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Air Pollution: The Trees Aren't Lichen It

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Research in Forest Park

- Started in 1993, repeated in 2003 and this summer
- Vegetation (trees, shrubs and herbaceous plants) measured at 25 long-term study sites
- Results reveal high tree mortality, especially seedlings and saplings
- Seedlings planted at 9 additional sites have shown high mortality (0-75%)

Why High Mortality?

- Sapling mortality was not related to mammalian grazing, soil moisture, light, slope aspect or disease
- The site with the highest mortality is directly above the Saint John's Bridge
- Suggests air pollution as the cause

Hypothesis

- Forest soils in the Pacific Northwest are normally nutrient deficient
- Nitrogenous air pollution (from transportation and NW industrial activities) is changing the soil so that young trees do not thrive and/or survive
- We are using lichens to study air pollution levels
- Sites with higher air pollution levels (as indicated by lichens) will have greater sapling mortality

What is a Lichen?

- A mutualistic relationship between a fungal component (mycobiont) and an algal or photosynthetic bacterial component (photobiont)
- Many have nitrogen fixing cyanobacteria
- Are crucial parts of Northwest forest ecosystems
  - They are the primary source of nitrogen

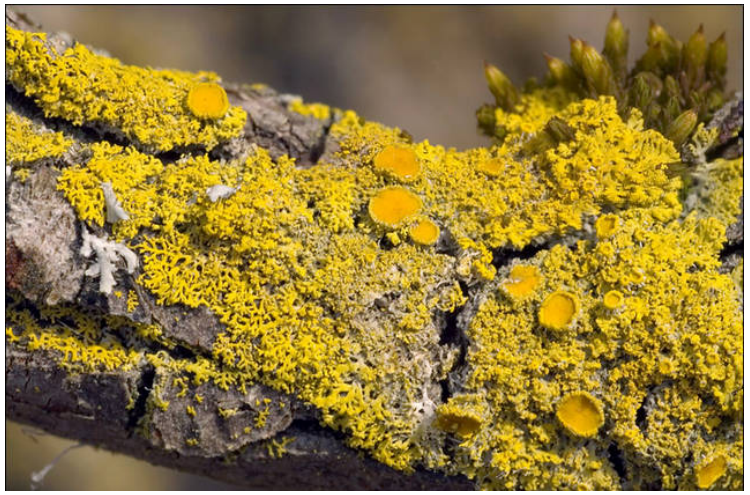
Lichens are Bioindicators

- Lichens lack a root system; absorb nutrients from the atmosphere
- US Forest Service is using lichen diversity and abundance to determine levels of nitrogenous air pollution in forests
- Many lichen species are intolerant of high levels of nitrogen (e.g., *Lobaria)*
  - Disappear from polluted forests
- Other species are nitrogen tolerant (e.g., *Platismatia*) or nitrogen loving (e.g., *Candelaria*)

Lichens

Lobaria

Platismatia



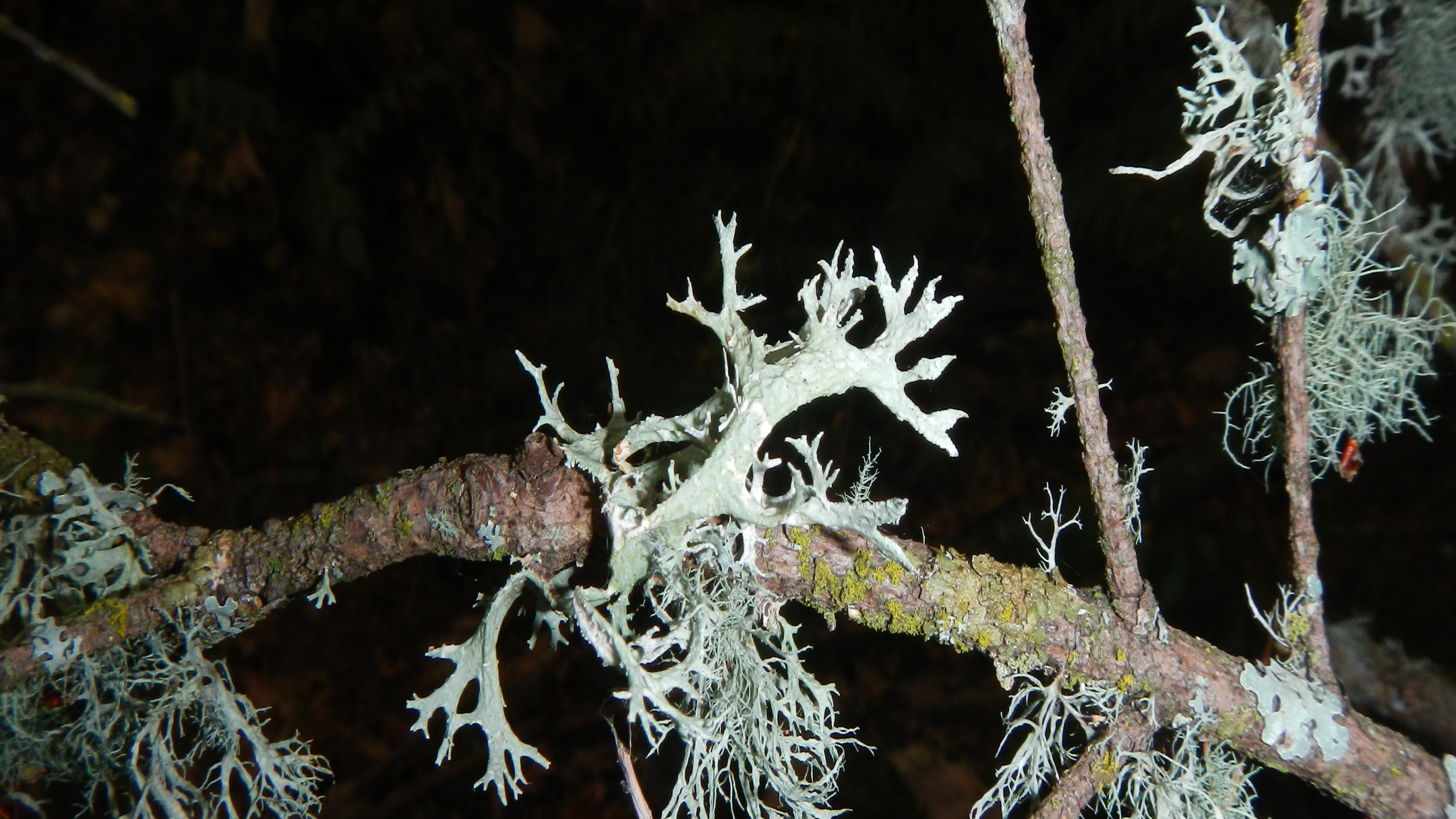
Candelaria

Goals of Our Study

- Conduct lichen surveys at 25 long-term research sites in Forest Park
- Use lichen abundance to determine nitrogenous air pollution levels at the sites; compare to N monitors (PSU study)
- Compare air pollution levels to tree, sapling and seedling survival at each site
- Produce a booklet that will allow people to easily identify urban lichens

Lichen Surveying Technique

- Each survey is centered in the long-term Forest Park study site
- Surveyors walk the area of a 120 foot radius circle looking for lichens
- We collect lichens for at least 30 minutes and no more than 2 hours
- We identify, categorize, and package each lichen
- Lichens are then returned to the laboratory for further inspection and identification



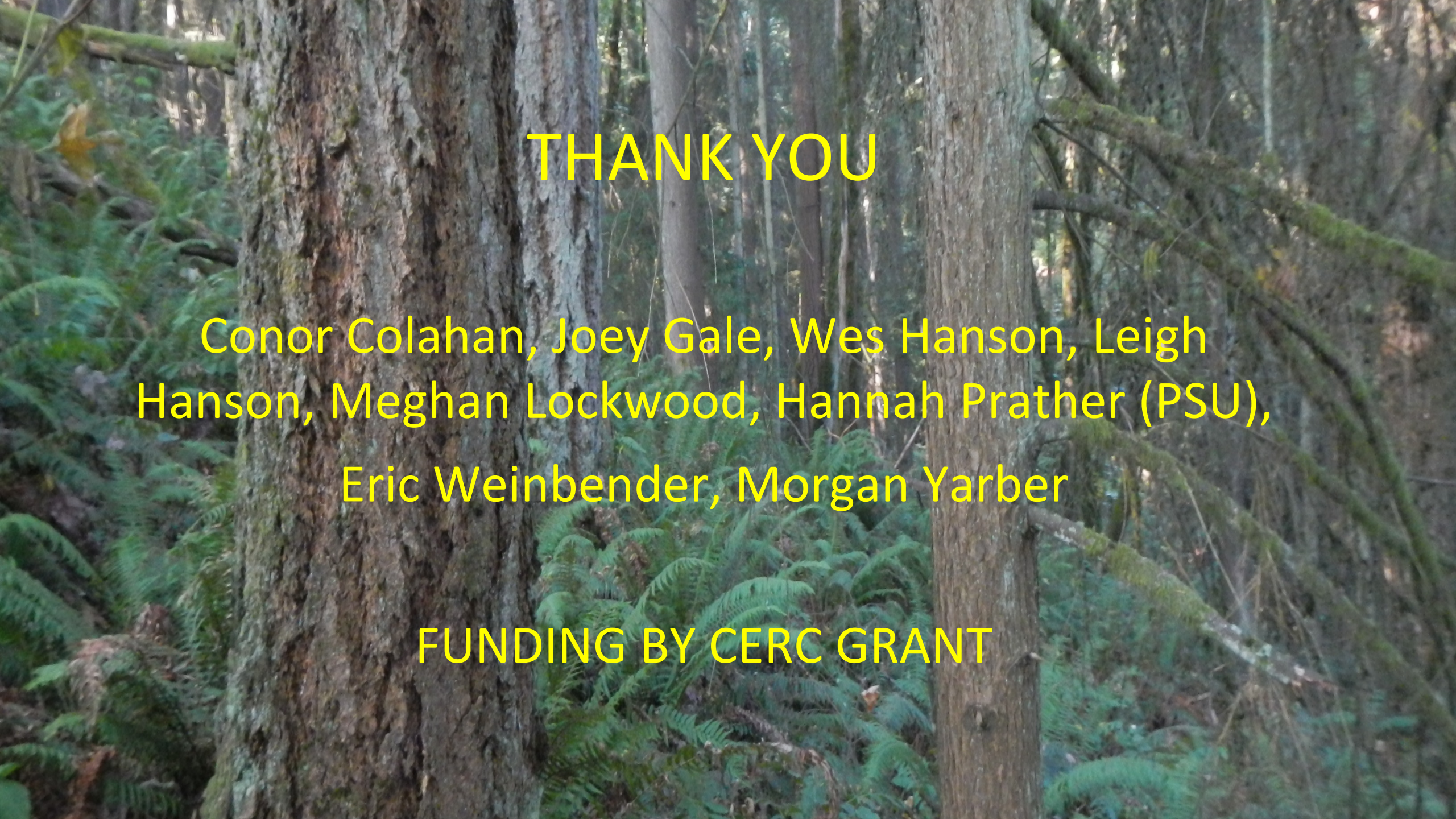
Lichen Booklet Sample

Evernia prunastri (Antler Perfume Lichen)

A relatively easy to identify lichen. The upper surface is a yellow-green color; the lower surface is white. Branches regularly (like deer antlers). Lobes are thin (7-13 cm long) and usually 1-5 mm wide.

Can be confused with *Ramalina*. The upper and lower surfaces of *Ramalina* are the same color, and the lobes of *Ramalina* do not branch as evenly as those of *Evernia*. *Ramalina* also feels dryer and more stiff to the touch than *Evernia*.

Fun fact: Pacific Northwest *Evernia prunastri* rebranch annually, meaning that its age can be determined by the number of branch points.



THANK YOU

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