Taxon: Salix cinerea L. **Family:** Salicaceae

Common Name(s): common sallow
gray sallow
gray willow
pussy willow

Synonym(s): Salix acuminata Mill.
Salix aquatica Sm.
Salix cinerea f. tricolor Dippel

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 1 Feb 2018

WRA Score: 9.0 **Designation:** H(HPWRA) **Rating:** High Risk

Keywords: Riparian Shrub, Environmental Weed, Dioecious, Suckers, Wind-Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
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
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)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
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	n
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	n
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-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
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

Qsn #	Question	Answer Option	Answer
302	Garden/amenity/disturbance weed	n=0, y = 1*multiplier (see Appendix 2)	n
303	Agricultural/forestry/horticultural weed		
303	Agricultural/forestry/horticultural weed		
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	y
305	Congeneric weed	n=0, y = 1*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
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic		
402	Allelopathic		
403	Parasitic	y=1, n=0	n
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	n
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n

Qsn #	Question	Answer Option	Answer
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
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
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	n
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	2
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
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
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant		
703	Propagules likely to disperse as a produce contaminant		
704	Propagules adapted to wind dispersal	y=1, n=-1	y
704	Propagules adapted to wind dispersal	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
705	Propagules water dispersed	y=1, n=-1	y
706	Propagules bird dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
708	Propagules survive passage through the gut	y=1, n=-1	y

Qsn #	Question	Answer Option	Answer
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
801	Prolific seed production (>1000/m2)	y=1, n=-1	y
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides	y=-1, n=1	y
803	Well controlled by herbicides	y=-1, n=1	y
804	Tolerates, or benefits from, mutilation, cultivation, or fire	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)		
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[No evidence of domestication] "It is a Eurasian species, commonly distributed throughout Europe, from the Mediterranean to Scandinavia, and extending eastward to Asia, from Crimea to the Caucasus, from northern Iran to Siberia and north of the Caspian and Aral seas to the Chinese border (Jalas and Suominen, 1976; Skvortsov, 1999)."

102	Has the species become naturalized where grown?	
	Source(s)	**Notes**
	WRA Specialist. 2018. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	**Notes**
	WRA Specialist. 2018. Personal Communication	NA

Qsn #	Question	Answer
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**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"C - Temperate/Mesothermal climate Preferred Average temp. of coldest month > 0°C and < 18°C, mean warmest month > 10°C Cf - Warm temperate climate, wet all year Preferred Warm average temp. > 10°C, Cold average temp. > 0°C, wet all year Cs - Warm temperate climate with dry summer Preferred Warm average temp. > 10°C, Cold average temp. > 0°C, dry summers Cw - Warm temperate climate with dry winter Preferred Warm temperate climate with dry winter (Warm average temp. >10°C, Cold average temp. > 0°C, dry winters)"
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 1 Feb 2018]	"Native Africa Northern Africa: Algeria ; Libya Asia-Temperate Caucasus: Azerbaijan Middle Asia: Kazakhstan Siberia: Russian Federation-Western Siberia Western Siberia Western Asia: Turkey Europe Eastern Europe: Belarus ; Estonia ; Latvia ; Lithuania ; Moldova ; Russian Federation-European part European part; Ukraine Middle Europe: Austria ; Belgium ; Czech Republic ; Germany ; Hungary ; Netherlands ; Poland ; Slovakia ; Switzerland Northern Europe: Denmark ; Finland ; Norway ; Sweden ; United Kingdom England Southeastern Europe: Albania ; Bosnia and Herzegovina ; Bulgaria ; Croatia ; Greece ; Italy ; Macedonia ; Montenegro ; Romania ; Serbia ; Slovenia Southwestern Europe: France ; Spain"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 1 Feb 2018]	

203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Climatic amplitude (estimates) - Altitude range: 0 - 1200 m - Mean annual rainfall: 400 - 2500 mm - Rainfall regime: summer; bimodal - Dry season duration: 0 - 2 months - Mean annual temperature: 0 - 15ºC - Mean maximum temperature of hottest month: 15 - 23ºC - Mean minimum temperature of coldest month: -10 - 5ºC - Absolute minimum temperature: > -30ºC"
	Flora of North America Editorial Committee. 2010. Flora of North America: North of Mexico, Volume 7. Magnoliophyta: Salicaceae to Brassicaceae. Oxford University Press, Oxford, UK	"Stream shores, mesic woodlands, gravelly or sandy beaches, waste ground; 0-700 m; introduced; Ont.; Ala., Conn., D.C., Ga., Iowa, Ky., La., Md., Mass., Mich., Mo., N.J., N.Y., N.C., Ohio, Pa., R.I., S.C., S.Dak., Tenn., Utah, Va., W.Va., Wis.; Eurasia."
	Plants for a Future. 2018. Salix cinerea. http://pfaf.org/user/Plant.aspx?LatinName=Salix+cinerea. [Accessed 1 Feb 2018]	"USDA hardiness 2-7" [Able to grow 5+ hardiness zones]

204	Native or naturalized in regions with tropical or subtropical climates	n
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"S. cinerea is a temperate species and can tolerate hard and persistent frost. Being a riparian species, it can also tolerate a wide variety of rainfall regimes as long as the soil in which is grows is permanently moist or wet."

205	Does the species have a history of repeated introductions outside its natural range?	y
	Source(s)	**Notes**
	Lansdown, R.V. 2014. Salix cinerea. The IUCN Red List of Threatened Species 2014: e.T19620468A19621296. http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T19620468A19621296.en. [Accessed 1 Feb 2018]	"Introduced: Australia (New South Wales, South Australia, Tasmania, Victoria, Western Australia); Canada (Nova Scotia, Ontario - Native); New Zealand (North Is., South Is.); United States (Alabama, District of Columbia, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Virginia, West Virginia, Wisconsin)"
	Fosberg, F.R. 1974. Specimen Details for Salix cinerea L. ID Number 646423. Collection Number 55469 - 15 Apr 1974. Bishop Museum, Honolulu, HI. http://nsdb.bishopmuseum.org/. [Accessed 1 Feb 2018]	"USA - Hawaii - Maui - East Maui, N of Pulehu Gulch, Upper Kula Road. near junction with Haleakala highway Gazetteered [-1409960688]"

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 1 Feb 2018]	"Naturalized Australasia Australia: Australia New Zealand: New Zealand"

Qsn #	Question	Answer
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2018. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/. [Accessed 1 Feb 2018]	No evidence in Hawaiian Islands to date

302	Garden/amenity/disturbance weed	n
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Environmental weed] "S.cinerea was introduced from its native Eurasia mainly for riverbank stabilization. It is now a serious threat to riparian and wetland environments in New Zealand, southeastern Australia and increasingly in parts of the east and northeast USA, one of the most invasive of several weedy Salix spp. it can spread profusely via seed and stem fragments, one or the other noted as prevalent in different areas, forming monocultures and crowding out native vegetation, and autumn leaf-fall is thought to affect water quality."

303	Agricultural/forestry/horticultural weed	
	Source(s)	**Notes**
	Beasley, R.R. and Pijit, P.M. (2010). Invasive plant species in hardwood tree plantations. FNR-230-W. USDA Forest Service, Northern Research Station, Hardwood Tree Improvement & Regeneration Center, & Purdue University, Department of Forestry & Natural Resources.	"Table 1. Invasive species commonly found in tree plantations and forested areas in the Central Hardwood Region." [Includes Salix cinerea. Impacts unspecified]
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Weed of: Cereals, Forestry, Orchards & Plantations"
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Primarily reported as an environmental weed] "The cost of willow management is about $2 million per year in Victoria, Australia alone, and control costs in New South Wales and New Zealand may also be expected to be equally high. However, Salix spp. play a vital role in flood prevention and erosion control, and there are no known suitable alternatives (Harman, 2004)."

304	Environmental weed	y
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Salix cinerea. https://keyserver.lucidcentral.org. [Accessed 1 Feb 2018]	"Grey sallow (Salix cinerea) is regarded as a significant environmental weed in Victoria, and as an environmental weed in the ACT, Tasmania and New South Wales. It is one of the willows that, as a group, are regarded as a Weed of National Significance (WoNS). These species are primarily of concern along waterways, in wetlands and around other waterbodies. They compete strongly for space, water and nutrients, eventually displacing the native vegetation in the habitats they invade. Unlike many of the other willows, grey sallow (Salix cinerea) also invades other habitats away from water, including heathlands, heathy woodlands, alpine and sub-alpine vegetation, the understorey or mature pine plantations."

Qsn #	Question	Answer
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. cinerea was introduced from its native Eurasia mainly for riverbank stabilization. It is now a serious threat to riparian and wetland environments in New Zealand, southeastern Australia and increasingly in parts of the east and northeast USA, one of the most invasive of several weedy Salix spp. it can spread profusely via seed and stem fragments, one or the other noted as prevalent in different areas, forming monocultures and crowding out native vegetation, and autumn leaf-fall is thought to affect water quality. "
	Weber, E. 2017. Invasive Plant Species of the World, 2nd Edition: A Reference Guide to Environmental Weeds. CABI Publishing, Wallingford, UK	"The tree competes for space, water and nutrients. Stands of the tree eliminate native vegetation by shading out and accumulate sediment, which in turn alters the shape of banks, stream beds and channels."

305	Congeneric weed	y
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Although willows (Salix spp.) are much appreciated for their various benefits, concern has grown over the past decade about their invasive natural spread in the water courses of southeastern Australia. The main environmental effects include obstruction and diversion of streams and hence erosion, extensive displacement of native vegetation with loss of biodiversity, and reductions in the quantity and quality of water. So far, only a few thousand kilometres of streams have been infested badly; that is less than 10% of potential willow habitat. Except for some of the S. cinerea infestations, it is still possible and worthwhile to control the willows in Australia."
	Henderson, L. (1991). Alien invasive Salix spp. (willows) in the grassland biome of South Africa. South African Forestry Journal, 157(1), 91-95	"Roadside surveys of alien plant invaders in the grasslands of the Transvaal, Natal, Orange Free State and eastern Cape showed that several alien Salix species (willows) are naturalized along watercourses in these regions. Salix babylonica, the weeping willow, and S. fragilis, one of the basket willows, are the most prominent species. S. babylonica is the most widespread woody riverine invader in the grasslands of South Africa. S. fragilis (fide R.D. Meikle) is less widely distributed but prominent in the high grasslands of the northeastern Orange Free State, southern Natal and north-eastern Cape. Both species have, in places, formed pure stands along whole river reaches. Although S. babylonica has been planted at dams and along riverbanks its extensive occurrence along watercourses is most likely due to self (vegetative) propagation and dispersal by floodwaters. It is probable that S. fragilis is propagated and dispersed in the same manner. Although aesthetically pleasing and having many beneficial qualities the alien willows also pose a potential threat to the conservation of indigenous riparian species and may alter the hydrology of the watercourses they invade."

401	Produces spines, thorns or burrs	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Flora of North America Editorial Committee. 2010. Flora of North America: North of Mexico, Volume 7. Magnoliophyta: Salicaceae to Brassicaceae. Oxford University Press, Oxford, UK	[No evidence] "Shrubs, 3-7 m. Stems: branches brownish, not glaucous, pilose, villous, or tomentose to glabrescent, (peeled wood with striae to 62 mm); branchlets yellow-brown, pilose, velvety, or densely villous. Leaves: stipules rudi-mentary or foliaceous on early ones, foliaceous on late ones, apex acute or rounded; petiole convex to flat adaxially, 4-15 mm, tomentose adaxially; largest medial blade elliptic, broadly elliptic, oblanceolate, or obovate, 65-105 × 22-52 mm, 2-3 times as long as wide, base convex or cuneate, margins slightly revolute, entire, crenate, or sinuate, (glands submarginal), apex acuminate or convex, abaxial surface glaucous, tomentose, hairs erect or spreading, curly, adaxial dull or slightly glossy, pubescent or tomentose; proximal blade margins entire; juvenile blade yellowish green, sparsely to densely tomentose abaxially, hairs white. "

402	Allelopathic	
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	No evidence provided
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	Unknown. Not mentioned among impacts

403	Parasitic	n
	Source(s)	**Notes**
	Flora of North America Editorial Committee. 2010. Flora of North America: North of Mexico, Volume 7. Magnoliophyta: Salicaceae to Brassicaceae. Oxford University Press, Oxford, UK	"Shrubs, 3-7 m." [Salicaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**
	Szmidt, A. (1975). Food preference of roe deer in relation to principal species of forest trees and shrubs. Acta Theriologica, 20(20), 255-266	"... S. amygdalina and S. cinerea belonged to the most willingly consumed species."
	Dzięciołowski, R. (1970). Foods of the red deer as determined by rumen content analyses. Acta Theriologica, 15(6), 89-110	"In descending order of importance the five species most important to red deer in all the three environments were Pinus silvestris, Juniperus communis, Calluna vulgaris, Salix sp. (mainly S. cinerea), and Vaccinium sp."
	Dzięciołowski, R. (1974). Selection of browse twigs by moose. Acta Theriologica, 19(18), 273-281	"Vaccinium vitis-idaea, V. myrtillus, Pirus communis, Rubus idaeus, and Salix cinerea were classed as high preference browse on a yearlong basis."

405	Toxic to animals	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Szmidt, A. (1975). Food preference of roe deer in relation to principal species of forest trees and shrubs. Acta Theriologica, 20(20), 255-266	"... S. amygdalina and S. cinerea belonged to the most willingly consumed species." [No evidence]
	Plants for a Future. 2018. Salix cinerea. http://pfaf.org/user/Plant.aspx?LatinName=Salix+cinerea. [Accessed 1 Feb 2018]	"Known Hazards None known"
	Dzięciołowski, R. (1974). Selection of browse twigs by moose. Acta Theriologica, 19(18), 273-281	[No evidence] "Vaccinium vitis-idaea, V. myrtillus, Pirus communis, Rubus idaeus, and Salix cinerea were classed as high preference browse on a yearlong basis."
	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 evidence

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	Victorian Resources Online. 2018. Impact Assessment - Grey sallow (Salix cinerea) in Victoria (Nox). http://vro.agriculture.vic.gov.au. [Accessed 1 Feb 2018]	"Disease host/vector? Not found in the extensive literature."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Harman (2004) includes a thorough list of insects recorded as attacking Salix spp. and S. cinerea in particular. Also, a list of 76 diseases found on Salix spp. in New Zealand is included in Harman (2004), who noted that only Melampsora epitea was specific, though it was also recorded on S. cinerea × viminalis, and S. reichardtii (pussy willow), a cross that contains S. cinerea. The self-introduced willow sawfly (Nematus oligospilus) damages many different willow species as well as poplars in New Zealand, with the host range being wider than was first anticipated (Harman, 2004). S. cinerea does not appear, however, to be suppressed by natural enemies in New Zealand, although an extensive number of invertebrates and diseases have been recorded from Salixspecies in the Northern Hemisphere. Some of these are highly damaging pests of commercially grown species such as S. viminalis, suggesting potential for reducing vigour and reproduction of S. cinerea."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Plants for a Future. 2018. Salix cinerea. http://pfaf.org/user/Plant.aspx?LatinName=Salix+cinerea. [Accessed 1 Feb 2018]	"Known Hazards None known"
	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 evidence

408	Creates a fire hazard in natural ecosystems	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Where willows grow densely, their shade tends to eliminate nearly all undergrowth and hence the fuels produced by such undergrowth. As the foliage and twigs shed by willows decay rapidly in moist sites, there is usually not enough fuel to carry fires into willow thickets. Such thickets thus tend to exclude any wild fires that burn the adjacent native bush or pastures."

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"It cannot grow in the shade."
	Weedbusters. 2018. Grey Willow. - Salix cinerea. http://www.weedbusters.org.nz/weed-information/salix-cinerea/59/. [Accessed 1 Feb 2018]	"Tolerates flooding, hot to cold temperatures, range of soils, and semi-shade."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"In New Zealand, S. cinerea 'has invaded most swamp areas throughout the country' (van Kraayenoord et al. 1995) where it now dominates large areas. It grows on a wide range of soils and can tolerate permanent water logging, poor aeration and a pH down to 3.5 (West 1994)."

411	Climbing or smothering growth habit	n
	Source(s)	**Notes**
	Wu, Z. Y. & Raven, P. H. (eds.) 1999. Flora of China. Vol. 4 (Cycadaceae through Fagaceae). Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis	"Shrubs to 5 m tall; bark dull gray. Branchlets densely gray tomentose."

412	Forms dense thickets	y
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. cinerea was introduced from its native Eurasia mainly for riverbank stabilization. It is now a serious threat to riparian and wetland environments in New Zealand, southeastern Australia and increasingly in parts of the east and northeast USA, one of the most invasive of several weedy Salix spp. it can spread profusely via seed and stem fragments, one or the other noted as prevalent in different areas, forming monocultures and crowding out native vegetation, and autumn leaf-fall is thought to affect water quality. "

Qsn #	Question	Answer
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Willows can seriously obstruct streams because their seedlings can establish thickets on exposed wet sediments and they can invade shallow water by the layering of branches and toppling of over mature, live stems. This will obstruct and divert floods with possible erosion of floodplains, roads and bridges." ... "The largely negative impacts are due to the fact that willows, unlike nearly all native plants: produce dense shade during the growing season. This eliminates most native terrestrial plants growing beneath and inhibits aquatic plants."

501	Aquatic	n
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	[Not aquatic, but can invade margins of aquatic habitats] "Willows in their native ranges occur in permanently or seasonally wet, inundated or waterlogged sites, and S. cinerea in the UK is found in fenland, carrs and occasionally in damp woods especially as sunny edges. Unlike other Salix spp., however, S. cinerea is the only one recorded to invade non-riparian habitats such as wetlands and drainage lines, and is found invading swamps, riverbanks and also wet areas behind coastal dunes. It may also become dominant in swampy areas in New Zealand (Roy et al., 2005). Harman (2004) noted that both subspecies, ssp. cinerea and, to a much lesser extent, ssp. oleifolia, are found in swamps, riverbanks, and other wet areas, and Cremer (2003) noted it as invasive in riparian habits, brackish wetlands on coastlands, wet forests, alpine bogs, disturbed and undisturbed lands."

502	Grass	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 1 Feb 2018]	"Family: Salicaceae"

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2018. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 1 Feb 2018]	"Family: Salicaceae"

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Flora of North America Editorial Committee. 2010. Flora of North America: North of Mexico, Volume 7. Magnoliophyta: Salicaceae to Brassicaceae. Oxford University Press, Oxford, UK	"Shrubs, 3-7 m. Stems: branches brownish, not glaucous, pilose, villous, or tomentose to glabrescent, (peeled wood with striae to 62 mm); branchlets yellow-brown, pilose, velvety, or densely villous. Leaves: stipules rudi-mentary or foliaceous on early ones, foliaceous on late ones, apex acute or rounded; petiole convex to flat adaxially, 4-15 mm, tomentose adaxially; largest medial blade elliptic, broadly elliptic, oblanceolate, or obovate, 65-105 × 22-52 mm, 2-3 times as long as wide, base convex or cuneate, margins slightly revolute, entire, crenate, or sinuate, (glands submarginal), apex acuminate or convex, abaxial surface glaucous, tomentose, hairs erect or spreading, curly, adaxial dull or slightly glossy, pubescent or tomentose; proximal blade margins entire; juvenile blade yellowish green, sparsely to densely tomentose abaxially, hairs white. "

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	Lansdown, R.V. 2014. Salix cinerea. The IUCN Red List of Threatened Species 2014: e.T19620468A19621296. http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T19620468A19621296.en. [Accessed 1 Feb 2018]	"This species is classed as Least Concern as it is widespread with stable populations and does not face any major threats."

602	Produces viable seed	y
	Source(s)	**Notes**
	Harman, H.M. 2004. Feasibility of biological control of grey willow Salix cinerea. DOC Science Internal Series 183. Department of Conservation, Wellington, New Zealand	"Both subspecies, cinerea and, to a much lesser extent, oleifolia, are found in swamps, riverbanks, and other wet areas. Both sexes occur in New Zealand, and reproduction is almost exclusively by seed that is capable of very wide dispersal (Ladson et al. 1997; ARMCANZ et al. 2000)."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Ripe fruits open when dry, and the movement of cottony hairs levers seed out, accelerated by wind. Seed will germinate on and under water and tiny seedlings can survive under water for up to a month but cannot grow until exposed to air (Cremer, 2003)."

603	Hybridizes naturally	y
	Source(s)	**Notes**
	PlantNET. 2017. New South Wales Flora Online - Salix x reichardtii. National Herbarium of NSW, Royal Botanic Garden, Sydney. http://plantnet.rbgsyd.nsw.gov.au. [Accessed 1 Feb 2018]	"Hybrid taxon involving Salix caprea x S. cinerea subsp. oleifolia or subsp. cinerea."
	Clift, S. H. 2008. Weeds of National Significance. Willow Identification An essential skill for successful willow management. Department of Primary Industries, State Government of Victoria. weeds.ala.org.au/WoNS/willows/	"Hybridisation between willows generally only occurs between plants within the same subgenus . Almost all willows are able to hybridise with at least one or more other willows, so long as they flower at the same time and fertile male and female plants grow near enough for pollination to occur." ... "Salix x reichardtii" ... "Male only, but may hybridise with female S. cinerea"

Qsn #	Question	Answer
	Harman, H.M. 2004. Feasibility of biological control of grey willow Salix cinerea. DOC Science Internal Series 183. Department of Conservation, Wellington, New Zealand	"Naturalised hybrids in New Zealand include S. cinerea: S. × reichardtii (S. caprea and S. cinerea) and S. × calodendron (S. caprea and S. cinerea, and S. viminalis) (Van Kraayenord et al. 1995). Although it is relatively easy to produce willow hybrids artificially (Thompson & Reeves 1994), natural hybridisation probably does not occur frequently in the native ranges of willows (Thompson & Reeves 1994; Van Kraayenord et al. 1995). The situation in New Zealand may be more complex because species, often originating from different geographic regions, have been brought into contact in new environments where barriers to hybridisation, such as differing flowering times, may be broken. This has been the case in Australia, where introduced willows have been described as 'especially promiscuous', and a number of streams have become dominated by swarms of varied hybrids of unknown parentage (Cremer 1999)."
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. cinerea is able to hybridize with other members of subgenus Vetrix."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. cinerea is a dioecious species, and both male and female flowers are highly attractive to bees, and as such considered to be commonly pollinated by insects such as the introduced European bee (Apis spp.) or native bees (Cremer, 1999) though maybe partly pollinated by wind. "

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"S. cinerea is a dioecious species, and both male and female flowers are highly attractive to bees, and as such considered to be commonly pollinated by insects such as the introduced European bee (Apis spp.) or native bees (Cremer, 1999) though maybe partly pollinated by wind. "
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Willows are predominantly pollinated by insects, and perhaps partly by wind (Argus 1986). In Australia, both male and female willow flowers are highly attractive to European bees (Apis) as well as native bees. Although bees may fly up to 3 or 5 km to collect pollen and nectar (nectar is produced by both male and female willows), crosspollination is usually considered to be restricted to much smaller distances, such as 50 m (Free 1970). However, two sets of female willows were found to produce many viable seeds in each of two years (but not in two other years), even though the nearest compatible male was 1 km away in both cases. To be reasonably sure to prevent pollination, willow males should thus be separated from females by at least 2 km."

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"- Ability to sucker"

Qsn #	Question	Answer
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"All willows in Australia generally flower in September and October, with fruit maturing a month later (CRC Weed Management, 2003), and S. cinerea as with most other willows will tolerates waterlogging and can sucker."
	Weedbusters. 2018. Grey Willow. - Salix cinerea. http://www.weedbusters.org.nz/weed-information/salix-cinerea/59/. [Accessed 1 Feb 2018]	"Seeds spread by the wind, and stem fragments and occasionally seed are spread by water. Suckers locally."
	Queensland Government. (2018). Weeds of Australia. Salix cinerea. https://keyserver.lucidcentral.org. [Accessed 1 Feb 2018]	"This species reproduces by seed and vegetatively via the rooting of detached twigs or branches."

607	Minimum generative time (years)	2
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Flowering and the production of viable seed may begin as soon as 2 or 3 years after germination, provided that the plant is at least 1 m tall if it is a shrub willow, or 2 m tall if it is a tree willow. If growth is slower, flowering begins later and, in some taxa, flowering tends to begin at larger sizes anyway,"
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Flowering and the production of viable seed may begin from 2-3 years old."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y
	Source(s)	**Notes**
	Queensland Government. (2018). Weeds of Australia. Salix cinerea. https://keyserver.lucidcentral.org. [Accessed 1 Feb 2018]	"The light and fluffy seeds are easily dispersed by wind and water, while twigs and branches may be spread during floods, by machinery, during removal, and in dumped garden waste."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Long distance dispersal has been due to intentional introduction and planting, largely for riverbank erosion control, and it continues to be promoted as such."

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Although establishment from seed transported by water is certainly possible (see above), transport by wind is far more important. The tiny seed with its fluffy parachute is superbly adapted to float even in the slightest breeze, and much of it travels for kilometres."
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	"Major Pathway/s: Contaminant, Forestry, Herbal, Ornamental" [Unable to confirm that produce contamination is a dispersal vector for this species]
	Weedbusters. 2018. Grey Willow. - Salix cinerea. http://www.weedbusters.org.nz/weed-information/salix-cinerea/59/. [Accessed 1 Feb 2018]	"Seeds spread by the wind, and stem fragments and occasionally seed are spread by water. Suckers locally. Planted intentionally on stream and river banks and also in damp places to absorb water."

704	**Propagules adapted to wind dispersal**	**y**
	Source(s)	**Notes**
	CABI. 2018. Invasive Species Compendium. Wallingford , UK: CAB International. www.cabi.org/isc	"Ripe fruits open when dry, and the movement of cottony hairs levers seed out, accelerated by wind."
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Seed is easily carried by wind for more than 1 km, and some travels up to 50 or even 100 km."
	Harman, H.M. 2004. Feasibility of biological control of grey willow Salix cinerea. DOC Science Internal Series 183. Department of Conservation, Wellington, New Zealand	"The prolific production of light wind-dispersed seed is probably an important factor in the invasiveness of this species."

705	**Propagules water dispersed**	**y**
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Transport of seed or live branches by streams also serves to spread willows, but is less effective, and only downstream."

706	**Propagules bird dispersed**	**n**
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Willow seeds are highly mobile. There is no evidence for dissemination by insects or animals."

707	**Propagules dispersed by other animals (externally)**	**n**
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Willow seeds are highly mobile. There is no evidence for dissemination by insects or animals."

Qsn #	Question	Answer
708	**Propagules survive passage through the gut**	**y**
	Source(s)	**Notes**
	Ansong, M., & Pickering, C. (2013). A global review of weeds that can germinate from horse dung. Ecological Management & Restoration, 14(3), 216-223	"Of the 2,739 naturalized plants in Australia, 156 (6%) germinate from horse dung. Of the 429 noxious weeds in Australia, 16 have viable seed in horse dung, including two weeds of national significance, the willows Salix nigra and Salix cinerea."

801	Prolific seed production (>1000/m2)	y
	Source(s)	**Notes**
	Flora of North America Editorial Committee. 2010. Flora of North America: North of Mexico, Volume 7. Magnoliophyta: Salicaceae to Brassicaceae. Oxford University Press, Oxford, UK	"In the northeastern states, S. atrocinerea and S. cinerea are thought to be invasive species. The species do reproduce by seed and hundreds of seedlings were observed in a drained reservoir (A. Zinovjev, pers. comm.) and on sandy pond shores (T. Rawinski, pers. comm.), where they are thought to compete with native species."
	Hopley, T. D. (2011). Reproductive ecology and dispersal dynamics of the invasive willow, Salix cinerea, in south-eastern Australia. PhD Dissertation. The Australian National University, Canberra	"Mean seed production was found to be higher than 300,000 seeds per tree across sites and years and is driven by tree size and flowering effort."
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	[Potentially Yes] "With, say, 30 flowers per catkin and 50 000 catkins on a large crown, and a potential of several seeds per flower, there could be several million seeds per tree. The actual observed seed production has, however, been less than that potential. It typically ranged from zero, where the catkins produced only fluff that did not shed, to 'ample' where the fluff extruded readily (leaving the fruits empty), and contained more than 10 seeds per catkin. Willow seed production in Australia is mainly from hybridisation. It does not depend on having both sexes of the same species."

802	Evidence that a persistent propagule bank is formed (>1 yr)	n
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"- Seed storage recalcitrant"
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"In most willows, the seed lives for only 1 to 9 weeks when kept dry and at room temperature, unless it is stored at subzero temperatures (McLeod and McPherson 1973). The longevity in Australia of seed of S. x rubens, S. nigra and S. cinerea was found to be about 2, 3 and 6 weeks, respectively."

803	Well controlled by herbicides	y
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"The main method is injection of stems with the weedicide Glyphosate. Details of this and other methods are given in Cremer (1999) and in Trounce and Cremer (1997). Painting of freshly cut stems with Glyphosate is particularly effective and the spraying of foliage of shorter plants (< 2 m tall) is often effective as well."

Qsn #	Question	Answer
	Weedbusters. 2018. Grey Willow. - Salix cinerea. http://www.weedbusters.org.nz/weed-information/salix-cinerea/59/. [Accessed 1 Feb 2018]	"What can I do to get rid of it? Begin control at top of catchment, treat every stem. 1. Cut and squirt (summer-autumn): Make 1 cut every 100mm around the trunk and saturate with undiluted glyphosate (10 ml) or 2,4-D ester (20 ml). 2. Cut stump application: apply picloram gel. Remove all plant material from site as all cut stems can root where they fall. 3. Bore and fill (summer-autumn): Make 1 hole every 100 mm around the trunk and saturate each hole with undiluted glyphosate (10ml) or metsulfuron-methyl 600g/kg (2ml of 20g/L) or undiluted 2,4-D ester (20ml). 4. Frilling (summer-autumn): glyphosate (100ml/L) or 2,4-D ester (200ml/L). 5. Spray (full leaf stage only): glyphosate (12.5ml/L + penetrant, total coverage needed) or metsulfuron-methyl 600 g/kg (35g/100L from January to April before leaf fall begins)."

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**
	Weedbusters. 2018. Grey Willow. - Salix cinerea. http://www.weedbusters.org.nz/weed-information/salix-cinerea/59/. [Accessed 1 Feb 2018]	"Cut stumps regrow rapidly. Best to poison while standing to avoid live stem contact with ground. Prevent grazing and other disturbance. Interplanting can follow if non-spray follow up control options used."
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"Recovery after fire. Willows cope with fire surprisingly well. Where fire is able to reach the stems, the willows are easily girdled (ringbarked) by fire, because their bark is thin, unless the trunks are thick (> 40 cm). However, unless they are old, girdled willows usually produce shoots. In burnt trees, these shoots come from buried portions of the stems."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24	"One reason why willows may thrive in foreign lands is relative freedom there from pests and diseases. Even so, willows in Australia and New Zealand have acquired quite a few maladies (Spiers 1989), especially the leaf rust that debilitates S. babylonica in coastal NSW. In 1998 a voracious sawfly began defoliating various tree willows in New Zealand (van Kraayenoord, pers. comm.)."

Qsn #	Question	Answer
	Harman, H.M. 2004. Feasibility of biological control of grey willow Salix cinerea. DOC Science Internal Series 183. Department of Conservation, Wellington, New Zealand	[Unknown for Hawaiian Islands] "The feasibility of biological control of Salix cinerea (grey willow) in New Zealand was investigated. Although there are no native relatives of S. cinerea in New Zealand, other introduced species of both tree and shrub willows are used for soil stabilisation and river bank protection, and damage to any willow species used commercially is unlikely to be accepted. No invertebrates or pathogens currently appear to suppress S. cinerea in New Zealand. An extensive fauna has been recorded on Salix species in the Northern Hemisphere in the native range of S. cinerea. The nematine gall-forming sawflies show potential as biological control agents, with some species reputedly specific to S. cinerea. There could also be as yet unidentified host races of some species in other invertebrate groups, and a species restricted to the reproductive parts of Salix species is also a prospect. Any potential agents will require rigorous testing to determine host range. Of the diseases recorded on Salix species in the Northern Hemisphere, the Melampsora rusts have received much attention because they can devastate valued species. The Melampsora species already in New Zealand, however, may not be effective agents. Other Melampsora species may prove more useful, as may Marssonina. A survey in the native range may reveal other pathogens that could be biological control agents. Development of a mycoherbicide is also possible. Although biological control of S. cinerea in New Zealand may be difficult, this should be weighed against the extreme weediness of the plant. There are prospects for suitable biological control agents, particularly among the gall-formers. A biological control programme is therefore worth pursuing, with initial emphasis on nematine gall-forming sawflies."

Summary of Risk Traits:

High Risk / Undesirable Traits
- Broad climate suitability
- Naturalized in Australia, New Zealand & possibly North America
- An environmental weed in Australia & New Zealand, reducing native biodiversity
- Other Salix species are invasive
- Tolerates many soil types
- Forms dense stands
- Reproduces by seeds & vegetatively by suckers
- Hybridizes with other species
- Reaches maturity in 2-3 years
- Seeds dispersed by wind, water, internally by horses & possibly other browsing animals, & intentionally by people
- Stem fragments dispersed by water
- Prolific seed production
- Able to resprout after cutting

Low Risk Traits
- Native to temperate regions, may limit ability to invade to higher elevations in tropical island ecosystems
- Unarmed (no spines, thorns, or burrs)
- Palatable to deer, moose & potentially other browsing animals
- Non-toxic
- Dioecious
- Recalcitrant seeds lose viability rapidly (within 6 weeks)
- Herbicides provide effective control