Taxon: Cotoneaster pannosus Franch. **Family:** Rosaceae

Common Name(s): silverleaf cotoneaster **Synonym(s):**

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 12 Jan 2017

WRA Score: 11.0 **Designation:** H(Hawai'i) **Rating:** High Risk

Keywords: Invasive Shrub, Dense Stands, Apomictic, Resprouter, Bird-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Low
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Intermediate
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	y
408	Creates a fire hazard in natural ecosystems		
409	Is a shade tolerant plant at some stage of its life cycle		
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally		
604	Self-compatible or apomictic	y=1, n=-1	y
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	y
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	y=-1, n=1	n

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	No evidence of domestication

102	Has the species become naturalized where grown?	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	Low
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 9 Jan 2017]	"Native: Asia-Temperate China: China - Sichuan, - Yunnan"
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Seeds require scarification and cold temperatures to germinate, so ingestion by animals is important to facilitate seed germination."
	WRA Specialist. 2017. Personal Communication	For the special case of a temperate species whose seeds have been reported to require cold-stratification for germination, the answer to this question is 0 (low) and the answer to question 2.02 is 1 (intermediate) regardless of knowledge of the species' native range.

202	Quality of climate match data	Intermediate
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	For the special case of a temperate species whose seeds have been reported to require cold stratification for germination, the answer to this question is 0 (low) and the answer to question 2.02 is 1 (intermediate) regardless of knowledge of the species' native range.

Qsn #	Question	Answer
203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"1100 - 3200 m." [Elevation range exceeds 1000 m, demonstrating environmental versatility]

204	**Native or naturalized in regions with tropical or subtropical climates**	**y**
	Source(s)	**Notes**
	Pacific Island Ecosystems at Risk (PIER). (2011). Cotoneaster pannosus. http://www.hear.org/Pier/. [Accessed 12 Jan 2017]	[A temperate species naturalized at mid to high elevations of a tropical/subtropical island] "Moist and wet forest areas, roadsides, openings, at 3,000-6,500 ft. elevation in Hawai'i."

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 12 Jan 2017]	"Naturalized: Africa Southern Africa: South Africa Australasia Australia: Australia Northern America : United States Cultivated: . also cult."

301	**Naturalized beyond native range**	**y**
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"Naturalised around populated areas mostly in the south-eastern parts of the country. It is most common in the coastal and sub-coastal regions of New South Wales, Victoria and Tasmania. Less common or scattered in the ACT, south-western Western Australia, south-eastern South Australia and south-eastern Queensland. Also naturalised on Lord Howe Island. Naturalised overseas in southern Africa, western USA (i.e. Oregon and California) and Hawaii."
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 9 Jan 2017]	"Naturalized: Africa Southern Africa: South Africa Australasia Australia: Australia Northern America : United States"

Qsn #	Question	Answer
	Parker, J.L. & Parsons, B. 2012. New Plant Records from the Big Island for 2010–2011. Bishop Museum Occasional Papers 113: 65-74	"Previously documented as naturalized on Kaua'i and Maui (Lorence et al. 1995: 49; Herbarium Pacificum staff 1999: 8), Cotoneaster pannosus grows vigorously at high elevation sites. a large naturalized population has been found near 'Umikoa Village in the Hāmākua Distr. Material examined. HAWAIʻI: Hāmākua Distr. 'Umikoa Village rd, 2211318n, 252407e. Densely clustered shrubs with alternate, silvery leaves, white flowers and orange berries, no thorns. spreading from gulch, 22 Jun 2010, J. Parker & R. Parsons BIED127."
	Herbarium Pacificum Staff. 1999. New Hawaiian plant records for 1998. Bishop Museum Occasional Papers 58: 3 -11	"This cultivated species was noted in Wagner et al. (1990) as persisting and sometimes reproducing in Volcano, Hawai'i, and Kula, Maui, and more recently was documented as definitely naturalizing on Kaua'i (Lorence et al., 1995). The only previous Maui specimen at BISH was collected in 1986 from Polipoli Park in the Kula Forest Reserve (Hobdy 2697), located at about 6,500 ft elevation. The plant (although not specifically stated) was apparently cultivated and described as bushy tree about 12 ft tall. A collection was made in 1998 far downslope at 2,450 ft elevation, below the town of Këökea in open Lantana scrubland/Pennisetum clandestinum pastureland from a 20 ft tall shrub with long, arching branches suckering profusely from the base. Smaller plants were randomly scattered in the surrounding pasturelands and adjoining black wattle forest. Material examined. EAST MAUI: Këökea, in open Lantana scrubland/kikuyu grassland downslope of Kula Hwy, 2450 ft, 17 Aug 1998, C. Imada, W. Char, & C. Morden 98-10."
	Lorence, D.H., Flynn, T.W. & Wagner, W.L. 1995. Contributions to the flora of Hawai'i. III. New additions, range extensions, and rediscoveries of flowering plants. Bishop Museum Occasional Papers 41: 19-58	"This is a new naturalized record of the genus Cotoneaster Medikus in the Hawaiian Islands. Wagner et al. (1990: 1100) noted that on Maui and Hawaii C. pannosus persists in the vicinity of cultivated plants although it has not spread, but they added "However, it could easily become a pest because of its attractive, presumably bird-dispersed fruit." On Kauai this shrub has escaped from cultivated plants in forestry plantings and around cabins in the Kokee area and on Makaha Ridge. This species has become naturalized in diverse mesic forest of Acacia koa, Metrosideros polymorpha, alien species, and forestry plantations in Waimea Canyon State Park, Kokee State Park, and Puu Ka Pele Forest Reserve at ca. 1000–1300 m elevation. Cotoneaster pannosus is distinguished from all other Rosaceae in the archipelago by the following characters: shrub 2–5 m tall; leaves simple, blades elliptic, 1.5–3 x 0.8–1.6 cm, glabrous above, whitish tomentose beneath, apex mucronulate, petiole 5–8 mm; flowers in terminal corymbs, petals white; fruit a bright red pome, subglobose to ellipsoid, 5–7 mm in diam.; seeds 2–5, 4–5 mm long. Another species, C. microphyllus Wall. ex Lindl., which differs from C. pannosus in its low habit up to 1 m tall, leaf blades up to 0.8 cm long, and the lower surface white-gray pilose-strigose, later glabrate, has been cultivated on the island of Hawaii and may be naturalized there (Herbst, pers. comm.). Material examined. KAUAI: Waimea District, Puu Ka Pele Forest Reserve, 13 mile marker from Waimea along Hwy 550, near turnoff to Methodist and Boy Scout camps, 1006 m (3300 ft), 2 Dec 1993, K.R. Wood & S. Perlman 2878 (PTBG), along road from Hwy 550 to Boy Scout Camp, 1036 m, 16 Nov 1994, Lorence & Flynn 7603 (PTBG)."

302	**Garden/amenity/disturbance weed**	**n**

Qsn #	Question	Answer
	Source(s)	**Notes**
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	[Environmental weed] "Grassland, coastal beaches and scrub. The species thrives in poor and droughty soils and shades out native sun-loving plant species. Eventually, large areas of native vegetation may become displaced by cotoneasters. The shrub has a strong and deep root system and branches profusely at ground level"

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	Environmental weed	y
	Source(s)	**Notes**
	California Invasive Plant Council. 2017. Invasive Plants of California's Wildland - Cotoneaster spp. http://www.cal-ipc.org. [Accessed 11 Jan 2017]	"Cotoneasters displace native plants by their rapid growth, competition for light, an aggressive, competitive root system, abundant seed production, and an effective seed-dispersal strategy. They may compete for the same ecological niche as the related native toyon (Heteromeles arbutifolia) in part of the toyon's range."
	Weber, E. 2003. Invasive Plant Species of the World. A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"Grassland, coastal beaches and scrub. The species thrives in poor and droughty soils and shades out native sun-loving plant species. Eventually, large areas of native vegetation may become displaced by cotoneasters. The shrub has a strong and deep root system and branches profusely at ground level"
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"Silver-leaved cotoneaster (Cotoneaster pannosus) is a moderately important or significant environmental weed in Victoria, Tasmania, the ACT and New South Wales, and a minor or potential environmental weed in Queensland and South Australia. Dispersed by fruit-eating (i.e. frugivorous) birds, this species forms thickets along roadsides and in disturbed and undisturbed natural plant communities. These infestations are capable of altering and displacing native plant communities by shading out the native ground flora and impeding the regeneration of overstorey plants."

305	Congeneric weed	y
	Source(s)	**Notes**
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Cotoneaster franchetii Boiss.; orange cotoneaster Cotoneaster lacteus W.W. Smith; Parney's cotoneaster Cotoneaster pannosus Franch.; silverleaf cotoneaster" ... "Impacts: On occasion, populations can become dense and crowd out native species. However, fruit likely provide a food source for some bird species. California Invasive Plant Council (Cal-IPC) Inventory: All three species are Moderate Invasiveness"

401	Produces spines, thorns or burrs	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence] "Shrubs semievergreen, to 2 m tall. Branchlets dark grayish brown or purplish brown, thin, initially densely white tomentose, glabrescent. Petiole 27 mm, tomentose; stipules caducous, linear, pubescent; leaf blade narrowly elliptic, elliptic, or ovate, 23(4) × 0.81.5 cm, leathery, midvein impressed adaxially, lateral veins 46 pairs, abaxially densely white tomentose, adaxially slightly pubescent or glabrous, base broadly cuneate, apex obtuse or acute."

402	Allelopathic	
	Source(s)	**Notes**
	Morita, S., Ito, M., & Harada, J. 2005. Screening of an allelopathic potential in arbor species. Weed Biology and Management, 5(1): 26-30	[Unknown for C. pannosus] "Among the 92 species tested in a dish-pack method(Table 1), both radicle and hypocotyl growth of lettuce seedlings was inhibited by volatile substances released from 34 species. Cotoneaster salicifolius Franch cv. Emerald gold and Platanus ¥ acerifolia Willd. completely inhibited the germination of lettuce. It was reported that the Cotoneaster spp. contain prunasin (Nahrstedt 1973); hence, it could be presumed that the inhibitory substances might be hydrogen cyanide and benzaldehyde released from the leaves by decomposition of prunasin."

403	Parasitic	n
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Shrubs semievergreen, to 2 m tall." [Rosaceae. No evidence]

404	Unpalatable to grazing animals	
	Source(s)	**Notes**
	Fake, C. (ed.). (2003). Deer Resistant Plants for the Sierra Foothills. Publication Number 31-113. University of California Cooperative Extension, Placer and Nevada Counties. http://ceplacer.ucanr.edu/. [Accessed 12 Jan 2017]	Possibly. Cotoneaster pannosus listed among deer-resistant plants

Qsn #	Question	Answer
405	**Toxic to animals**	**n**
	Source(s)	**Notes**
	Western Australian Herbarium (1998–2017). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 12 Jan 2017]	"Reproduction. Seed. Dispersal. Birds, pigs, garden refuse." ... "Toxicity. Friuts are poisonous to humans." [No evidence of toxicity to humans]
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	No evidence

406	**Host for recognized pests and pathogens**	
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 12 Jan 2017]	"Silver-leaved cotoneaster (Cotoneaster pannosus) can also act as a host for bacterial fireblight, a disease of orchards." [Possibly. Importance in Hawaii & Pacific unknown]

407	**Causes allergies or is otherwise toxic to humans**	**y**
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"The fruit of this species are poisonous to humans."
	Western Australian Herbarium (1998–2017). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 12 Jan 2017]	"Toxicity. Friuts are poisonous to humans."
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	No information for C. pannosus, but several other species described as poisonous or cyanogenic

408	**Creates a fire hazard in natural ecosystems**	
	Source(s)	**Notes**
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	[Could increase fire risk in fire prone ecosystems] "Cotoneaster is thought capable of invading intact ecosystems, where it competes with native vegetation for water, nutrient, and light resources. ... In addition, the dense shrubs frequently grow under trees and can facilitate the spread of fire by forming a fuel ladder."

409	**Is a shade tolerant plant at some stage of its life cycle**	
	Source(s)	**Notes**
	Dave's Garden. (2017). Cotoneaster - Cotoneaster pannosus. http://davesgarden.com/guides/pf/go/84567/. [Accessed 12 Jan 2017]	"Sun Exposure: Full Sun"

Qsn #	Question	Answer
	The National Gardening Association. (2017). Cotoneaster (Cotoneaster pannosus). https://garden.org/. [Accessed 12 Jan 2017]	"Sun Requirements: Full Sun; Full Sun to Partial Shade"
	Boyce, R. L. (2009). Invasive shrubs and forest tree regeneration. Journal of Sustainable Forestry, 28(1-2), 152 -217	"TABLE 5 Physiological Characteristics and Soil and Moisture Requirements of Invasive Shrubs. For Shade Tolerance, T = Fully Shade Tolerant, P = Partially Tolerant, and I = Intolerant. For Leaf Habit, E = Evergreen, DE = Deciduous-Extended, D = Deciduous, and GS = Green (Photosynthetic) stem. Under Soils Requirements, WR = Wide Range. N-Fixing Species are also Noted. ND = no Data were Found" [Cotoneaster pannosus = T = Fully Shade Tolerant]

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Carbutt, C. 2012. The emerging invasive alien plants of the Drakensberg Alpine Centre, southern Africa. Bothalia, 42 (2): 71-85	"Cotoneaster pannosus - Highly adaptable, can grow in moist or dry soils, and even in thin rocky soils underlying native grasslands."
	Boyce, R. L. (2009). Invasive shrubs and forest tree regeneration. Journal of Sustainable Forestry, 28(1-2), 152 -217	"TABLE 5 Physiological Characteristics and Soil and Moisture Requirements of Invasive Shrubs. For Shade Tolerance, T = Fully Shade Tolerant, P = Partially Tolerant, and I = Intolerant. For Leaf Habit, E = Evergreen, DE = Deciduous-Extended, D = Deciduous, and GS = Green (Photosynthetic) stem. Under Soils Requirements, WR = Wide Range. N-Fixing Species are also Noted. ND = no Data were Found" [Cotoneaster pannosus - Soil requirements = WR = Wide Range]

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Shrubs semievergreen, to 2 m tall."

412	Forms dense thickets	y
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"Dispersed by fruit-eating (i.e. frugivorous) birds, this species forms thickets along roadsides and in disturbed and undisturbed natural plant communities."
	Invasive Species South Africa. 2017. Silver leaf cotoneaster - Cotoneaster pannosus. http://www.invasives.org.za/. [Accessed 12 Jan 2017]	"Why is it a problem? It competes with and has the potential to replace indigenous species. Dense stands could reduce grazing available for domestic and wild animals"

Qsn #	Question	Answer
501	**Aquatic**	**n**
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[Terrestria] "Shrubs semievergreen, to 2 m tall." ... "Thickets, rocky places, waste places in mountain regions, slopes"

502	**Grass**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 9 Jan 2017]	Family: Rosaceae Subfamily: Amygdaloideae Tribe: Maleae Subtribe: Malinae

503	**Nitrogen fixing woody plant**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 11 Jan 2017]	Family: Rosaceae Subfamily: Amygdaloideae Tribe: Maleae Subtribe: Malinae [No evidence]

504	**Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)**	**n**
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Shrubs semievergreen, to 2 m tall. Branchlets dark grayish brown or purplish brown, thin, initially densely white tomentose, glabrescent."

601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 11 Jan 2017]	No evidence. Common in native range & widespread introduced range

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	California Invasive Plant Council. 2017. Invasive Plants of California's Wildland - Cotoneaster spp. http://www.cal-ipc.org. [Accessed 11 Jan 2017]	"Natural propagation is almost exclusively by seed."

Qsn #	Question	Answer
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Plants reproduce by seed that are dispersed primarily by animals, particularly birds. Seeds require scarification and cold temperatures to germinate, so ingestion by animals is important to facilitate seed germination."

603	Hybridizes naturally	
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"The shrubs are widely planted as ornamentals for their attractive fruits and flowers, and as borders, hedges, and ground cover. Further studies are necessary to clarify a taxonomy complicated by hybridization and apomixis."
	Li, F., Fan, Q., Li, Q., Chen, S., Guo, W., Cui, D., & Liao, W. (2014). Molecular phylogeny of Cotoneaster (Rosaceae) inferred from nuclear ITS and multiple chloroplast sequences. Plant Systematics and Evolution, 300(6): 1533-1546	[Unknown for C. pannosus] "Cotoneaster Medik. (Rosaceae, Maloideae) is distributed in Europe, North Africa, and temperate areas of Asia except Japan. Members of the genus exhibit considerable morphological variation. The infrageneric classification is also obscured by polyploidy, hybridization, and apomixis."

604	Self-compatible or apomictic	y
	Source(s)	**Notes**
	Bonner, F.T. & Karrfalt, R.P. (eds.). 2008. The Woody Plant Seed Manual. USDA FS Agriculture Handbook 727. Government Printing Office, Washington, D.C.	"Cotoneasters are apomictic and will, therefore, propagate true from seed (Wyman 1986). However, because of the apomictic habit, many variants occur within each species (Everett 1982)."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	California Invasive Plant Council. 2017. Invasive Plants of California's Wildland - Cotoneaster spp. http://www.cal-ipc.org. [Accessed 12 Jan 2017]	"Although cotoneasters are apomictic (able to produce seed without benefit of fertilization), their flowers are attractive to wasps (especially yellow jackets), and this apparently can result in sexual reproduction. The plants self-sow abundantly."
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	[No evidence. Apomictic, & flowers unspecialized] "Corymbs 13 × 1.52.5 cm, to 10(20)-flowered; rachis and pedicels densely tomentose; bracts caducous, linear, pubescent. Pedicel23 mm. Flowers 7 8 mm in diam. Hypanthium campanulate, abaxially densely tomentose. Sepals triangular, apex shortly acuminate or acute. Petals spreading, white, broadly ovate or suborbicular,33.5 mm, base shortly clawed and puberulous adaxially, apex obtuse. Stamens 20, nearly as long as petals; anthers purplish red. Ovary pubescent apically; styles 2(or 3), free, ca. as long as stamens."

Qsn #	Question	Answer
606	**Reproduction by vegetative fragmentation**	**n**
	Source(s)	**Notes**
	California Invasive Plant Council. 2017. Invasive Plants of California's Wildland - Cotoneaster spp. http://www.cal-ipc.org. [Accessed 11 Jan 2017]	"Natural propagation is almost exclusively by seed. Plants grow through the spring months, flower in summer, and set fruit in autumn; berries persist through winter."
	Western Australian Herbarium (1998–2017). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 12 Jan 2017]	"Vegetative regeneration strategy. Resprouts from base."

Qsn #	Question	Answer
607	**Minimum generative time (years)**	**2**
	Source(s)	**Notes**
	Western Australian Herbarium (1998–2017). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 12 Jan 2017]	"Cotoneaster pannosus ... Time to first flowering. 2 years."

Qsn #	Question	Answer
701	**Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)**	**y**
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"The seeds are also dispersed in dumped garden waste and if plants are cut down they will produce suckers from the base (i.e. crown)."

Qsn #	Question	Answer
702	**Propagules dispersed intentionally by people**	**y**
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"A popular garden plant (i.e. ornamental) in southern and eastern Australia."
	Wagner, W.L., Herbst, D.R.& Sohmer, S.H. 1999. Manual of the flowering plants of Hawaii. Revised edition. University of Hawai'i Press and Bishop Museum Press, Honolulu, HI.	"Cotoneaster pannosa Franch., a shrub up to 2 m tall with simple, elliptic leaves 1-2.5 em long, flowers in dense corymbs, carpels 2-5, and fruit a globose to ellipsoid, dull red pome ca. 6 mm long, is occasionally cultivated in Hawai'i. It appears to persist and occasionally (Volcano, Hawai'i, and Kula, Maui) reproduces in the vicinity of cultivated plants,"
	Schmidt, E., Lötter, M. & McCleland, W. 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Jacana Media, Johannesburg, South Africa	"Native to China, now well established in the horticultural industry and invading the wild, particularly in the central highveld areas of Mpumalanga."

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 12 Jan 2017]	"The seeds are also dispersed in dumped garden waste and if plants are cut down they will produce suckers from the base (i.e. crown)." [Spread accidentally, but generally not grown with produce]

Qsn #	Question	Answer
704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Fruit dark red, globose or ovoid, 78 mm in diam.; pyrenes often 2." [Adapted for zoochory]

705	**Propagules water dispersed**	**n**
	Source(s)	**Notes**
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Abundant seed production and bird-dispersed fruits." [Seeds may be secondarily dispersed by water if growing in riparian areas]

706	**Propagules bird dispersed**	**y**
	Source(s)	**Notes**
	Wu, Z. Y., P. H. Raven & D. Y. Hong, eds. 2003. Flora of China. Vol. 9 (Pittosporaceae through Connaraceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Fruit dark red, globose or ovoid, 78 mm in diam.; pyrenes often 2."
	Invasive Species South Africa. 2017. Silver leaf cotoneaster - Cotoneaster pannosus. http://www.invasives.org.za/. [Accessed 12 Jan 2017]	"How does it spread? Birds that feed on the berries spread the plant further afield"
	Aslan, C., & Rejmanek, M. (2012). Native fruit traits may mediate dispersal competition between native and non-native plants. NeoBiota 12: 1-24	"Table 3. Selection indices (wi) for similarity experiment using red fruit and testing preferences of hermit thrushes (Catharus guttatus). Selection index values greater than 1.0 indicate preference by hermit thrush individuals for a food item, and these values are underlined. Values are presented for number of fruits as selection indices ± SE." [Cotoneaster pannosus preferred by thrushes]
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"This plant reproduces by seed, which are commonly spread by birds that eat the brightly coloured fruit. The seeds are also dispersed in dumped garden waste and if plants are cut down they will produce suckers from the base (i.e. crown)."

707	**Propagules dispersed by other animals (externally)**	**n**
	Source(s)	**Notes**
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Plants reproduce by seed that are dispersed primarily by animals, particularly birds. Seeds require scarification and cold temperatures to germinate, so ingestion by animals is important to facilitate seed germination." [No means of external attachment]

708	**Propagules survive passage through the gut**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Plants reproduce by seed that are dispersed primarily by animals, particularly birds. Seeds require scarification and cold temperatures to germinate, so ingestion by animals is important to facilitate seed germination."
	Western Australian Herbarium (1998–2017). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 12 Jan 2017]	"Reproduction. Seed. Dispersal. Birds, pigs, garden refuse."

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Abundant seed production and bird-dispersed fruits." [Densities unspecified]

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	**Notes**
	Gu, Z. H., Zhang, Z. M., & Cao, Y. L. (1993). The dormancy and rapid-germination of five kinds of wild cotoneaster seeds. Plant Physiology Communications, 29(4), 253-256	"Following treatment with H2SO4 and 30% H2O2, seeds of 5 Cotoneaster species (C. dielsianus, C. moupinensis, C. ambiguus, C. pannosus and C. salicifolius var. angustus) were treated with 250 p.p.m. GA3 for 24 h and then put into a refrigerator at 2-4 deg C for 1.5-3.0 months. The low temperature treatment did break seed dormancy and promoted the germination of C. moupinensis and C. salicifolius. Cold treatment followed by GA3 increased germination rates of C. dielsianus and C. salicifolius to 80-90%. It was concluded that treating seeds with H2SO4 and GA3 together with exposure to 1 -4 deg for 3 months followed by germination at 25 deg was the best way of breaking the dormancy of wild Cotoneaster seeds. "[Need specific treatment to break dormancy]
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Seed longevity is not known, but may be several years."
	Western Australian Herbarium (1998–2017). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 12 Jan 2017]	"Seedbank persistence. Possibly short, days-1 year."
	Bonner, F.T. & Karrfalt, R.P. (eds.). 2008. The Woody Plant Seed Manual. USDA FS Agriculture Handbook 727. Government Printing Office, Washington, D.C.	"Seeds of many cotoneasters exhibit double dormancy due to their hard, impermeable seedcoats and the physiological condition of their embryos. First-year germination is enhanced by acid scarification followed by warm incubation and wet prechilling (USDA SCS 1988)"

803	Well controlled by herbicides	y
	Source(s)	**Notes**

Qsn #	Question	Answer
	Bossard, C. C., Randall, J. M. & Hoshovsky, M. C. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley and Los Angeles, CA	"Cut and treat. Cut stumps close to the ground during the fall and winter. Practitioners using herbicides apply a 50 percent concentration of glyphosate to the stumps. Painting stumps with glyphosate is effective on large shrubs but becomes more difficult on the smaller ones, as the many small stems can be hard to see. For smaller plants, it may be preferable to spray the herbicide."
	Pacific Island Ecosystems at Risk (PIER). (2011). Cotoneaster pannosus. http://www.hear.org/Pier/. [Accessed 12 Jan 2017]	"Cut branches back to stump and treat stump with 100 percent glyphosate herbicide."
	Western Australian Herbarium (1998–2017). FloraBase—the Western Australian Flora. Department of Parks and Wildlife. https://florabase.dpaw.wa.gov.au/. [Accessed 12 Jan 2017]	"Suggested method of management and control. Hand pull or dig out seedlings ensuring removal of all roots. For mature plants cut and paint with 50% glyphosate. Read the manufacturers' labels and material safety data sheets before using herbicides."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**
	Queensland Government. (2017). Weeds of Australia. Cotoneaster pannosus. http://keyserver.lucidcentral.org. [Accessed 9 Jan 2017]	"...if plants are cut down they will produce suckers from the base (i.e. crown).
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"Seedlings and small plants can be hand pulled. Manually removing individual shrubs when discovered can help prevent the spread of cotoneaster species in natural areas. However, stumps and roots can resprout, necessitating follow-up control. Roots need to be completely removed to prevent resprouting."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	**n**
	Source(s)	**Notes**
	DiTomaso, J. M., Kyser, G. B., Oneto, et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	"There are many species of cultivated cotoneaster. As such, there has not been any effort to develop biological control agents for their management."

Summary of Risk Traits:

High Risk / Undesirable Traits
• Elevation range exceeds 1000 m, demonstrating environmental versatility
• Able to grow in mid-to high elevation subtropical & tropical islands
• Naturalized on Hawaii, Maui, & Kauai, Hawaiian Islands & elsewhere
• An environmental weed (esp. in Australia, California, & Hawaii)
• Other Cotoneaster species have become invasive
• Fruit reported to be toxic to humans
• May increase fire risk in fire prone habitats
• Tolerates many soil types
• Forms dense stands that exclude & shade other vegetation
• Reproduces by seeds
• Apomictic
• Reaches maturity in 2 years
• Seeds dispersed by birds, pigs, dumped garden waste & intentionally by people
• Prolific seed production (densities unknown)
• Able to resprout after cutting

Low Risk / Desirable Traits
• Unarmed (no spines, thorns, or burrs)
• Ornamental used
• Not reported to spread vegetatively (although resprouts & suckers if cut)
• Herbicides provide effective control