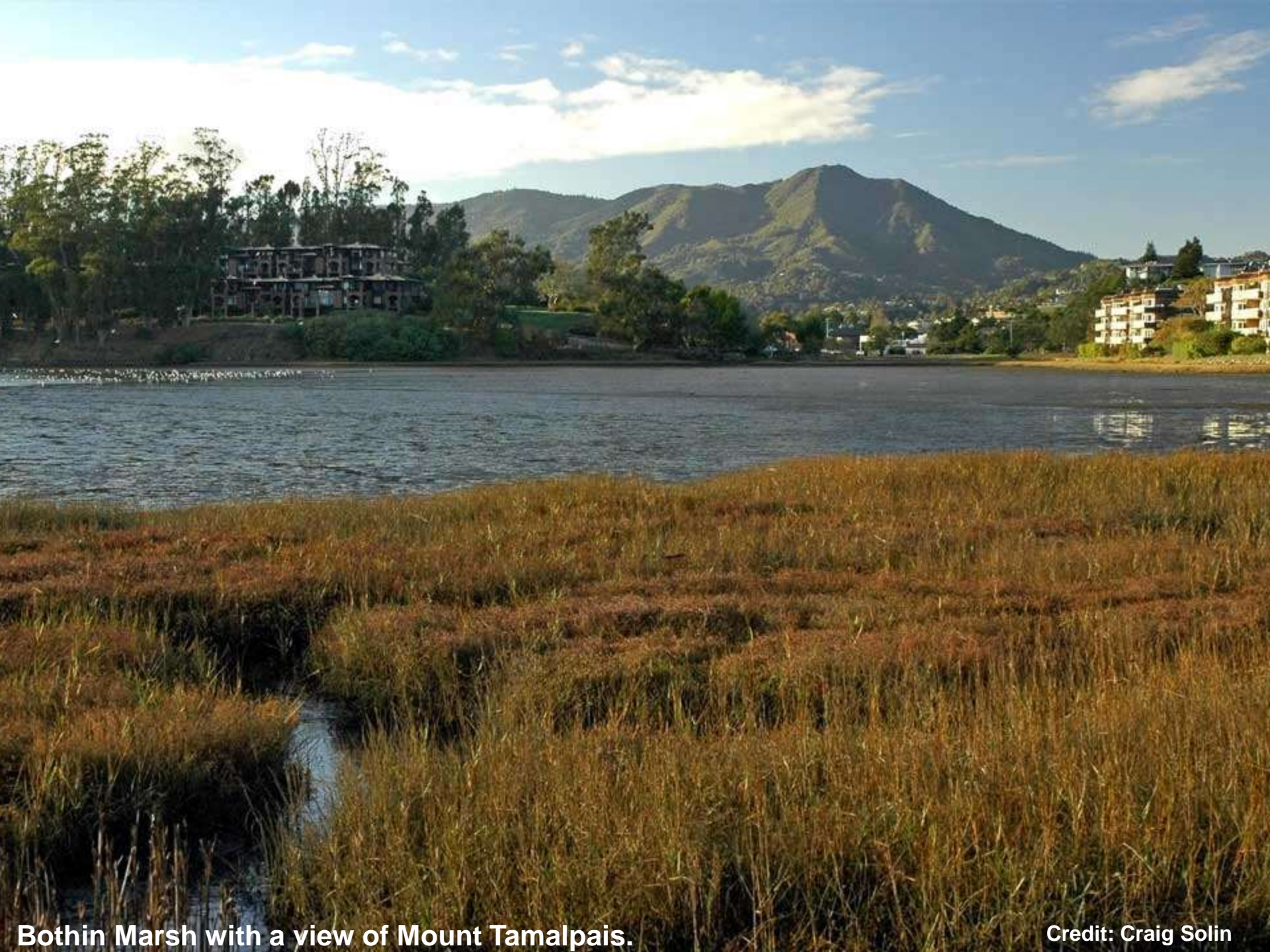




Managing Invasive Sea Lavender at Bothin Marsh

Tatiana Manzanillo
Marin County Parks
November 8, 2018



Bothin Marsh with a view of Mount Tamalpais.

Credit: Craig Solin

Bothin Marsh

- 106-acres of marsh, slough, tidal wetlands
- Habitat for rare and endangered species
 - Ridgway's Rail (*Rallus longirostris obsoletus*)
 - Salt marsh harvest mouse (*Reithrodontomys raviventris*)
 - Point Reyes bird's beak (*Chloropyron maritimum ssp. palustre*)



Credit: USGS



Credit: Len Blumin

Discovery of Non-native *Limonium* Species

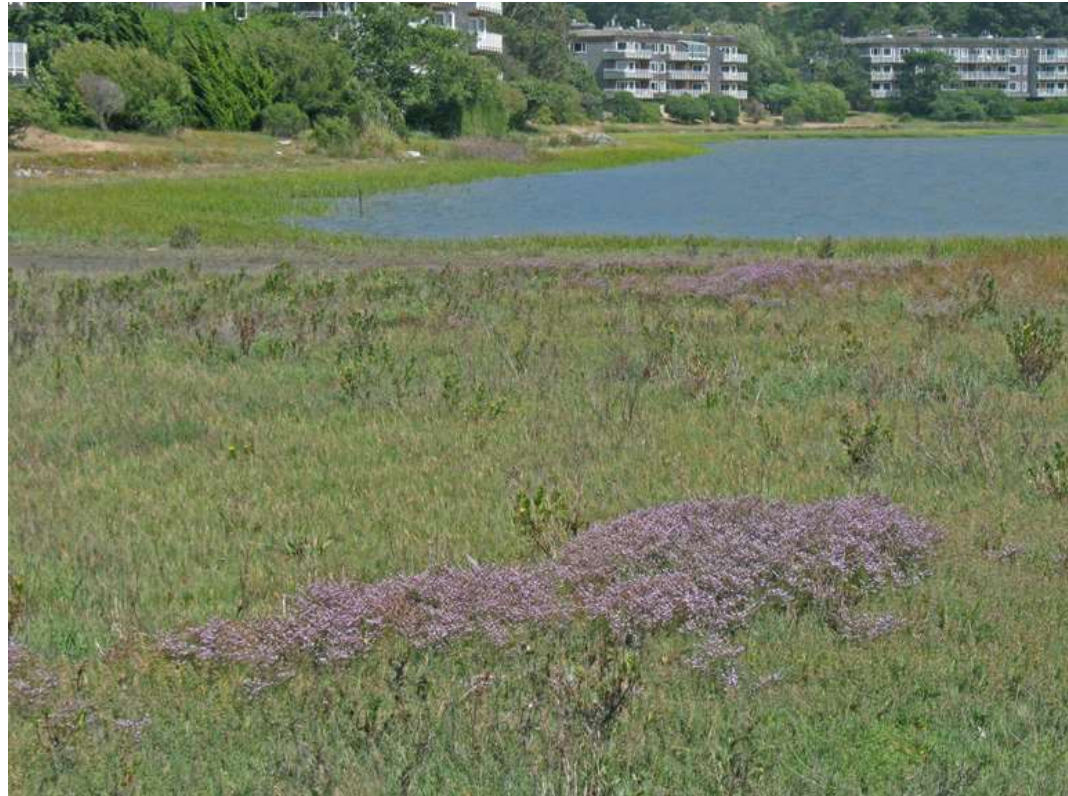
- 2006: Discovery of non-native *Limonium*
- 2007-2010: SFSU Kathy Boyer and Gavin Archibald mapped 25 *Limonium* sites in San Francisco Bay (15,110 m²)
- 2010: BAEDN listed LIRA as invasive
- 2015: Boyer Lab, Kerstin Kalchmayr remaps sites (32,002 m²)
- 2016-2017: Cal-IPC treated 15 sites as pilot
- 2018: NFWF grant allowed mapping of 34,683 m² and treating 95% of known sites in SF Bay



Credit: Mike Perlmutter

Known Limonium sp. in Marin

- **Non-native, Invasive:**
 - *Limonium ramosissimum*
 - *Limonium duriusculum*
 - *Limonium binervosum*
- **Non-native:**
 - *Limonium perezii*
- **Native:**
 - *Limonium californicum*



Credit: Vernon Smith

Limonium General Characteristics



Credit: Margo Bors

- PLUMBAGINACEAE: Leadwort Family
- Perennial
- Basal leaves
- Inflorescence of papery flowers
- Salt-tolerant
- Invasive characteristics:
 - 36,000 – 130,000 seeds per m²
 - Establishes in human- and naturally-disturbed upper salt marsh habitats

Limonium californicum

California sea lavender

Native to Mediterranean region

Blooms May to November

Large, rounded leaves

Spatulate

One prominent vein

Can reach 1-2 ft. in height
and width



Credit: Santa Monica Mountains National Recreation Area

Open inflorescence

Small, pale violet
flowers



Credit: John Doyen

Limonium ramosissimum

Algerian sea lavender

Native to Mediterranean region

Blooms May to November

Inflorescence “not curved”

Flowers crowded
at inflorescence
tips



Credit: Ron Vanderhoff

Acute tipped leaves
oblanceolate or spoon-
shaped



Credit: Margo Bors



Credit: Ron Vanderhoff

Limonium duriusculum

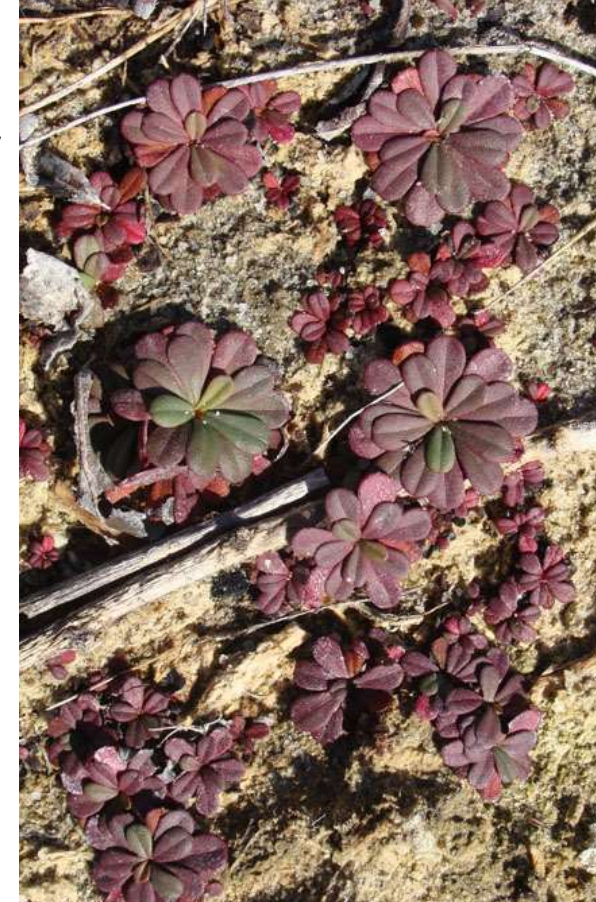
European sea lavender

Native to Mediterranean region

Blooms September-June

Leaves oblanceolate-
spatulate
Tip obtuse, never
acute
Small in size
compared to LIRA

Inflorescence “curved”
(as compared to LIRA)
Flowers more evenly spaced
along inflorescence



Credit: Ron Vanderhoff

MARIN COUNTY
PARKS

PRESERVATION • RECREATION

Credit (above and right):
Vernon Smith



Limonium binervosum

Rock sea lavender

Native to the UK and Britain

Blooms June-September

Flowers bunched

Inflorescence spikes 13-25mm

Acute tipped leaves
(spine on tip end of
vein)
obovate shaped
3 veins but no pinnate
leaf



Credit: David Fenwick



Credit: David Fenwick



Generally smaller
than LIRA

Credit: C.E. Salmon

Limonium perezii

Canary sea lavender

Native to Canary Islands

Blooms March-September

Inflorescence branched
panicle reaches up to 18in
tall

Flowers have purple
calyces with white corollas

Triangle shaped rounded leaves with long petioles



Can grow up to
3ft tall, 1ft long
leaves



Credit: Debra Cook

Credit: Robert Sikora

Our Work So Far

- Marin County Parks began treating *Limonium* at Bothin Marsh ~2010 using hand removal techniques with staff and volunteers.



Credit: Tatiana Manzanillo



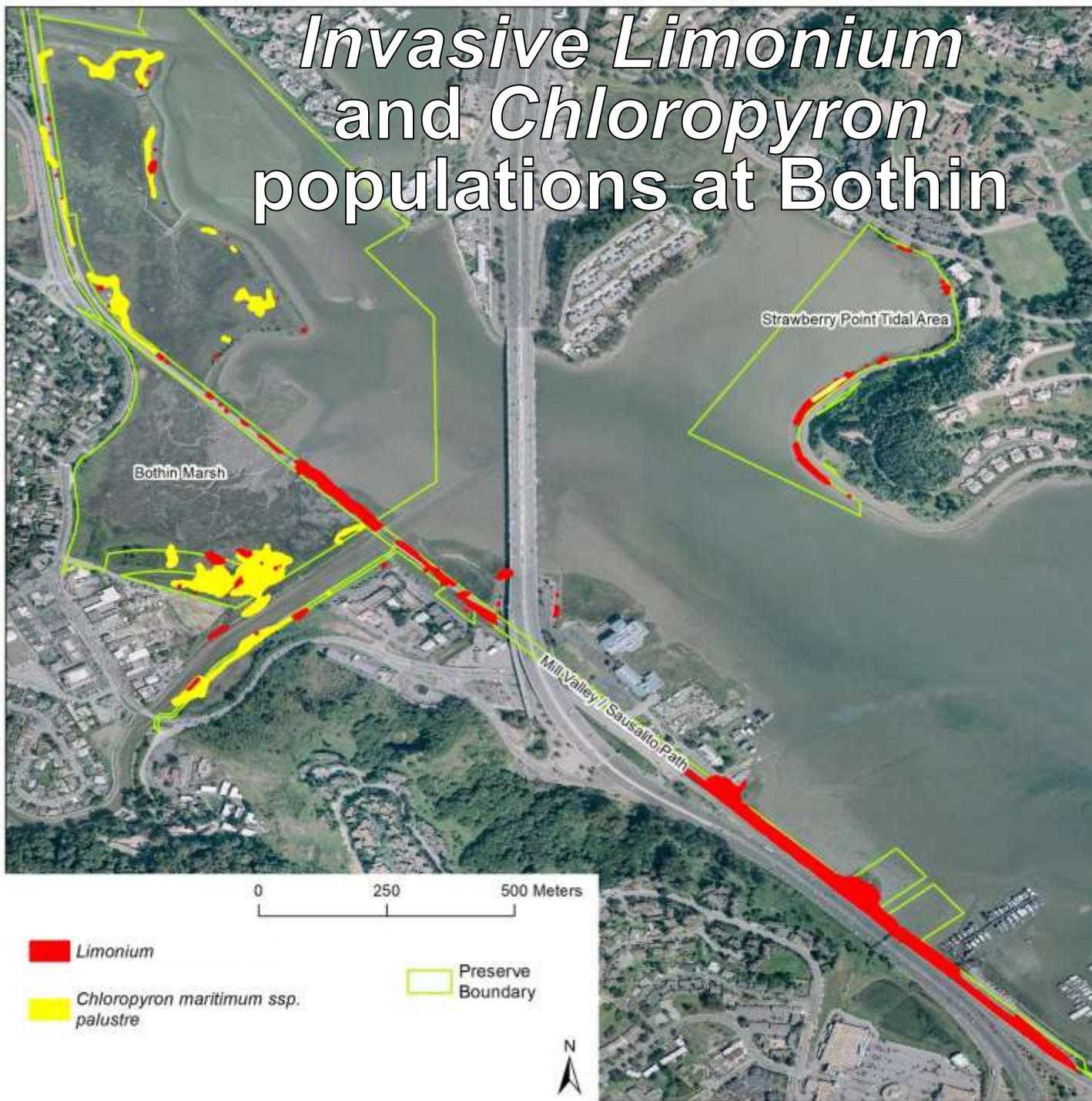
Our Work So Far



MCP staff survey for invasive *Limonium* and *Chloropyron maritimum* ssp. *palustre*

Credit: Tatiana Manzanillo

Invasive *Limonium* and *Chloropyron* populations at Bothin



Credit: Julian Geoghehan

Treatment

- *Limonium* can easily be hand pulled
 - Removes whole plant and taproot
- Other treatments include:
 - Herbicide application (Cal-IPC)
 - Propane flaming (MCP)



Credit: MCOSD Restoration Crew

Our Work So Far

	2015	2016	2017	2018
Total Staff Time Spent	46.3	37.7	221.5	124.5
Total Number of Sites Treated	25	25	35	60
Total Number of Individuals Treated	2816	1881	8130*	58170*
Total Acres Treated	0.44	0.47	2.16	5.7

*Estimates were used for areas that contained greater than 1000 individuals.



2017 Test Plots

Steaming results one month after treatment. Scorching results one month after treatment.



Credit (both): Pete Frye

Treatment Comparison

- Comparison of different treatment methods on invasive *Limonium sp.*
 - Hand pull
 - Steaming Flame
 - Scorching Flame





Plots testing different types of treatment.



MCP staff collect data to compare different effects of removal techniques on *Limonium*.

Credit: Tatiana Manzanillo

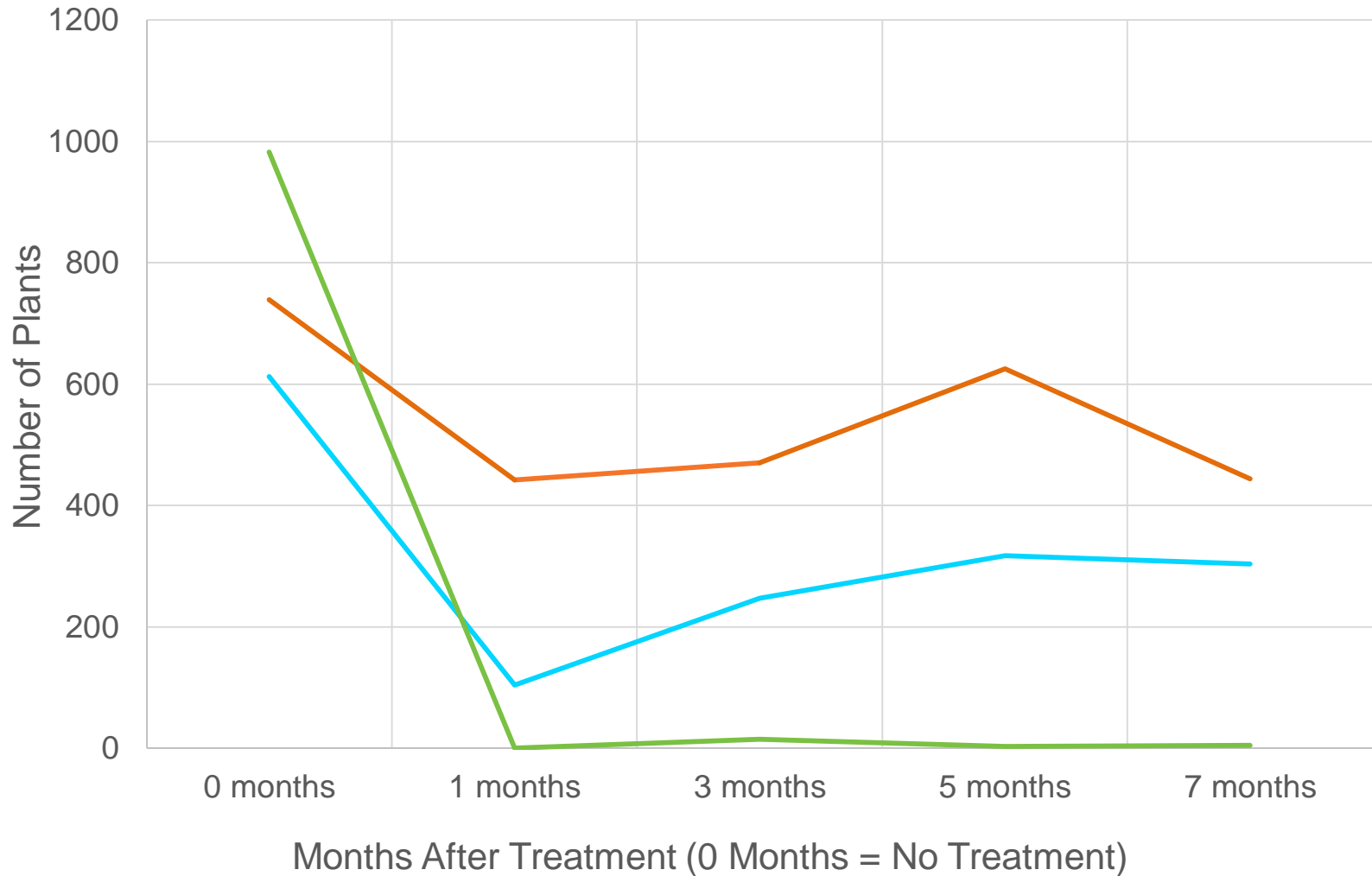


Area where *Limonium* has started to crowd out native species.

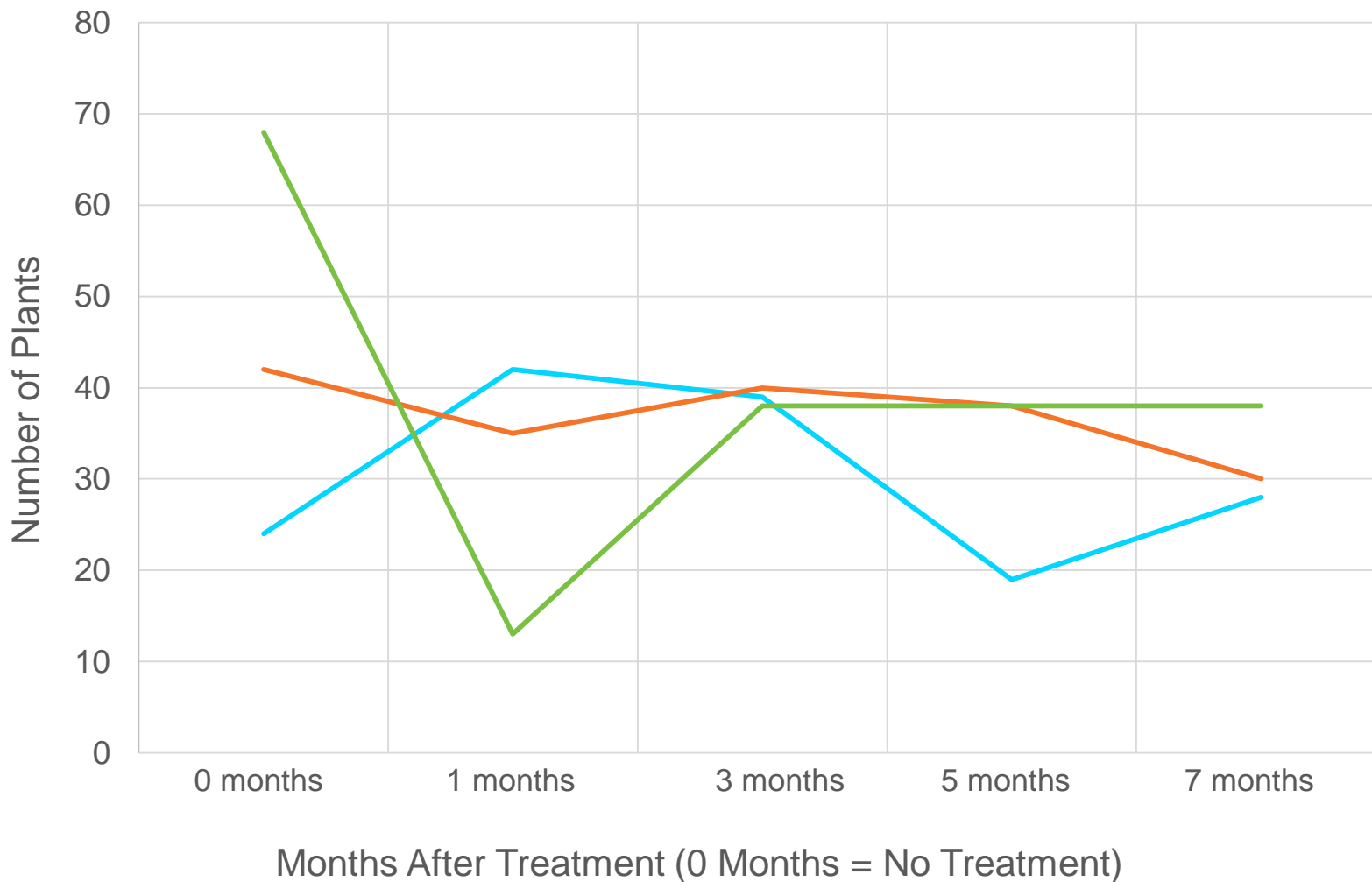


Propane torch treatment of invasive *Limonium* sp.

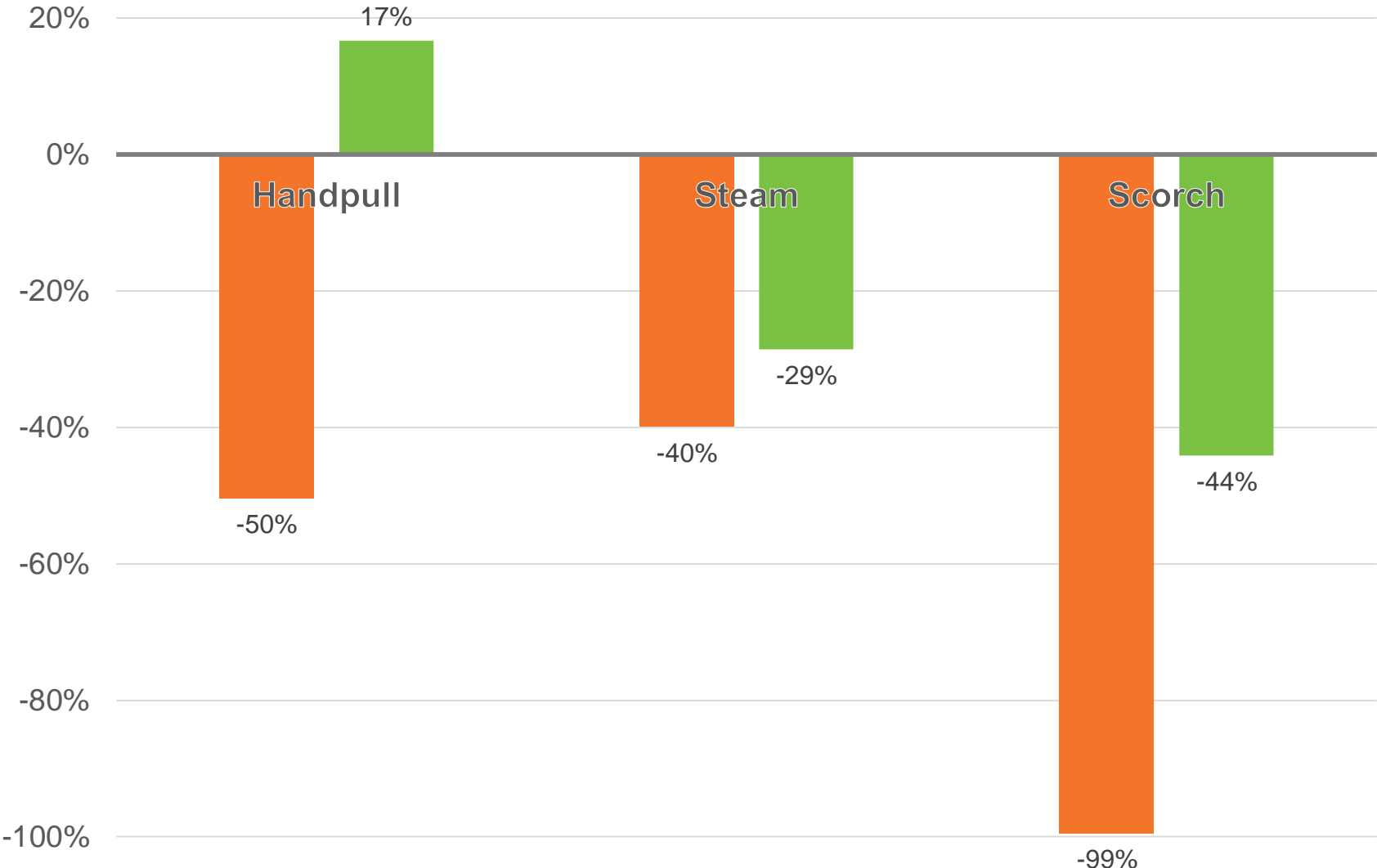
Invasive Limonium Counts



Native Limonium Counts



Limonium Species Total % Change



■ Invasive % Change ■ Native % Change

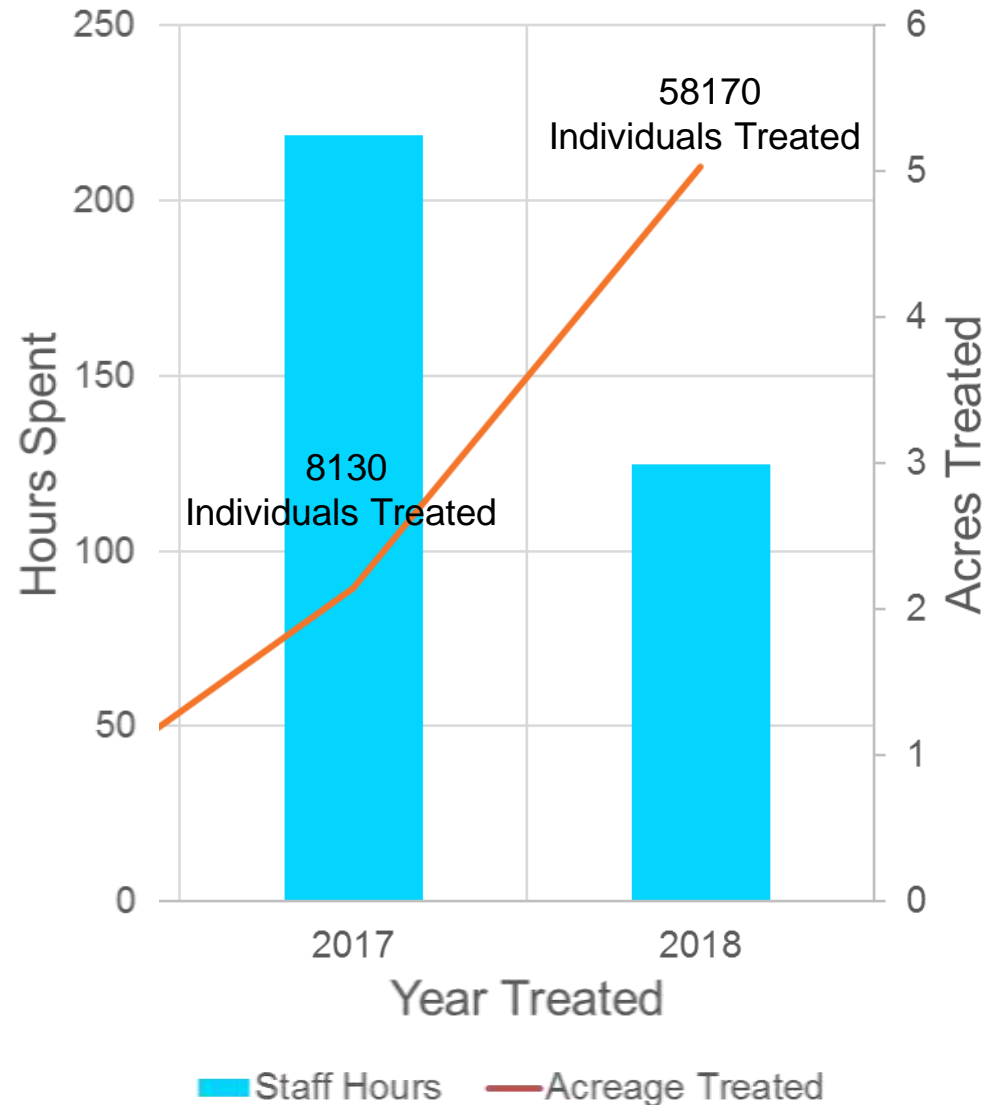


MCP staff propane flaming areas of invasive *Limonium* sp.

Credit: Tatiana Manzanillo

Staff Time and Area Treated for Limonium sp.

- Propane torch treatment in 2018 significantly reduced amount of staff time spent removing invasive plants.
- 40,291 individuals were treated by flaming in 2018.





Thank you!

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pfrye@marincounty.org

MCP staff hand pulling invasive *Limonium*

Credit: Tatiana Manzanillo

Resources

- http://www.cal-ipc.org/ip/management/plant_profiles/Limonium_amosissimum.php
- <http://cal-ipc.org/symposia/archive/pdf/2011/PerlmutterPoster2011.pdf>
- http://www.baydeltalive.com/assets/c5f67c17ca965d44d6e39c3bc257f5c8/application/pdf/SFEWS_12.2_Archibald_and_Boyer_2014.pdf
- <https://baynature.org/article/watch-out-for-invading-sea-lavender/>
- <http://www.bcdc.ca.gov/planning/SPLG.pdf>
- <http://ft.floatinghomes.org/invasive-sea-lavender-threatens-our-shores/>
- <http://nathistoc.bio.uci.edu/plants/Plumbaginaceae/Limonium%20amosissimum/Limonium%20amosissimum.htm>
- <https://www.cal-ipc.org/wp-content/uploads/2018/02/2017-Symposium-Controlling-Algerian-sea-lavendar-in-SF-Estuary-Drew-Kerr.pdf>
- <https://www.cal-ipc.org/wp-content/uploads/2018/02/2017-Symposium-Assessing-changes-of-Limonium-in-SF-Bay-wetlands-Kerstin-Kalchmayr.pdf>

