

# Reproductive Ecology and Seed Bank Dynamics of Endangered Plants in Constructed and Natural Vernal Pools

Christina M. Sloop and Hattie K. Brown

Laguna de Santa Rosa Foundation, Santa Rosa, CA, christina@lagunafoundation.org, www.lagunafoundation.org

## Abstract

We investigated the reproductive ecology of Burke's Goldfields (*Lasthenia burkei*), Sonoma Sunshine (*Blennosperma bakeri*), and Sebastopol Meadowfoam (*Limnanthes vinculans*) - three state and federally listed endangered annual plants with remnant populations occurring in both natural and constructed vernal pool ecosystems predominantly located on the Santa Rosa Plain. Understanding the reproductive ecology, or the interplay between plants, pollinators, and seed production and storage will help manage these species and establish matrices for evaluating the health of endangered annual plants.

In the first year of a multi-year study, we visited three extant populations of each species, or nine vernal pools - both natural and constructed seasonal wetlands. At each pool we:

- 1) Installed pollinator exclusion devices to determine if the endangered annual plants are self-incompatible and require insect pollinators to set seed; and
- 2) Collected seeds from individual inflorescences to determine seed set for each of the three species.

We also conducted a pilot study of the soil seed bank to quantify the seeds stored in the soil.



Sonoma Dunshine



Sebastopol Meadowfoam



Burke's Goldfields

## Study Objectives

- Confirm whether Burke's Goldfields, Sonoma Sunshine, and Sebastopol Meadowfoam are obligate out-crossing species and so depend on insect pollinators for viable seed set *in situ*.
- Determine yearly seed set in natural and constructed pools.
- Establish estimates of seed bank numbers through soil cores.
- Assess whether yearly seed set estimates suggest a substantial addition to the seed bank, or indicate a continual draw down from the seed bank without proper replenishment of seeds each year at natural and constructed sites.

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## Preliminary Results



photo H. Brown

Enclosed inflorescence keep insect pollinators out.



photo K. Gilmore

photo K. Gilmore

*L. vinculans* in flower

*L. vinculans* in fruit



photo K. Gilmore

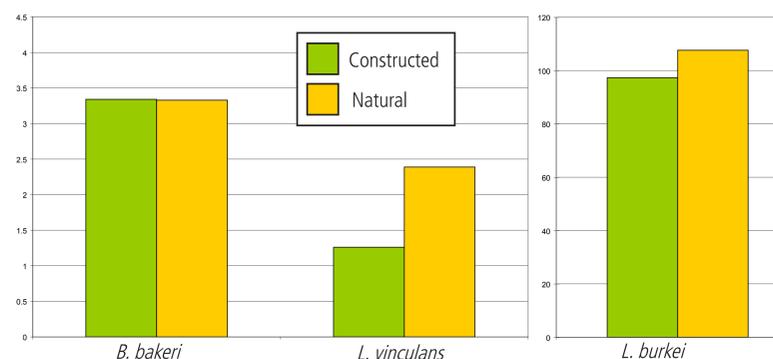
Soil auger collects samples to quantify the soil seed bank.

- Seed set in open pollinated inflorescence varied across species: *B. bakeri* (4.08 +/- 1.55), *L. vinculans* (2.06 +/- 1.77), and *L. burkei* (108.66 +/- 62.27).
- Both enclosed and open pollinated inflorescences produced developed seed.
- Cover class has no discernible effect on seed set in *B. bakeri*. Cover class does have a discernible effect on seed set in *L. vinculans* and *L. burkei* where increasing cover correlated with increasing seed set.
- Pool type (constructed or natural) had a discernible effect on seed set in *L. vinculans* and *L. burkei*, but no discernible effect on *B. bakeri*.

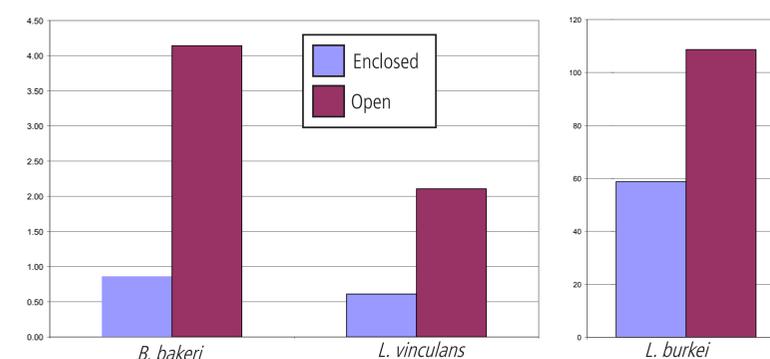
Average seed set per open pollinated inflorescence for each species

CNPS Cover Class	BLBA	LABU	LIVI
10% and below	3.98	90.76	1.48
15% to 35%	4.27	100.30	2.80
50% and above	3.97	121.79	3.38
Grand Total	4.08	108.66	2.06

Average Seed Set in Constructed vs. Natural Vernal Pools



Average Seed Set in Enclosed vs. Open Inflorescences



## Conclusions

- Viable seed production in enclosed inflorescences suggests that all species are able to self fertilize or that our enclosures failed allowing pollen transfer.
- Seed collections in the coming years will further elucidate the reproductive ecology of these endangered species, however preliminary results suggest that *L. vinculans* and *L. burkei* may produce more seeds in natural vernal pools with dense flower cover whereas *B. bakeri* seed set is less affected by pool type or cover class.
- Preliminary analysis of the soil seed bank suggests that *B. bakeri* seed are only present in the surface organic matter and the first two inches of soil.