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# CANOPY DENSITY AND ITS EFFECT ON MACROFUNGAL ABUNDANCE

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## ABSTRACT

The presence of macrofungi plays a crucial role in the forest ecosystem as well as for their influence on humans. Forest canopy density provides conditions that may influence the growth of macrofungal growth. The density of the canopy was quantified in order to determine whether canopy density influences fungal growth. Sites were located when there was fungal growth near the base of different trees. Within a 10 foot radius of the tree, the number of macrofungi was counted and the canopy density was determined. A Pearson Product-Moment Correlation analysis was conducted which resulted in an  $r$  value of 0.4382 which indicated a positive correlation, however the  $p$  value (0.2053) indicated that there is no statistical significance between canopy density and the abundance of macrofungi. The slight positive correlation indicates that perhaps the conditions received from a greater canopy density play a role in the growth of macrofungi, but there are other important factors that are required for a greater abundance of macrofungi.

*Key words: macrofungi abundance, canopy density, fungal growth, moisture, light*

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## INTRODUCTION

Fungi are one of the most diverse groups of organisms, however, it is estimated that only 5% of fungal species have been described to this day (Hawksworth, 2001). The presence of macrofungi plays a crucial role in the forest ecosystem as well as for their influence on humans (Nueller et al., 2004). While they play an important role, they are frequently overlooked. Macrofungi are not only primary decomposers, but they also mediate nutrients and water uptake by their host trees. They facilitate nutrient transfer among many species of plants, protect the roots from pathogens and environmental conditions, as well as a food source (Amaranthus 1998; Roberts et al., 2004). It is currently unknown what drives macrofungal diversity, however there are major factors that are considered to influence fungal growth. Climatic conditions, including rainfall, air and soil temperatures, evapotranspiration, relative

humidity, and the deficit of excess water (Agerer, 1985; Brunner et al., 1992). Other factors include geomorphological features as slope, aspect and altitude (Yang et al., 2006). Forest canopy density (FDC) refers to the proportion of an area in the ground that is covered by the crown of trees and is expressed in percentage of the total area. Bonet et al. (2004) suggests that conditions such as temperature, moisture, light, soil, and wind could partially explain productivity, population composition and dynamics of forest fungi. Forest canopy density provides those conditions therefore there is an indication that canopy density may influence the growth of macrofungal growth. The denser the canopy density, the greater the moisture and the darker the conditions. The dense canopy allows less moisture to evaporate which allows a dark and moist area which is the ideal environment for fungi. Therefore, it is believed that the denser the canopy, the greater the fungal abundance.

## METHODS AND MATERIALS

This study took place in two different field sites. The data was collected from wooded areas in both Huntingdon, PA and Delaware County, PA. The sites were located in the span of 3 weeks, therefore, occurred in different conditions. Some were located after rainfall and some were located in sunshine. This may impact the results; however, it took many hours to find sites with macrofungi presence and it would not have been possible to locate all the sites in the same day during the same conditions. For this study, sites were located when there was fungal growth near the

base of different species of trees. Within a 10 foot radius of the tree, the number of macrofungi was counted. Photographs were taken of the canopy from the base of the tree and a photograph was taken of the macrofungi. The canopy density was determined in a percentage value of canopy covering the sky when looking at the photograph taken when looking up from the base of the tree seen in Figure 1. After the sites were located, a statistical analysis was conducted found in Figure 2. A Pearson Product-Moment Correlation analysis was conducted to measure the linear correlation between two sets of continuous variables.



*FIGURE 1: This is an example of how the sites were used and recorded. The canopy was photographed in order to determine the percent of canopy density. An image was also taken of the macrofungi.*

## RESULTS

After collecting data from 10 different sites, the canopy density and the number of macrofungi were

determined. None of the sites had to be excluded giving us 10 different sets of data to analyze. Below is Table 1 which is a representation of the data collected for the 10 different sites.

*TABLE 1: The table below is a summary of the data for the 10 different sites found. For each site the canopy density was determined in a percentage, which is shown in the first column. In addition, for each site the number of fungi that were found in a 10 foot radius of the base of the tree were counted. Each row represents a different site.*

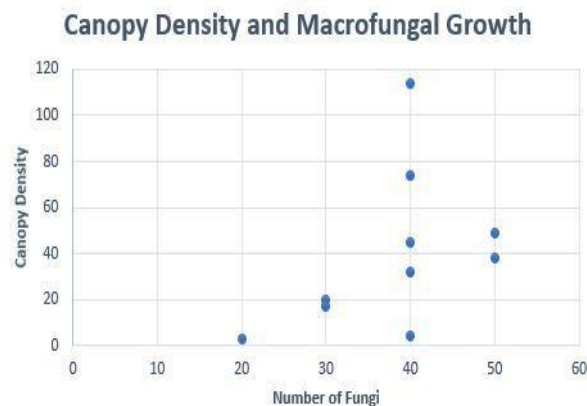
CANOPY DENSITY (%)	NUMBER OF FUNGI
40	74
40	4

DOI

50	38
40	114
30	20
40	32
30	17
20	3
50	49
40	45

After the data from the 10 sites was collected, statistical analysis was performed using a Pearson Product-Moment Correlation analysis seen in Figure 2 to determine if the data was statistically significant and if it supported the hypothesis.

*significant relationship between canopy density and macrofungal abundance.*



*FIGURE 2: The figure above represents a Pearson Product-Moment Correlation analysis. It was conducted in order to determine whether there was a significant relationship between canopy density and the abundance of macrofungi. The test conducted outputs an  $r$  value between 1 and -1. An  $r$  value above 0 indicates a positive correlation, a value under 0 indicates a negative correlation, and a value of 0 represents no correlation. The  $r$  value was 0.4382 which indicates that there is a slightly positive correlation. The  $p$ -value was 0.2053 which is greater than alpha (0.05) therefore we fail to reject the null hypothesis that canopy coverage will have no effect on the abundance of macrofungi. The statistical results indicate that there is no statistically*

## DISCUSSION

A Pearson Product-Moment Correlation analysis resulting in a positive correlation meaning that a greater canopy density slightly influences the abundance of macrofungi, however the  $p$ -value suggests that canopy density does not significantly impact the abundance or growth of macrofungi. Therefore, it is appropriate to assume that the factors derived from a greater canopy density influence the growth of macrofungi; however, there are other factors that play a crucial role in their abundance. There were a few setbacks during the phase of data collection. The 10 sites were not found on the same day, therefore may have experienced rainfall or sunshine more than others which may have influenced the data. This study has only considered light and moisture when evaluating the abundance of macrofungi. In a previous study Bonet et al. (2004) suggests that conditions such as temperature, moisture, light, soil, and wind could partially explain productivity, population composition and dynamics of forest fungi. Future studies may need to include these many conditions when evaluating their correlation to the growth of macrofungi. A denser canopy influences a few of the conditions that are needed for the growth of macrofungi, however, factors such as temperature, soil, and wind need to be evaluated as well. In the future, a study conducted in the warmer weather of the summer months, when there is also more canopy density, could yield more conclusive results with more consistent data. Further understanding the conditions in which macrofungi

thrive will aid in ecosystem protection and restoration, as well as impact people positively as a food and medicine source.

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