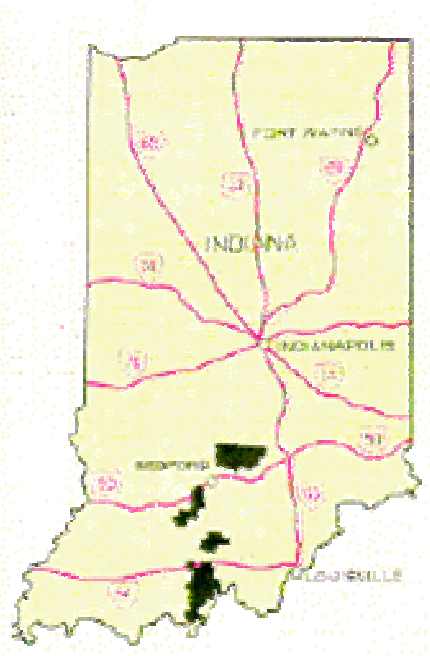

A Comparative Study Tree Community Structures and Topographical Positions in Ovenbird Ravine, Hoosier National Forest in Indiana

By
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Abstract:

In this study, I investigated the Ovenbird Ravine in the Hoosier National Forest in the state of Indiana. The major hypothesis of this study was to examine whether the distribution of tree species composition was independent of topographical position. Two sites were randomly selected (ridge and ravine sites) in an area of 800m^2 (200m×4m). Within the area, all tree species were identified as adult trees with diameter at breast height (dbh) $\geq$4 inches or $\geq$10cm. The relationship between the two sites was statistically calculated by applying Pearson's Chi-Square Test, testing Independence χ^2. I concluded that tree species compositions varied at the ridge and ravine sites.

Introduction:

The Hoosier National Forest is managed by the U.S. Forest Service (8). It is the largest natural area in Indiana, with an area between 192,000 to 194,000 acres (1,3). The depression of the 1930's, the Hoosier National Forest was born (3, 6). It is located in the southern part of the state of Indiana (1, 3, 6). The Hoosier National Forest consists of several lands that were purchased from private owners. Much of the forest's area was cleared of trees, and the soil was roughly corroded (6).

The Hoosier National Forest consists of vast stands of hardwoods, cedars, and pines. The forest is characterized by large lakes, caves, sinkholes, springs, and streams. Moreover, there are two beautiful recreational areas. One is Hardin-Ridge Recreational Area, located in the northern part of the forest in close proximity to Bloomington, Indiana. The second is known as the Indian-Celina Lake Area. This area has six various campgrounds and is located in mature mixed hardwood and pinewoods alongside a ridge (1).

The Hoosier National Forest provides various opportunities and resources for both people and wildlife. For people, among the many recreational activities are hiking, camping, boating, hunting, and horseback riding

(8). For wildlife (e.g. deer, squirrels, turtles, and birds, insects, and snakes) the Hoosier provides different breeding and feeding habitats (2, 5).

Environmental agencies and land managers work collaboratively with the public aiming to develop and enhance visions of how such a forest should be managed and protected (8). The challenge is to provide satisfaction and enjoyment to people, and at the same time, protect the unique ecosystems in the Hoosier National Forest (8). Further, the main task is to restore the vigor and productivity of this land (3, 6).

The main purpose of this study was to investigate whether the distribution of tree species composition was independent of topographical position. The topographical position has two sites, ridge and ravine. Thus the main two variables were tree species composition and topographical position.

Study Area:

The study was conducted in a fraction in an area called Ovenbird Ravine in the Hoosier National Forest in south-central part of the state of Indiana. Data were collected in two topographical positions, ridge and ravine sites. These sites were randomly selected. The study area had a length of 200m and a width of 4m. In this area (800

m^2), mature trees, which were counted for this study, were defined as adult trees with diameter at breast height (dbh) of $\geq$ 4 inches or $\geq$ 10cm were considered.

Method:

In the study area, I considered two topographical positions, ridge and ravine sites in Ovenbird Ravine in the Hoosier National Forest as important. Collection of data started at 8:30 in the morning of May 14, 2002 and ended in the same day at 11:30am. Briefly, the data collection method involved establishing a 200m transacts at a randomly selected location. I identified all trees within the area. Identified trees were categorized by dbh. However, I did not identify or estimate density of shrubs and birds. I identified 71 trees on the ridge site and 53 trees in the ravine site.

In respect to data analysis, I used a standard method known as (Pearson's Chi-Square Test, testing Independence χ^2). This test was conducted to compare the differences in numbers of trees on the ridge site to those in the ravine site. The degree of freedom was calculated by using this formula $df=(r-1)(c-1)$, where r was the number of rows and c was the number of columns in the contingency table. Therefore, the calculated df was equal to 11. Eventually, I

compared the critical value against the value of χ^2. An appropriate and reasonable conclusion was stated.

Results:

The main result I discovered was that there was a difference in tree species composition on the ridge and in the ravine sites. The following tables showed the tree species, common names, and their frequencies in both sites:

1. The Ridge Site:

Species	Common name	Freq.
Acer saccharum	Sugar Maple	34
Quercus alba	White Oak	10
Quercus velutina	Black Oak	1
Quercus rubra	Red Oak	4
Carya glabra	Pignut Hickory	9
Carya cordiformis	Bitternut Hickory	2
Carya ovata	Shagbark Hickory	8
Tiliaceae Family	Basswood	2
Fraxinus Family	Ash	1
Moraceae Family	Beech	0
Liriodendron tulipifera	Tulip Tree	0
Platanceae Family	Sycamore	0
Total		**71**

Table 1: Ridge site trees and frequency of each tree.

From this table, it was obvious that the most numerically dominant tree was the sugar maple and the least present were beeches, tulip trees, and sycamores.

2. The Ravine Site:

Species	Common name	Freq.
Acer saccharum	Sugar Maple	24
Quercus alba	White Oak	0
Quercus velutina	Black Oak	0
Quercus rubra	Red Oak	1
Carya glabra	Pignut Hickory	1
Carya cordiformis	Bitternut Hickory	5
Carya ovata	Shagbark Hickory	0
Tiliaceae Family	Basswood	1
Fraxinus Family	Ash	4
Moraceae Family	Beech	9
Liriodendron tulipifera	Tulip Tree	6
Platanceae Family	Sycamore	2
Total		**53**

Table 2: Ravine site trees and frequency of each tree.

From this table, it was obvious that the most dominant tree was the sugar maple and least dominants were white oaks, black oaks, and shagbarks.

Conducting Pearson's Chi-Square Test, the result of calculating the expected frequency from the observed frequency was the following:

Contingency table	Observed Frequencies (F_o)			Expected Frequencies (F_e)	
	Ridge	Ravine	Total	Ridge	Ravine
Sugar Maple	34	24	58	33.2	24.7
White Oak	10	0	10	5.7	4.2
Black Oak	1	0	1	0.5	0.4
Red Oak	4	1	5	2.8	1.4
Pignut Hickory	9	1	10	5.7	2.8
Bitternut Hickory	2	5	7	4	1.9
Shagbark Hickory	8	0	8	4.5	2.2
Basswood	2	1	3	1.7	0.8
Ash	1	4	5	2.8	1.4
Beech	0	9	9	5.1	2.5
Tulip Tree	0	6	6	3.4	1.6
Sycamore	0	2	2	1.1	0.5
Total	**71**	**53**	**124**		

Table 3: Contingency table for both Observed Frequencies (F_o) and Expected Frequencies (F_e).

Statistically, when the df=11 and the level of significance $\alpha = 0.05$, the critical value was equal to 19.675. The calculated χ^2 was equal to 72.2. The χ^2 exceeded the critical value region. As a statistical result, there was a relationship between tree species composition and topographical position (Ridge, Ravine). The variables were not independent; therefore, tree species on the ridge site were different from tree species in the ravine site.

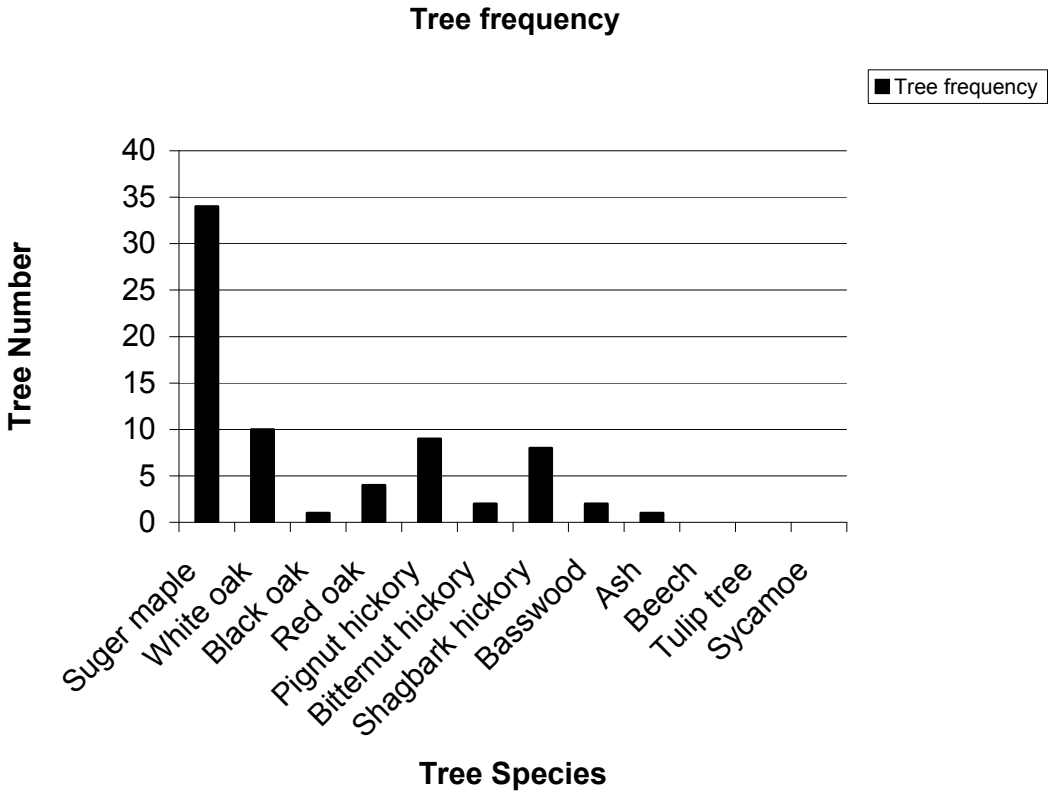
Discussion:

As mentioned, the main goal of this study was to examine whether the distribution of tree species composition was different in terms of topographical positions (e.g. ridge and ravine sites). My results supported the stated hypothesis that there were variations in tree species structures in both sites in the Ovenbird Ravine compartment.

The Ridge Site:

Regarding the ridge site, the number of identified trees was 71. These trees varied in terms of distribution, size, and frequencies. However, sugar maples were the most abundant species with 47.8% and then the white oaks with 14.1%. The remaining species were below 12.5%. This conclusion was supported by Mohlenbrock (1994). He stated

that a ridge forest was dominated by white oaks and maples (5) and basswood (7). Kley et al stated that there were a mixture of different species could be found on dry mesic ridge sites such as black oaks, red oaks, pignut hickories, and shagbark hickories (9). However, Mohlenbrock revealed that beside the white oaks and maples, there were other species that covered the ridge site such as tulip tree, black gum (5), sassafras, red maple, and chestnut oak (9), which is not suggested by my findings.

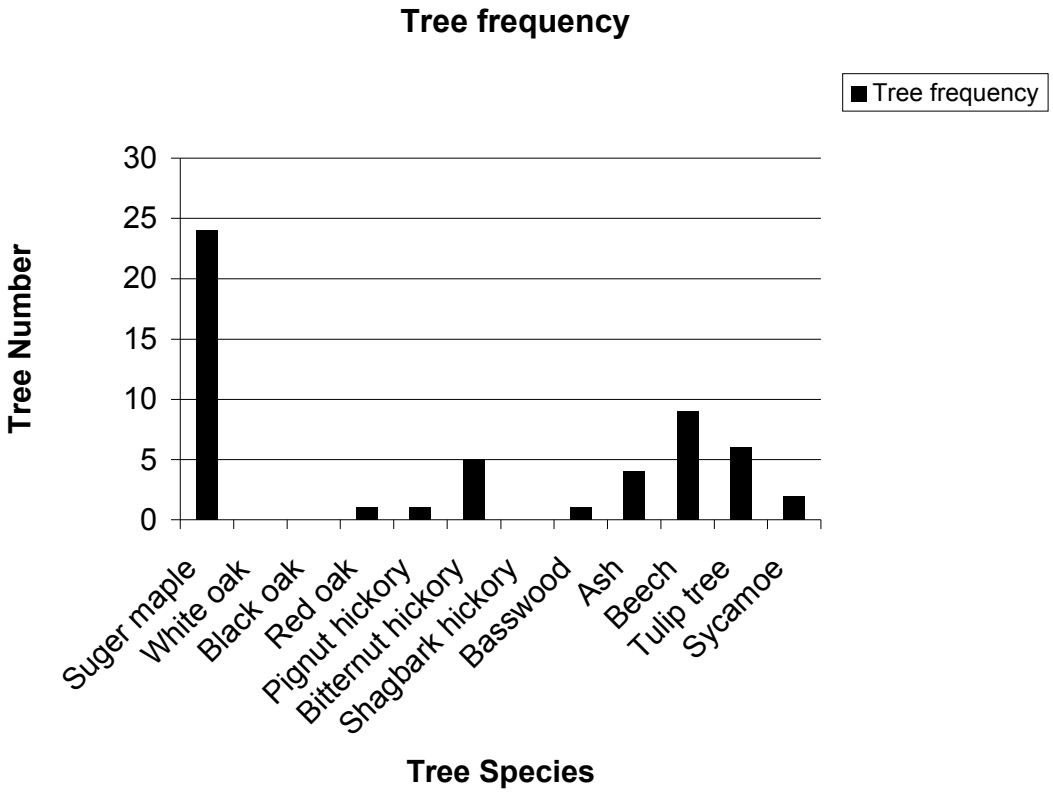


In the study area, there were some species that were completely absent from the ridge such as beeches, tulip

trees, and sycamores. Forrest (1986) and Mohlenbrock (1994) also suggested that ridge sites were strongly supported by oaks and hickories (4, 7).

The Ravine Site:

Along the ravine site, there were 53 trees. Like the ridge site, these trees were different in their distributions, sizes, and frequencies. Similar to the ridge site, the dominated tree species were the sugar maples with 54.3% and then the beeches with 16.9%. The rest of the trees were below 11.3%.

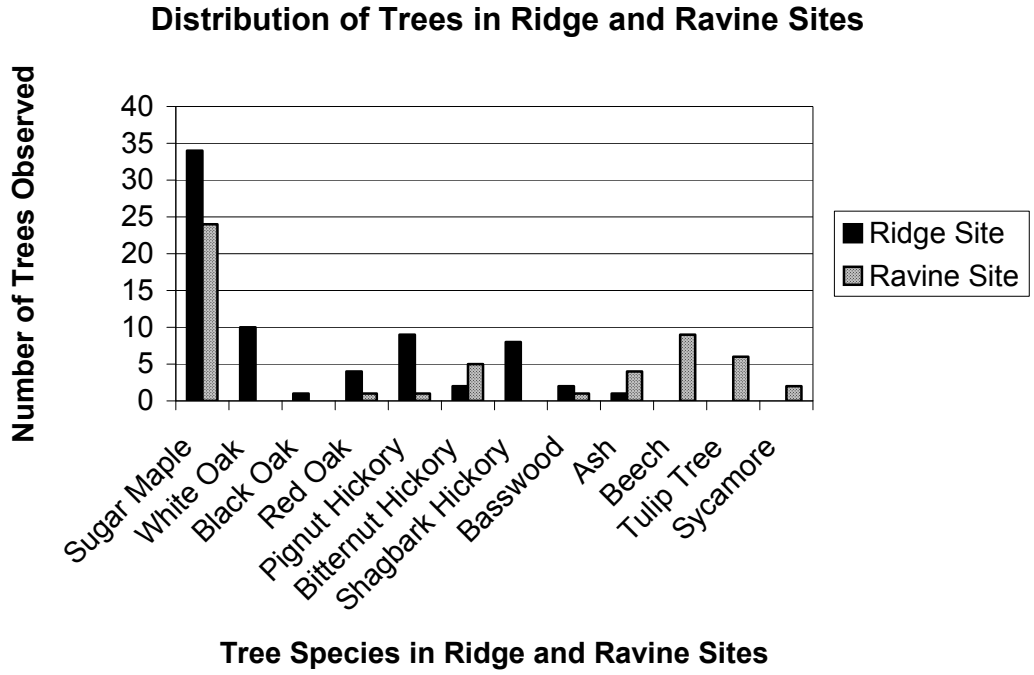


Studies found some important tree species in ravine sites such as sugar maples, bitternut hickories, American beeches, and white oaks (7) tulip trees, ashes, red oaks, basswood, and shagbark hickories (9). These findings matched mine except for the absence of white oaks in the ravine in my study area. It is described that there were other trees that can be found in a ravine site such as ironwood, sweet gum (7), American elm, and black walnut (9).

Conclusion:

My results supported the stated hypothesis. The common tree species between the ridge and the ravine sites represented about 66.33%, whereas the uncommon tree species represented 33.33%. According to the observed data, the most dominant species in both sites was sugar maples. They stand for 46.7%.

Finally, the distribution of tree species composition was independent of topographical position. Therefore, ridge and ravine sites were different from each other.



Acknowledgment:

I am especially grateful to Dr. Donald R. Whitehead, a retired professor at Indiana University in Bloomington - Biology Department, and his AI Donald E. Winslow for giving me this opportunity to conduct a study investigating the differences in tree species composition in a given topographical position (ridge and ravine).

I do not regret any of the time I spent on this study because it has "real world" value for me. I have already promised to share the results with several classmates, friends, and all of who e-mailed me with helpful ideas and references.

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