

Central Valley *Arundo*: Distribution, Impacts, and Management



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Final Report to the
State of California
Wildlife Conservation Board
Agreement WC-1561MM



EXECUTIVE SUMMARY

Arundo donax (giant reed) is a large and extremely damaging invasive plant found along waterways across California. The Central Valley is among the most impacted regions, along with coastal rivers from the San Francisco Bay Area south to the border with Mexico. *Arundo* damages both ecosystems and human infrastructure. It impacts water resources, flooding, habitat for wildlife including sensitive species, and wildfire. To date over \$200 million has been spent on *Arundo* removal projects in California, including major projects on the Santa Ana, San Luis Rey, Santa Margarita, San Diego, Ventura, Santa Clara, San Juan and Salinas rivers. Cal-IPC estimates that well-executed *Arundo* control projects on high-priority watershed across the Central Valley would provide a benefit-to-cost ration of 1.7 to 1 based on an economic valuation of benefits to water supply, flood and fire safety, and wildlife habitat.

This report summarizes results from an extensive *Arundo* mapping effort in California's Central Valley, which includes the surrounding foothills. Using the mapping dataset as a basis, we estimate *Arundo*'s impacts in each of 25 watershed units across the region and assess the relative benefits of removal in each unit. We then integrate the impact for each watershed unit with an assessment of local capacity to build and implement a long-term *Arundo* removal program. (Local capacity is critical—it is a big lift to secure permits and landowner access authorization, implement control work, and build a system for consistent long-term follow-up up for a minimum of 10 years.) From these integrated factors we suggest priorities and make management recommendations.

The overall study area spans 38.4 million acres; we searched 17.4 million core acres to find all *Arundo*. We mapped *Arundo* upstream along major tributaries until we identified the uppermost populations (*Arundo* was concentrated at lower elevations, with 97% found below 500 feet elevation in California). Because *Arundo* is a large distinctive plant, we were able to map it from high-resolution aerial imagery. We followed up with field visits to a subset of sites to verify accuracy in the field. While in the field we measured *Arundo* physical properties to see how it compared to *Arundo* in California's coastal watersheds and in other studies across the world. We found that the average height of *Arundo* in the Central Valley was 12% shorter than *Arundo* in coastal southern California watersheds, and biomass was 15% lower. (Results reflect timing of sampling: Central Valley *Arundo* was sampled in 2018 after a prolonged drought while coastal *Arundo* was sampled in 2010 after a period of normal rainfall.)



We mapped a total of 2,256 acres of *Arundo* in the Central Valley. Of this total, 74% was found in the Sacramento River Valley and 26% in the San Joaquin River Valley. This represents a lower level of

invasion than in coastal watersheds where 7,864 acres was mapped. However, the most heavily invaded areas in the Central Valley, such as Stony Creek watershed with over 500 acres of *Arundo*, demonstrate the potential for *Arundo* to become more extensive in the future.

We established the 25 watershed units based on a hydrologic GIS layer. For each watershed unit, we scored the level of four impacts—impact to water, impact to geomorphology, impact to wildfire, and impact to sensitive plant and wildlife species—as described below.

Water: *Arundo* water use in the Central Valley was calculated to be 19.4 acre-feet/year per acre of *Arundo* based on current stand structure sampled across the Central Valley. This represents potential water use of *Arundo* stands if water is available, which it is in many Central Valley systems, especially those conveying water from dams to the valley floor. This is significantly more than native vegetation whose use is estimated as 4 acre-feet/year per acre. This is nearly five times greater water use than that of native vegetation, so removal of *Arundo* can provide a significant increase in water availability (15.4 acre-feet/year per acre of *Arundo* controlled) and hydrologic function in impacted areas of the Central Valley. As part of the project, we developed a spreadsheet-based model that calculates annual *Arundo* water use for a particular region based on user inputs for *Arundo* stand and site characteristics: live cane density, height, percent cover of cane area and seasonal daylight. This tool allows program managers to generate site-specific water use estimates.

Geomorphology: The geomorphology of waterways is impacted when dense stands of *Arundo* obstruct and modify streamflow, raising the floodplain and changing braided channels to single channels. High flow events can result in more frequent bank failure and flooding. Bank failure can result in dense clumps of *Arundo* being carried downstream where it can damage infrastructure such as bridges and roads. Flows confined to a single narrow channel may also result in less groundwater recharge.

Fire: In addition to providing a high fuel load, *Arundo* stands have a tall, well-ventilated fuel structure containing dry fuels throughout the year, which is especially conducive to carrying wildfire. *Arundo* stands increase the number of fire events by harboring significantly greater number of transient camps than native vegetation. Transient camps in *Arundo* are a primary ignition source for fires in riparian areas as documented in the coastal *Arundo* study. Central Valley field work documented encampments and open fires in *Arundo* stands. In southern California, *Arundo* stands have been documented as being the starting point for fires as well as conveying wildfires through riparian areas. As fire frequency and size increases in the Central Valley, these patterns are likely to be repeated.

Sensitive species: Plants and wildlife can be harmed when *Arundo* changes abiotic and biotic properties of ecosystems. This includes habitat structure, stream flow patterns, water availability, fire and available food sources. We examined 24 sensitive species from five taxonomic groups—plants, insects, fish, herps, birds and mammals—to determine the degree to which *Arundo* is likely to impact the species and the degree to which the species co-occurs with *Arundo* in a given watershed. Elderberry beetle is the most impacted, followed by bank swallow, Central Valley DPS of steelhead, Chinook salmon CV spring-run ESU, and tricolored blackbird.



We score each of these four types of impact (water, geomorphology, fire, sensitive species) for each of the 25 watershed units based on the amount of *Arundo* present and other factors, then aggregate the scores to capture the relative impact of *Arundo* on each watershed unit. This aids in setting priorities for *Arundo* removal efforts across the Central Valley region.

We conclude the report by making management recommendations for removing *Arundo* in Central Valley watersheds using a ‘top down’ approach to assure long term program viability. Planning and implementing a successful watershed-scale *Arundo* removal project is a major undertaking. It means acquiring permits, obtaining right-of-entry agreements from landowners, securing funding, coordinating partners, and implementing comprehensive treatments over a period of ten years. For each watershed unit we rate the capacity and readiness of the presumptive project lead organizations and suggest approaches for effective *Arundo* removal. These organizations are often RCDs but County Agricultural Departments and NGOs such as River Partners also have a role and history of work on *Arundo* control regionally. The top three watershed units are Cache-Putah Creeks (where an *Arundo* removal effort by Yolo RCD is currently underway with funding from the California Wildlife Conservation Board), Stony Creek in the Sacramento Valley, and Chowchilla-Fresno Rivers in the San Joaquin Valley.

Some groups have sufficient capacity to take on such an effort. In the Cache Creek and Putah Creek watersheds for instance, the Yolo County Resource Conservation District (RCD) has secured state funding to begin an eradication effort. At the top of the Sacramento River watershed, the Western Shasta RCD has a CEQA document in place and is poised to apply for implementation funding. But in many areas, significant local capacity will have to be built if *Arundo* is to be controlled effectively. We will work to foster this growth and to pass on lessons learned from each watershed. With successful full-watershed *Arundo* removal programs being implemented in California’s most infested coastal watersheds, and new programs like the one on Cache and Putah creeks to serve as a model for the Central Valley, we are hopeful that more full-watershed programs will form to protect the region’s resources from the impacts of *Arundo*.

Compiled by (in alphabetical order):

Jutta Burger, Cal-IPC

Jason Giessow, Dendra, Inc.

Doug Johnson, Cal-IPC

Dana Morawitz, Cal-IPC

With additional contributions by:

Jason Casanova, Council for Watershed Health

Barb Castro, Department of Water Resources

Tim Stillinger, Nature Collective

Alex Young, Sonoma Ecology Center

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Cover photos:

Top: *Arundo* distribution mapping from Cal-IPC dataset.

Middle: *Arundo* controlled as part of management by the California Dept of Water Resources. Photo: Paul Hames, DWR. 2009.

Bottom: Steelhead trout. The California Central Valley DPS is one of the sensitive species that is impacted by *Arundo* in the region. Photo from NOAA Fisheries website.