



Species diversity of moss in Westchester county, NY

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Abstract

- Moss is an absorbent, spore bearing, nonvascular species
- Moss contributes to controlling water levels and preserving soil moisture playing a vital role in the environment.
- Moss creates a stable habitat for other surrounding plants to thrive.
- Various samples of moss were collected from three locations in Westchester County: The Bronx River Parkway, The Leatherstocking Trail, and Pinebrook Blvd.
- Each sample was initially identified using iNaturalist and paper field guides.
- After the initial identification we DNA barcoded each specimen.
- We aim to use DNA barcoding to identify the diversity of moss species in Westchester County.

Introduction

- Moss is very small in size, typically 0.2-10 cm tall. The tallest moss in the world can grow to around 50cm, but it still plays such a helpful role for the environment.
- Moss dates back to the Permian Period, some 470 million years ago.
- Out of approximately 12,000 moss species that have been found globally, 200 were discovered in the County of Westchester.
- Moss is commonly found in moist shady locations on top of rocks, along rivers, and along streams.
- From the three locations we collected forty four samples of moss to be self identified and later be DNA barcoded.
- In order to initially identify the species of the collected samples we used iNaturalist, microscopes, stereoscopes, and paper field guides.
- Then we extracted DNA, amplified it using PCR, and ran gel electrophoresis to DNA to confirm presence of DNA in our samples in Regeneron DNALC. Subsequently our samples were sent to company Genewitz, which sequenced them.
- We used two websites called DNA subway.org, and BLAST analyze our DNA sequences.

Methodology

collection

- A total of 44 samples of moss were gathered from all around Westchester County
- 20 samples from The LeatherStocking trail
- 14 samples from Pinebrook Blvd
- 10 from The Bronx River Parkway.

identification

- Pictures of each sample were uploaded to iNaturalist and identified based on physical features. This gives results that match based on previous findings in the area.
- Each individual leaf of the sample was observed under a microscope.
- We used a stereoscope to observe each tuft of moss.
- Then we used a paper field guide for the last identification.

DNA Barcoding

- The DNA was first extracted using the silica resin method.
- An ITS primer is used in the PCR process.
- Next, the samples are mixed with the loading dye and put in gel electrophoresis chambers.
- The samples were then sent to be sequenced and analyzed by professionals

DNA Subway and BLAST

- Finally the sequences were organized and analyzed using a website DNASubway.org/BLAST.
- The final species were determined when all methods yielded the same outcome.

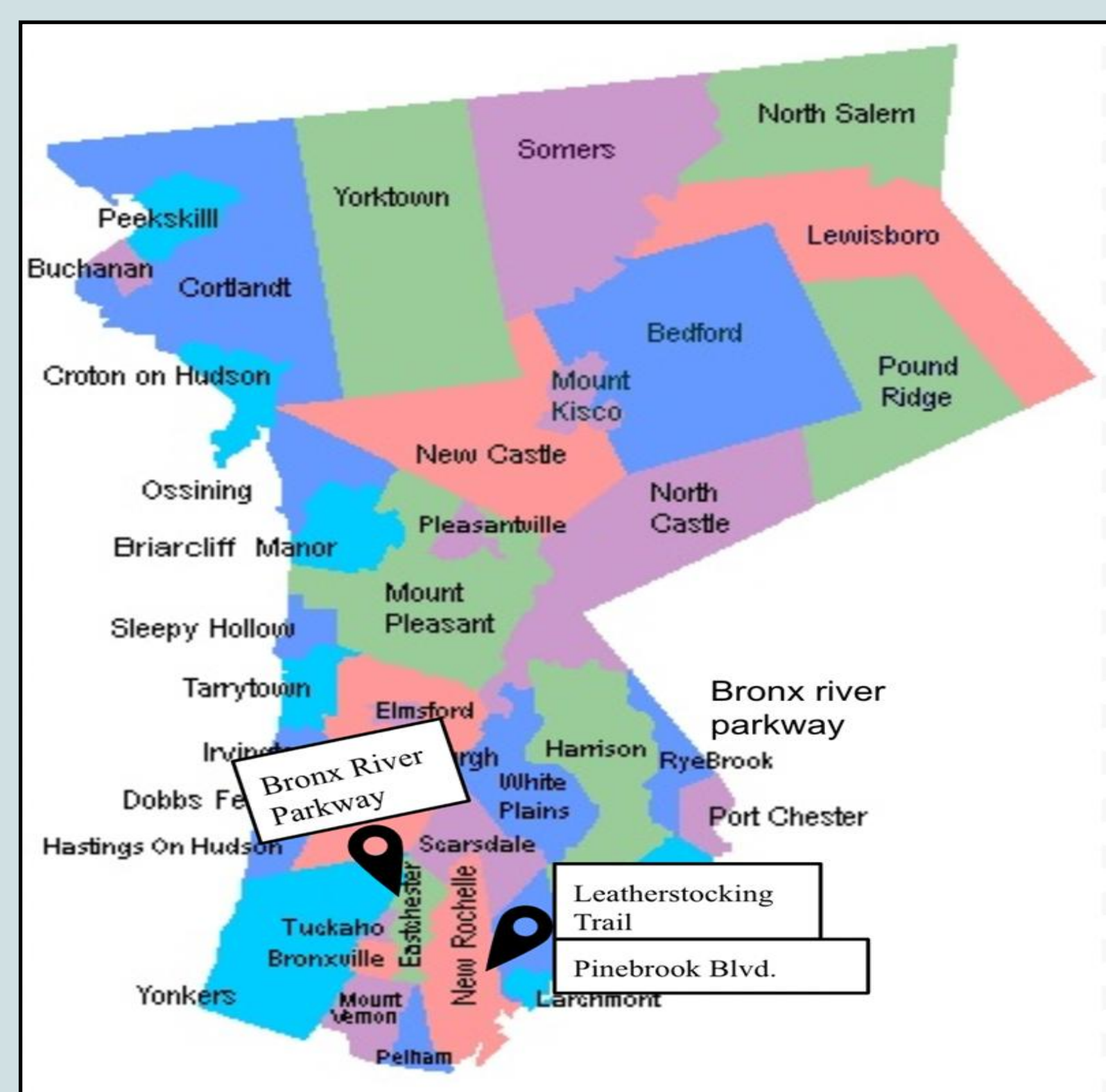


Figure 1. Map of sample collection area. W. Bronx River Parkway, 40.8618° N, -73.8717° W, Leatherstocking Trail, 40.94006° N, 73.77851° W, and Pinebrook Blvd., 40.93409° N, 73.77862° W

Results

- Out of the twenty samples collected at The Leatherstocking Trail, five samples were successfully identified by DNA barcoding.
- Out of the ten samples collected at the Bronx River Parkway, four were successfully identified by DNA barcoding.
- Out of the fourteen samples collected on Pinebrook Blvd. none were successfully DNA barcoded.
- Out of 9 moss samples, all 9 successfully yielded DNA sequences. In this way, out of 44 collected specimens we got 35 unidentified by DNA barcoding specimens.
- According to DNA subway and BLAST, out of these 9 samples we were able to identify 8 had different species moss.

Tables and Figures

iNaturalist Identification	Field Guide Identification	DNA barcoding identification with DNA subway/BLAST
<i>Platygyrium repens</i>	<i>Andreaea rupestris</i>	<i>Pseudocalliergon lycopodioides</i>
<i>Entodon seductrix</i>	<i>Bryoandersonia illecebra</i>	<i>Amblystegium tenax</i>
<i>Fissidens taxifolius</i>	<i>Encalypta Procera</i>	R: <i>Sanionia uncinata</i> F: <i>Pseudoanomodon attenuatus</i>
<i>Dicranum Fulvum</i>	<i>Tetraphis pellucida</i>	<i>Amblystegium tenax</i>

Table 1. Bronx River Parkway, Samples and Identification Methods. iNaturalist, Field Guide, DNA Subway/BLAST.

Smoothcap moss	<i>Ditrichum pallidum</i>	<i>Sanionia uncinata</i>
<i>Atricum angustatum</i>	<i>Sphagnum squarrosom</i>	<i>Sciuro-hypnum flotowianum</i>
<i>Dicranium majus</i>	<i>Pleurozium schreberi</i>	<i>Atricum angustatum</i>
<i>Schistidium apocarpum</i>	<i>Ditrichum pallidum</i>	<i>Sesamum indicum</i>
<i>Hygro Amblystegium varium</i>	<i>Leucobryum longifolium</i>	<i>Brachythecium laetum</i>

Table 2. Leatherstocking Trail, Samples and Identification Methods. iNaturalist, Field Guide, DNA Subway, BLAST.

Bronx River Parkway	Leatherstocking Trail
<i>Pseudocalliergon lycopodioides</i>	<i>Sanionia uncinata</i>
<i>Amblystegium tenax</i>	<i>Sciuro-hypnum flotowianum</i>
<i>Pseudo Anomodon attenuatus</i>	<i>Atricum angustatum</i>
<i>Amblystegium tenax</i>	<i>Sesamum indicum</i>
	<i>Brachythecium laetum</i>

Table 3. Moss species found in Bronx River Parkway and Leatherstocking Trail areas.

Discussion

- The four ways to identify species were, iNaturalist, paper field guide, DNA barcoding done with DNA subway/BLAST.
- Admittedly these three methods rarely yielded the same results.
- We took microscopic photos of our mosses to the best of our ability, but we had errors during this identification process.
- Another limitation of our study is that because moss is practically microscopic, identifying it based on features to the naked eye is a challenge. Although it is possible to identify some species of moss by the physical appearance, samples can be confused with other species of moss.
- Future studies on this topic may include expanding our sample size.

Aknowlegments

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