

# Lichens in Forest Park and Nitrogenous Air Pollution

Wes Hanson, Meghan Lockwood, Morgan Yarber, and Nancy Broshot  
Linfield College Environmental Studies

## What are Lichens?

- A mutualistic relationship between a fungal component (mycobiont) and an algal or photosynthetic bacterial component (photobiont)
- Many have nitrogen fixing cyanobacteria
- Common and important members of Pacific NW coniferous forest ecosystems (source of nitrogen)

## Lichens as Bioindicators

- Lack a root system; absorb nutrients from the atmosphere
- US Forest Service is using lichens to determine levels of nitrogenous air pollution
- Categorized by nitrogen sensitivity
  - ✧ Oligotrophic - intolerant of high levels of nitrogen (e.g., *Lobaria*)
  - ✧ Mesotrophic - somewhat nitrogen tolerant (e.g., *Platismatia*)
  - ✧ Eutrophic - nitrogen loving (e.g., *Candelaria*)
- Preliminary work in Forest Park has shown most lichen species present are Eutrophic; nitrogen sensitive species (e.g., *Lobaria*) are mostly absent

## Goals of Study

- Conduct lichen surveys at Nancy Broshot's 25 long-term research sites in Forest Park
- Use lichen abundance to approximate nitrogenous air pollution levels in the park

## Hypothesis

- Nitrogenous air pollution (from transportation and NW industrial activities) is affecting lichen species abundance and diversity in Forest Park
- The lichens we find will be indicative of poor air quality throughout the park and in the Ancient Forest Preserve

## Acknowledgements

This study was funded through a grant from the Keck Foundation's CERC (Community Engaged Research to Classroom) with additional assistance from Portland Parks and Recreation

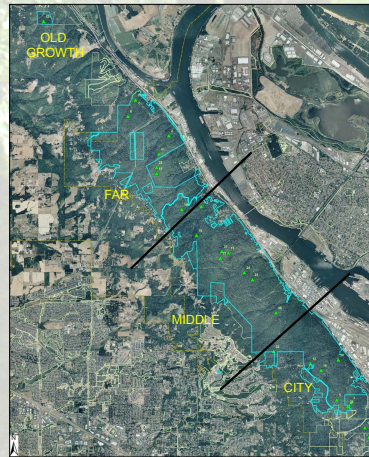


Figure 1. Forest Park and Ancient Forest Preserve (site locations noted in green)

## Methods

- Lichen surveys were conducted at each of the 25 long-term research sites
- A 120 foot radius circle plot was laid out
- Surveyors walked each area for 30 minutes to 2 hours to find lichens
- Lichens were collected that were on tree trunks, shrubs, and fallen and attached lower branches
- Samples of each lichen species found were identified, categorized, and packaged; abundance of each was estimated
- Lichens were returned to the laboratory for further inspection and identification

## Nitrogen Sensitivity Scores

- Assigned to each species based on Jovan (2008)
- Range from -0.50 (best) to 1.15 (worst air)
- Calculated the sum and mean for each site
- Also categorized each species into tolerance class

## Results

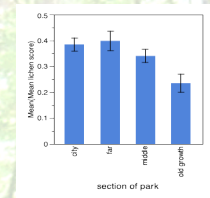


Figure 2. Mean (SE) lichen sensitivity scores by section (ns)

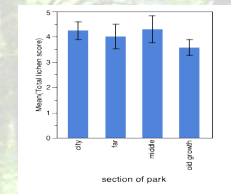


Figure 3. Total (SE) lichen sensitivity scores by section (ns)

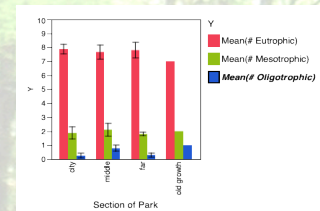


Figure 4. Mean (SE) number of lichens in sensitivity categories by section (ns)

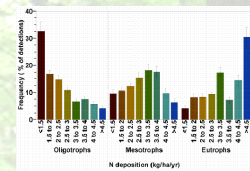


Figure 5. Relative likelihood of finding lichen categories based on Nitrogen deposition (USFS)

## Conclusions

- No significant differences among the sections of the park
  - Total and mean sensitivity scores
  - Nitrogen sensitivity categories
- Sites were dominated by eutrophic species; only found *Lobaria* at two sites (and specimens were small and poor)
- Indicate relatively high nitrogen pollution scores at all sites
- Forest Park and the Ancient Forest Preserve appear to have relatively high levels of nitrogen deposition
- Need to be correlated with nitrogen levels in the air and soil

## References

- Jovan, S. 2008. Lichen Bioindication of Biodiversity, Air Quality, and Climate: Baseline Results From Monitoring in Washington, Oregon, and California. USDA. Forest Service, Pacific Northwest Research Station. General Technical Report PNW-GTR-737
- USFS. Understanding air pollutants and air pollution effects on lichens: A Pacific Northwest perspective. <http://gis.nacse.org/lichenair/?page=airpollution>