A Comparison of Urban Soil to Rural Soil
Nancy Brosho, Hayden Cooksy, Tatiana Taylor, and Wes Hanson
Linfield College Environmental Studies

Introduction
In 2003, Nancy Brosho found high levels of tree mortality in Forest Park, especially for seedlings and saplings. Seedlings that had been present in 1993 were mostly gone by 2003. The loss of seedlings and saplings, concomitant with the lack of recruitment by new seedlings evidenced in 2013 was similar to findings in other urban forests, and raises concerns about the future of Forest Park. In 2019, three control sites were added that showed significantly more seedlings and saplings at sites above Estacada in the Mount Hood National Forest than in any area in Forest Park (Figure 1). We believe the lack of recruitment is related to nitrousous air pollution (lichen studies show Forest Park to have a greater number of nitrogen loving species than rural forests). To try to elucidate soil parameters that may be affected by air pollution, we measured soil aspects including the soil moisture, temperature, pH, depth of the O horizon, and the carbon to nitrogen ratio (C/N). We also measured the amount of CO$_2$ produced in the soil over a 24 hour period to get an indication of soil respiration rates.

Goals of Study
- To find correlations between soil characteristics and tree community variables, especially those related to recruitment
- To measure soil characteristics in urban forests (Forest Park) and rural forests (control sites above Estacada in Mount Hood National Forest)
- To find correlations between soil characteristics and tree community variables, especially those related to recruitment

Methods
- Soil samples from the A Horizon were collected from 17 of the permanent research sites in Forest Park and at 3 control sites located above Estacada in the Mount Hood National Forest (Figures 2 and 5)
- Depth of the O horizon was measured at each site
- Soil temperature, moisture, and ECP were measured in the A horizon using a hand held decagon probe
- The pH in the A horizon was measured using a Hannah Instruments pH meter
- Collected soil samples were processed and sent to the OSU Analytical Laboratory, where they were analyzed for C, N, and the C/N ratio
- To measure soil respiration rates:
  - 24 hour CO$_2$ collection containers did not always seal well in the soil, leading to errors. We are in the process of obtaining a better system of data collection.
  - We also plan to examine seedling and sapling roots for mycorrhizael fungi.

Results

<table>
<thead>
<tr>
<th>Site Location</th>
<th>Mean(O Horizon Depth (cm))</th>
<th>Mean(C/N)</th>
<th>Mean(CO$_2$ (ppm))</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>8</td>
<td>12</td>
<td>1000</td>
</tr>
<tr>
<td>Middle</td>
<td>10</td>
<td>14</td>
<td>1500</td>
</tr>
<tr>
<td>Far</td>
<td>12</td>
<td>16</td>
<td>2000</td>
</tr>
<tr>
<td>Estacada</td>
<td>14</td>
<td>18</td>
<td>2500</td>
</tr>
<tr>
<td>Control Site</td>
<td>16</td>
<td>20</td>
<td>3000</td>
</tr>
</tbody>
</table>

Conclusions and Limitations
- Rural control sites had significantly deeper O horizons, higher C/N ratios, and greater levels of soil respiration (Figures 5-7) than urban sites
- Rural control sites also had significantly more live trees (90 vs. 16-25) and seedlings and saplings (Figure 1), as well as a higher % conifers (93% vs. 28-53%) and greater total tree dbh (1008 vs. 583-783); all p<0.0001
- The number of seedlings and saplings was positively correlated with the C/N ratio (R=0.48; p<0.0001) and the depth of the O horizon (R=0.42; p=0.0026) and the depth of the O horizon (R=0.42; p=0.0026) and the depth of the O horizon (R=0.42; p=0.0026) and the depth of the O horizon (R=0.42; p=0.0026)
- The level of soil respiration was not found to be correlated with any other variable.

Acknowledgements
This study was funded through grants from Linfield College (SFCRG and Jane Claire Dricks Edmonds) with additional assistance from Portland Parks and Recreation.