Monitoring native forb restoration at a Sacramento River gravel bar site: Improving methods for the future

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Objective

The goal of our study is to investigate the success of eight planted forb species by comparing densities and dispersal throughout a Sacramento River gravel bar in the La Barranca Unit of the Sacramento River Wildlife Refuge.

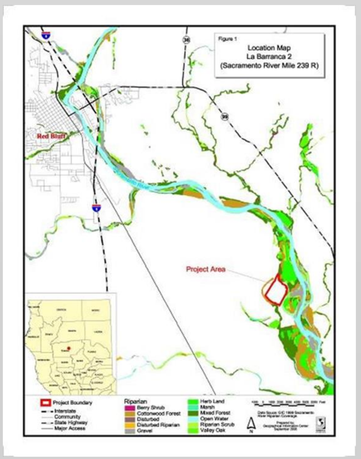
Introduction

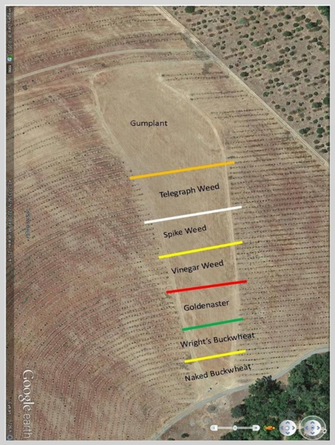
Anthropogenic alterations to hydrologic processes are resulting in broad impacts to ecosystems which are intrinsically dependent on these processes. In the Central Valley of California, many floodplains which were once regularly inundated prior to the construction of major dams have now transitioned to drier conditions in the absence of a frequent flooding regime. Gravel bars are common features along rivers and under historic hydrologic conditions these sites would be colonized by *Salix spp.* and *Populus sp.* In early 2013, River Partners initiated restoration of a gravel bar site through seeding of eight upland forb species in predominantly single species bands (River Partners 2014). River Partners sampled the site in 2014 and we revisited in Fall 2016. The goal of our study is to investigate the success of eight planted forb species by comparing densities and dispersal throughout the gravel bar and over time.

Study Site Location

We conducted fieldwork at the La Barranca Unit of the Sacramento River Wildlife Refuge in California, USA. This site is located near Red Bluff and Gerber about 45 minutes from Chico. It was previously used as agricultural land before the U.S. Fish and Wildlife Service acquired it for restoration purposes. It occupies 116 acres adjacent to remaining orchards, and is located at River Mile 237.5-239.5 on the west bank of the Sacramento River.

The 7-acre gravel bar which we focused on for this study was seeded by River Partners in 2013 with eight upland forb species in predominantly single species bands. The area around this gravel bar was planted with native trees and shrubs between 2011 and 2014.





2014-2016 Comparison

May 2014: one year after restoration

September 2016: three years after restoration

Methods

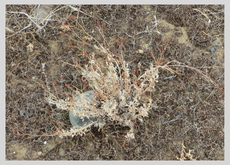
We measured plant density to monitor and compare the success of the eight forb species within the gravel bar. Most fieldwork was completed during October and November, 2016. Additional sampling will take place in the spring of 2017.

Field Methods:
- We recorded GPS coordinates of plots using a handheld Garmin device to monitor and compare dispersal of the forb species.
- We used seven 1m^2 plots for each forb species section, with each plot being randomly assigned to different locations and bounded using a PVC plot frame during sampling.
- For each plot, we counted the number of plants from each species so that density and dispersal could be compared between species.

Data analysis:
- Density change over time for each forb species
- Comparison of dispersal between forb species

Forb Species

Eriogonum nudum (Naked Buckwheat)



Eriogonium wrightii (Wright's Buckwheat)

Centromadia fitchii (Fitch's Spikeweed)

Trichostema lanceolatum (Vinegar Weed)

Heterotheca oregona (False Goldenaster)

Heterotheca grandiflora (Telegraph Weed)

Calycadenia sp. (Tarweed)

Grindelia camporum (Gumplant)

Data Summary

Table 1. Densities of each forb species in May 2014, September 2014, and October-November 2016. Most species densities changed by more than five plants/m² between 2014 and 2016.

Species Name	05/14 Density (plants/m²)	09/14 Density (plants/m²)	10/16-11/16 Density (plants/m²)
Eriogonum nudum (naked buckwheat)	10.3	5.3	4.0
Eriogonium wrightii (Wright's buckwheat)	19.4	15.9	3.7
Centromadia fitchii (Fitch's spikeweed)	0	2.0	15.7
Trichostema lanceolatum (vinegar weed)	0	0.3	0.4
Heterotheca oregona (false goldenaster)	0	0.3	0.6
Heterotheca grandiflora (telegraph weed)	6.4	NA	0.7
Calycadenia sp. (tarweed)	0	4.5	12.4
Grindelia camporum (gumplant)	9.2	NA	1.4

Table 2. Average species richness for each gravel bar section planted with a different forb species. This can be used as an indicator of colonization by other species.

Gravel Bar Section	2016 Average Species Richness (# of species/m²)
Eriogonum nudum (naked buckwheat)	5.0
Eriogonium wrightii (Wright's buckwheat)	5.1
Centromadia fitchii (Fitch's spikeweed)	7.6
Trichostema lanceolatum (vinegar weed)	8.9
Heterotheca oregona (false goldenaster)	7.3
Heterotheca grandiflora (telegraph weed)	8.3
Grindelia camporum (gumplant)	7.0
Total Gravel Bar	7.0

Results

Density Results:
- *Calycadenia sp.* and *C. fitchii* densities increased the most.
- *T. lanceolatum* and *H. oregona* increased by less than one plant/m².
- *E. nudum*, *E. wrightii*, *H. grandiflora*, and *G. camporum* decreased.

Dispersal Results:
- *E. nudum* dispersed the farthest from its original planted sections.
- *C. fitchii*, *G. camporum*, *Calycadenia sp.*, and *H. grandiflora* also dispersed from their starting sections.
- *E. wrightii*, *T. lanceolatum*, and *H. oregona* remained in their starting sections.

Future Work

Future work will include examination of additional forb dispersal and density dynamics using GIS software. We will also sample more plots to get a better representation of the forb populations, as well as overall species richness of each gravel bar section. The final results of this study will be used by River Partners to guide further restoration of similar sites that require transitioning assistance from riparian to xeric conditions and plant communities.

Additional research questions that will be investigated during the spring semester include:
- How does forb density differ between original and new locations?
- How does forb density and dispersal differ between species in the grass dominated areas around the gravel bar?
- Are there any relationships between native forb, invasive weed, and grass densities?
- What do our results mean for future gravel bar restoration?

Acknowledgments
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Sources
River Partners. 2014. Riparian Restoration of the La Barranca Unit of the Sacramento River Wildlife Area, Phase II. Tehama County, California. Final report. Michael Rogner. Chico, California.