

Effects of Changes in Canopy Cover on Understory Vegetation in the Long Island Pine Barrens

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Introduction

The Central Pine Barrens (CPB) is a protected 41,480 ha ecosystem on Long Island, New York (Figure 1). Pine barrens are rare and threatened ecosystems found on coarse, droughty soils in the northeastern United States [1].

The Central Pine Barrens Monitoring Program was begun in summer 2005 to provide a baseline of the ecological health of the CPB [2].

Pine barrens ecosystems are mosaics of shrubland, woodland, and forest communities. Open-canopy pitch pine and scrub oak shrubland becomes closed-canopy pitch pine forest and ultimately coastal oak forest as succession occurs.

Canopy structure is an important factor in determining the composition of understory plant communities [3].



Figure 2. A pitch pine-scrub oak community.

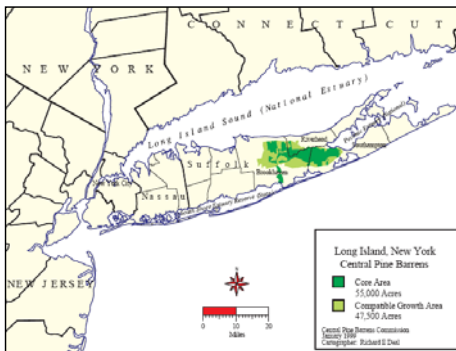


Figure 1. Long Island's Central Pine Barrens [4].

Objectives

- Determine whether and how differences in tree canopy cover affect the composition and species richness of understory plant communities in the Long Island pine barrens.

- As part of the CPB Monitoring Program, contribute to providing a baseline of the ecological health of the Central Pine Barrens.

We expected to find:

- negative relationship between total canopy cover and understory species richness and percent cover
- greatest understory species richness in areas with a mixed pine-oak canopy.

Methods

Study Area. Research was conducted in the 22,275 ha Core Preservation Area of the CPB (Figure 1). Data collection for the first year of the study focused on closed-canopy pine barrens communities

Field Methods. Field data collection methods were developed by Batcher [2] for the CPB Monitoring Program. Study plots (400 m²) were randomly selected within the study area.

Canopy and understory cover were sampled systematically in each plot along line transects. Understory plant (<2m) cover was sampled by vertically dropping a 2-meter pole at each sampling point and recording each species touching the pole.

Tree canopy (≥2m) cover was sampled by taking densitometer readings at each sampling point. Total percent canopy cover and percent of canopy cover made up of hardwood (proportion hardwood cover) were calculated.

Quantitative Methods. Understory characteristics were analyzed as a function of total percent canopy cover and proportion of hardwood cover. Linear regression was used to model relationships unless a nonlinear model explained at least an additional 10% of variance in the dependent variable [3]. Correlation was used to measure the strength of the relationships.

Results

Overstory and understory cover data were sampled from 43 plots.

Total percent canopy cover did not explain differences in species richness. Species richness was greatest where there was mixed pine-hardwood cover (Figure 3).

Percent total understory cover was negatively related to percent canopy cover and proportion of canopy cover made up of hardwood (Figure 4).

Understory shrub cover and *Quercus ilicifolia* (scrub oak) cover decreased as hardwood cover in the canopy increased (Figure 5).

Herbaceous plant cover was not explained by overstory characteristics.

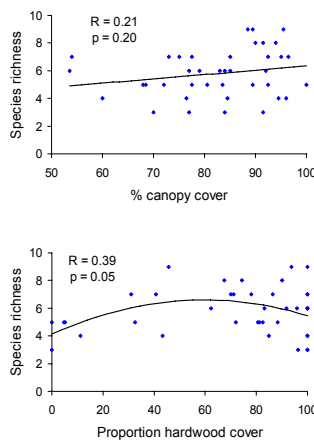


Figure 3. Overstory influences on understory species richness.

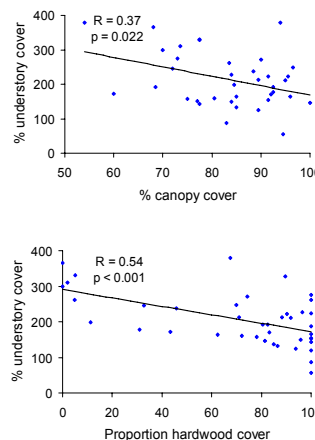


Figure 4. Overstory influences on understory percent cover.

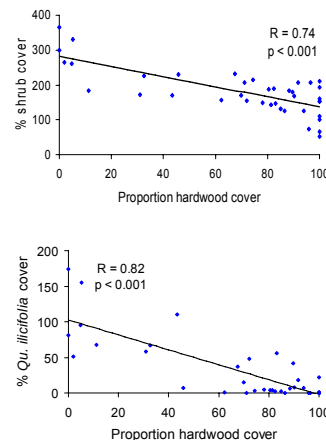


Figure 5. Overstory composition influences on shrub communities.

Conclusions

Overstory characteristics explained differences in understory composition, as predicted. Total understory and shrub cover were highest in communities with more open canopy and therefore more light availability, a pattern observed in many previous studies [5,6].

Shrub cover decreased as hardwood cover increased. In particular, scrub oak, a host species for rare Lepidoptera [7], was most abundant in pitch pine communities.

Understory species richness was greatest in mixed pine-oak forest, an intermediate successional community. This finding supports the intermediate-disturbance hypothesis.

Understanding the interactions between overstory and understory will allow us to predict changes in understory diversity and composition as a result of successional change and forest management. The Central Pine Barrens Monitoring Program's ongoing research will document these changes and provide information to help preserve the health of the pine barrens.

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Works Cited

- [1] M. J. Jordan, W. Patterson, and A. G. Windisch, "Conceptual ecological models for the Long Island pitch pine barrens: implications for managing rare plant communities," *Forest Ecology and Management*, vol. 185, no. 1-2, pp. 151-168, 2003.
- [2] M. Batcher, *Monitoring Protocols for Central Pine Barrens Field Plots*, 2005.
- [3] E. L. Bainbridge and W. L. Strong, "Pinus contorta understory vegetation dynamics following clearcutting in west-central Alberta, Canada," *Forest Ecology and Management*, vol. 213, no. 1-3, pp. 133-150, 2005.
- [4] Central Pine Barrens Commission, [Online document], Jan. 1999, [2005 Aug 5]. Available HTTP: http://pb.state.ny.us/maps_pdf/longis.pdf
- [5] K. D. Broszofski, J. Chen, and T. J. Crow, "Understory vegetation and site factors: implications for a managed Wisconsin landscape," *Forest Ecology and Management*, vol. 146, no. 1-3, pp. 75-87, 2001.
- [6] D. McKenzie, C. B. Halpern, and C. R. Nelson, "Overstory influences on herb and shrub communities in mature forests of western Washington USA," *Canadian Journal of Forest Research*, vol. 30, pp. 1655-1666, 2000.
- [7] J. Grand and M. J. Mello, 2004. "A multi-scale analysis of species-environment relationships: rare moths in a pitch pine-scrub oak (*Pinus rigida*-*Quercus ilicifolia*) community," *Biological Conservation*, vol. 119, no. 4, pp. 495-506, 2004.