Investigating anthropogenic stressors and the relationship with *Schismus barbatus* for the threatened Little *Linanthus maculatus*

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Introduction

- *Linanthus maculatus* (Fig. 1) is an herb endemic to the western edge of the southern California deserts.
- Researches have noted an increase in *Schismus barbatus* (Fig. 2) density in the historic *L. maculatus* habitat, fueled by N deposition (Fig. 3).
- Is this invasion of the weedy grass impacting *L. maculatus* populations?

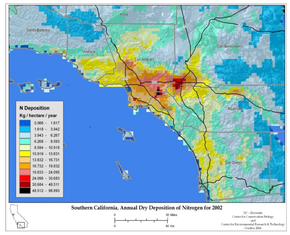


Figure 3. N deposition in Southern California (Fenn *et al.* 2006)

Figure 1. *L. maculatus* flowers measuring approximately 3-5 mm across.

Figure 2. *S. barbatus* growing in a fine-gravelly wash measuring approximately 10 cm.

Methods

- Early survey to track emergence starting in February (Fig. 4)
- Survey pre-established transects and suitable micro-habitat for new plot locations.
- Lay transect through center of stand across the long axis (Fig. 5)
- Within 1 m^2 plot frame (Fig. 6):
  - Number of *L. maculatus*
  - Co-occurring plant species and percent cover
  - Percent cover *S. barbatus*
  - Aspect, slope, percent gravel (2 mm – 2.5 cm particle size) and concavity of microhabitat within plot frame.

Figure 4. Searching for tiny *L. maculatus*.

Figure 5. Transect through center of stand. Orange pin flags mark *L. maculatus* location within a Low-Density *S. barbatus* transect.

Figure 6. 1 m^2 plot area.

Additional Resources

Allen, M.F., J.T. Rotenberry, C.W. Barrows, V.M. Rorive, R.D. Cox, L. Hargrove, D. Hutchinson, and K.D. Fleming. 2005. Coachella Valley Multiple Species Habitat Conservation Plan Monitoring Program: 2002-2005 Progress Report. UC Riverside: Center for Conservation Biology.

Browning, D.M., S.J. Beaupré, and L. Duncan. 2005. Using partitioned Mahalanobis D2 (k) to formulate a GIS-based model of timber rattlesnake hibernacula. Journal of Wildlife Management. 69:33-44.

Fenn, M. E., E. B. Allen, S. B. Weiss, S. Jovan, L. H. Geiser, G. S. Tonnesen, R. F. Johnson et al. Nitrogen critical loads and management alternatives for N-impacted ecosystems in California. Journal of Environmental Management 91, no. 12 (2010): 2404-2423.

Patterson, R. 1989. Taxonomic relationships of Gilia maculata (Polemoniaceae), Madroño 36(1):15-27.

Rao L.E., Allen E.B. 2009. Combined effects of precipitation and nitrogen deposition on native and invasive winter annual production in California deserts. SpringerLink. http://link.springer.com/article/10.1007/s00442-009-1516-5

Sanders, A.C. 2006. Little San Bernardino Mountains Gilia. West Mojave Plan Species Accounts. U.S. Department of the Interior, Bureau of Land Management. January 2006. Available at

Results

- Commonly co-occurred with native annuals including *Cryptantha micrantha, Filago depressa* and *Nemacladus rubescens*
- Appeared to be absent from high densities of invasive *S. barbatus (Fig. 8)*.

Low-density *Schismus barbatus*

Figure 7. Low density *S. barbatus* with orange pin flags demarcating *L. maculatus* locations.

High-density *Schismus barbatus*

Figure 8. High-density *S. barbatus* plot with no *L. maculatus* occurrences.

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
LIMA_LD	21	208	9.904761905	159.7904762
SCBA_LD	21	29	1.380952381	2.347619048

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	762.880952	1	762.8809524	9.410261682	0.003861048	4.08474573
Within Groups	3242.76190	40	81.06904762			
Total	4005.64285	41				

Anova: Single Factor

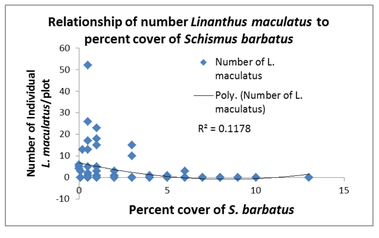
SUMMARY

Groups	Count	Sum	Average	Variance
LIMA_HD	60	38	0.633333333	5.117514124
SCBA_HD	60	245	4.083333333	11.03225989

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	357.075	1	357.075	44.22043302	9.62E-10	3.92147818
Within Groups	952.836666	118	8.074887006			
Total	1309.91166	119				

Table 1 Analysis of Variance (ANOVA) comparing low- to high-density *S. barbatus.* Significantly more *L. maculatus* (average of nearly 10, p=0.0039) in low-density *S. barbatus* plots than high-density plots ($p=9.62\times10^{-10}$).



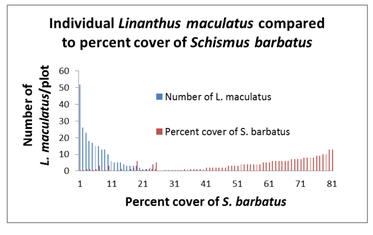
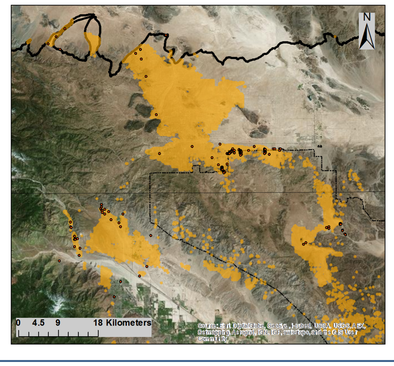
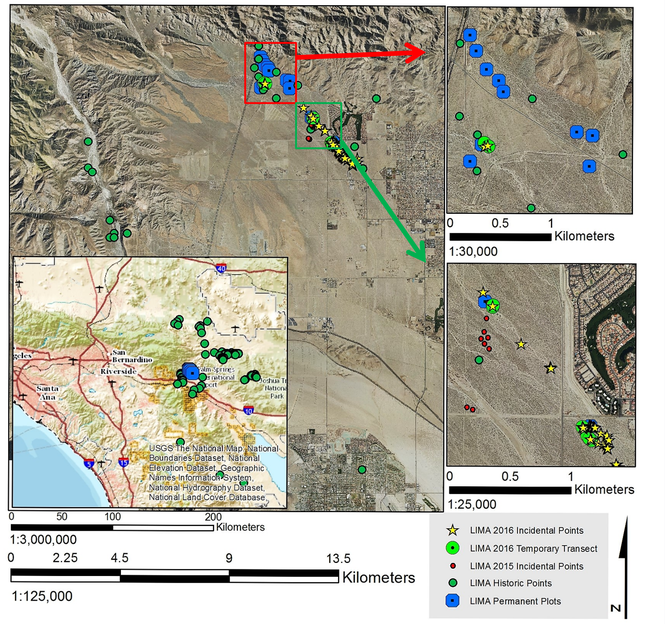


Figure 9. Modeled potential habitat of *L. maculatus based on environmental variables*



Study Area



Discussion

- Apparent decreases in populations in the future for *L. maculatus* as Nitrogen deposition fuels the proliferation of *S. barbatus,* a species which appears to out-compete the endemic *L. maculatus.*
- Monitoring challenges: unknowns in timing of emergence and flowering, and detectability due diminutive size and year-to-year variability in where they occur.
- Possible mechanisms of *S. barbatus* impact on *L. maculatus :*
  - Stabilizing otherwise loose, well aerated soil
  - Resource preemption
  - Altering microhabitat micro-hydrologic regime through increased above ground organic matter and soil stabilization (decreasing scarification)

Acknowledgments

We would like to thank R. Merizan for taking time out of her other monitoring projects to work on this. C. Heintz for organizing JGH's field notebook while she took notes and grew JGH's son. C. Barrows, and the Coachella Valley Brewery for inspiration. Funding for this project came from the Coachella Valley Conservation Commission's Coachella Valley Multiple Species Habitat Conservation Plan.