Soil Nitrogen and Carbon in Urban and Rural Forests

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Background Information

- Research in Forest Park between 1993 and 2013 showed a lack of tree recruitment (small saplings and seedlings) throughout the urban forest, perhaps due to air pollution
- Lichen surveys conducted at 33 sites in Forest Park in 2013 showed the lichen community consisted primarily of species that can tolerate or thrive at high levels of nitrogenous air pollution
- This suggests that air pollution (especially high nitrogen compounds) may be affecting seedling survivorship in the urban forest
- This poster will compare lichen surveys between urban forest sites and three rural control sites in the Mount Hood National Forest; we also will compare total nitrogen and carbon in soil samples from those sites

Goals of Study

- Establish 3 control sites in the Mount Hood National Forest in a area believed to be outside of Portland's air pollution stream
- Compare lichen survey data from the control sites to those from Forest Park
- Compare total soil nitrogen and carbon between urban and rural sites

Hypothesis

- Lichen surveys will indicate higher air quality (in terms of lower levels of nitrogen) in the control sites than in the urban forest sites
- The urban soils will have higher levels of nitrogen than soils at the control sites

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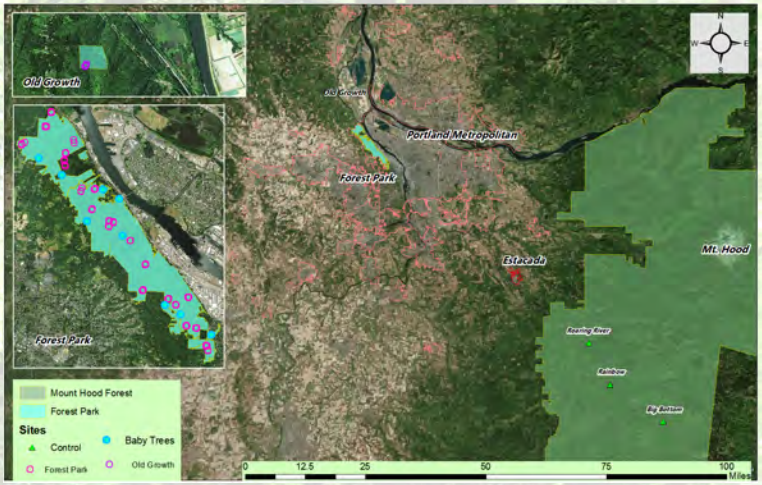

Figure 1. Locations of permanent study sites and baby tree sites in Forest Park and the Ancient Forest Preserve in Portland, Oregon; and the three control sites above Estacada, Oregon relative to Portland.

Methods

- 3 control sites were located in the Mount Hood National Forest along a perceived air quality gradient
- Lichen surveys were conducted at each control site in the same manner they had been conducted at the Forest Park sites in 2013 according to US Forest Service protocol (Jovan 2008)
- 4 soil samples were collected at each of the sites
- We collected soil at 24 long-term research sites and 8 conifer recruitment (baby tree) sites in Forest Park, as well as at the 3 control sites
- After soil was collected, it was returned to the lab where it was dried at 35°C until weight was constant, sieved to reduce to fine particle size, and stored
- 0.20 grams of each of the 4 soil samples from each site were mixed together to create one site soil sample
- Soil samples will be analyzed using an elemental analyzer at PSU, which will determine total nitrogen and total carbon in each sample

Results

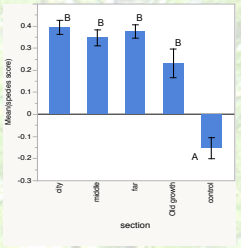

Figure 2. Mean (SE) lichen nitrogen sensitivity score by location; the lower the score, the more sensitive the lichen is to nitrogenous air pollution

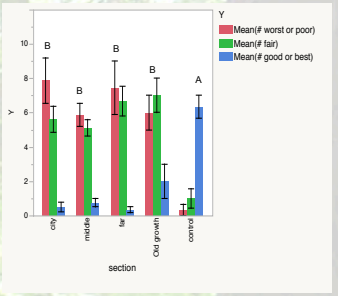

Figure 3. Mean lichen abundance (SE) in air quality rating standards based on nitrogen for the different locations

Nitrogen Sensitivity Scores

- Each lichen species was assigned a score of nitrogen air sensitivity based on Geiser and Neitlich (2007) and Jovan (2008)
- Range from -0.50 (best) to 1.15 (worst air)

Conclusions

- The lichen surveys show significantly higher air quality at the control sites than any of the urban sites
- Fahy, Hanson and Broshot found significantly more seedlings and saplings at the control sites than at sites in Forest Park
- Due to circumstances beyond our control, we are still waiting for the soil to be analyzed
- We hope our soil results will help elucidate the reasons for the differential tree recruitment

References

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