Soil Particle Size Distribution at Lincoln University’s Living Laboratory

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Abstract
The purpose of this study was to characterize soil particle size distribution of in the Living Laboratory on Lincoln University’s campus. The Living Laboratory is a 2.60 ha forested area recently acquired by Lincoln University. Students and faculty in the School of Agriculture and Natural Sciences will use the forest for field studies. Soil samples were collected from 15 different locations in the forest. Global positioning System (GPS) was used to pinpoint each sampling location. The samples were air-dried for 14 days and separated using sieves with different diameters that only let specific size of soil particles through. Graphs were created representing the different particle size distribution. Particles of 2mm and larger diameters were the most abundant. The amounts of sand silt and clay varied depending on the location.

Introduction
Soil is a lot more complex than people really actually think. You could actually take soil samples from two different locations only inches apart and the soil composition could be entirely different. That is why in one location Silver Maple could grow better in one area and right next to it Sweet Gum is striving for survival. Soil diversity is due to parent material, weathered rock, climate, environment, and a few other factors. Soil is comprised of sand, silt, clay, and other particles and substances (rocks, minerals, etc.).

Soil has biological, chemical and physical properties. These properties can tell specific information about how well the soil will function as a home to organisms, perform as a filter of wastes, as a location for buildings, and in other important uses (Nyle C. Brady and Ray R. Weil, June 15, 1998). Soil properties can also tell whether the soil has the potential to store enough water to keep plants growing through a drought, to withstand a flood, and to provide the right combinations of chemicals to plants (as indicated in measurements of pH, and N, P, K levels) so that they will grow properly.

The way a soil feels is called the soil texture. Soil texture depends on the amount of each size of particle in the soil. Sand, silt, and clay are names that describe the size of individual particles in the soil. Sands are the largest particles and they feel "gritty." Silts are medium sized, and they feel soft, silky or floury. Clays are the smallest sized particles, and they feel "sticky" and they are hard to squeeze (Arshad, M.A. et. al., 1996).

Soil properties data are a key piece of the picture of how an ecosystem works. Knowledge on soil particle size distribution can therefore help to predict how fast water will move through the soil, how often to irrigate, when to cultivate and what crops to plant.

Characterization of the distribution of soil particle sizes across the entire Lincoln University Living Laboratory (2.60 ha) would require several days of intensive sampling and analysis. Due to time constraint between our classes and this research project, this
study would have become an impossible task. Fortunately, Lincoln University’s Center of Excellence Geographic Information Systems has technology readily available to help accomplish our tasks with not intensive but sufficient number of samples. The objective of this study was therefore to characterize distribution of soil particle size across Lincoln University forest using Geographic Information Systems.

Materials & Method

Using baggies, soil samples were collected from 15 different locations of the Living Laboratory using a hand shovel. Using a GPS system the sample locations were marked and the bags were labeled 1 – 15. Then the 15 baggies were moved taken to the laboratory and separated using three different sieves. The first held particles larger than 2mm, the second held particles 2 – 1mm, third held particles 1mm – 250\(\mu\)m, and the fourth level had a pan that held particles less than 250\(\mu\)m. The first bag was separated through the sieves and weighed with an electronic scale. Weights were recorded and the samples were put back in their sample bag. Same procedures were used for all the sample sizes. Then using ArcGIS the data was graphed according to size classes.

![Lincoln University Forest](image)

Fig. 1. Lincoln University Living Laboratory

Results and Discussion

According to the USDA classification as adopted by the American Society of Agronomy (Gee and Bauder, 1986), i.e. sands (<2000-50\(\mu\)m), silts (<50-2\(\mu\)m) and clays (< 2\(\mu\)m), it is clear that particles larger than 2mm were the most abundant in all the soil samples, as for the other class sizes abundance varied. At some of the locations sand may have dominated as the most abundant particle size, while in others it may have been silt or clay. The tables below represents the different data collected. The Table 1 represents
the data recorded in the laboratory. Note that it shows the weight of the different class sizes for each location. Table 2 represents the percentage of the different particle sizes in that location, for example sand at location one was only 8.8%.

Table 1. Summary of Simple statistics

<table>
<thead>
<tr>
<th></th>
<th>&lt;2mm</th>
<th>2 - 1mm</th>
<th>1mm - 250um</th>
<th>&gt;250um</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>53.16</td>
<td>16.25</td>
<td>19.60</td>
<td>10.98</td>
</tr>
<tr>
<td>SD</td>
<td>15.65</td>
<td>7.08</td>
<td>7.52</td>
<td>7.31</td>
</tr>
<tr>
<td>C.V.</td>
<td>29.43</td>
<td>43.60</td>
<td>38.35</td>
<td>66.20</td>
</tr>
<tr>
<td>Minimum</td>
<td>33.20</td>
<td>8.60</td>
<td>7.20</td>
<td>0.60</td>
</tr>
<tr>
<td>Median</td>
<td>50.10</td>
<td>14.00</td>
<td>20.20</td>
<td>13.20</td>
</tr>
<tr>
<td>Maximum</td>
<td>82.90</td>
<td>31.40</td>
<td>31.70</td>
<td>23.00</td>
</tr>
<tr>
<td>Skew</td>
<td>0.88</td>
<td>0.64</td>
<td>0.16</td>
<td>-0.12</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.37</td>
<td>-0.62</td>
<td>-0.73</td>
<td>-1.10</td>
</tr>
</tbody>
</table>

Then this information was taken and applied to ArcGIS and mapped. The Figure 1 is of the Lincoln University Forest also called the Living Laboratory. The Figure 2 and Figure 3 represent the distribution of the different particle class sizes.
Figure 2. Soil particle size distribution at Lincoln University Living Laboratory. a) particle size < 2mm, b) particle size 2mm-1mm

Figure 3. Soil particle size distribution at Lincoln University Living Laboratory. a) particle size 1mm-250µm, b) particle size >250µm
Conclusion
This project proved that soil characteristics could greatly differ within a small area. So it is important to research your soil before you conduct any type of work with a landscape. Who knows you might find gold.

References


www.wikipedia.com

www.yahoo.com

www.msn.com
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