Weed Risk Assessment for *Senecio angulatus* L. f. (Asteraceae) – Cape-ivy

United States Department of Agriculture

Animal and Plant Health Inspection Service

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Version 1

Left: Scrambling and climbing habit of *Senecio angulatus*. Right: Flowers (source: http://riomoros.blogspot.com.es/p/nombres-de-plantas.html).

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

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

***Senecio angulatus* L. f. – Cape-ivy**

Species Information

Family: Asteraceae

Synonyms: None.

Initiation: On November 25, 2011, Al Tasker (PPQ, National Weeds Program Coordinator) asked the PERAL Weed Team to evaluate *Senecio angulatus* for potential listing as a Federal Noxious Weed (Tasker, 2011). This species has been proposed for listing under APHIS' Not Authorized Pending Pest Risk Analysis (NAPPRA) regulations (APHIS, 2011).

Foreign distribution: Native to South Africa (NGRP, 2013). Introduced to many other countries as an ornamental (Csurhes and Edwards, 1998; Groves et al., 2005; Kartuz, 2013; Rossini Oliva et al., 2003). It is escaping in Albania and Chile (Barina et al., 2011; Ugarte et al., 2011). In Italy, Portugal, and Spain, it is considered naturalized (NGRP, 2013; Pyke, 2008; Romero Buján, 2007). Finally, in Australia, France and New Zealand it is spreading or has spread across portions of the country (Brunel and Tison, 2005; Champion, 2005; Murray and Phillips, 2012).

U.S. distribution and status: *Senecio angulatus* was probably introduced to the United States after 1930, as it is not listed in the first edition of *Hortus* (Bailey and Bailey, 1930). We found very limited evidence that it is cultivated in the United States (Bailey and Bailey, 1976). One nursery that used to carry it, no longer offers it for sale (SanMarcosGrowers, 2013). Cal-IPC reports it is not cultivated in California (Cal-IPC, 2008), but we found one nursery that lists it on its webpage (Kartuz, 2013). Dave's Garden, an online gardening forum has a data page for this species, but no one has commented on it (DavesGarden, 2013). We found no evidence it has become naturalized outside of cultivation in the United States; however, it is escaping in one site in California at the edge of Agua Hedionda Ecological Reserve (UC, 2013). *Senecio angulatus* is targeted by the Oregon Department of Agriculture for early detection and rapid response should it escape from cultivation (ODA, 2007).

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

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1. *Senecio angulatus* analysis

Establishment/Spread Potential *Senecio angulatus* has demonstrated an ability to escape, naturalize, and spread in several other countries (GBIF, 2013; see also references under "Foreign distribution" in the Species Information section). This species spreads through seeds and stem fragments that can easily root (FloraBase, 2013; Hussey et al., 2007; Williams and Hayes, 2007). Yard waste is believed to be a significant pathway for its spread, because it can establish from plant fragments (Hussey et al., 2007; Williams and Hayes, 2007). Although this plant is a perennial scrambler/vine, it can set seed within its first year (FloraBase, 2013; Williams and Hayes, 2007). Seeds are wind dispersed (FloraBase, 2013; Weber, 2003; Williams and Hayes, 2007), and very likely animal dispersed (FloraBase, 2013; The University of Queensland, 2013). It readily forms dense infestations in open/disturbed areas, particularly coastal environments (Champion, 2005; Williams and Hayes, 2007). Although many factsheets and anecdotal comments are available for this species, few ecological studies have been done on it. Several questions were answered as unknown, resulting in relatively high uncertainty for this risk element.
Risk score = 15 Uncertainty index = 0.26

Impact Potential Because it forms dense vine tangles and mats (Bergin, 2006; WMC, 2013), *Senecio angulatus* changes community structure, alters species composition (Newton, 1996; Weber, 2003; WMC, 2013), reduces regeneration of native species (Williams and Hayes, 2007), and is likely to threaten rare species. It is generally recognized as a weed of natural and human-disturbed systems (Groves et al., 2005; Landcare Research, 2013; Randall, 2007), and it is contained and controlled to zero density in conservation areas (Champion, 2005; Newton, 1996; Wotherspoon and Wotherspoon, 2002). This species does not appear to threaten agricultural areas; however, *Senecio* species in general are known to be toxic to livestock and humans (Burrows and Tyrl, 2001). The uncertainty associated with this element was about average.
Risk score = 2.2 Uncertainty index = 0.14

Geographic Potential Based on three climatic variables, we estimate that about 8 percent of the United States is suitable for the establishment of *S. angulatus* (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 *S. angulatus* represents the joint distribution of Plant Hardiness Zones 9-11, areas with 10-70 inches of annual precipitation, and the following Köppen-Geiger climate classes: steppe, Mediterranean, humid subtropical, and marine west coast.

The area estimated likely represents a conservative estimate as it uses three climatic

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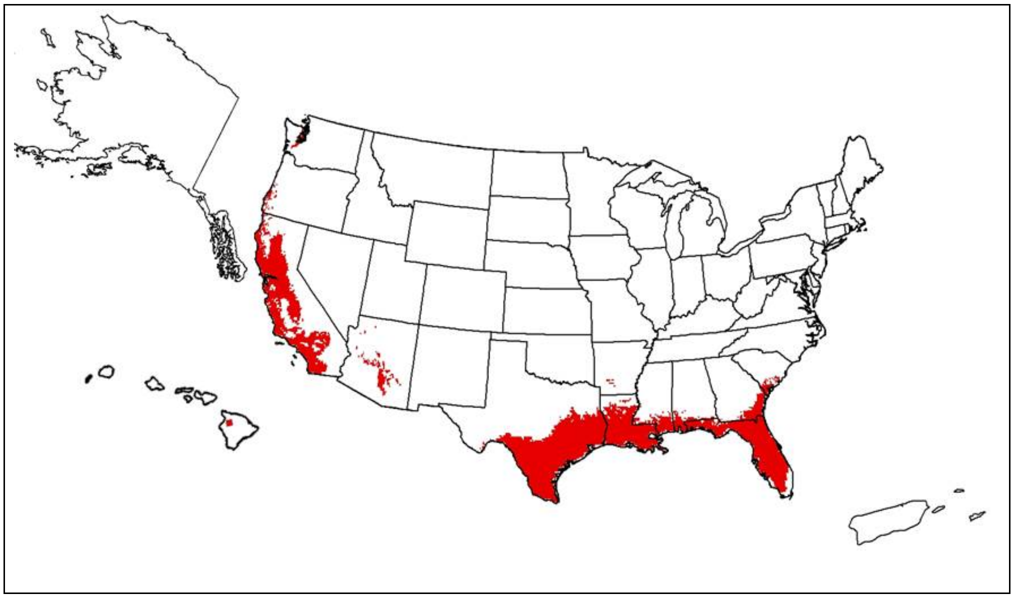
[1] "WRA area" is the area in relation to which the weed risk assessment is conducted [definition modified from that for "PRA area" (IPPC, 2012).

variables to estimate the area of the United States that is suitable for establishment of the species. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish. *Senecio angulatus* invades and is a threat to coastal, rocky areas, cliffs, bush edges, grassy woodlands, dry sclerophyll forests, and regenerating lowland forests (Csurhes and Edwards, 1998; Healy, 1959; WMC, 2013). This species appears to grow primarily in coastal regions (GBIF, 2013).

Entry Potential We did not assess *Senecio angulatus*' entry potential because this species is already cultivated to a very minor extent in the United States (Kartuz, 2013), and has escaped in one location in southern California (UC, 2013).

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



<u>2. Results and Conclusion</u>

Model Probabilities: P(Major Invader) = 67.3%
P(Minor Invader) = 31.2%
P(Non-Invader) = 1.4%

Risk Result = High Risk
Secondary Screening = Not/Applicable

Figure 2. *Senecio angulatus* 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.

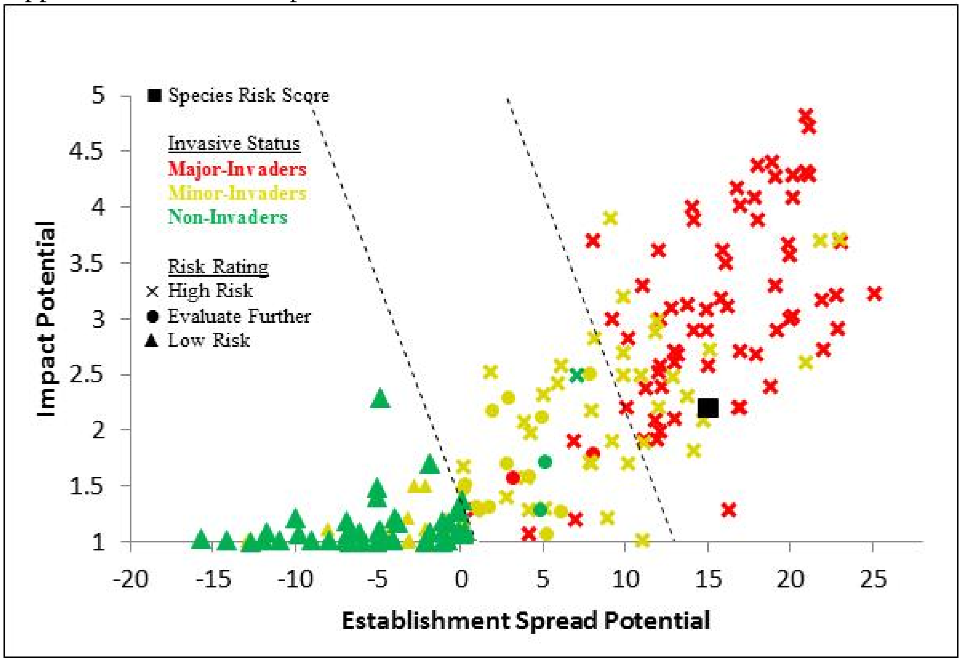
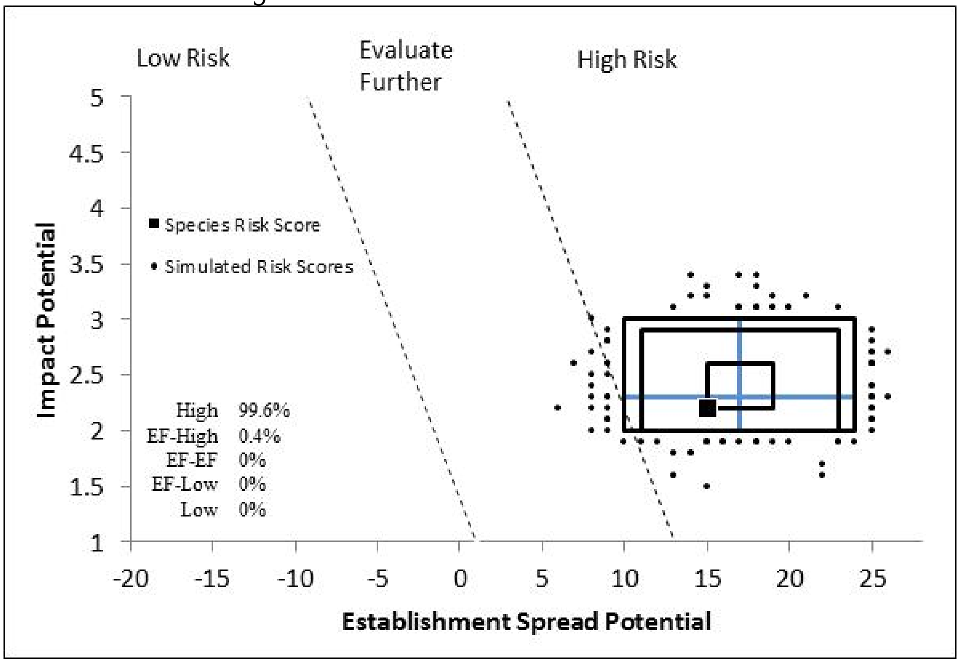


Figure 3. Monte Carlo simulation results (N=5,000) for uncertainty around the risk scores for *Senecio angulatus*[a].



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

3. Discussion

The result of the weed risk assessment for *Senecio angulatus* is High Risk (Fig. 2). Despite the lack of ecological studies and the uncertainty associated with its establishment/spread and impact potential, we are confident in these results. Most of the simulated risk scores resulted in a conclusion of High Risk (Fig. 3). This species has been evaluated by at least two other weed risk assessment models, and in both cases it obtained results of High Risk or "reject" (Champion, 2005; Fried, 2010). The behavior of *Senecio angulatus* elsewhere in the world supports these results. This species is native to South Africa (NGRP, 2013) and has naturalized in other countries including Australia, New Zealand, and several countries in southern Europe (Brunel and Tison, 2005; GBIF, 2013; Howell and Sawyer, 2006; NGRP, 2013; Pyke, 2008).

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Appendix A. Weed risk assessment for *Senecio angulatus* L. f. (Asteraceae). The following information was obtained from the species' risk assessment, which was conducted using Microsoft Excel. The information shown in this appendix was modified to fit on the page. The original Excel file, the full questions, and the guidance to answer the questions are available upon request.

Question ID	**Answer - Uncertainty**	**Score**	**Notes (and references)**
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 (Status/invasiveness outside its native range)	f - negl	5	Native to South Africa (NGRP, 2013). Introduced to the Canary Islands (Stierstorfer and Gaisbergm, 2006). Escaping or naturalized in Albania (Barina et al., 2011) and Chile (Ugarte et al., 2011). Escaping in one site in California at the edge of an ecological reserve and a roadway (UC, 2013). Naturalized in Australia (Randall, 2007; Ross and Walsh, 2003), Croatia (Milovic´ et al., 2010), Spain (Pyke, 2008; Romero Buján, 2007), and in France, Italy, and Portugal (NGRP, 2013). Naturalized in New Zealand (Howell and Sawyer, 2006). One of the most invasive species in the western Mediterranean (Brundu et al., 1999). Spreading ("major invader") in mediterranean France (Brunel and Tison, 2005). Widespread in New Zealand, suggesting it has readily spread in the past (Champion, 2005). Has demonstrated an ability to rapidly spread in Australia (category 5A of Randall 2007) (Murray and Phillips, 2012). Alternate answers for the Monte Carlo simulation are both "e."
ES-2 (Is the species highly domesticated)	n - low	0	Species is cultivated as an ornamental (Csurhes and Edwards, 1998; Groves et al., 2005; Kartuz, 2013; Rossini Oliva et al., 2003). Introduced to New Zealand as an ornamental (Newton, 1996). But no evidence it has been domesticated in such a way that weed potential has been reduced.
ES-3 (Weedy congeners)	y - negl	1	Several species of *Senecio* are considered significant weeds (Holm et al., 1979; Randall, 2012), including *S. glastifolius*, *S. inaequidens*, *S. jacobaea*, *S. mikanioides*, and *S. vulgaris*. Some reduce crop yield (e.g., *S. vulgaris*, CABI, 2013), others affect pasture productivity and are poisonous to livestock (e.g., *S. madagascariensis* CABI, 2013), while others affect native plant communities (e.g., *S. elegans*, Weber, 2003).
ES-4 (Shade tolerant at some stage of its life cycle)	n - low	0	Competitive only in open situations; does not tolerate shade (Williams and Hayes, 2007). Intolerant of shade (FloraBase, 2013). "Tolerates semi-shade" (WMC, 2013), which suggests it will not tolerate full shade. Seeds require lots of light for germination (DPI, 2013).
ES-5 (Climbing or smothering growth form)	y - negl	1	A perennial herbaceous vine (Csurhes and Edwards, 1998). Bushy climber (Hussey et al., 2007). Herb, half-climbing scrub (Weber, 2003) to three and five meters (Newton, 1996; The University of Queensland, 2013).
ES-6 (Forms dense thickets)	y - negl	2	Forms dense stands in coastal scrublands and wet areas in mediterranean France (Fried, 2010). Forms dense infestations in open/disturbed areas, particularly coastal environments (Champion, 2005). Forms dense tall thickets (WMC, 2013). Forms dense thickets (Williams and Hayes, 2007).
ES-7 (Aquatic)	n - negl	0	Not an aquatic. Perennial, terrestrial, scandent herb, sometimes forming tangled bushes up to 2 meters tall (Landcare Research, 2013).

Question ID	Answer - Uncertainty	Score	Notes (and references)
ES-8 (Grass)	n - negl	0	Not a grass, species in the Asteraceae family (NGRP, 2013).
ES-9 (Nitrogen-fixing woody plant)	n - negl	0	No evidence. Species is not in a family known to contain nitrogen-fixing species (Martin and Dowd, 1990).
ES-10 (Does it produce viable seeds or spores)	y - negl	1	Reproduces by seeds (The University of Queensland, 2013). Spreads by seeds (FloraBase, 2013; Weber, 2003).
ES-11 (Self-compatible or apomictic)	? - max	0	Unknown.
ES-12 (Requires special pollinators)	n - mod	0	Visited by bees for nectar in New Zealand (Butz Huryn and Moller, 1995), but it is unknown if they are pollinating it. Because this plant has established in several places in the world beyond its native range and it is producing seeds (FloraBase, 2013; Weber, 2003), it is unlikely it requires any specialist pollinators.
ES-13 (Minimum generation time)	b - low	1	Can produce fruit in its first year (FloraBase, 2013; Williams and Hayes, 2007). This species can also spread through root suckering (Bergin, 2006). The Victoria weed risk assessment estimated that it could produce vegetative propagules within its first year (DPI, 2013), although we question whether they can be called "propagules." Alternate answers for the Monte Carlo simulation are "a" and "c."
ES-14 (Prolific reproduction)	? - max	0	Inflorescence a terminal cymose corymb or panicle of usually 8-12 capitula; disk florets are 10-15 (Newton, 1996; The University of Queensland, 2013). Images on the internet show that there can be dozens if not hundreds of flowers per square meter, but there is no data on how many florets set seed or on seed viability. Anecdotal comments in the literature indicate that seeds are produced in abundance (Bergin, 2006; Williams and Hayes, 2007). Without additional data, answering unknown.
ES-15 (Propagules likely to be dispersed unintentionally by people)	y - negl	1	Establishes from fragments of dumped yard clippings (Hussey et al., 2007; ODA, 2007; Williams and Hayes, 2007).
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	? - max	0	No evidence for *S. angulatus*. But because this species produces small, wind-dispersed seeds and because it grows in disturbed areas, it is possible for seeds to become associated with certain commodities. For this reason, answering unknown.
ES-17 (Number of natural dispersal vectors)	2	0	Fruit/seed description for ES17a-ES17e: "Achenes terete, with hairs on ribs, c. 4 mm long; pappus 5-7 mm long" (Landcare Research, 2013). Produces an achene (i.e., a fruit that tightly envelopes a seed) that is 2.2 × 0.5 mm with a pappus (bristles or feather-like hairs) (Newton, 1996).
ES-17a (Wind dispersal)	y - negl		Produces "fluffy seeds" that are dispersed a long way from the parent plant (WMC, 2013). Easily dispersed by wind-dispersed seed (ODA, 2007). Dispersed by wind (FloraBase, 2013; Weber, 2003; Williams and Hayes, 2007).
ES-17b (Water dispersal)	? - max		One source indicates it is dispersed by water (FloraBase, 2013), but it provides no specific data or references. Because seeds of this species don't appear to be specifically adapted for water dispersal, and because it is not an aquatic species or limited to riparian habitats, answering unknown.
ES-17c (Bird dispersal)	? - max		Unknown.
ES-17d (Animal external	y - high		Dispersed by animals (FloraBase, 2013), but this source

Question ID	Answer - Uncertainty	Score	Notes (and references)
dispersal)			provides no specific evidence or citations. A Lucid Key factsheet also states it is spread by animals (The University of Queensland, 2013). Given that seed bristles would help them stick to animal fur, and the previous two unsupported statements, answering "yes" but with "high" uncertainty.
ES-17e (Animal internal dispersal)	n - mod		No evidence.
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	? - max	0	Unknown. Two sources state this species produces long-lived seeds (DPI, 2013; WMC, 2013) with supporting evidence. These reports did not specify if it is more than a year.
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	y - negl	1	Tolerates damage (WMC, 2013). In a comment about management, authors note that cut stumps and dropped stems resprout (WMC, 2013). Grows from small pieces after manual treatment (Williams and Hayes, 2007). Small fragments can root (FloraBase, 2013).
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	y - high	1	*Senecio vulgaris* has developed resistance to some herbicides in numerous countries, including the United States (Heap, 2013). Because species of *Senecio* frequently hybridize (e.g., Brennan et al., 2013; Buggs, 2012; Winter et al., 2013) answering "yes" because *S. angulatus* may acquire resistance indirectly through hybridization.
ES-21 (Number of cold hardiness zones suitable for its survival)	3	-1	
ES-22 (Number of climate types suitable for its survival)	4	2	
ES-23 (Number of precipitation bands suitable for its survival)	6	0	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	n - low	0	No evidence. An analysis using the Victoria weed risk assessment also found no evidence of allelopathy (DPI, 2013).
Imp-G2 (Parasitic)	n - negl	0	Species is not in a family known to contain parasitic plants (Heide-Jorgensen, 2008; Nickrent, 2009).
Impacts to Natural Systems			
Imp-N1 (Change ecosystem processes and parameters that affect other species)	n - high	0	No specific evidence. Reported to alter natural ecosystems, but the authors were not specific as to how it alters these ecosystems (Guillot Ortiz and Van Der Meer, 2004).
Imp-N2 (Change community structure)	y - high	0.2	Forms ground mats that prevent germination of native seedlings (WMC, 2013). Smothers native regeneration (Williams and Hayes, 2007), but in stable situations natives can overtake it (Williams and Hayes, 2007). Prevents native species from establishing (Bergin, 2006). Forms tangles of vegetation (Bergin, 2006). Forms dense mats of tangled vegetation that prevents native plant recruitment (Weedbusters, 2013). Answering "yes" because dense mats and vine tangles change the physical structure of plant communities and affect the plant community at the ground, but using "high" uncertainty because this was not explicitly stated in the literature.
Imp-N3 (Change community composition)	y - negl	0.2	Smothers native herbs and shrubs (Newton, 1996; Weber, 2003; WMC, 2013). Competes with native Spanish vines (Guillot Ortiz and Van Der Meer, 2004). Outcompetes native

Question ID	Answer - Uncertainty	Score	Notes (and references)
			successional species in New Zealand (Williams and Hayes, 2007).
Imp-N4 (Is it likely to affect federal Threatened and Endangered species)	y - low	0.1	Given its impact to community composition (see evidence in Imp-N3), this species is likely to affect Threatened and Endangered species.
Imp-N5 (Is it likely to affect any globally outstanding ecoregions)	n - high	0	No evidence.
Imp-N6 (Weed status in natural systems)	c - negl	0.6	Weed of the natural environment in Australia (Groves et al., 2005; Randall, 2007) and New Zealand (Butz Huryn and Moller, 1995). Establishes in coastal shrublands in France (Fried, 2010). Aggressive weed in New Zealand (Landcare Research, 2013). Regionally controlled in New Zealand to contain or limit impacts (Champion, 2005). Controlled in at least one New Zealand area of conservation (Timmins and Mackenzie, 1995). Controlled to zero density on Rangitoto Island, New Zealand (Wotherspoon and Wotherspoon, 2002). Control strategies have been described (Bergin, 2006; Weber, 2003; WMC, 2013), but they don't specify which type of system. Herbicide trials to control it in natural areas have been conducted (Newton, 1996). Alternate answers for the Monte Carlo simulation are both "b."
Impact to Anthropogenic Systems (cities, suburbs, roadways)			
Imp-A1 (Impacts human property, processes, civilization, or safety)	n - mod	0	No evidence.
Imp-A2 (Changes or limits recreational use of an area)	n - mod	0	No evidence. Vine tangles could limit or reduce access in natural areas, but this has not been reported.
Imp-A3 (Outcompetes, replaces, or otherwise affects desirable plants and vegetation)	n - mod	0	No evidence.
Imp-A4 (Weed status in anthropogenic systems)	b - low	0.1	Establishes in roadsides and wastelands in mediterranean France (Fried, 2010). Aggressive weed in wastelands of New Zealand (Howell, 2008; Landcare Research, 2013). No evidence of control in these systems. Alternate answers for the Monte Carlo simulation were "a" and "c."
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	n - low	0	One factsheet noted it is not a threat to agriculture (Williams and Hayes, 2007). Based on a lack of evidence for production system impacts and the previous statement, using "low" uncertainty for most questions in this sub-element.
Imp-P2 (Lowers commodity value)	n - low	0	No evidence.
Imp-P3 (Is it likely to impact trade)	n - low	0	No evidence. This species does not appear to be officially regulated as a quarantine pest by a foreign country (APHIS, 2013).
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	n - low	0	No evidence.
Imp-P5 (Toxic to animals, including livestock/range animals and poultry)	? - max	0	Unknown. There is no evidence this species is toxic, but other species of *Senecio* are economically important because they cause liver disease in livestock (Burrows and Tyrl, 2001). Humans are also susceptible to their toxins (Burrows and Tyrl,

Question ID	Answer - Uncertainty	Score	Notes (and references)
			2001). *Senecio angulatus* may also be toxic, but it has not been reported; this species is not typically associated with production systems.
Imp-P6 (Weed status in production systems)	a - low	0	No threat to agriculture (Williams and Hayes, 2007).
GEOGRAPHIC POTENTIAL			Unless otherwise noted, all evidence below represents point-occurrences obtained from GBIF (2013).
Plant cold hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	No evidence.
Geo-Z2 (Zone 2)	n - negl	N/A	No evidence.
Geo-Z3 (Zone 3)	n - negl	N/A	No evidence.
Geo-Z4 (Zone 4)	n - negl	N/A	No evidence.
Geo-Z5 (Zone 5)	n - negl	N/A	No evidence.
Geo-Z6 (Zone 6)	n - negl	N/A	No evidence.
Geo-Z7 (Zone 7)	n - negl	N/A	No evidence.
Geo-Z8 (Zone 8)	n - high	N/A	A few points were in this zone in Spain, but these were right on the coast and this may represent a microclimate. Answering "no" with "high" uncertainty since this plant has been reported to possibly be frost tender (Williams and Hayes, 2007).
Geo-Z9 (Zone 9)	y - negl	N/A	New Zealand and Spain. May be frost tender (Williams and Hayes, 2007).
Geo-Z10 (Zone 10)	y - negl	N/A	Australia, New Zealand, and South Africa.
Geo-Z11 (Zone 11)	y - negl	N/A	South Africa.
Geo-Z12 (Zone 12)	n - high	N/A	One point in zone 11 near zone 12 in Tanzania, but this point may represent a misidentification since it is the only one for this country.
Geo-Z13 (Zone 13)	n - negl	N/A	No evidence.
Köppen-Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - negl	N/A	No evidence.
Geo-C2 (Tropical savanna)	n - low	N/A	No evidence.
Geo-C3 (Steppe)	y - negl	N/A	Spain. Two points in South Africa.
Geo-C4 (Desert)	n - low	N/A	No evidence.
Geo-C5 (Mediterranean)	y - negl	N/A	Australia, California, Spain, and one point in South Africa.
Geo-C6 (Humid subtropical)	y - low	N/A	Australia.
Geo-C7 (Marine west coast)	y - negl	N/A	Australia, Portugal, South Africa, and Spain.
Geo-C8 (Humid cont. warm sum.)	n - negl	N/A	No evidence.
Geo-C9 (Humid cont. cool sum.)	n - negl	N/A	No evidence.
Geo-C10 (Subarctic)	n - negl	N/A	No evidence.
Geo-C11 (Tundra)	n - negl	N/A	No evidence.
Geo-C12 (Icecap)	n - negl	N/A	No evidence.
10-inch precipitation bands			
Geo-R1 (0-10 inches; 0-25 cm)	n - high	N/A	One isolated point in Australia far from the coast where this species typically occurs. This point may represent a misidentification. Another single point in Spain.
Geo-R2 (10-20 inches; 25-51 cm)	y - negl	N/A	Australia, California, South Africa, Spain
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	South Africa, Chile, Spain
Geo-R4 (30-40 inches; 76-102	y - negl	N/A	Australia

Question ID	Answer - Uncertainty	Score	Notes (and references)
cm)			
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	Australia, New Zealand, Spain
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	New Zealand.
Geo-R7 (60-70 inches; 152-178 cm)	y - negl	N/A	New Zealand.
Geo-R8 (70-80 inches; 178-203 cm)	n - high	N/A	No evidence.
Geo-R9 (80-90 inches; 203-229 cm)	n - low	N/A	No evidence.
Geo-R10 (90-100 inches; 229-254 cm)	n - negl	N/A	No evidence.
Geo-R11 (100+ inches; 254+ cm))	n - negl	N/A	No evidence.
ENTRY POTENTIAL			
Ent-1 (Plant already here)	y - negl	1	Present in the United States (GBIF, 2013; UC, 2013) and previously sold by one nursery in California, but no longer sold by this grower (SanMarcosGrowers, 2013).
Ent-2 (Plant proposed for entry, or entry is imminent)	-	N/A	
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	
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	