Large Grey Willow (*Salix cinerea*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, December 2014
Revised, October 2018
Web Version, 9/16/2021

Organism Type: Plant
Overall Risk Assessment Category: High

Photo: Robert Vidéki/Bugwood.org. Licensed under Creative Commons BY-NC 3.0. Available: https://www.invasive.org/browse/detail.cfm?imgnum=5395906. (October 18, 2018).

1 Native Range and Status in the United States

Native Range

From CABI (2018):

"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)."

According to GISD (2017), *Salix cinerea* is native to Albania, Austria, Azerbaijan, Belarus, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Ex-Yugoslavia, Finland, France, Germany, Greece, Hungary, Italy, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Netherlands, Norway, Poland, Romania, Russian Federation, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

Status in the United States

According to USDA, NRCS (2018), *Salix cinerea* is introduced in Alabama, Connecticut, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Virginia, West Virginia, and Wisconsin.

From CABI (2018):

"It had been noted as spreading along riverbanks in eastern USA in the 1990s, but it was only noticed as an invasive species in Massachusetts, USA in 2005, though was assumed to have been present for many decades (USDA Forest Service, 2006), and it is possible that it remains an unidentified invasive elsewhere in the USA or in other countries."

No records of *Salix cinerea* in trade in the United States were found.

Means of Introductions in the United States

From GISD (2017):

"Introduced in the early period of European settlement and widely planted in many wet areas for soil reclamation and stabilization (Royal New Zealand Institute of Horticulture 2005)."

Remarks

From GISD (2017):

"*S. cinerea* forms hybrids with other shrub willows (Australian Department of the Environment and Heritage, 2003)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

According to WFO (2021) *Salix cinerea* L. is the accepted name for this species.

From ITIS (2018):

Kingdom Plantae
  Subkingdom Viridiplantae

Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Rosanae
Order Malpighiales
Family Salicaceae
Genus *Salix*
Species *Salix cinerea* L.

Size, Weight, and Age Range

From GISD (2017)

"*Salix cinerea* is a small tree that can reach heights of 10m but is typically found to be a small shrub of only 1-2m in height."

Environment

From Cremer (2003):

"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)."

Climate

From CABI (2018):

"*S. cinerea* is a temperate species and can tolerate hard and persistent frost."

CABI (2018) lists the latitude range for *Salix cinerea* as 66-37°N.

Distribution Outside the United States

Native

From CABI (2018):

"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)."

According to GISD (2017), *Salix cinerea* is native to Albania, Austria, Azerbaijan, Belarus, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Ex-Yugoslavia, Finland, France, Germany, Greece, Hungary, Italy, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Netherlands, Norway, Poland, Romania, Russian Federation, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.

Introduced
From Cremer (2003):

"*S. cinerea* – This is the most invasive willow in Australia. The spread by seed of male and female *S. cinerea*, in the eastern half of Victoria, is largely beyond control. It is not confined to riparian habitats but ranges extensively also to brackish wetlands at the coast, through wet forests, to alpine bogs, in disturbed as well as undisturbed sites in National Parks and many other places (Carr 1996 and pers. comm.). In NSW it is at present known only at five places and probably is still controllable. In Tasmania there is a still manageable spread south of Hobart. In New Zealand, *S. cinerea* 'has invaded most swamp areas throughout the country' (van Kraayenoord et al. 1995) where it now dominates large areas."

According to GISD (2017), *Salix cinerea* is alien, invasive, and established in Australia and New Zealand.

From GISD (2017):

"Most *Salix* spp. are amonst [*sic*] Australias [*sic*] Weeds of National Significance."

"In New Zealand *S. cinerea* readily spread from seed. Thompson et al. (1994) recorded that *S. cinerea* in one wetland increased from a few bushes in the 1940s to 1243 ha some 50 years later. They state that this species will dominate wherever there is shallow permanent (or near-permanent) water, and that it spreads faster in areas disturbed by clearing, draining or roading (Cremer, 1999)."

According to CABI (2018), *Salix cinerea* is also introduced to Canada.

DAISIE (2018) lists *S. cinerea* as alien and established in the Azores.

Means of Introduction Outside the United States

From GISD (2017):

"Introduced in the early period of European settlement and widely planted in many wet areas for soil reclamation and stabilisation (Royal New Zealand Institute of Horticulture, 2005)."

Short Description

From Swearingen and Bargeron (2016):

"Appearance
Salix cinerea is a is a [sic] small tree that can reach heights of about 33 ft (10 m) tall. It is generally branched from the base but can form a single trunk. It usually has a broad, rounded to flattened crown. The bark is dark grey-brown and often becomes fissured with age.

“Foliage
The leaves are shiny on the upper surface, with soft grey hairs on the underside. The leaves are usually obovate or broadly oblanceolate, 0.8-3.5 in (2-9 cm) long by 0.4-1.2 in (1-3 cm) wide.

“Flowers
The flower are cylindrical catkins which appear before the leaves in spring. They are about 0.8-1.2 in (2-3 cm) long by 0.2-0.4 in (0.6-1 cm) wide with female catkins longer and narrower than male catkins.

“Fruit
The fruits are small capsules with two valves, containing many tiny seeds.”

From GISD (2017):

“The twigs are dark reddish-brown, which are densely pubescent at first and can remain so for the first year before becoming glabrous or sub-glabrous.”

Biology

From CABI (2018):

“*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. Flowering and the production of viable seed may begin from 2-3 years old. 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).”

Human Uses

From GISD (2017):

“Plants for a Future, (2000) report that, "The fresh bark of all members of this genus contains salicin, which probably decomposes into salicylic acid (closely related to aspirin) in the human body. This is used as an anodyne [pain relief] and febrifuge [fever reduction]. The bark of this species is used interchangeably with *S. alba*. It is taken internally in the treatment of rheumatism, arthritis, gout, inflammatory stages of autoimmune diseases, diarrhea, dysentery, feverish illnesses, neuralgia and headache. The bark is removed during the summer and dried for later use. The leaves are used internally in the treatment of minor feverish illnesses and colic. The leaves can be harvested throughout the growing season and are used fresh or dried.”

Diseases

Poelen et al. (2014) list *Potania pedunculi*, *Polynema vitripenne*, *Asecodes lineophagum*, *Polynema euchariforme*, *Seladerma saurus*, *Gastrancistrus torymiformis*, *Sphegigaster obliqua*, *Tamarixia leptothrix*, *Sphegigaster glabrata*, *Torymus amurensis*, *Elachertus isadas*, *Dimmockia brevicornis*, *Trichomalopsis albopilosus*, *Aprostocetus salictorum*, *Aprostocetus diversus*,

Pachyneuron groenlandicum, *Mesopolodus semiclavatus*, *Pseudencyrtus salicisstrobili*, *Gastrancistrus salicis*, *Achrysocharoides zwoelferi*, *Reikosiella* sp., *Sympiesis gyorfii*, *Pteromalus dolichurus*, *Pediobius alcaeus*, *Chrysocharis laomedon*, *Trichogramma agrotidis*, *Derostenus gemmeus*, *Derostenus punctiscuta*, *Cirrospilus lyncus*, *Sympiesis gordius*, *Chrysocharis elongata*, *Pnigalio longulus*, *Tetrastichus* sp., *Chrysocharis nepherus*, *Cirrospilus diallus*, *Cirrospilus vittatus*, *Pediobius saulius*, *Pnigalio soemius*, *Sympiesis sericeicornis*, *Melampsora caprearum*, *Closterocerus trifasciatus*, *Pnigalio pectinicornis*, *Melampsora epitea*, *Chrysocharis pentheus*, *Quadrastichus brevinervis*, *Erysiphe adunca adnuca*, *Cytidia salicina*, and *Phellinus pomaceus* as parasites and pathogens of *Salix cinerea*.

Threat to Humans

No information found on threats to humans from *Salix cinerea*.

3 Impacts of Introductions

From Eser and Rosen (2000):

"An exotic shrub species, *Salix cinerea* (grey willow), has spread dramatically in the South Taupo Wetland within the last 20 years (Eser 1998). This weed species has displaced the wetland's low-stature vegetation over large areas. An increase in lake levels over several years is likely to drown certain areas of native shrub communities. These communities were found to be most resistant to the colonization of *S. cinerea* (Eser 1998). The destruction of the dense native canopy would allow *S. cinerea* to replace the native shrub species, as *S. cinerea* is tolerant of much higher water tables than the present native shrub species."

From Watts et al. (2012):

"We have evidence that grey willow trees alter the composition of the beetle communities present in the Waikato wetlands we studied. For example, the beetle community composition differed significantly between grey willow-dominated and native wetlands, and this was related to changes in the structural complexity of the vegetation. Those study plots with a higher proportion of native plant species, i.e. the native wetlands, had a high proportion of native beetles present. However, when grey willows dominated, the proportions of native versus introduced beetles changed, with introduced beetles being more common. […] In addition, the functional structure of the beetle community differed between the grey willow-dominated plots and native wetlands. Herbivorous beetles were more commonly caught within native wetland vegetation, while detritivorous beetles dominated the samples from grey willow-dominated wetlands. The dominance of detritivores could result from the increased amounts of CWD [coarse woody debris] within the willow-dominated wetlands."

From Cremer (2003):

"Information on environmental impacts is sketchy but extensive (Bobbi 1999, Ladson et al. 1997). 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. It also decreases the temperature and the oxygen content of the water (with good and bad consequences).
- are deciduous. Leaf inputs to streams are largely restricted to autumn and are massive at this time. This may cause scarcity of food for some organisms at most times, and superabundance in autumn (with consequent anaerobic decay in stagnant waters).
- have underwater roots. These modify the banks, and in shallow streams, cover the ground, eliminating niches for organisms needing shelter in hollows.
- are exotic. Thus willows are a poor link in the food chain for native organisms."

"A draft analysis indicates that willows can critically reduce water supplies in certain situations, for instance, when both the banks and the surface of the river bed are dry but the stream is still flowing underground. Removal of the riparian willows could save some 12 million L/summer per km of stream in such a situation in the Canberra climate, provided that this amount of water would have been readily available to the willows' roots. Such a saving could be locally significant where people depend on extracting water from below the surface of the riverbed. The above estimate is based on the assumption (justified by the results of Myers et al. 1996) that a dense crop of plants tends to use about as much water as would evaporate from a similarly exposed area of water, provided that ample water is readily available to the plants, and the plants do not readily shut their stomata in response to the air's dryness. The roots of willows such as *S. babylonica* and *S. fragilis*, unlike those of most other plants, do indeed grow underwater and effectively follow receding water tables. In a climate like Canberra's, where pan evaporation during December to February averages 7 mm/day, it is calculated that two rows of large willows each with 10 m wide crowns lining a 1 km stretch of river would use 10m x 2 x 1000m x 7mm x 90 days = 12.6 million L/summer."

From GISD (2017):

"Millions of dollars are spent each year on willow control in southeastern Australia using chemical and/or mechanical techniques. In Victoria alone, the cost of willow management is about $2 million annually (Australian Department of the Environment and Heritage, 2003)."

4 History of Invasiveness

Salix cinerea is a willow native to Eurasia. It is alien, invasive, and established in Australia and New Zealand that was introduced in the early period of European settlement and widely planted in many wet areas for soil reclamation and stabilization (Royal New Zealand Institute of Horticulture 2005). Millions of dollars are spent each year on willow control in southeastern Australia using chemical and/or mechanical techniques. The species is also established in the United States. Information on environmental impacts is sketchy but extensive (Bobbi 1999, Ladson et al. 1997). The largely negative impacts are typically impacts on water tables/supplies, crowding native plants, and impacting insect communities. The history of invasiveness for this species is classified as high.

5 Global Distribution

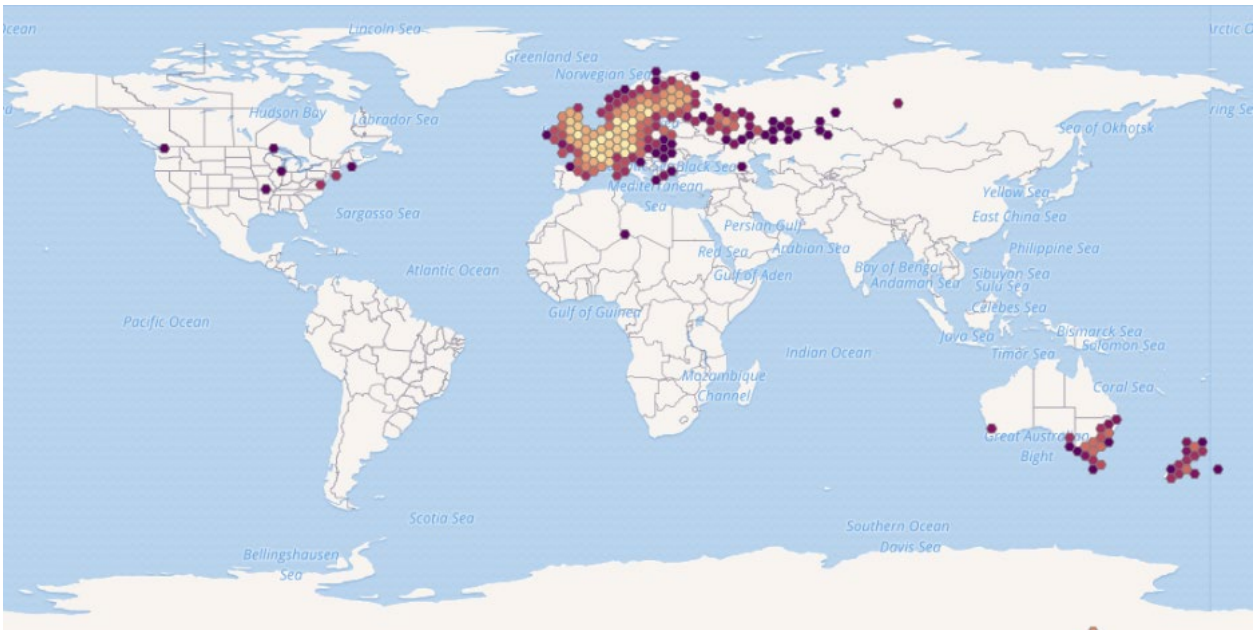

Figure 1. Known global distribution of *Salix cinerea*. Map from GBIF Secretariat (2018). The location in Algeria (northern Africa) was not used as a source point for the climate match. The record information may be erroneous and no other source reports an occurrence of *Salix cinerea* on the African continent.

6 Distribution Within the United States

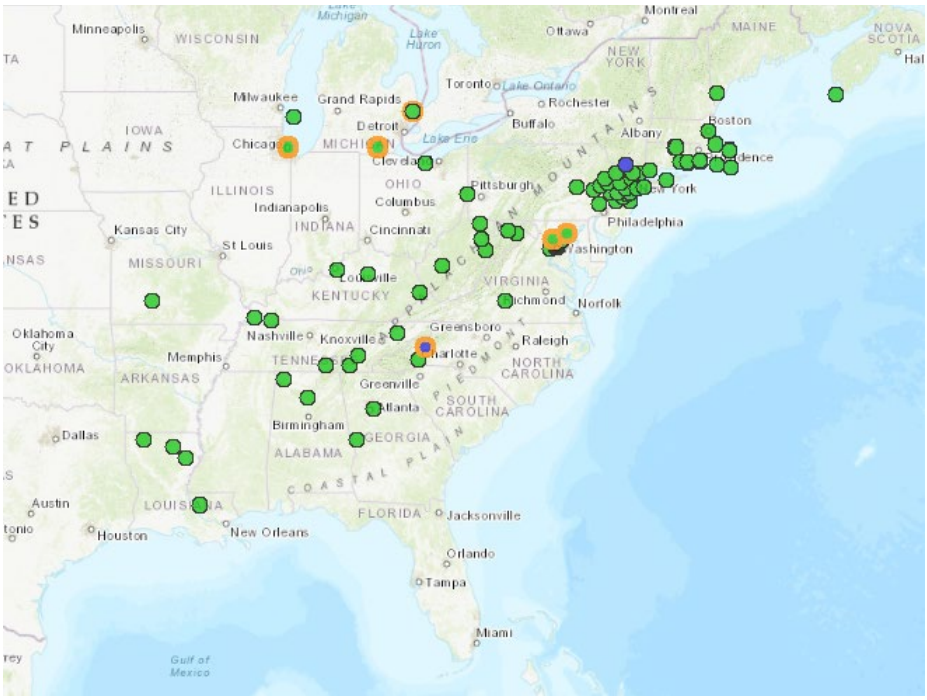

Figure 2. Known distribution of *Salix cinerea* in the United States. Map from BISON (2018).

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Salix cinerea* is high for much of the eastern contiguous United States. It is also high in the upper Midwest, in patches in the Great Plains, and the Pacific Northwest. There are areas of low match in small pockets along the Mexican border, Pacific Coast, and east of the Rocky Mountains. There is a larger area of medium match in southern Nevada. Everywhere else had a medium match. The overall Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for contiguous United States was 0.590, high (scores of 0.103 and greater are considered high). All States had high individual climate scores except for California and Nevada which had medium scores.

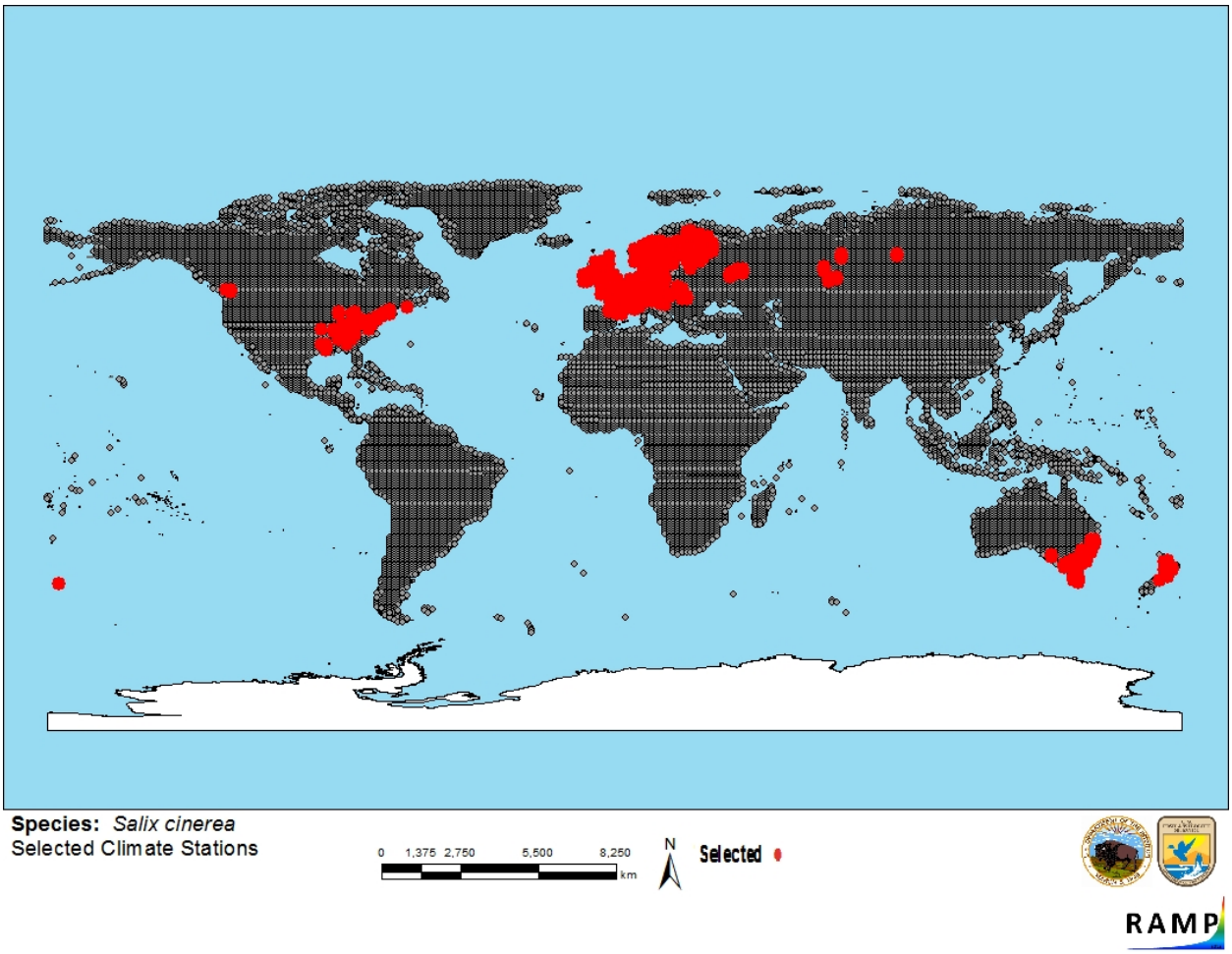

Figure 3. RAMP (Sanders et al. 2018) source map showing weather stations in North America, Eurasia, Australia, and New Zealand selected as source locations (red) and non-source locations (gray) for *Salix cinerea* climate matching. Source locations from BISON (2018) and GBIF Secretariat (2018). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

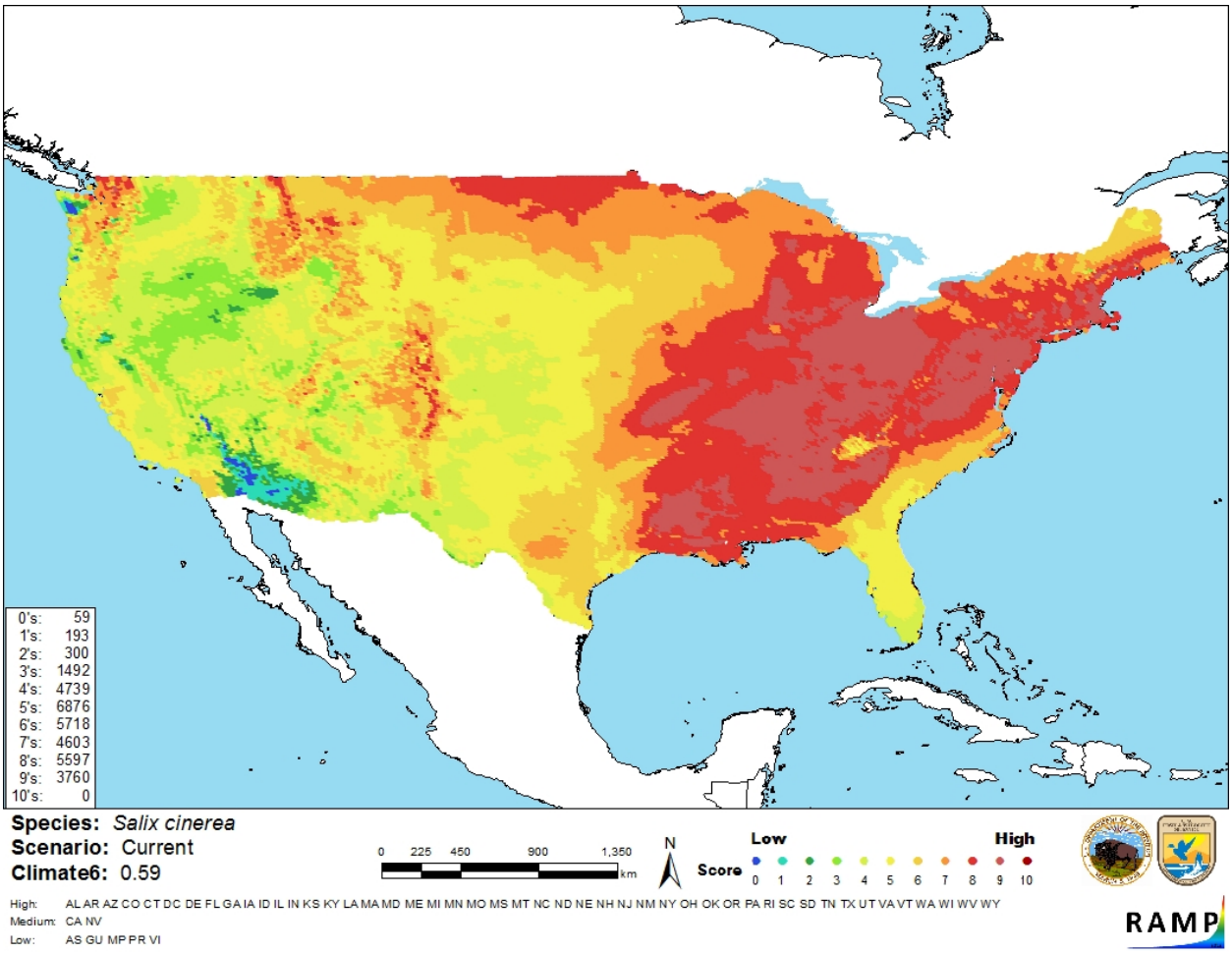

Figure 4. Map of RAMP (Sanders et al. 2018) climate matches for *Salix cinerea* in the contiguous United States based on source locations reported by BISON (2018) and GBIF Secretariat (2018). Counts of climate match scores are tabulated on the left. 0/Blue = Lowest match, 10/Red = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

Information on the biology, invasion history and impacts of *Salix cinerea* is available, including some peer-reviewed literature. There is enough information available to describe the risks posed by this species. Certainty of this assessment is medium.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Large grey willow (*Salix cinerea*) is a woody shrub native to Eurasia. It requires moist soil conditions but can tolerate extended cold temperatures. The bark has been used for medicinal purposes. The history of invasiveness is classified as high. *S. cinerea* has been introduced to and become established in Canada, the United States, Australia, and New Zealand. The species was introduced to prevent erosion. Impacts of invasion include excluding native plant species, alteration of invertebrate communities, alteration of organic matter deposition, and reductions in surface water availability. Climate matching indicated the contiguous United States has a high climate match. The eastern portion of the country had the largest area of high match and already contains established populations of *S. cinerea*. Certainty of this assessment is medium. The overall risk assessment category is high.

Assessment Elements

- **History of Invasiveness (Sec. 4): High**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Medium**
- **Remarks/Important additional information:** No additional information.
- **Overall Risk Assessment Category: High**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 11.

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11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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