Lichen Biodiversity of Northwestern Polk County, Florida: Implications for Air Quality

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Abstract

Lichens are excellent indicators of atmospheric air quality because even relatively low levels of common air pollutants can significantly alter the physiology, composition, growth, distribution, and reproduction of lichen communities. This long-lived, cosmopolitan group of symbiotic organisms is frequently used to monitor air quality throughout the World, yet few attempts have been made to survey lichens in upland habitats of central Florida. In this study, epiphytic lichen floras were surveyed in three distinct habitats: rural (Lakeland Highland Scrub Preserve), suburban (Florida Southern College), and metropolitan (downtown Lakeland). Lichen species were photographed and measured, then collected and preserved in the Florida Southern College herbarium. Surveyed specimens were then taxonomically identified using a North American species key. To spatially display results, a GPS point was recorded for each specimen and imported into ArcGIS. Some of the common species collected in our region are: Bumpy Ramalina (*Ramalina complanata*), Candleflame Lichen (*Candelaria concolor*), Common Button Lichen (*Buellia stillingiana*), Dirinaria Lichen (*Dirinaria picta*), Southern Strap Lichen (*Ramalina stenospora*), Streaked Rosette Lichen (*Physcia atrostriata*), and White Fringe Lichen (*Heterodermia albicans*). In general, our results were consistent with previous studies; we found an increasingly diverse and abundant (i.e., healthy) lichen community as we moved further away from the urban center.

Introduction

Lichens are the coexistence of two organisms living in a mutual symbiosis. Each lichen species consists of a fungus and/or cyanobacteria within the thallus. Lichens are found on both abiotic and biotic substrates, including living animals! There are over 14,000 species of lichens, each differing in color, shape, and chemistry. For this study, lichens were classified into 3 broad categories based on thallus structure: crustose (figure 1), foliose (figure 2), and fruticose (figure 3). Lichens are cosmopolitan (found world-wide) and indicators of a healthy ecosystem. These traits combined with their sensitivity to atmospheric pollutants make lichens wonderful organisms for studying air quality, biodiversity, and chemistry of different biomes.

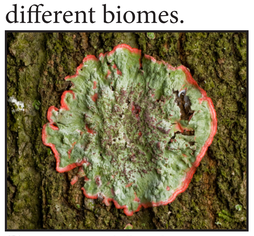


Figure 1 - *Herpothallon rubrocinctum* is a crustose lichen.

Figure 2 - This is an example of a foliose lichen.

Figure 3 - *Ramalina stenospora* is a fruticose lichen.

Methods

We studied epiphytic lichen flora biodiversity in three regions of increasing human activity including the Lakeland Highlands Scrub (LHS) habitat, the Florida Southern College (FSC) campus, and Munn Park area of downtown Lakeland. These surveyed regions are within the Lakeland Ridge consisting of scrub, pine savannah, oak hammock, and wetland habitats.

Figure 4 - *Candelaria concolor* is very vibrant and beautiful.

Figure 5 - This shows the 2-3-2 code and measurements for a specimen.

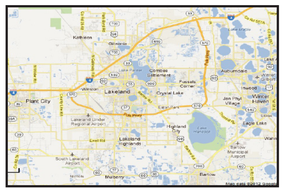
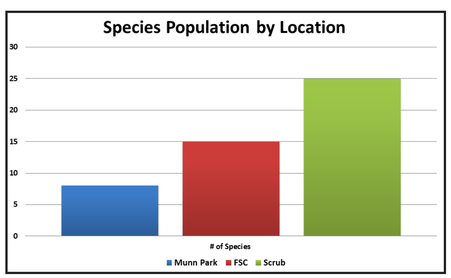


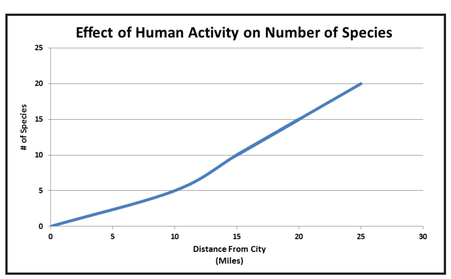
Figure 6 - This is a map of Lakeland and the surrounding area where the study took place.

The surveyed tree substrates were at least 25cm in diameter at the base of the trunk and had colonized lichens present. Each tree surveyed was catalogued as a data point with a site specific ID using a Garmin eTrex Legend HCx GPS. Individual data points consisted of a 2-3-2 code, where a 2-digit regional code (denoting FSC, LHS, or Munn Park), a 3-digit tree count number for that entire surveyed region, and a 2-digit species number for each specific tree surveyed, was used (figure 5). Finally, each surveyed specimen was placed in a herbarium packet for storage and later reference. This process continued for each new species found, until an approximate height of 2 meters was reached. Following the field surveys, each species was then keyed using a North American lichen key and a biodiversity index was formed.

Results

Throughout the study we found a wide variety of species in each area surveyed, ranging in structure, color, and general health. We found that the affects of human impact (in the form of air pollution via automobile) caused discoloration, smaller thalli, and a lack of biodiversity (specifically fruticose species) in the surveyed lichen communities. The data gathered was catalogued in a species checklist for each area, and qualitative statistics were used to analyze biodiversity and the effect of pollutants (see right).





Discussion

Lichens hold a major role in monitoring ecosystem health, biodiversity, and atmosphic quality when used as bioindicators. Studying the ecology and evolution of these organisms allows biologists to continue making connections between the importance of conservation and the effects of human impact on ecosystems. Lichen sensativity gives these organisms a keystone species status in that, by dedicatining studies and conservation of these organisms, we as humans can ultimately have a positive influence on the other species and the ecosystem as a whole.

Figure 9 - A branch from the scrub habitat showing the high amount of diversity. There are 5 species on this one branch!

Conclusions

Based on our findings, we concluded that human activity does in fact directly impact the biodiversity, health, physiology, and overall success of lichen communities. The evidence suggesting this leads us to hypothesize that human activity affects other sensative biological organisms as well.

References

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