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# A Genetic Assessment of the Conservation Status of a Threatened Scrub Endemic

## Angela Ricono

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### INTRODUCTION

Reductions in population size can cause a loss of genetic diversity and a reduced ability to adapt to changes in habitats (e.g. environmental changes/anomalies; anthropogenic effects; Frankham et. al, 2009). *Lupinus westianus* (Gulf Coast lupine) is a threatened scrub endemic plant that has suffered drastic declines in population size (Wunderlin and Hansen, 2008). Habitat degradation has fragmented *L. westianus* into small populations that are likely to be geographically isolated from one another. An understanding of current levels of genetic diversity and connectivity among populations is important for management of threatened, isolated, and declining populations. Findings of this research will aid in the development of a management plan for *L. westianus*.

### RESEARCH QUESTIONS

- What is the level of genetic diversity in populations of *L. westianus*, and how do these values compare with other lupines in Florida?
- What is the amount of genetic differentiation among populations of *L. westianus* and two closely related species of lupine?
- Based on the results of this study, should *L. westianus* populations be treated as separate conservation units?

Fig. 1. STRUCTURE output with number of clusters (K) equal to six. Each color represents its own genetic cluster, and each rectangle represents an individual within that population. More than one color in a rectangle corresponds to the proportion that each individual is assigned to a particular cluster within each population. Clearly, each population of *L. westianus* is genetically different, as are the populations of *L. aridorum* and *L. diffusus*, with some CSX individuals being admixed with Springs Community.

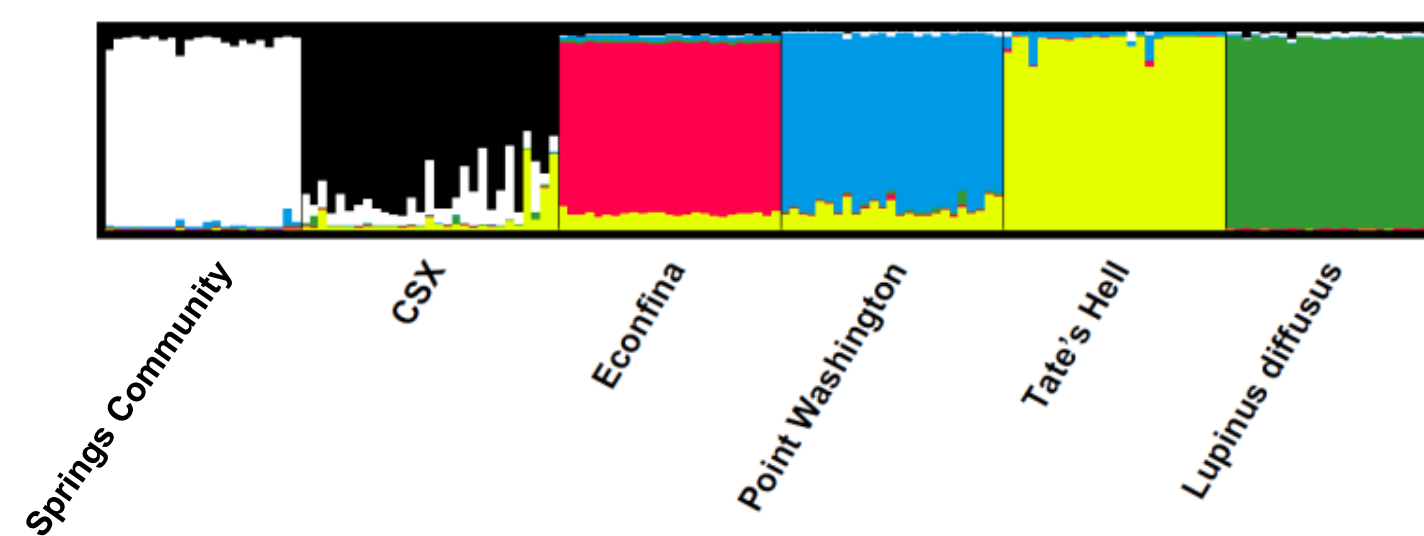


Fig. 2. Google Earth view of sample locations for lupines



Fig. 3. PCoA shows *L. westianus* populations (Econfina, Point Washington, Tate's Hell; diamonds) are genetically different from each other. Further, all three populations are different from *L. diffusus* (triangle) and *L. aridorum* (Springs Community, CSX; circles). Axes explain 88% of the variance.

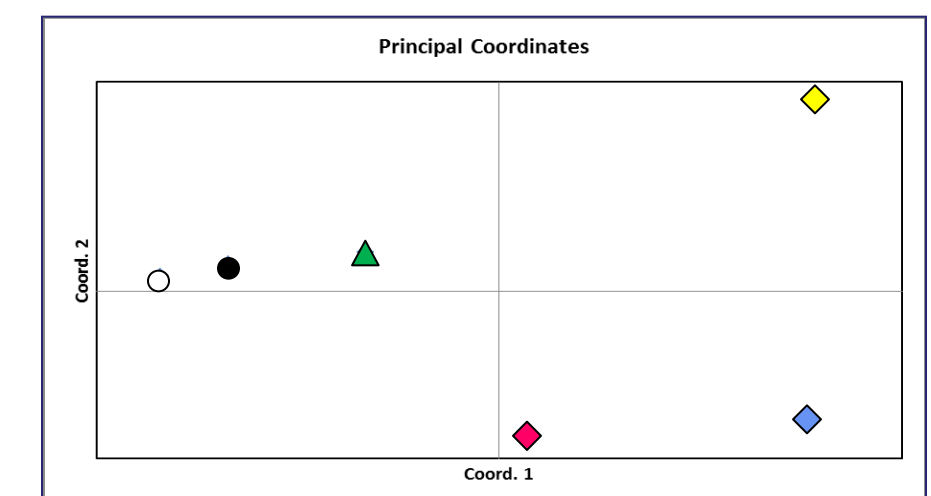


Table 1. Estimates of genetic diversity for three species of lupine. To account for differences in population size (N), allelic richness ( $A_R$ ) was used to represent number of alleles. He-expected heterozygosity; Ho-observed heterozygosity.

	N	He	Ho	$A_R$
Springs Community	22	0.34	0.44	2.98
CSX	29	0.38	0.28	3.86
Econfina	25	0.51	0.53	4.25
Point Washington	25	0.46	0.60	3.74
Tate's Hell	25	0.33	0.23	2.72
Lupinus diffusus	23	0.49	0.34	5.59

### METHODS

I amplified and genotyped 8 microsatellite loci from three populations of *L. westianus*, two populations of *L. aridorum*, and a collection of samples of *L. diffusus* pooled as a single population (Fig 2, Table 1). I used Arlequin (Excoffier et al. 2005) to estimate pairwise  $F_{ST}$  values and genetic diversity. I created a Principal Coordinate Analysis (PCoA) graph using pair-wise  $F_{ST}$  values in the program GenAlEx (Peakall and Smouse, 2006). I used the program STRUCTURE v. 2.2 (Pritchard et al., 2000) to determine population structure and to evaluate levels of gene flow. Allelic richness was calculated using FSTAT v. 2.9.3.2 (Goudet, 2001).

### CONCLUSIONS

- *Lupinus westianus* populations show low genetic diversity similar to the endangered *L. aridorum*, with both species having lower diversity than non-endangered *L. diffusus* (Table 1). This suggests that *L. westianus* has lost diversity due to small population size.
- The three *L. westianus* populations are unlikely to be connected by gene flow, as they are genetically different from one another (Fig 1; Fig 3).
- All three species of lupine are genetically divergent from one another (Fig 1; Fig 3), suggesting that they be managed as separate units.
- Any species recovery plan for *L. westianus* should include genetic information to inform management practices, including future translocation efforts to increase diversity.

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