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DIVERSITY AND DISTRIBUTION OF PLANT COMMUNITIES RELATED TO FOREST SIZE, SHAPE, AGE, AND STRUCTURE

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Introduction

In the Midwest region of the United States, forested areas have been removed to make way for agriculture and settlement lands. In the southern states, including Indiana, cultivation and pasture account for 80-90% of rural landscapes. (Figure 1).

In ecology, the theory of fragmentation explains species variation occurring in segregated environments, which influences biodiversity through distance, size, age, and shape of the forest.

Objectives

1) To identify the relationships between forest fragment size, shape, isolation level, age, human influence, and connection to other forests and the understory plant communities
2) To test the hypothesis that fragmentation principles are applicable to forest fragments surrounded by agricultural matrix
3) To compare forest fragmentation results in Northeast Indiana to previous studies.

Methods

Thirty forest fragments were sampled from June to August. Selection was prioritized in north Adams, northeast Wells, and southeast Allen counties. Plants were identified to species for under and midstory in 5x5 m random stratified plots (Figure 2). Physical environmental characteristics measured included soil moisture and compaction and forest canopy cover. An incremental borer assessed forest age.

Results

Multiple Regression Analysis
Understory Richness: Positive: forest area and overstory diversity
Understory Diversity: Positive: forest perimeter and canopy cover. Negative: forest age and forest neighbor count (1KM)
Midstory Richness: Positive: forest area and selective harvest. Negative: forest perimeter
Midstory Diversity: Positive: selective harvest. Negative: forest perimeter/area

Species Space
Understory: Quercus spp. (positive with moisture and P/A); positive influence of overstory diversity and canopy cover (Figure 3A).
Midstory: Negative influence of forest age and distance to nearest neighbor (Figure 3B).

Discussion

Area, Perimeter Influence
Greater forest patch area positively influenced richness and FQI in under and midstory species. The influence of larger area is characterized by provision of more niches, a larger dispersal target, and space for specialist species.

A negative relation with perimeter/area was noted in the understory species space and midstory diversity and FQI. Forest fragments often have a high edge to interior ratio, which creates a greater influence of the surrounding agriculture matrix upon the forest itself, decreasing biodiversity.

Intermediate Disturbance
Intermediate disturbance theory predicts highest levels of richness following occurrences of mid-levels of disturbance. Selective harvests provide such disturbance and affects other environmental factors that were significant. Forest age is decreased by alteration of succession, increasing biodiversity. Overstory diversity increases with younger forests due to greater competition. Canopy cover constantly shifts between open and close, allowing for vertical stratification growth.

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