Suitability Analysis for Potential Prairie Restoration Sites in the Piedmont of North and South Carolina

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ABSTRACT

The purpose of this study was to develop a method to assist with selecting suitable sites for Piedmont prairie restoration efforts. Our approach was to evaluate remnant prairie sites to determine which site characteristics (soil series, slope, aspect, landform index, temperature, and precipitation) may be useful for predicting suitable restoration sites. A literature review produced nine prairie and rare plant sites in the Piedmont of North and South Carolina. Characteristics common among these sites were used to create raster data layers containing each characteristic. Using GIS, these raster data layers were combined using map algebra to develop a rating of Piedmont prairie site suitability throughout the North and South Carolina Piedmont. Piedmont prairie restoration was predicted to be potentially more successful on sites with southern aspects, slopes generally less than 15%, upper slope positions, and occurring on Cecil, Enon, Iredell, Mecklenburg, Monacan, Pacolet, Wilkes, and Zion soil series.

INTRODUCTION

Prairie-like plant communities were once scattered across parts of the Carolinas' Piedmont (Figure 1) region (Barden 1997). After settlement by early Europeans, these prairies began to disappear, primarily, because of fire being excluded from the landscape and wide spread agriculture. Growing interest in restoring prairie remnants as components of the southeastern landscape might be enhanced by suitability analysis within GIS.

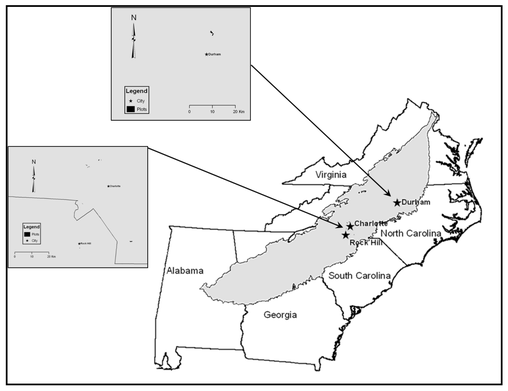

Figure 1. Piedmont region of the Southeastern United States and prairie locations.

OBJECTIVES

- Locate prairie remnants in the Piedmont of North and South Carolina using current literature (Figure 2);
- Determine common site characteristics between prairie remnants.

MATERIALS AND METHODS

Study area: The study area encompasses the central Piedmont in North Carolina ranging from Charlotte to Durham and the northeastern Piedmont in South Carolina near Rock Hill.

Field data collection: At each site we collected the following information:

- Aspect;
- GPS location;
- Landform index (McNab 1993);
- Landscape position;
- Slope;
- Soil series.

GIS Data acquisition: ArcGIS 9.1 (ESRI, Redlands, CA) was used to perform all GIS analyses. Spatial datasets used in this analysis are summarized in Table 1.

Table 1. Data sources and descriptions.

Data layer	Description	Source
Precipitation (cm)	Maximum average annual, minimum average annual and July average precipitation	http://datagateway.nrcs.usda.gov/
Temperature (C)	Maximum average annual, minimum average annual and July average temperature	http://datagateway.nrcs.usda.gov/
Soils	Soil Survey Geographic Database (SSURGO 2.2)	http://datagateway.nrcs.usda.gov/
Elevation (M)	Digital elevation model	http://www.ncdot.org/it/gis/ & http://www.dnr.sc.gov/gis.html
Slope (%)	Thirty (30) meter slope grid	http://www.ncdot.org/it/gis/ & http://www.dnr.sc.gov/gis.html
Aspect (°)	Thirty (30)meter aspect grid	http://www.ncdot.org/it/gis/ & http://www.dnr.sc.gov/gis.html
Landform index	Thirty (30) meter landform index grid	Landform aml, http://arcscripts.esri.com
Urban	Urban area boundaries	http://www.census.gov/geo/www/cob/
Piedmont	Piedmont Region	http://www.epa.gov/wed/

Data analysis: Selections for characters important to Piedmont prairies were performed and new rasters created containing each character. These rasters were added to obtain a rating of each cell's suitability (Taverna et. al. 1999). A cell that contained all the chosen characteristics was considered suitable.

RESULTS

The analysis indicated that Piedmont prairie remnants occurred on:

- Predominantly Alfisols;
- Soil series Cecil, Enon, Iredell, Mecklenburg, Monacan, Pacolet, Wilkes, and Zion;
- Slope positions greater than 80%;
- Slopes less than 15%;
- Southern exposures (except two locations with a northern exposure);
- Landform indices near zero.

Throughout the region, 235,875 hectares were classified as potential prairie restoration sites (Figure 3).

Figure 2. Mineral Springs Barrens is a Piedmont prairie remnant in Union County, NC.

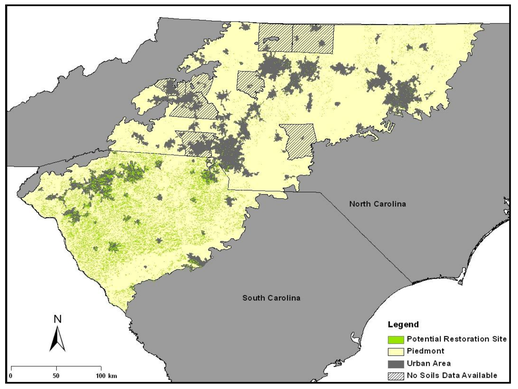

Figure 3. Potential prairie restoration sites in the Piedmont.

CONCLUSIONS

More than 235,000 hectares of potentially suitable restoration sites were identified throughout the North and South Carolina Piedmont by suitability analysis. Sites occurred predominately on soil series Cecil, Enon, Iredell, Mecklenburg, Monacan, Pacolet, Wilkes, and Zion. Soil series Enon, Iredell, Mecklenburg, Wilkes, and Zion formed in material weathered from mafic rock, tend to be well drained, and have slow permeability. The Cecil and Pacolet soil series formed in weathered residuum from felsic igneous and metamorphic rocks, are well drained, and are moderately permeable. Monacan is moderately well to somewhat poorly drained, has moderate permeability, and formed in recent alluvial sediments (Soil Survey Staff 2007). All these soil series belong to the soil order Alfisol, which contains soils that have high fertility (McDaniel 2006). Potentially suitable restoration sites also occurred on upper slope positions, southern exposures, and at locations unprotected by the surrounding landscapes. These locations tend to be less mesic.

Predicting potential restoration sites over a large region based on nine clustered prairie and rare plant sites may not give the most accurate result. Therefore, analysis on a smaller scale may be more useful and meaningful in identifying suitable sites in a specific locale. Local site characteristics associated with prairie existence must be taken into account in selecting potentially suitable restoration sites (Figure 4).

Figure 4. Piedmont prairie restoration at Latta Plantation, Huntersville, NC.

LITERATURE CITED

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