



The effects of fire on the genetic diversity of the federally endangered species, *Polygala lewtonii*



Background

Florida scrub is an endangered, fire-maintained ecosystem^{1,2}. Disturbance events such as fire can have a profound effect on the genetic makeup of a population³, and can, especially in plants that form a persistent seed bank, cause rapid genetic shifts and allow the expression of genetic material stored in seed banks to be expressed in the aboveground plant population⁴. Swift et al⁵ analyzed the genetic diversity and structure of a fire-maintained, scrub endemic species, *Polygala lewtonii*, showing it exhibits fine-scale genetic structuring, and a high level of inbreeding. The present study investigates the effects of fire on the reproductive biology and the genetic diversity and structure of same populations.


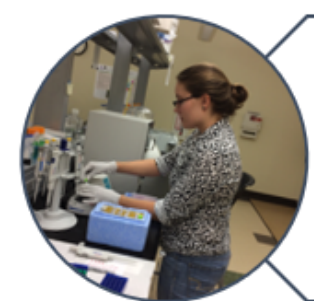

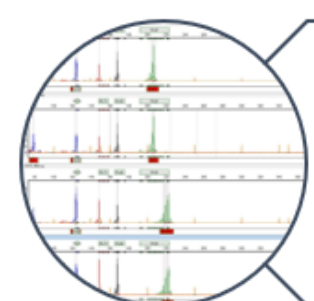
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Conclusions and Future Research

1. Fire causes a shift in alleles present in the population, with new alleles emerging from the plant's seed bank after fire.
2. This species relies primarily on the selfing mechanisms of the three flower types for reproduction, both before and after fire events.
3. Potential follow-up question: if outcrossing plays such a small role in the reproduction of the species, why does the plant invest in its plentiful, showy flowers?
4. Future research will further analyze seeds from above-ground flowers to understand if more outcrossed seeds are being produced.

Methods

-  Fine-scale sampling of post-fire leaf tissue from Lake Wales Ridge area
-  DNA extraction using a modified CTAB protocol
-  PCR amplification using 11 four fluorescently labeled microsatellites
-  Microsatellite peak scoring, data analysis and comparison with pre-fire samples

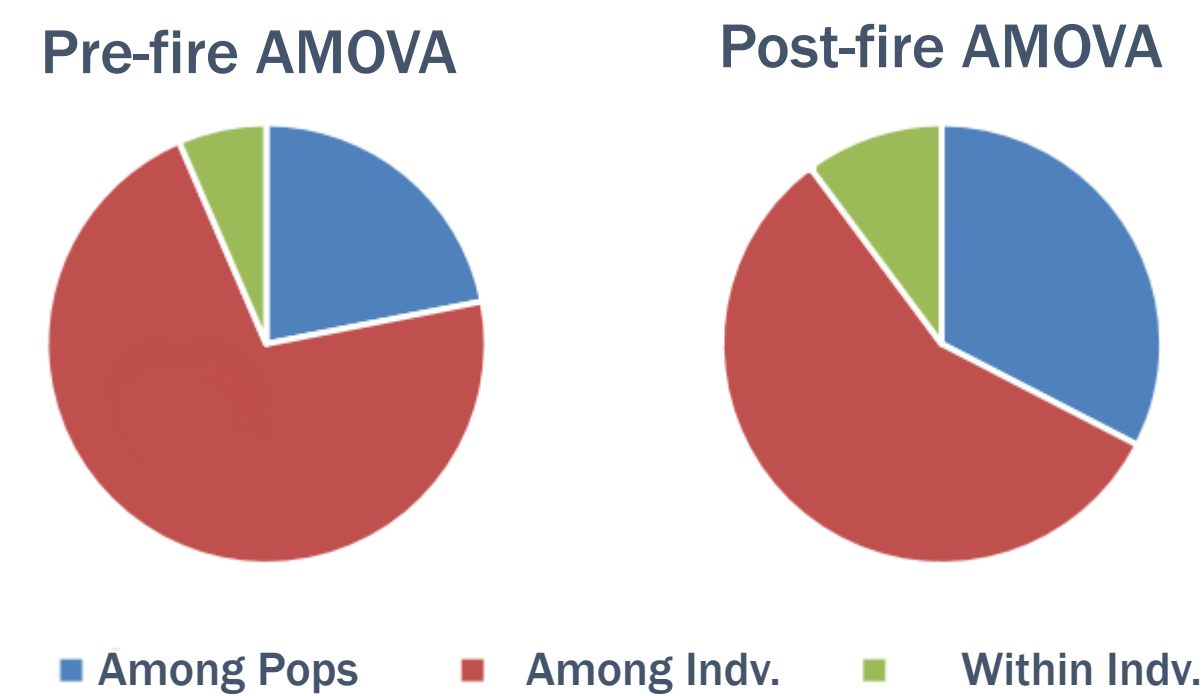
Study Species

Polygala lewtonii Small (Polygalaceae), or Lewton's Polygala, is a federally endangered¹ perennial plant endemic to six counties in central Florida⁶. Populations of *P. lewtonii* are scattered, mostly small, and many have experienced fire suppression⁷. There are multiple benefits of fire to *P. lewtonii*, including increased seedling recruitment, survival, and increased fitness of progeny⁸. *P. lewtonii* produces three types of flowers: above-ground chasmogamous flowers (CH), closed aboveground cleistogamous flowers (CL), and below-ground CL flowers, making it a member of a sub-group of about thirty plants worldwide which have an amphicarpic breeding system (i.e., a mix of both aboveground and belowground flowers)⁹; which results in seeds being produced both aboveground, both of which form a persistent seed bank⁸.

Goals

1. To examine the effects of fire on the genetic diversity and structure of populations of *P. lewtonii*.
2. To understand the effects of fire on the favored mating system in the species.
3. To understand how to use fire to manage for genetic diversity in *P. lewtonii*

Results



Above: *Polygala lewtonii* seeds.

Private Alleles

A total of 8 alleles are unique to the pre- fire populations. A total of 6 alleles are unique to the post- fire populations. ~17% of all total alleles change after fire.

Heterozygosity

Expected heterozygosity (H_E) and observed heterozygosity observed (H_O) remained low overall.

There was a small increase for H_O after fire.

There was a small decrease in H_E after fire.

AMOVA analysis (shown above)

Both at population and plot level, both the amount of genetic variation within individuals and the amount of genetic structure among populations increased.

Preliminary seed data

From a sample of 30 *P. lewtonii* seeds from two populations from this study, both H_E and H_O remained low ($H_O = 0.092$, $H_E = 0.350$). These values are in line with the values obtained from tissue analysis.



Above: *Polygala lewtonii* with above-ground flowers (left) and below-ground flowers (right).

References & Acknowledgments

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