Arundo donax in the Upper Salinas River Watershed

A comprehensive analysis by the Upper Salinas-Las Tablas Resource Conservation District

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March 2021

Funded by the California Department of Food and Agriculture's 2019 Noxious Weeds Grant Program

Purpose and Need

Program Background

In August 2019, the Upper Salinas-Las Tablas Resource Conservation District (USLTRCD) was awarded funding from the California Department of Food and Agriculture's Noxious Weeds Grant Program for the "Salinas River Watershed *Arundo* Eradication Program" (Program). The goal of the Program was to identify and map populations of invasive *Arundo donax (Arundo)* within the Upper Salinas River and improve overall ecosystem health of the river through partnerships with landowners, farmers, and local agencies. Agencies actively pursuing *Arundo* eradication programs are often limited to jurisdictional boundaries. For example, Resource Conservation District of Monterey County (RCDMC) has been working with farmers and stakeholders in Monterey County to remove approximately 430 acres of invasive *Arundo*, without the ability to identify potential populations occurring upstream in San Luis Obispo County. Camp Roberts has commenced with mapping *Arundo* on the base, though they have not done any surveying or mapping beyond the base boundaries. *Arundo* reproduces vegetatively by rhizomes and by stems that are dislodged during flooding events. As a result, *Arundo* populations upstream contribute significantly to populations downstream. The first step to *Arundo* eradication in the entire Salinas River is identification and mapping to assess the extent of infestation within the Upper Salinas watershed. Once populations are identified and recorded, the best cost-effective methods for treatment and removal can be determined. USLTRCD assisted the efforts already underway in Monterey County and Camp Roberts by working with the San Luis Obispo County Agricultural Commissioner's Office and the Weed Management Area partners to identify and map populations of *Arundo* in the Upper Salinas River Watershed.

Figure 1. *Arundo* rooting at nodes along the stalk can easily become dislodged and establish new stands. Photographs taken by USLTRCD staff of *Arundo* in the Upper Salinas River on March 4, 2021.

Ecosystem Services

Arundo stands use significant water, far more than native vegetation, reducing available water for aquifer recharge, agricultural producers (who operate using groundwater wells) and native species. Limited water supply is an ongoing fact of life in California, which will only be exacerbated by the changing climate. Water availability for aquifer recharge, agricultural producers and wildlife are critical issues that require both conservation of resources and complicated balancing of benefits. Reducing populations of *Arundo* in the Salinas River may result in an improvement of ground water reserves as well as provide a benefit to flora and fauna. *Arundo* stands not only reduce available water during drought years, but also increase flood risk in wet years by blocking and diverting flows during high flow events. By trapping sediment, mature *Arundo* stands raise the streambed elevation. Additionally, *Arundo* stands have a significantly higher roughness versus the mix of values that would occur with native vegetation as the dominant species composition. The effects of these impacts are flooding of adjacent agricultural fields as well as additional sediment trapping in the river profile, further reducing flow conveyance. Flooding, soil erosion and/or soil deposition in production areas pose significant economic threats to local producers. Fresh vegetable crops, such as those dominate in the Salinas Valley's $4.5

billion agricultural industry, must be destroyed if contacted by flood water and inundated fields are barred from production for months until floodwater-borne pathogens posing human food safety risks are no longer evident. While this is not a stated resource priority for this program, it is the over-riding concern for landowners along the river and a primary motivator for conducting the proposed habitat improvement work on their lands.

Figure 2. *Arundo* identified by USLTRCD staff in Atascadero Creek, a tributary to the Salinas River.

Biology

Habitat for species of concern, including South-Central California Coast steelhead trout, California red-legged frog, least Bell's vireo, San Joaquin kit fox, California tiger salamander and arroyo southwestern toad, are severely impacted in the Salinas River watershed by invasion of *Arundo* and other non-native plant species. *Arundo* is a very fast-growing plant that forms dense stands of vegetation. *Arundo* degrades habitat value by displacing native vegetation, modifying fluvial geomorphic processes, and impacting water availability for multiple federally and state listed species, most notably steelhead trout. The Salinas River supports steelhead and is considered a Core 1 Watershed by the National Marine Fisheries Service in the 2013 South-Central California Coast Steelhead Recovery Plan (Plan). The Plan specifically identifies *Arundo* control on the river as a critical task towards population recovery in the watershed (NMFS, 2013). With the removal of *Arundo* and improvement of habitat quality, these listed species could extend their distributions into a more functional riverine system.

Project Methods

USLTRCD built upon the previous mapping efforts done by other agencies, such as San Luis Obispo County Agricultural Commissioner's Office and the California Invasive Plant Council, as well as historical information uploaded into the Calflora database, to develop a comprehensive map of the Upper Salinas River watershed. Eight points on Calflora were identified as *Arundo* within the Upper Salinas River. Each point from Calflora was assigned a number for tracking and verification, from the Monterey County Line south to the headwaters of the Salinas River at Santa Margarita Lake.

Aerial imagery analysis

US-LTRCD staff performed an extensive search for the best available aerial imagery and remote sensing technologies to begin mapping *Arundo* in the Upper Salinas River. Map layers from government databases such as the National Agricultural Imagery Program and United States Geological Service were uploaded to GIS and reviewed extensively. Agricultural mapping software on a program called Agrian that accesses data from the multi-spectral imagery captured by the Sentinel-2 satellite was utilized by USLTRCD staff. Cloud cover and resolution proved to be sub-optimal for *Arundo* identification at this scale. A helicopter survey was proposed but proved to be cost-prohibitive. Staff determined the most cost-effective and user-friendly approach to identifying *Arundo* from aerial imagery is through Google Earth. Although the imagery date is from September 2018 for the Upper Salinas, cross-referencing *Arundo* points from Calflora and obtaining directions to access points was straightforward and less time consuming through the Google Earth platform. Staff uploaded verified Calflora points to Google Earth to key in on what *Arundo* looks like from aerial imagery and how to identify potential stands in the Upper Salinas (Figure 3). Staff then examined vegetation in the Upper Salinas from the headwaters to the San Luis Obispo County line. Plants that were identified as potential *Arundo* stands were then verified in the field.

Figure 3. Aerial imagery through Google Earth utilized to determine locations of Arundo stands in the Upper Salinas.

Field verifications

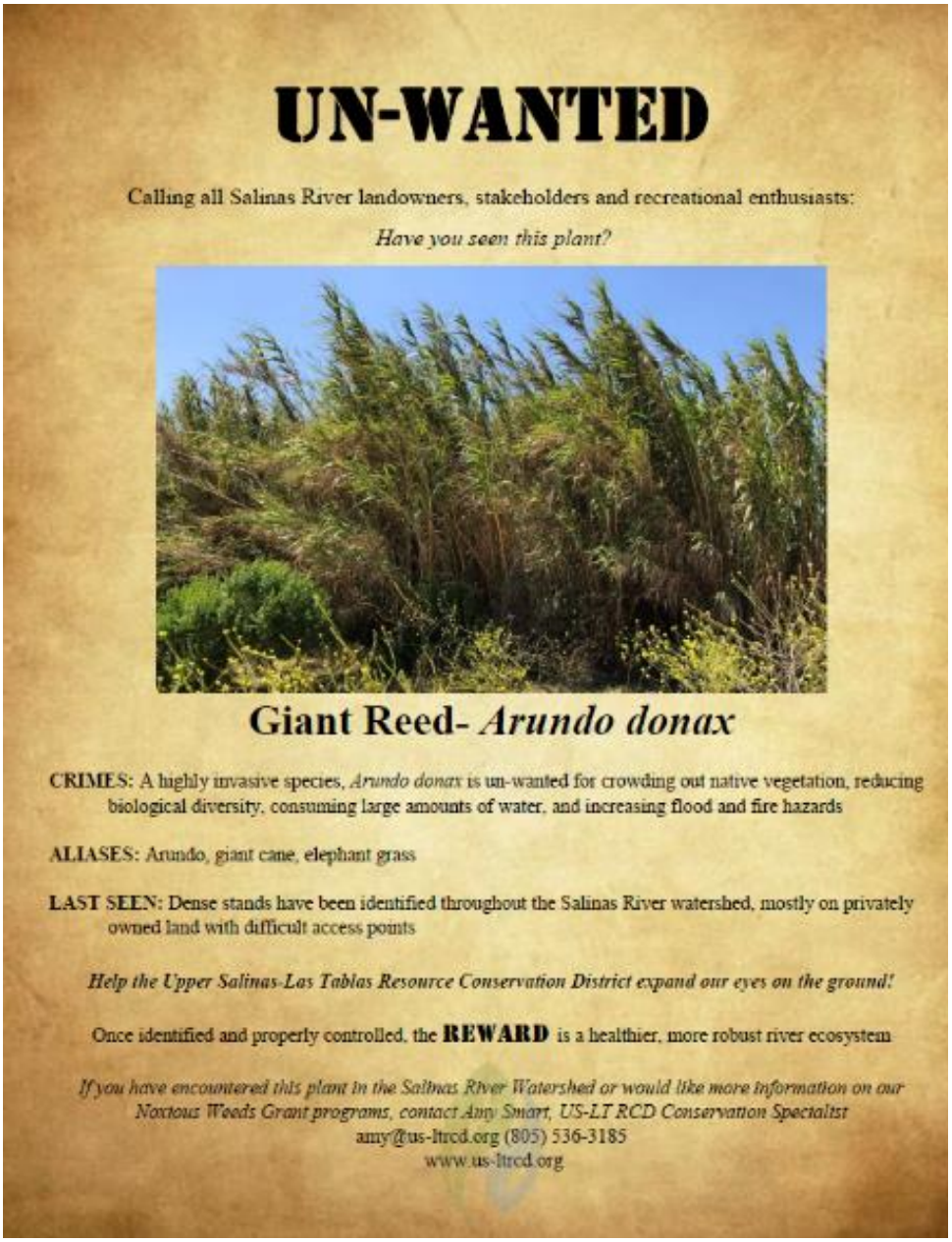
Points logged in the Calflora database were field surveyed to determine if *Arundo* was in fact present or absent, the density of population, and landowner access (private, public, other). If a historic population was present, a GPS pin was set, and information updated in Calflora. To determine if the population had spread, a site-survey and aerial survey of two (2) mile radius from known populations was conducted. Windshield surveys were performed in locations where roads provided a good vantage point of the river. Access was limited in many sections of the Upper Salinas, therefore continued outreach to local landowners proved to be essential in areas where staff could not safely survey.

Outreach

Coordination with local agencies
USLTRCD staff maintained on-going correspondence with staff at the San Luis Obispo County Agricultural Commissioner's Office and Camp Roberts to stay up to date on treatment records and eradication efforts. As co-chair for the San Luis Obispo Weed Management Area (SLO WMA), USLTRCD Project Manager Andrew Johnson, met biannually to discuss the Program and collaborate with partners in the SLO WMA. A site visit was held with the City of Paso Robles staff and Congressman Salud Carbajal to discuss potential funding opportunities for invasive species management within the Salinas River corridor. Outreach via email blasts to the USLTRCD listserv of approximately 1,000 individuals was conducted. Targeted outreach to local advisory groups, municipalities, stakeholders, recreational groups, and landowners along the Salinas River was conducted throughout the length of the Program.

Community engagement
An informative flyer was generated to conduct outreach to landowners along the Salinas River. The "UN-WANTED" poster was created by US-LTRCD staff and posted to physical message boards throughout the community and virtual social media channels (Figure 4).

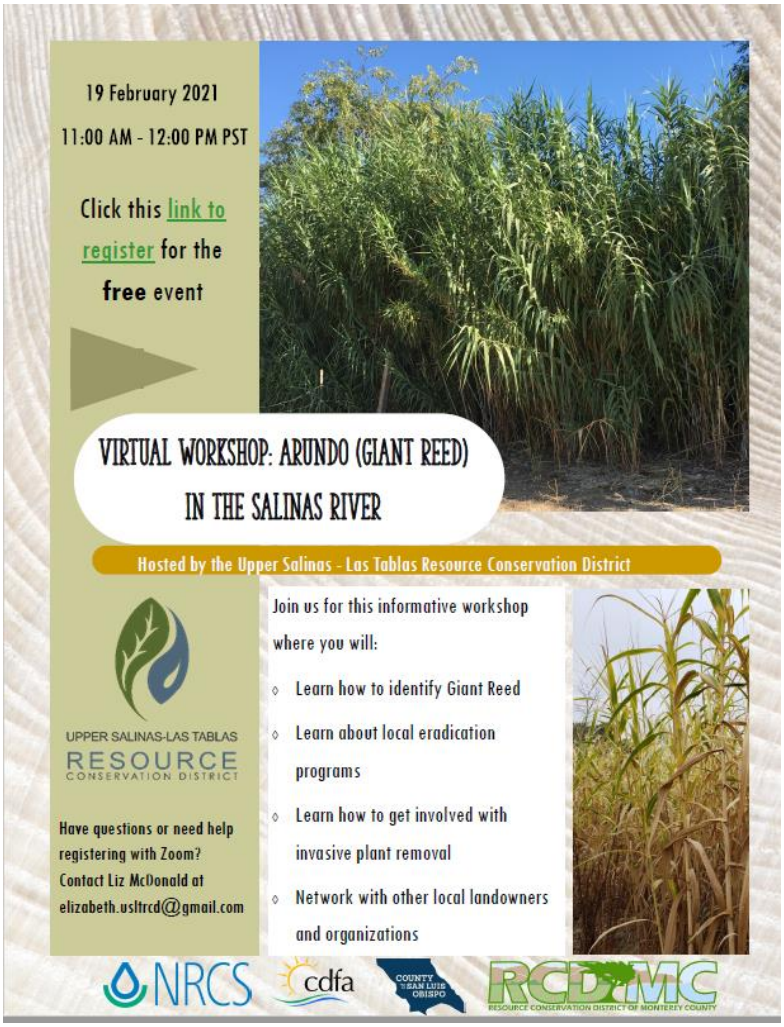
Figure 4. UN-WANTED poster distributed throughout the community via message boards and social media posts.

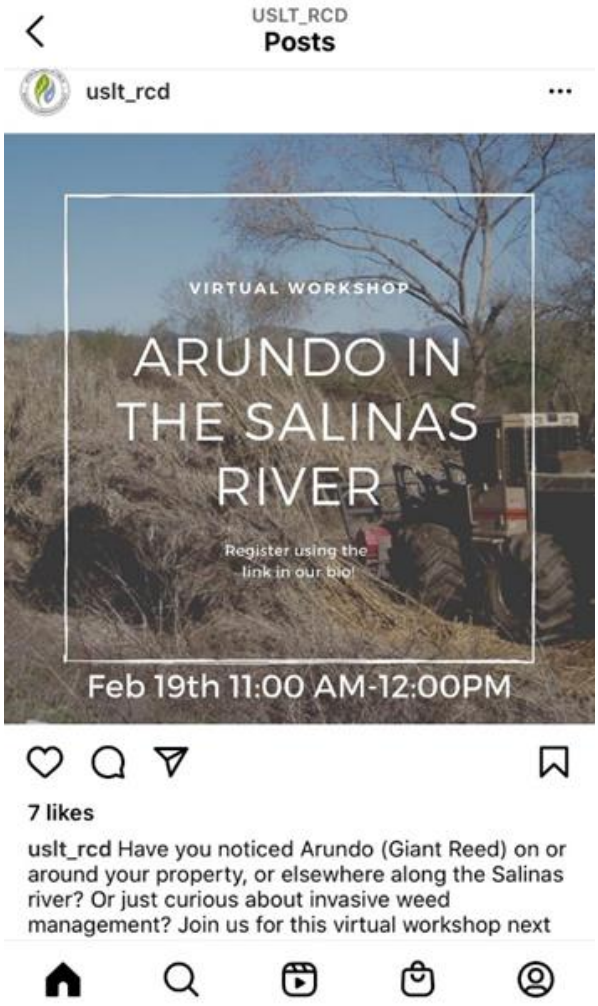


Virtual Workshop

A vitrual workshop (due to COVID-19 restrictions) was held to increase awareness and education about *Arundo* eradication programs in the Salinas River and develop a resource network to disseminate resources and information. A panel of guest speakers was assembled for the workshop, including representatives from the San Luis Obispo Agricultural Commissioner's (SLOCAC) Office, Camp Roberts and the RCDMC. Workshop flyers were posted on community message boards and in local businesses adjacent to the Salinas River. Virtual workshop announcements were posted on USLTRCD's social media channels and sent to the organization's listserv of approximately 1,000 individuals. A total of 14 participants attended the workshop. A pdf of the workshop presentation as well as a recording of the virtual workshop is available on the USLTRCD website and YouTube for those who were unable to attend.

Figure 5. Workshop flyer and Instagram post created by USLTRCD staff.





Results

River mile summary

New *Arundo* populations that were identified in surveys performed by USLTRCD staff were documented and uploaded to the Calflora database. Survey results were summarized by river mile. River miles were identified using the Add Path feature in Google Earth. River miles were broken into five (5) mile sections and results were consolidated in an Excel spreadsheet (Figure 6). Based on the river mile results summary, it was determined the greatest concentration of *Arundo* in the Upper Salinas river occurs between river miles 30 and 35 within the City of Paso Robles boundaries (Figure 7). The largest individual stands of *Arundo* in the Upper Salinas were identified on privately owned property also within this river segment.

Figure 6. *Arundo* survey results by river mile.

River Miles	Arundo (Y=1, N=0)	Notes (features, access, ownership, date of site visit, etc.)
1 -- 5	0	Access to Santa Margarita Lake dam to Las Pilitas Road limited, accessed all public roads during 1/31/2020 survey, correspondence w park rangers to gain access to county road, outreach to landowner for access to Truck Trail Road, extensive aerial imagery search
5 -- 10	0	Highway 58 bridge, populations of common reed, private landownership access very limited, public access roads during 1/31/2020 survey, extensive aerial imagery search
10 -- 15	0	Hanson Quarry site visit 10/5/2020, extensive aerial imagery search
15 -- 20	1*	Sparse riparian vegetation to just beyond Halcon road, windshield survey of Rocky Canyon Road to Templeton and accessed riverbed from Juan Bautista de Anza trailhead at Aragon Street conducted 2/12/21, Hwy 41 overpass windshield survey 10/21/2020. *Atascadero Creek tributary: *Arundo* identified 8/27/2020.
20 -- 25	1	Calflora point (CF8), survey 5/15/2020 from Ferrocarril Park/Juan Bautista de Anza to gain access to CF8, water too high to safely cross, find alternate route, sparse vegetation to Graves Creek/Paso Robles Creek tributaries, abundant Phragmites population throughout segment as seen on Martinelli property during Templeton survey 1/17/2020, possible Arundo fragment in channel (mapped on Google Earth)
25 -- 30	1	Accessed river to locate CF7 on 1/17/2020 survey, point not found, extensive aerial imagery search
30 -- 35	1	CF6 - CF1, Largest concentration of *Arundo* stands, City of Paso Robles and privately owned land, 1st - 13th street bridges, surveyed 1/10/2020 and 3/4/2021, added CF9
35 -- 40	0	Extensive aerial imagery search, windshield/vantage point survey performed 10/22/2020 to field verify potential *Arundo* stands
40 -- 45	1*	*Arundo* in residential area of San Miguel adjacent to river (recorded on Calflora), windshield/vantage point survey to County Line/Camp Roberts 10/22/2020, extensive aerial imagery search

Figure 7. Largest stands of *Arundo* identified by USLTRCD staff in the Upper Salinas River, Paso Robles, CA

Next Steps

The USLTRCD will continue to maintain an *Arundo* database, via Google Earth and Calflora, and update points as needed. USLTRCD will continue to collaborate with stakeholders and landowners regarding *Arundo* eradication opportunities within the Upper Salinas Watershed. RCDMC and USLTRCD were awarded a Regional Conservation Partnership Program (RCPP) through Natural Resource Conservation Service (NRCS). The funds are provided for the RCDs to enroll participating landowners in NRCS programs such as Environmental Quality Incentive Program (EQIP) to provide a cost-share opportunity for invasive species removal and habitat restoration on working lands. USLTRCD is working with SLOCAC to update the mapping information of *Arundo* in the Upper Salinas River watershed in preparation for additional treatment moving forward. Both Camp Roberts and the SLOCAC office have committed their own funds for the vegetation management work they conduct. USLTRCD is currently discussing potential funds for invasive species removal with the City of Paso Robles for both fire safety and riparian habitat improvement. Funds from the City of Paso would be directed towards treatment and removal of the largest stands of *Arundo* (Figure 7) identified during this Program.