Arboreal and terrestrial lichen species richness in Eagle Lake watershed, Rowan County, KY

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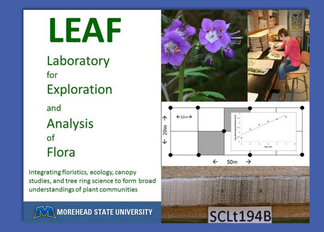

Abstract

A lichen is a symbiotic relationship between algae and fungi. These organisms have the ability to perform photosynthesis, detect pollution, provide building material for small animals, and can be locally diverse in a forest. A 20 X 20 m plot was established to assess arboreal and terrestrial lichen species richness in the Eagle Lake watershed. The terrestrial zone included three species found on soil, six on rocks, and seven species on coarse woody debris. In the arboreal zone four species were found on sourwood, two on mountain chestnut, and six species on the central oak. The most common lichens identified were *Punctelia rudecta* and *Parmotrema hypotropum*. Future research will involve identifying collections made thus far and establishing more plots in the Eagle Lake watershed.

Introduction

Forests are spatially complex, three dimensional habitats that are home to a variety of organisms. Forests consists of different zones which support a range of flourishing diversity. A group of small organisms that impacts the ecosystem are lichens.

Lichens are a symbiotic relationship between fungi and algae. Lichens enable algae to live all over the world due to the valuable protection by the fungi. Although often small, lichens have an important role in the balance of the ecosystem. The organism has the ability to perform photosynthesis which converts carbon dioxide into carbohydrates. They are also used as a form of building material, food, and homes for small organisms. Lichens can directly benefit humans and the forest by absorbing harmful pollutants that occur in the air.

Lichen species richness can be thought of as the number of species found in an area. It is important to sample lichens from a variety of substrates when conducting a study. Boch et al. (2013) examined lichen richness on different zones of trees in a series of plots in southwestern Germany. The team collected samples from various substrates and litter fall. On average 54% of lichens and 20% of bryophytes were overlooked if the tree tops were not included. The crowns of the trees proved to be rich in lichen species.

The objective of our study is to examine lichen species richness found on woody debris, trees, soils, rocks, and the crowns of trees. This approach to sampling will allow us to compare lichen species richness between arboreal and terrestrial zones.

Figure 1: County map of Kentucky indicating Rowan County in red.

Methods

Study Area.

The study area was at Eagle Lake (figures 1 and 2), near Morehead, Kentucky. The upper region of the Eagle Lake watershed is owned by Daniel Boone National forest, and the lower region is owned by Morehead State University. Eagle Lake is surrounded by a oak-hickory forest dominated by white oak, black oak, scarlet oak, mountain chestnut oak, pignut hickory, mockernut hickory, American beech, red maple, flowering dogwood, sour gum, and sourwood. Annually there are 46 inches of rain, and 26 inches of snow. Approximately 81.1 days experience precipitation. The July high is an average of 86 degrees and the average low for January is 22 degrees.(http://www.bestplaces.net). The elevation of the Eagle Lake watershed ranges from 810-1240 feet.

The geology of the Eagle Lake watershed is principally comprised of the Borden Formation (Mississippian Period). This formation includes the Cowbell and Nancy members. The Nancy is a thin-bedded siltstone that makes up the lower slopes (820-900 elev.). The Cowbell is siltstone with interbedded silty shale that makes up the upper slopes (900-1240 elev.) (Hoge and Chaplin, 1972).

Figure 2: Eagle Lake with surrounding oak-hickory forest on Morehead State University campus.

Field and Laboratory Methods.

During the 2017 spring semester a 20 X 20 meter plot was established in the forest of Eagle Lake (figure 4). The dimensions of the plot were centered around a large white oak (Figure 6). The terrestrial portion was divided into rock, soil, and coarse woody debris. Lichen samples were extracted from each individual substrate category and separately collected. When examining the arboreal zone, each species of woody plant was examined for a species of lichen (Figure 5). The collections were labeled and then taken back to the lab for identification.

A variety of lab equipment was used to help with the identification process. A microscope (figure 3) was first used to examine the thallus of the lichen. Two guides, “Lichens of North America” and an in progress “Guide to the Macrolichens of Kentucky’s Land of 10,000 Outcrops,” were also used as aids for identifying. Tests were conducted to ensure the proper name was given. K and C tests along with ultraviolet test are one of the many ways we can differentiate one lichen from another. The North American checklist was then used to give proper credit to the person who named the particular lichen. The collections at this point consists of 48 arboreal, 26 rock, 5 soil, 3 tree, and 32 coarse woody debris lichen specimens.

Figure 3: Lichen identification by a dissecting microscope.

Figure 4: Boundary line of study plot 1.

Figure 5: Collecting lichens from bark of a sourwood.

Figure 6: White oak (at right) that was in the center of the study plot.

Results

Though our work in the plot is incomplete at this time, thus far we have identified six lichen species in the arboreal zone and seven in the terrestrial. The terrestrial zone included three species found on soil, six on rocks, and seven species on coarse woody debris. In the arboreal zone four species were found on sourwood, two on mountain chestnut, and six species on the central oak. The most frequent species that occurred were *Punctelia rudecta* (figure 7), *Cladonia ochrochlora*, *Flavoparmelia caperata*, and *Parmotrema hypotropum* (figure 8).

Figure 7: Example of a foliose lichen, *Punctelia rudecta*, rough speckled shield lichen.

Figure 8: *Parmotrema hypotropum*, powdered ruffle lichen, one of the most common lichens in the plot.

Future Research Plans

First, collections made thus far will need to be identified. Second, research will continue by examining the central white oak’s branches using single rope and doubled rope tree climbing methods.

In the upcoming months, further study plots will be established throughout the Eagle Lake watershed (Figure 9).

Literature Cited

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Figure 9: Eagle Lake watershed.