U.S. Fish & Wildlife Service

Giant Reed (*Arundo donax*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, December 2023
Revised, May 2024
Web Version, 6/13/2025

Organism Type: Flowering Plant
Overall Risk Assessment Category: High

Photo: Momali. Licensed under CC BY-SA 3.0. Available: https://commons.wikimedia.org/wiki/File:Phragmites_Juybar_iran_2.jpg (December 2023).

1 Native Range and Status in the United States

Native Range

From Lansdown (2013):

"According to the World Checklist of Selected Plant Families (Board of Trustees of the Royal Botanic Gardens, Kew), this species is native only to a fairly narrow area bounded by Cyprus,

Kazakhstan and Turkmenistan in the west, the Gulf States in the south and Japan south to Myanmar in the east."

From Goolsby et al. (2023):

"*Arundo donax* is native to the Old World, possibly from the Iberian Peninsula of Europe to south Asia, including North Africa, the Middle East, the Arabian Peninsula, and the Persian Gulf regions (Hardion et al. 2014, 2015, 2017; Tarin et al. 2013). The true native range is, however, most likely limited to the Indus River basin and surrounding areas of India, Bhutan, Nepal, Pakistan, Afghanistan, Iran, Turkmenistan, and Uzbekistan, extending possibly to the Middle East (Jiménez-Ruiz et al. 2021; Sutton et al. 2021), with areas to the west and east of that area being ancient or modern introductions."

POWO (2023) list the following countries and regions as the native range of *Arundo donax:* Afghanistan, Bangladesh, Cambodia, China (South-Central, Southeast, Hainan), Cyprus, East Himalaya (encompassing parts of Bhutan, China, and India), Egypt (Sinai), Gulf States (Bahrain, Qatar, United Arab Emirates), India (Assam), Iran, Iraq, Japan (major islands, Nansei-shoto, and Ogasawara-shoto), Kazakhstan, Laos, Lebanon-Syria, Myanmar, Nepal, Oman, Pakistan, Palestine (Gaza Strip, Israel, Jordan, West Bank), Tadzhikistan, Thailand, Tibet, Transcaucasus (Armenia, Azerbaijan, Georgia), Turkey, Turkmenistan, Uzbekistan, Vietnam, West Himalaya (encompassing parts of India and Pakistan) and Yemen.

Status in the United States

According to Velez-Gavilan (2024), *Arundo donax* has been introduced and is invasive in Arizona, California, Florida, Georgia, Hawaii, Illinois, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nevada, New Mexico, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, U.S. Virgin Islands, Utah, Virginia, and West Virginia.

According to Velez-Gavilan (2024), *A. donax* has been introduced, with invasive status not recorded, in Alabama, Arkansas, Delaware, Guam, Maryland, and Northern Mariana Islands.

From USDA-APHIS (2016):

"[*Arundo donax*] is now found throughout the southern half of the United States from Maryland to California; however, it is most invasive along muddy banks of creeks and rivers in the southwestern United States."

From Velez-Gavilan (2024):

"It has been cultivated as far north as Washington, DC, and it escaped from cultivation as far north as Virginia and Missouri (McWilliams, 2004)."

From USDA, NRCS (2025):

"Commercial Availability: Routinely Available"

From California Invasive Plant Council (2025):

"Horticultural propagation is widely conducted, and varieties of Arundo are available and commonly used in gardens or for erosion control (Sunset 1967)."

Regulations

Arundo donax is regulated in Arizona (AZDA 2022), California (CDFA 2021), Colorado (CDA 2023), Idaho (IDDA 2022), Nebraska (Nebraska Department of Agriculture 2022), Nevada (Nevada Department of Agriculture 2021), New Mexico (NMDA 2020), Utah (UDAF 2022), and Wisconsin (Wisconsin DNR 2022). Please refer back to state agency regulatory documents for details on the regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family, for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

From Velez-Gavilan (2024):

"It was planted in California, USA between the late 1700s and early 1800s for erosion control in drainage canals and as windbreaks, although it is reported as possibly introduced in the 1500s by Spaniard settlers as a fibre source (Csurhes, 2016). It is also reported as first introduced into USA at Los Angeles, California in the early 1800s, as an ornamental (Hoddle and Goolsby, 2010; Invasive Plant Atlas of the United States, 2023)."

"It is almost certain that invasive populations [along the Rio Grande, Texas, USA, and Mexico] are the result of escapes and displacement of plants from commercial plantations and horticultural propagation. It is spread throughout the southern USA in private gardens […] It is particularly prominent in the coastal river basins in southern California where it […] is thought to have invaded following large storms in the late 1960s."

Remarks

This ERSS was previously published in November 2017. Revisions were completed to incorporate new information and conform to updated standards.

From Velez-Gavilan (2024):

"*Arundo donax* can be confused with the closely related common reeds (*Phragmites australis* or *P. communis*), also with cultivated bamboos, and in its earlier growth stages with some large-stature grasses such as *Elymus* spp. Common reed (*Phragmites* spp.) is, however, less than 4 m tall and has panicles with long hairs between the florets."

"*Arundo donax* is often confused with *Phragmites vallatorius* [*P. karka*], from which it can be distinguished by its membranaceous ligule, and the broader leaves that are cordate at the junction with the sheath (PROTA, 2023)."

There is uncertainty concerning the native range of *Arundo donax.*

From Canavan et al. (2017):

"Arundinoideae is one of the most unresolved grass subfamilies, historically known as the dustbin group by taxonomists (Barker et al. 1995; Hardion et al. 2012; Linder et al. 1997). For *A. donax* this is further complicated by the fact that the reeds are a "cryptogenic species," and thus its true origin is highly debated, as the biogeographic and evolutionary origin of the species is obscured through ancient cultivation (Mariani et al. 2010)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina
Class Magnoliopsida
Superorder Lilianae
Order Poales
Family Poaceae
Genus *Arundo* L.
Species *Arundo donax* L.

According to WFO (2023), *Arundo donax* is the current valid name for this species.

Size, Weight, and Age Range

From Morningstar (2024):

"Up to 6-10m in height (Lambert et al 2010[b]; Oakins 2001; Rieger and Kreager, 1989)"

From GISD (2024):

"*Arundo donax* is a very tall and robust bamboo-like, perennial grass with large, spreading clumps of thick culms to 6.1 m tall. The numerous leaves are about 5 cm wide and 30.5-61 cm long […]"

Environment

From GISD (2024):

"*Arundo donax* is a hydrophyte, and grows best where water tables are near or at the soil surface. It establishes in moist places such as ditches, streams, and riverbanks, growing best in well drained soils where abundant moisture and sunlight is available. *A. donax* has also been demonstrated to prefer areas with enriched nitrogen levels. It tolerates a wide variety of conditions, including high salinity, and can flourish in many soil types from heavy clays to loose sands. It is well adapted to the high disturbance dynamics of riparian systems."

"*Arundo donax* photosynthesizes through C3 fixation which requires abundant sunlight and moisture."

From Velez-Gavilan (2024):

"[…] it does not appear to tolerate high elevations over much of its native and introduced ranges […]"

"It tends to favour low gradients (<2% grade) over steeper and smaller channels, but scattered colonies can be found in moist sites or springs on steeper slopes. It is tolerant to […] a soil pH of 5.0-8.7 (Duke, 1975)."

Climate

From GISD (2024):

"*A. donax* inhabits USDA zones 6-11 (Benton et al, 2006; Ambrose & Rundel, 2007)."

From Velez-Gavilan (2024):

"*Arundo donax* is extremely tolerant to different climates, being adapted to tropical, subtropical and warm temperate climates […] However, it does not […] like continental environments where regular freezing occurs."

"It is tolerant to annual precipitation of 300-4000 mm, annual temperatures of 9-29°C […] It does not grow well in areas subjected to winter frosts, although it has been reported to be hardy to -5 to -10°C. It can survive very low temperatures when dormant, but it is seriously damaged by frost after growth has started (PROTA, 2023)."

From Hopper (2023):

"Dormant plants possess the ability to survive low temperatures down to 7°F but frost after initiation of spring growth can cause serious damage; 220 frost free days a year are required for growth (Perdue 1958; USDA 2017)."

Distribution Outside the United States

Native

From Lansdown (2013):

"According to the World Checklist of Selected Plant Families (Board of Trustees of the Royal Botanic Gardens, Kew), this species is native only to a fairly narrow area bounded by Cyprus, Kazakhstan and Turkmenistan in the west, the Gulf States in the south and Japan south to Myanmar in the east."

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POWO (2023) lists the following countries and regions as the native range of *Arundo donax*: Afghanistan, Bangladesh, Cambodia, China (South-Central, Southeast, Hainan), Cyprus, East Himalaya (encompassing parts of Bhutan, China, and India), Egypt (Sinai), Gulf States (Bahrain, Qatar, United Arab Emirates), India (Assam), Iran, Iraq, Japan (major islands, Nansei-shoto, and Ogasawara-shoto), Kazakhstan, Laos, Lebanon-Syria, Myanmar, Nepal, Oman, Pakistan, Palestine (Gaza Strip, Israel, Jordan, West Bank), Tadzhikistan, Thailand, Tibet, Transcaucasus (Armenia, Azerbaijan, Georgia), Turkey, Turkmenistan, Uzbekistan, Vietnam, West Himalaya (encompassing parts of India and Pakistan) and Yemen.

Introduced

From Goolsby et al. (2023):

"*Arundo donax* is found in at least 99 countries and is invasive across at least 89 countries and islands that are part of countries […]"

"***Mexico***
Arundo donax is found in 27 states (IMTA 2008; Martínez Jiménez et al. 2017) […] from the Baja Peninsula and Chihuahuan and Sonoran deserts in the northwest to the tropical mountain drainages, forests, and grasslands of the Yucatan Peninsula in the southeast."

"***Bermuda to the Caribbean***
Populations of *Arundo donax* occur in the Bahamas, Bermuda, Cuba […], Curacao, Dominica, Dominican Republic, Granada, Haiti, Jamaica, Trinidad and Tobago, St. Kitts and Nevis, and St. Vincent and the Grenadines."

"***Central America***
Arundo donax occurs in Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua […]"

"***South America***
Arundo donax is found in Argentina, Brazil, Bolivia, Chile, Colombia, Ecuador, Peru, Suriname, and Uruguay."

"***Europe***
Populations of *A. donax* occur in Albania, Andorra, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, […] France, Germany, Greece, Italy, Luxembourg, Monaco, Montenegro, Netherlands, Norway, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland […] (Jiménez-Ruiz et al. 2021) […]"

"***Africa***
Arundo donax occurs in Algeria, Botswana, […] Ethiopia, Kenya, Lesotho, Madagascar, Morocco, South Africa, Swaziland, Tanzania, Tunisia, and Zimbabwe […]"

"***Asia and Melanesia***
Arundo donax is found in […] Indonesia, […] Sri Lanka, South Korea, Taiwan […]"

"***Oceania***
Arundo donax was introduced into Australia in the mid-1800s. It has become widespread in Australia, with scattered records from all mainland states and the Northern Territory (Virtue et al. (2010) […] Newspaper articles indicate that *A. donax* was present in New Zealand by the late 1800s (e.g., Anonymous 1894) and naturalized by 1936 (Edgar et al. 1991). *Arundo donax* occurs in both the North and South Islands (NZVH 2022) […] Populations are also known from Fiji, Marshall Islands, Papua New Guinea, Samoa, Seychelles Islands, Tonga, and Vanuatu."

From Canavan et al. (2017):

"It [*Arundo donax*] was deliberately introduced into South Africa in the late 1700s, […] The reed spread throughout the country […] it has since become one of the worst invasive alien species in the country and is now present in all nine provinces (Guthrie 2007; Van der Merwe et al. 1990; van Wilgen et al. 2007)."

According to Velez-Gavilan (2024), *Arundo donax* has also been introduced and is:

- **invasive** in Bangladesh, Canary Islands (Spain), Christmas Island, Easter Island (Chile), French Polynesia, Galapagos Islands (Ecuador), Nauru, New Caledonia, Norfolk Island, Uganda, Palau, Saint Lucia, Singapore, and Wallis and Futuna;
- **naturalized** in Balearic Islands (Spain), Corsica (France), Malta, Madeira (Portugal), and Ukraine; and
- **invasive status not recorded** in Angola, Antigua and Barbuda, Barbados, Belize, Cabo Verde, Canada, Equatorial Guinea, Federated States of Micronesia, French Guiana, Gabon, Guadeloupe, Guinea, Guinea-Bissau, Guyana, Libya, Malaysia, Martinique, Montserrat, Nigeria, Niue, North Macedonia, Philippines, Russia, Saint Helena, Sint Maarten, Slovakia, Somalia, United Kingdom, and Western Sahara.

GISD (2025) also reports *A. donax* as **alien and established** in Cayman Islands, Cook Islands, Gibraltar, Hungary, Namibia, Paraguay, and Venezuela; and **cryptogenic and established** in Indonesia.

Means of Introduction Outside the United States

From Canavan et al. (2017):

"[*Arundo donax*] was deliberately introduced into South Africa in the late 1700s, primarily for erosion control (Guthrie 2007). The reed spread throughout the country as vegetative growth was facilitated by anthropogenic activities, including building of dams and soil stabilization […]"

"*Arundo donax* […] was recorded to have been taken from populations in the Mediterranean in the late 1700s (Milton 2004; Perdue 1958)."

From Velez-Gavilan (2024):

"It is believed that *A. donax* was introduced from Asia via the Middle East to the entire Mediterranean basin in prehistory (McWilliams, 2004; Mariani et al., 2010). It was later exported from the Mediterranean by early French and Spanish colonialists, and widely dispersed, largely by man, into all the subtropical and warm temperate areas of the world."

"*Arundo donax* has been purposefully introduced by man and cultivated into many of the subtropical and warm temperate areas of the world for a number of uses. It is planted as an ornamental and cultivated for a variety of uses including erosion control along ditches and drainage canals. It is available via the nursery trade (Cal-IPC, 2011; Csurhes, 2016; PIER, 2023)."

Short Description

From GISD (2024):

"Arundo donax is a very tall and robust bamboo-like, perennial grass with large, spreading clumps of thick culms to 6.1 m tall. The numerous leaves are about 5 cm wide and 30.5-61 cm long, and arranged conspicuously in two opposing ranks on the culms. The leaves look like those of a corn plant. […] The inflorescence, appearing in late summer, is a 0.3-0.6 m long purplish, aging to silver, plume that stands above the foliage. Giant reed spreads from thick, knobby rhizomes. Once established, it tends to form large, continuous, clonal root masses, sometimes covering several acres. These root masses can be more than 1 m thick. The foliage dries to light brown in the winter and rattles in the wind. Striped giant reed (*A. donax* var. *versicolor*, [sic] has leaves with bold white stripes, and is a smaller plant, to 2.4 m tall (Christman, 2003; McWilliams, 2004)."

Biology

From GISD (2024):

"Reproduction of *Arundo donax* is primarily vegetative by way of rhizomes which root and sprout readily and layering in which stems touching the ground sprout roots. Layering has been demonstrated to expand *A. donax* as much as 7.4 times faster than spread by rhizomes but is thought to only occur within flood zones. *A. donax* tends to form large, continuous, clonal root masses, sometimes covering several acres. It very rarely produces seeds and very little is known about its sexual reproduction (Benton et al, 2006; Boland, 2006; McWilliams, 2004)"

From Moran and Goolsby (2022):

"Seeds are often absent or are sterile."

"The production of viable seed has not been recorded in North America, and all population spread occurs vegetatively through rhizome growth and branching, stem fragments, and rhizome fragments. New stems grow from rhizomes or stem fragments throughout the season, but most commonly in spring. Stems are unbranched the first year but often produce side branches in the second year. Stem growth continues throughout the growing season. In cold climates, stems and leaves turn straw-colored and become dormant over winter, sprouting new stems from rhizomes in spring. In warm areas, stems may remain green and grow year-round. In either climate, when stems fall over and come in contact with the soil or water […], they grow new stems from nodes (layering). Flooding events readily break apart stems and rhizomes of giant reed, and fragments carried downstream often sprout from nodes."

From Hopper (2023):

"*Arundo donax* stems and leaves contain a variety of noxious chemicals which likely protect it from insects and grazers. Chemicals include silica, triterpines, sterols, cardiac glyscoides, curare-mimicking indoles, hydroxamic acid and other alkaloids (Bell 1997; Zúniga et al. 1983). However, corn borers, spider mites, and aphids have been reported to infest the plant (Bell 1997)."

Human Uses

From Lansdown (2013):

"The leaves are considered to have antibiotic properties and a paste may be applied externally in cutaneous affections. The root is considered to be diaphoretic, diuretic, emollient and galactofuge. An infusion is said to stimulate menstrual discharge and diminish milk flow. A paste of the root is applied to the forehead to treat headaches. Isolated alkaloids have been experimentally shown to raise the blood pressure and contract the intestine and uterus. The rhizome or rootstock is used in the treatment of dropsy. Boiled in wine with honey, the root or rhizome has been used for treating cancer. The plant contains the alkaloid gramine which is said to be a vasopressor, raising the blood pressure in dogs after small doses, causing a fall in larger doses. The stems have been used as splints for broken limbs. Other uses include basketry,

biomass, broom, dye, hedge, as a musical instrument, paper; pipes, plant support, soil stabilization, thatching, weaving and windbreak."

From Hopper (2023):

"*Arundo donax* is of "great promise" for the development of novel drugs for human diseases (Al-Snafi 2015). It has also shown potential for nutrient removal from wastewater and phytoremediation of heavy metals from water (Liao et al. 2017; Mirza et al. 2010; Papazoglou et al. 2004)."

From GISD (2024):

"*Arundo donax* is grown as an ornamental for the its [sic] striking appearance, purplish stems, and for the huge feather-like panicles of purplish flowers. It is the largest and tallest ornamental grass other than bamboo, and the tallest grass that can be grown outside the tropics. The large, thick and fluffy flower plumes are used in floral arrangements."

From Velez-Gavilan (2024):

"*Arundo donax* has been extensively cultivated throughout Asia, southern Europe, North Africa and the Middle East for thousands of years and has been planted widely in North and South America and Australasia in the past century (Perdue, 1958; Zohary, 1962). Subsequent plantings have been made for the production of reeds for a variety of musical instruments including bassoons and bagpipes. […] It can offer good yields of 15-40 t dry matter/ha. It can be used for energy production (Duke, 1983), fibre production (e.g. cellulose for rayon manufacture), paper pulp production, materials for basketwork, living barriers such as garden fences and trellises, crude shelters, building and roofing material, erosion control or bank stabilization, arrows, fishing rods and livestock fodder (PROTA, 2023)."

"Culinary uses include the cooking of the rhizomes, young shoots and leaves. The rhizomes are dried and ground to make bread, usually in conjunction with cereal flours (PROTA, 2023)."

"With the recent upsurge in demand for biofuels that is likely to continue, interest in *A. donax* as a very fast-growing source of biomass is increasing, and further introductions and/or plantations are to be expected. However, the debate as to possible demerits of establishing potential invasive biofuel species will continue (e.g. Raghu et al., 2006; Low and Booth, 2007)."

From USDA, NRCS (2025):

"Commercial Availability: Routinely Available"

From California Invasive Plant Council (2025):

"Horticultural propagation is widely conducted, and varieties of Arundo are available and commonly used in gardens or for erosion control (Sunset 1967)."

Diseases

From Goolsby et al. (2023):

"*Arundo donax* is an alternate host for several viruses of crop plants (Tracy and DeLoach 1999) and also of several fungi that are plant pathogens (Duke 1983). Surveys in California indicated that it is a host plant for the blue-green sharpshooter [*Graphocephala atropunctata* (Signoret); Hemiptera: Cicadellidae], which can vector the bacterium that causes Pierce's disease of grapes (*Vitis vinifera* L. or other species/hybrids) (Herrera and Dudley 2003). An adventive leaf-feeding aphid [*Melanaphis donacis* (Passerini); Hemiptera: Aphididae] is known from California (Dudley et al. 2008), South America (Underraga et al. 2020), and South Africa (Canavan et al. 2019) and is spreading invasively in the native range of *A. donax* in Pakistan (Amin et al. 2019), where it is considered a pest on that plant as well as on common reed [*Phragmites australis* (Cav.) Trin. ex Steud.; syn.: *Phragmites communis* Trin.] and on some members of the Rosaceae. A total of 14 other aphid species occur on *A. donax* across the world, including several pests of sugarcane (*Saccharun officinarum* L.), wheat (*Triticum aestivum* L.), and other crops (Blackman and Eastop 2022). Dudley et al. (2008) reported stem tip-mining and rot damage indicative of the adventive presence of a *Cryptonevra* sp. fly species (Diptera: Chloropidae)."

Poelen et al. (2014) lists the following as parasites or pathogens of *Arundo donax: Aphelinus varipes, Cerchysius subplanus, Cheiloneurus boldyrevi, Endobia donacis, Eupelmus muellneri, Eurytoma steffani, Gugolzia harmolitae, Lathromeris cecidomyiiae, Melanaphis donacis, Muscidifurax, Rakosina deplanata,* and *Tetramesa romana*

Threat to Humans

From Hopper (2023):

"In Southern California *Arundo donax* creates a fire hazard which is a hazard to human health and property. It also alters hydrology, forcing streams in new directions which can result in areas becoming designated as high flood risk increasing insurance costs and reducing property value (Oakins 2001)."

From GISD (2024):

"The leaves look like those of a corn plant. Their margins are sharp to the touch and can cut careless hands."

3 Impacts of Introductions

From Goolsby et al. (2023):

"*Arundo donax* has numerous adverse effects on the physical characteristics of riparian ecosystems. In the United States (Cushman and Gaffney 2010; Decruyenaere and Holt 2005) and South Africa (Henderson 2001), *A. donax* has been designated as a "transformer" species in the region due to its ability to alter the structure, integrity, and functioning of the ecosystems that it invades. Dense stands reduce the carrying capacity of waterways by narrowing channels in the southwestern United States (Cal-IPC 2020) […] and in South Africa (Guthrie 2007; Holmes et

al. 2005). During flood events, the shallow rhizomes destabilize riverbanks, increasing erosion (Frandsen and Jackson 1994; Stover et al. 2018), and the narrowed channels can exacerbate flood damage (Spencer et al. 2013) by dislodging mats of shoots that then threaten infrastructure (Cal-IPC 2020). *Arundo donax* fuels wildfires in riparian habitats, increasing fire risk due to its dense dead/dormant biomass (Guthrie 2007) acting as a vertical fuel source and increasing fire intensity (Coffman et al. 2010; Holmes et al. 2005). In the Central Valley of California, fire frequency in watersheds is positively correlated with the area of *A. donax* invasion (Cal-IPC 2020), and in coastal watersheds, fires promote spread of this weed into native riparian vegetation and impair native plant recovery (Lambert et al. 2010a). […] Dense *A. donax* stands block access to water and reduce its recreational benefits (Cal-IPC 2020)."

"Invasion by *A. donax* leads to loss of plant biodiversity, as demonstrated by studies along the Rio Grande in Texas (Racelis et al. 2012[a]; Rubio et al. 2014) and in California (Bell 1997; Cushman and Gaffney 2010; Quinn and Holt 2008). In the United States (most studies conducted in California), *A. donax* invasion reduces diversity of insects (Herrera and Dudley 2003; Lovich et al. 2009), birds and reptiles (Cal-IPC 2020; Dudley 2000; Tracy and Deloach 1999), and rare fish populations (Tracy and DeLoach 1999), likely causing local (Cuatrocienegas, Coahuila) extinction of an endemic Mexican fish species, the Rio Salado darter [*Etheostoma segrex* (Norris and Mickley); Percidae] (McGaugh et al. 2006). Top carnivores such as coyotes (*Canis latrans* Say) and bobcats (*Lynx rufus* Schreber) tend to avoid *A. donax*, creating a partial refuge for small mammal prey (Hardesty-Moore et al. 2020). […] In the lower Rio Grande basin of Texas, the *A. donax* invasion represents the first time an exotic weed has been shown to facilitate invasion of an exotic livestock pest, the cattle fever tick [*Rhipicephalus microplus* (Canestrini)] (Racelis et al. 2012[b])."

From Velez-Gavilan (2024):

"When flooding occurs in areas heavily populated by *A. donax*, it forces flood waters out of the primary channels and into critical banks, bridges and other physical structures. This leads to costly clean-up operations to un-block obstructed waterways, and quite possibly structural damage and hazards when trapped behind bridges and other structures. This can put an economic strain on areas inundated with *A. donax*. Costs of removal vary but can be in excess of US$10,000/ha, and areas are rapidly re-infested if sustained control efforts are not maintained over many years. *Arundo donax* stands collect sediments from stream flow. As the sediment surface under the stands rise [sic], it can force the stream water into new paths which then interact with other infestations downstream or across the stream. The result is accelerated erosion of stream banks, lost property and expensive repairs to the property (Cal-IPC, 2011; USDA-APHIS, 2012). The plants' excessive water usage affects the available water resources downstream. In the Santa Ana River, California alone, the species is estimated to use drinking water valued at US$18 million each year (Csurhes, 2016)."

"Dense *A. donax* stands negatively impact fauna through a reduction in food resources, alteration in structure for nesting, and the creation of a physical barrier for movement within and through riparian habitats to upland areas. The two most severely impacted species in USA are the Least Bell's vireo (*Vireo belli pusillus*) and the Arroyo toad (*Bufo californicus* [*Anaxyrus californicus*]), followed by the southwestern willow flycatcher (*Empidonax traillii extimus*),

southern steelhead (*Oncorhynchus mykiss*) and tidewater goby (*Eucyclogobius newberryi*). Changes in hydrology, habitat degradation and fires caused by *A. donax* are factors that are affecting the threatened listed species in USA (Cal-IPC, 2011; USDA-APHIS, 2012). Research on the impacts of *A. donax* to arthropods indicates a reduced diversity, density and/or productivity of species within the *A. donax* stands compared to native riparian vegetation. A large reduction in aerial insects in particular has a negative impact on insectivorous birds. The grass stands create a physical barrier that impede reptile and amphibian movement within the riparian habitat, and to adjacent upland areas (Cal-IPC, 2011). Furthermore, *A. donax* has displaced native vegetation which provides nesting sites for native species such as the Least Bell's vireo, the willow flycatcher and the yellow cuckoo (*Coccyzus americanus occidentalis*) (Bell, 1993). *Arundo donax* is also known to be a habitat for the invasive Norway rat (*Rattus norvegicus*) which has caused/contributed to the extinction/range reduction of native mammals, birds, reptiles and invertebrates through predation and competition."

From Hopper (2023):

"Where invasive in Southern California, *Arundo donax*, has shown high environmental impact. Its competitive abilities have led to declines of native species including *Salix spp., Baccharis salicfolia*, and *Populus spp*. which provide nesting habitat for native birds (Oakins 2001). The dominance of *Arundo donax* also caused a decline of arthropod abundance (Herrera and Dudley 2003). It also alters the ecosystem with its large continuous clonal root masses which stabilize banks and terraces altering hydrology (Bell 1997)."

From Coffman (2013):

"The federally endangered least Bell's vireo (*Vireo bellii pusillus*) and other riparian birds require structural diversity provided by riparian scrub and mature forest communities for breeding. [Zembal 1990; Bell 1993; Bell 1997] When naturally diverse riparian vegetation types are replaced by thick stands of *A. donax*, bird species abundance and other native wildlife have been found to decline. [Bell 1993, Bell 1997, Herrera and Dudley 2003, Kisner 2004] Movement of medium to large mammals is most likely impaired by dense *A. donax* infestations. Herrera and Dudley [2003] showed that arthropod abundance and diversity associated with native riparian vegetation was twice that associated with *A. donax* infestations. In addition, fish and aquatic invertebrates may be affected by increased stream temperature owing to lack of shading where *A. donax* has replaced mature riparian forests.[Bell 1997]"

Arundo donax is a regulated species in Arizona (AZDA 2022), California (CDFA 2021), Colorado (CDA 2023), Idaho (IDDA 2022), Nebraska (Nebraska Department of Agriculture 2022), Nevada (Nevada Department of Agriculture 2021), New Mexico (NMDA 2020), Utah (UDAF 2022), and Wisconsin (Wisconsin DNR 2022). See section 1.

4 History of Invasiveness

The History of Invasiveness for *Arundo donax* is classified as High. This species has become widely introduced outside of its native range. Many of these introductions have resulted in established populations. There are well-documented negative impacts resulting from the introduction of this species in the United States, including reduced abundance of native

arthropods and birds, increased wildfire risk, increased flood damage, and reduced access to water. *A. donax* is routinely available in trade in the United States, although trade, transport, or possession is regulated in at least nine States.

5 Global Distribution

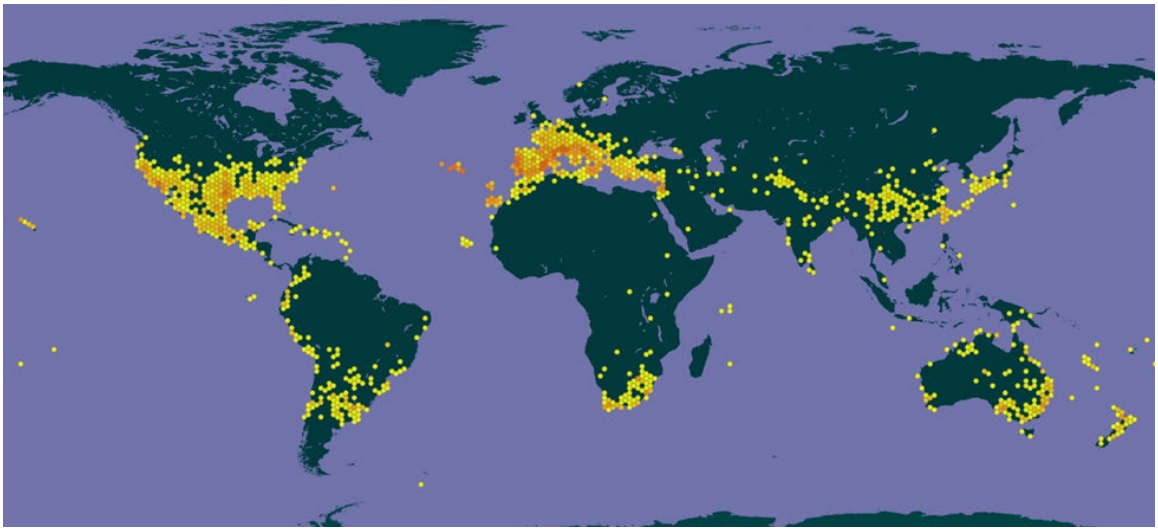

Figure 1. Reported global distribution of *Arundo donax*. Map from GBIF Secretariat (2023). Observations are reported from every continent in the world except Antarctica. Points in Norway, Sweden, and the Philippines were excluded from climate matching analysis because they represent cultivated plants. Points in Cabo Verde, Democratic Republic of the Congo, Gambia, Malaysia, Philippines, United Kingdom, the northern contiguous United States (see figure 2 caption for details), and a point in northern China were excluded because there was insufficient information to determine if these points represent wild, established populations. Points not located on land in marine environments are due to incorrect coordinate data; they did not correspond to climate stations and were therefore not factored into the climate matching analysis.

No georeferenced occurrences were available for parts of the established range of *A. donax* in Armenia, Cambodia, Kazakhstan, Laos, Oman, Singapore, Suriname, Turkmenistan, Uganda, or Yemen.

6 Distribution Within the United States

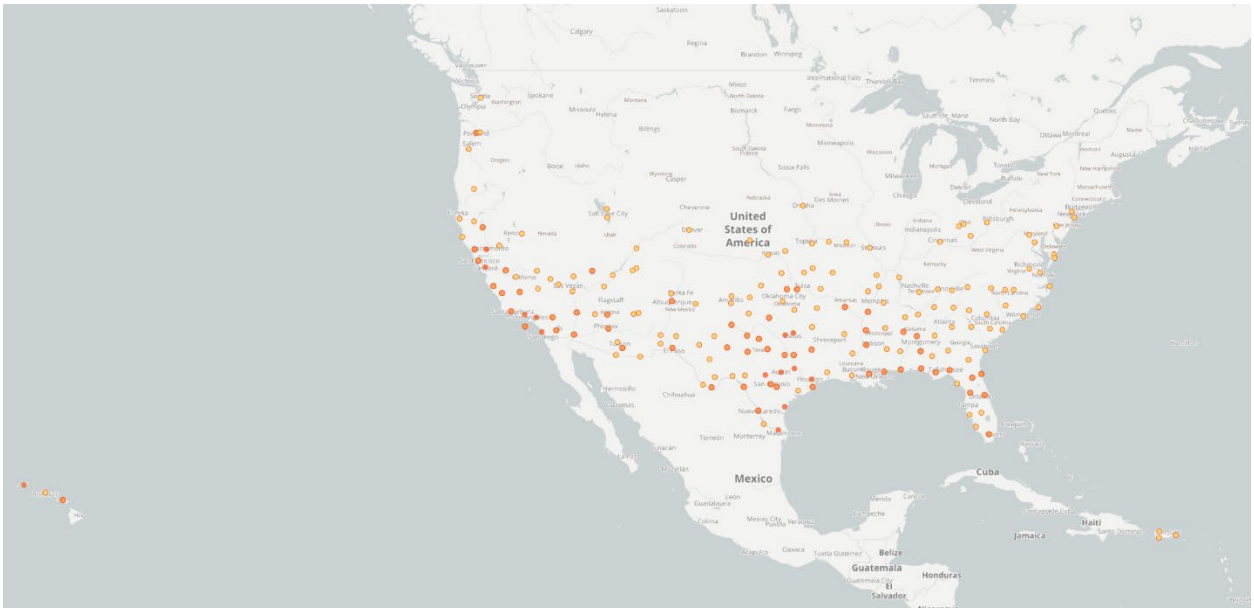

Figure 2. Reported distribution of *Arundo donax* in the United States. Map from GBIF-US (2024). Observations are reported from the southern United States, the Midwest, the Atlantic and Pacific coasts, Hawaii, and Puerto Rico. Points in Colorado, Delaware, Indiana, Maryland, New Jersey, New York, Ohio, Oregon, Pennsylvania, northern Utah, Washington, and West Virginia were excluded from climate matching analysis because they are not known to represent wild, established populations of this species.

7 Climate Matching

Summary of Climate Matching Analysis

Most areas of the contiguous United States have a high climate match for *Arundo donax.* There are very few areas that have a medium climate match and those include areas in the Northeast, areas in the Rocky Mountains and areas in the Pacific Northwest. There were no areas with a low climate match. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.995, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(count of all target points). Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Arundo donax* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.

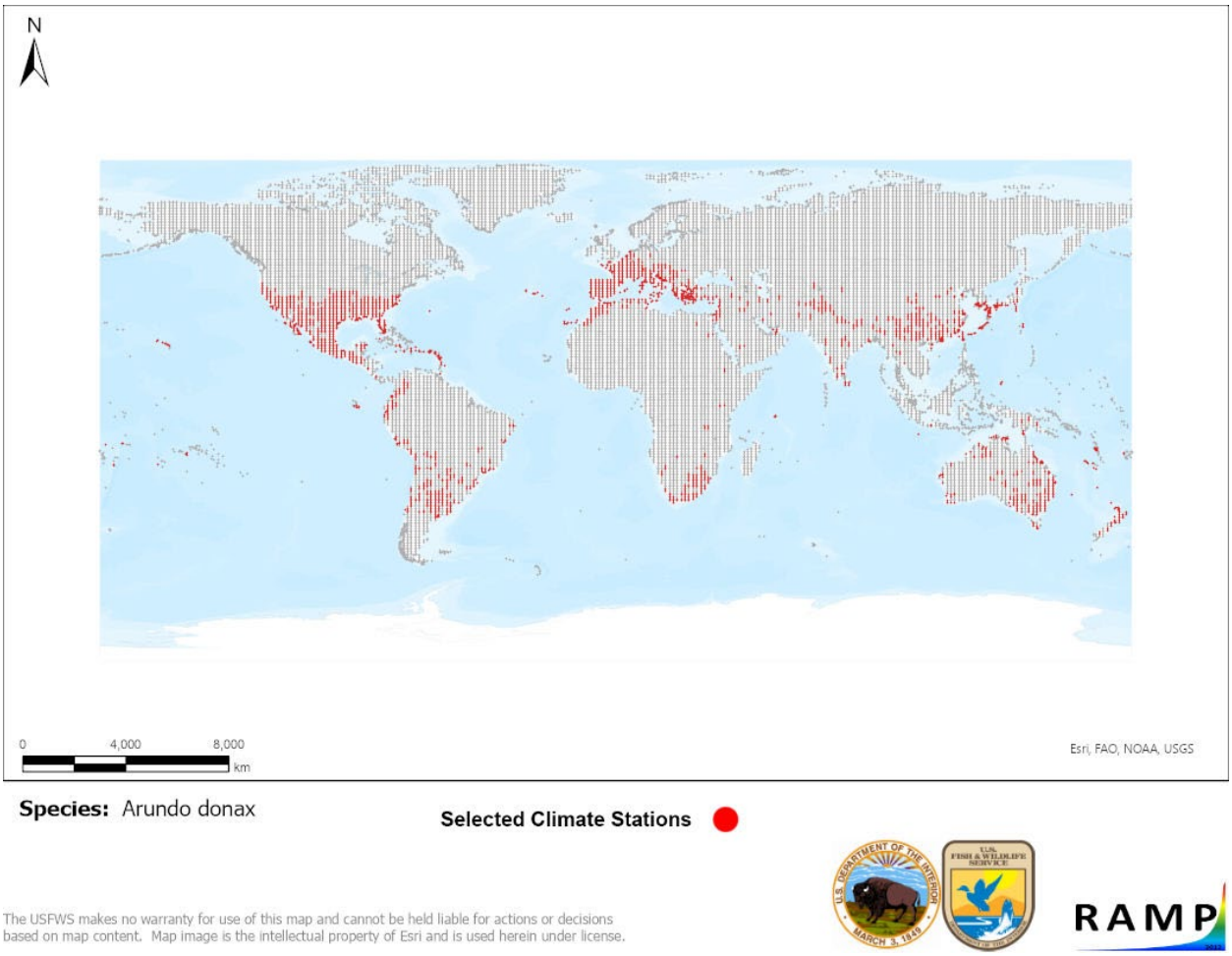

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations in the world selected as source locations (red; North and Central America: Bermuda, Costa Rica, Cuba, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Puerto Rico, United States, islands of the Lesser Antilles; South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Trinidad and Tobago, Uruguay; Europe: Albania, Austria, Azores, Belgium, Bosnia and Herzegovina, Bulgaria, Canary Islands, Croatia, Cyprus, Czechia, France, Germany, Greece, Hungary, Italy, Montenegro, Netherlands, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland, Turkey; Africa: Algeria, Botswana, Egypt, Eswatini, Ethiopia, Kenya, Lesotho, Morocco, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Tunisia, Zimbabwe; Asia: Afghanistan, Azerbaijan, Bhutan, China, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Lebanon, Myanmar, Nepal, Pakistan, Saudi Arabia, South Korea, Syria, Taiwan, Tajikistan, Thailand, United Arab Emirates, Uzbekistan; Oceania: Australia, Fiji, New Caledonia, New Zealand, Palau, Papua New Guinea, Vanuatu) and non-source locations (gray) for *Arundo donax* climate matching. Source locations from GBIF Secretariat (2023). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

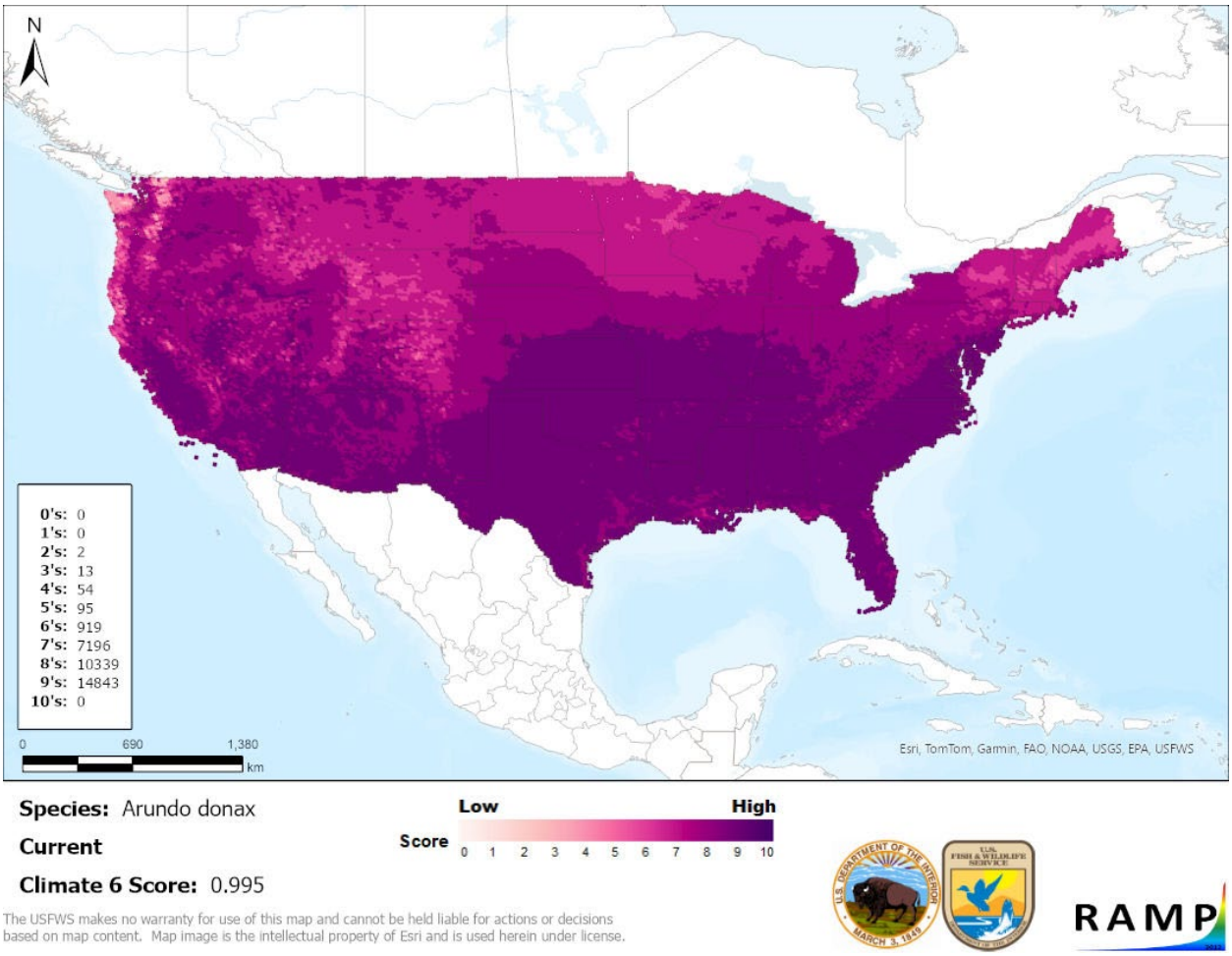

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Arundo donax* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Arundo donax* is classified as High. There is ample information about the biology and ecology of this species. It has become established outside of its native range on every continent except Antarctica, and there is overwhelming evidence that it has negative impacts where introduced. There are questions about the true native range of the species, but this uncertainty does not affect the classification of History of Invasiveness or Establishment Concern, given all the other information available on the species.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Arundo donax, Giant Reed, is a plant native to parts of Asia, although the true native range is uncertain because this species has been widely introduced and utilized since ancient times. This plant is fast growing and is easily able to displace native plant species, including plant

communities that are important habitat for threatened and endangered bird species. Ecosystem alterations from *A. donax* have been implicated in both wildfires and flooding, which cause economic damage. Although some States regulate possession of *A. donax*, it is still regularly available in trade, including in the United States. The History of Invasiveness for *A. donax* is classified as High due to this species being widely established outside of its native range and having documented negative impacts. The climate matching analysis for the contiguous United States indicates establishment concern. Most of the United States had a high climate match, and there were no areas of low match. The Certainty of Assessment for this ERSS is classified as High due to the abundant evidence of established nonnative populations of *A. donax* and their negative impacts. The Overall Risk Assessment Category for *Arundo donax* in the contiguous United States is High.

Assessment Elements

- **History of Invasiveness (see Section 4): High**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): High**
- **Remarks, Important additional information: Cryptogenic**
- **Overall Risk Assessment Category: High**

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Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2023).

Under the future climate scenarios (figure A1), high climate match for *Arundo donax* was projected to occur consistently in all regions of the contiguous United States except the Northern Pacific Coast. For the Northern Pacific Coast region, the climate match ranged from low-medium along the coastline and in the Cascade Mountains, to high match further inland. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.979 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.996 (model: GFDL-ESM4, SSP3, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.995, figure 4) falls within the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085. Under one or more time step and climate scenarios, areas within the Colorado Plateau, Great Lakes, Northeast, and Northern Plains saw a moderate increase in the climate match relative to current conditions. No large increases were observed regardless of time step and climate scenarios. Under one or more time step and climate scenarios, areas within the Appalachian Range, California, Great Basin, Gulf Coast, Mid-Atlantic, Southeast, Southern Atlantic Coast, Southern Florida, Southern Plains, and Southwest saw a moderate decrease in the climate match relative to current conditions. No large decreases were observed regardless of time step and climate scenarios. Additional, very small areas of large or moderate change may be visible on the maps (figure A3). The magnitude of change was projected to be greater in time step 2085 than in time step 2055.

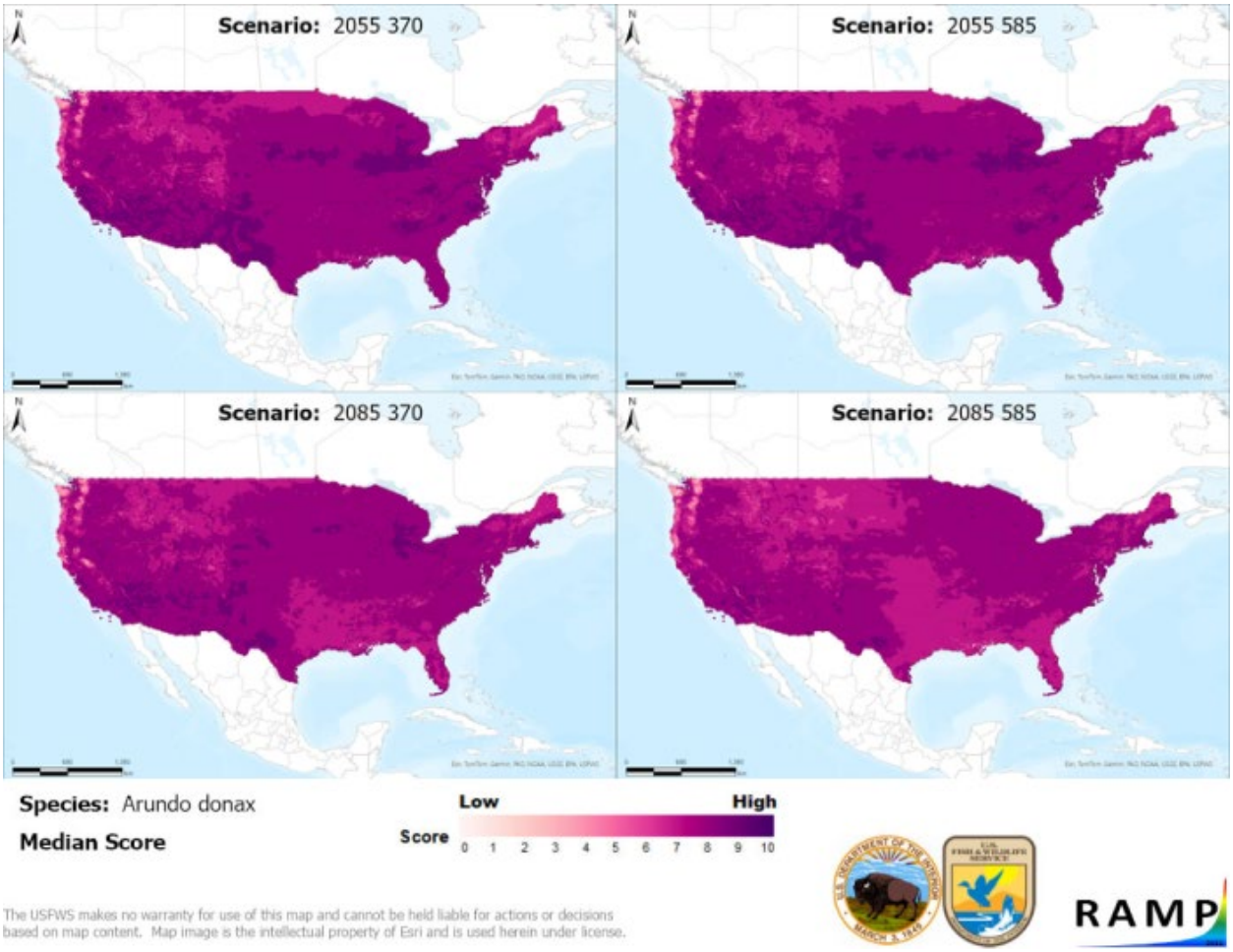

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Arundo donax* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

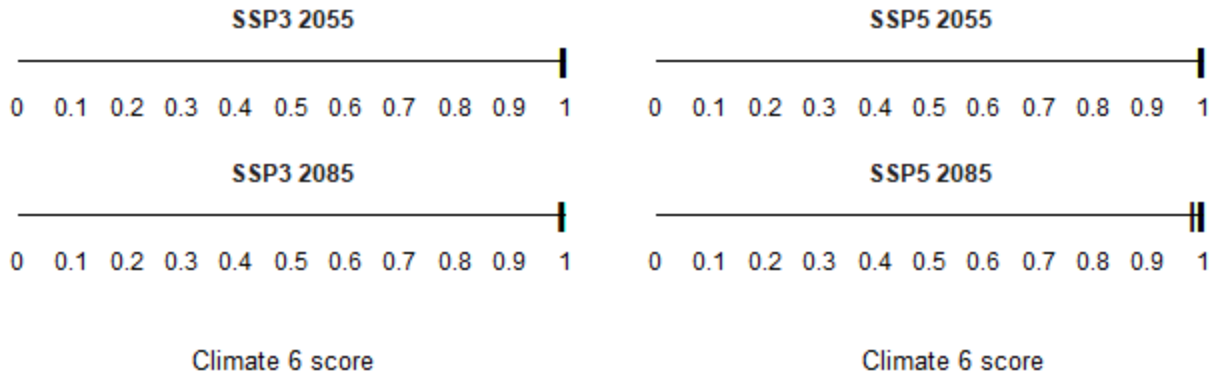

Figure A2. Comparison of projected future Climate 6 scores for *Arundo donax* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

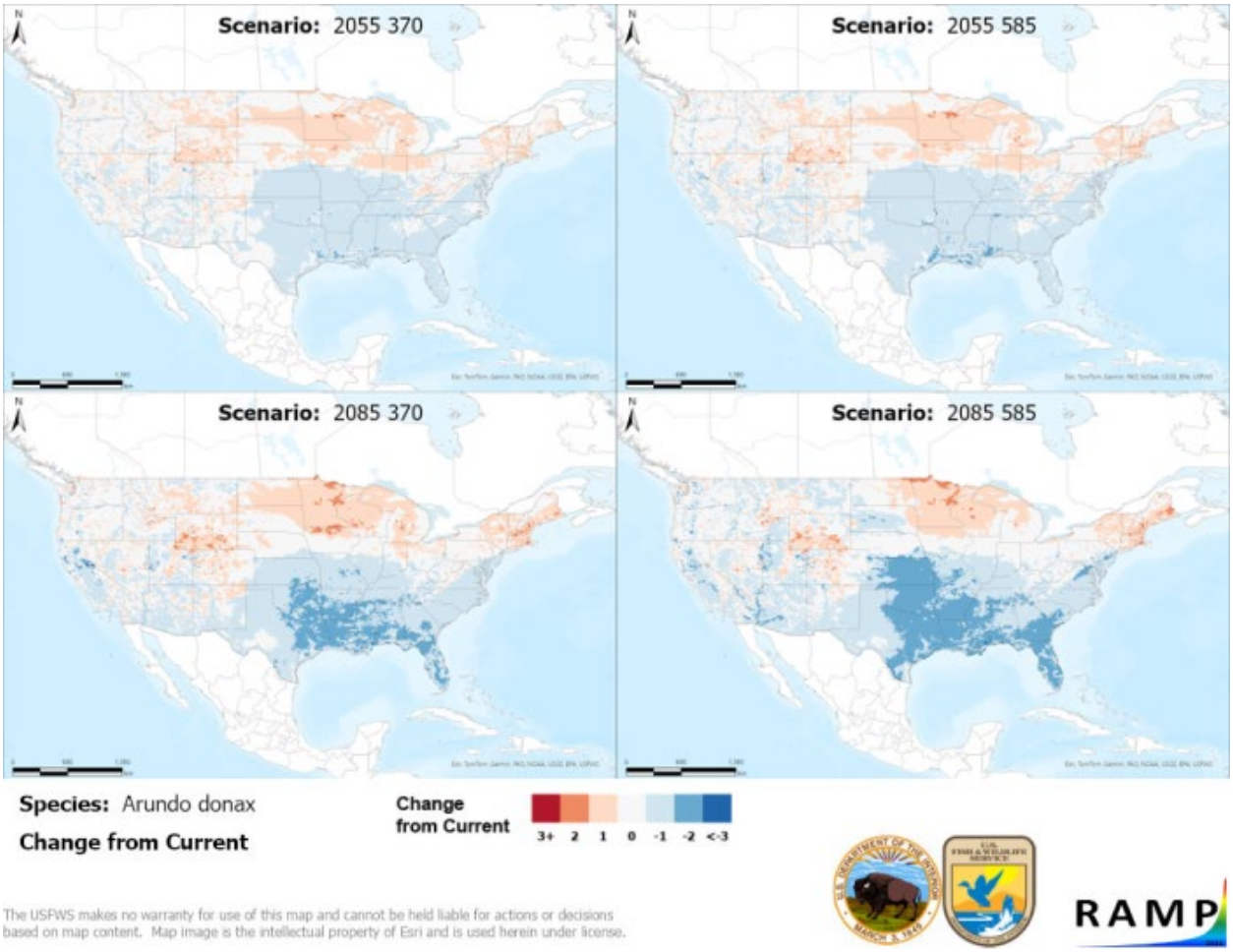

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Arundo donax* based on source locations reported by GBIF Secretariat (2023). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

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