Huston-Brumbaugh Nature Center
Environmental Science Outreach STEM Program
Thursday, June 11
ECOLOGICAL SUCCESSION at HBNC

Introduction

Ecological succession is the gradual process by which biological communities change over time after a disturbance, moving from pioneer species to a stable climax community. In forest ecosystems of Northeast Ohio, succession follows predictable patterns in species composition, canopy development, and biomass accumulation. Early stages are dominated by fast-growing, sun-loving species such as grasses and shrubs. As the system matures, shade-tolerant trees replace pioneer species, leading to increased structural complexity and biodiversity. Over time, these systems develop into late-successional or climax forests characterized by stable canopy cover and long-lived hardwood species.

This study investigates how plant community characteristics vary across four plots of differing ages to determine their ecological succession stage.

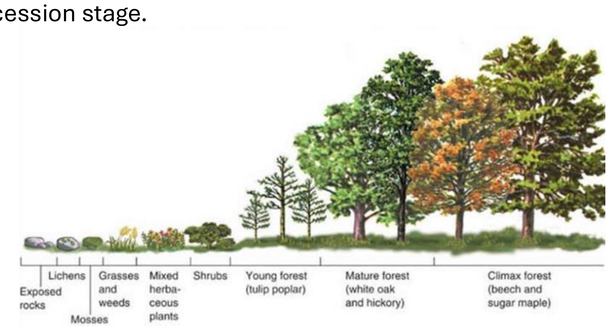

Figure 1. Example of ecological succession and the natural progression followed from disturbance to climax.

Methods

1. **Sampling Design**
   - Four 30 m × 30 m plots representing different successional stages
   - Quadrat-style sampling across entire plot
2. **Data Collection**
   - Identified all plant species in each plot
   - Measured DBH (≥ 8 cm) for all trees
   - Counted saplings (< 8 cm DBH)
   - Estimated canopy cover and plant height
   - Recorded density, dominance, and biomass estimates
3. **Data Analysis**
   - Calculated:
     - Relative density
     - Relative dominance
     - Importance value (IV)
     - Shannon's Index
     - Relative woody biomass
   - Compared species composition across plots to determine succession stage

References & Acknowledgements

We gratefully acknowledge **Dr. Mike Zimmerman** for leading this field activity and providing the methods and framework through his Ecology lab manual developed for his classes. His guidance in teaching species identification, DBH measurement, and ecological sampling techniques made this investigation possible. In addition, we would like to thank **Adam Schlarb** for his assistance throughout the activity.

*Poster created by Amy Miller. Text assistance provided by Microsoft Copilot (AI); content reviewed and approved by program staff.

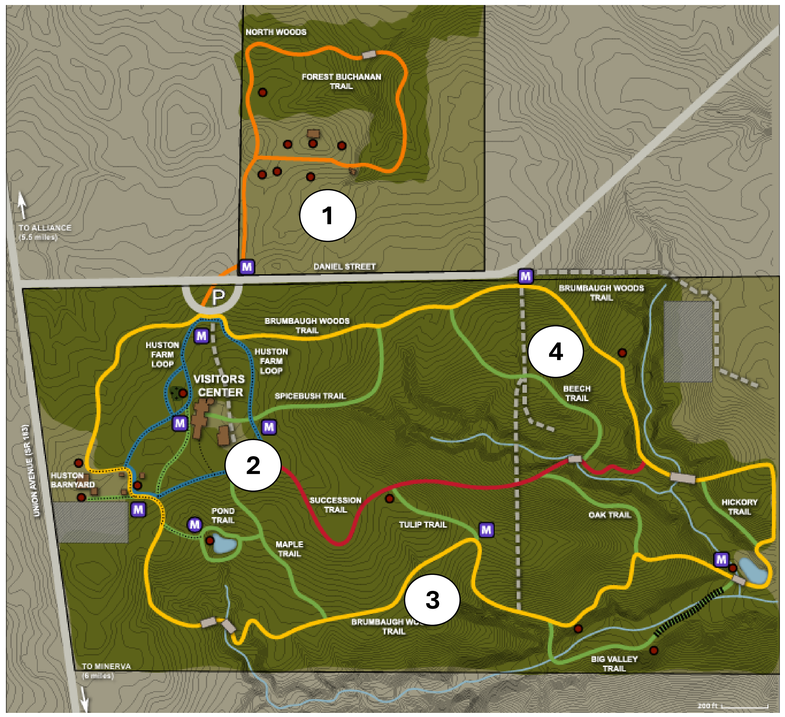

Figure 2. Map of the Huston-Brumbaugh Nature Center where data collections will be made. The numbers in white circles correspond to the numbered plots sampled for this lab.

Results

	Plot 1	Plot 2	Plot 3	Plot 4
Canopy Cover	No cover	Low	Moderate	High
Avg DBH (cm)	0	42	53	71
Tree Species Richness	Low	Moderate	Moderate	Low
Dominant Tree Species	No species	American Beech	Red Maple	American Beech
Successional Stage	Pioneer	Early/Mid-range	Late Stage	Late Stage/ Climax

Table 1. Summary of tree species composition across four study plots representing a successional gradient.

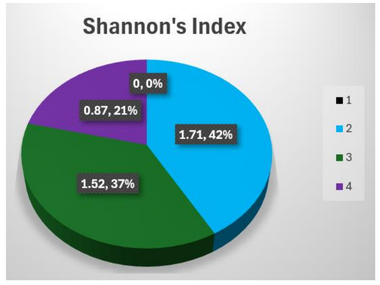

Figure 3. Shannon's Index across four plots for tree species. Shannon's Index values indicate that tree species diversity is highest in the mid-successional plot and lower in both early and late stages. This pattern reflects increased diversity during transitional communities and reduced diversity as dominant shade-tolerant species establish in later succession.

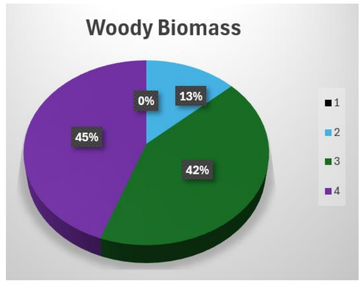

Figure 4. Woody biomass distribution across four plots for tree species. Woody biomass increases progressively from the pioneer plot to the climax plot, showing that forest structure and carbon storage expand with successional age. The highest biomass occurs in the late-stage plots, where larger, mature trees dominate.

Conclusion

The four plots demonstrate a clear successional gradient from pioneer to climax community, reflected in increasing canopy cover, DBH, and shifts in species composition. Early plots lacked woody vegetation or were dominated by early-successional species, while mid- and late-stage plots showed increasing tree size and canopy development. Dominance by American Beech in both early/mid and late-stage plots highlights its role as a shade-tolerant, late-successional species, while Red Maple in Plot 3 indicates a transitional forest stage. The largest DBH values and high canopy cover in Plot 4 confirm a mature climax community.

In addition, Shannon's Index peaks in the mid-successional plot and declines in the climax plot, indicating that species diversity is greatest during transitional stages and decreases as competitive exclusion increases in mature forests. Woody biomass increases steadily across plots, reinforcing that structural complexity and carbon storage rise with succession.

Overall, the combined patterns of species composition, diversity, and biomass confirm predictable ecological succession, with forests shifting from pioneer communities to stable, shade-tolerant hardwood systems.