Investigating the Impacts of Land-use History on Monhegan Island's Vegetation

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Monhegan Island, located twelve miles off the coast of Maine, is composed of natural wildlands that cover ~75% of the island. In the 1800s, large swaths of its coastal forest were cleared for sheep pastures that were subsequently abandoned near the end of the 19th century. Furthermore, white-tailed deer (*Odocoileus virginianus*) were introduced in 1954 for hunting and the entertainment of tourists; however, all deer were culled by 1999 due to the increased levels of Lyme disease they carried. Rick Dyer, a graduate student at the University of Maine, conducted a study on the island's vegetation in 2002, just after the removal of the deer. His work provided a key comparison point to our data analysis and an overall foundation to our work. The island's complex land-use history has greatly impacted the Wildlands and understanding how the vegetation changed over large periods of time is the driving force behind this study. How has the island's vegetation changed since the creation of pastures and the removal of deer? How does the vegetation differ across forest types?

Across the two most drastic forest types, the old-growth forest that has never been cleared and the cleared secondary forests, we established twenty randomized plots. The center of each plot was geolocated using the Garmin Explore app so that no physical marker would disrupt the natural landscape. Using a surveyor's chain, we marked out a 200 m^2 circular plot in which all large trees were characterized in terms of species, crown class, degree of eastern dwarf mistletoe infection, DBH (diameter at breast height/1.3 m above ground), and geolocation. Within the plot, in a smaller 100 m^2 sub-plot, all saplings above 2 m in height were measured in terms of DBH and species identity. All saplings and seedlings below this height threshold were counted and identified. Lastly, we also collected data on the herbaceous layer of every plot, which included shrubs and plants below a 1.5 m threshold, by placing a 1 m^2 quadrat 3 m from the center in the east and west direction.

In comparison to Dyer's data, we found an increase in the basal area (a measurement of the total area of tree trunks) of broadleaf trees such as red maple (*Acer rubrum*) and paper birch (*Betula papyrifera*) across both forest types and an abundance of *Aronia floribunda* and *Viburnum nudum* seedlings that were not documented in 2002. Additionally, the herbaceous layer had less *Rubus* species and more *Dryopteris* than in 2002, indicating new species growth in the absence of deer. A snapshot of today's forests reveals increased seedling densities and sapling biodiversity in the secondary forest.

Figure 1. Images of a secondary, cleared forest site (left) and an old-growth, uncleared site (right). 2025.

Further analysis and data collection is currently underway, as we have cored broadleaf trees in nine of our plots (the rest will be completed in the fall). These cores will be used to age the trees to determine whether they survived deer browsing or are new growth. A heartfelt thank you to everyone I have collaborated with to make this research possible, including my co-workers Tori Bacall and Lars Sorom, my faculty mentor Barry Logan, Fred and Ellen Faller, Melissa Cullina, Rebecca Fitzpatrick, Aaron Gilbreath, and the Monhegan Island Associates Inc.

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