Community and landscape ecology of forest interiors at Merry Lea

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Abstract

This project explores the growth and growing conditions of forest plants in the diverse plant communities of the Thomas, Wysong, and Byer woodlands of Merry Lea Environmental Learning Center (Wolf Lake, Indiana). The research conducted was driven by the following questions:

- What plant species are found in the interior forests of Merry Lea?
- Are invasive species found in these forests, and if so, which ones and how abundant?
- What is the relationship between tree canopy, shrub and herb layers in these forests?

The forests overall were diverse both in plant species and abundance. There were significant disturbances in the forests such as deer trails, trash and fallen trees which affected plant growth and presence of invasive species.

Plots 10m in diameter and 50m apart were observed in the interior of each of the three woodlands. The identification of the trees, shrubs, herbs and vines were recorded. Taking the environmental conditions of canopy cover, litter depth, soil type and adjacent land use into consideration, the plots were categorized according to species similarity. It was observed that tree size does not affect the herb community, but larger shrubs correlate with larger trees. Invasive species—such as garlic mustard and multiflora rose--were observed to be less prevalent in the interior of the plots compared to what was observed around the edges.

The conclusions of this project may be useful in making recommendations for various management practices, including those related to invasive plants.

Introduction

- The current topographic landscape of Indiana (IN) has been shaped by its glacial history. The landscape, in turn, shapes historical and current land uses which affects the composition of plant species in their natural communities (Kuhman, 2010).

- The dynamic and complex forests included in this project contain high levels of species and habitat variability and warrant further study.

- Native species are those present before Modern European arrival.
  - In IN, the total number of native plants reaches to over 2300 species and around 550 non-native species (INPAWS, 2013).

- Non-native plants are species introduced with human assistance to a new landscape (Walker & Bellingham 2011).

- Invasive species are "an alien plant spreading naturally [without further human assistance] and producing a significant change in terms of composition, structure and ecosystem process" (Cronk & Fuller 2001). For example:
  - Glossy buckthorn occurs in wetlands, taking over the understory and eliminating native plant communities.
  - Autumn olive is found in disturbed areas and has spread throughout all counties of IN.

Materials and Methods

The study was conducted in the interior plots of the Thomas, Wysong and Byer woodlands of Merry Lea Environmental Learning Center (Wolf Lake, Indiana). Each plot was 10m in diameter and 50m apart. The focus of the research was to provide a description of the plant community and important environmental variables at each plot.

Trees: species identified and diameter measured at breast height

Shrubs: species identified, measured stem count and area observed

Herbs: species identified and visual area observed in four 1m quadrats

Vines: species identified, visual abundance observed and counted number of trees with vine growth

Environmental Factors: canopy cover, litter depth, bearing and slope

GIS-based Data: distance to nearest non-forest land cover, soil series description (SSURGO – USDA)

Fig 1. Map of the plot locations at Thomas (left upper), Wysong (left lower) and Byer (right) Woodlands.

Fig 2. Typical plot structure of Thomas (left) and Wysong (right).

Results

The forest plots were diverse in terms of composition and structure. Thomas was different in terms of species richness as it had the least number of species in the shrub and herb layers with an average of one and nine species per plot respectively. Interestingly, Thomas also had the highest number tree species with an average of four species per plot. The largest and most abundant tree species observed in Thomas was the American Hophornbeam. Wysong was observed to have the largest trees in diameter and the most herb and shrub cover, probably due to its richer soil content. (Table 1) Byer has the highest species richness in the shrub and herb layer, containing an average of three and thirteen species per plot, respectively.

Forest	Mean Shrub Cover (m^2)	Mean Herb Cover (%)	Mean Tree DBH (in)
Thomas	2.29	2.95	5.85
Wysong	5.14	9.08	6.67
Byer	1.36	7.25	5.00

Table 1. Mean growth of shrub, herb and tree size in the woodland.

High levels of plant invasion were observed at the edge of each forest, in contrast to the forest interiors which were not affected as much. The interior invasion was limited to four species: garlic mustard, burning bush, multiflora rose and autumn olive. Invasion was also related to disturbance factors such as deer trails, fallen trees and trash. Specifically in Byer as disturbance of fallen trees and deer trials increased the percent cover of garlic mustard increased.

A positive correlation was observed with tree size and higher shrub cover; larger trees often accompanied larger shrubs such as prickly ash. (Fig 3)
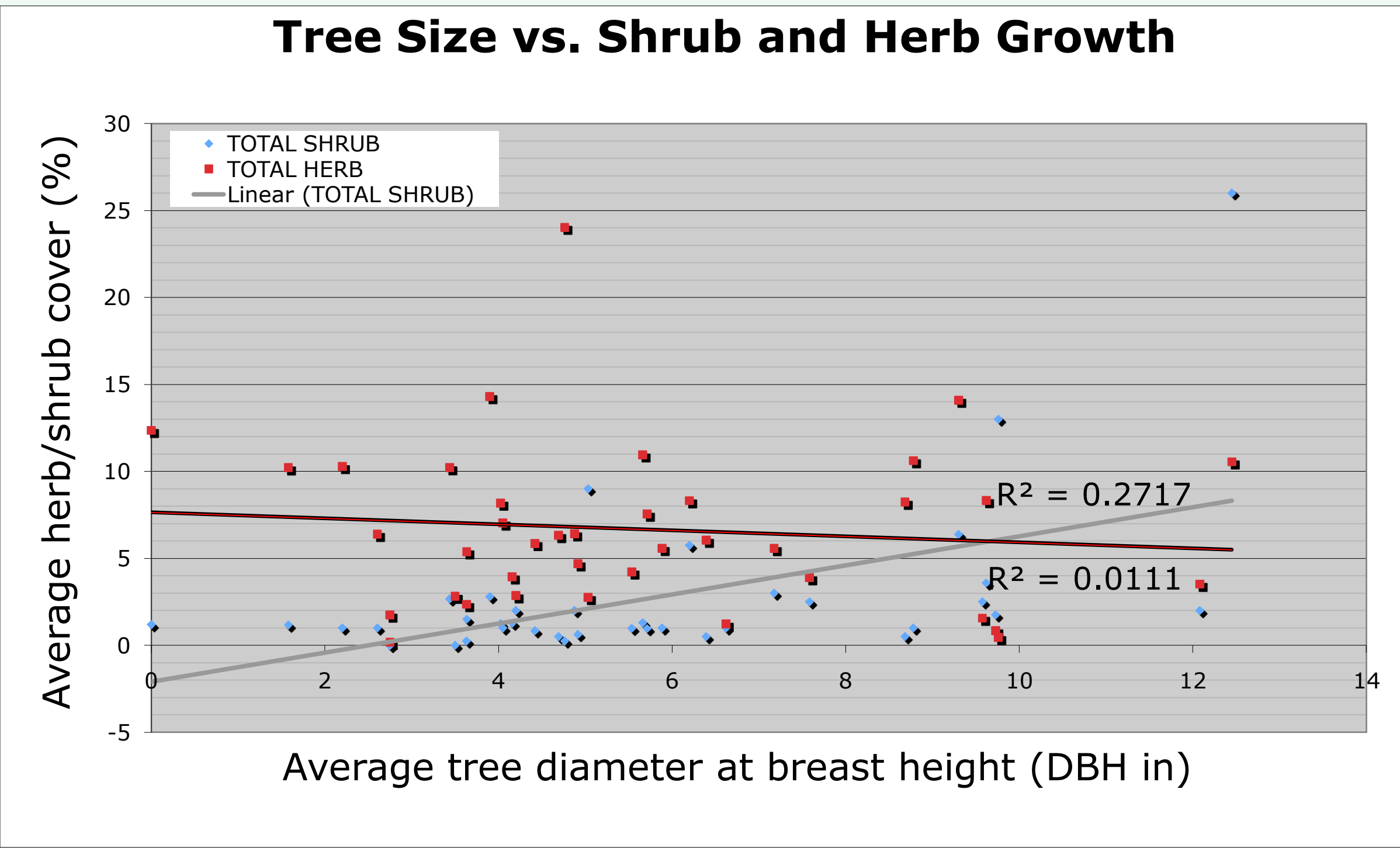

Fig 3. Relationship of tree size to shrub and herb growth: tree size has little effect on herb cover but is positively correlated to a higher density of shrubs.

The ordination graph (Fig 4) illustrates the similarities between the different plots according to the herbaceous species present. Plots close together in the ordination graph have more similarity in their herbaceous community than plots located farther apart. The environmental factors correlating to the similarity of the plots include canopy cover, litter depth, soil type and adjacent land use type. Interestingly, Wysong has rich muck soil allowing growth of larger trees and more herbs and shrubs compared to Byer, which has a majority of drier upland soils.
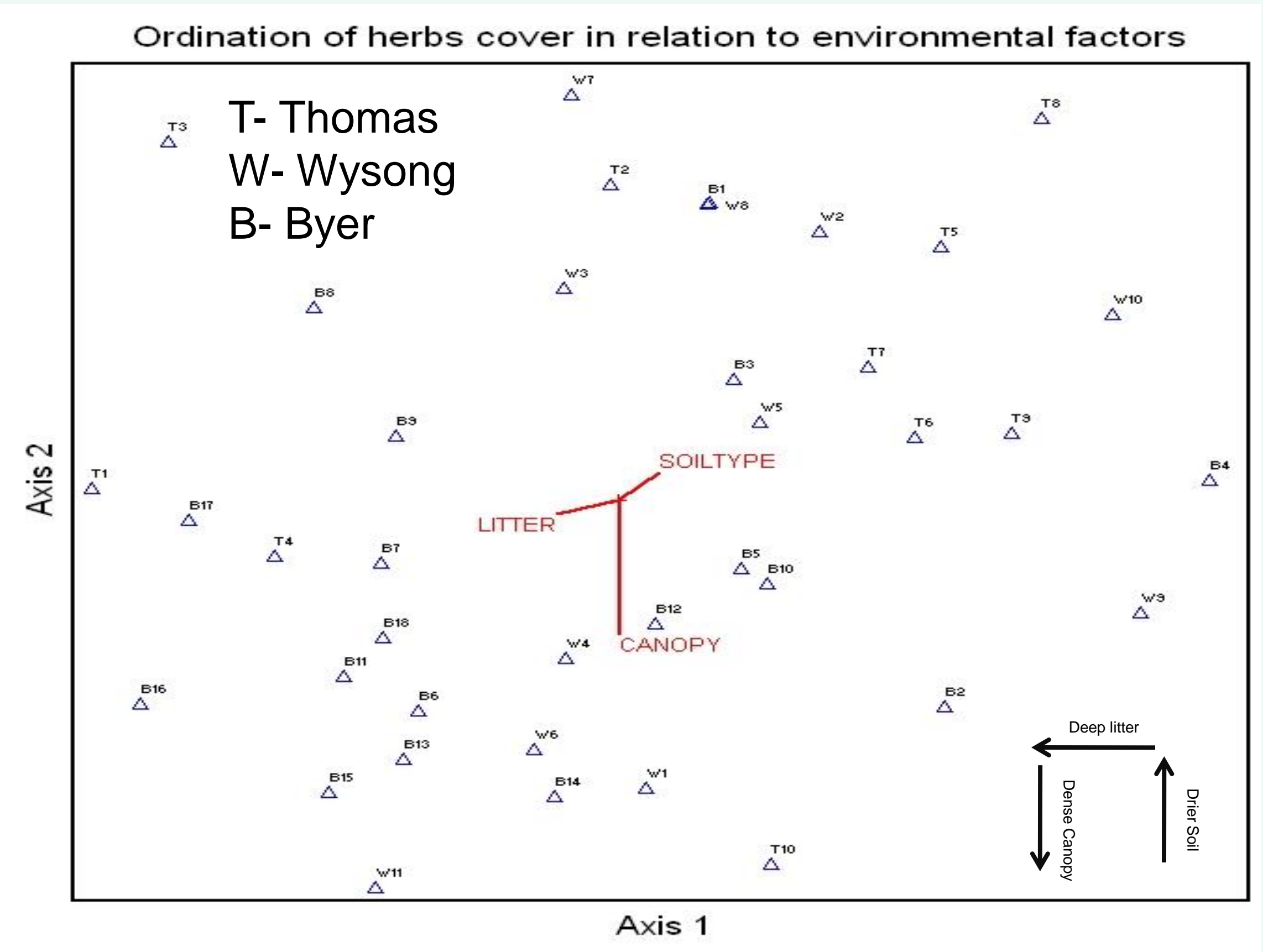

Fig 4. Ordination describing the similarity of plots according to herb cover and environmental factors.

Discussion

This study provides information about interior forest plant composition and species interactions as well as a greater understanding of the connections between diverse species and environmental factors.

The ordination shows that the environmental factors of canopy cover, litter depth and soil type influence the plant community in the forest. This is true especially for soil type, which is a major underlying factor in plant growth. It was also observed that larger shrubs correlated with larger trees, where as herb cover has no relationship with tree size. Invasive species such as garlic mustard and multiflora rose were observed both along the edges and in the interior of the forest. Interestingly, however, there was significantly less invasion in the interior of the forest compared to what was observed at the edges. Higher growth rate of invasive species were observed where disturbances such as deer trails, trash and fallen trees were present. These conclusions may be useful in making recommendations for various management practices, including those related to invasive plants.

Fig 5. Illustration of the Byer woodland understory growth and a raccoon visiting the plot.

References

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