The Nature Conservancy (TNC) study comparing old-growth associated lichens and bryophytes across experimental study areas at Ellsworth Creek Preserve in southwest Washington.

We are carrying out a study to : 1) identify multiple old-growth indicator lichens and bryophytes and 2) use those indicator species to quantify the degree to which restoration treatments have accelerated forest succession towards old-growth conditions. Previous studies have shown that restoration thinning can establish and enhance suitable habitat for a variety of old-growth indicator species, including lichens (Root et al., 2010). Furthermore, thinning techniques, such as variable-density thinning can help develop critical structural habitats in the lower canopy for indicator species of lichens and bryophytes (Marcot, 2018).

We propose to survey for key indicator non-vascular vegetation species and test whether our restoration treatments have led to an increase in their presence and/or abundance. We will also sample in the old-growth area at Ellsworth Creek to represent reference conditions.

To learn more or volunteer, please contact Old-growth Indicator Project coordinator Carl Baker carlbak22@gmail.com 206-427-7695

Old-Growth Forest Indicators Project

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Research Hypothesis

Forest management treatments (thinning) have led to an increase in indicator vegetation species that are associated with old-growth forests or mature forests.

Evaluating the effect of restoration treatments, such as forest thinning, is challenging because there is no single indicator to measure success. Therefore, we propose to 1) identify multiple old-growth indicator lichens, and bryophytes and 2) use those indicator species to quantify the degree to which restoration treatments have accelerated forest succession towards old-growth conditions. Previous studies have shown that restoration thinning can establish and enhance suitable habitat for a variety of old-growth indicator species, including lichens (Root et al., 2010). Furthermore, thinning techniques, such as variable-density thinning can help develop critical structural habitats in the lower canopy for indicator species of lichens and bryophytes (Marcot, 2018).

We propose to survey for key indicator non-vascular vegetation species and test whether our restoration treatments have led to an increase in their presence and/or abundance. Our survey plots will be focused on the North and Central experimental sub-basins to capture the differences between restoration ("Active") and no restoration ("Control") treatments (Figure 1). We will also sample in the old-growth area to represent reference conditions. Our initial surveys in the old-growth area found multiple old-growth or mature forest lichen and bryophyte indicator candidate species (Table 1).

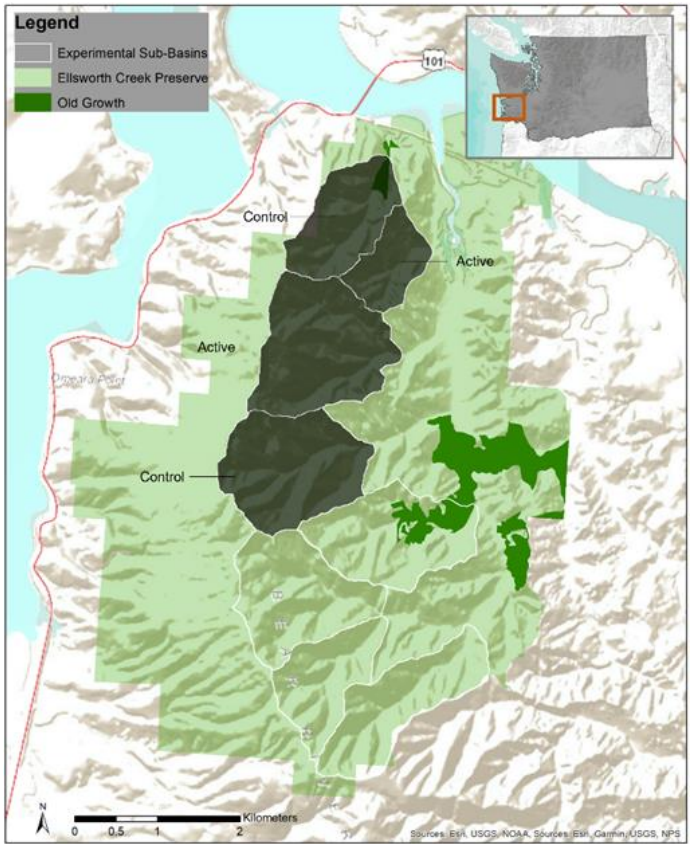

Figure 1. [insert figure title/legend]

The effect of forest restoration treatments on indicator non-vascular vegetation species is still relatively unknown. We aim to fill this critical knowledge gap and to inform future forest management at Ellsworth and other westside forests. Our information will also be useful for the US Fish and Wildlife Service's Willapa Bay Refugee and their restoration objectives.

Research Questions

1) What relevant old-growth indicator lichen and bryophyte species exist in the study area?
2) Are there differences in old-growth indicator lichen and bryophyte species presence and abundance between old-growth areas and Control and Active sub-basins?
3) In what way do these old-growth indicator species differ across treatments?
4) Have restoration treatments affected the presence and/or abundance of the old-growth indicator species?
5) Are there rare and/or threatened old-growth indicator non-vascular vegetation species or locally endemic species in the study areas?

Methodology

TNC will partner with academic, nonprofit, state, and federal collaborators to complete this project. We will team with volunteers and interns from organizations, such as Reed College, The Evergreen State College, University of Washington (UW) Herbarium, the Northwest Lichenologists, Washington Native Plant Society, and independent botanists. Leveraging these partnerships, we propose to sample 30 survey plots from May 2023 to September 2024 in the old-growth areas and Control and Active sub-basins. Old-growth indicator non-vascular vegetation species will be identified in conjunction with iNaturalist and other expert identifiers. A limited number of voucher species will be collected for submission to the UW Herbarium and will conform to TNC and UW Herbarium guidelines.

Old-growth indicator vegetation species survey methods will be adapted from the USDA Forest Service Forest Health Monitoring Program (Mangold, 2000). In addition to identifying old-growth indicator lichen and bryophyte species at each survey plot, we will also take GPS locations and photographs of each specimen. These photos will be uploaded to iNaturalist and we will consult with independent experts to verify identifications.

Table 1. Old-Growth Indicator Candidates

Scientific Name	Type
Alectoria sarmentosa	Lichen
Bryoria sp.	Lichen
Cladonia norvegica	Lichen
Hypogymnia oceanica	Lichen
Lobaria oregana	Lichen
Lobaria scrobiculata	Lichen
Platismatia norvegica	Lichen
Pseudocyphellaria citrina	Lichen
Pseudocyphellaria rainierenis	Lichen
Sphaerophorus tuckermanii (globosus)	Lichen
Sphaerophorus venerabilis (globosus)	Lichen
Usnea longissima	Lichen
Pseudocyphellaria hawaiiensis	Lichen
Lobaria anomala	Lichen
Bryoria bicolor	Lichen
Peltigera britannica	Lichen
Hypotrachyna afrorevoluta	Lichen
Usnea diplotypus	Lichen
Usnea subgracilis	Lichen
Usnea silesiaca Motyka	Lichen
Conocephalum conicum	Liverwort
Diplophyllum albicans	Liverwort
Pellia neesiana	Liverwort
Scapania bolanderi	Liverwort
Antitrichia curtipendula	Moss
Buxbaumia piperi	Moss
Dicranum fuscescens	Moss
Hylocomium splendens	Moss
Hypnum circinale	Moss
Plagiomnium insigne	Moss
Buckiella undulata	Moss
Rhizomnium glabrescens	Moss
Rhytidiadelphus loreus	Moss