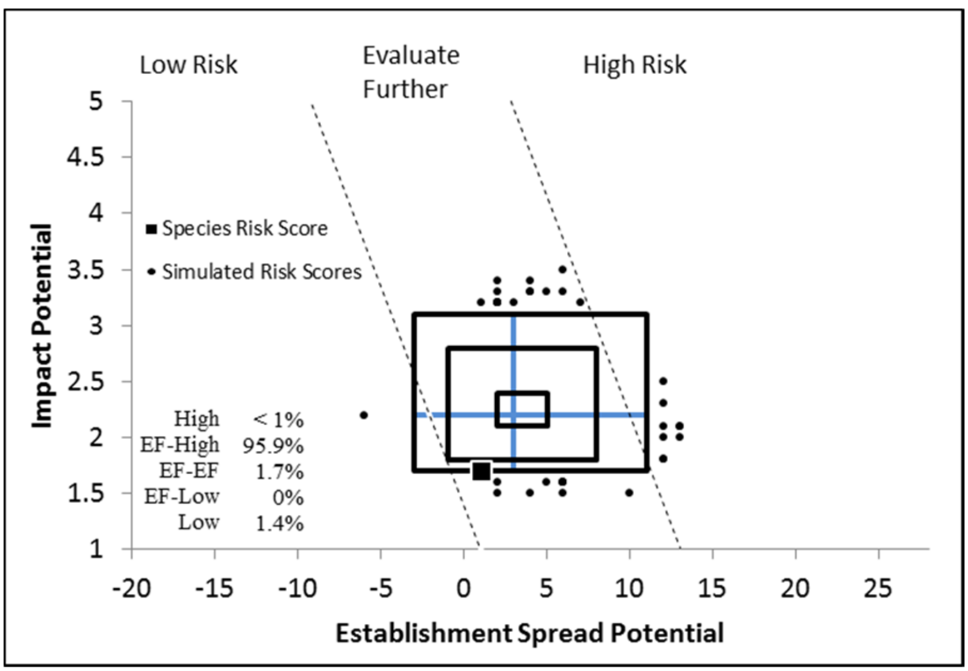


Figure 3. Monte Carlo simulation results (N=5,000) for uncertainty around the risk scores for *Pistacia chinensis*[a].



[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

Our model indicated a 60 percent probability of being a minor invader and a 35 percent probability of being a non-invader. The initial result of the weed risk assessment for *P. chinensis* was Evaluate Further, while the secondary screening resulted in a conclusion of High Risk. The most important traits leading to an evaluation of High Risk were having bird-dispersed fruit, its history of spread elsewhere, and potential impacts in urban areas. It is naturalizing in wooded and waste areas, similar to the habitats invaded by *Ailanthus altissima* (Krings, 2011), a widely distributed pest tree that is known to replace native plants and change community structure. Only one (anecdotal) source indicates that *P. chinensis* displaces native plants, however, and we found no reports that it changes community structure. Notably, based on threat and ability to impact biodiversity in New South Wales, a model ranked this species a low priority (323 out of 340 species) (Downey et al., 2010). Because this species is in the nursery trade and is a fairly popular landscape plant, encouraging purchases of the seedless cultivar may help minimize any negative impacts.

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Appendix A. Weed risk assessment for *Pistacia chinensis* Bunge (Anacardiaceae). 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 (Invasiveness elsewhere)	f – low	5	Introduced into Britain in 1897 and into Australia in the 1940s; in Australia, it had spread from cultivation into natural areas by the 1990s and is considered a major woody weed in some areas (Smith et al. 2000). Naturalized in Australia as follows: Armidale and Tamworth areas and in the Hawkesbury/Nepean catchment (Csurhes and Edwards, 1998; Randall, 2007), New South Wales (Smith et al., 2000), Canberra (Mulvaney, 1991), the Australian Capital Territory(ACT) and Lord Howe Island (University of Queensland, 2011). Naturalized in the United States (AL, CA, GA, TX) (NRCS, 2012) and NC (Krings, 2011). Alternate answers for the Monte Carlo simulation are both "e".
ES-2 (Domesticated to reduce weed potential)	n – mod	0	This tree does not appear to be highly domesticated, however, there is a new male cultivar, 'Keith Davey' that doesn't produce any fruit (Dave's Garden, 2012). Garden sites are beginning to recommend this cultivar for planting, given the "invasive" tendencies of female trees (Dave's Garden, 2012), however some people are concerned about the overproduction of pollen from the male trees (Valentino, 2011).
ES-3 (Weedy congeners)	n – low	0	Of six *Pistacia* species listed in the Global Compendium of Weeds, *P. chinensis* appears to have the worst reputation, listed as a weed, sleeper weed, naturalized, garden escape, and environmental weed. Only one other *Pistacia* species (*P. khinjak*) is listed as a weed (HEAR, 2011; Randall, 2011).
ES-4 (Shade Tolerance)	n – mod	0	Although the seedlings have been reported to be shade tolerant (McWilliams and Arnold, 1998), most other sources of evidence state that this species requires sun (Dave's Garden, 2012; Evans, n.d.). The plant is said to grow quickly in full sun to partial shade and the crown becomes misshapen in too much shade (Gilman and Watson, 1994). Smith (2000), in his review of *P. chinensis* in Australia, mentions that very little establishment of large plants had taken place at a heavily shaded site. Answering no because the preponderance of evidence supports shade intolerance, but giving moderate uncertainty level because there is some question about the ability of seedlings to tolerate shade.
ES-5 (Climbing or smothering growth form)	n – negl	0	Deciduous, large shrub or small tree (Smith et al., 2000).
ES-6 (Dense Thickets)	n – mod	0	No evidence. There are reports of numerous seedlings growing near female trees (Dave's Garden, 2012), but no one describes dense thickets.
ES-7 (Aquatic)	n – negl	0	Not an aquatic. Species is found in hill and mountain forests on rocky soils (Min and Barford, 2008); drought tolerant (Gilman and Watson, 1994).
ES-8 (Grass)	n – negl	0	Family Anacardiaceae (Min and Barford, 2008).
ES-9 (N2-fixer)	n – negl	0	No species within the family Anacardiaceae are known to fix nitrogen (Martin and Dowd, 1990).
ES-10 (Viable seeds)	y – negl	1	Propagation is by seed (Gilman and Watson, 1994); propagate from seed, direct sow after last frost (Dave's Garden, 2012).
ES-11 (Self-compatible)	n – low	-1	Dioecious; male and female plants must be grown if seed is required; the plant is not self-fertile (Plants for a Future, n.d.); male and female

			flowers grow on separate trees (Smith et al., 2000).
ES-12 (Special Pollinators)	n – negl	0	*Pistacia chinensis* is a wind-pollinated, perennial dioecious plant species (Yu and Lu, 2011).
ES-13 (Min generation time)	d – negl	-1	Planted *P. chinensis* trees first flower at 6-10 years of age but produce few fruits for several years after that; wild trees appear to grow and reach flowering more slowly; one generation can be considered to be c. 25 years (Smith et al., 2000). Nursery grown *P. chinensis* plants first flower at 6-10 years of age; wild trees appear to grow and reach flowering stage more slowly (Yu and Lu, 2011). Alternate answers for the Monte Carlo simulation are both "b".
ES-14 (Prolific reproduction)	? – max	0	Unknown. Female are said to produces huge amounts of berries (Dave's Garden, 2012), but this source did not provide any quantification of "huge amounts".
ES-15 (Unintentional dispersal)	n – mod	-1	No evidence.
ES-16 (Trade contaminant)	n – mod	-1	No evidence.
ES-17 (#Natural dispersal vectors)	1 –	-2	For questions ES-17a through ES-17e: Species produces drupes that are obovate-globose, slightly compressed, about 5 mm in diam., and longitudinally striate in dried condition (Min and Barford, 2008).
ES-17a (Wind dispersal)	n – low		Not likely. Fruits appear too large and heavy to be dispersed long distances by the wind (see description ES-17).
ES-17b (Water dispersal)	n – mod		No evidence.
ES-17c (Bird dispersal)	y – negl		Fruits are dispersed by multiple species of birds, but particularly the pied currawong (Smith et al., 2000). "Fruits ripen in October and either fall or are taken by birds before late November" (Dirr, 1998). "Through the agency of birds, squirrels, and wind, the fruits disappear, almost completely (Copeland, 1955).
ES-17d (Animal external dispersal)	? – max		"Through the agency of birds, squirrels, and wind, the fruits disappear, almost completely" (Copeland, 1955); squirrels may cache the fruits, thus assisting in dispersal. Other than the cited reference, no evidence for external animal dispersal could be located, however, it is plausible.
ES-17e (Animal internal dispersal)	n – mod		No evidence. In Pakistan, *Pteropus giganteus*, the Indian flying-fox, consumes the petals of *Pistacia chinensis*, but there is no evidence (i.e., seed germination) that it consumes the fruit (Mahmood-ul-Hassan et al., 2010).
ES-18 (Seed bank)	n – low	-1	Results from a study focused on soil seed banks in karst forests in central China suggested that *P. chinensis* had transient (i.e., short lived, less than 1 year) seed banks (Shen et al., 2007).
ES-19 (Tolerance to loss of biomass)	n – mod	-1	No evidence.
ES-20 (Herbicide resistance)	n – low	0	*Pistacia chinensis* is controlled with a combination of mechanical and chemical methods (Texas Invasive Plant and Pest Council, 2011). There is no evidence that it has shown herbicide resistance and it is not listed in the International Survey of Herbicide Resistant Weeds (Heap, 2012).
ES-21 (# Cold hardiness zones)	6	0	
ES-22 (# Climate types)	5	2	
ES-23 (# Precipitation bands)	8	1	
Impact Potential			
General Impacts			
Imp-G1 (Allelopathic)	n – mod	0	Although there are some species within the family Anacardiaceae that exhibit allelopathy, there is no evidence that *Pistacia chinensis* is among

			them.
Imp-G2 (Parasitic)	n – negl	0	The family Anacardiaceae is not known to contain any parasitic plants (Heide-Jorgensen, 2008; Nickrent, 2012).
Impacts to Natural Systems			
Imp-N1 (Ecosystem processes)	n – mod	0	No evidence.
Imp-N2 (Community structure)	? – max		Unknown. Because *P. chinensis* is a tree, it does have the potential to change community structure; it is reported as naturalizing in wooded and waste areas, similar to the habitats invaded by *Ailanthus altissima* (Krings, 2011); however, there are no reports of this plant changing community structure.
Imp-N3 (Community composition)	? – max		Unknown. One gardening website reports that it has escaped cultivation and is displacing native trees in Texas (Dave's Garden, 2012). Otherwise, there is no real evidence that it is outcompeting native plants or changing community composition.
Imp-N4 (T&E species)	? – max		Unknown. *Pistacia chinensis* is reported as a weed of the environment (see Imp-N6), but it is unclear what kind of impacts it may have on native plant communities.
Imp-N5 (Globally outstanding ecoregions)	? – max		The predicted geographical range for *P. chinensis* in the United States spans a number of globally outstanding ecoregions (Ricketts et al., 1999). If it does escape into natural areas, because it is a tree and has already been reported as displacing native trees in some introduced areas (see Imp-N3), it is likely could impact sensitive ecoregions.
Imp-N6 (Natural systems weed)	b – mod	0.2	Regarded as an environmental weed in New South Wales and the Australian Capital Territory and as a potential environmental weed or 'sleeper weed' in other parts of southern Australia (University of Queensland, 2011); recorded as having escaped from cultivation and as a weed of the natural environment in Australia (Randall, 2011); described as a potential environmental weed in Australia (Csurhes and Edwards, 1998); described as invading a national park in Australia and invading local habitats faster than expected for a woody plant species in Australia (Smith et al., 2000). Alternate answers for the Monte Carlo simulation are both "c".
Impact to Anthropogenic areas (cities, suburbs, roadways)			
Imp-A1 (Affects property, civilization, ...)	y – low	0.1	Reports from a popular online garden website include the following: the problem is the full grown tree is an accident waiting to happen; the wood is a soft type that will easily snap or break off large (6 inch diameter or larger) limbs; several trees are toppling over due to apparent root rot, all this without any apparent warning; they start leaning over and will crush any vehicle they fall over onto; the mature trees send out horizontal roots that lift sidewalks and will extend under the streets and lift the curbs (Dave's Garden, 2012).
Imp-A2 (Recreational use)	n – mod	0	No evidence.
Imp-A3 (Affects ornamental plants)	? – max		Because it has been reported as outcompeting native plants in natural areas (Dave's Garden, 2012), it may be able to cause impacts on desirable plants in anthropogenic areas, particularly when it is establishing in neighborhoods. However, because there is no direct evidence stating that this has happened, answering "unknown" with "maximum" uncertainty.
Imp-A4 (Anthropogenic weed)	c – low	0.4	One Australian city has begun planting only male trees in an effort to quell the spread of this species (Smith et al., 2000). A new cultivar has been bred that doesn't produce fruit; although fall color was the focus of the development of the Keith Davey cultivar (Valentino, 2011), garden

			sites are beginning to recommend this cultivar as being preferential to the female cultivars (Dave's Garden, 2012). Recorded as having escaped from cultivation in Australia (Randall, 2007). Saplings are reported as coming up in residential areas in Texas (Dave's Garden, 2012). Widely adapted to urban soils (Gilman and Watson, 1994). Seedlings and young trees now appear sporadically in waste places, disturbed margins, and intended beds (Krings, 2011). Alternate answers for the Monte Carlo simulation are both "b".
Impact to Production systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Crop yield)	n – mod	0	No evidence that this plant is an agricultural weed.
Imp-P2 (Commodity Value)	n – mod	0	No evidence that this plant is an agricultural weed.
Imp-P3 (Affects trade)	n – mod	0	No evidence that this plant is an agricultural weed.
Imp-P4 (Irrigation)	n – mod	0	No evidence that this plant is an agricultural weed.
Imp-P5 (Animal toxicity)	? – max		Unknown. Does not attract wildlife (Gilman and Watson, 1994); handling plant may cause skin irritation or allergic reaction (Dave's Garden, 2012); the genus *Pistacia* is listed as toxic (Burrows and Tyrl, 2001).
Imp-P6 (Production system weed)	a – mod	0	Recorded as a weed of agriculture in Australia (Randall, 2007); however, no additional evidence was located suggesting that this taxon is a weed of agriculture. Alternate answers for the Monte Carlo simulation are both "b".
Geographic Potential			
Plant cold hardiness zones			
Geo-Z1 (Zone 1)	n – negl	NA	Cannot tolerate temperatures below -10ºC (Plants for a Future, n.d..).
Geo-Z2 (Zone 2)	n – negl	NA	Cannot tolerate temperatures below -10ºC (PFAF, n.d.).
Geo-Z3 (Zone 3)	n – negl	NA	Cannot tolerate temperatures below -10ºC (PFAF, n.d.).
Geo-Z4 (Zone 4)	n – negl	NA	Cannot tolerate temperatures below -10ºC (PFAF, n.d.).
Geo-Z5 (Zone 5)	n – low	NA	No evidence; cannot tolerate temperatures below -10ºC (PFAF, n.d.).
Geo-Z6 (Zone 6)	y – low	NA	China (occ.) (Min & Barford, 2008); adapted to zone 6 (Gilman and Watson, 1994; Dave's Garden, 2012); tolerates temperatures down to -5 and -10C (PFAF, n.d.); Zones 6 to 9 (Dirr, 1998).
Geo-Z7 (Zone 7)	y – negl	NA	Japan, China; the United States (TX) (Texas Invasive Plant and Pest Council, 2011); adapted to zone 7 (Gilman and Watson, 1994; Dave's Garden, 2012); hardiness zones 7 to 9 (Evans, n.d.); zones 6 to 9 (Dirr, 1998).
Geo-Z8 (Zone 8)	y – negl	NA	Japan, China; The United States (TX) (Texas Invasive Plant and Pest Council, 2011); USA (AL, GA) (occ.) (Weakley, 2010); USA (NC) (occ.) (Krings, 2011); adapted to zone 8 (Gilman and Watson, 1994; Dave's Garden, 2012); hardiness zones 7 to 9 (Evans, n.d.); zones 6 to 9 (Dirr, 1998).
Geo-Z9 (Zone 9)	y – negl	NA	the United States (CA), Taiwan, Australia, China; USA (TX) (Texas Invasive Plant and Pest Council, 2011); adapted to zone 9 (Gilman and Watson, 1994; Dave's Garden, 2012); hardiness zones 7 to 9 (Evans, n.d.); zones 6 to 9 (Dirr, 1998).
Geo-Z10 (Zone 10)	y – negl	NA	Ethiopia, Taiwan, Australia; adapted to zone 10 (Dave's Garden, 2012).
Geo-Z11 (Zone 11)	y – negl	NA	Ethiopia, Taiwan; adapted to zone 11 (Dave's Garden, 2012).
Geo-Z12 (Zone 12)	n – low	NA	No evidence.
Geo-Z13 (Zone 13)	n – low	NA	No evidence.
Köppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	n – low	NA	No evidence.
Geo-C2 (Tropical savanna)	n – low	NA	No evidence.

Geo-C3 (Steppe)	y – negl	NA	The United States (TX) (Texas Invasive Plant and Pest Council, 2011); China (occ.) (Min and Barford, 2008).
Geo-C4 (Desert)	n – low	NA	No evidence.
Geo-C5 (Mediterranean)	y – negl	NA	The United States (CA).
Geo-C6 (Humid subtropical)	y – negl	NA	Japan, Taiwan, Australia; the United States (TX) (Texas Invasive Plant and Pest Council, 2011); USA (AL, GA) (occ.) (Weakley, 2010); USA (NC) (occ.) (Krings, 2011).
Geo-C7 (Marine west coast)	y – negl	NA	Ethiopia, Australia.
Geo-C8 (Humid cont. warm sum.)	y – mod	NA	China (occ.) (Min and Barford, 2008).
Geo-C9 (Humid cont. cool sum.)	n – low	NA	No evidence.
Geo-C10 (Subarctic)	n – negl	NA	Cannot tolerate temperatures below -10ºC (Plants for a Future, n.d.).
Geo-C11 (Tundra)	n – negl	NA	Cannot tolerate temperatures below -10ºC (Plants for a Future, n.d.).
Geo-C12 (Icecap)	n – negl	NA	Cannot tolerate temperatures below -10ºC (Plants for a Future, n.d.).
10-inch precipitation bands			
Geo-R1 (0-10")	n – low	NA	No evidence.
Geo-R2 (10-20")	y – negl	NA	The United States (CA); (TX) (Texas Invasive Plant and Pest Council, 2011).
Geo-R3 (20-30")	y – negl	NA	Australia; the United States (TX) (Texas Invasive Plant and Pest Council, 2011); China (occ.) (Min and Barford, 2008).
Geo-R4 (30-40")	y – negl	NA	Australia; the United States (CA); USA (TX) (Texas Invasive Plant and Pest Council, 2011).
Geo-R5 (40-50")	y – negl	NA	Ethiopia, China; the United States (TX) (Texas Invasive Plant and Pest Council, 2011); (GA) (occ.) (Weakley, 2010); (NC) (occ.) (Krings, 2011).
Geo-R6 (50-60")	y – negl	NA	The United States (CA), China; the United States (TX) (Texas Invasive Plant and Pest Council, 2011); (GA) (occ.) (Weakley, 2010).
Geo-R7 (60-70")	y – negl	NA	Japan, China.
Geo-R8 (70-80")	y – negl	NA	Taiwan, China.
Geo-R9 (80-90")	y – negl	NA	Taiwan, China.
Geo-R10 (90-100")	n – mod	NA	No evidence.
Geo-R11 (100"+)	n – low	NA	No evidence.
Entry Potential			
Ent-1 (Already here)	y – negl	1	Naturalized in Alabama, California, Georgia and Texas (NRCS, 2012); listed as uncommonly planted, rarely persistent or naturalizing in Alabama and Georgia (Weakley, 2010); promoted in the Pacific Northwest (Levine, 2003); said to be growing in AL, AZ, CA, CO, KS, NE, NM, OK, TX, VA, WV (Dave's Garden, 2012); naturalizing in North Carolina (Krings, 2011).
Ent-2 (Proposed for entry)	–	N/A	
Ent-3 (Human value & cultivation/trade status)	–	N/A	
Ent-4 (Entry as a Contaminant)			
Ent-4a (In MX, CA, Central Amer., Carib., or China)	–	N/A	
Ent-4b (Propagative material)	–	N/A	
Ent-4c (Seeds)	–	N/A	
Ent-4d (Ballast water)	–	N/A	
Ent-4e (Aquaria)	–	N/A	

Ent-4f (Landscape products)	–	N/A
Ent-4g (Container, packing, trade goods)	–	N/A
Ent-4h (Commodities for consumption)	–	N/A
Ent-4i (Other pathway)	–	N/A
Ent-5 (Natural dispersal)	–	N/A