

Characterization of biological diversity within old-growth refugia and managed forests in the Willapa Hills, WA

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Background

Over the last century, coniferous forests within the Willapa Hills of Washington have been extensively managed for timber production; today, less than 1% of the original old-growth forests remain. A diverse range of compositional and structural diversity amongst these remnants is recognized, but it has never been documented. The Nature Conservancy's recent conservation efforts in the Willapa Hills have focused on landscape scale forest restoration of young, managed ("regrowth") lowland coniferous forests. A pivotal question for restoration, however, concerns the role old-growth forest remnants play in supporting biological diversity across the existing young-managed forest landscape. In order to better define restoration goals, managers need a clearer understanding of the range of conditions found in unmanaged forests throughout the Willapa Hills. To fill this information gap, The Nature Conservancy initiated a study to document and compare vegetation, canopy lichen, and arthropod communities of old-growth forest patches and 35-70 year-old regrowth stands located within the Willapa Bay watershed.



Does forest structure, biomass, and species diversity differ between old-growth and regrowth forests in the Willapa Hills?

Arthropods



Collecting Methods

Ground Surveys

- Sampled 4 old-growth stands representing a range of forest types (eg., Cedar/hemlock upland, Sitka spruce floodplain terrace)
- Sampled 4 regrowth stands (selected similarly to the process described for vegetation surveys)
- Set 5 randomly placed pitfall traps at each site
- Gathered material for Berlese extraction



Canopy Surveys

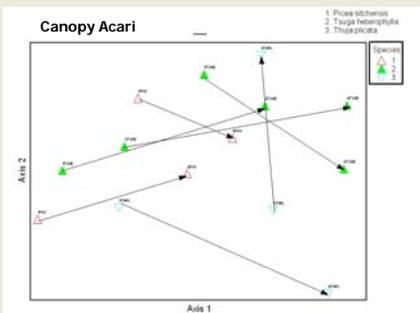
- Sampled 3 old-growth and 3 regrowth stands
- Climbed 2-3 trees in each stand
- Collected canopy material for Berlese extraction

Processing and Identification

The contents of the Berlese and pitfall traps were brought to Oregon State University where the samples were sorted and identified to Order (several groups were identified to genus or species). Arthropods were then pinned or preserved in 70% ethanol for long term storage at OSU's Arthropod Museum. All Berlese materials were dried and weighed to the nearest .1 gram.

Preliminary Results

Canopy Acari



- Acari (mites) only group where significant differences detected (NOTE: other groups may lack taxonomic resolution to effectively detect differences).
- Higher richness and diversity of mites in snag habitat of older forests than in regrowth forests (richness: $p < 0.04$; diversity: $p < 0.03$).
- Higher richness of canopy mites (per gram of collected material) from canopies of old trees than collected from canopies regrowth trees ($p < 0.02$).
- Acari ordination illustrates a separation of mite community assemblages between old-growth tree canopies and regrowth tree canopies. Among study pairs, mite communities in old-growth trees generally align to the left side of Axis 1 and communities in regrowth trees align to the right side of Axis 1.

Vegetation

Sampling Methods

Eleven old-growth sites were surveyed within the Willapa Bay watershed. All remnant old-growth forest patches remaining in the Willapa Hills were sampled. These forests represent a range of types, including Cedar/hemlock upland, Douglas-fir upland, and Sitka spruce floodplain terrace. For each old-growth stand, a young regrowth stand with similar topographic position, historic species composition, and geographic proximity, was selected for a paired comparison. Forest vegetation was sampled using four randomly selected 0.1 ha circular plots. In each plot four 0.002 ha subplots were located in each cardinal direction, 9m from plot center.

Measurements in the full plot included:

- Live trees
- Snags
- Large woody debris and stumps
- Tree heights (subsample)
- Dwarf mistletoe ratings (subsample)



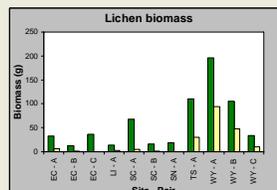
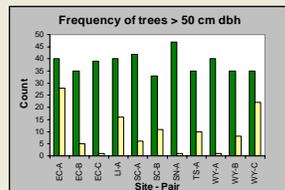
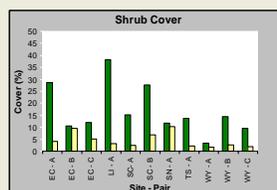
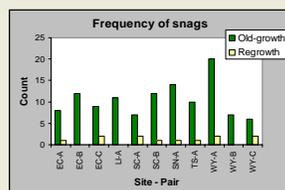
Measurements in the subplot included:

- Name and % cover of all non-tree species
- Seedling and sapling tally
- Percent cover of all major lifeforms (e.g., shrubs, herbs, moss)
- Average height of 4 major lifeforms
- Percent cover of major ground cover
- Percent overstory canopy cover
- Canopy macrolichen litter collection (methods followed McCune 1994)



All lichens were transported to Oregon State University where they were sorted, dried, and weighed.

Preliminary Results



- Trees greater than 50 cm diameter at breast height and snags (all diameters) are much more common in old-growth forests than regrowth.
- Old-growth forests have a much higher abundance of shrubs. Other lifeforms do not appear to exhibit strong differentiation between forest types
- Canopy lichen biomass is greater in the old-growth forests than in the regrowth.

Preliminary results indicate that the structure of old-growth forests in the Willapa Hills is more complex than that found in regrowth forests. Statistical tests have not yet been performed. Preliminary results based only on visual assessment of trends in graphs.

Conclusion and Continuing Work

Prior to this study, little empirical information existed on old-growth forests of the Willapa Hills to guide management and restoration activities in surrounding regrowth forests. The Nature Conservancy has only just begun to analyze the data collected over the past few years. Preliminary results suggest that old-growth forests in the Willapa Hills are more structurally diverse and possess a greater biomass and diversity of some organisms, such as shrubs, lichens, and mites, than surrounding regrowth forests. However, these differences are much stronger for some structures and organisms than others. Future data analysis will explore the trends detected in preliminary analyses in more depth and assess how species diversity and biomass relate to forest structure. This information will help managers in this region to better understand how management or restoration of certain forest structures and habitat features in regrowth forests may help to achieve ecological composition and function similar to the range of conditions found in late-seral forests.



Hundreds of specimens await further identification

Acknowledgements

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Reference

McCune, B. 1994. Using epiphyte litter to estimate epiphyte biomass. *Bryologist* 97:396-401.

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