**Taxon:** Salix nigra

**Family:** Salicaceae

**Common Name(s):** black willow
swamp willow

**Synonym(s):** Salix falcata Pursh

**Assessor:** Chuck Chimera

**Status:** In Progress

**End Date:** 17 Feb 2015

**WRA Score:** 5.0

**Designation:** EVALUATE

**Rating:** Evaluate

**Keywords:** Naturalized, Environmental Weed, Riparian Tree, Wind-Dispersed, Spreads Vegetatively

| 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) | Intermediate |
| 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 |
| 204 | Native or naturalized in regions with tropical or subtropical climates | | |
| 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 | y=1, n=-1 | n |
| 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 | | |
| 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 |

| Qsn # | Question | Answer Option | Answer |
|---|---|---|---|
| 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 |
| 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 | y=1, n=-1 | y |
| 604 | Self-compatible or apomictic | y=1, n=-1 | n |
| 605 | Requires specialist pollinators | y=-1, n=0 | n |
| 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 | >3 |
| 701 | Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas) | y=1, n=-1 | n |
| 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 | y |
| 705 | Propagules water dispersed | y=1, n=-1 | y |
| 706 | Propagules bird dispersed | 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 | n |
| 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 |
| 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) | | |

**Supporting Data:**

| Qsn # | Question | Answer |
|---|---|---|
| 101 | **Is the species highly domesticated?** | **n** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | [No evidence] "Population differences exist but the magnitude and distribution of the variation of specific characters awaits verification through analysis of provenance and progeny tests. Clonal differences in defoliation of black willow by the cottonwood leaf beetle were noted in experimental plots in Mississippi; feeding was also heavier on the male clones (6). In another study, black willows from two natural stands 160 km (100 mi) apart on the lower reaches of the Mississippi River had significantly different fiber lengths (8)." |

| | | |
|---|---|---|
| 102 | **Has the species become naturalized where grown?** | |
| | **Source(s)** | **Notes** |
| | WRA Specialist. 2015. Personal Communication | NA |

| | | |
|---|---|---|
| 103 | **Does the species have weedy races?** | |
| | **Source(s)** | **Notes** |
| | WRA Specialist. 2015. 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"** | **Intermediate** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | [Marginal] "Black willow is found throughout the Eastern United States and adjacent parts of Canada and Mexico. The range extends from southern New Brunswick and central Maine west in Quebec, southern Ontario, and central Michigan to southeastern Minnesota; south and west to the Rio Grande just below its confluence with the Pecos River; and east along the gulf coast, through the Florida panhandle and southern Georgia." |

| | | |
|---|---|---|
| 202 | **Quality of climate match data** | **High** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | |

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

| Qsn # | Question | Answer |
|---|---|---|
| | Silberhorn, G. 1996. Salix nigra. Wetland Flora Technical Report. No. 96-3. http://ccrm.vims.edu/publications/wetlands_technical_reports/96-3-black-willow.pdf. [Accessed 16 Feb 2015] | [Broad distribution] "Salix nigra is a widely distributed species, ranging from the southern Maritime Provinces of Canada, west to central Minnesota, south to Texas and east to northern Florida. It is found in various types of fresh water wetlands." |
| | Plants for a Future. 2015. Salix nigra, http://www.pfaf.org/user/Plant.aspx?LatinName=Salix+nigra. [Accessed ] | [Grows in 5 hardiness zones] "USDA hardiness zone : 4-8" |

| | | |
|---|---|---|
| **204** | **Native or naturalized in regions with tropical or subtropical climates** | |
| | **Source(s)** | **Notes** |
| | Queensland Government. 2011. Weeds of Australia - Black willow. Salix nigra. http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Salix_nigra.htm. [Accessed 17 Feb 2015] | [SE Queensland may be marginally subtropical] "Widely naturalised in south-eastern Australia (i.e. in many parts of eastern New South Wales and in north-eastern Victoria). Also sparingly naturalised in south-eastern Queensland and possibly naturalised in the ACT." |
| | USDA, ARS, National Genetic Resources Program. 2015. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 17 Feb 2015] | No evidence |

| | | |
|---|---|---|
| **205** | **Does the species have a history of repeated introductions outside its natural range?** | **y** |
| | **Source(s)** | **Notes** |
| | CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK | "S. nigra is not widely cultivated outside its native range. Experimental trials were established in the 1960s in parts of Europe, Australia, and New Zealand, but were most successful in Argentina." [Perhaps not widely cultivated, but still introduced a number of times to other locations outside its native range] |

| | | |
|---|---|---|
| **301** | **Naturalized beyond native range** | **y** |
| | **Source(s)** | **Notes** |
| | CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK | "S. nigra has a tendency to naturalise and become a weed in Australia." |

| Qsn # | Question | Answer |
|---|---|---|
| 302 | Garden/amenity/disturbance weed | n |
| | Source(s) | Notes |
| | Queensland Government. 2011. Weeds of Australia - Black willow. Salix nigra. http://keyserver.lucidcentral.org/weeds/data/03030800-0b07-490a-8d04-0605030c0f01/media/Html/Salix_nigra.htm. [Accessed 17 Feb 2015] | [Environmental Weed] "Black willow (Salix nigra) is regarded as an environmental weed in New South Wales and Victoria, and as a potential environmental weed in the ACT. It is one of the willows (Salix spp.) that together as a group are regarded as a Weed of National Significance (WoNS). This species was deliberately introduced and cultivated for the stabilization of creekbanks. It is now becoming an invasive woody weed of these areas, and also has the potential to become a major invader of swamps and wetlands." |

| | | |
|---|---|---|
| 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 | Environmental Weed. See 3.04 |

| | | |
|---|---|---|
| 304 | Environmental weed | y |
| | Source(s) | Notes |
| | Stokes, K. E. (2008). Exotic invasive black willow (Salix nigra) in Australia: influence of hydrological regimes on population dynamics. Plant Ecology, 197(1), 91-105 | "In Australia invasive S. nigra is classified as a Weed of National Significance (ARMCANZ 2000), due to detrimental impacts on riparian environments (Cremer 1999; Stokes and Cunningham 2006),..." |
| | Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24 | "Invasion by seed : colonisation of exposed stream sediments by multitudes of willows (in this case the aggressive S. nigra) can dominate the riparian environment to the exclusion of native species, block flood channels, divert floods and cause erosion of land and structures" |

| | | |
|---|---|---|
| 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." |

| Qsn # | Question | Answer |
|---|---|---|
| | 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 north-eastern 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** |
| | 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] "Trees, 5-20+ m. Stems: branches highly brittle at base, red-brown to yellow-brown, glabrous; branchlets gray-brown to red-brown, glabrous or pilose to villous. Leaves: stipules rudimentary or foliaceous on early ones, usually foliaceous on late ones, (glands few or absent adaxially), apex acuminate, acute, or rounded; petiole (margins covering groove, with spherical glands distally), (2-)3-10(-15) mm, glabrous or pilose adaxially; largest medial blade (sometimes amphistomatous), very narrowly elliptic, lanceolate to narrowly lanceolate, or linear to lorate, (50-)70-103(-190) × (6-)7.5-17(-23) mm, 6-13 times as long as wide, base cuneate to convex, margins serrulate, apex acuminate, acute, or caudate, abaxial surface (not glaucous), glabrous or pilose, hairs white or ferruginous, wavy, adaxial slightly glossy, glabrous or pilose (especially on midribs); proximal blade margins serrulate; juvenile blade glabrous or pilose abaxially, hairs white and/or ferruginous." |

| | | |
|---|---|---|
| **402** | **Allelopathic** | |
| | **Source(s)** | **Notes** |
| | Ahmed, W., Ahmad, M., Mushtaq, N., Rauf, A., & Khan, Z. (2014). Phytotoxic and leishmanicidal activity of Salix nigra. International Journal of Biosciences (IJB), 5(7): 75-79 | [Unknown] "Salix nigra is a member of family Salicaceae and has been planted frequently to help stabilize the banks of eroding streams, to hold the soil in road cuts and embankments, and to bind shifting sands. The plant has also been used for its antiperiodic, antipyretic, antiseptic, antirheumatic and analgesic effects. The current research was aimed to evaluate the in vitro phytotoxic and leishmanicidal effects of the methanolic extract of plant. Our results showed that the methanolic crude extract of Salix nigra possess remarkable phytotoxic & leishmanicidal activity which might be due to the presence of bioactive constituents in the plant's extract." |

| Qsn # | Question | Answer |
|---|---|---|
| **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 | "Trees, 5-20+ m" [No evidence. Salicaceae] |

| Qsn # | Question | Answer |
|---|---|---|
| **404** | **Unpalatable to grazing animals** | **n** |
| | **Source(s)** | **Notes** |
| | USDA NRCS. 2010. Plant Fact Sheet - Black Willow - Salix nigra. http://plants.usda.gov/factsheet/pdf/fs_sani.pdf.. [Accessed 5 Feb 2015] | "Domestic grazing animals browse in willow thickets. Elk and beaver browse on willow leaves in the summer and willow twigs in the winter." |
| | Silberhorn, G. 1996. Salix nigra. Wetland Flora Technical Report. No. 96-3. http://ccrm.vims.edu/publications/wetlands_technical_reports/96-3-black-willow.pdf. [Accessed 16 Feb 2015] | "In addition to serving as cover and nesting areas for birds, the bark, tender twigs and buds are food for browsers such as deer, rabbits and beaver." |
| | Castleberry, S. B., Ford, W. M., Miller, K. V., & Smith, W. P. (1999). White-tailed deer browse preferences in a southern bottomland hardwood forest. Southern Journal of Applied Forestry, 23(2), 78-82 | "We examined spring and summer use of woody browse by white-tailed deer (Odocoileus virginianus) in forest gaps created by group selection timber harvest in a South Carolina bottomland hardwood forest during 1995 and 1996. Percent available twigs browsed, relative abundance, and relative use were calculated for each species with more than 50 twigs sampled. We used chi-square analysis to rate species as preferred, proportional, or low use. Total percent browsed was low in both years (2.5% in 1995; 3.0% in 1996). In 1995, 6 species were rated as high use, 4 species as proportional use, and 10 species as low use. In 1996, 6 species were rated as high use, 7 as proportional use, and 9 as low use. Species ratings generally were in agreement with other food habits studies in the Southeast. Preferred browse species included red maple (Acer rubrum), winged elm (Ulmus alata), greenbrier (Smilax spp.), and black willow (Salix nigra). The low rates of browsing probably were due to low use of the study area by deer during the growing season. Deer browsing likely had little impact on regeneration of most species in this bottomland hardwood forest. " |

| Qsn # | Question | Answer |
|---|---|---|
| **405** | **Toxic to animals** | **n** |
| | **Source(s)** | **Notes** |
| | USDA NRCS. 2010. Plant Fact Sheet - Black Willow - Salix nigra. http://plants.usda.gov/factsheet/pdf/fs_sani.pdf.. [Accessed 17 Feb 2015] | [No evidence of toxicity] "Domestic grazing animals browse in willow thickets. Elk and beaver browse on willow leaves in the summer and willow twigs in the winter." |
| | Castleberry, S. B., Ford, W. M., Miller, K. V., & Smith, W. P. (1999). White-tailed deer browse preferences in a southern bottomland hardwood forest. Southern Journal of Applied Forestry, 23(2), 78-82 | [No evidence of toxicity] "Preferred browse species included red maple (Acer rubrum), winged elm (Ulmus alata), greenbrier (Smilax spp.), and black willow (Salix nigra)." |
| | Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL | No evidence |

| Qsn # | Question | Answer |
|---|---|---|
| 406 | Host for recognized pests and pathogens | |
| | Source(s) | Notes |
| | USDA NRCS. 2010. Plant Fact Sheet - Black Willow - Salix nigra. http://plants.usda.gov/factsheet/pdf/fs_sani.pdf.. [Accessed 5 Feb 2015] | "A number of insect species attack black willow but few cause serious damage, such as, forest tent caterpillar, cotton wood leaf beetle, willow sawfly, stem borers, and twig borers." |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Several insects attack live willow but few cause serious damage. The forest tent caterpillar (Malacosoma disstria), the gypsy moth (Lymantria dispar), the cottonwood leaf beetle (Chrysomela scripta), the willow sawfly (Nematus ventralis), and the imported willow leaf beetle (Plagiodera versicolora) sometimes partially, occasionally completely, defoliate willow trees, reducing growth but seldom killing. Stem borers, such as the cottonwood borer (Plectrodera scalator) attack willows and may kill by girdling the base. Twig borers, like the willow-branch borer (Oberea ferruginea), feed on the branches and cause deformities that may be undesirable in ornamentals. Insects are frequently the vectors for disease organisms. Willow blight, the scab and black canker caused by Pollaccia saliciperda, is transmitted by borers. Members of the genus Salix are the only known hosts. Phytophthora cactorum causes bleeding canker, lesions on the lower trunk that discharge a dark-colored, often slimy liquid. Confined to the phloem and cambium area, it can result in death if the canker girdles the trunk. Cytospora chrysosperma causes canker in poplar and willow. Under forest conditions, cytospora canker is of little consequence but when trees become weakened by drought, competition, or neglect, losses can be heavy. In nursery beds, losses of up to 75 percent of cuttings have been reported. Leaf rust caused by Melampsora spp. is common on seedlings throughout the range of black willow. Mistletoes (Phoradendron spp.) damage and deform but seldom kill willows." |

| Qsn # | Question | Answer |
|---|---|---|
| 407 | Causes allergies or is otherwise toxic to humans | |
| | Source(s) | Notes |
| | Pollen Library. 2015. Black Willow (Salix nigra). http://www.pollenlibrary.com/Specie/Salix+nigra/. [Accessed 17 Feb 2015] | [Susceptible individuals may be allergic to pollen] "Allergenicity: Black Willow (Salix nigra) is a severe allergen." |
| | Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL | No reports of toxicity |

| Qsn # | Question | Answer |
|---|---|---|
| 408 | Creates a fire hazard in natural ecosystems | n |
| | Source(s) | Notes |
| | Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24 | [No evidence] "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." |

| Qsn # | Question | Answer |
|---|---|---|
| 409 | Is a shade tolerant plant at some stage of its life cycle | n |
| | **Source(s)** | **Notes** |
| | CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK | "S. nigra is a very shade-intolerant, pioneer species that generally occurs in pure, even-aged stands on fine-textured soils on newly exposed mud flats along major rivers." ... "Because of its narrow requirements for successful seed germination and its extreme intolerance to shade, S. nigra does not succeed itself naturally and is generally replaced by more shade-tolerant riverfront hardwood species." |

| | | |
|---|---|---|
| 410 | Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island) | y |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Black willow is most commonly associated with the soil order Entisols, particularly the Haplaquents and Fluvaquents derived from alluvium. Willow grows on almost any soil, but its extensive, shallow roots need an abundant and continuous supply of moisture during the growing season." |
| | Stokes, K. E. (2008). Exotic invasive black willow (Salix nigra) in Australia: influence of hydrological regimes on population dynamics. Plant Ecology, 197(1), 91-105 | "Eco-physiological information indicates S. nigra prefers wet soils near water courses, has low-water use efficiency and is prone to drought-induced leaf abscission (McLeod and McPherson 1973; McLeod et al. 1986; Pitcher and McKnight 1990)." |
| | CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK | Soil descriptors<br>- Soil texture: light; medium; heavy<br>- Soil drainage: impeded; seasonally waterlogged<br>- Soil reaction: acid; neutral; alkaline<br>- Soil types: swamp soils |

| | | |
|---|---|---|
| 411 | Climbing or smothering growth habit | 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 | "Trees, 5-20+ m. Stems: branches highly brittle at base, red-brown to yellow-brown, glabrous; branchlets gray-brown to red-brown, glabrous or pilose to villous." |

| | | |
|---|---|---|
| 412 | Forms dense thickets | y |
| | **Source(s)** | **Notes** |
| | CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK | "S. nigra is a very shade-intolerant, pioneer species that generally occurs in pure, even-aged stands on fine-textured soils on newly exposed mud flats along major rivers. These dense, pure stands tend to stagnate early because individual S. nigra trees do not assert dominance very well. Consequently, natural mortality is very high." |

| | | |
|---|---|---|
| 501 | Aquatic | n |
| | **Source(s)** | **Notes** |

| Qsn # | Question | Answer |
|---|---|---|
| | CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK | [Terrestrial, but in riparian habitat] "S. nigra is a very shade-intolerant, pioneer species that generally occurs in pure, even-aged stands on fine-textured soils on newly exposed mud flats along major rivers." |

| | | |
|---|---|---|
| **502** | **Grass** | **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 | Salicaceae |

| | | |
|---|---|---|
| **503** | **Nitrogen fixing woody plant** | **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 | Salicaceae |

| | | |
|---|---|---|
| **504** | **Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)** | **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 or trees, heterophyllous or not, sometimes clonal, forming clones by root shoots, rhizomes, layering, or stem fragmentation; glabrous or glabrescent to pubescent; branching monopodial or sympodial. Stems erect to pendent; branched. Leaves persistent, deciduous or marcescent, alternate (opposite or subopposite in Salix purpurea), spirally arranged, simple; stipules present or not; petiole present; blade margins toothed or entire, sometimes glandular. Peduncles present or absent." |

| | | |
|---|---|---|
| **601** | **Evidence of substantial reproductive failure in native habitat** | **n** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Black willow is found throughout the Eastern United States and adjacent parts of Canada and Mexico. The range extends from southern New Brunswick and central Maine west in Quebec, southern Ontario, and central Michigan to southeastern Minnesota; south and west to the Rio Grande just below its confluence with the Pecos River; and east along the gulf coast, through the Florida panhandle and southern Georgia." |

| | | |
|---|---|---|
| **602** | **Produces viable seed** | **y** |
| | **Source(s)** | **Notes** |

| Qsn # | Question | Answer |
|---|---|---|
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Seed production usually starts when the trees are about 10 years old, although viable seeds can be obtained at younger ages. Optimum seed-bearing age is from 25 to 75 years. The trees have good seed crops almost every year, with only a few interspersed poor crops and rare failures resulting from late freezes after flower buds have begun to open. Large volumes of seeds are produced; they average 5 million/kg (2.3 million/lb). When the seeds fall, the long silky hairs act as wings to carry the seeds very long distances. The seeds are widely disseminated by wind and water." |

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| **603** | **Hybridizes naturally** | **y** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Although the genus Salix is widely distributed and many species occupy sympatric ranges, natural hybrids apparently are not common (3). Putative hybrids are difficult to verify since the identity of one parent is often uncertain. The following willows hybridize with Salix nigra: Salix alba (S. x hankensonii Dode), S. amygdaloides (S. x glatfelteri Schneid.), S. bonplandiana, S. caroliniana, S. lucida (S. x schneideri Boivan), and S. sericea." |
| | 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 | "Salix nigra forms natural hybrids with S. alba, S. amygdaloides, S. caroliniana, S. gooddingii, and S. lucida." |

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| **604** | **Self-compatible or apomictic** | **n** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Black willow is dioecious. No consistently reliable morphological characteristics are associated with the identification of the sexes. Male and female are indistinguishable except during flowering and seed development." |

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| **605** | **Requires specialist pollinators** | **n** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "The many-flowered catkins usually appear at the time of or immediately preceding leafing out. Pollination is mainly by insects; the flowers contain nectar. Pollen is also carried by winds." |
| | USDA NRCS. 2010. Plant Fact Sheet - Black Willow - Salix nigra. http://plants.usda.gov/factsheet/pdf/fs_sani.pdf.. [Accessed 5 Feb 2015] | "The willows are among the first plants to provide honey bees, after long winters, with nectar and pollen." |
| | 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." |

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| **606** | **Reproduction by vegetative fragmentation** | **y** |

| Qsn # | Question | Answer |
|---|---|---|
| | **Source(s)** | **Notes** |
| | Stokes, K. E. (2008). Exotic invasive black willow (Salix nigra) in Australia: influence of hydrological regimes on population dynamics. Plant Ecology, 197(1), 91-105 | "Salix nigra can reproduce via seed or vegetatively; in most cases ramets remain intact underground but occasionally the initial stem rots and the second stem survives, an event detectable by the residual presence of the initial stem stump. Salix nigra plants are also capable of re-rooting from detached root and shoot fragments." |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Willows also sucker readily. Under certain conditions, an essentially pure willow stand of 1 or more hectares (2.5 acres) may consist of relatively few clones." |

| Qsn # | Question | Answer |
|---|---|---|
| **607** | **Minimum generative time (years)** | **>3** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | [ca. 10 years] "Seed production usually starts when the trees are about 10 years old, although viable seeds can be obtained at younger ages. Optimum seed-bearing age is from 25 to 75 years." |

| Qsn # | Question | Answer |
|---|---|---|
| **701** | **Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)** | **n** |
| | **Source(s)** | **Notes** |
| | Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24 | [Unlikely. No means of external attachment] "Willow seeds are highly mobile. There is no evidence for dissemination by insects or animals." |

| Qsn # | Question | Answer |
|---|---|---|
| **702** | **Propagules dispersed intentionally by people** | **y** |
| | **Source(s)** | **Notes** |
| | USDA NRCS. 2010. Plant Fact Sheet - Black Willow - Salix nigra. http://plants.usda.gov/factsheet/pdf/fs_sani.pdf.. [Accessed 5 Feb 2015] | "Ornamental: Black willow can be planted as an ornamental where a fine-textured shade tree is desired. It will tolerate dry soils with reduced vigor." |

| Qsn # | Question | Answer |
|---|---|---|
| **703** | **Propagules likely to disperse as a produce contaminant** | **n** |
| | **Source(s)** | **Notes** |
| | Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24 | [No evidence] "Willow seeds are highly mobile. There is no evidence for dissemination by insects or animals." |

| Qsn # | Question | Answer |
|---|---|---|
| **704** | **Propagules adapted to wind dispersal** | **y** |
| | **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. Cremer (1999) showed that the seed of S. nigra has spread this species to 50 or 100 km in all directions since it was planted at Tumut some three decades earlier." |

| Qsn # | Question | Answer |
|---|---|---|
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "When the seeds fall, the long silky hairs act as wings to carry the seeds very long distances. The seeds are widely disseminated by wind and water." |

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| **705** | **Propagules water dispersed** | **y** |
| | **Source(s)** | **Notes** |
| | Cremer, K., Kraayenoord, C. V., Parker, N., & Streatfield, S. 1995. Willows spreading by seed-implications for Australian river management. Australian Journal of Soil and Water Conservation (4): 18-27 | "Except for S. cinerea (which has spread not only along rivers, but also into swamps, and even into moist forest), and S. nigra (which has spread along rivers as well as road ditches), willows have regenerated only on the continuously wet bare margins of rivers." |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "When the seeds fall, the long silky hairs act as wings to carry the seeds very long distances. The seeds are widely disseminated by wind and water." |

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| **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." |

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|---|---|---|
| **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." |

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|---|---|---|
| **708** | **Propagules survive passage through the gut** | **n** |
| | **Source(s)** | **Notes** |
| | Cremer, K. W. (2003). Introduced willows can become invasive pests in Australia. Biodiversity, 4(4), 17-24 | [Unlikely. No evidence of ingestion or internal dispersal] "Willow seeds are highly mobile. There is no evidence for dissemination by insects or animals." |

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|---|---|---|
| **801** | **Prolific seed production (>1000/m2)** | **y** |
| | **Source(s)** | **Notes** |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "The trees have good seed crops almost every year, with only a few interspersed poor crops and rare failures resulting from late freezes after flower buds have begun to open. Large volumes of seeds are produced; they average 5 million/kg (2.3 million/lb)." |

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| **802** | **Evidence that a persistent propagule bank is formed (>1 yr)** | **n** |
| | **Source(s)** | **Notes** |

| Qsn # | Question | Answer |
|---|---|---|
| | 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." |
| | Cremer, K., Kraayenoord, C. V., Parker, N., & Streatfield, S. 1995. Willows spreading by seed-implications for Australian river management. Australian Journal of Soil and Water Conservation (4): 18-27 | "Their seeds live only a few days, and need favourable conditions as soon as they fall, around November, and for several weeks or months thereafter." |
| | Burns, R.M. & Honkala, B.H. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. | "Unless the willow seed is floating on water, it must reach the seedbed within 12 to 24 hours because viability is greatly reduced by only a few days of dry conditions. Germination is epigeal. Germinative capacity is usually high and no dormancy is known." |

| 803 | **Well controlled by herbicides** | **y** |
|---|---|---|
| | **Source(s)** | **Notes** |
| | CRC Weed Management. 2003. Weed Management Guide - Willow (Salix spp.) http://www.environment.gov.au/biodiversity/invasive/weeds/publicat ons/guidelines/wons/pubs/salix.pdf. [Accessed 17 Feb 2015] | "Herbicides available for woody weeds are effective in controlling willow. Trees can be killed by stem injection, application to leaves and stems, bark (chemical girdling) and cut and paint methods (check with state/territory agencies for current recommendations). In dry conditions herbicide can also be applied by basal bark spraying and treatment of seedlings. Although stem injection may be a slower, more laborious method, it is an important option for avoiding chemical runoff and protecting native vegetation." |

| 804 | **Tolerates, or benefits from, mutilation, cultivation, or fire** | **y** |
|---|---|---|
| | **Source(s)** | **Notes** |
| | CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK | "- Tolerates fire; waterlogging; frost<br>- Ability to sucker; regenerate rapidly; coppice; pollard" |
| | USDA NRCS. 2010. Plant Fact Sheet - Black Willow - Salix nigra. http://plants.usda.gov/factsheet/pdf/fs_sani.pdf.. [Accessed 5 Feb 2015] | "Black willow is very susceptible to fire. Hot fires can kill entire stands of willows. Black willow will sprout at the base following fire." |

| 805 | **Effective natural enemies present locally (e.g. introduced biocontrol agents)** | |
|---|---|---|
| | **Source(s)** | **Notes** |
| | WRA Specialist. 2015. Personal Communication | Unknown |

**Summary of Risk Traits:**

High Risk / Undesirable Traits
• Broad climate suitability
• Naturalized in Australia
• Regarded as an environmental weed of riparian environments in Australia
• Other Salix species have become invasive in Australia
• Tolerates many soil types (as long as moisture content is high)
• Able to form pure stands
• Produces viable seeds
• Able to hybridize with other Salix species
• Able to sucker and spread by vegetative fragments
• Seeds dispersed by wind and water, & intentionally by people
• Prolific seed production in native range
• Able to coppice & resprout after cutting or fires

Low Risk Traits
• A temperate species that may only pose a threat to higher elevations of tropical islands
• Unarmed (no spines, thorns or burrs)
• Palatable to a variety of browsing animals
• Non-toxic to animals and people (although pollen may be an allergen)
• Ornamental
• Shade-intolerant
• Dioecious (and therefore self-incompatible)
• Reaches maturity in 10+ years
• Seeds lose viability quickly
• Herbicides provide effective control

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Yes. Shade-intolerant, but able to form pure stands in native range
(B) Bird- OR clearly wind-dispersed?> Yes. Wind-dispersed seeds
(C) Life cycle < 4 years? No. 10+ years to maturity
Outcome = Evaluate Further