ANTIOCH UNIVERSITY
NEW ENGLAND

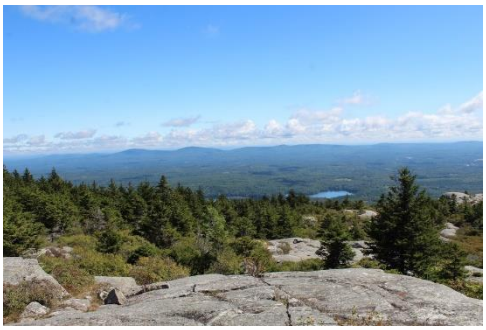
Monadnock Ecological Research and Education Project
MERE
Antioch University New England

Climate change effects on natural communities on Mt. Monadnock

Environmental Studies Department
MERE Project
March 29, 2020
Issue #0004

Technical Bulletin

Abstract:
Mount Monadnock, located in southwestern New Hampshire, has a unique set of environmental and ecological conditions that may prove to be extremely valuable in determining the impacts of climate change on the region's natural communities. In order to track the response of Mount Monadnock's natural communities to future climatic changes, permanent sampling plots were established to describe their current characteristics and distribution. During the spring and summer of 2007, 88 plots were established between 2000 and 3000 feet in elevation. At each plot, the size and species of each tree (greater than two inches in diameter), tree canopy height, a tally of saplings of each species, the percent cover of shrubs, the presence of ground cover plant species, and soil depths were recorded. A qualitative health assessment of live trees was conducted and a qualitative assessment of dead tree decay was recorded, as well as the general community structure and composition outside of each plot. Seven distinct community types were identified within the study area; subalpine rocky bald, sheep laurel-Labrador tea heath-krummholz, red spruce-heath-cinquefoil rocky ridge, high elevation spruce fir forest, northern hardwood-spruce-fir forest, sugar maple-beech-yellow birch forest, and hemlock-beech-oak pine forest. Subalpine rocky bald and sheep laurel-Labrador tea heath krummholz communities are both rare statewide (S2) and along with the dominant high elevation spruce-fir forest are regionally extremely rare and considered to be highly sensitive to climate change. The presence of rare communities on Mount Monadnock sensitive to climate change makes this mountain an important early indicator of the impacts to northeastern mountain ecosystems if rapid climate change occurs. Mount Monadnock as well as provide an inventory that will aid in management decisions at Monadnock State Park.



Introduction:
An understanding of natural community changes and the rates of change would help in the long term conservation planning of this unique natural resource. A Monadnock Master Plan Steering Committee was established in the fall of 2000 to assist the New Hampshire Division of Parks and Recreation in the master planning process. In this, conservation includes protecting the natural and cultural resources of Mount Monadnock while promoting the use of these resources in an appropriate, ecologically sound manner. Resources include vegetation, wildlife, soils, water, trails and recreation facilities, sites of historical, geological or archaeological interest, scenic views, vistas and areas of high aesthetic value. Education involves methods of deepening visitors' awareness of Mount Monadnock's geological past,

For More Information:
Email: mere@antioch.edu
Website: www.mereproject.weebly.com

its biological and zoological diversity, and the cultural, social and political aspects of its past. By conducting a study designed to determine the distribution of the forest and natural communities of Mount Monadnock, the resulting information would provide information necessary in attaining these goals that the Monadnock Master Plan Steering Committee has established.

Methods:

Eight, permanently marked transects were randomly selected on four different slopes of Mount Monadnock as described above between May and September of 2007. Each transect was mapped using GPS waypoints from each study plot and GIS software Arcmap 9. Each transect began at 3000 feet in elevation in the scrub zone and ended at 2000 feet in elevation in the hardwood zone. The top point for each transect was determined by pacing out the distance and direction that had been determined on the topographical map. Once the top plot was determined, the azimuth for each transect was followed down slope using a Suunto MC-2 sighting compass. Along each transect, five meter radius sampling points were established every 100 feet in elevation, yielding 11 plots per transect for a total of 88 plots. Elevation points were determined by use of Garmin GPS 12 units and a Thommen barometric altimeter. Along the azimuth between plots flagging was used to mark the transect. The center of each five meter radius plot was established by pounding a 30 inch PVC pipe in the ground. Each pipe was labeled and flagged with the plot number. All distances were measured from the exposed end of the pipe. A five meter rope was fixed to a peg which was inserted in the end of the pipe.

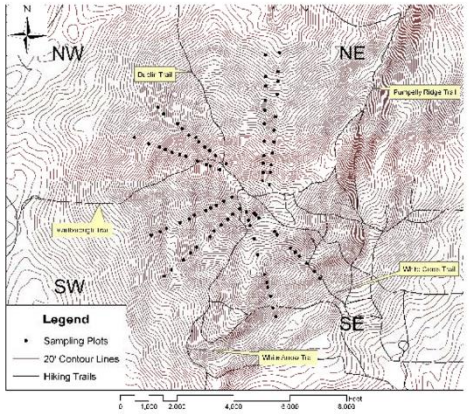


Figure 2. Map of the study areas and sampling plots on Mount Monadnock, New Hampshire, 2008.

The rope was then used to establish the perimeter of the plot by placing flags at 90 degree increments parallel and perpendicular to the azimuth. No slope correction was made on either the parallel or the perpendicular.

Results:

A total of 223 taxa were identified during my field season May-September 2009, with 230 different plant specimens collected. Only 8.5% of the species occurred either abundantly or frequently at collecting sites. 71% of species occurred either infrequently or rarely, including 35% of species that were recorded at no more than two collecting sites. The 223 taxa surveyed are distributed into 142 different genera. One hundred eighty seven (187) of the taxa are native to the Monadnock region and 36 are introduced species. The majority of the introduced species are dicots, a total of 29 taxa. Dicots also make up the highest number of native species, 114 out of 223. Families with the most number of taxa include the Asteraceae at 13.2 % of all species observed, the Cyperaceae at 13.6%, and the Rosaceae at 6.6 %. Ericaceae was at 5.8%.

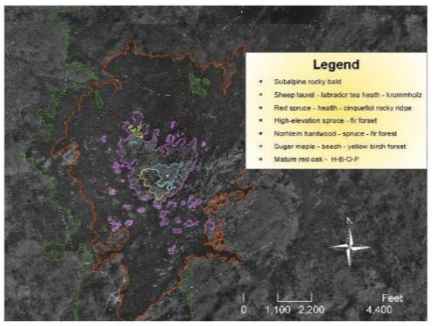


Figure 4. Delineation of the natural communities present above 2,000 feet on Mount Monadnock, New Hampshire.

Discussion:

Given the range of natural communities that are present on Mount Monadnock, the location of the mountain in relation to the communities ranges, and the projected ecological changes to occur, it is reasonable to suggest that Mount Monadnock will be extremely valuable in determining rates of change on mountain ecosystems resulting from climate change. Furthermore, the high public visibility of Mount Monadnock to the greater public, as the second most climbed mountain in the world and the region's namesake, studies conducted on Mount Monadnock can inform the public about the impacts of climate change.

Thesis Citation:
Mallard, D. (2008). *The description and distribution of natural communities on Mount Monadnock, NH: implication in the face of climate change.* (Unpublished master's thesis). Antioch University New England, Keene, NH.