Edge Effects on Soil pH, Vegetation Cover, and Canopy Cover

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Research Experiences for Community College Students

Introduction

- Habitat destruction and fragmentation are leading causes of species loss [**1**]. An important way that conservation biologists assess the impact of fragmentation on communities is by studying edge effects [2].
- Edge effects describe varied biotic and abiotic changes associated with the boundaries between habitat fragments [3,4], such as a forest and an adjacent meadow or agricultural area.
- One of the most endangered and least understood ecosystems is the soil [5], and soils provide essential ecosystem services such as production and consumption of atmospheric trace gases, regulating soil carbon dynamics, and mediating nutrient cycling [5,6]. However, our knowledge of edge effects on soil organisms is very limited.
- Previous work on edge effects in plants has found that edges can affect soil pH, organic carbon quality and quantity, and plant communities and abundance associated with the edge [4].
- Because these characteristics, especially pH, are also important determinants of soil microbial communities [6,7], investigating edge effects on soil characteristics is an important first step in understanding how soil communities change in fragmented habitats. We expected an edge effect of pH, and additionally that we would observe lower pHs in the forest habitat than in the adjacent meadow due to the acidity of pine needles.

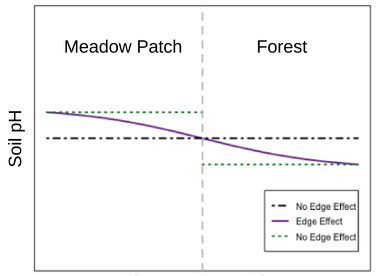

Figure 1

Methods

- We laid 100 m transects perpendicular to each of the four edges between a rectangular patch of meadow and the surrounding mixed pine forest, for a total of twenty transects across five replicate sites at the Savannah River Site (SRS), South Carolina.
- We collected soil samples from points every 10 meters along the four transects.
- We used a spherical densiometer to measure canopy cover along the transects.
- Vegetation cover was averaged to the nearest percent based on photos taken from a standardized height.
- We took duplicate measurements of the soil pH, averaging out the two readings.
- We used R to make all plots.

Figure 2

Figures

Figure 1: A line plot displaying expected pH vs distance from edge
Figure 2: Aerial view of a meadow patch (Top), landscape view of a transect (Left), aerial view of the Savannah River Site (Right). Aerial photos from Google Earth.
Figure 3: Line plot displaying vegetation and canopy cover at one site in relation to distance from the edge
Figure 4: Average pH in relation to distance from edge from five sampled sites

Results

Vegetation and Canopy Cover vs. Distance From Edge

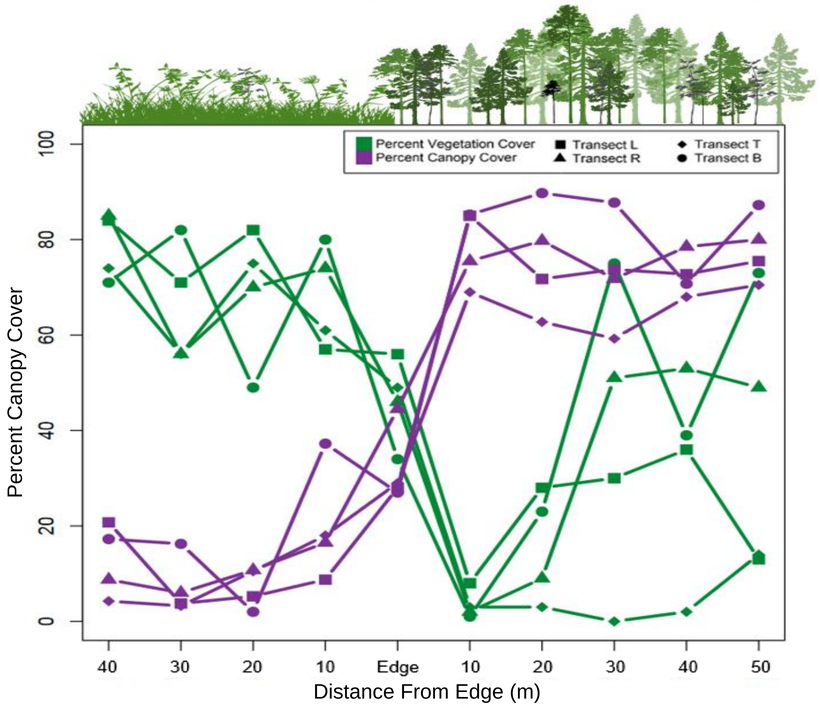

Figure 3

- As we expected, canopy cover changed dramatically at the edge, with the canopy cover in the forest being much higher than in the meadow. However, while vegetation cover was usually lower in the forest, some forest transect points had high cover due mainly to fast-growing understory plants and young trees.
- We observed no general pH trend across our 5 sites (Fig 3). Instead, some sites had very little change across the transect and some were random. Site 2 shows a slight, subtle dip in pH in the forest.

Average pH vs. Distance From Edge

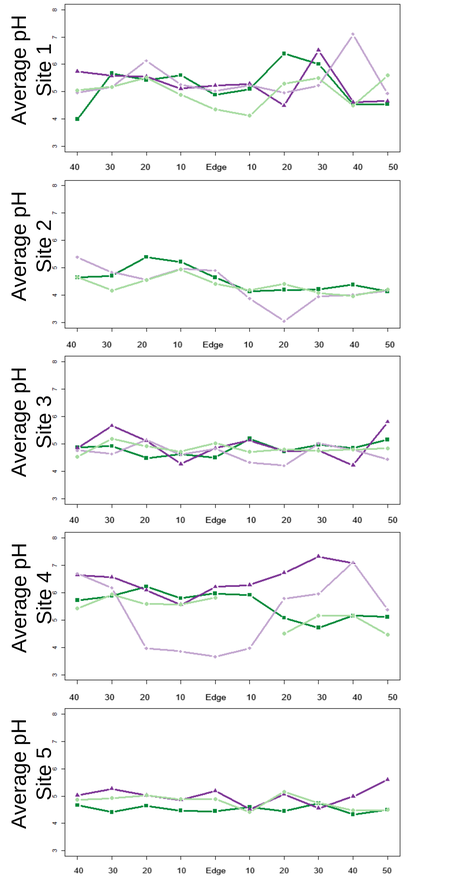

Figure 4

Discussion and Future Work

- Contrary to our expectations we did not see an edge effect on soil pH, nor did we find strong support for our hypothesis that pH would be lower in the forest than in the meadow patch. Instead, pH fluctuated randomly with respect to the edge or was generally constant along the transect.
- Events or disturbances in the past may have affected the pH we observed. For example, heterogeneity in fire intensity would likely affect pH [8]. In addition, the transects and sites vary in their land use history prior to 1951, when the SRS was created. A signal of land use history in soil pH can be measured for many years [9] Alternatively, it is possible that the presence of other understory plants in the forest dampened the effect of the pines on pH.
- Next, we will investigate how different communities of soil organisms are affected by distance from edge. Since pH is the best predictor of soil bacterial richness [6] and aboveground plants may also influence soil communities [6,10], our data will be useful in determining the factors structuring soil communities on and near the edge.

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