Plant assemblages in zero-order basins

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Introduction

Zero-order basins are contributors to 1st-order systems, including all drainage areas above **sustained** scour and deposition (**Figure 1**, **Figure 2**).

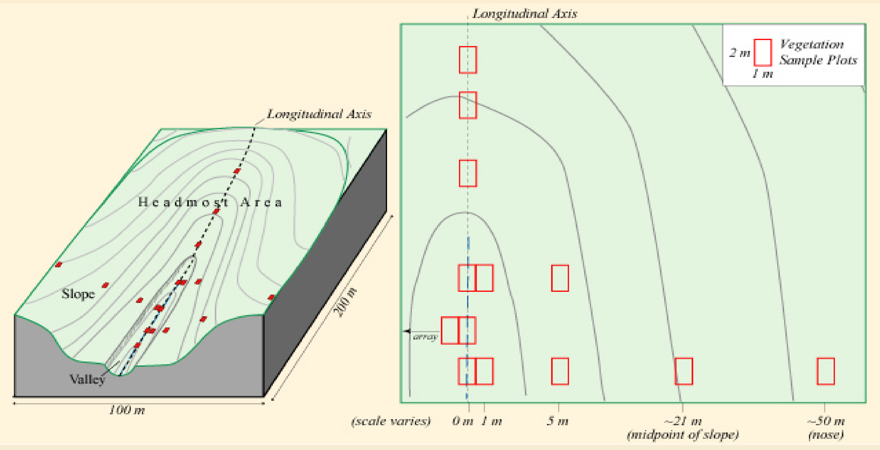

Figure 1. Zero-order basin geomorphology and plot set-up.

Zero-order basins constitute a significant proportion of steep forested landscapes in the Northwest (Benda 1990), but their plant communities have not been described. This study was designed to provide **baseline** information about zero-order basin **plant assemblages**. Specifically, the study sought to:

1. Identify plant species and vegetation types in these basins, including riparian species and types.
2. Characterize environmental conditions associated with vegetation types.
3. Identify plants associated with specific geomorphic surfaces, and with the lateral zones nested within them.

Figure 2. Zero-order basins.

Methods

Study sites included **63** unmanaged zero-order basins in headwater areas of the Coquille River Basin, in lands administered by the BLM (**Figure 3**). Plant cover and environmental conditions were sampled in 17 plots per basin, **stratified** by geomorphic surface and lateral zone (**Figure 1**).

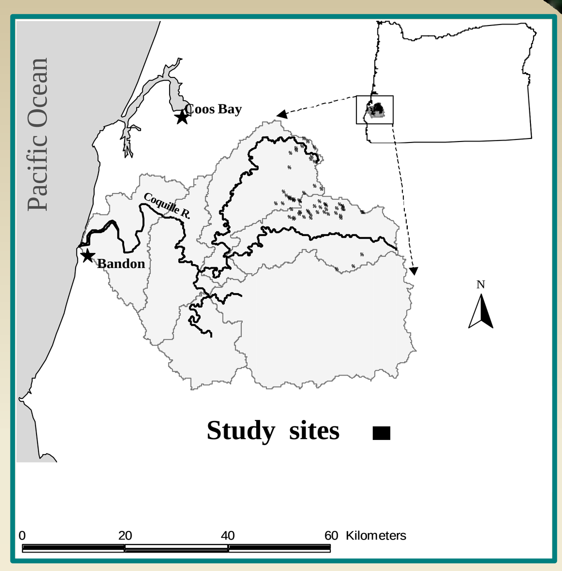

Figure 3. Study area and study sites.

I quantified plant species **richness** and **diversity** using metrics developed by Hill (1973). I developed plant **vegetation types** using hierarchical cluster analysis (McCune and Mefford 1997). For each vegetation type, I calculated means for **environmental parameters,** and **percent cover** in each geomorphic/ lateral zone.

I identified plant **species assemblages** associated with **geomorphic surfaces**, and **lateral zones** within these surfaces, using indicator species analysis (**ISA**: Dufrene and Legendre 1997). I assigned species to the geomorphic/lateral zone they were best indicators for, considering only species whose **maximum indicator values** were significant (p<0.05).

Results

I identified 138 plant species in unmanaged zero-order basins. Plant species richness was highest in areas 5 m from basin center: diversity was highest within 1 m of center (**Figure 4**).

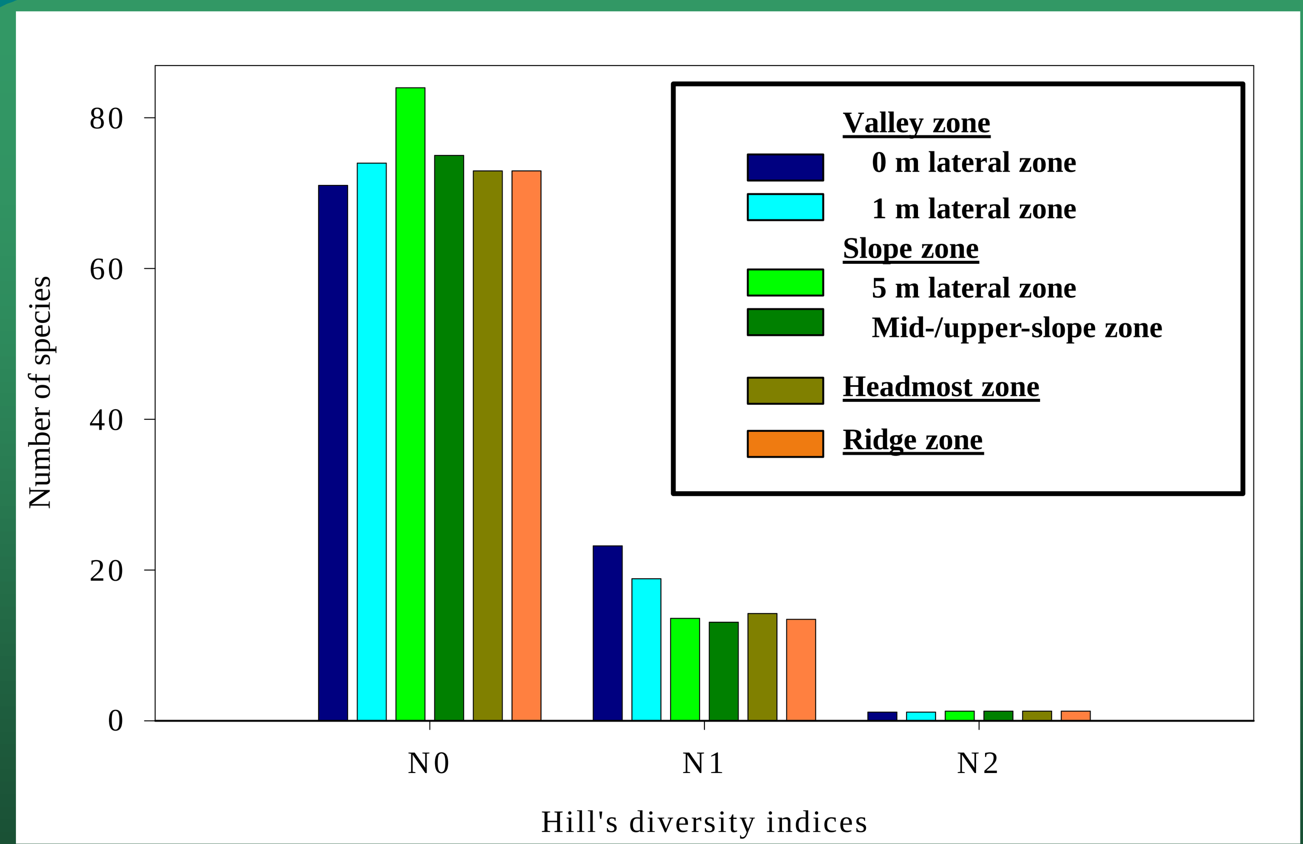

Figure 4. Species richness and diversity (Hill 1973), produced using plant plot data corrected for unequal sample size, averaged for each of 6 lateral zones. N0 is species richness, N1 is exp(-Shannon's Index), N2 is 1/(Simpson's Index).

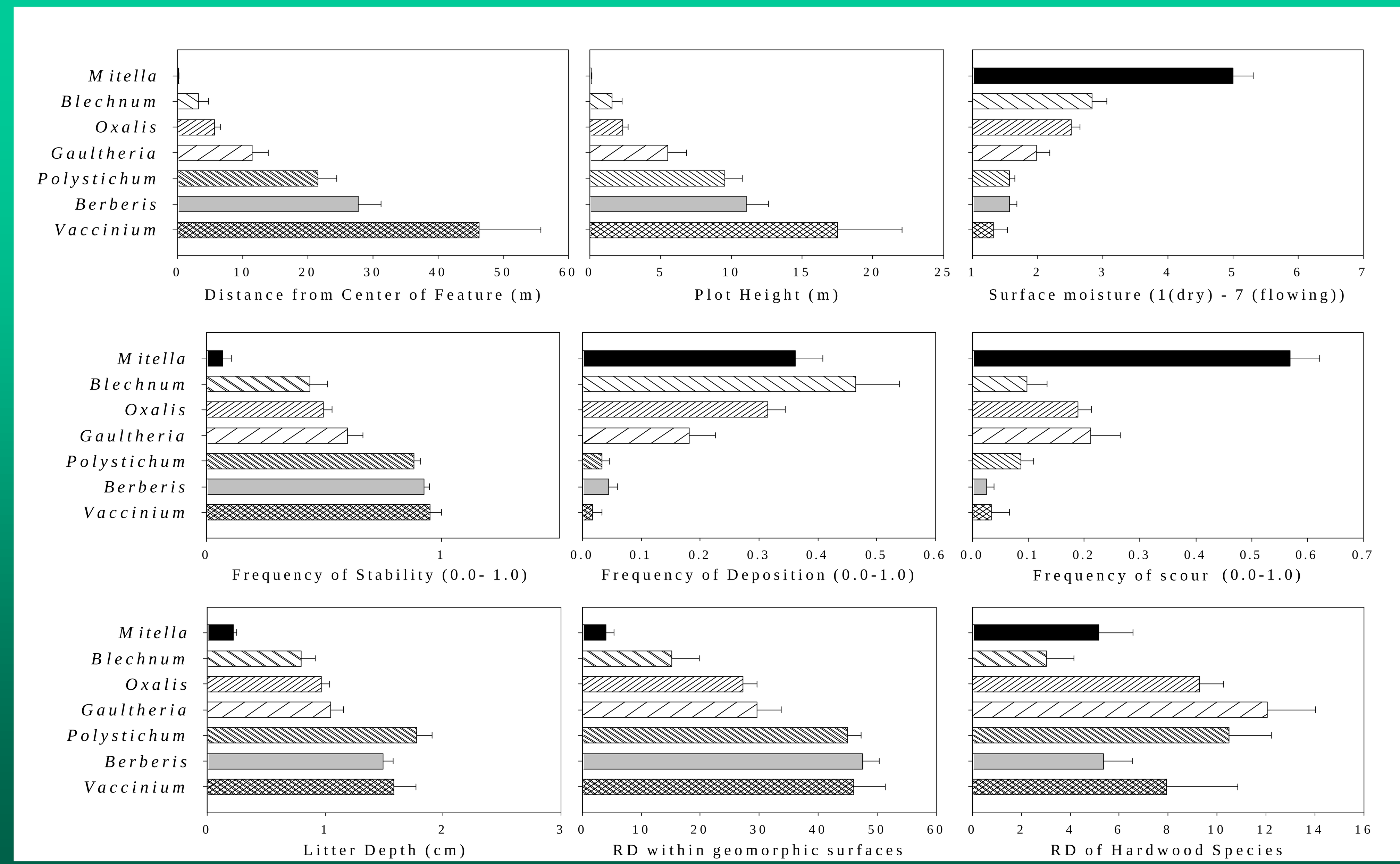

Figure 6. Averages of nine environmental variables (with 1 SE) for seven vegetation types, ordered by distance from center.

Seven vegetation types were identified in zero-order basins. The *Mitella* and *Blechnum* types were associated with fluvial (0 m) and splash zone (1 m) conditions in valleys (**Figure 5**). These types had the highest surface moistures and lowest overstory densities and litter depths, occurring in scour and deposition areas, respectively (**Figure 6**). The *Oxalis*, *Gaultheria* and *Polystichum* vegetation types were more widespread. These types were intermediate in most measured environmental parameters. The *Berberis* and *Vaccinium* vegetation types occurred in dry, stable upper slope and ridge geomorphic surfaces.

Fluvial (0 m) and splash zone (1 m) areas in **valleys** supported the highest number of significant indicator species (**Table 1**), predominantly **riparian** plant species. Headmost surfaces supported only one (upland) significant indicator species. All significant indicator species for slope geomorphic surfaces were associated solely with the **5 m** lateral zone; mid- and upper slope surfaces were dominated by generalists.

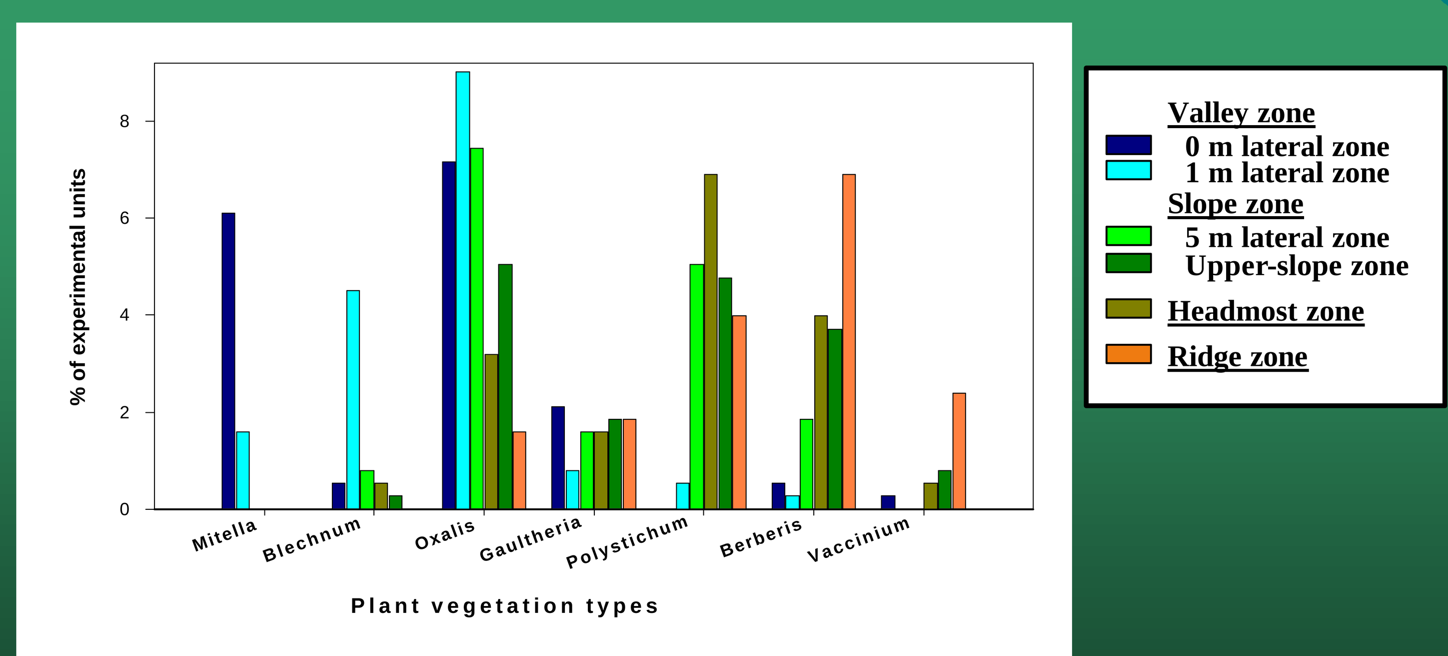

Figure 5. Percent of experimental units (plots averaged for each lateral zone) supporting particular plant vegetation types, for each geomorphic and lateral zone. Vegetation types named using the genus name of the species with the highest maximum indicator value for that type.

Table 1. Indicator species analysis for geomorphic surfaces and lateral zones. Only species with maximum indicator values significantly higher than random expectation ($p \leq 0.05$) shown. "Maximum indicator" is the percent of perfect indication (0-100) of a species for the zone it is most associated with. "Total species" is the total number of species associated with each zone. N=377.

Zone / Species	Maximum Indicator Value	p<	Total species
Valley zones			
0 m lateral zone			*33*
Mitella ovalis	35.3	0.001	
Mimulus dentatus	19.1	0.001	
Tolmiea menziesii	17.7	0.001	
Rubus spectabilis	10.8	0.017	
1 m lateral zone			**20**
Blechnum spicant	30	0.001	
Athyrium filix-femina	23.4	0.001	
Oxalis oregana	23.1	0.001	
Streptopus amplexifolius	17.1	0.001	
Tiarella trifoliata var. trifoliata	11.3	0.007	
Slope zones			
5 m lateral zone			**16**
Polystichum munitum	22.5	0.001	
Trillium ovatum	12.2	0.002	
Dicentra formosa	11.6	0.004	
Mid/ Upper slope zone			**10**
None			
Headmost zones			**14**
Trientalis latifolia	9	0.001	
Ridge zones			**18**
Berberis nervosa	29.3	0.001	
Vaccinium ovatum	12	0.004	

Conclusions

- Zero-order basins supported two riparian plant vegetation types and 9 significant indicator species for fluvial and splash zone habitats. Riparian species were most common in valley and lower slope surfaces, following fluvial and substrate gradients.
- Valleys, slope areas < 5 m from center (**inner gorges**), and ridge geomorphic surfaces supported distinct plant assemblages. Upper slope and headmost surfaces supported generalist species.
- **Management** should consider the importance of zero-order basin valleys and inner gorges in supporting plant diversity and distinct plant assemblages in forested landscapes.

Citations

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