United States Department of Agriculture

Weed Risk Assessment for *Ipomoea biflora* (L.) Pers. (Convolvulaceae) – Bell vine

United States Department of Agriculture

Animal and Plant Health Inspection Service

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Ipomoea biflora (sources: left and bottom right: Bart Wursten; top right: Encyclopedia of Life (Encyclopedia of Life, 2014)

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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.

Ipomoea biflora (L.) Pers. – Bell vine

Species Information

Family: Convolvulaceae

Synonyms: The taxonomy of this species may be unsettled; floras for Africa, Asia, and Malesia recognize two species; *I. plebeia* and *I. sinensis*. However, Chinese specimens called *I. biflora* are similar to what has been called *I. plebeia* in African and Malesian floras. The epithet *biflora* is well established in the Chinese literature and the authors describe it as a highly variable taxon (Fang and Staples, 1995). *Aniseia biflora* (L.) Choisy, *A. calycina* (Roxburgh) Choisy, *Convolvulus biflorus* L., *C. hardwickii* Spreng., *C. plebeius* (R. Br.) Spreng., *C. ser* Spreng., *C. sinensis* Desr., *Ipomoea calycina* Benth. Ex C.B. Clarke, *I. hardwickii* (Spreng.) Hemsl., *I. plebeia* R. Br., *I. sinensis* (Desr.) Choisy, *I. timorensis* Blume (Fang and Staples, 1995; The Plant List, 2013). Most sources for Africa and Australia used in this assessment refer to the synonym *I. plebeia* (Brisbane City Council, 2014; Graham, 2006; Hyde et al., 2014; NGRP, 2014; Sugar Research Australia, 2010).

Common names: Bell vine (Sugar Research Australia, 2010), bellvine (Graham, 2006; NGRP, 2014).

Botanical description: *Ipomoea biflora* is a twining or scandent annual herbaceous vine that grows 1 to 2 m tall. It is found in woodlands, grasslands, scrub, and ruderal habitats (Hyde et al., 2014); valleys, mountain slopes, and other dry habitats (Fang and Staples, 1995); and agricultural fields (Chivinge, 1988; Graham, 2006; Sugar Research

Australia, 2010).

Initiation: APHIS received a market access request from South Africa for corn seeds for planting in the United States (South Africa DAFF, 2012). During the development of that commodity pest risk analysis, *I. biflora* was identified as a weed of potential concern to the United States. The PPQ Weeds Cross Functional Working Group decided to evaluate this species with a weed risk assessment.

Foreign distribution: *Ipomoea biflora* is reported to be native to southern Africa and Asia, the Ryukyu Islands of Japan, and Australia (Fang and Staples, 1995; NGRP, 2014; Van Ooststroom and Hoogland, 1953). Its continent of origin is unclear. *Ipomoea plebeia* subsp. *africana* is reported as native to Africa, while subsp. *plebeia* is native to Australia and Malaysia (Hyde et al., 2014; Hyland et al., 2010); however, some sources describe the taxon *I. biflora* as native to all of these countries (Brisbane City Council, 2014; NGRP, 2014}). It is also known to occur in Papua New Guinea, and its nativity there is also unclear (Esso Highlands Limited, 2010). We found no evidence that it has been introduced elsewhere in the world.

U.S. distribution and status: *Ipomoea biflora* is not known to occur as a weed or a cultivated plant in the United States or its territories (e.g., Kartesz, 2014; NGRP, 2014; NRCS, 2014).

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

1. *Ipomoea biflora* analysis

Establishment/Spread Potential

Ipomoea biflora is an annual vine (Fang and Staples, 1995) that produces viable seeds (DAFF, 2010; Johnson, 2006) and is a frequent seed contaminant of wheat and corn (DAFF, 2010; Emerald Grain, 2013). It inhabits several climate types and tolerates extreme precipitation (Fang and Staples, 1995; GBIF, 2014). Its score was reduced because it is not spread by wind, water, or birds or other animals, it is easily destroyed during cultivation, and its seedbank does not persist in agricultural sites (Graham, 2006). We had high uncertainty for this risk element due to a lack of information about the species' life history.

Risk score = 3 Uncertainty index = 0.24

Impact Potential

In its current range, *I. biflora* is primarily a weed of cotton (Graham, 2006), wheat (Emerald Grain, 2013), sugar cane (Sugar Research Australia, 2010), and corn (Mashingaidze, 2004). It is a seed contaminant in Australia (DAFF, 2010; Emerald Grain, 2013). It can damage farm equipment (Graham, 2006) and its seeds are reportedly toxic to livestock (DAFF, 2010). Otherwise, we found no evidence that *I. biflora* negatively impacts natural systems or urban

[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).

and suburban areas. We had high uncertainty for this risk element due to a lack of information about its biology and ecology.
Risk score = 2.1 Uncertainty index = 0.24

Geographic Potential Based on three climatic variables, we estimate that about 39 percent of the United States is suitable for the establishment of *I. biflora* (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 *I. biflora* represents the joint distribution of Plant Hardiness Zones 7-13, areas with nearly 0-100+ inches of annual precipitation, and the following Köppen-Geiger climate classes: tropical rainforest, tropical savanna, steppe, desert, Mediterranean, and humid subtropical. Our determination was based on georeferenced records from Africa, Asia, and Australia (GBIF, 2014), which were representative of reported occurrences in the literature.

The area estimated as suitable in the United States likely represents a conservative estimate as it only uses 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. The adaptive potential of *I. biflora* may be high based on the broad range of environmental conditions it inhabits. These include grasslands, dry thickets, and areas with a pronounced dry season (Van Ooststroom and Hoogland, 1953); open forests, vine thickets, and monsoon forests (Hyland et al., 2010); mountain slopes, roadsides, (Fang and Staples, 1995), pastures, gardens, disturbed sites, and waste areas (Brisbane City Council, 2014). Additionally, it is a weed of dryland cropping areas (Osten et al., 2007).

Entry Potential We found no evidence that *I. biflora* is present in the United States. This species does not appear to be cultivated. It is known to be a corn and wheat seed contaminant (DAFF, 2010; Emerald Grain, 2013), and this may be its only likely pathway for introduction into the United States. We had average uncertainty for this risk element.
Risk score = 0.1 Uncertainty index = 0.15

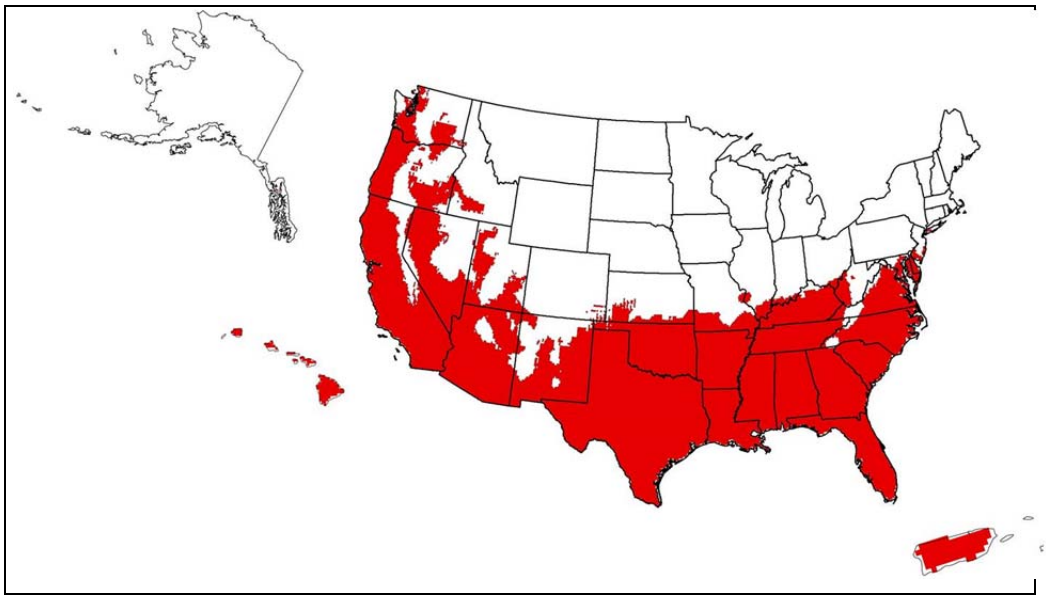

Figure 1. Predicted distribution of *Ipomoea biflora* in the United States. Map insets for Alaska, Hawaii, and Puerto Rico are not to scale.

2. Results and Conclusion

Model Probabilities: P(Major Invader) = 10.9%
P(Minor Invader) = 69.3%
P(Non-Invader) = 19.8%

Risk Result = Evaluate Further

Secondary Screening = Evaluate Further

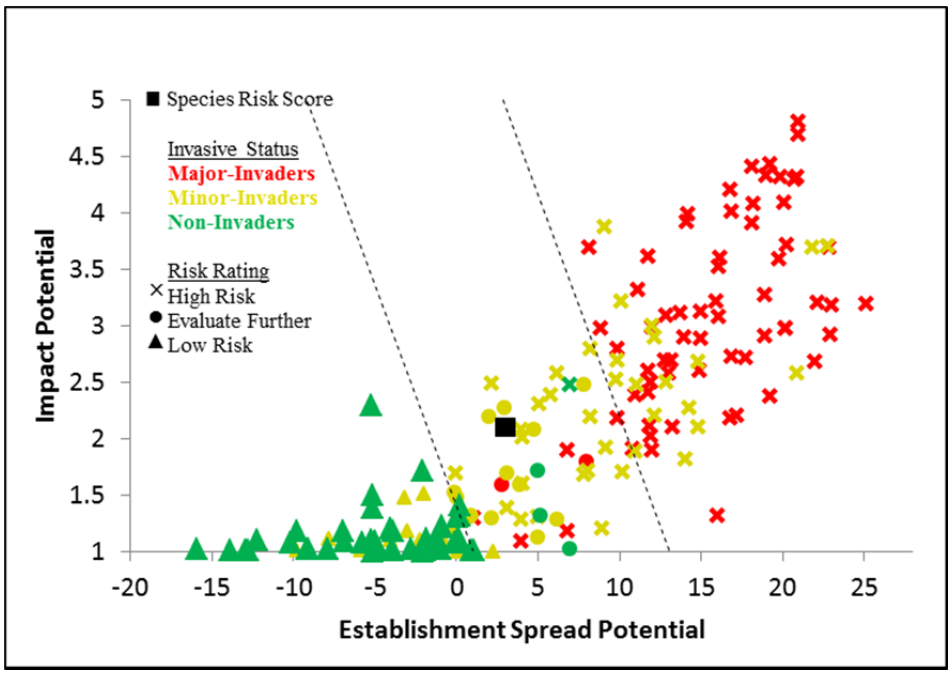

Figure 2. *Ipomoea biflora* risk score (black box) relative to the risk scores of species used to develop and validate the PPQ WRA model (other symbols). See Appendix A for the complete assessment.

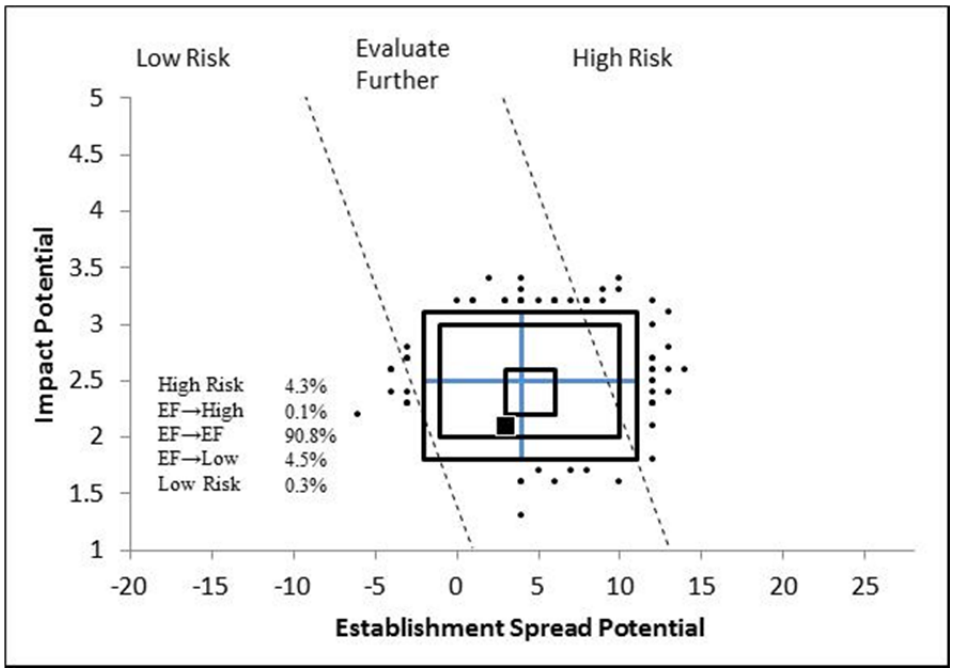

Figure 3. Model simulation results (N=5,000) for uncertainty around the risk score for *Ipomoea biflora*. The blue "+" symbol represents the medians of the simulated outcomes. The smallest box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

3. Discussion

The result of the weed risk assessment for *Ipomoea biflora* is Evaluate Further, and the result of the secondary screening is also Evaluate Further (Fig. 2). Our conclusion was supported by the results of the uncertainty simulation (Fig. 3). *Ipomoea biflora* is a weed of agriculture in its known range and does not appear to have been introduced to areas outside of its native range. This lack of information about its behavior in new locations causes a high level of uncertainty about the risk of its introduction. Numerous herbicides are labeled for use against it in Australia and it is apparently easily controlled with mechanical cultivation (Graham, 2006). However, nearly 40 percent of the United States could be suitable for this species (Fig. 1). *Ipomoea biflora* is found in a wide range of environmental conditions (Fang and Staples, 1995; GBIF, 2014) and may be tolerant of a greater range of climate conditions than we predict because of this adaptive potential. Additionally, its seeds are a known contaminant of grain (DAFF, 2010; Emerald Grain, 2013), increasing the risk of its introduction.

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Appendix A. Weed risk assessment for *Ipomoea biflora* (L.) Pers. (Convolvulaceae). The following information came from the original risk assessment, which is available upon request (full responses and all guidance). We modified the information to fit on the page.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 (Status/invasiveness outside its native range)	c - mod	0	*Ipomoea biflora* (L.) Pers. is native to eastern Africa, southeastern Asia, and northern Australia. Specifically it occurs in Ethiopia, Kenya, Tanzania, Malawi, Mozambique, Zambia, Zimbabwe, Botswana, Namibia, South Africa, Swaziland, southern China, Japan (Ryukyu Islands), Taiwan, India, Vietnam, Indonesia, Myanmar, Australia (Northern Territory, New South Wales, Queensland, and western Australia) (Fang and Staples, 1995; NGRP, 2014), Java, Kangean, Lesser Sunda Islands (Lombok, Sumbawa, and Timor), South Celebes, and the Philippines (Van Ooststroom and Hoogland, 1953 as cited by Simoes et al., 2011). It occurs in Papua New Guinea (Esso Highlands Limited, 2010) but it is unclear whether it is native or introduced. Randall reports that it is a garden escape (Randall, 2012), but we found no other evidence of this. Because we found no evidence that it has been introduced beyond its native range, we answered "c." We used moderate uncertainty because of the single citation stating that it has escaped cultivation. The alternate answers for the Monte Carlo simulation were "b" and "e." We chose "e" as an alternate answer because its status in Papua New Guinea is unclear.
ES-2 (Is the species highly domesticated)	n - low	0	*Ipomoea biflora* is reported to be cultivated as an ornamental (Randall, 2012) and is a food source in its native range (Teklehaymanot and Giday, 2010), but we found no other evidence to support this. It is highly unlikely that this species has been domesticated in any fashion.
ES-3 (Weedy congeners)	y - negl	1	The genus *Ipomoea* contains approximately 500 species (Mabberley, 2008), and several members of *Ipomoea* are considered weeds around the world. *Ipomoea triloba* is a serious weed of Australia and the Phillipines (Holm et al., 1979). *Ipomoea indica* is a problem weed in Europe, southern Africa, and Oceania (Weber, 2003). *Ipomoea wrightii* and *I. purpurea* are weeds of the United States (Bridges, 1992). *Ipomoea cairica* has become a major invasive weed in China (Hui and Shuang Tao, 2012).
ES-4 (Shade tolerant at some stage of its life cycle)	n - high	0	*Ipomoea biflora* inhabits valleys, mountain slopes, roadsides, forests (Fang and Staples, 1995) grasslands, and dry thickets (Van Ooststroom and Hoogland, 1953). It is a common vine along roadsides and cultivated areas (Esso Highlands Limited, 2010) (as *I. plebeia*). One source reports that several species, including *Ipomoea biflora* (as *I. plebeia*) can grow in dense corn plantings under heavy shading from the crop, where *I. biflora* forms long thin vines that only emerge above canopy toward flowering (Chivinge, 1988). We answered no with high uncertainty because light availability can vary highly in these habitats, *I. biflora* is problematic in high-light cropland systems, and we found no solid evidence that it is shade

Question ID	Answer - Uncertainty	Score	Notes (and references)
			tolerant.
ES-5 (Climbing or smothering growth form)	y - negl	1	*Ipomoea biflora* is a scandent or twining vine with stems 1-2 m in length (Fang and Staples, 1995); a prostrate or twining herb (as *I. plebeia*; Hyde et al., 2014).
ES-6 (Forms dense thickets)	n - low	0	We found no evidence that *Ipomoea biflora* forms dense thickets.
ES-7 (Aquatic)	n- negl	0	This species is terrestrial, growing in open forests, vine thickets, monsoon forests, woodlands, scrub (as *I. plebeia*; Hyde et al., 2014), grasslands, and dry thickets (Van Ooststroom and Hoogland, 1953).
ES-8 (Grass)	n - negl	0	Not a grass. *Ipomoea biflora* is a member of the Convolvulaceae (Fang and Staples, 1995).
ES-9 (Nitrogen-fixing woody plant)	n - negl	0	We found no evidence that *Ipomoea biflora* fixes nitrogen. It is an annual herbaceous member of the Convolvulaceae, which is not known to contain nigrogen-fixing species (Martin and Dowd, 1990).
ES-10 (Does it produce viable seeds or spores)	y - negl	1	Seedling establishment of *Ipomoea biflora* has been observed (Johnson, 2006), and the seeds are a known grain contaminant (DAFF, 2010; Emerald Grain, 2013).
ES-11 (Self-compatible or apomictic)	? - max	0	Unknown.
ES-12 (Requires special pollinators)	? - max		We found no information about pollinators of *Ipomoea biflora*. The genus *Ipomoea* includes species requiring specialist pollinators as well as those that are pollinated by generalists (Cronk and Ojeda, 2008; Rosas-Guerrero et al., 2011).
ES-13 (Minimum generation time)	b - mod	1	*Ipomoea biflora* is an annual (Fang and Staples, 1995). In Australia it is thought to establish from September through April and to reproduce from February to May (Johnson, 2006). Alternate answers for the Monte Carlo simulation were "c" and "a."
ES-14 (Prolific reproduction)	n - high	-1	*Ipomoea biflora* is an annual vine. Soil cores from heavily infested cotton fields contained *Ipomoea biflora* seed densities ranging from 100 to 3000 seeds/m^2, although the highest density found was 8800 seeds/m^2 (Graham, 2006). The source does not say whether this was a previously fallow field, so it is unlikely that the seed bank was the product of a single year's production. However, the authors describe "tremendous seed production capacity".
ES-15 (Propagules likely to be dispersed unintentionally by people)	? - max	0	*Ipomoea biflora* is a weed of agriculture. It could be spread in contaminated soil (Brisbane City Council, 2014), and can tangle and bind harvesting machinery (Graham, 2006), which may allow seeds to be spread from field to field. However, we found no direct evidence that this occurs.
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	y - negl	2	In Australia, *Ipomoea biflora* is "frequently a contaminant of sorghum and maize... difficult to grade out" (DAFF, 2010). It is also a wheat seed contaminant (Emerald Grain, 2013).
ES-17 (Number of natural dispersal vectors)	0	-4	Fruit and seed description for ES-17a through ES-17e: *Ipomoea biflora* fruits are glabrous, dry, papery capsules and are approximately 9 mm in length. Seeds are ovoid-trigonous, puberulent to tomentellous, and approximately 4 mm long (Fang and Staples, 1995).
ES-17a (Wind dispersal)	n - low		We found no evidence. *Ipomoea biflora* seeds are not adapted

Question ID	Answer - Uncertainty	Score	Notes (and references)
			for wind dispersal.
ES-17b (Water dispersal)	n - mod		*Ipomoea biflora* is a dryland-crop weed (Osten et al., 2007), although moving water may provide a means of dispersal (Brisbane City Council, 2014). We found no evidence that its seeds are especially adapted for water dispersal.
ES-17c (Bird dispersal)	n - mod		We found no evidence. *Ipomoea biflora* seeds are borne in a dry, papery, dark capsule appromately 9mm in length (Fang and Staples, 1995).
ES-17d (Animal external dispersal)	n - low		We found no evidence that *Ipomoea biflora* is dispersed by animals externally. Neither fruit nor seeds possess any adaptations for attachment to animal fur, as seeds are "ovoid-trigonous, puberulent to tomentellous (Fang and Staples, 1995).
ES-17e (Animal internal dispersal)	n - mod		We found no evidence that it is dispersed by animals internally.
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	? - max	0	No information is available regarding length of seed vitality. "*Ipomoea biflora* seeds appear to have a short seed dormancy and a short seedbank life" (Graham, 2006).
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	n - mod	-1	We found no evidence that mutilation causes plants to resprout or that stem fragments are able to root. *Ipomoea biflora* is an annual vine that can be easily controlled with shallow cultivation (Graham, 2006).
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	n - high	0	There is no evidence that *Ipomoea biflora* is resistant to herbicides. The congener *Ipomoea purpurea* is resistant to at least one herbicide (Sunderland et al., 1995), but we found no evidence that the genus is especially prone to hybridizing.
ES-21 (Number of cold hardiness zones suitable for its survival)	7	0	
ES-22 (Number of climate types suitable for its survival)	6	2	
ES-23 (Number of precipitation bands suitable for its survival)	11	1	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	? - max		We found no evidence that *Ipomoea biflora* is allelopathic. However, some congeners of this species, including *I. cairica* (Takao et al., 2011) and *I. tricolor* (Anaya et al., 1995) are known to be allelopathic.
Imp-G2 (Parasitic)	n - low	0	We found no evidence that *Ipomoea biflora* is parasitic (Nickrent, 2009).
Impacts to Natural Systems			
Imp-N1 (Change ecosystem processes and parameters that affect other species)	n - low	0	We found no evidence that *Ipomoea biflora* changes natural ecosystems; it appears to be primarily a weed of agriculture (Brisbane City Council, 2014; Chivinge, 1988; Graham, 2006).
Imp-N2 (Change community structure)	n - low	0	*Ipomoea biflora* is an annual vine of 1 to 2 meters in length (Fang and Staples, 1995) that does not appear to form a dense layer over underlying vegetation or otherwise change community structure.
Imp-N3 (Change community composition)	n - mod	0	We found no evidence that this species changes community composition.
Imp-N4 (Is it likely to affect	n - high	0	We found no evidence that *Ipomoea biflora* would affect any

Question ID	Answer - Uncertainty	Score	Notes (and references)
federal Threatened and Endangered species)			Threatened and Endangered species.
Imp-N5 (Is it likely to affect any globally outstanding ecoregions)	n - mod	0	Athough *Ipomoea biflora* is predicted to be able to naturalize in the tropical dry forest of Hawaii, we found no evidence of any impact anywhere it is found.
Imp-N6 (Weed status in natural systems)	a - mod	0	We found no evidence that *Ipomoea biflora* is a weed of natural areas anywhere; it appears to be primarily a weed of agriculture (Brisbane City Council, 2014; Chivinge, 1988; Graham, 2006). Alternate answers for the Monte Carlo simulation were both "b."
Impact to Anthropogenic Systems (cities, suburbs, roadways)			
Imp-A1 (Impacts human property, processes, civilization, or safety)	n - low	0	We found no evidence that *Ipomoea biflora* impacts human property or processes; it appears to be only a weed of agriculture (Brisbane City Council, 2014; Chivinge, 1988; Graham, 2006).
Imp-A2 (Changes or limits recreational use of an area)	n - mod	0	We found no evidence that *Ipomoea biflora* impacts recreational use; it appears to be a weed of agriculture (Brisbane City Council, 2014; Chivinge, 1988; Graham, 2006).
Imp-A3 (Outcompetes, replaces, or otherwise affects desirable plants and vegetation)	n - mod	0	We found no evidence that *Ipomoea biflora* affects desirable plantings.
Imp-A4 (Weed status in anthropogenic systems)	a - mod	0	We found no evidence that *Ipomoea biflora* is a weed of suburban areas. Alternate answers to the Monte Carlo simulation were both "b."
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	? - max		Unknown. Although *I. biflora* appears to be a common weed and is controlled in crops, we found no specific evidence of yield loss caused by this weed.
Imp-P2 (Lowers commodity value)	y - mod	0.2	*Ipomoea biflora* is a wheat and corn seed contaminant (DAFF, 2010; Emerald Grain, 2013). Additionally, it is difficult to control in cotton, climbing through and over crop plants, and it can tangle farm equipment (Graham, 2006), potentially increasing grower costs.
Imp-P3 (Is it likely to impact trade)	y - low	0.2	In Australia, *Ipomoea biflora* is a contaminant of sorghum and maize that is difficult to grade out (DAFF, 2010). It is also a wheat seed contaminant (Emerald Grain, 2013). It is a quarantine pest in New Zealand (Ministry of Primary Industries, 2012).
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	n - mod	0	We found no evidence that *Ipomoea biflora* strongly competes for or diminishes irrigation water.
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	y - high	0.1	*Ipomoea biflora* is said to cause severe enteritis in pigs fed contaminated feed (DAFF, 2010). The plant is said to be moderately palatable to goats (Holst and Simmonds, 2000). We answered yes but with high uncertainty because it appears that seeds in contaminated grain would be the most likely pathways for introduction. *Ipomoea biflora* leaves are eaten by some people in Ethiopia but reportedly must be repeatedly boiled to be edible (Teklehaymanot and Giday, 2010).
Imp-P6 (Weed status in production systems)	c - negl	0.6	*Ipomoea biflora* is a well-documented weed of cotton (Graham, 2006), wheat (Emerald Grain, 2013), sugar cane

Question ID	Answer - Uncertainty	Score	Notes (and references)
			(Sugar Research Australia, 2010), and corn (Mashingaidze, 2004). It is among the most common of crop weeds in Australia (Osten et al., 2007) and is cited as one of the most difficult to control in Zimbabwe (Chivinge, 1988). Alternate answers for the Monte Carlo simulation were both "b."
GEOGRAPHIC POTENTIAL			Unless otherwise indicated, the following evidence represents geographically referenced points obtained from the Global Biodiversity Information Facility (GBIF) (GBIF, 2014). If there is an additional citation, it refers to a regional occurrence.
Plant cold 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)	y - negl	N/A	South Africa.
Geo-Z8 (Zone 8)	y - low	N/A	We found no observations in this hardiness zone; however, there are numerous records of the plant in zones 7 and 9.
Geo-Z9 (Zone 9)	y - negl	N/A	Zimbabwe, Zambia, Japan (Fang and Staples, 1995; NGRP, 2014), South Africa, and eastern Australia.
Geo-Z10 (Zone 10)	y - negl	N/A	Malawi, Mozambique, Zambia, Zimbabwe (NGRP, 2014), Papua New Guinea (Esso Highlands Limited, 2010), Botswana, Namibia, South Africa, Laos, Taiwan, and Australia.
Geo-Z11 (Zone 11)	y - negl	N/A	Ethiopia, Kenya, Malawi, Zambia (NGRP, 2014), India, Myanmar, Vietnam (Fang and Staples, 1995; NGRP, 2014), Tanzania, Cameroon, Taiwan, and northern Australia.
Geo-Z12 (Zone 12)	y - negl	N/A	Ethiopia, Kenya, Mozambique(NGRP, 2014), India, Vietnam (Fang and Staples, 1995; NGRP, 2014), Indonesia (Van Ooststroom and Hoogland, 1953 as cited by Simoes et al., 2011), Tanzania, Taiwan, and northern Australia.
Geo-Z13 (Zone 13)	y - negl	N/A	India, Indonesia (Fang and Staples, 1995; NGRP, 2014), Taiwan, and Australia.
Köppen -Geiger climate classes			
Geo-C1 (Tropical rainforest)	y - high	N/A	There were only four points in Australia in this climate zone; however, this species is known to occur in Indonesia (Van Ooststroom and Hoogland, 1953 as cited by Simoes et al., 2011) and in Papua New Guinea (Esso Highlands Limited, 2010).
Geo-C2 (Tropical savanna)	y - negl	N/A	Australia.
Geo-C3 (Steppe)	y - negl	N/A	Cameroon, Namibia, and Tanzania.
Geo-C4 (Desert)	y - negl	N/A	South Africa.
Geo-C5 (Mediterranean)	y - negl	N/A	Australia.
Geo-C6 (Humid subtropical)	y - negl	N/A	South Africa, Swaziland, Laos, China, and Australia.
Geo-C7 (Marine west coast)	n - negl	N/A	We found no evidence that it occurs in this climate type.
Geo-C8 (Humid cont. warm sum.)	n - negl	N/A	We found no evidence that it occurs in this climate type.
Geo-C9 (Humid cont. cool sum.)	n - negl	N/A	We found no evidence that it occurs in this climate type.
Geo-C10 (Subarctic)	n - negl	N/A	We found no evidence that it occurs in this climate type.

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Geo-C11 (Tundra)	n - negl	N/A	We found no evidence that it occurs in this climate type.
Geo-C12 (Icecap)	n - negl	N/A	We found no evidence that it occurs in this climate type.
10-inch precipitation bands			
Geo-R1 (0-10 inches; 0-25 cm)	y - high	N/A	Namibia, South Africa, and Australia. We used high uncertainty because these points may have been obtained in irrigated fields.
Geo-R2 (10-20 inches; 25-51 cm)	y - negl	N/A	Botswana, Namibia, South Africa, Australia, and New Guinea.
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	Cameroon, South Africa, Tanzania, and Australia.
Geo-R4 (30-40 inches; 76-102 cm)	y - negl	N/A	South Africa, Swaziland, Tanzania, Taiwan, and Australia.
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	South Africa, Taiwan, and Australia.
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	Australia.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	Laos and China.
Geo-R8 (70-80 inches; 178-203 cm)	y - negl	N/A	Taiwan, China, and Australia.
Geo-R9 (80-90 inches; 203-229 cm)	y - mod	N/A	Taiwan.
Geo-R10 (90-100 inches; 229-254 cm)	n - mod	N/A	We do not have data occurences for this precipitation class, but the species is found in zones 9 and 11.
Geo-R11 (100+ inches; 254+ cm)	y - mod	N/A	Taiwan.
ENTRY POTENTIAL			
Ent-1 (Plant already here)	n - mod	0	We found no evidence that *Ipomoea biflora* is present in the United States at this time.
Ent-2 (Plant proposed for entry, or entry is imminent)	n - negl	0	*Ipomoea biflora* has not been proposed for entry into the United States, nor do we know of any intent to import it.
Ent-3 (Human value & cultivation/trade status)	a - mod	0	Although the genus *Ipomoea* is known for several showy cultivated species, we found no evidence that *I. biflora* is cultivated or positively valued. Randall, 2012) lists it as a garden escape but we found no additional evidence that it is cultivated.
Ent-4 (Entry as a contaminant)			
Ent-4a (Plant present in Canada, Mexico, Central America, the Caribbean or China)	y - negl		*Ipomoea biflora* is native to China (Fang and Staples, 1995; NGRP, 2014).
Ent-4b (Contaminant of plant propagative material (except seeds))	n - low	0	We found no evidence that *Ipomoea biflora* is a contaminant of propagative materials. A twining vine is unlikely to be accidentally imported with propagative materials.
Ent-4c (Contaminant of seeds for planting)	y - high	0.08	*Ipomoea biflora* is a wheat and corn seed contaminant (DAFF, 2010; Emerald Grain, 2013). Although these sources do not state the intended use of the products, some portion of the harvest is likely saved for planting seed.
Ent-4d (Contaminant of ballast water)	n - low	0	We found no evidence. *Ipomoea biflora*, a terrestrial plant, is unlikely to contaminate ballast water (Fang and Staples, 1995). We found no evidence that it occurs in coastal habitats.
Ent-4e (Contaminant of aquarium plants or other aquarium products)	n - low	0	We found no evidence.
Ent-4f (Contaminant of	n - low	0	We found no evidence.

Question ID	Answer - Uncertainty	Score	Notes (and references)
landscape products)			
Ent-4g (Contaminant of containers, packing materials, trade goods, equipment or conveyances)	n - mod	0	We found no evidence.
Ent-4h (Contaminants of fruit, vegetables, or other products for consumption or processing)	y - low	0.02	*Ipomoea biflora* is a contaminant of wheat and corn that may be processed for livestock feed (DAFF, 2010). It is also a weed of cotton in Australia (Graham, 2006), and *I. biflora* seeds could lodge in cotton fibers.
Ent-4i (Contaminant of some other pathway)	a - high	0	We found no evidence of other pathways.
Ent-5 (Likely to enter through natural dispersal)	n - low	0	*Ipomoea biflora* does not occur in countries adjacent to the United States (see evidence under ES-1), and seeds or viable plants are unlikely to arrive in the United States naturally.