



# Bryophyte community ecology in Olympic rainforests: The importance of structural diversity

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Carrie L. Woods

cwoods@pugetsound.edu, [University of Puget Sound](#)





**World  
Biosphere  
Reserve**



**Temperate  
rainforest**

<3 % of Earth's  
surface



**Wettest place in  
contiguous US**

>150 inches of rain  
per year



**Bryophytes  
cover every  
surface**


# Hoh Rainforest





[Hall of mosses by porbital on DeviantArt](#)



A photograph of a dense forest where every surface is covered in vibrant green moss. A paved path leads through the trees, and a large, moss-covered tree trunk is prominent on the right. In the distance, two people can be seen walking on the path.

First went to Olympic rainforests in 2015...

Community Ecologist

- Patterns in species distributions
- Variations in where species are found

I made two observations

- Bryophyte species on the trunk and branch were different
- Not all nurse logs were created equal

Research to date focused on other facets of systems



# Habitat Heterogeneity Hypothesis

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- Species are specialized to particular niches
  - Topography and substrate
  - Light
  - Temperature and relative humidity
- Greater variation in environment leads to greater diversity

Does variation in the **tree canopies** and the **forest floor** influence bryophyte distributions?





# Epiphytic Bryophytes?

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- Epiphytes
  - Structurally-dependent plants
  - Non-parasitic
  - Habitat, diversity, ecosystem function
- Bryophytes
  - Non-vascular (no true roots, stems, leaves)
  - Poikilohydric
  - 20,000 species (second to Angiosperms)



My picture!

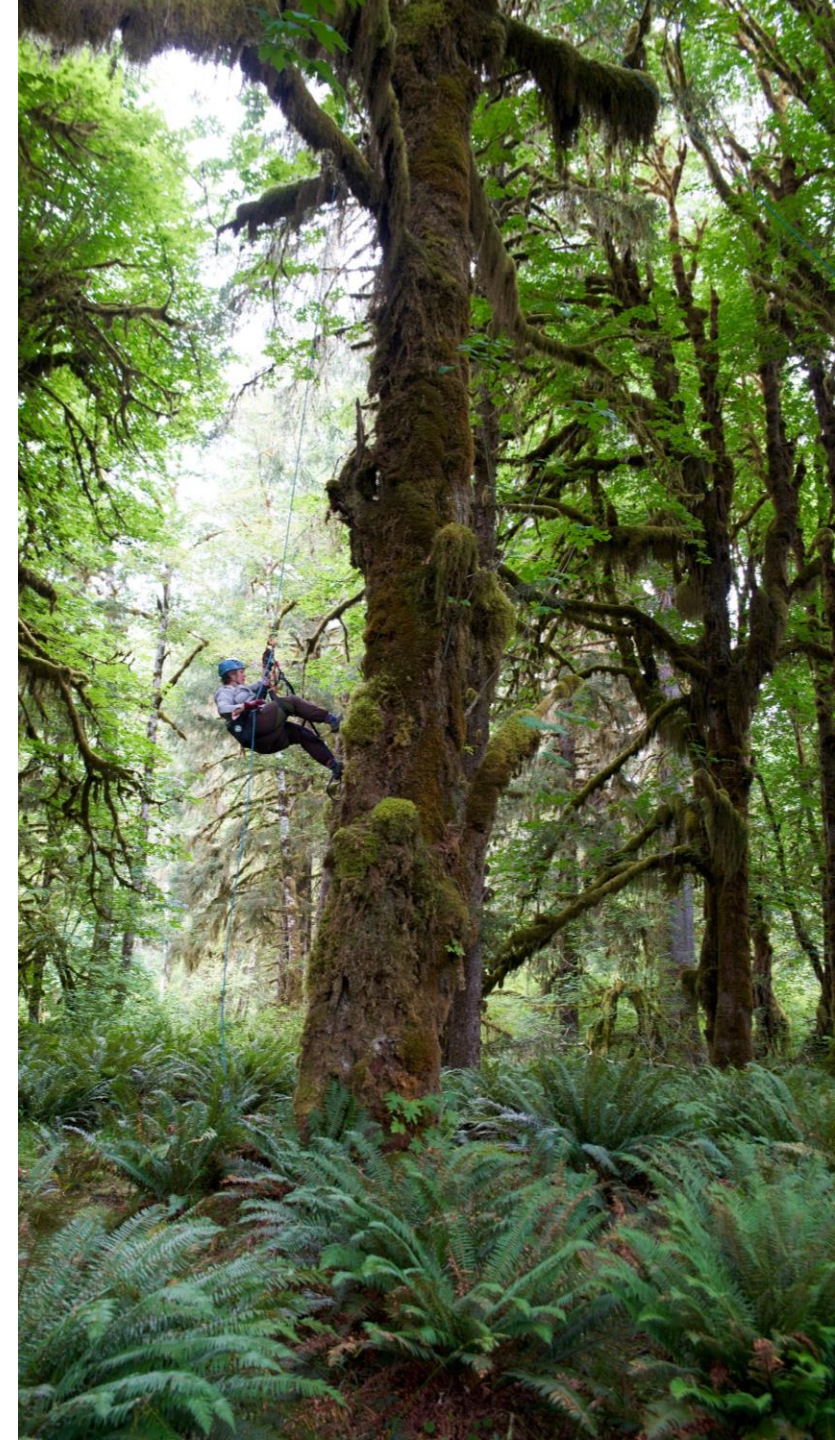
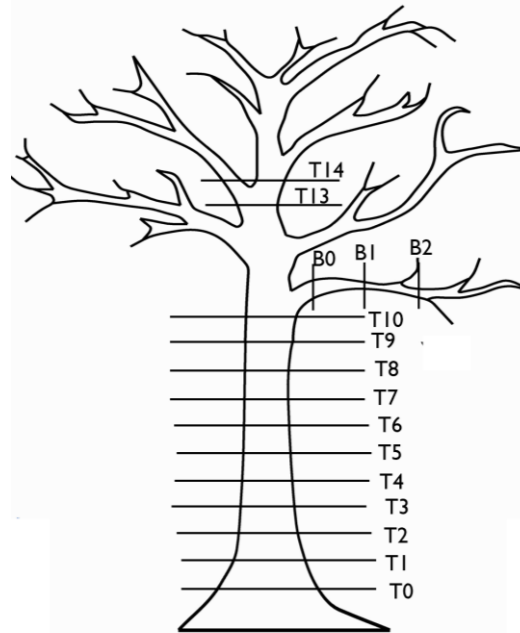


# Surveyed Epiphytic Bryophytes

- Climbed three large *Acer macrophyllum* trees
- Surveyed epiphytes
  - every meter along trunk to 14-16 m
  - Every meter along branch to 3 m
    - 576 total surveys
- Considered structural features

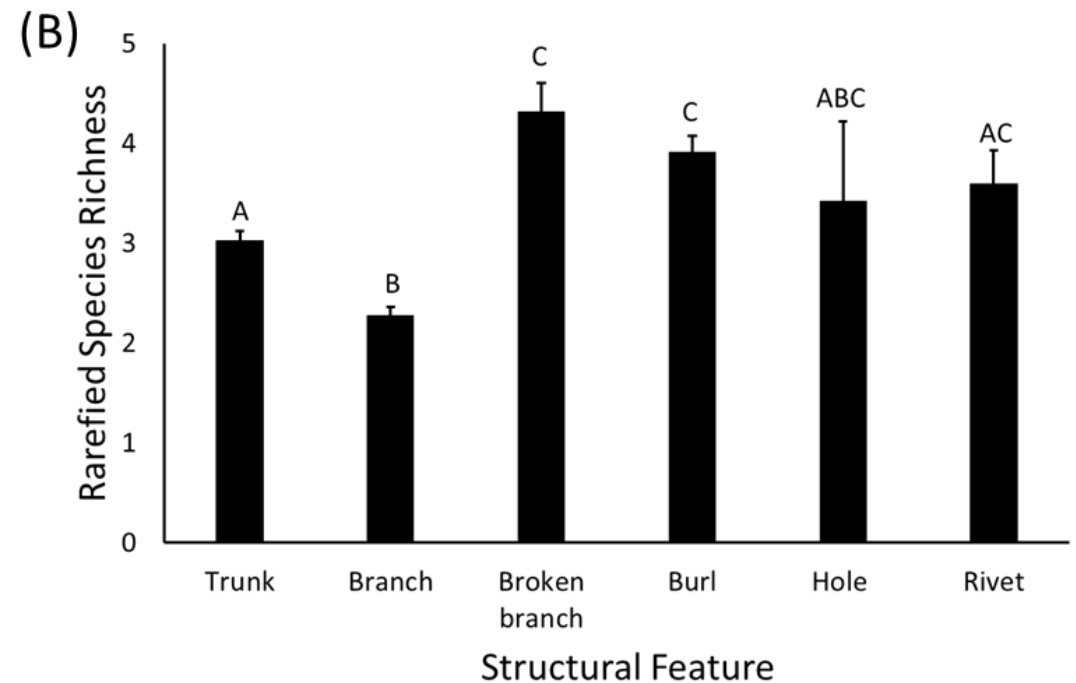
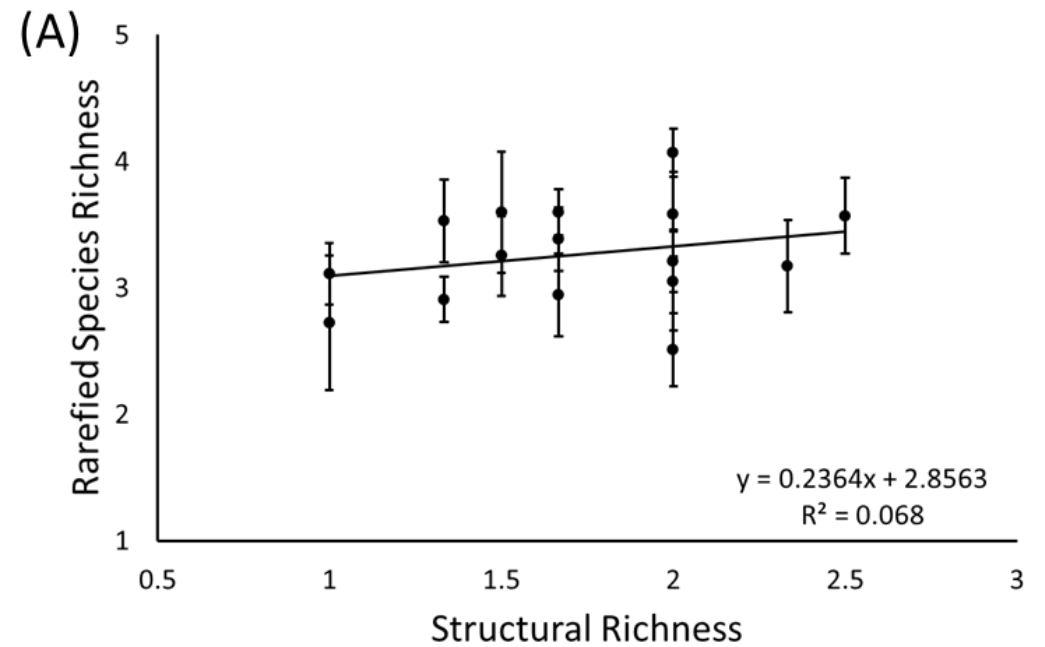


Kaela Hamilton



# Species richness patterns

- 22 species observed
  - 16 mosses, 3 liverworts, 1 lichen, 1 lycophyte and 1 fern
- Relationship between structural richness (e.g., burls, broken branch) and species richness
- More species found in structural features on trunk than trunk or branches





# Habitat Specialization: Trunk



*Selaginella oregana*  
Lycophyte



*Metaneckera menziesii*



*Isothecium myosuroides*



*Leucolepis acanthoneuron*

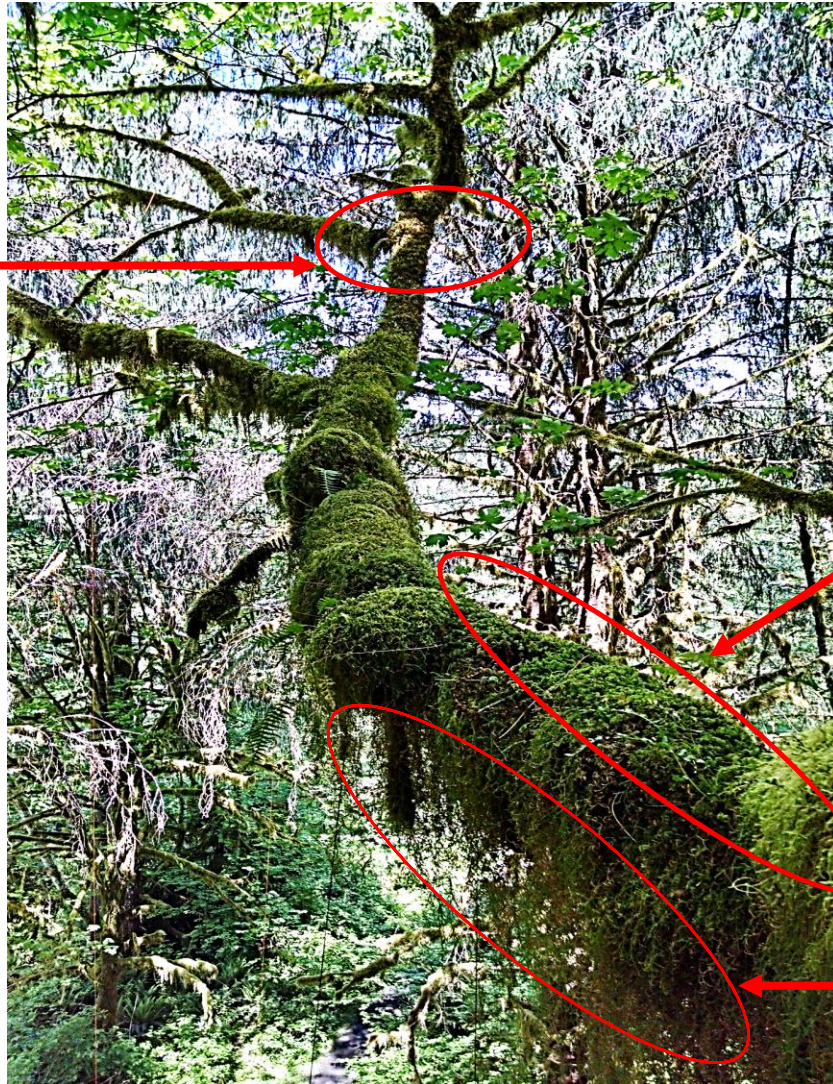




# Habitat Specialization: Branches



*Neckera douglasii*



*Rhytidiadelphus loreus*



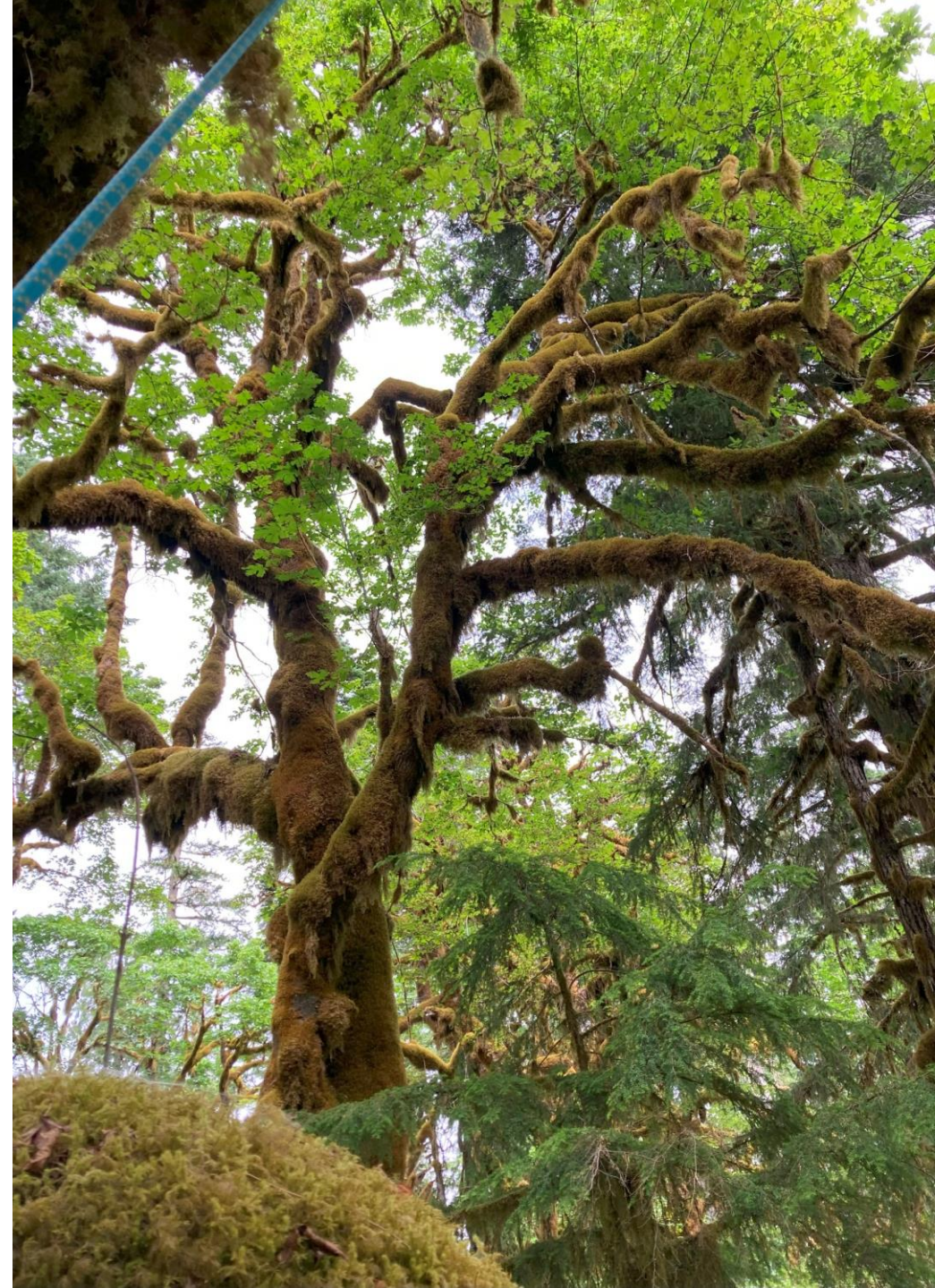
*Selaginella oregana*  
Lycophyte



# Habitat Heterogeneity Hypothesis

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Structural heterogeneity  
in tree canopies influence  
bryophyte distributions  
and diversity





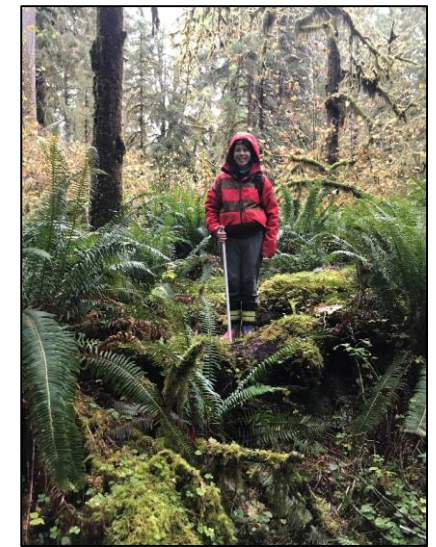
# Nurse log bryophyte surveys

In 166 plots (1 m<sup>2</sup>):

- Bryophyte community composition
- Tree seedling density
  - Western hemlock and Sitka spruce
- % canopy cover
- Bryophyte depth
- Decay class (kick test)



Katy Maleta



Kimmy Ortmann



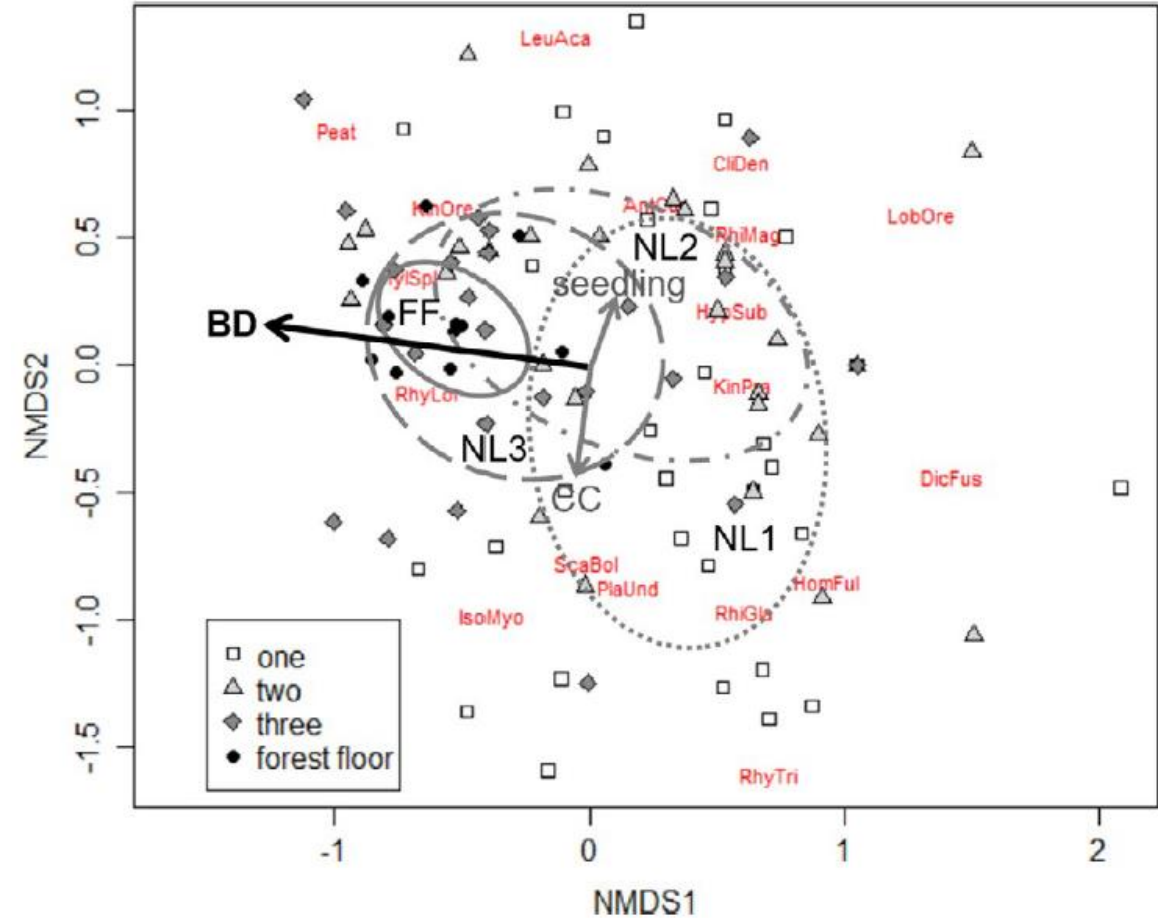
Spherical densiometer  
(% canopy openness)





# Nurse logs support unique bryophytes

- On nurse logs, we found a total of 18 different nonvascular species
  - 16 mosses, 1 liverwort, 1 lichen
- We found only 6 different bryophyte species on the forest floor





# Bryophyte community changes with nurse log decay

- Young logs were dominated by short bryophytes
  - Fan moss (*Rhizomnium glabrescens*)
  - Wavy-leaved cotton moss (*Plagiothecium undulatum*)
- Older logs were dominated by tall bryophytes
  - Step moss (*Hylocomium splendens*)
  - Lanky moss (*Rhytidiadelphus loreus*)



*Rhizomnium glabrescens*



*Plagiothecium undulatum*



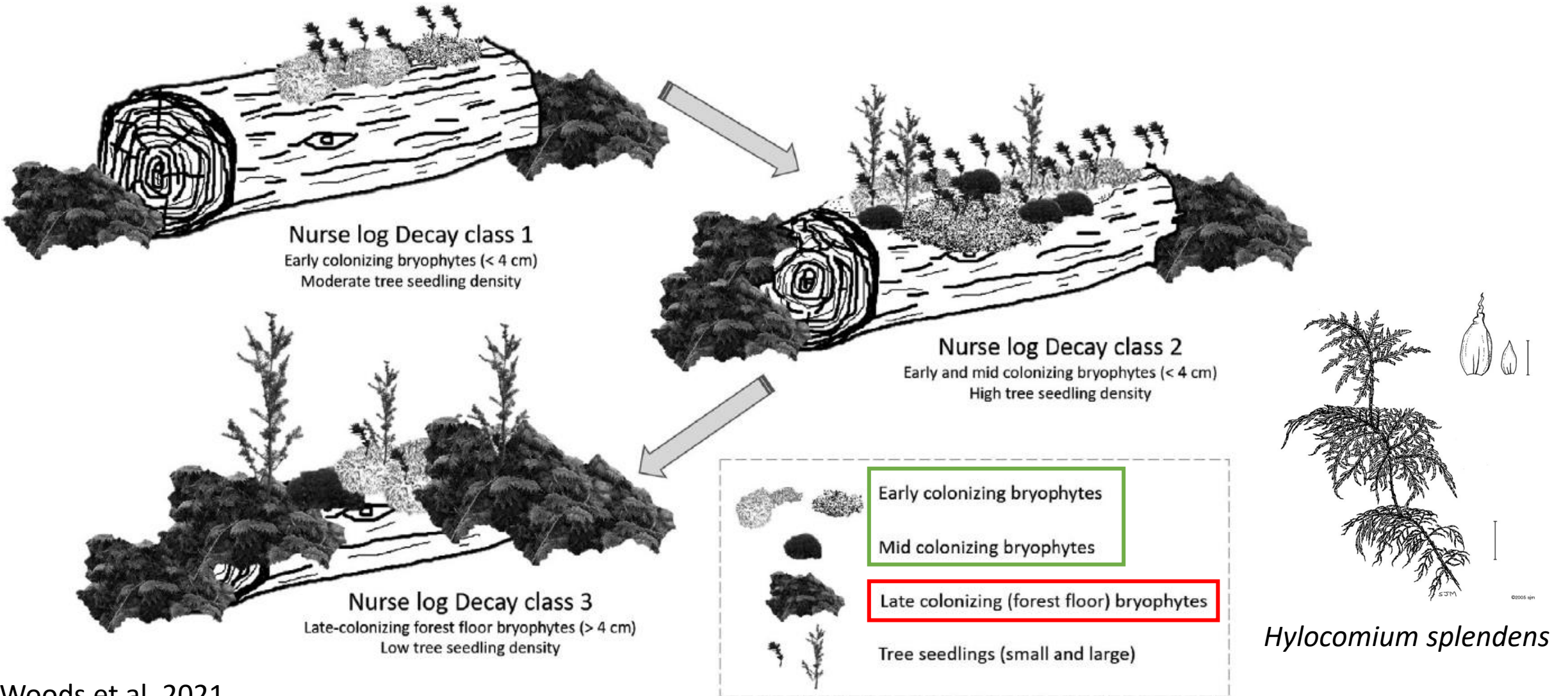
*Hylocomium splendens*



*Rhytidiadelphus loreus*



# Conceptual model of bryophyte succession on nurse logs





# Habitat Heterogeneity Hypothesis

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Structural heterogeneity  
on the forest floor  
influences bryophyte  
distributions and  
diversity





A lush forest scene with moss-covered trees and a path. The trees are heavily covered in vibrant green moss, and a path winds through the forest. The overall atmosphere is dense and verdant.

# Structural Variation Matters!





UNIVERSITY of  
**PUGET  
SOUND**



Thanks to so many!

