Washington Invasive Ranking System

Washington Natural Heritage Program

Arundo donax (Giant Reed)

Assessed by
Molly S. Wiebush (Washington Natural Heritage Program)
30 September 2024 (WIRS Version 1.5)

Ecological Impact Rank: **High** (79) Confidence: **High** (67)

Management Difficulty Rank: High (89)	Confidence: High (90)
Biological Characteristics of Invasiveness: Moderate (67)	Confidence: High (92)
Concern Related to Distribution and Abundance: Moderate (52)	Confidence: Moderate (50)

Photo Credit: Chris Wagner SBNF 2006, used under Creative Commons license (CalPhotos, 2024).

Ranking Notes

Arundo donax can be difficult to distinguish from *Phragmites australis*, which includes a native subspecies found in Washington (McWilliams, 2004). There is limited information on the behavior and impact of *A. donax* in Washington. Most of the information presented here comes from California.

Legal Listings

Washington State Weed Board: Monitor list, Washington State quarantine list (except for variegated cultivars)

Washington Invasive Species Council: No

Section 1: Distribution and Abundance

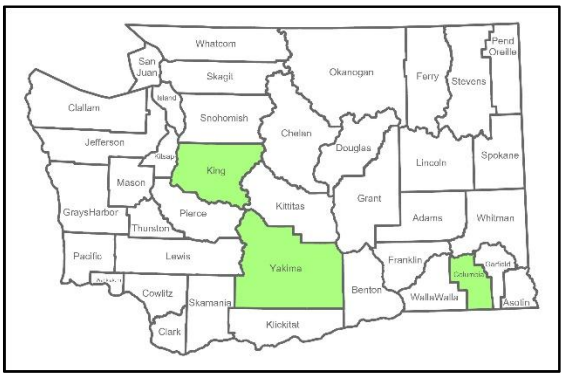

Figure 1. Distribution of counties where *Arundo donax* has been documented in Washington State (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Q1: Current Range Size in Washington

Rating: Low

Confidence: High

Arundo donax is documented in 8% of counties in Washington (CPNWH, 2023; EDDMapS, 2023; iNaturalist Contributors, 2023).

Source: iNaturalist records and other observations

Q2: Current Trend in Total Range

Rating: Unknown

Confidence: Not Rated

Not enough information is available to determine current trends and range for this species. The earliest reports of escaped *Arundo donax* in Washington appear to be from 2012 (EDDMapS, 2023; iNaturalist Contributors, 2023), suggesting it has only recently arrived in the state.

Experimental plantings of *A. donax* were done in Prosser, WA in 2003 and 2006, but failed to establish. In 2013, ornamental cultivation was reported from Yakima, Tacoma, and a community garden in Seattle. Only the community garden had populations that were potential escapes (NWCB, 2013).

Source: Informal publication, iNaturalist records and other observations

Q3: Proportion of Potential Range Currently Unoccupied

Rating: High

Confidence: Moderate

Most models predict that *A. donax* has the potential to spread throughout most of Washington (NWCB, 2013; EDDMapS, 2023), but at least one model suggested that only the Puget Sound area and parts of the Columbia Plateau with active irrigation may be suitable for persistence of this species in Washington (Goolsby et al., 2023).

Source: Published research, Informal publication, Model predictions

Q4: Local Range Expansion or Change in Abundance

Rating: Unknown

Confidence: Not Rated

There are very few documented naturalized populations of *Arundo donax* in Washington, so not enough data is available to determine changes in local range or abundance.

Source: iNaturalist records

Q5: Diversity of Ecosystems Invaded

Ecosystem types: Emergent Open Wetland, Coastal Brackish Tidal Wetland, Bogs & Fens, Forested Wetland

Rating: High

Confidence: High

Arundo donax invades riparian areas and wetlands, particularly in arid, Mediterranean and temperate oceanic environments (McWilliams, 2004; Goolsby et al., 2023). This species grows best where the water table is at or near soil surface but is drought resistant once established. In California, where most research has been done, *A. donax* grows near lakes, streams, ditches, and other wet areas, but can expand past riparian zones and into upland habitats once it is established. This species can grow in brackish water, and greenhouse experiments suggest it can establish in salt marshes. It has also been observed in bog and fen habitats (McWilliams, 2004). Freezing temperatures reduce *A. donax's* survival, and in cold areas, this species requires human support to maintain persistent populations (Goolsby et al., 2023).

Source: Published research, Informal publication

Section 2: Biological Characteristics

Q6: Aggressive Mode of Reproduction

Rating: Yes

Confidence: High

Arundo donax does not produce viable seed anywhere in its invasive range (Goolsby et al., 2023). Instead, this species reproduces vegetatively via rhizomes,

stem nodes, layering, and plant fragments (most commonly rhizome fragments) (McWilliams, 2004; NWCB, 2013). Clonal reproduction can produce stands of several acres. This species grows rapidly after establishment, up to four inches a day, and readily resprouts from roots. It may be able to sprout even from deeply buried rhizomes (between 3–10 feet) (McWilliams, 2004).

Source: Published research, Informal publication

Q7: Innate Potential for Long-Distance Dispersal

Rating: Yes

Confidence: High

Vegetative propagules of *Arundo donax* can be dispersed over long distances within watersheds by flooding (Goolsby et al., 2023). Fragments have also been known to disperse to marine islands and establish populations despite exposure to sea water (NWCB, 2013).

Source: Published Research, Informal Publication

Q8: Potential to be Spread by Human Activities

Rating: Yes

Confidence: High

Arundo donax has been widely cultivated for thousands of years and for a multitude of uses, including woodwind instrument reeds, construction materials, and high-quality paper. In ancient Egypt, it was even used to wrap mummies. This species was introduced to the U.S. as an ornamental plant and for erosion control (McWilliams, 2004). Many cultivars of this species are still used as ornamentals, and it has also been proposed for use as a biofuel and in phytoremediation (NWCB, 2013). Distribution of this species follows human disturbance, including construction, agriculture, livestock grazing, and manipulation of rivers and streams. Human dispersal is the main source of invasive propagules for this species (Goolsby et al., 2023).

As of 2013, this species was being tested for commercial growth in both Oregon and Washington for use in biofuels and making paper. Experimental plantings of this species in Washington had apparently failed by 2008 (NWCB, 2013) and it was added to the Washington's quarantine list in 2012.

Source: Published research, Informal publication

Q9: Allelopathy

Rating: Yes

Confidence: Moderate

Leachate from *Arundo donax* has been shown to inhibit growth of some species of algae (Mary et al., 2024). This species produces a number of secondary chemicals (McWilliams, 2004), suggesting that it could potentially be allelopathic to plants as well.

Source: Published research, Informal publication

Q10: Competitive for Limiting Abiotic Factors

Rating: Yes

Confidence: High

Arundo donax is highly competitive for water. This species has relatively efficient photosynthesis, and can transfer water several meters along rhizomes from wet parts of a stand to culms in drier parts (NWCB, 2013; Goolsby et al., 2023). *Arundo donax* is considered a national threat in South Africa, because of its heavy water use. This species is also efficient at nutrient uptake (Goolsby et al., 2023).

In California, *Arundo donax* can remain green year-round, but it can also exhibit winter dormancy. (McWilliams, 2004). Washington is at the northern edge of this species range, suggesting that *A. donax* will exhibit winter dormancy here.

Source: Published research, Informal publication

Q11: Growth Form

Rating: Yes

Confidence: High

Arundo donax forms large monotypic, clonal stands that can be several acres in size, and physically exclude other species. The rhizomes can form mats up to three feet thick (McWilliams, 2004).

Source: Informal publication

Q12: Germination Requirements

Rating: No

Confidence: High

Vegetative propagules of *Arundo donax* generally require bare ground to establish, such as might be found after flooding, fire, or other disturbances (Goolsby et al., 2023). In at least some circumstances, established native plant communities can prevent re-invasion by *A. donax* (NWCB, 2013).

Source: Published research, Informal publication

Q13: Invasiveness of Other Plants in Genus

Rating: No

Confidence: Moderate

A literature search found no other species currently included in the genus *Arundo* documented as invasive.

Source:

Q14: Shade Tolerance

Rating: Moderate

Confidence: High

Arundo donax grows in full sun to partial shade, but can survive low light conditions (up to 90% reduction in sunlight), but may not establish or spread in full shade. (NWCB, 2013).

Source: Informal publication

Q15: Disturbance Tolerance

Rating: Yes

Confidence: High

Arundo donax is well-adapted to disturbance, and is especially invasive in disturbed areas (McWilliams, 2004; NWCB, 2013). Changes in hydrology, disturbed riparian vegetation, and fire can all spread and increase abundance of *A. donax*. In particular, this species recovers much more quickly after fire than native riparian vegetation (McWilliams, 2004; NWCB, 2013; Goolsby et al., 2023). Eutrophication of rivers and other water sources also benefits *A. donax* (Goolsby et al., 2023).

Source: Published research, Informal publication

Q16: Propagule Persistence

Rating: <5 years

Confidence: High

Arundo donax rhizomes live for 3–4 years (Goolsby et al., 2023).

Source: Published research

Q17: Palatability

Rating: Yes, plant is unpalatable

Confidence: High

Arundo donax is not grazed by wildlife, and livestock do not preferentially graze this species, though cattle and goats will eat it if no other options are available (McWilliams, 2004).

Source: Informal publication

Section 3: Ecological Impact

Q18: Impact on Ecosystem Abiotic Processes

Abiotic Processes: Fire, Hydrology, Light availability, Chemistry, Water quality

Rating: High

Confidence: Moderate

In California, *Arundo donax* has very high water transpiration rates, with an estimated 56,000 acre feet/year (compared to native vegetation transpiring an estimated 18,700 acre feet/year) (McWilliams, 2004). It can increase water loss from underground aquifers (NWCB, 2013). In South Africa, this species is considered a major threat because of its water use (Goolsby et al., 2023).

In southern California, *A. donax* can change the defining disturbance in desert riparian communities from flood to fire. This species can produce up to 20 tons of above ground biomass per hectare, and its height allows it to function as ladder fuel, carrying fire into tree canopies. Riparian areas with intact native vegetation can serve as fire barriers, but *A.*

donax turns riparian corridors into conduits of fire (McWilliams, 2004).

Arundo donax reduces the canopy directly over streams because it does not overhang channels. This increase in sunlight can then lead to increased water temperatures. This species can change water quality and pH, including changing ammonium to toxic ammonia (McWilliams, 2004).

This species is difficult to remove, so changes in abiotic processes may be irreversible.

Source: Published research, Informal publication

Q19: Impact on Ecosystem Structure

Rating: High

Confidence: High

Arundo donax can displace native vegetation such as cottonwood, willow, and other native riparian dominants, replacing them with a community that has no native analogs and does not support wildlife, with the exception of providing shelter for feral pigs (McWilliams, 2004). This species narrows waterways in the southwestern U.S., and can increase erosion of river banks during floods (Goolsby et al., 2023).

Source: Published research, Informal publication

Q20: Impact on Ecosystem Composition

Rating: High

Confidence: High

In California, *Arundo donax* is known to reduce insect, bird, and reptile diversity, and habitats dominated by this species are avoided by predators such as coyotes and bobcats (Goolsby et al., 2023). In parts of southern California, loss of riparian canopy due to *A. donax* can be linked to declines of several fish species. *Arundo donax* supports less than 50% of the invertebrate diversity found in native habitats (McWilliams, 2004). Native species diversity increases when *A. donax* is removed (NWCB, 2013).

Source: Published research, Informal publication

Q21: Impact on Particular Native Species

Rating: Unknown

Confidence: Not Rated

While *Arundo donax* currently does not affect any particular native species in Washington, it has potential to do so. In California, *A. donax* invasions reduces suitable native habitat for two species of endangered birds, the Southwestern Willow Flycatcher and the Least Bell's Vireo. In Monterrey, Mexico, *A. donax* may have led to the local extinction of a rare fish species (NWCB, 2013; Goolsby et al., 2023). No information was available on whether the impact on these species were greater than the impact on co-occurring species with similar habitat requirements.

Source: Published research, Informal publication

Q22: Observed Ability to Invade Undisturbed Ecosystems

Rating: Low

Confidence: Moderate

Arundo donax can be an early colonizer or a late successional species (McWilliams, 2004), but appears to rely on disturbance to facilitate invasion (Goolsby et al., 2023).

Source: Published research, Informal publication

Q23: Observed Ability to Invade Naturally Disturbed Ecosystems

Rating: Yes

Confidence: High

Arundo donax is dispersed and establishes new populations after floods (McWilliams, 2004; NWCB, 2013; Goolsby et al., 2023).

Source: Published research, Informal publication

Section 4: Management Difficulty

Q24: General Management Difficulty

Rating: High

Confidence: High

Arundo donax management is costly, time-consuming, and can require cooperation between

multiple organizations and governments to be successful. Its dispersal ability means that successful management requires cooperation of all stakeholders within a watershed. Treatment requires multiple approaches, including herbicides (McWilliams, 2004). By 2013, *A. donax* control costs in coastal California averaged $25,000 per acre (NWCB, 2013). Biocontrol agents are in development and have been shown to reduce *A. donax* biomass in Texas (Goolsby et al., 2023).

Source: Published research, Informal publication

Q25: Minimum Time Commitment

Rating: High

Confidence: High

Two projects in California were able to reduce *Arundo donax* cover to almost zero after 20 years. However, existing methods are generally regarded as inadequate and control efforts generally fail due to lack of follow up (Goolsby et al., 2023). Successful management of *A. donax* must include removing or killing rhizomes. All parts of the plant need to be burned, chipped, or otherwise disposed of to prevent re-establishment from vegetative propagules (McWilliams, 2004), and equipment used needs to be cleaned to prevent movement of plant fragments to new habitats (NWCB, 2013). Successful control of *A. donax* also requires careful planning of restoration plantings to establish native plant communities resistant to re-invasion (NWCB, 2013).

Source: Published research, Informal publication

Q26: Impacts of Management on Native Species

Rating: High

Confidence: High

Manual treatment of small populations of *Arundo donax* is least impactful to native vegetation (McWilliams, 2004). Treating large populations of this species may require mowing and backhoes to remove rhizomes (NWCB, 2013). This is likely to have large negative impacts on any co-occurring native plants. Grazing by goats, sheep, and cows is a possible treatment for *A. donax*, but may also have effects on co-occurring native plants through grazing pressure and soil compaction. *Arundo donax* is not generally a preferred food for grazers (NWCB, 2013), so effectiveness of grazing may be limited for other reasons as well.

Source: Informal publication

Q27: Inaccessibility of Invaded Areas

Rating: Insignificant

Confidence: High

In Washington, all documented occurances of *Arundo donax* are in easily accessible areas (iNaturalist Contributors, 2023). Evidence from California suggests that this species tends not to expand up steep, narrow canyons into montane areas. This is likely due to this species' mode of dispersal, as fragments are generally broken off by flooding to take root downstream of source populations (McWilliams, 2004), or are dispersed by human activities (Goolsby et al., 2023).

Source: Published research, Informal publication, iNaturalist observations

Q28: Sociopolitical Implications of Management

Rating: Moderate/Low

Confidence: Moderate

Arundo donax is regarded as invasive worldwide (Goolsby et al., 2023), but management will likely involve some sociopolitical difficulties. This species' dispersal capabilities requires cooperation of all stakeholders within a watershed for successful management (McWilliams, 2004). This species has been considered for use in biofuels and phytoremediation, including a proposal in 2013 to grow it for use by Portland General Electric as a replacement for coal at their Boardman, Oregon plant (NPSO, 2013).

More recently, tests using *A. donax* as biofuel or in phytoremediation have not been regarded as successful. In South Africa, harvesting invasive populations has proven to be inefficient (more costly than the energy produced) (Goolsby et al., 2023).

Source: Published research, Informal publication

Additional Comments

None

References

CalPhotos. 2024. Berkeley Natural History Museums, University of California, Berkeley. https://calphotos.berkeley.edu/. Accessed: December 17, 2024.

Consortium of Pacific Northwest Herbaria (CPNWH). 2023. Consortium of Pacific Northwest Herbaria Specimen Database. http://www.pnwherbaria.org/index.php. Accessed: October 17, 2023.

EDDMapS. 2023. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. http://www.eddmaps.org. Accessed: October 15, 2023.

Goolsby J.A., P.J. Moran, M. Martínez Jiménez, C. Yang, K. Canavan, Q. Paynter, N. Ota, and D.J. Kriticos. 2023. Biology of Invasive Plants 4. Arundo donax L. *Invasive Plant Science and Management* 16(2):81–109.

iNaturalist Contributors. 2023. iNaturalist Research-grade Observations, Accessed via GBIF.org. https://doi.org/10.15468/ab3s5x. Accessed: October 5, 2023.

Mary M.A., S. Tábora-Sarmiento, S. Nash, G.D. Mayer, J. Crago, and R. Patiño. 2024. Plant-derived products selectively suppress growth of the harmful alga Prymnesium parvum. *Water* 16(7):930.

McWilliams J. 2004. Arundo donax: In: Fire Effects Information System, [Online]. US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. https://www.fs.usda.gov/database/feis/plants/graminoid/arudon/all.html. Accessed: September 26, 2024.

Native Plant Society of Oregon (NPSO). 2013. State of Oregon control area established for Arundo donax. *Bulletin of the Native Plant Society of Oregon* 46(1).

Noxious Weed Control Board (NWCB). 2013. Draft Report: Written findings of the Washington State Noxious Weed Control Board, Arundo donax. Washington State Noxious Weed Control Board, Olympia, WA.