

## Analyzing the Relationship between Soil Profiles and Plant Succession Rate

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### Abstract

The Unionville serpentine barrens are a temperate grassland ecosystem that is home to a significant number of rare and threatened plant and animal species. While the serpentine barrens contain forest, woodland, and grassland, it is the latter that are home to the majority of rare species, even though they make up the smallest amount of area. However, these important species are diminishing in population as the grasslands shrink in size because of an interruption in the disturbance cycle that had maintained them for thousands of years. In order to maintain the populations of the species of concern, the grassland habitat must be restored to a larger size and maintained by reintroducing the disturbance cycle in a resource-effective manner. To guide this effort, we must determine what to measure now that will allow us to prioritize management of the site most effectively and efficiently in the near and distant future, given limited resources.

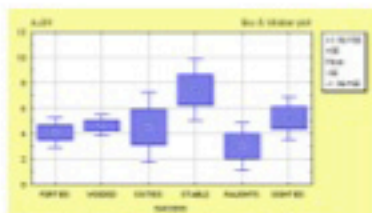
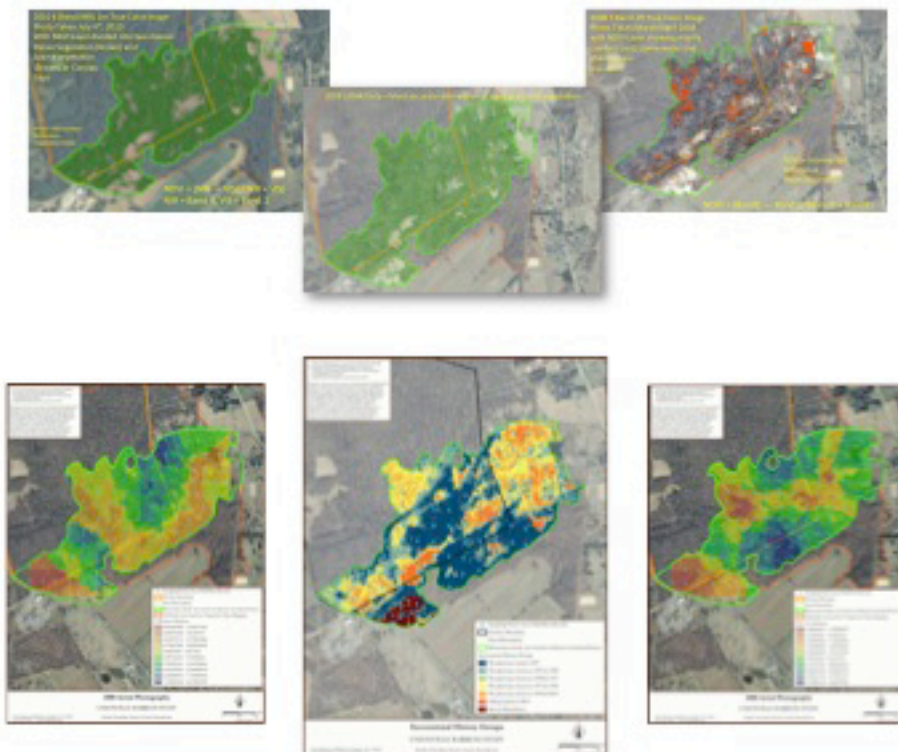
### Data Collection Method



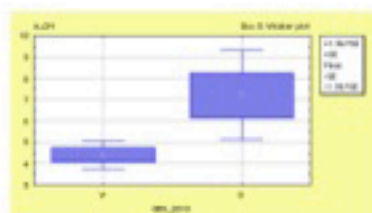
### Tools Used for Data Collection

- Trimble Geo6 handheld GPS unit including 200' point grid and restoration study area used to navigate to all 185 points.
- 40-inch long, 3/8-inch diameter, stainless-steel, high-carbon steel soil probe to take three soil depth to bedrock measurements.
- 19-inch long, 3/4-inch diameter soil tube sampler to extract soil and examine its horizons.
- Munsell soil color chart to determine the hue, value, and chroma of each horizon.

### Analysis and Results



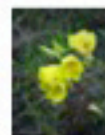
Box and Whisker Plot  
A-horizon depth for successional history categories



Box and Whisker Plot  
A-horizon depth for observed 2010 data (Wooded v. Open)

### Conclusions

Kriging interpolation was used in ArcGIS with each of the data variables recorded at each sampling point. Additionally, discriminant function analysis and box and whisker plots were used to determine that only one of the measured variables contributes significantly to discriminating among successional history groups as well as among present-day community types. The thickness of the A horizon is the variable in both of these cases.



*Genothere fruticosa* L.



*Phlox subulata* L.

### Conservation Implications

Through the data collection and subsequent data analysis work, prioritization areas will be selected for the grassland restoration effort. These areas will be based on the factors uncovered in this research, and will be the areas of the Unionville serpentine barrens that are least likely to succeed quickly into a forest. The more recently disturbed areas will most likely be selected. Natural Lands Trust plans to begin the grassland restoration effort based on these priority areas in 2011. Subsequent research examining the results of this restoration effort in future years may help to further clarify the results of this field work, research, and selection of priority areas. Additionally, a plant survey of the newly restored grassland areas could help to determine if there is indeed any increase in rare or threatened plant communities on the barrens after the restoration efforts.

### Grassland restoration and invasive plant management efforts can include the following:

- Maintenance and restoration controlled burning
- Selective tree cutting
- Soil organic matter and Smilax rhizome removal
- Seedbank augmentation
- Annual or alternate-year mowing