Survivorship and Growth of Seedlings and Saplings in Urban Forests

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Introduction

Research in 1993, 2003, and 2013 showed high rates of tree mortality and low rates of recruitment (new trees) in Portland, Oregon's Forest Park and the Ancient Forest Preserve (Figure 1). To determine if the lack of young trees was an urban phenomenon, we added three control sites in the Mount Hood National Forest above Portland's air pollution plume in 2013 (Figure 2). The lack of recruitment has been noted in many urban forests. Over the last decade, we have ruled out soil moisture and pH, as well as light as contributing factors. We believe the loss of baby trees may be due to high levels of nitrogenous air pollutants in the Portland area. Last summer we returned to all our sites, located all the seedlings and saplings present, and measured them.

Goals of Study

- Locate and tag every seedling and sapling at each site
- Measure each seedling and sapling to determine growth characteristics such as increased diameter and increased height, as well as live crown ratio (the percent of the tree that is alive)
- Analyze data to determine growth rates for seedlings and saplings and correlate with degree of urbanization

Methods

- Attempt to locate every seedling and sapling found in 2013 on each of the three transects at each site
  - Seedlings are tree species less than 2 meters tall; saplings are tree species that are over 2 meters tall but less than 10cm in diameter
- Measure the height, height of the lowest living branch, and dbh or basal area for each seedling and sapling (including ones not present in 2013)
- Note species and whether each is alive or dead

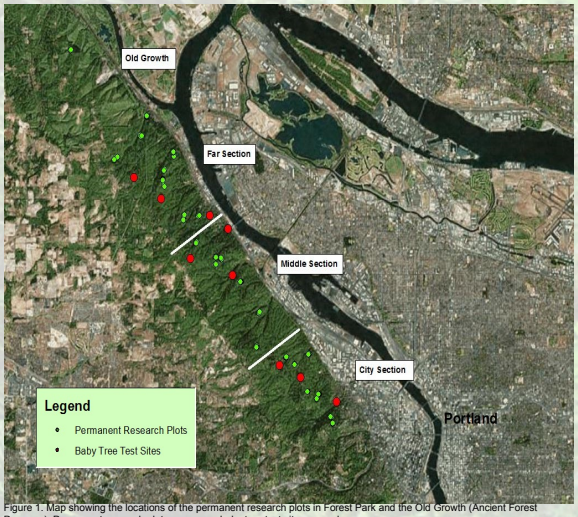


Figure 1. Map showing the locations of the permanent research plots in Forest Park and the Old Growth (Ancient Forest Preserve). Permanent research plots are green; baby tree test sites are red.

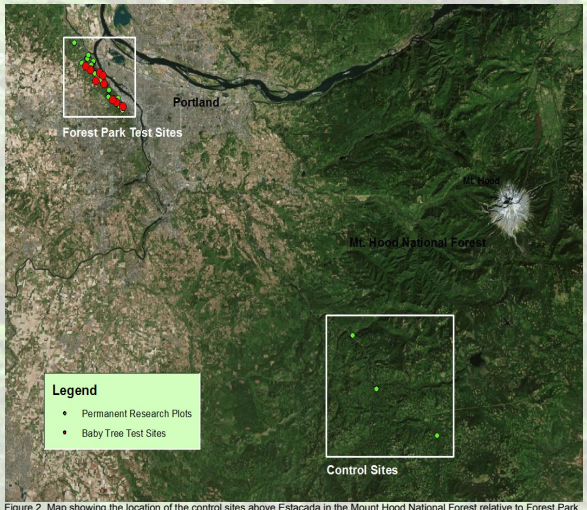


Figure 2. Map showing the location of the control sites above Estacada in the Mount Hood National Forest relative to Forest Park. Permanent research plots are green; baby tree test sites are red.

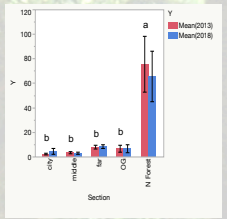


Figure 3. Mean number of live seedlings and saplings in different locations ($p<0.0001$) as per ANOVA in different years. Means with different letters are significantly different as per Tukey HSD Post hoc test.

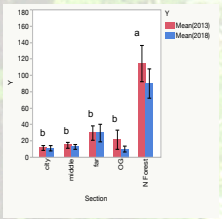
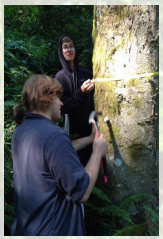


Figure 4. Mean total diameter of seedlings and saplings in different locations ($p<0.0001$) as per ANOVA in different years. Means with different letters are significantly different as per Tukey HSD Post hoc test.



Results

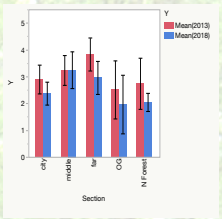


Figure 5. Mean average diameter (cm) of seedlings and saplings in different locations ($p=0.7$ for both years) as per ANOVA in different years.

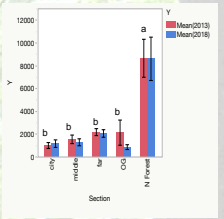


Figure 6. Mean total seedling and sapling height (cm) in different locations as per ANOVA ($p<0.0001$) in different years. Means with different letters are significantly different as per Tukey HSD Post hoc test.

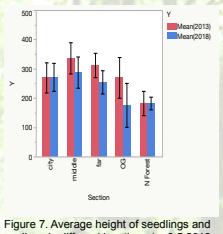


Figure 7. Average height of seedlings and saplings in different locations ($p=0.5$ 2013; 0.7 2018) as per ANOVA in different years.

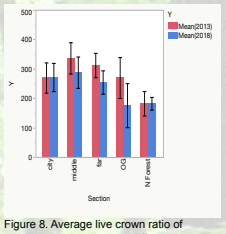


Figure 8. Average live crown ratio of seedlings and saplings in different locations ($p=0.13$ 2013; 0.75 2018) as per ANOVA in different years.

Results Summary

- The number of live seedlings and saplings (Figure 3) as well as the total diameter and the total height of seedlings and saplings were significantly greater at the control sites in the National Forest than at any urban location in both 2013 and 2018 (Figures 4-7).
- None of the variables listed above were significantly different between years in any of the sections.
- The live crown ratio was not significantly different by section in either year; likewise it was not significantly different between the years (Figure 8).

Conclusions and Limitations

- Five years is probably too short a time to see significant changes in the forest
- Although the tendency was for fewer, smaller, and less healthy seedlings and saplings, the results were not significant between 2013 and 2018.
- Not all seedlings and saplings, especially in the National Forest, had been labeled in 2013, making it difficult to match them up tree for tree to determine individual survivorship.

Acknowledgements

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