



Carpinteria Salt Marsh *Limonium duriusculum* Removal Project *(amended)*

Recipient: Upper Salinas-Las Tablas Resource Conservation District
Project Period: 02/01/2020 – 10/31/2021
Award Amount: \$42,900
Project Number: #8006.20.067452

Summary of Accomplishments

The Upper Salinas-Las Tablas Resource Conservation District (US-LTRCD) was the project management team for this grant. US-LTRCD staff developed progress reports and budget materials for the project.

The project team (Tidal Influence-subcontractor) completed a site wide *Limonium duriusculum* (LIDU) treatment efficacy survey and mapping of the endangered Salt Marsh Bird's Beak (*Chloropyron maritimum* ssp. *maritimum* [CHMAMA]) on August 2-3, 2021. The first round of treatments in the SOW project area were August 23-26, 2021, with a second visit on September 13-16, 2021. During the 2021 treatment season, a total of 40,981 square feet were treated manually, 26,159 square feet were treated with solarization, and 23,008 square feet were re-treated with flame treatments for a total of 90,148 square feet or 2.07 acres of LIDU treatments in the Basin III treatment area.

Project Activities

The subcontractor surpassed the proposed treatment acreage. The original plan called for the treatment of 0.75-1.15 acres of LIDU. The subcontractor was able to treat 2.07 acres of LIDU with site appropriate methods.

The original grant agreement timeline was designed to have project work completed by March 31st, 2021. COVID-19 access restrictions and crew safety concerns delayed some project work. California Department of Fish and Wildlife (CDFW) Lake and Streambed Alteration (1600) permitting restrictions only allow treatment at the site from August 15th through March 31st. Concurrent California Department of Food and Agriculture (CDFA) Noxious Weeds grant funding for similar treatments in a separate section of the Carpinteria salt marsh but on a tighter timeline required the field crew to focus efforts for the August-March 2020-2021 treatment season on the CDFA grant SOW. This decision delayed expenditure of these NFWF grant funds. The US-LTRCD requested an extension of the project timeline to ensure full treatment and reporting could occur during the beginning of the 2021-2022 treatment season.

Project Outcomes

The grant agreement SOW listed two project objectives:

1. Remove 1 acre of *Limonium duriusculum* over a 2.5-acre area of emergent salt marsh
2. Restore treated area by seeding native wetland plants to discourage re-colonization by *Limonium duriusculum*.

In 2020, site wide LIDU treatment efficacy surveys and mapping of the endangered CHMAMA were performed on August 10-11, just 3 weeks after the reserve was reopened. The CHMAMA mapping identified a total of five occurrences within the area targeted for NFWF. Two of these occurrences had not been previously identified and all of them had not been documented before 2019, indicating that this endangered plant is spreading at this location. Furthermore, all the occurrences overlapped or were in close proximity to LIDU infestations, demonstrating the sensitivity of this project. LIDU surveys in the area targeted for NFWF showed that much of the LIDU was growing underneath small trees and large shrubs which would require trimming before the site could be treated. Tree trimming in the coastal zone of California is allowed between October 1 and December 31. On October 23, 2020, after coordination with the landowner, all shrubs and trees growing over and around LIDU were trimmed to prepare the site for treatment the following season.

The 2021 treatment season started with site wide LIDU treatment efficacy surveys and mapping of the endangered CHMAMA on August 2-3, 2021. The first round of treatments in the NFWF area was August 23-26 with a second visit on September 13-16. A total of 40,981 square feet were treated manually, 26,159 square feet were treated with solarization, and 23,008 square feet were re-treated with flame treatments for a total of 90,148 square feet or 2.07 acres of LIDU treatments in Basin III.

Objective 2 from the SOW called for collection and dispersal of CHMAMA seeds at the site. The project team was able to accomplish this task with the concurrent funding from CDFA. During the 2020/2021 treatment season, project staff collected, dried, and sorted 19,500 for future dispersal at treatment sites. Seeds were dispersed at post-treatment sites in Basin II in October of 2021.

Solarization treatment is a very effective method for LIDU removal, but mostly effective if in place for at least 6 months. The team was able to install solarization tarps at the project site early in the 2021/2022 treatment season. They will return in March of 2022 to remove the tarps.

The amount of funding necessary to conduct full marsh surveys, efficiently treat all LIDU areas, and conduct re-treatment as necessary is unlikely to come available from any source. Small funding sources that allow contractors to treat areas of the greatest importance is likely the way forward for LIDU work. The opportunity to acquire the CDFA funding concurrently with this NFWF funding did complicate reporting and timelines. The CDFW 1600 permit restrictions were a further complicating factor, and COVID-19 access and safety restrictions were unforeseeable. The flexibility of NFWF staff helped ensure project success along the way and was very appreciated by the US-LTRCD, Tidal Influence, and UC Reserve staff. See Table 1 for funding and progress breakdown.

Lessons Learned

The NFWF funding was the fourth funding source secured by the US-LTRCD in the past 4 years for treatment of LIDU in the Carpinteria salt marsh. Initial US-LTRCD involvement began with a grant agreement with the Wildlife Conservation Board (WCB) in 2016. The WCB grant funded the treatment and eradication of 5 noxious weed species in San Luis Obispo and Santa Barbara Counties. LIDU in the Carpinteria salt marsh had been a target, and collaboration with the UC Reserve manager, Dr. Andrew Brooks made access to the site straightforward.

To undertake treatment activities in the Carpinteria Salt Marsh the UC Reserve Manager needed to acquire a CDFW Lake and Streambed Alteration permit. This permit allowed treatment of LIDU only from August 15th to March 31st to protect Belding's savannah sparrow nesting habitat.

After initial site surveys for LIDU and CHMAMA presence within the entire salt marsh (230 acres) it became apparent that the perceived LIDU populations had been severely underestimated and the allotted WCB funding would not allow treatment goals to be reached. Manual treatments occurred with contractor staff and volunteers over 4.7 acres. Approximately 4,000 pounds of LIDU was removed and brought to the dump.

The US Fish and Wildlife Service (USFWS) Coastal Program staff became interested in funding treatment work in 2018. Tidal Influence was hired to undertake project work at the site with this grant funding and was able to treat 18,010 sq. ft. of LIDU between scraping and solarization methods. 3,400 pounds of LIDU was removed and brought to the dump. During this implementation period Tidal Influence staff experimented with heaping scraped LIDU material under solarization tarps in lieu of hauling to the dump. This process saved significant time and money and neutralized the LIDU beneath the tarps. Tidal Influence also collected 7,000 CHMAMA seeds for future dispersal during this implementation.

This agreement with NFWF began in February of 2020 to treat one acre of LIDU near the marsh entrance. Soon after, the CDFA Noxious Weeds Grant became available with a very short implementation window. Project work was to be completed by December 31st of 2020. A separate treatment site in Basin III was chosen for the CDFA funded project with the goal of 4,000 lbs. of LIDU removed manually and 36,000 sq. ft. treatment area. Through increased efficiency and staff experience, Tidal Influence was able to treat 164,299 sq. ft. and remove approximately 15,000 lbs. of LIDU material with the CDFA funding.

After two treatment seasons, between NFWF funding and matching funding from California Department of Food and Agriculture, 60,388 square feet were treated with solarization, 159,689 square were treated manually by scraping and hand pulling, and 34,370 square feet were re-treated with flame treatments. This is a combined total of 254,447 square feet, or 5.84 acres.

Table 1. Carpinteria Salt Marsh – *Limonium duriusculum* project efforts since 2018

Area	Task	Treatment Method	Funding Source	Total Acreage	Treatment Timeline	Material Totals
Nature Park (NP)	Survey	N/A	Wildlife Conservation Board	15	August 2019	N/A
South Marsh (SM)	Survey	N/A	Wildlife Conservation Board	10	August 2019	N/A
Basin I	Survey	N/A	Wildlife Conservation Board	20	August 2019	N/A
Basin II	Survey	N/A	Wildlife Conservation Board	60	August 2019	N/A
Basin III	Survey	N/A	Wildlife Conservation Board	125	August 2019	N/A
Basin II, Basin III	Treatment	Manual	Wildlife Conservation Board	0.37	September 2018	N/A
Basin II, III, NP, SM	Treatment	Manual	Wildlife Conservation Board	2.7	October 2018	4,000 lbs
Basin I, II, III, NP, SM	Survey	N/A	US Fish and Wildlife Service	230	August 2019	N/A
Basin III	Treatment	Manual	US Fish and Wildlife Service	0.06	September 2019	2,960 lbs
Basin III	Treatment	Solarization	US Fish and Wildlife Service	0.21	September 2019	N/A
Basin III	Seed Collection	N/A	US Fish and Wildlife Service	N/A	September 2019	7,000 seeds
Basin III	Treatment	Manual	US Fish and Wildlife Service	0.13	October 2019 – January 2020	440 lbs
Basin III	Treatment	Solarization	US Fish and Wildlife Service	0.1	October 2019 – January 2020	N/A
Basin III	Seed Dispersal	N/A	US Fish and Wildlife Service	N/A	N/A	7,000 seeds

Area	Task	Treatment Method	Funding Source	Total Acreage	Treatment Timeline	Material Totals
Basin I, II, NP, SM	Survey	N/A	CDFW Noxious Weeds	230	August 2020	N/A
Basin II, III	Treatment	Manual	CDFW Noxious Weeds	2.21	August – September 2020	12,000 lbs
Basin II, III	Treatment	Solarization	CDFW Noxious Weeds	0.79	August – September 2020	N/A
Basin II, III	Seed Collection	N/A	CDFW Noxious Weeds	N/A	August – September 2020	19,500 seeds
Basin II, III	Treatment	Manual	CDFW Noxious Weeds	0.52	October-December 2020	3,000 lbs
Basin II, III	Treatment	Green Flame	CDFW Noxious Weeds	0.26	October-December 2020	N/A
Basin I, II, II, NP, SM	Survey	N/A	NFWF OSPR	230	August 2021	N/A
Basin III	Treatment	Solarization	NFWF OSPR	0.5	August 2021	N/A
Basin III	Treatment	Solarization	NFWF OSPR	0.1	September 2021	N/A
Basin III	Treatment	Manual	NFWF OSPR	0.94	September 2021	N/A
Basin III	Treatment	Green Flame	NFWF OSPR	0.52	September 2021	N/A
Basin II	Seed Dispersal	N/A	NFWF OSPR	N/A	October 2021	19,500 seeds

Methods

Solarization treatments consist of covering areas with greater than 25% LIDU coverage with 6 mil black plastic sheeting. The plastic sheeting is secured by landscape staples and weighed down with rocks, material found

on site, and/or sandbags that are filled with LIDU that has been scraped from surrounding areas. The solarization treatments are left on as long as possible, and preferably for at least 6 months. During that time, the LIDU is killed by a combination of increased heat and lack of photosynthesis.

Scraping treatments consist of using shovels to scrape the top layer of the marsh removing the LIDU. This is done in dense areas where CHMAMA is not present.

Hand pulling consists of removing LIDU individuals by hand and small hand-tools. This is done in areas directly surround the sensitive CHMAMA plants.

Flame treatments consist of using a hand-held applicator attached to a small propane tank mounted on a backpack. Flame is applied directly to LIDU individuals destroying the plant's cell structure and preventing future photosynthesis

Results

After several years of treatments, the subcontractors have found the most effective method for controlling LIDU is a combination of solarization treatments, followed by flame re-treatments the next season.

Solarization treatments are 100% effective immediately after removal, but because of the seed bank and distribution of new seeds from other areas by the tides, regrowth is seen the following year. Regrowth the following year can range from 1-5% in these solarized areas. If left untreated, solarized areas may experience up to 10% coverage after two years.

Scraping treatments can be up to 100% effective at the time of treatment, but because the soil is exposed, regrowth can be observed by the end of the season. After one year without re-treatments, these areas can have up to 10-25% regrowth. After two years of no re-treatments, coverage could be up to 50% of what was originally there before treatments.

Hand pulling is the least effective treatment. Hand pulling is never 100% effective, even right after treatment. This is because numerous incredibly small individuals will often be left behind or obscured by the disturbed soil. Hand pulling also leaves much of the existing seed bank in place. Areas treated by hand pulling will have evidence of regrowth at the end of the same treatment season. After one year of no re-treatments these areas can easily see 10-25% regrowth. After two years of no re-treatments, coverage could be up to 75% of what was originally there before treatments.

Flame treatments seem to be most effective for re-treating areas or treating areas that have sparse coverage. It effectively targets individuals but is less effective on large clumps of plants. Therefore, it is useful for re-treating areas that are showing signs of re-growth.

The results thus far have shown the most effective combination of treatments is initial solarization treatments for six months, followed up by flame re-treatments in following years. Areas with up to 100% LIDU coverage can be held to under 5% with this combination of treatment. With years of treatments and re-treatments,

hopefully the seed bank can be reduced to a level where significant re-treatment efforts are not required at such levels in every location every year.

Dissemination

US-LTRCD staff wrote a short article for inclusion in the Santa Barbara County Agriculture commissioner's Office newsletter highlighting the project success thus far.

US-LTRCD staff shared a project update with the San Luis Obispo Weed Management Area group at the winter 2021 meeting.

Tidal Influence's Principal Restoration Ecologist attended the quarterly Santa Barbara County Weed Management Area meetings on June 6th and September 2nd, 2020, and on March 3rd, 2021 to provide updates to the members of the management group.

Tidal Influence created the WMA presentation 3-1-21 document to highlight project. This has been uploaded.

Project Documents

Please contact CDFW-OSPR for more information and photos about this project.

Project Photos

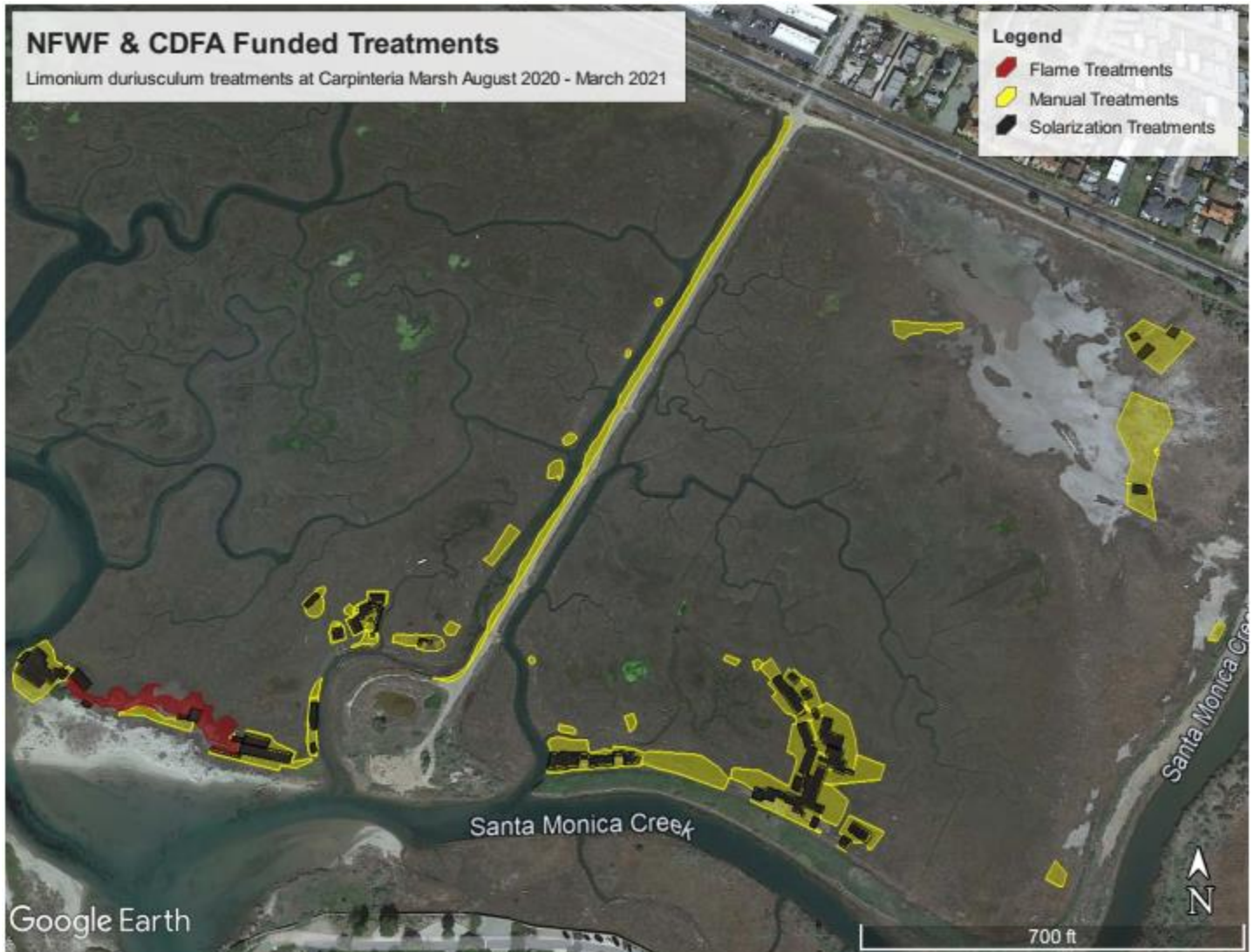


Figure 1: Treatment areas by method for both NFWF and CDFA funded project areas.



Figure 2: Treatment area by method for NFWF funded project area.



Figure 3: Flame re-treatment areas.



Figure 4: Areas before solarization treatments.



Figure 5: Solarization Treatments

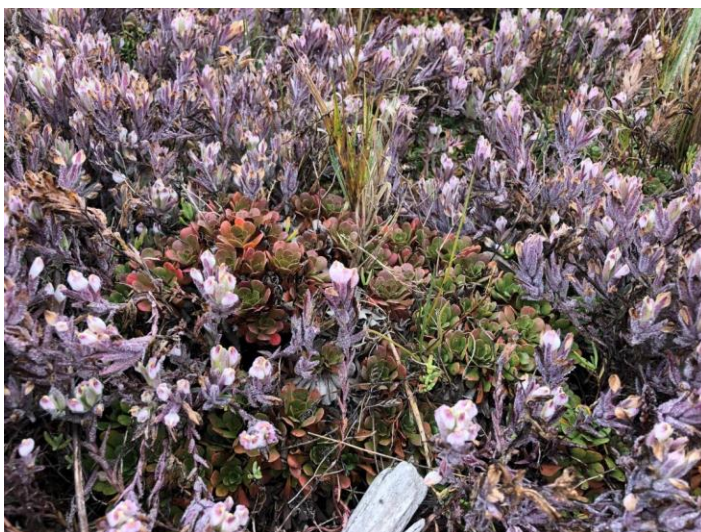


Figure 6. Limonium duriusculum mats with Salt Marsh Bird's Beak overlapping.