A Comparison of Litter Densities in Six Community Types of the Long Island Central Pine Barrens

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ABSTRACT

The condition of the Long Island Central Pine Barrens has been an area of ecological concern for the past three decades. In 2003, the Foundation for Ecological Research in the Northeast (FERN) was founded to support scientific research in the Pine Barrens. FERN's groundbreaking project is the Central Pine Barrens Monitoring Program, for which field research began during the summer of 2005 at Brookhaven National Laboratory. The purpose of this 10 year longitudinal study is to determine the current status of forest health in order to promote longevity and conservation in the Pine Barrens, as well as to learn what research should be done in the future. Litter densities from Pitch Pine, Pine-Oak, Oak-Pine, Coastal Oak, Scrub Oak, and Dwarf Pine habitats were compared in order to justify the succession of the Pine Barrens and prepare for future prescribed forest fires. Using Geographic Information System (GIS) and Global Positioning System (GPS) technology, random 16 by 25 meter plots of land were selected throughout eastern Long Island and then thoroughly surveyed. Litter and duff depth data were collected at four points along each of the ten line transects in the plot. Pitch Pine forests were found to have the most litter, with an average depth of 6.12 centimeters. Pine-Oak forests have an average litter depth of 6.03. Oak-Pine and Coastal Oak forests have comparable litter depths. Oak-Pine forests have an average litter depth of 5.01 while Coastal Oak forests have an average litter depth of 4.82. Scrub Oak lands have almost no litter with an average depth of 3.63 while Dwarf Pine Forests have an average litter depth of 2.49. A comparison of the vastly different litter densities of the six community types yields results that are consistent with the previously determined succession of the Pine Barrens and shows that litter density plays a key role in aiding forest succession. Data collected under the Central Pine Barrens Monitoring Program was used to determine a threshold for litter density, 4.82 cm. However, this trend is only from the first two years of research. In the future, a more accurate threshold can be determined in order to prescribe forest fires at appropriate times and preserve the Pine Barrens in the most effective manner.

Figure 1. A map of the Central Long Island Pine Barrens indicating the core preservation area [5]

INTRODUCTION

The Long Island Pine Barrens Society was founded in 1977 in order to bring attention to the depleting natural resources of the Pine Barrens. Initial preservation attempts to provide core or "greenbelt" areas, shown in Figure 1, during the late 1970's and early 1980's did not alleviate threats to the Pine Barrens ecosystem [1].

In 2003 the Foundation for Ecological Research in the Northeast (FERN) was founded to fund ecological and environmental research [1]. The primary project of FERN is the Central Pine Barrens Monitoring Program. The goal of this project is to track the current and future health of the Pine Barrens so that future research needs and priorities can be identified [2].

It is anticipated that the results of this research will provide data relevant to the determination of appropriate timing for prescribed forest fires. Properly timed wildfires benefit the Pine Barrens. Reduction of litter (which is composed of leaves, twigs, pine needles, and other dead vegetation) and canopy cover in the forest provides for direct sunlight on the soil and triggers new tree growth. Melting of the pine cones' resin coating enables the cone to burst open and scatter seeds directly on bare soil [3].

Baseline data for this longitudinal study was collected during the summers of 2005 and 2006. Dwarf Pine, Scrub Oak, Pitch Pine, Pine-Oak, Oak-Pine, and Coastal Oak community types were targeted at this time. Pitch Pine forests commonly have a canopy cover of nearly 100 percent pitch pine trees while Pine-Oak and Oak-Pine forests have a canopy of mixed pitch pine and oak trees. All these community types include a shrub layer consisting of huckleberry, blueberry, and scrub oak. Coastal Oak forests typically contain a canopy of various tree oaks and little to no pitch pines in addition to "a nearly continuous shrub layer of huckleberry and blueberry" [2]. Scrub Oak forests have a canopy of less than 59% that consist of primarily pitch pine trees and some oak trees. There is generally a continuous layer of scrub oak and scattered huckleberry and blueberry. Dwarf Pine forests lack canopy cover and contain Pitch Pine and Dwarf Pines that are about two meters tall. The presence of scrub oak is nearly continuous [3]. .

In order to validate the succession of the Pine Barrens and determine a threshold for litter density, litter was measured in each of the six community types.

MATERIALS AND METHODS

Plots in the Central Pine Barrens throughout eastern Long Island were randomly selected using Geographic Information System (GIS). Each plot was first located using Global Positioning System (GPS) to insure that it was in the targeted community type. Next, shrub, tree, and herbaceous cover was recorded at 20 points, each one meter apart, along each of ten transects. A densitometer was used at each point to determine an exact reading of the canopy cover. Litter and duff depths were measured to the nearest millimeter at points 3, 8, 13, and 18 along each transect [2].

Belt transects were completed following the line transects. Tapes were placed at two, four, six, and eight meters along the 16-meter edge of the plot so that seedling and sapling data could be collected for four belt transects. Next, data on trees, snags, and downed logs were collected [2].

Before leaving the plot, we estimated the percent cover and average height of each stratum including trees, shrubs, vegetation, and epiphytes. The edges and center of the plot as well as a witness tree were marked so that the plot can be located in the future [2].

A total of 91 plots were measured, however three were excluded from this study due to the vagueness of the actual community type. The breakdown of the 88 plots included for data analysis is noted in Table 1. Litter depth and seedling data for each plot (the 88 points sampled) was averaged to create a mean litter depth for each plot. This data was then sorted by community type and graphically analyzed.

Plant Community	Number of plots
Dwarf Pine	4
Scrub Oak	7
Pitch Pine	17
Pine-Oak	12
Oak-Pine	30
Coastal Oak	18

Table 1. The community type breakdown of the 88 plots used in this research.

Dana Tievsky measuring the litter depth of an Oak-Pine Forest.

RESULTS

	Dwarf Pine	Scrub Oak	Pitch Pine	Pine-Oak	Oak-Pine	Coastal Oak
Litter Depth (cm)	2.45	3.63	6.12	6.03	5.01	4.82
Standard Deviation	1.14	1.66	2.24	2.66	0.86	1
Variance	1.31	2.75	5.02	2.75	0.74	1

Table 2. The average litter depth of each community type (the mean of the average litter depth for each plot by community type). Standard deviation and variance of each mean is also displayed
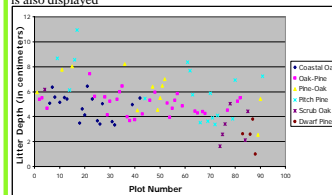

Figure 2. A comparison of average litter depth by community type.

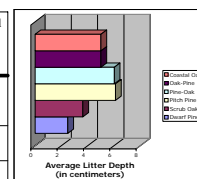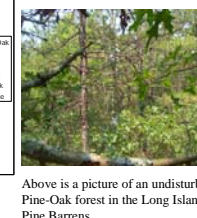Figure 3. The average litter depth of each plot graphed to show variation in results for each community type.
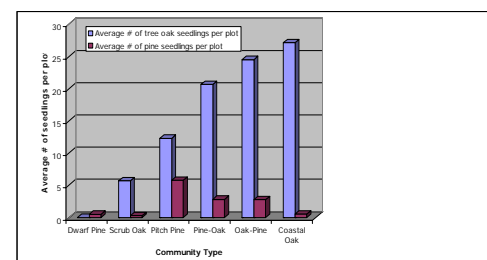

Figure 4. A comparison of the average number of tree oak seedlings to pine seedlings for each community type (in table and graph form).

Emily Efstration treks through the scrub oak to get to the plot location for the day.

DISCUSSION AND CONCLUSION

By comparing the data in Figure 2 to the forest succession, it is evident that litter depth plays an important role in the transitions of forest succession. The early stages of succession, Pitch Pine and Pine-Oak, have a high average litter depth per plot whereas the later stages of succession, Coastal Oak and Oak-Pine forests have lower litter depths. This data can be considered statistically significant since the data for each community type is within two standard deviations of its' corresponding mean.

Furthermore, community transitions because of succession occur at a very slow rate without initiation by fire. Therefore, it is sometimes necessary to prescribe forest fires and establish and maintain them safely and correctly. "Many seedlings have grown to more than six feet tall in the areas burned by the 1995 (Sunrise) fires" [4]. Pitch Pine and Scrub Oak forests are endangered community types and since these forests support uncommon species of plants and animals, it is beneficial to preserve the lands.

From the data findings of the Central Pine Barrens Monitoring Program in 2005 and 2006, a litter depth threshold of 4.82 cm. was determined. This piece of data enables prescribed fires to be properly timed for maximum conservation efforts. Resource managers of the New York State Department of Environmental Conservation can control forest fires in areas of Coastal Oak (and some Oak-Pine) forest with a litter depth of about 4.82 cm. This will jump start the forest succession and initiate more pitch pine tree growth and therefore rejuvenate the forest and help to save the endangered forest types (Pitch Pine, Scrub Oak, and Dwarf Pine)[4].

The baseline data of this research shows an abundance of Coastal Oak and Oak Pine forests as well as little regeneration in the areas of concern. Without prescribed fires it seems more than likely that the endangered community types of the Long Island Central Pine Barrens will gradually disappear.

When this project is continued in ten years, a new threshold of litter depth should be determined. Since the lands will have changed dramatically, this will help restore and manage the Pine Barrens in the most efficient way.

Prescribed forest fires should be planned and started as soon as possible so that future generations can enjoy the unique and fascinating resources that the Long Island Central Pine Barrens holds.

REFERENCES

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[3] Raquel M. Dillion, "A Controlled Burn on the Ossipee Pine Barrens," *NHPR News*, July 22, 2003.

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Above is a picture of an undisturbed Pine-Oak forest in the Long Island Pine Barrens.