

Host plant choice in the frosted elfin, *Callophrys irus* Godart (Lepidoptera: Lycaenidae).

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Introduction

What makes a habitat suitable and even optimal to an organism is important to consider for those that are concerned with threatened and endangered species. Factors such as habitat quality, quantity, and connectivity are crucial in enabling the presence and prolonged existence of butterflies, many of which are under severe extinction pressure due to habitat fragmentation and loss (Harrison et al., 1988, Thomas et. al, 1992; Hanski & Thomas, 1994; Fownes & Roland, 2002, Heisswolf, et al., 2009). Spatial connectivity between occupied patches, ground coverage of host plant (Bauerfeind, et al., 2009), and the proximity of larval (host) and adult (nectar) food plants to one another (Fred, et al., 2006) are specific examples of factors that influence butterfly presence. Each example is a different type of resource that is needed by butterflies at different life stages, a common occurrence within the arthropods (Dennis, et al., 2003; Vanreusel & Dyck, 2007). Identifying suitable habitat for a rare, threatened, or endangered organism is of serious consideration for conservationists and land managers, and should rely upon clear taxonomic certainty, expansive sampling if possible, and ample consideration of ecological and physical habitat factors (Naumann & Crawford, 2009; Singh, et al., 2009).

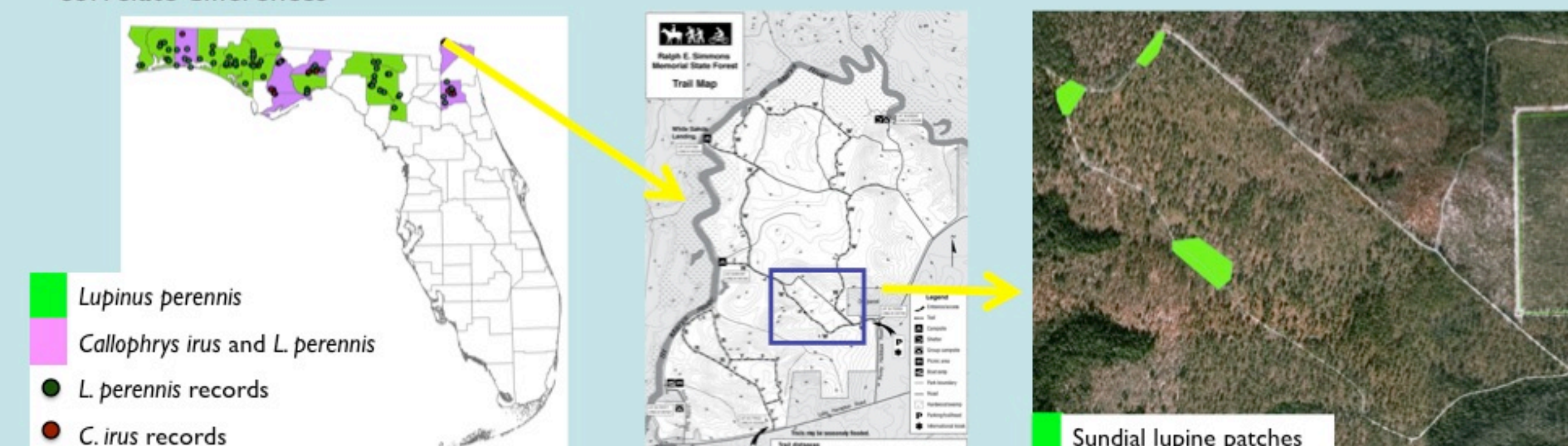


Objectives

- Survey frosted elfin habitat at Ralph E. Simmons Memorial State Forest
- Identify and correlate factors that are associated with frosted elfin presence/absence

Methods

- Several surveys were conducted between April and June 2010 at Ralph E. Simmons Memorial State Forest, Nassau County, Florida
- Sundial lupine plants were flagged and assessed for stem and leaf number
- Each lupine plant was inspected for presence of the frosted elfin butterfly: eggs, larvae, and larval feeding damage
- Non-host plant cover was measured by placing a 1m² square PVC frame centered around a sundial lupine plant and visually estimating the percent of ground covered by other vegetation, breaking this down into general types: graminoid, herbaceous, and woody
- Other variables included proximity to and size of other sundial lupine plants in a 1m² square surrounding the focal plant and light intensity measurements using a handheld light meter
- Statistical analysis using R included Wilcoxon rank sum tests for differences between sites and logistic regression to correlate differences

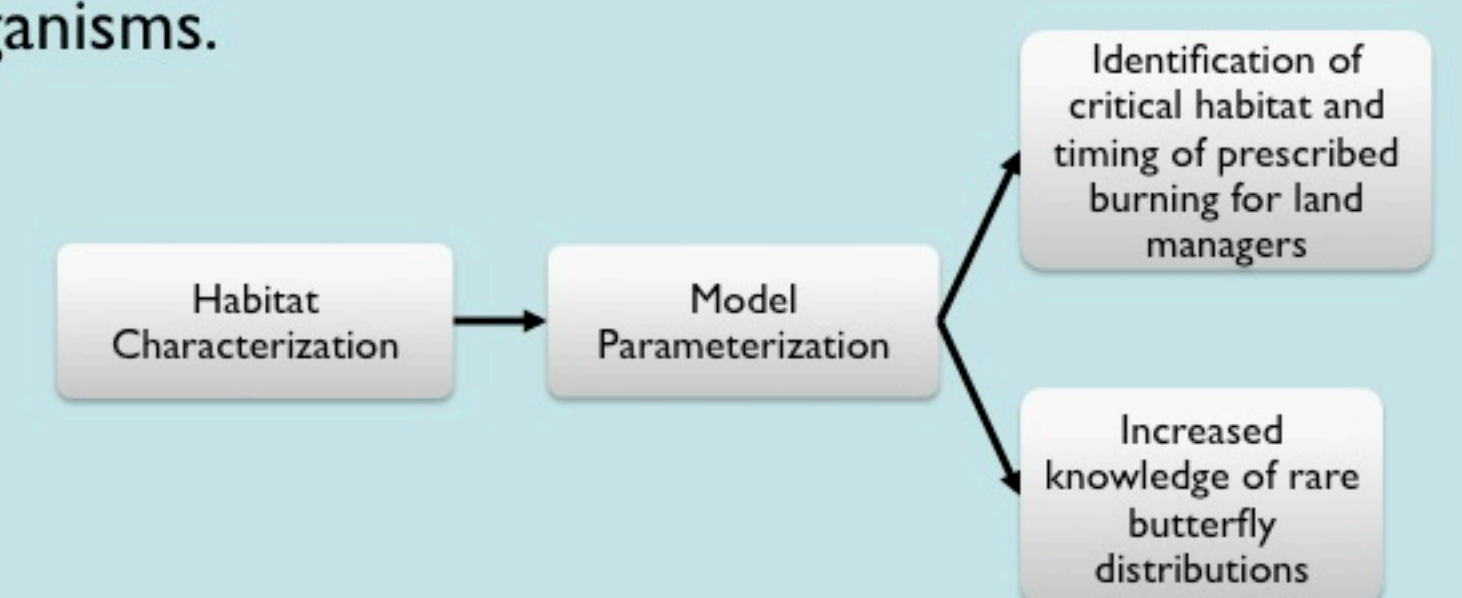


Conclusions

- Differences in ground cover estimates between sites did not account for differences in presence of frosted elfins
- Other factors may account for site differences such as host plant nutrient quality or predation/parasitism
- Large lupine plants had higher occurrence of frosted elfins:
Probability of feeding damage (%) = 0.51*Max Leaves + 0.5
 - Large plants may be more apparent to ovipositing females
 - Large plants may be of higher quality

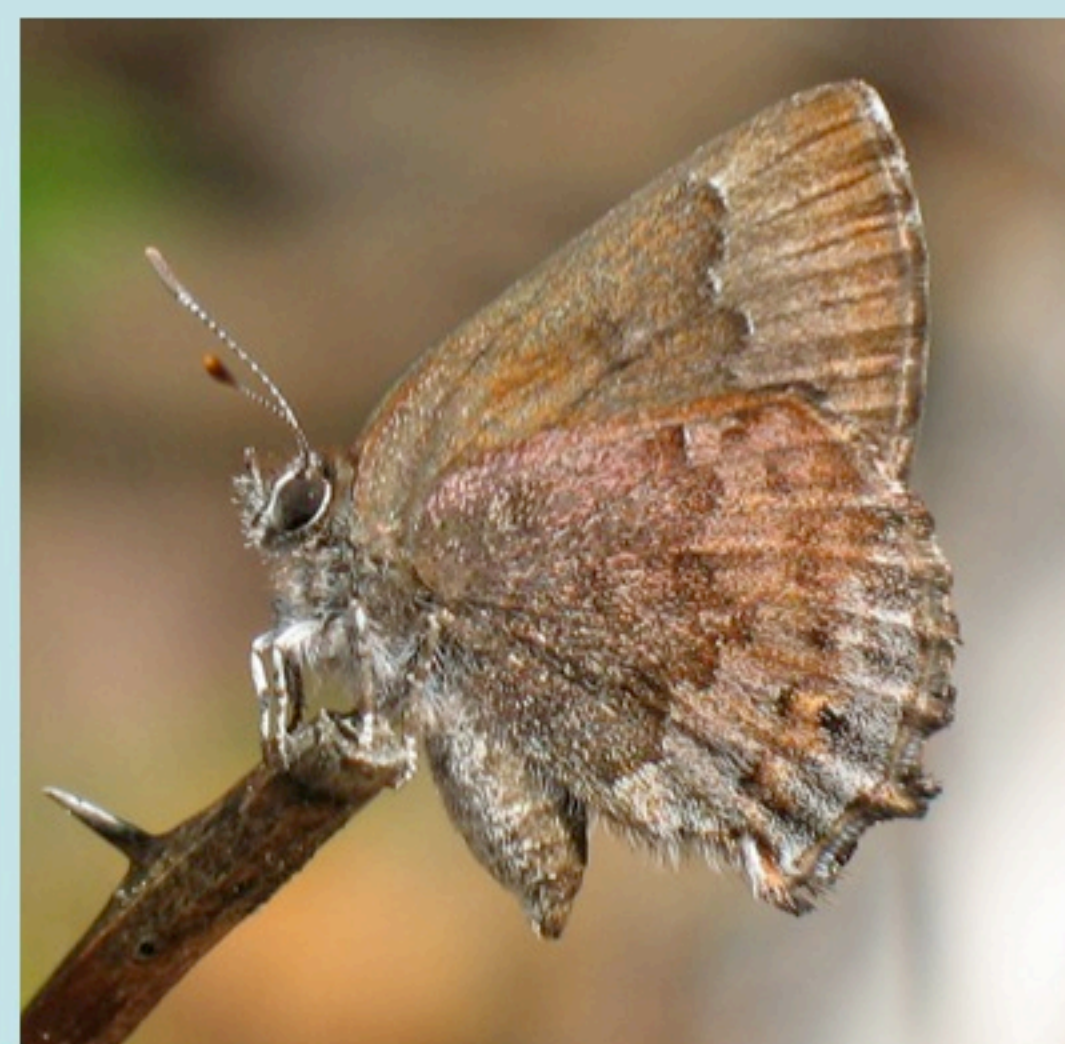
Synthesis

The habitat suitability model generated by this and future studies will aid habitat restoration projects by effectively identifying the parameters that are necessary or vital for *C. irus* populations. This study could also turn into a framework that could be applied to other species in this type of ecosystem. Finally, general scientific knowledge will be enhanced by this study, as the reasons for the distribution of a particular species will be uncovered, a species that may share much in common with other threatened and endangered organisms.



Study System & Species

- The hairstreak butterfly *Callophrys irus* Godart (Lepidoptera: Lycaenidae)
- Larval host-plant sundial lupine, *Lupinus perennis* L. (Fabaceae)
- Sandhill pine savannah/barrens and oak scrub at Ralph E. Simmons Memorial State Forest, Nassau County, Florida



Results

Summary

- Three distinct patches of sundial lupine
- Lupine patches varied in presence of frosted elfin and ground cover (Figures 1 and 2)
- Total ground cover vegetation was not correlated to presence (Table 1)
- Patches were correlated to presence (Table 1)
- Lupine size positively correlated to frosted elfin presence (Table 2 and Figure 3)

Formula = Feeding damage ~ Site + Total vegetation cover

Coefficients:	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.996881	0.508704	1.960	0.0500 *
site2	-1.467577	0.613527	-2.392	0.0168 *
site3	-1.649664	0.785419	-2.100	0.0357 *
Totalveg	0.006418	0.011793	0.544	0.5863

Null deviance: 114.08 on 82 degrees of freedom
Residual deviance: 105.95 on 79 degrees of freedom
AIC: 113.95

TABLE 1. Logistic regression output of feeding damage as a function of patch and vegetation cover.

Formula = Feeding damage ~ Max leaves + Max stems

Coefficients:	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.27631	0.30091	0.918	0.35850
maxleaves	0.05253	0.01819	2.887	0.00388 *
maxstems	-0.30055	0.20772	-1.447	0.14794

Null deviance: 246.07 on 204 degrees of freedom
Residual deviance: 232.85 on 202 degrees of freedom
AIC: 238.85

TABLE 2. Logistic regression output of feeding damage as a function of maximum lupine leaves and stems at a single patch.

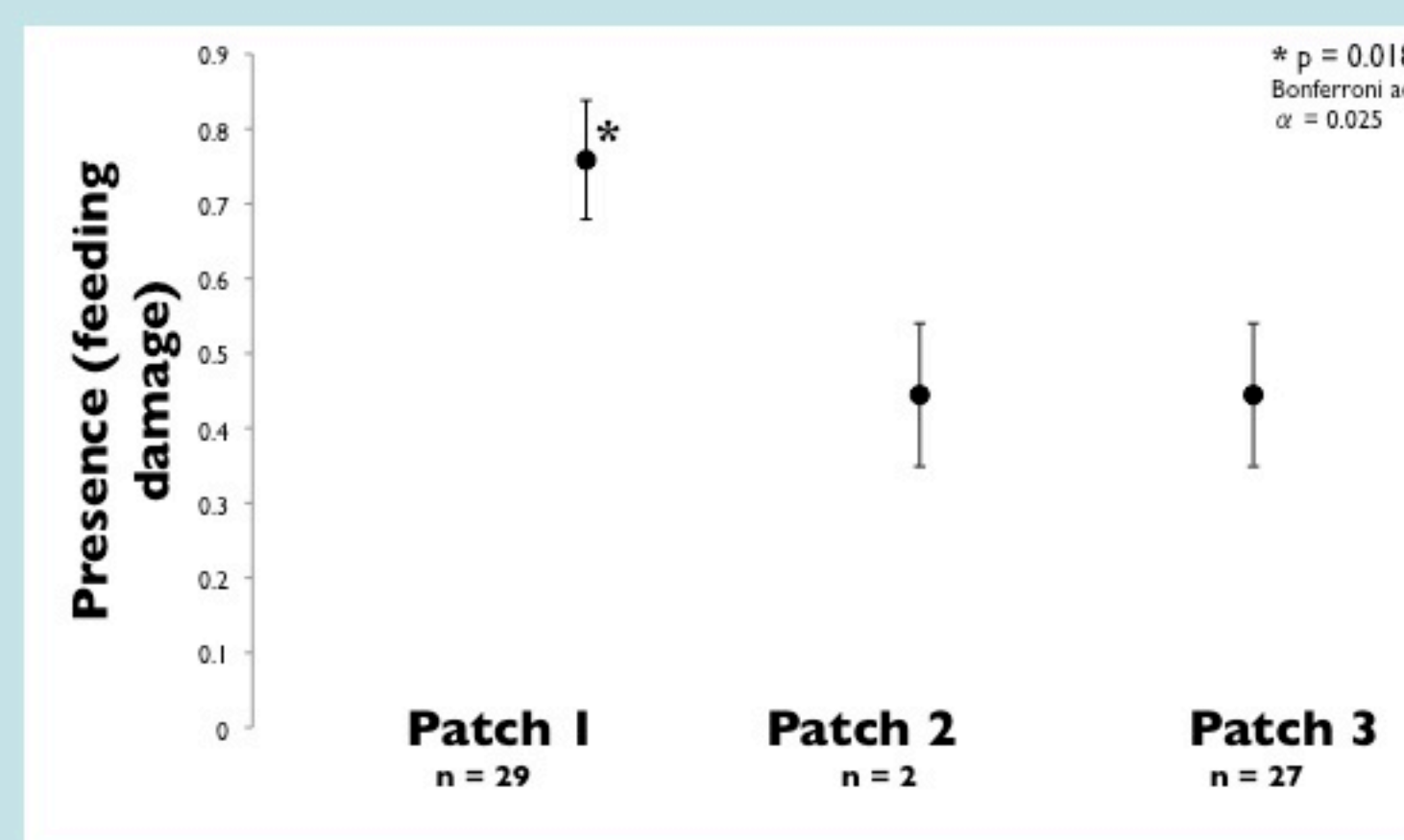


FIGURE 1. Wilcoxon sign rank test for presence as a function of patch number.

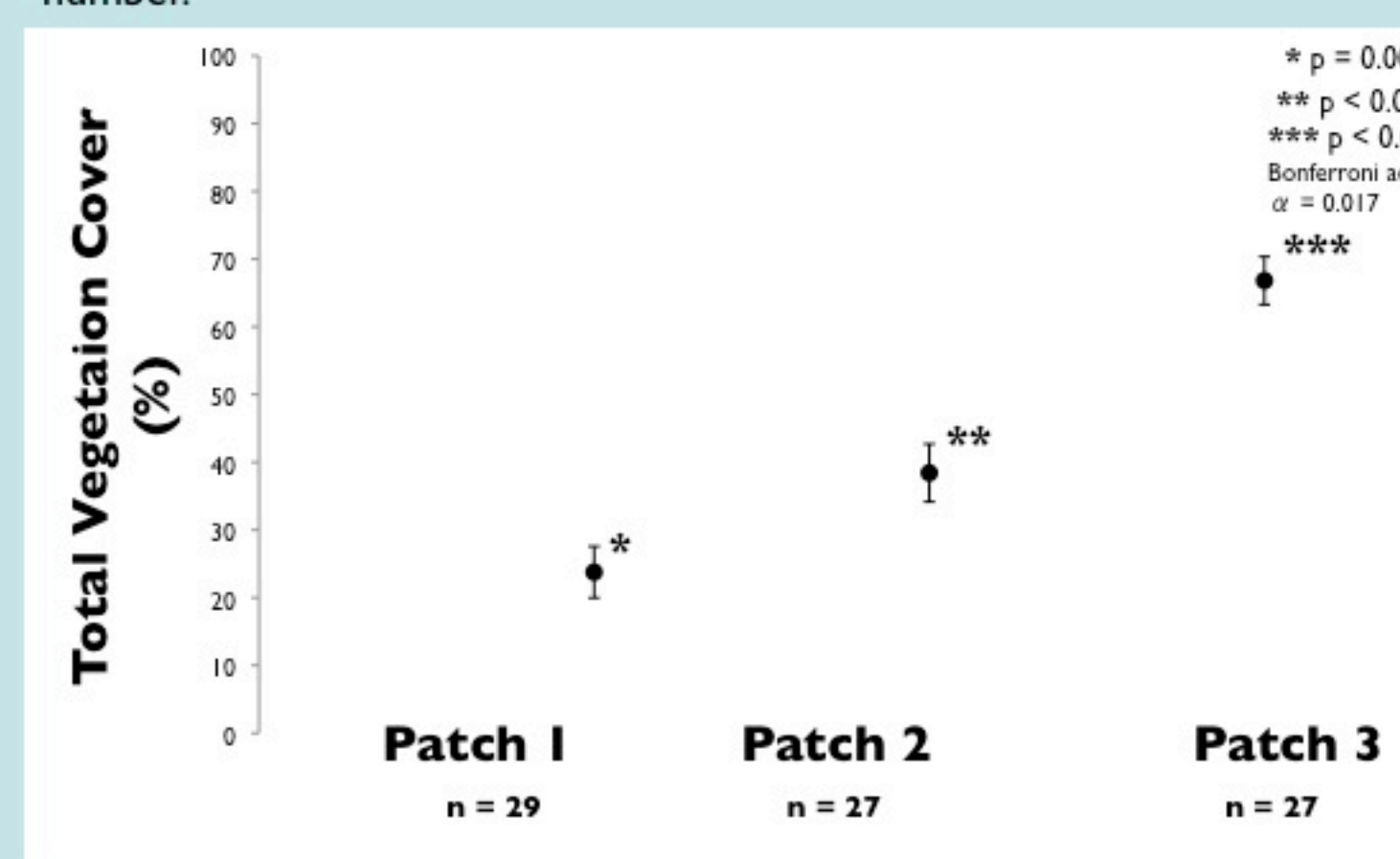


FIGURE 2. Wilcoxon sign rank test for presence as a function of total vegetation cover.

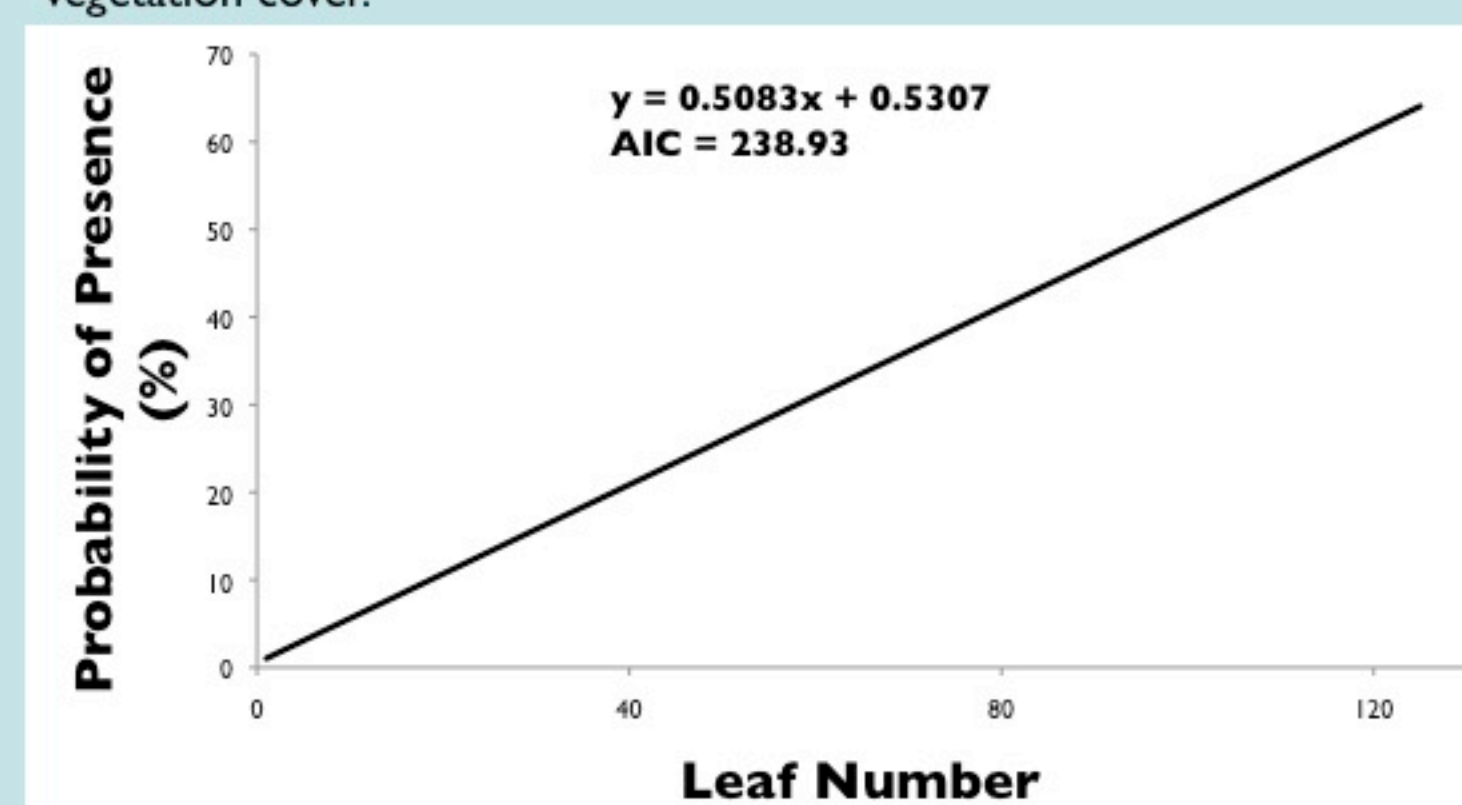


FIGURE 3. Logistic regression of feeding damage as a function of host-plant leaf number.

Future Directions

- Follow cohorts at Ralph E. Simmons Memorial State Forest to aid in life table analysis.
- Further development and testing of a habitat suitability model for the frosted elfin in Florida.
- Experimental study of fire effects on host plant quality and pupal survival.

Selected References

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