Understory composition of the Long Island Pine Barrens.
Miranda Davis, Dr. Tim Green, and Robert Anderson
(Brookhaven National Laboratory)

Abstract
The Pine Barrens of Long Island is a unique community that must be properly managed in order to preserve the diverse array of flora and fauna it supports. Without management involving prescribed burnings it is likely that the Pine Barrens will disappear through natural succession leading to an oak-based climax community. In general the Pine Barrens are dominated by Pinus rigida and other shrub species that are believed to be facilitated by regular burning; however, few studies have been conducted in this area. In order to better understand the sequence of succession and the importance of this community, we have studied the vegetation composition of the under-story in both pine and oak-based communities on Long Island. By examining random plots within both forest types we calculated the percent composition of different plant species for the under-story of both oak and pine-based forests.

Introduction
The Central Pine Barrens of Long Island is currently of great ecological concern. This primarily pitch pine (Pinus rigida) and scrub oak (Quercus ilicifolia) based community type has been documented to host a diverse array of rare flora and fauna including quite a few state- and national-endemic species (Wagner et al. 2003). The Lepidoptera are often dependent on specific under-story shrub species, which are common in the Pine Barrens (Wagner et al. 2003). Much of the biodiversity is also dependent on the characteristic open canopy and extensive shrub cover provided by this habitat (Forman & Boerner 1981). Unfortunately, the fire-dependent Pine Barrens communities are under threat by the increased human development and over-zealous fire suppression, which has already resulted in the loss of 50 percent of the Pine Barrens historical range (Jordan & Mello 2004). Without frequent burning the typical pitch pine community of the Pine Barrens gives way to more shade-tolerant hardwood communities dominated by various oaks (Quercus spp.) (Jordan 2003; Forman & Boerner 1981; Seischab 1991).

As part of a larger study being done by FERN (The Foundation for Ecological Research in the Northeast) I have set out to examine the variation in under-story vegetation between the near-eliminative pitch pine forest and oak-based community types with in the Pine Barrens. Previous studies have found that under-story vegetation varies greatly across successional stages in other Pine Barrens communities (Matlack et al. 1992; Plocher 1999). It is likely that pine and oak-based communities may vary in under-story composition and the overall height and coverage of their shrub and herbaceous layers. To my knowledge this has yet to be documented in the Long Island Pine Barrens. I will estimate the species composition of the under-story and compare the extent and diversity of this layer in pitch-pine forest as opposed to the later successional stages which incorporate a higher amount of hardwood (primarily oak) trees and which may take over if a proactive fire management plan is not implemented.

Methods and Materials
Vegetation maps of the Long Island Pine Barrens region were commissioned by the Nature Conservancy and used to distinguish pine-based areas (characterized by >90 percent pitch pine canopy cover) from other community types with a relatively higher amount of oak species in the canopy (<90 percent pitch pine canopy cover). Random plots were then chosen for sampling using the Global Information System (GIS). Seven plots were completed within pitch pine communities and forty plots within relatively oak-based communities.

Line transects were then used to measure the composition of the shrub/herb layers. Random numbers were chosen to determine the location of the transects (ten per plot) and the points along it to be sampled. Points were sampled by dropping a rod (less than 1 cm in diameter) to the ground and recording the species “hit” by the rod. Plants were only recorded as a “hit” if they were less than two meters in height (comprising part of the under-story). For the purposes of this study “hits” of mosses and lichens were not included. This method led to a total of 200 sample points per plot. The number of hits of each species of plant was added up with in each plot. When comparing the ocular estimations of the cover and height of the shrub and herb layers between the two communities, some more interesting results are found. The estimated average height of the shrub and herbaceous layer does not vary significantly between pine and oak communities; however, the estimated cover varies considerably. While there is an estimated 8.7 percent of shrub cover in exclusively pitch pine communities, there is only an estimated 79.9 percent of shrub cover in oak communities (two-tailed t-test, p<0.001, α=0.05, assuming unequal variances). Without the extensive shrub layer there is an estimated 10.6 percent cover in oak plots and only 2.7 percent of cover in pine plots (two-tailed t-test, p<0.001, α=0.05, assuming unequal variances).

Discussion
These results show that the extent and composition of the under-story vegetation varies a great deal between these pine and oak-based communities within the Pine Barrens. While both communities were dominated by primarily the same under-story species the relative proportions of these species varied a lot. The pitch pine communities observed in this study showed a much more extensive shrub layer (represented by overall cover) than the oak communities. This difference is most likely due to the higher amount of Quercus ilicifolia in the pitch pines sampled. The cover of this species is estimated to have a higher degree of herbaceous cover coincides with the higher proportions of Periderium aquilinum and Carex pensylvanica found in these plots, and makes sense as high amounts of shrub cover most likely shade out many herbaceous plants. As pitch pine communities mature and succumb to primary succession plant communities through the understory are shaded out and make way for Quercus ilicifolia. This trend coincides with other studies, which found significant variation in under-story composition (Black et al. 1992; Hylander et al. 1996), and which found Quercus ilicifolia was more common in communities undergoing regular disturbance due to severe burning (Jordan et al. 2003; Plocher 1999). These findings have important implications for the fauna of the Pine Barrens. The Pine Barrens are known for supporting a diverse array of bird and arthropod species, particularly Lepidoptera. Wagner et al. (2003) found that 96 percent of Lepidoptera species, which are of conservation concern and are known to utilize shrubland habitats in the Northeast, at least 29 percent are dependent on Q. ilicifolia for survival and/or reproduction. Without the extensive shrub layer of these species provided by pitch pine communities, many rare Lepidoptera may be doomed to local extinction. The same fate may apply to many of the bird species inhabiting the Pine Barrens which are known to prefer these areas due to the open canopy (Forman & Boerner 1981).

The extreme variation in under-story composition and the extent of cover in the herb and shrub layers in combination with the ecological importance of these factors suggest that future study in this area would be wise. In the future FERN should continue monitoring under-story species and take their results into account when developing comprehensive management plans for the Pine Barrens. Results of this study illustrate that if the pitch pine communities are not managed properly, pitch pines and oak forests then will there be drastic changes in the under-story composition leading to a reduced shrub layer and dire consequences for the fauna endemic to this area.

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References