ARUNDO DONAX IN THE SALINAS RIVER

VIRTUAL WORKSHOP

February 19, 2021

Amy Smart, Conservation Specialist

Upper Salinas-Las Tablas Resource Conservation District

Salinas River Watershed *Arundo* Eradication Programs

- California Department of Food and Agriculture (CDFA) Noxious Weeds Grant Program
- Natural Resources Conservation Service (NRCS) Regional Conservation Partnership Program
- Resource Conservation District of Monterey County (RCDMC), Camp Roberts, San Luis Obispo County Agricultural Commissioner

Salinas River

- San Luis Obispo County
- Monterey County
- Land use and demographics
- Watershed Action Plan, 2004

Arundo donax – Giant Reed

- First introduced by Spanish colonists to California in the early 1800s for construction material and erosion control in drainage canals
- US Army Corps of Engineers originally planted the species in the 1940s for Salinas river-bank stabilization
- In 2011, the California Invasive Plant Council determined that the Salinas River watershed had the second-largest infestation of *Arundo* in California

IDENTIFICATION

Arundo

- Resembles bamboo or corn, Common Reed, Wild Rye
- Perennial
- Found along streambank and floodplain

Giant Reed vs Common Reed

Arundo donax

Phragmites australis

Aerial Imagery

- Availability
- GIS analysis, flyovers, government databases
- Field verification

Can you find *Arundo*?


Arundo
Arundo
Arundo
Google Earth
© 2020 Google
300 ft
N

Removal

- Privately owned land
- Permit assistance
- Biological monitoring
- Mechanical removal and disposal
- Herbicide application
  - Follow up treatments

Salinas River Arundo Control Program: Progress and Lessons Learned

Paul Robins, Executive Director

(lifted from) Emily Zefferman, PhD Ecologist

Resource Conservation District of Monterey County

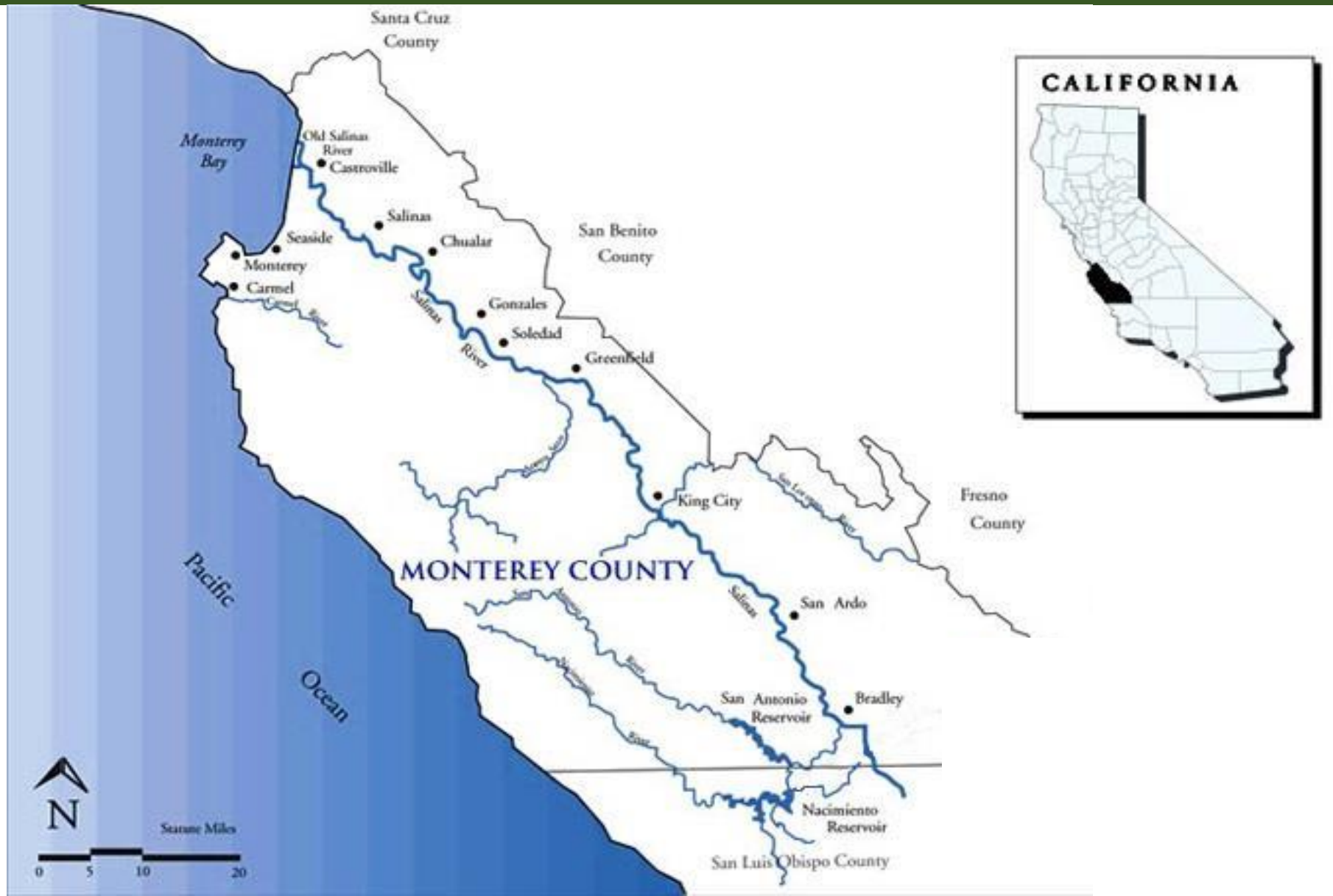
February 19, 2021

Outline

- Background on Salinas River
- History of Arundo Control Program
- Program approach and methods
- Progress to-date
- Lessons learned
- Questions

Salinas River (the “Upside-down River”)

- 175 miles long, 92 miles in Monterey County
- Flows south -> north, underground
- Altered hydrology: reservoir releases in summer months lead to increased vegetation growth



Salinas River: *Arundo donax* invasion

- Planted for erosion control, bank stabilization
- Cal-IPC mapped arundo in Salinas River watershed in 2011: 1470 infested acres
- Rapid recovery and expansion since end of drought

Salinas River: Arundo impacts

- Increased flood risk
- Poor quality habitat
- Arundo high water use increased impacts of drought

Salinas River Arundo Control Program: History

Program History

- Monterey County Agricultural Commissioner began program, sprayed scattered patches of arundo and tamarisk in southern part of county in 2008 and 2009
- 2011-2014, RCD of Monterey County developed large-scale program with consultant Jason Giessow (Dendra, Inc.)
- Program permits
  - CEQA Mitigated Negative Declaration
  - CDFW Streambed Alteration Agreement (1600)
  - USFWS Technical Assistance Letter
  - NOAA/NMFS Technical Assistance Letter
  - SWRCB NPDES permit
  - ACOE consultation

Salinas River Arundo Control Program: Funding

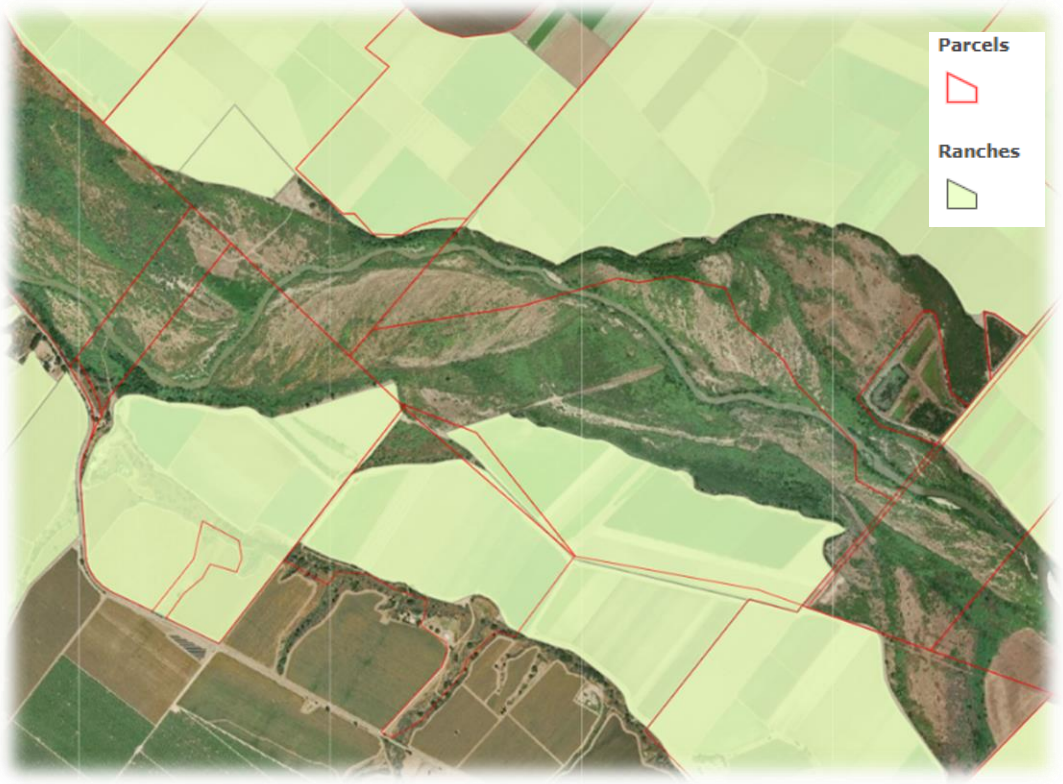
Grants and other Funding

- Wildlife Conservation Board
  - $1.1 million, 2014-2019, Habitat Conservation Fund
    - ~150 acres
  - $3.3 million, 2016-2021, Prop 1 Streamflow Enhancement Program
    - ~350 acres
  - $2.9 million, 2019-2023, Prop 1 Streamflow Enhancement Program
    - ~275 acres
- USDA Natural Resources Conservation Service (NRCS)
  - $1.8 million, 2018-2023, Regional Conservation Partnership Program
- California Dept. of Food and Agriculture
  - $60,000, 2019-2020, Noxious Weed Grant Program
- Monterey County Agricultural Commissioner
  - >$400,000, 2014-2020
- Cost-share agreements – private and public
  - $150,000, 2019-2024

Salinas River Arundo Control Program: Permissions

Landowner Agreements

- ~350 parcels adjacent to or intersecting Salinas River
- Mostly private agricultural land, often farmed by tenant
- 10 year access agreements, per WCB requirements
  - First five years- RCD treatment
  - Last five years- landowner/tenant treatment
- 41 agreements signed



Salinas River Arundo Control Program: Strategy

- Upstream to downstream treatment
- Mow large stands to reduce biomass
- Small stands – spray only
- Treat with herbicide for multiple years

Biomass Reduction
Mow in Year 1 (fall)


Just after fall mowing


Summer after mowing

Initial herbicide treatment
Spray in Year 2 (summer/fall)

- Glyphosate (aquatic approved)


Before initial spray


After initial spray

Herbicide re-treatment
Spray in Year 3, etc. (summer/fall)

- Glyphosate + imazapyr (aquatic approved)

Cut stump treatment

- Needed in limited cases

Mower hazards

Avoiding overspray into water

Organic field

Upper watershed treatment

Scattered small patches arundo and tamarisk

Spray only

- Glyphosate + imazapyr (aquatic approved)

Upper watershed treatment

Re-mapped via helicopter survey (Wildlands Conservation Science) in 2019

Upper watershed treatment

Treatment via land and canoe in 2019 and 2020

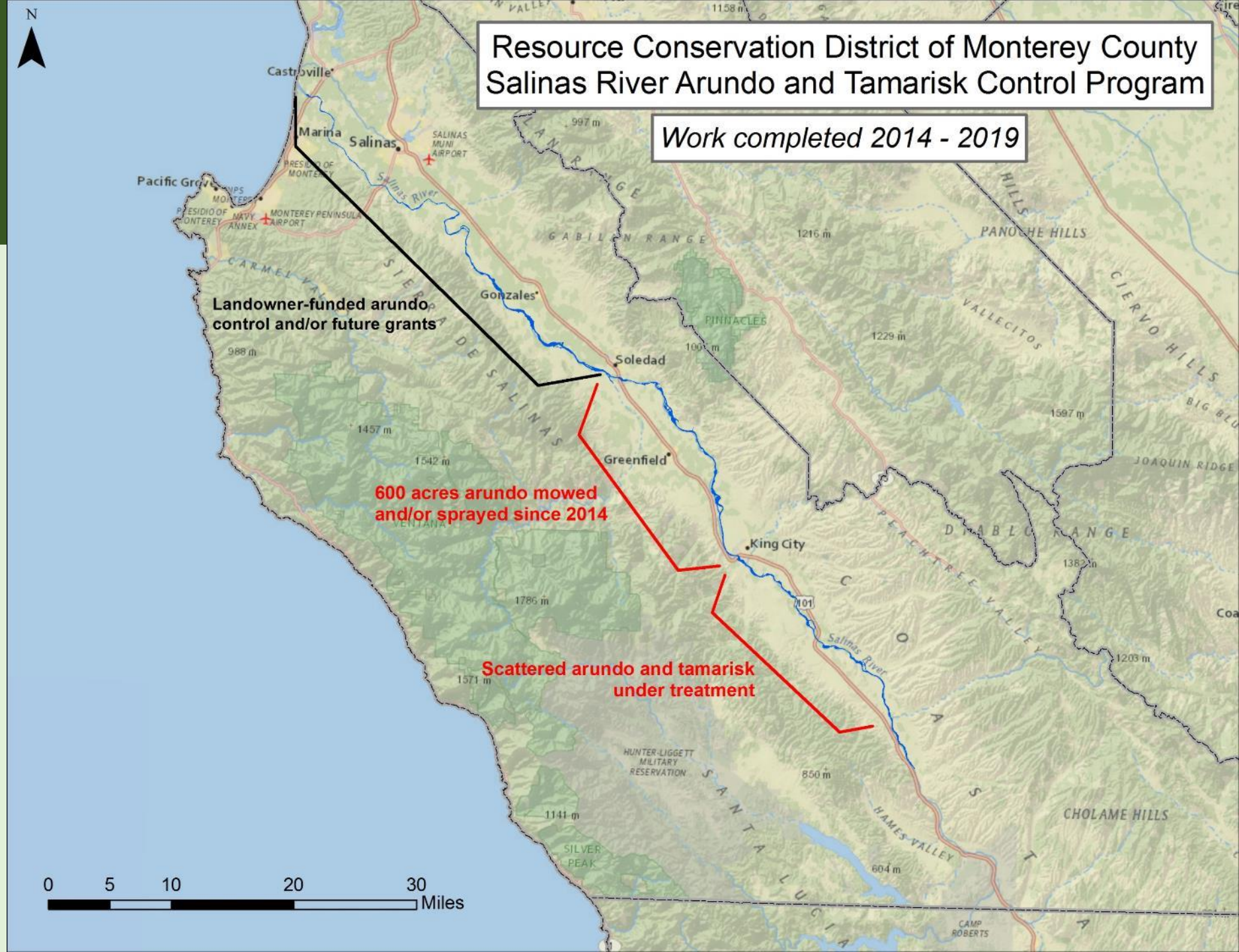
- Glyphosate +imazapyr

Biological surveys and monitoring

- Pre-activity surveys by contracted biologists
  - Avian surveys prior to September 1
  - Buffers around burrows, woodrat nests, other sensitive habitats
  - Flag wetlands
  - Mark hazards
- On-site biological monitoring by RCD staff
  - Morning sweep of work site
  - Work closely with work crews to ensure permit compliance
  - On-the-ground contacts
- Water sampling

Salinas River Arundo Control Program: Progress

- Seven work seasons since 2014
- ~750 acres mowed/sprayed San Ardo-Soledad
- Total: Treated almost all arundo along 48 rivermiles



Lessons Learned

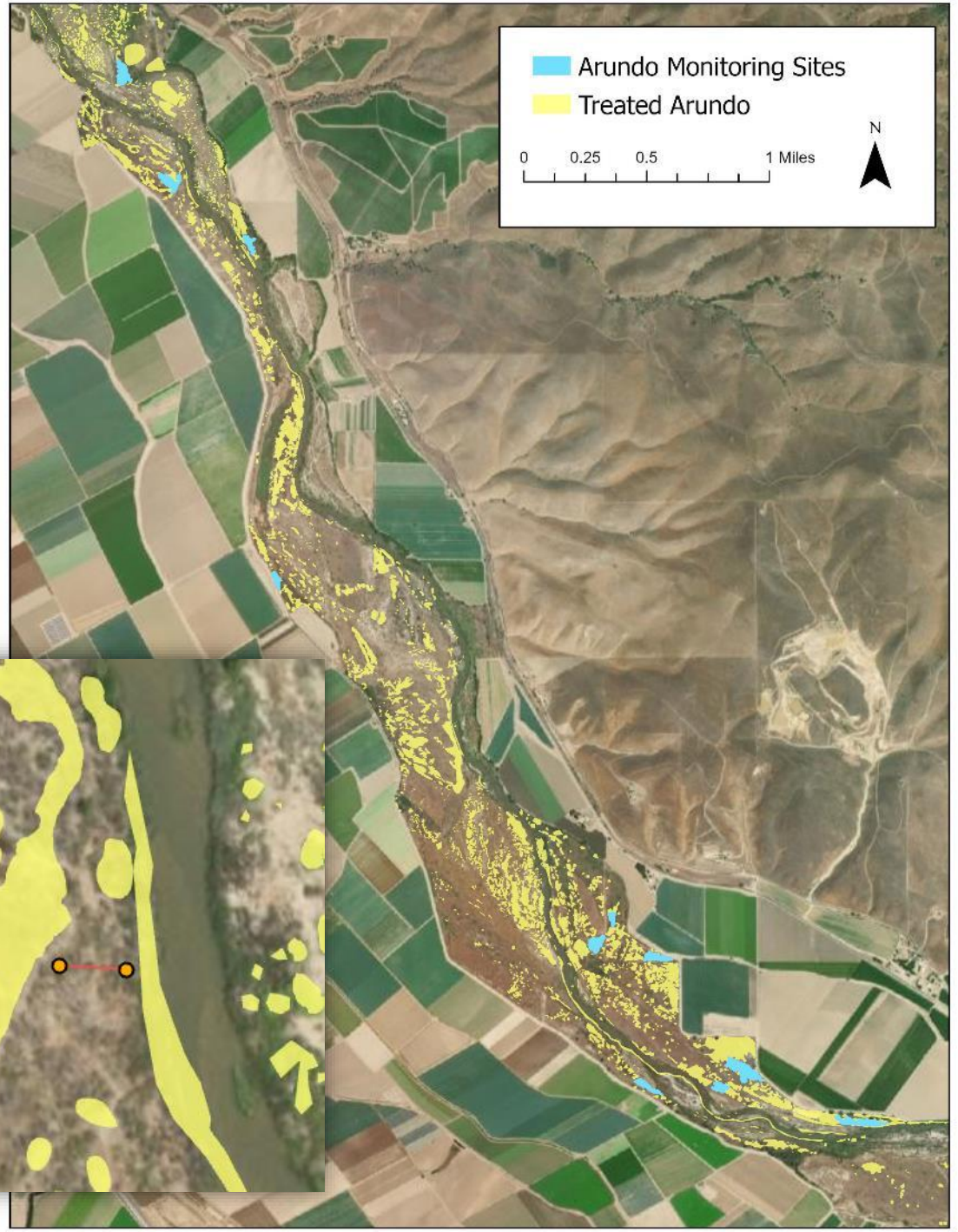
Plant Community Response

Plant Community Transect Monitoring

- Treatment efficacy
- Plant community recovery
  - Relying on passive restoration (no planting)
  - Are plant communities in former arundo stands recovering?

Plant community survey methods

- Selected 11 large arundo patches mowed fall 2016
- Each patch:
  - Two transects in arundo stand (“arundo transects”) and two outside of arundo stand (“control transects”)
  - Arundo cane density
  - Species presence
  - Data on percent cover
    - Herbaceous
    - Woody
    - Graminoids (grasses)



Treatment Efficacy

- First herbicide treatment – dramatic results!
- But hard to eradicate…
- Observation: Herbicide treatment seems more effective on healthy (unstressed) arundo, and unmowed arundo

Plant Community Recovery


Coyote brush


Coast live oak


Narrow leaf milkweed


California blackberry

Plant Community Recovery

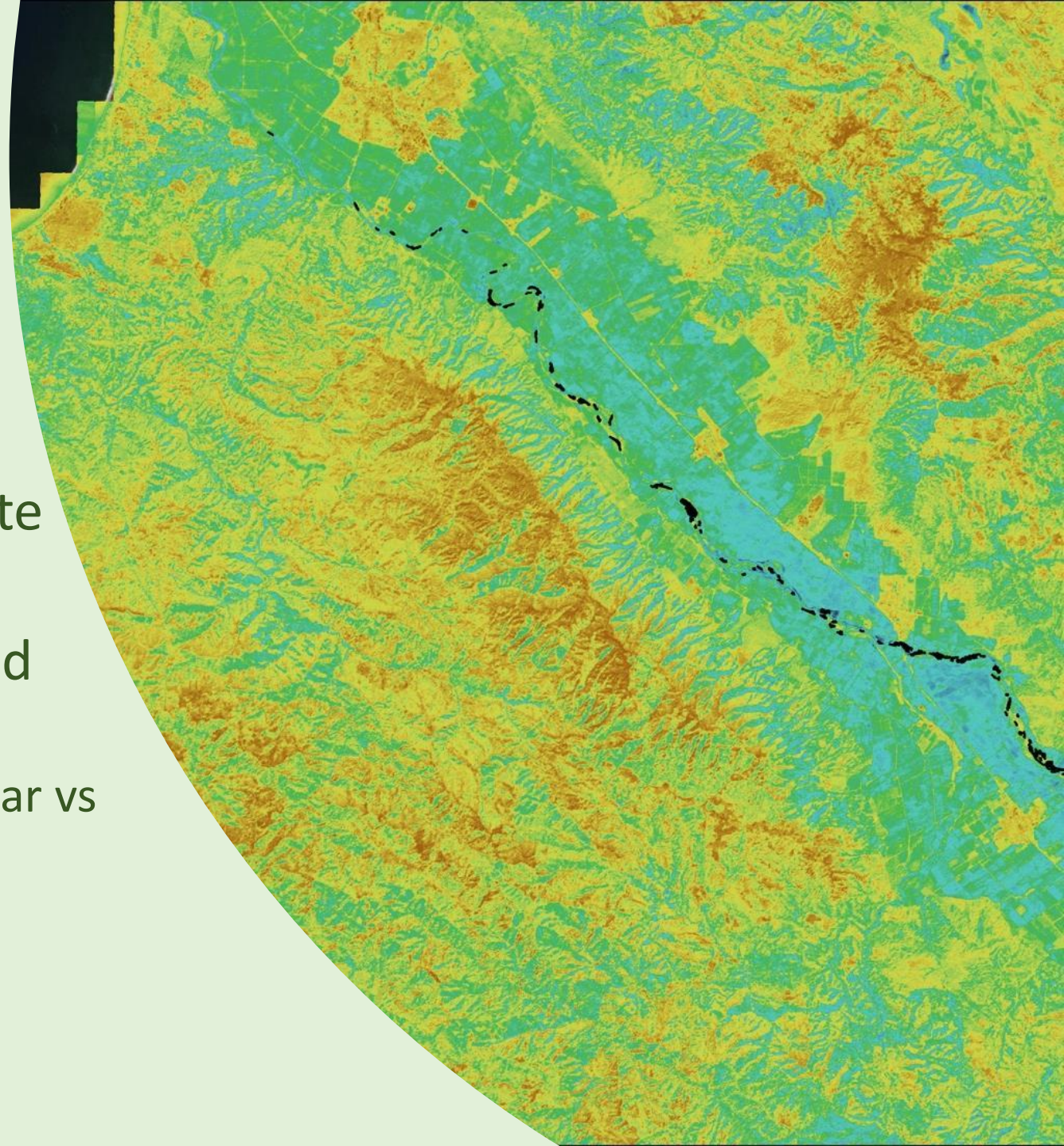
Poison hemlock

Perennial pepperweed

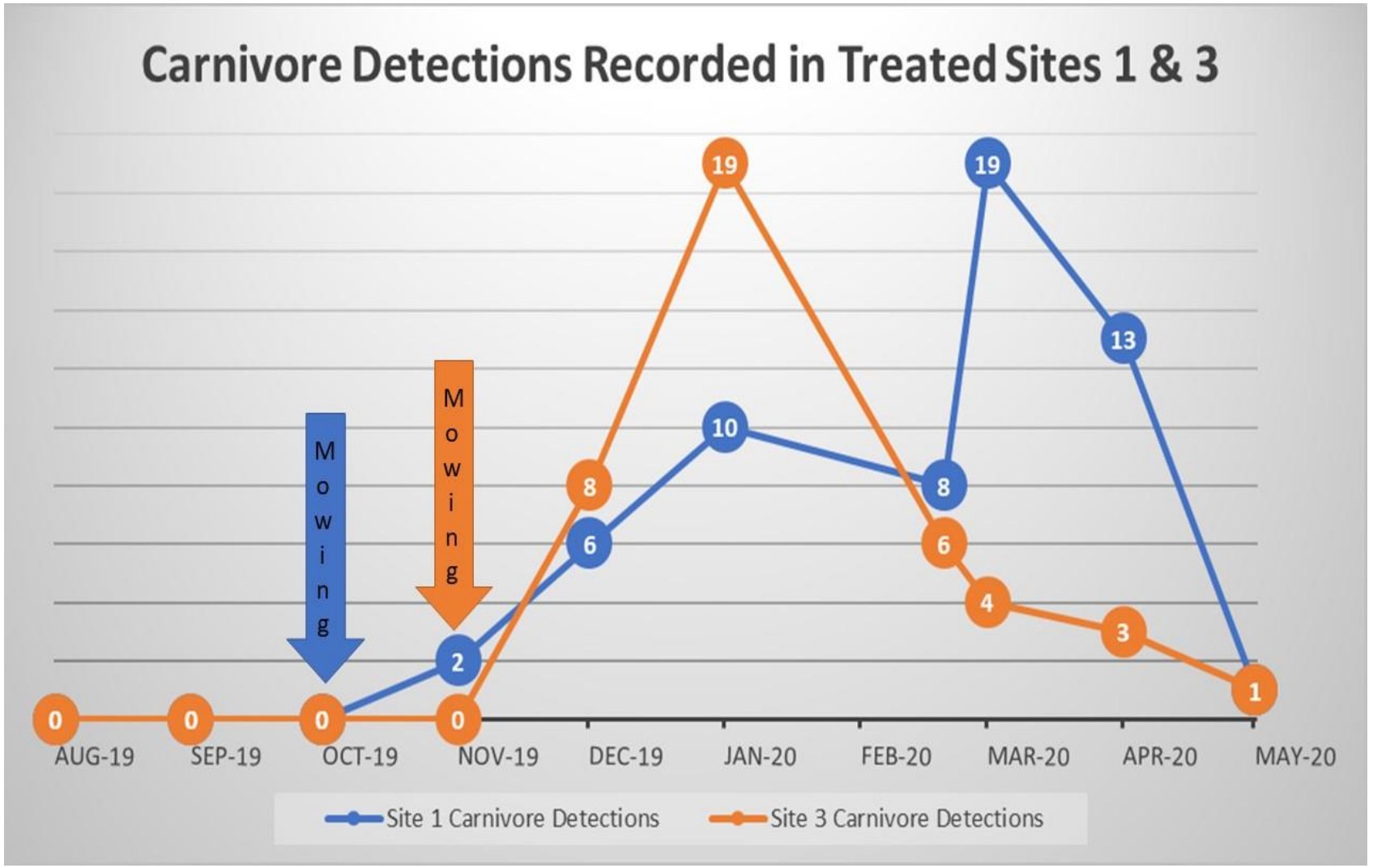
Arundo Evapotranspiration

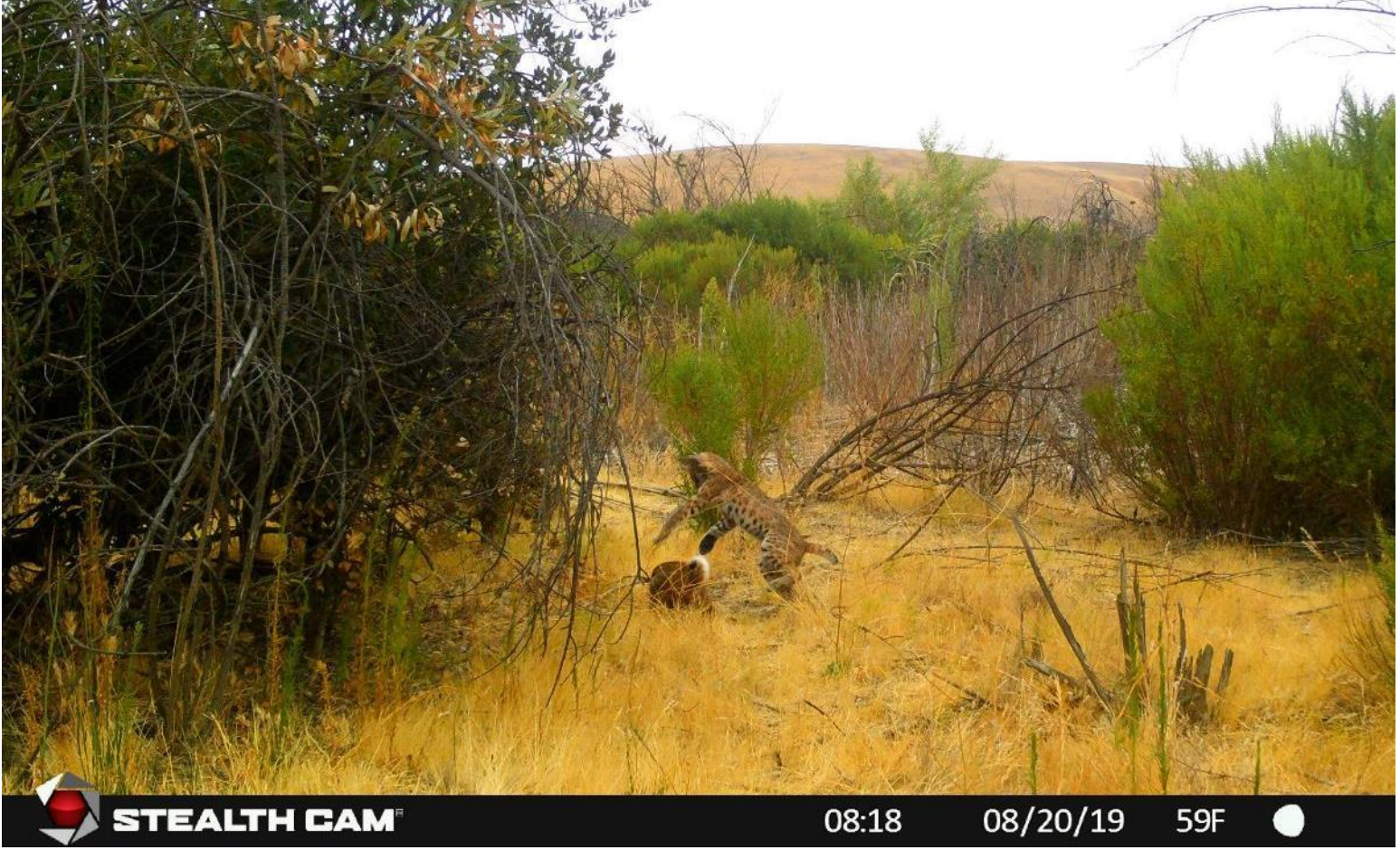
Dr. Forrest Melton, CSUMB

- Using remote sensing data to estimate ET of Salinas River arundo stands
- Finding much lower ET than predicted using other methods
  - water savings of ~1.5 acre-feet/acre/year vs 19.2 acre-feet/acre/year



Large Wildlife

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STEALTH CAM
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STEALTH CAM
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06/15/20
50F
SITE4BCONTROL


STEALTH CAM
05:33
10/02/19
27F


STEALTH CAM
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46F
SITE4BCONTROL

Additional Project Monitoring

Aquatic and Aerial Invertebrate Monitoring

Dr. John Olson, CSU Monterey Bay

Bat monitoring

Dr. Jenny Duggan, CSU Monterey Bay

Questions?

Contact:

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emily.zefferman@rcdmonterey.org

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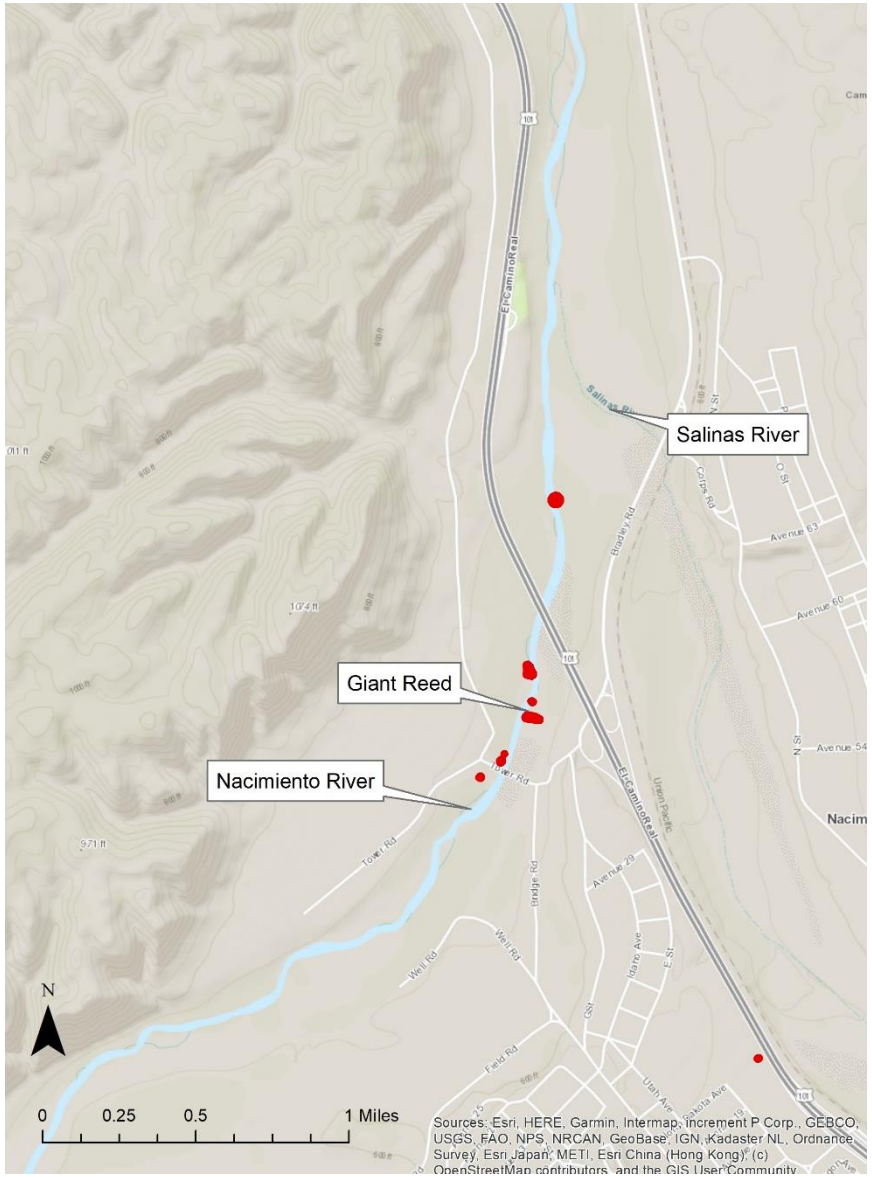
RCDMC
RESOURCE CONSERVATION DISTRICT OF MONTEREY COUNTY

Arundo donax treatment at Camp Roberts

- Treatment history
- Extent
- Sensitive species



Future Directions

- Early Detection Rapid Response
- Mapping
- Building partnerships

Thank you!

Nora Bales
Environmental Scientist
California Army National Guard

eleanor.h.bales.nfg@mail.mil

Eradicating Giant Reed (*Arundo donax*) from the Salinas River Watershed

Rusty Hall-

SLO County Department of Agriculture

SLO County Weed Management Area, Coordinator

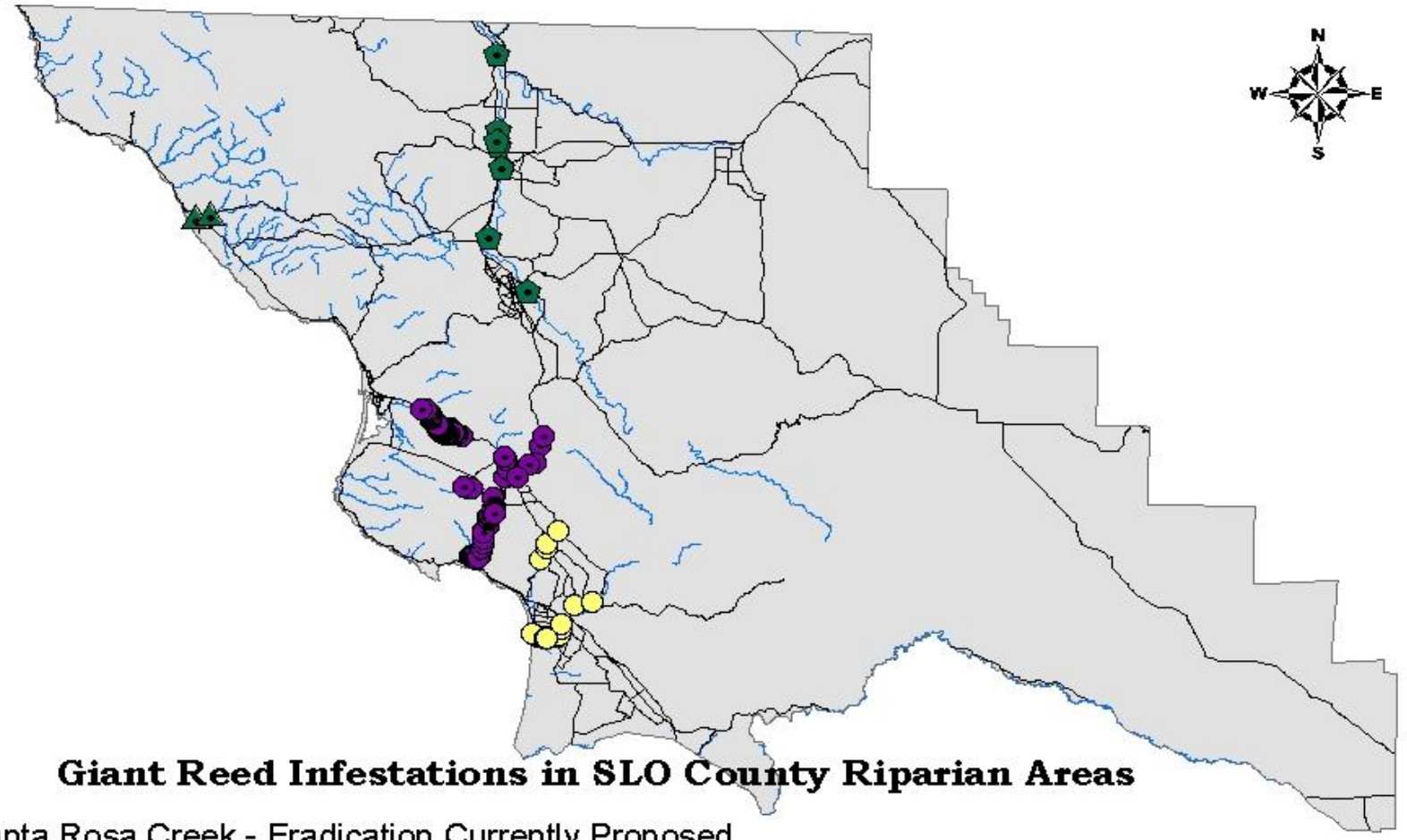
“A weed is a plant that is not only in the wrong place,
but intends to stay”
~ Sara Stein

Watershed Surveys

- Surveys conducted from the top of the watershed down
- Several different data sources utilized.
- In past used GPS position recorded – crucial for follow-up activities. Now use smart phones with Calflora Observer Pro.
- Verification of outside sources. CalFlora, iNaturalist and internal records.

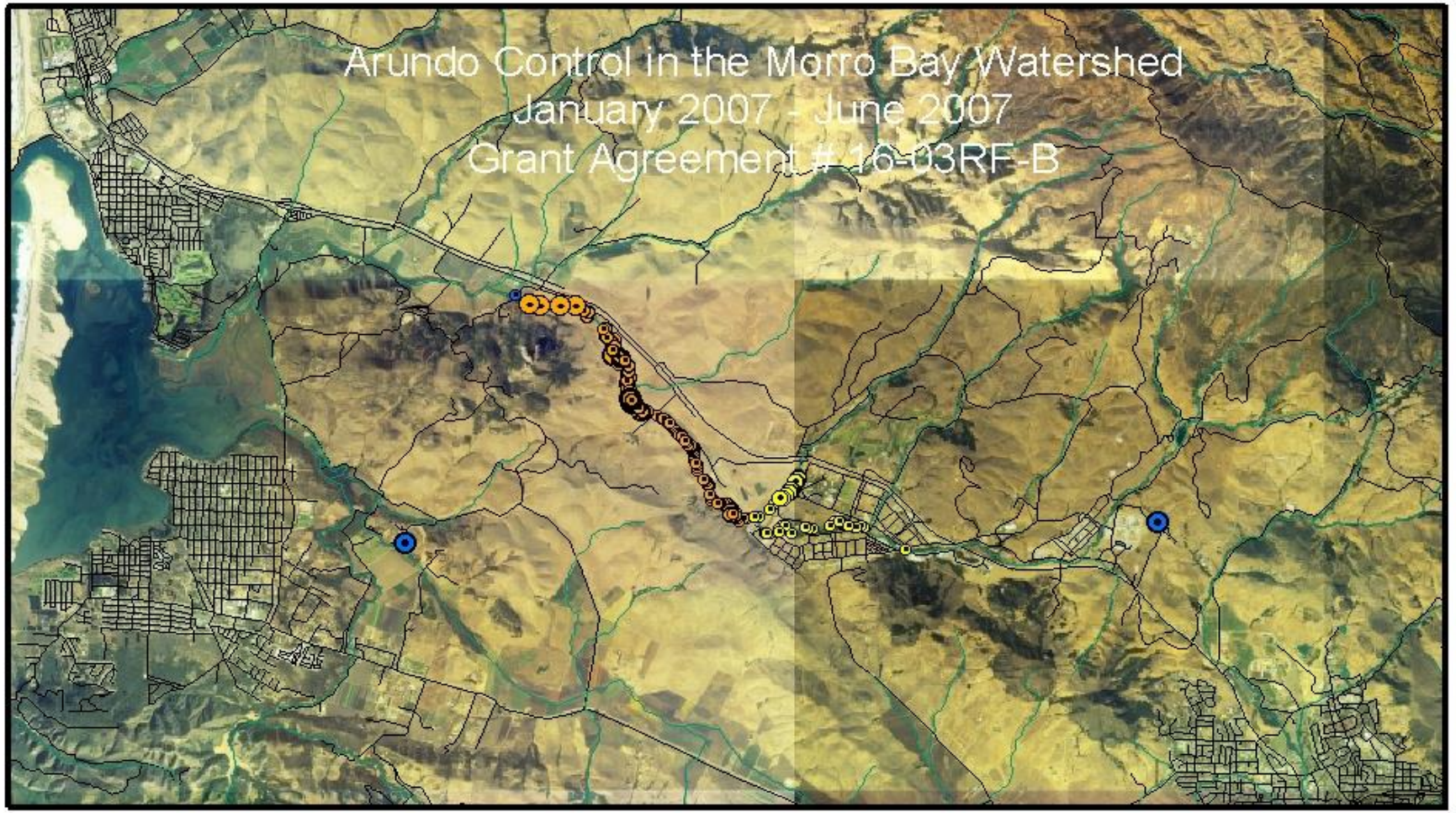
Map # 1

San Luis Obispo County - Countywide Distribution of Giant Reed (Arundo donax)



Giant Reed Infestations in SLO County Riparian Areas

- Santa Rosa Creek - Eradication Currently Proposed
- Salinas River - Eradication Currently Proposed
- Chorro Creek and San Luis Creek watersheds - Eradication Programs Underway Since 1999
- Arroyo Grande & Pismo Creeks - Untreated Areas



Legend

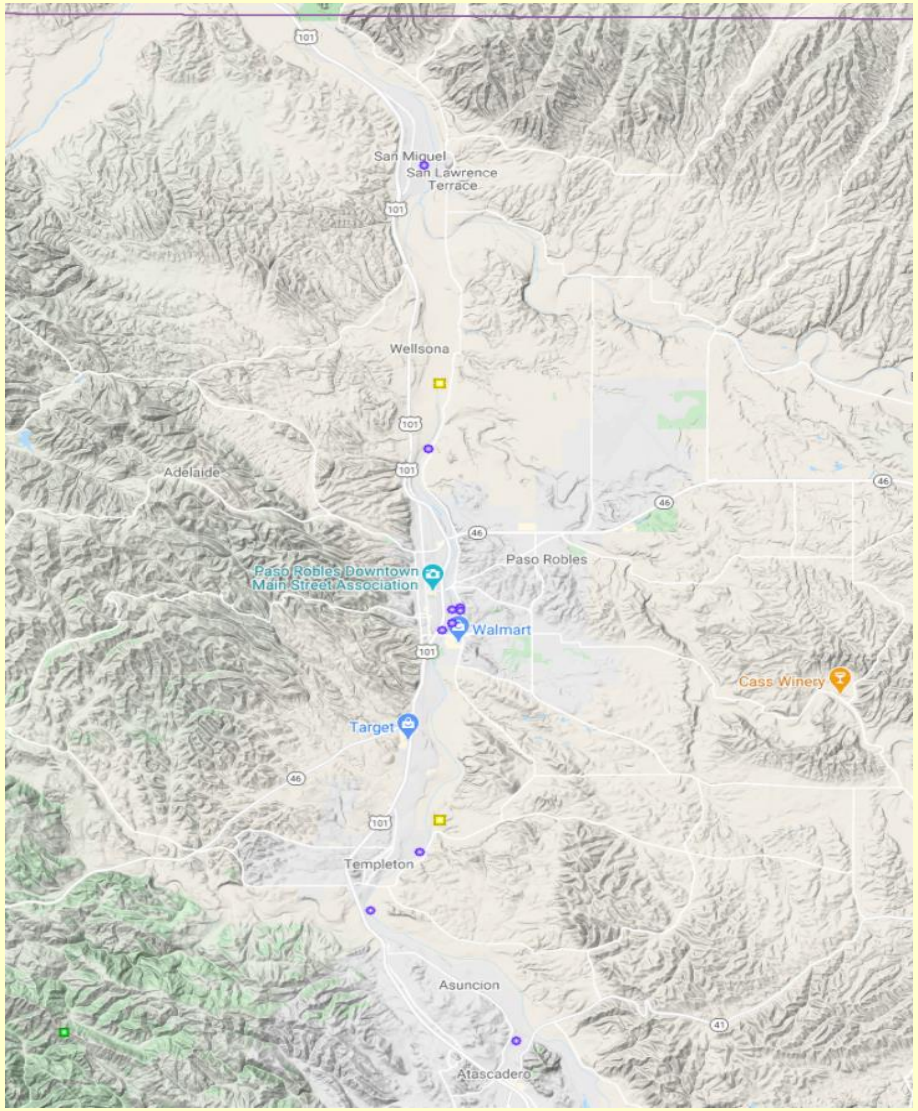
Arundo Clumps Initially Treated in 2007

- 1 - 5 ft clump diameter
- 6 - 15 ft clump diameter
- 16 - 25 ft clump diameter
- 26 - 50 ft clump diameter
- over 50 ft clump diameter
- Arundo Clumps Retreated in 2007 - MBNEP Funds
- Arundo Clumps Surveyed and Retreated (in-kind funds)

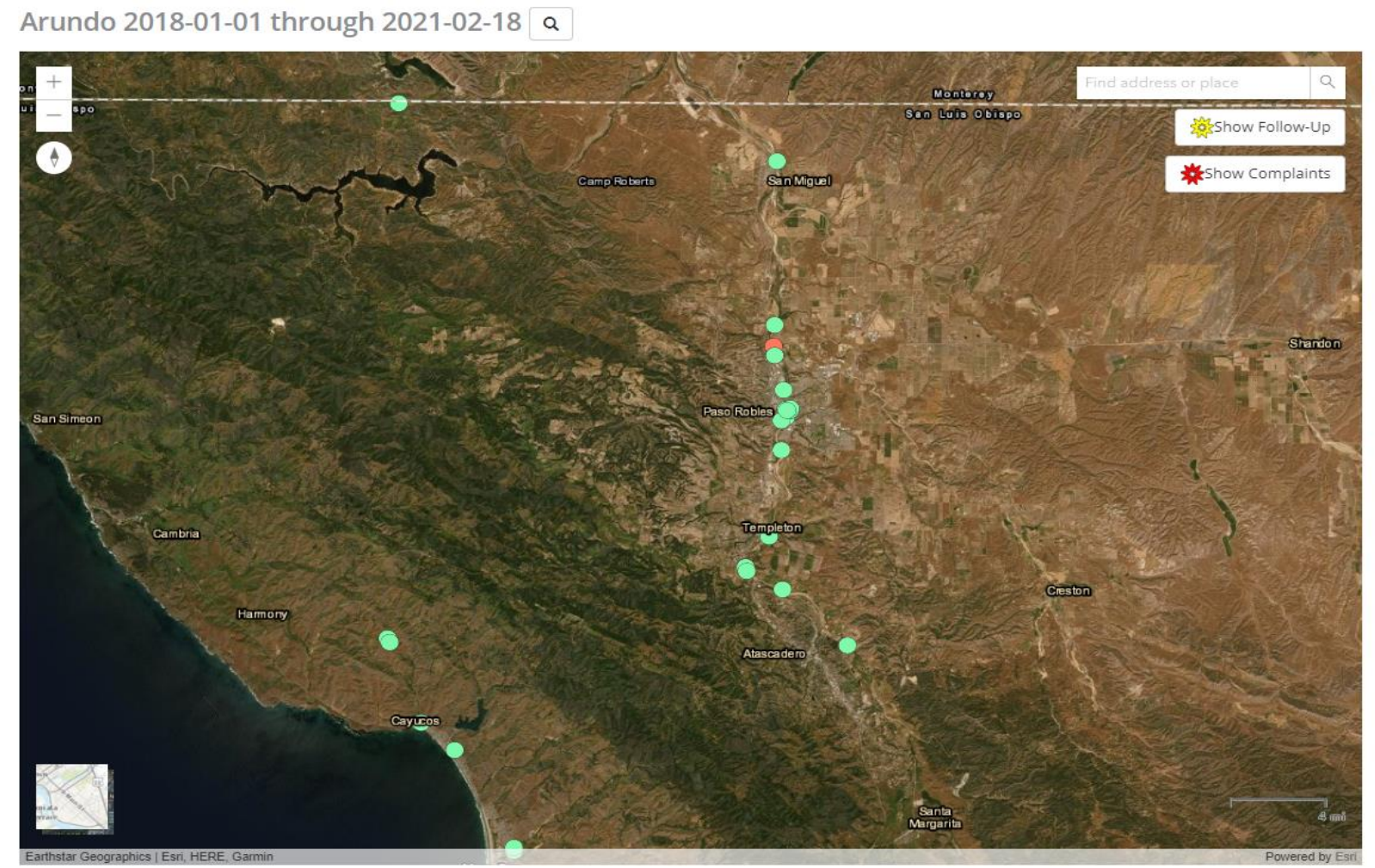
N
W E
S

0 0.35 0.7 1.4 2.1 2.8
Miles

Calflora Database 2018 to 2020 Salinas River Surveys

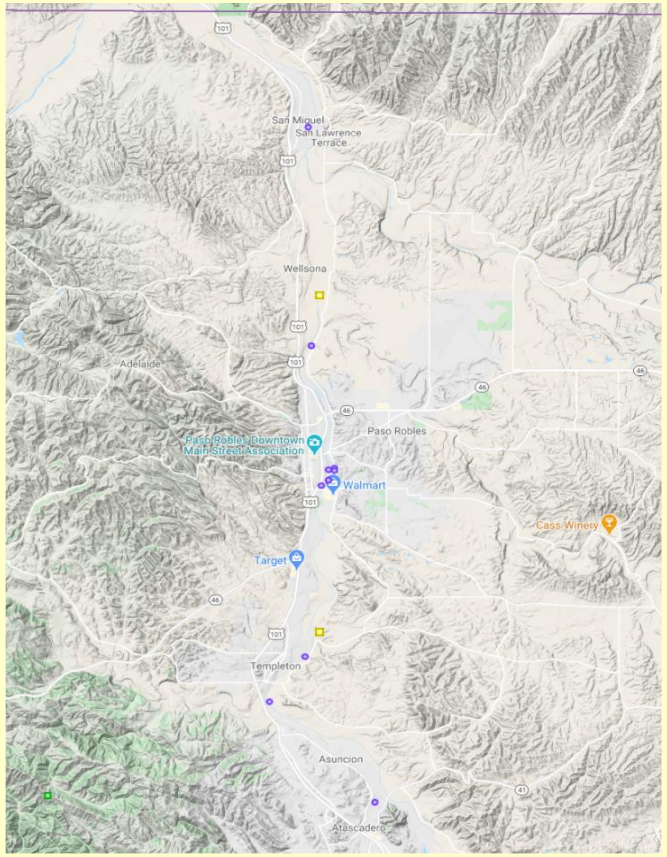


Weed Program Mapping



Achievability

- Few isolated locations
- Patches are small
- Much more accessible than past locations.
- Equipment now available
- CEQA categorical exemptions.
- Property owner databases to obtain permission to treat.



Old Record Keeping

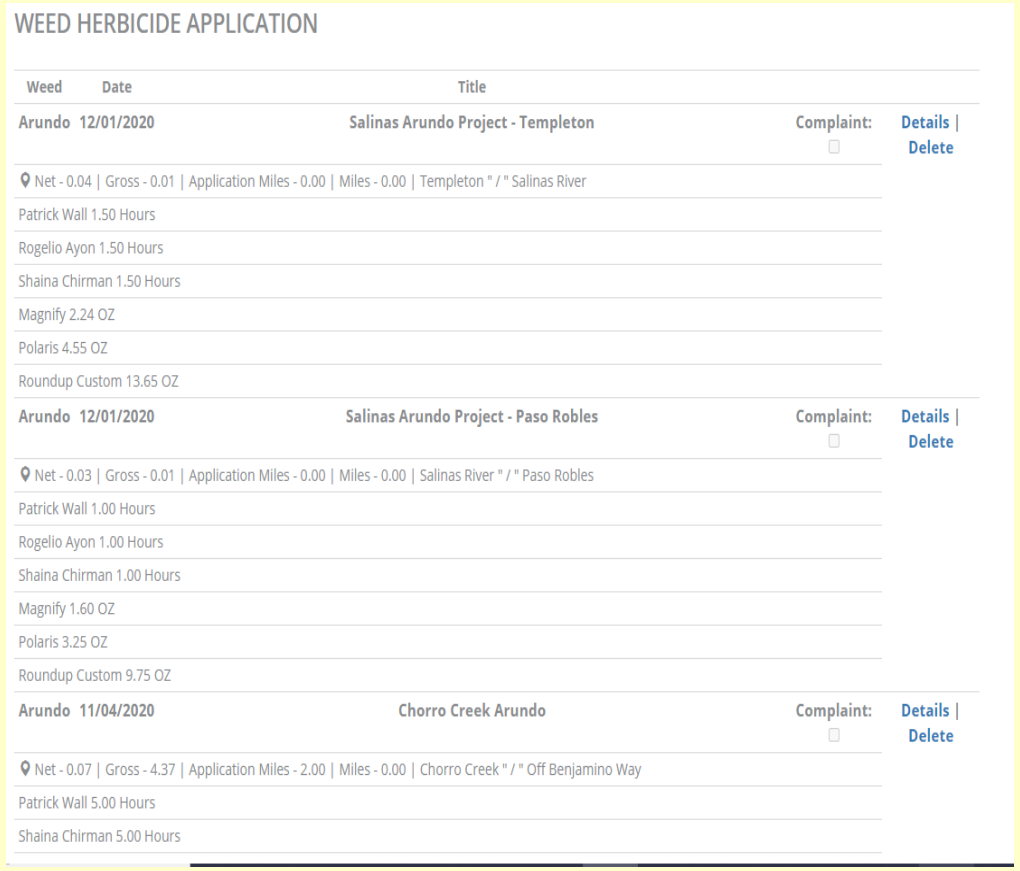
Arundo Control Program - Chorro Creek Watershed

Site Identification: Chorro Creek - Cal Poly Bridge Section 2003 & 2004

Clump ID	Clump Name	Clumps		Initial Removal		Initial Herbicide Treatment				Re-Treatment Dates		
		Description	Approx. Diam	Date	Agency	Method	Rodeo Rate	Date	Agency	2004	2005	2006
CCPB 1	June 2003 #1	e/bank edge	50 ft	Jun-03	CCC	Foliar (c/r/s)	1.5%	18-Sep-03	SLOCAC	29-Sept-04 cs	27-Oct-05 cs	
CCPB 2	June 2003 #2	e/bank edge	6 ft	Jun-03	CCC	Cut Stump	50%	11-Sep-03	SLOCAC	None	Gone	
CCPB 3	June 2003 #3	50 ft up e/bank	50 ft	Jun-03	CCC	Cut Stump	50%	9-Sep-03	SLOCAC	29-Sept-04 cs	27-Oct-05 cs	
CCPB 4	June 2003 #4	e/bank edge	15 ft	Jun-03	CCC	Foliar (c/r/s)	1.5%	18-Sep-03	SLOCAC	29-Sept-04 cs	None	
CCPB 5	June 2003 #5	5 ft up w/bank	1 ft	Uncut		Cut Stump	50%	9-Sep-03	SLOCAC	29-Oct-04 cs*	None	
CCPB 6	June 2003 #6	e/bank edge	10 ft	Uncut		Cut Stump	50%	9-Sep-03	SLOCAC	None	None	
CCPB 7	June 2003 #7	w/bank near trail	10 ft	Jun-03	CCC	Cut Stump	50%	9-Sep-03	SLOCAC	None	None	
CCPB 8	Pig Hollow	east plateau	2 ft	Uncut		Cut Stump	50%	29-Oct-04	SLOCAC		None	
CCPB 1-02	Ladders	see 2002 spreadsheet										
CCPB 9	Candyland	e/bank nx to Ladders	25 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	29-Oct-04 cs	27-Oct-05 cs	
CCPB 2-02	Chutes	see 2002 spreadsheet										
CCPB 10	June 2003 #8	w/bank near trail	2 ft	Uncut		Cut Stump	50%	9-Sep-03	SLOCAC	None	None	
CCPB 11	Rathole	w/bank edge	10 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	29-Oct-04 cs	None	
CCPB 12	Hack-a-Path CCC	w/bank near trail	20ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	29-Oct-04 cs	27-Oct-05 cs	
	Hack-a-Path SLOCAC	w/bank edge	3 ft	Uncut		Cut Stump	50%	25-Aug-05	SLOCAC			
CCPB 13	June 2003 #9	between 2 forks	20 ft	Jun-03	CCC	Cut Stump	50%	11-Sep-03	SLOCAC	None	None	
CCPB 14	Pig Plateau #1	e/bank plateau;	3 ft	Uncut		Cut Stump	50%	28-Oct-04	SLOCAC		None	
	Pig Plateau #2	access from hay	10 ft	Jul-05	CCC	Cut Stump	50%	25-Aug-05	SLOCAC			
	Pig Plateau #3	field road	10 ft	Jul-05	CCC	Cut Stump	50%	25-Aug-05	SLOCAC			
CCPB 15	East Fork	e/bank of E. Fork	10 ft	Jul-05	CCC	Cut Stump	50%	25-Aug-05	SLOCAC			
	East Fork	buried in willows	15 ft	Jul-05	CCC	Cut Stump	50%	25-Aug-05	SLOCAC			
CCPB 16	Pile	island near June #9	5 ft	Uncut		Cut Stump	50%	29-Oct-04	SLOCAC		None	
CCPB 17	June 2003 #10	access from w/bank	25 ft	Jun-03	CCC	Foliar (c/r/s)	1.5%	18-Sep-03	SLOCAC	29-Oct-04 cs	None	
CCPB 18	Excalibur	3 clumps up e/bank	25 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	21-Sept-04 cs	27-Oct-05 cs	
CCPB 19	Excalibur West Bank Ac	w/bank edge	10 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	None	None	
CCPB 20	Pain in the	e/bank (no GPS)	5 ft	Uncut		Cut Stump	50%	28-Sep-04	SLOCAC		None	
CCPB 21	June 2003 #11	w/bank near fence	3 ft	Jun-03	CCC	Cut Stump	50%	9-Sep-03	SLOCAC	None	None	
CCPB 22	Deep Pool Strays	up fr Bwire (no GPS)	5 ft	Uncut		Cut Stump	50%	28-Sep-04	SLOCAC		None	
CCPB 23	Barbwire #1	w/side near fence	5 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	27-May-04; 28-Sept-04 cs	None	
CCPB 24	Barbwire #2	w/bank	50 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	27-May-04; 28-Sept-04 cs	27-Oct-05 cs	
CCPB 25	Killer Tree Clump	w/bank near gate	25 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	30-Oct-03	SLOCAC	27-May-04; 28-Sept-04 cs	None	
CCPB 26	The Terminated	w/bank	2 ft	Uncut		Cut Stump	50%	4-Sep-03	SLOCAC	None	None	
CCPB 27	Black Walnut Access^	w/bank	15 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	29-Oct-03	SLOCAC	27-May-04; 28-Sept-04 cs	None	
CCPB 3-02	Box Elder	see 2002 spreadsheet										
CCPB 4-02	Big Un	see 2002 spreadsheet										
CCPB 5-02	Bombadil	see 2002 spreadsheet										
CCPB 28	Gary Coleman's Quagmir	in stream	5 ft	Sep-03	SLOCAC	Removed Completely - including Rhizomes				Gone	Gone	
CCPB 29	Blue Dot Willow 2003^^	across ck fr BDW	50 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	29-Oct-03	SLOCAC	27-May-04; 13-Oct-04 cs	31-Oct-05 cs	
CCPB 6-02	Blue Dot Willow	see 2002 spreadsheet										
CCPB 7-02	Snag	see 2002 spreadsheet										
CCPB 30	Road #1	e/s near CP hay rd	10 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	29-Oct-03	SLOCAC	27-May-04; 13-Oct-04 cs	None	
CCPB 31	Road #2	e/s near CP hay rd	15 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	29-Oct-03	SLOCAC	None	None	
CCPB 32	Khe San^^^	e/s along ck edge	15 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	29-Oct-03	SLOCAC	27-May-04	None	
CCPB 33	Below Bridge #1	cross bridge	5 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	29-Oct-03	SLOCAC	27-May-04; 13-Oct-04 cs	None	None
CCPB 34	Below Bridge #2	turn rt before bridge	20 ft	Sep-03	CCC	Foliar (c/r/s)	1.5%	29-Oct-03	SLOCAC	27-May-04; 13-Oct-04 cs	12-May-05 cs	None

New Record Keeping

- Actual computer data base.
- Records now with satellite map points
- Records herbicides used and the rates.
- Surveys are tracked
- Work needing any follow up is recorded.
- Multiple ways to query and generate internal reports.



WEED HERBICIDE APPLICATION

Weed	Date	Title		
Arundo	12/01/2020	Salinas Arundo Project - Templeton	Complaint: ☐	Details | Delete
Net - 0.04 | Gross - 0.01 | Application Miles - 0.00 | Miles - 0.00 | Templeton " / " Salinas River				
Patrick Wall 1.50 Hours				
Rogelio Ayon 1.50 Hours				
Shaina Chirman 1.50 Hours				
Magnify 2.24 OZ				
Polaris 4.55 OZ				
Roundup Custom 13.65 OZ				
Arundo	12/01/2020	Salinas Arundo Project - Paso Robles	Complaint: ☐	Details | Delete
Net - 0.03 | Gross - 0.01 | Application Miles - 0.00 | Miles - 0.00 | Salinas River " / " Paso Robles				
Patrick Wall 1.00 Hours				
Rogelio Ayon 1.00 Hours				
Shaina Chirman 1.00 Hours				
Magnify 1.60 OZ				
Polaris 3.25 OZ				
Roundup Custom 9.75 OZ				
Arundo	11/04/2020	Chorro Creek Arundo	Complaint: ☐	Details | Delete
Net - 0.07 | Gross - 4.37 | Application Miles - 2.00 | Miles - 0.00 | Chorro Creek " / " Off Benjamino Way				
Patrick Wall 5.00 Hours				
Shaina Chirman 5.00 Hours				

Arundo Control Measures Available

- Primarily a foliar herbicide application to standing clumps
    * Optional cut-stump herbicide treatment
    * Cut and foliar herbicide application to Arundo regrowth. Glyphosate (MOA 9) and/or imazapyr (MOA 2).
- Tarping – not feasible.

Arundo Herbicide Treatment

- Cut stump method is logistically difficult for larger clumps
- Foliar applications of glyphosate to uniform regrowth have proven very effective, especially when conducted in early fall

Arundo Removal

- Small, pioneer (outlier) plants can be cut, and stump treated on the spot
- Larger clumps can be removed by us, CCC's or another contractor
- All plants removed require follow-up activities, typically foliar herbicide applications

Arundo Disposal

- When our efforts began, many arundo control projects were either burning arundo biomass (very limited) or hauling it to local landfills
- Arundo canes can be removed from the riparian area, or chipped on-site
- Chipping freshly cut canes is better than allowing the canes to dry out

Follow-Up Surveys & Retreatments Goals

- Remove as much viable biomass from the riverbed as possible (difficult)
- Resurvey project area annually.
- Retreat any surviving portions of Arundo clumps or resprouting.

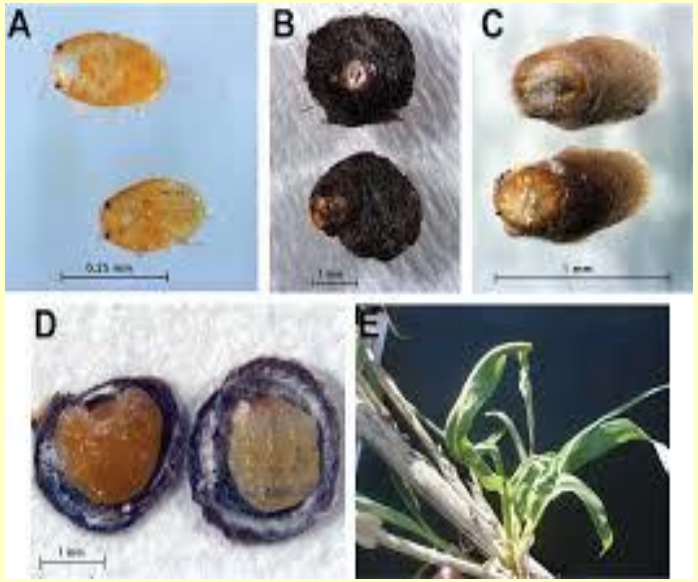
Bio-Control: Hope is on the Horizon

- Bio Control Under Evaluation
- In native Spain Arundo is kept under control by a host of insects.
- Bio-Control agents were searched and four brought back to the United States under quarantine research permits.
- Some are more effective than others.

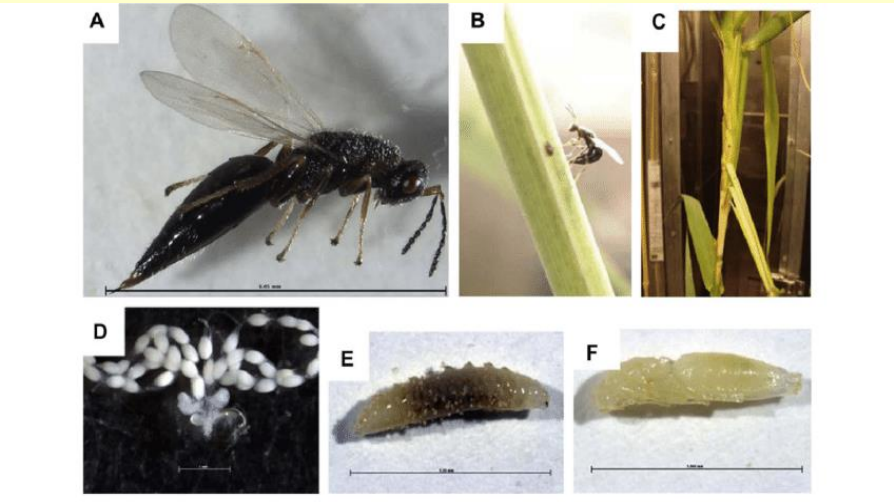
Four species are in different stages of review and introduction.

- **Scale insect** – Rhizaspidiotus donanis. Attacks the reed's root. Has a high reproductive capacity and feeds on the rhizome. Show the most promise. Attacking the rhizome would have a big impact on the plant's growth and spread.
- **Wasp** – Tetramesa romana. Released in Texas n April 2009. Attacks the main stem forming galls putting outside shoots weakening the plant and reducing the overall height.
- **Arundo fly** – Cryptonevra spp. Eats the inside of the new shoots.
- **Leaf sheath miner** – Lasioptera donacis. Eats the inside of the plants leaves.

Rhizaspidiotus donatus scale



Tetramesa romana wasp



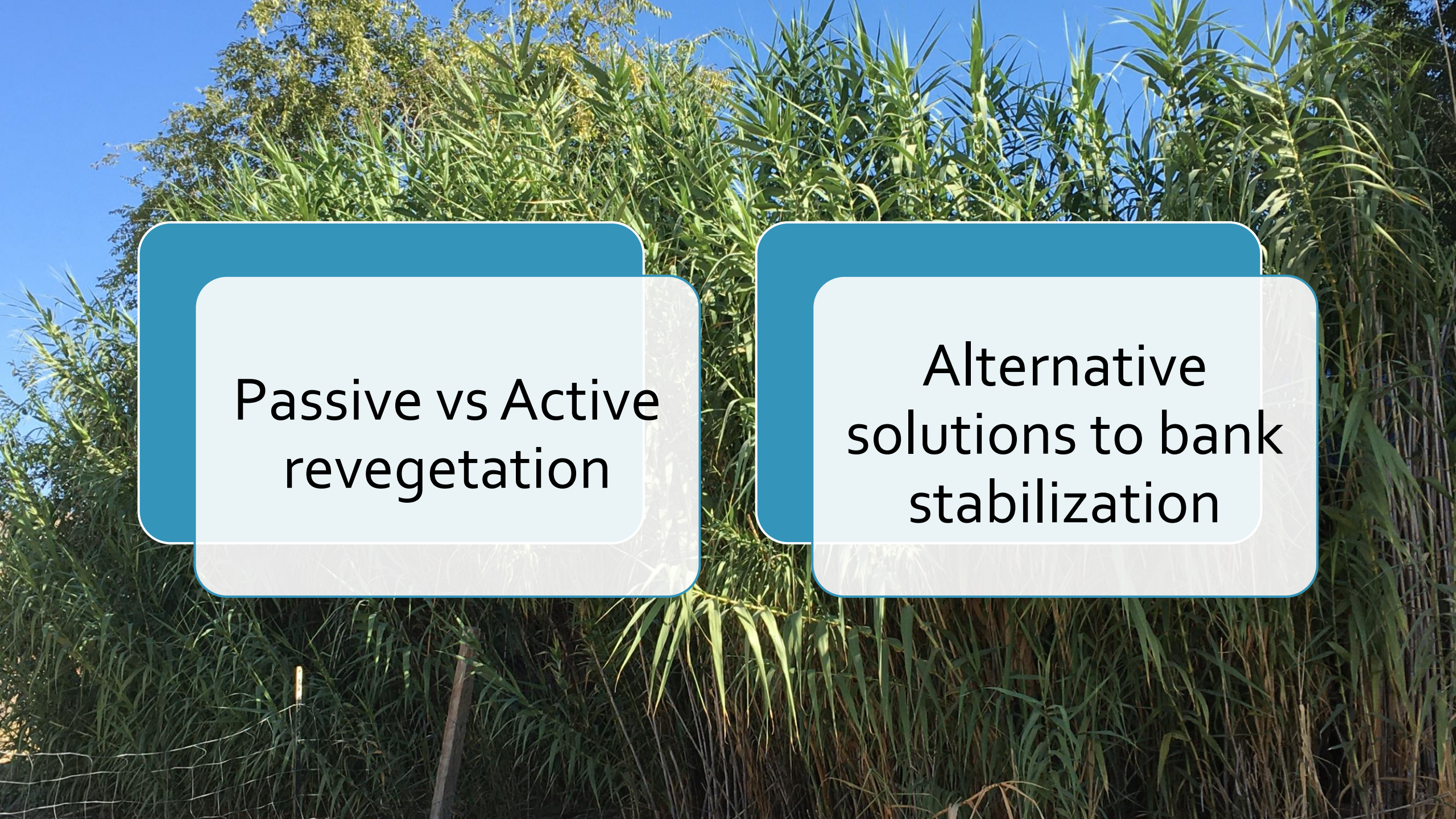
Cryptonevra Fly

Lasioptera donacis Fly

Other Salinas River Invaders

- Other invasive species in the Salinas River riparian area include Tamarisk (Tamarix sp.) and Stinkwort (Dittrichia graveolens)

Thank you.
Questions?


Passive vs Active revegetation
Alternative solutions to bank stabilization

Thank you to our partners and participants

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