

Evaluation of canopy estimation techniques and repeatability of the Monitoring Protocols for Central Pine **Barrens Field Plots**

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Abstract The Central Pine Barrens of Long Island is an important and unique region of an ecosystem of which little is known. Due to anthropogenic disturbance, however, there is an ever-decreasing amount of this important community type. The Central Pine Barrens of Long Island is instrumental for maintaining a proper functioning aguifer essential for Long Island and thus merits study. A baseline index for the Pine Barrens is currently underway, but the effectiveness and accuracy of one of the protocols used is unknown. One of the most important parts of scientific endeavors is maintaining repeatability. I evaluated the densitomete rements to check for accuracy and repeatability, using repeated plots to highlight both. The repeated plots demonstrated possible problems in terms of repeatability and accuracy, having large differences between the first and second data sets. The data also showed large discrepancies between the measured densitomete readings and visual estimation, indicative of inaccuracies most likely from observer bias. The purpose of using the densitometer is to have a more accurate measurement than estimation, but if the densitometer is no accurate this can cause problems with naming the community type and may merit amending the Protocols

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Introduction The Central Pine Barrens of Long Island encompasses roughly 100,000 acres, 52,000 belonging to a core preservation area, never to be developed. Due to a lack of management the Pine Barrens community type has drifted towards an unnatural state of climax. It has been estimated that over half of the naturally occurring Pine Barrens has either been developed or reverted to unnatural climax community (Noss et al., 1995). The fire suppression in the Pine Barrens causes the forest to revert to a closed canopy system where tree oaks dominate (Jordan et al., 2003). There are currently fire management projects underway in the Pine Barrens to attempt to restore what is thought to be the more natural community type

However what is the natural species composition compared to the unnatural? This baseline index of species composition is requisite for proper management of the Pine Barrens. Fortunately a project started this summer is taking on this task. The data being collect is critical for the future of the Pine Barrens, which is a unique and necessary ecosystem. Besides being a taxonomic treasure trove of coarse droughty soil loving organisms, the Pine Barrens are essential for maintaining a proper functioning aguifer for Long Island. The Pine Barrens is also critical for a number of rare | epidoptera (Wagner et al. 2003; Grand & Mello 2004).

This examination will focus on the canopy estimation of the baseline species index, concerning the repeatability and accuracy of a vertical densitometer. Canopy estimation techniques are numerous but necessary; estimating fuel amounts (Andersen 2005) to judge future fire potential, to estimating Leaf Area Index (LAI) for canopy productivity (Eriksson 2005). The measure of the canopy can have a great impact on the understory vegetation. The openness of the canopy can lead to more or less species and affect great aspects of their ecology (Brosofke et al. 2001). Canopy cover is also important for fauna as well, habitat for squirrels and other arboreal animals is greatly affected by the amount of canopy cover, and measuring the canopy can be indicative of potential habitat (Nelson et al. 2005)

Our method of using the vertical densitometer saves money over some other options, but how accurate it is should be evaluated and compared to other methods of estimation. In this scenario optical estimates are also being taken along with the densitometer readings, these will be compared. Also, different persons, to check for observer bias, with repeat of a select number of plots. The two data sets will then be examined for congruence because maintaining repeatability in science is guintessential

Methods and Materials For a more thorough account of the sampling methods see Monitoring Protocols for Central Pine Barrens, Michael S. Batcher 2005

The canopy cover data was recorded using a vertical densitometer. A densitometer is a "t" shaped tube with two levels and a mirror allowing you to see the point just above you, and identify the canopy cover. For our purposes the canopy cover was recorded as pine, hardwood or sky. Percentage cover of emergent, canopy and sub-canopy categories also estimated canopy cover. Those three categories, however, were estimated without aid of instrumentation. The canopy data was also collected twice in select plots by a different team of researchers to provide a means for checking observer bias and repeatability.

The data was examined using percentages and comparison; the repeated plots were analyzed using a





What is it like to look through a densitometer (above) You can see the two level bubbles, and what is just above where you are standing to determine canopy cov



A side profile view of a densitometer (above). It is T shaped PVC tube with two levels and a min

Results The data for the densitometer readings were changed into percentages to ease comparison between those measured and those estimated (from now on estimated" will be those data gleaned without instrumentation and "measured" wil be those gleaned with the densitometer). As visible in the Canopy cover table, there are large amounts of disparity between the estimated and the measured

As a whole, the estimated numbers appear to be low of the measured values, though no statistical significance could be attained due to lack of fields Some of the differences are very large, as in plots 1 and 31 being a factor of two apart

The repeated plots are impressive as well: plots 25 and 31 demonstrated statistically significant results using a T-test of P < 0.01. Though the other plots were not statistically significant the differences are worthy of note and consideration.

Discussion The difference between the measured and the estimated data within plots could be explained in several ways. Either the densitometer o the estimation data collection could have been incorrect due to a flaw in the protocol or in the recorder. Another concern could simply be that the technique isn't very accurate. Lastly, it could be that one is biased in its outcome. When examined, the estimation technique would naturally be the choice as being biased, its methodology as flawed, and susceptible to inc recording. With the densitometer the sampler could easily not be holding the instrument level or using the sighting mechanism correctly. One would assume, however, that the estimation is the flawed collection method here as it is up to complete observer bias to decide the figures. The data demonstrate no visible preference, with both estimation and measuring differing or average 13.5% on the repeats

The repeated plots do show significance. Two of the plots showed a significant difference between the measured and the estimated via t-test. The estimated values can be explained in terms of observer bias, since it is simply estimation. The densitometer readings, however, are collected data using an instrument and would hopefully be more accurate.

An explanation of flawed densitometer outcomes involving random questions the accuracy and precision of the Protocol. Twenty points along each line transect may not be enough for an accurate representation of the canopy. A possible thought would be that because of the reselection of random numbers, the exact points sampled would be different. The difference in the measured canopy cover because of different random points could demonstrate non repeatability aspect of the protocol. Observer bias can always be demonstrated, however, through incorrect use of the instrument of blatant erroneous recording; the latter hopefully could be discarded as a genuine explanation, but it is possible

With the preliminary data showing a possible flaw in the densitometer measurements the accuracy of the plot community type may also be erroneous. The end community type is determined by the percentage of canopy cover. If we examine plots 25 and 25b, with a gap of 25% cover we see the possibility of a misidentified plot community type. If those numbers were 49% and 73%, in a Pitch Pine community, the original data would have given it an open woodland designation, while the latter would be designated as a forest community.

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