

# Moth Abundance and Diversity in Intensively Managed Early-seral Forests of Oregon

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# Role of Herbicides

Post harvest = abundant early seral competition



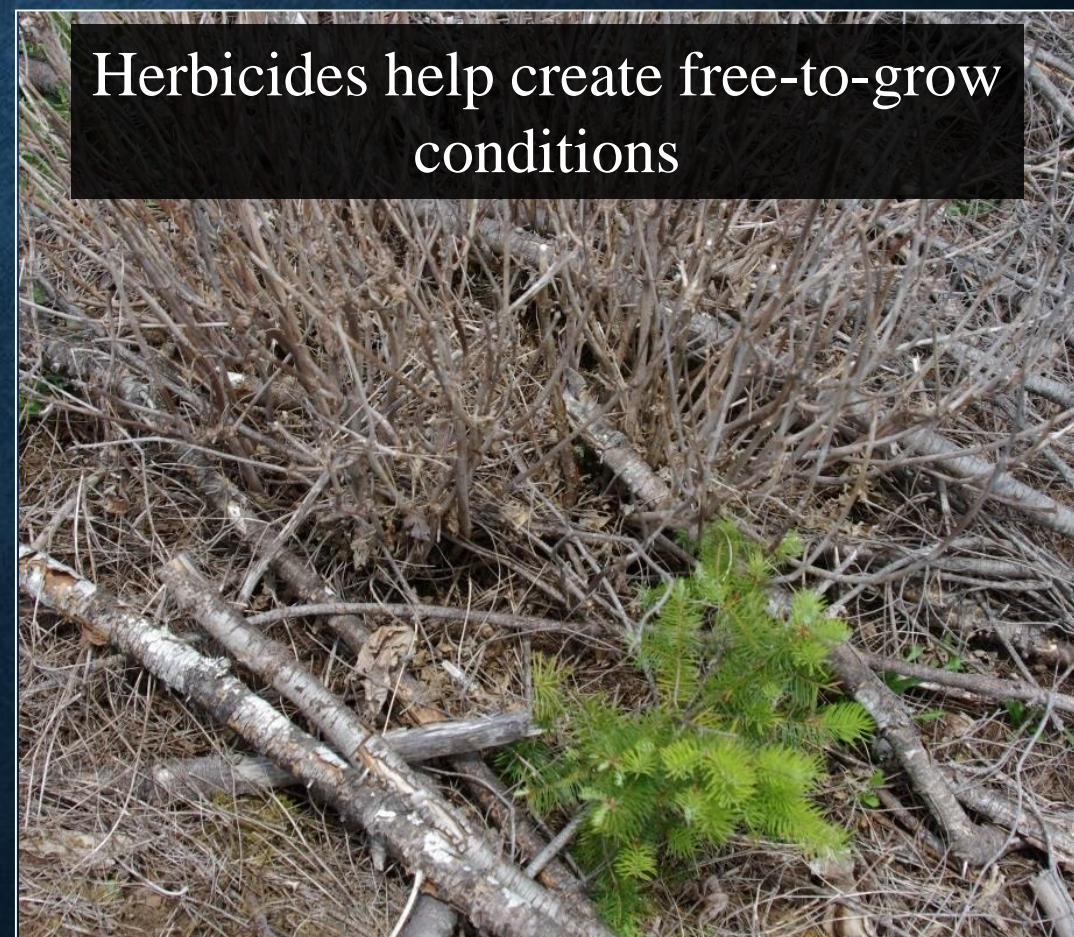
Reduced seedling growth with competition for water and light



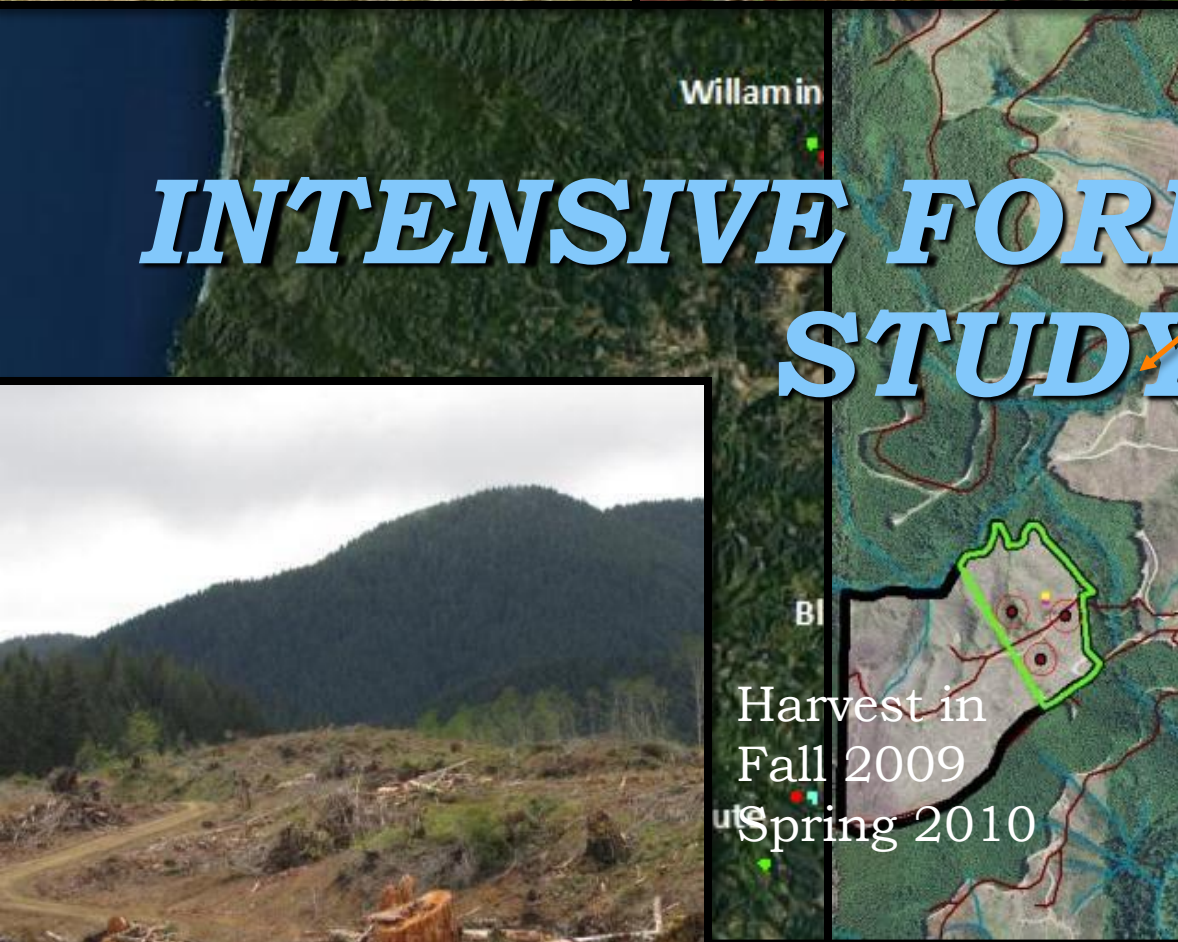
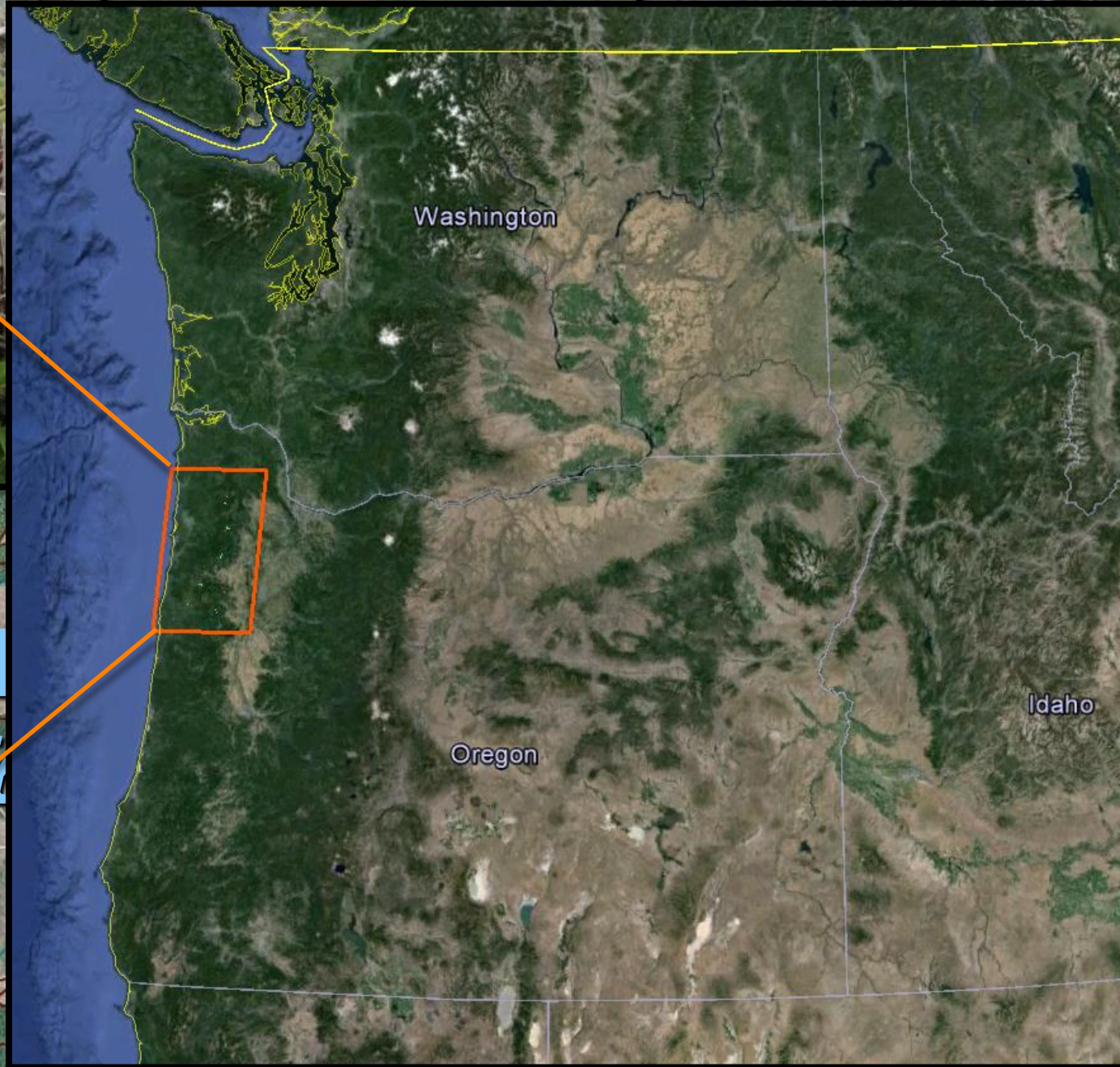
Silvicultural herbicides target competitors



Herbicides help create free-to-grow conditions







# *INTENSIVE FOREST STUDY*

## IFM Study Area



# IFM Study Major Topics

- Avian occupancy, abundance, and diversity
- Avian demography
- Ungulate browse
- Vegetation community composition
- Moth community composition, abundance, and diversity
- Food webs and top-down pressure by birds
- Tree growth, survival and trade-offs



# Why Moths?

- Represent substantial biodiversity in the Pacific Northwest with greater than 2000 species known in Oregon
- Play a key role in food web dynamics as prey for arthropod and vertebrate predators
- Large effect on pollination and herbivory
- Many moth larvae feed exclusively on a single taxonomic group of plants
- Thus moth species diversity is often representative of functional diversity especially in forested systems
- Most species are also sensitive to changes in moisture and temperature which are affected by forest management



# Context:

## Butterflies and Moths at the H.J. Andrews Experimental Forest

564 species

### Larval Foodplant

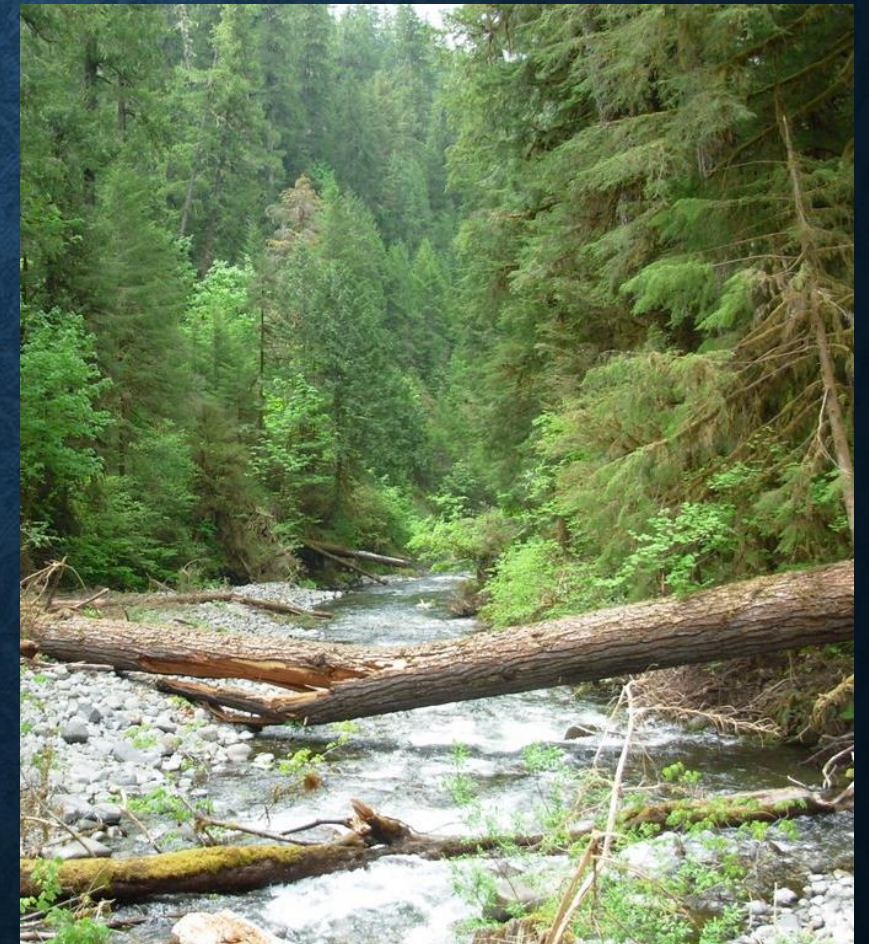
conifers                      56 species      (10%)

flowering plants          508 species    (90%)

### Habitat

forest                        412 species    (73%)

meadow                     152 species    (27%)





# Objectives

Determine the effect of management intensity treatments on:

- Moth abundance/biomass and species richness
- Moth community composition
- Plant specialist moth abundance by group (broadleaf, forb, conifer feeders)





# Moth Trapping



Black light traps placed 3 per stand near point count locations





## Moth Trapping and Taxonomy



- 32 stands; 3 traps/stand
- Sampled once monthly, May - August
- 2560 trap nights over 2 years
- Avoided full moon and rainy conditions

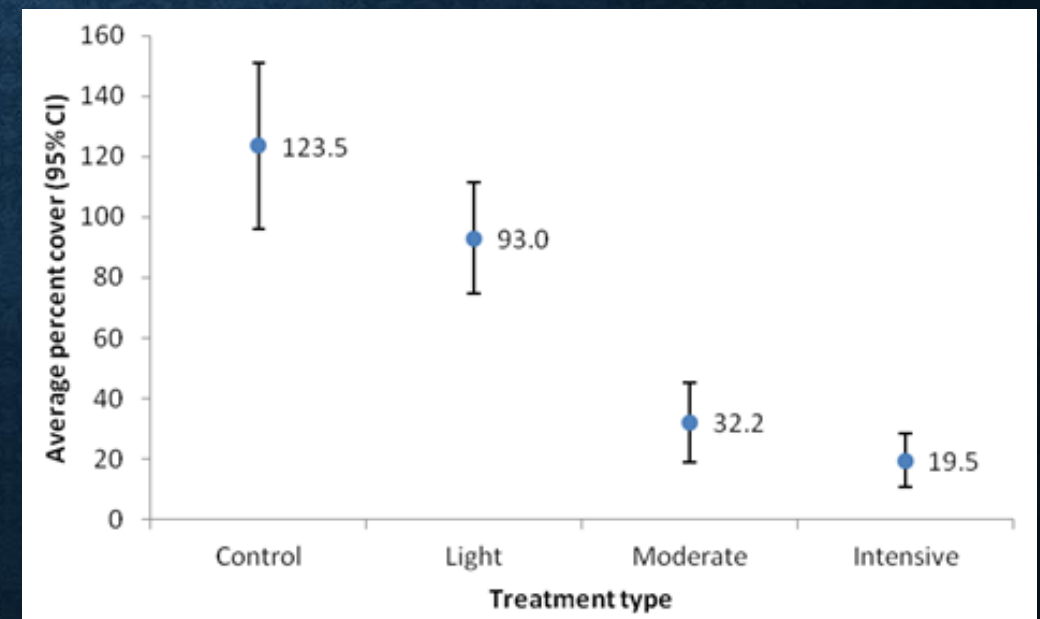


# Vegetation Sampling

- Shrub cover collected around avian point count locations in each stand
- 9 – 3 meter radius plots per stand (approx. 84 m<sup>2</sup>) with ocular estimation of cover
- Plant cover analyzed within Conifer, Herbaceous, and Broadleaf (trees and shrubs) categories to correspond with feeding associations of moth functional groups



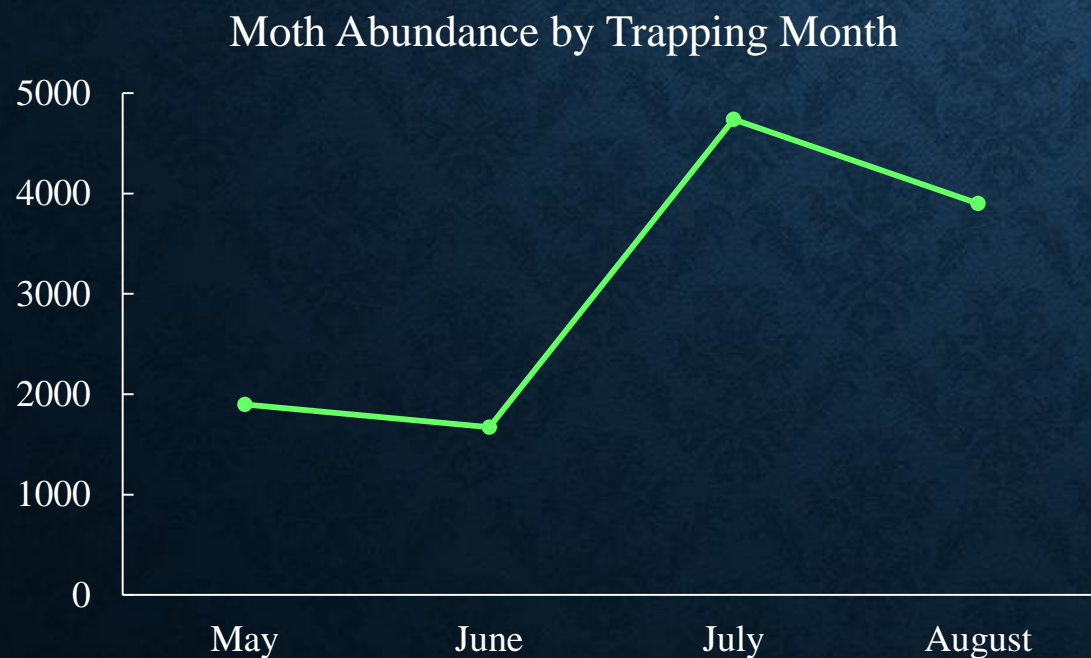
Shrub cover after 3 years of stand growth





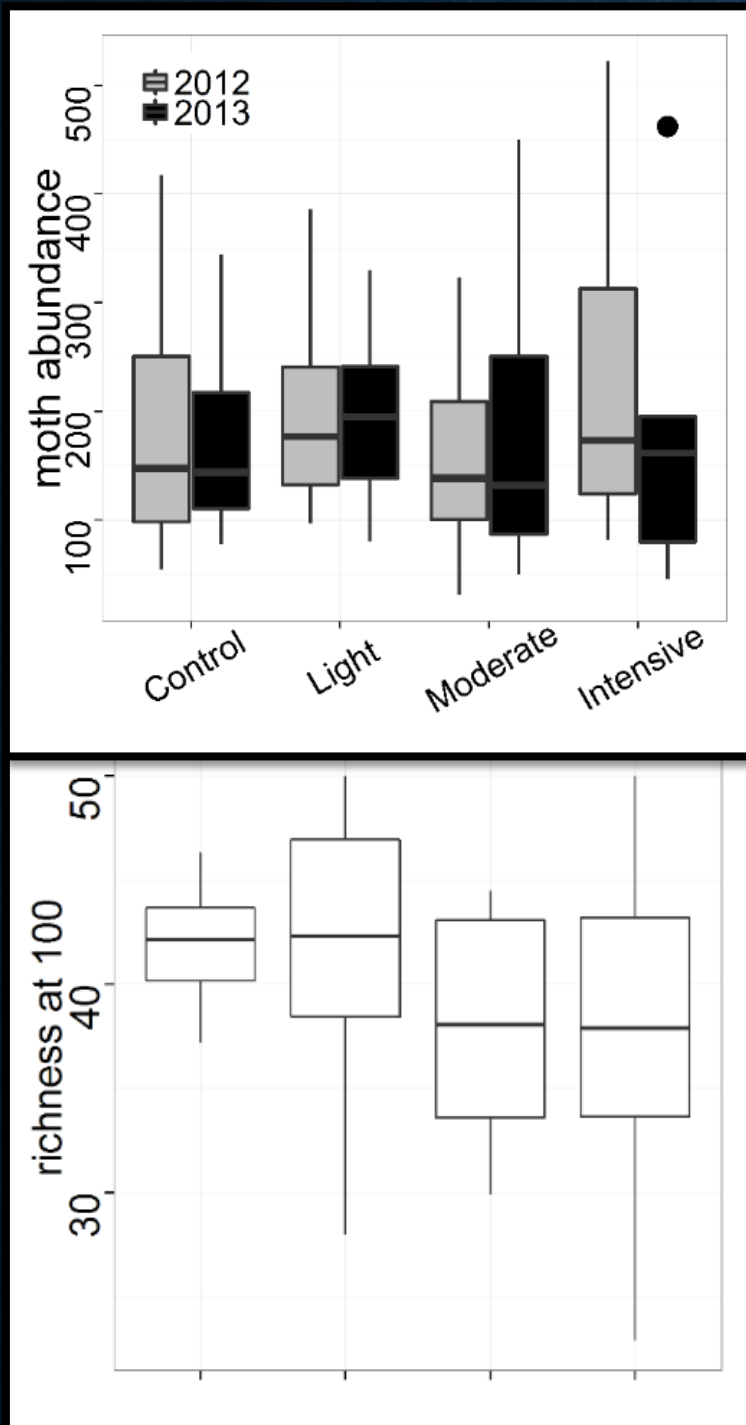
# Results

- 316 moth species
- 59 were only captured once
- > 12,000 moths collected (6432 in 2012; 5821 in 2013)
- 30 new species records for the Coast Range; 1 state record





# Moth Abundance and Richness



- No evidence that moth abundance differed among treatments in either year.
- Weak evidence of a treatment effect on moth species richness (est. at 100 individuals;  $p = 0.04$ )
- Control and Light treatments were estimated to have 8.8 more species per stand compared with the Moderate and Intensive treatments (SE = 3.0, post-hoc test  $p = 0.035$ ).

Moth richness and abundance in four herbicide treatments in eight blocks in the Oregon Coast Range, USA.

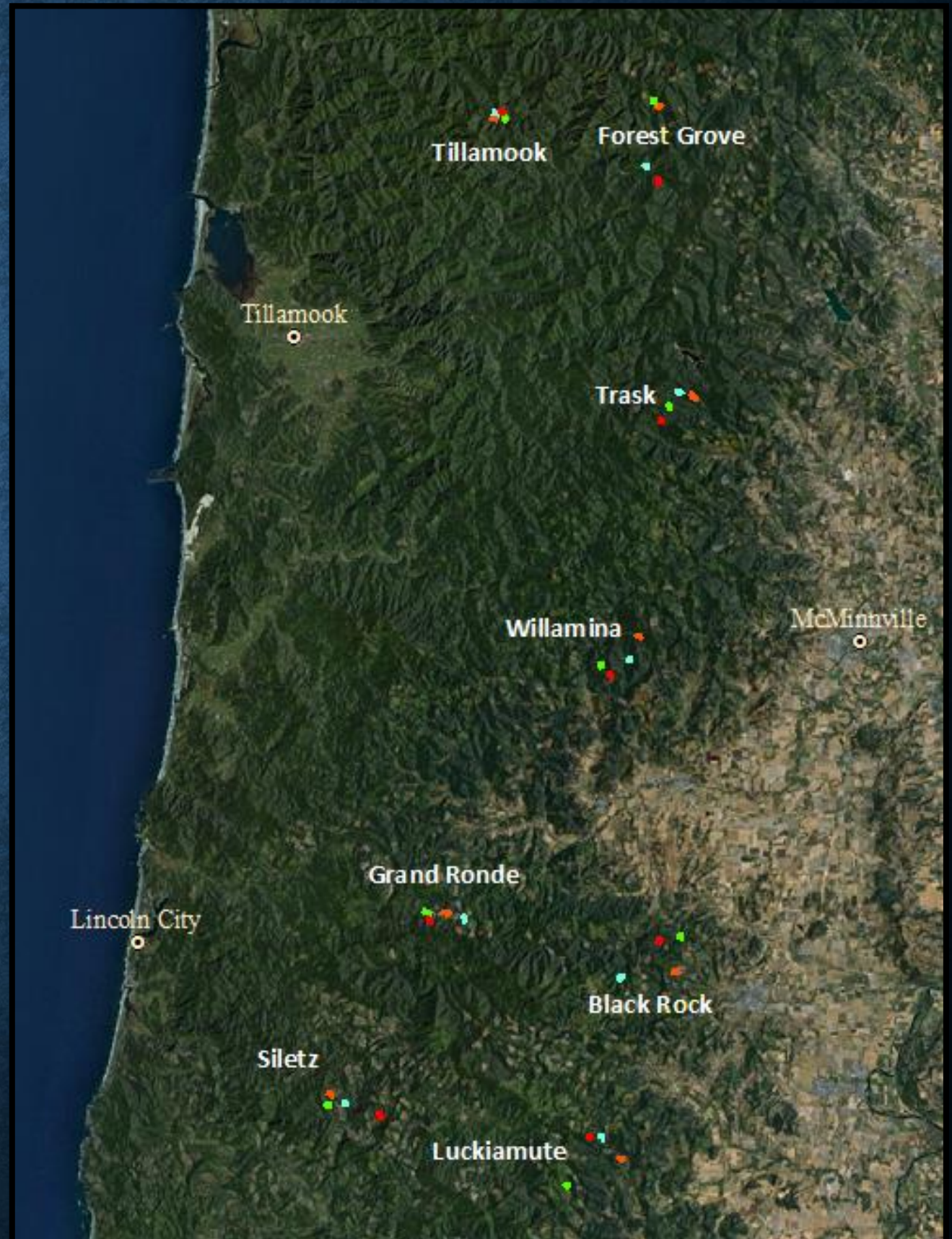


# The “Block Effect” and Biophysical Setting

- Block was included as a random effect in all richness and abundance models

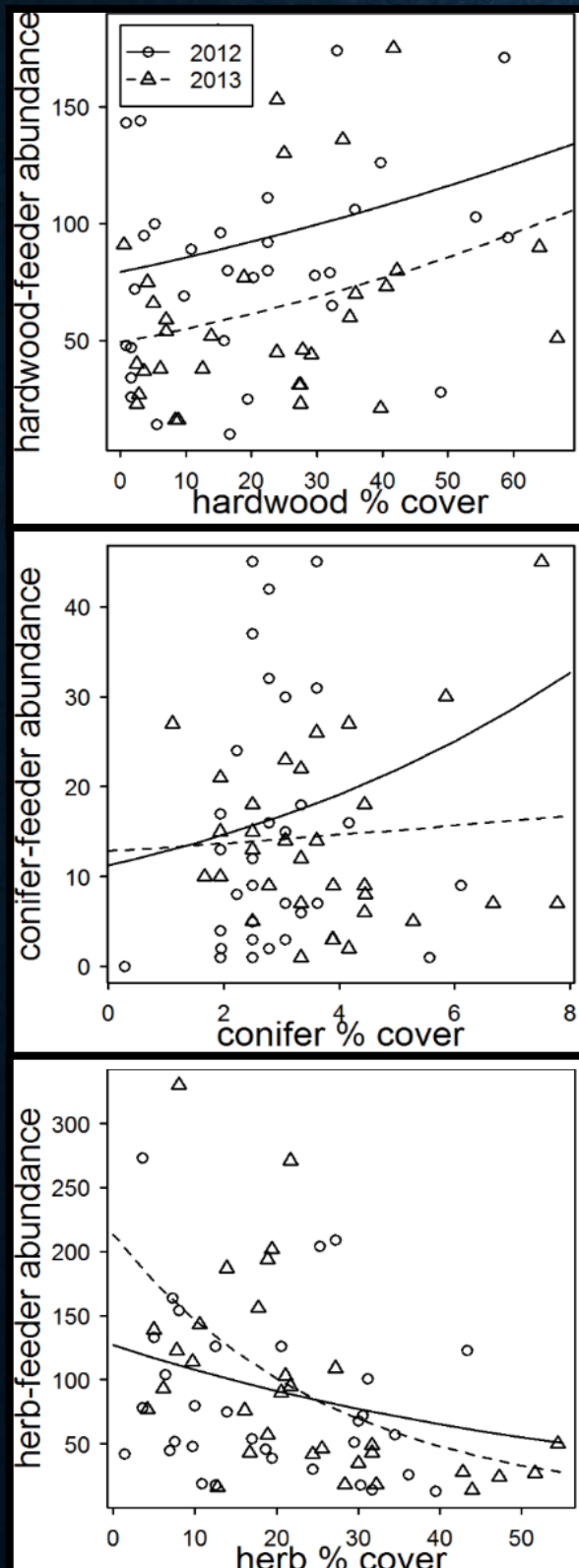
When block was excluded:

- Elevation ( $p = 0.02$ ) and latitude ( $p < 0.001$ ) were individually significant in the abundance model, both having a negative effect on abundance.
- Elevation ( $p = 0.02$ ) and longitude ( $p = 0.02$ ) were significant fixed effects in the richness model, both having a negative effect on richness.





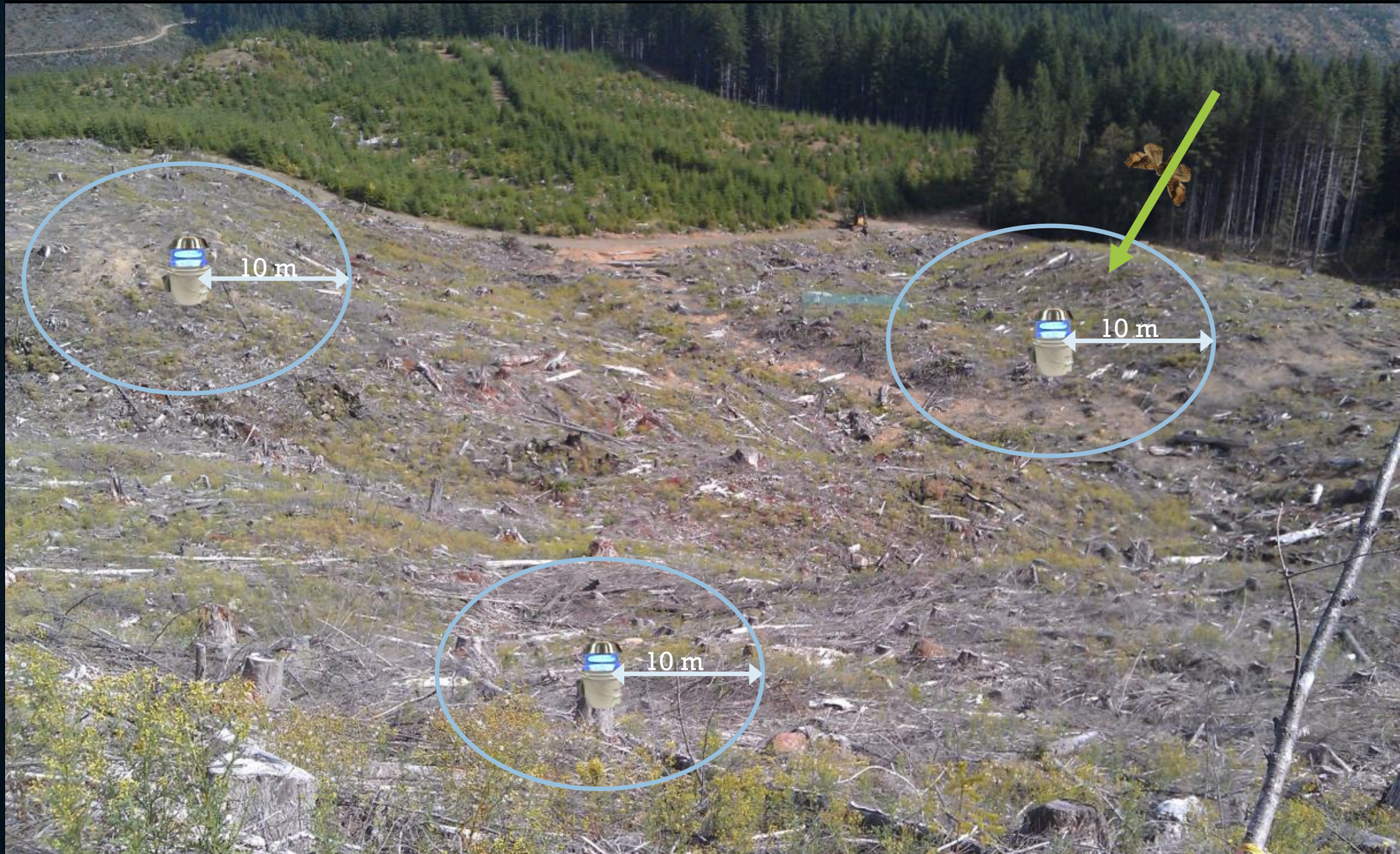
# Foraging Guild Results



- Hardwood-feeding moth abundance was not associated with hardwood percent cover
- Conifer-feeding moths were not affected by the percent cover of conifers or year
- Herb-feeding moths also did not show a significant relationship with herb cover
- Early seral community is dominated by herb-feeding moths, while hardwood-feeding moths are less abundant

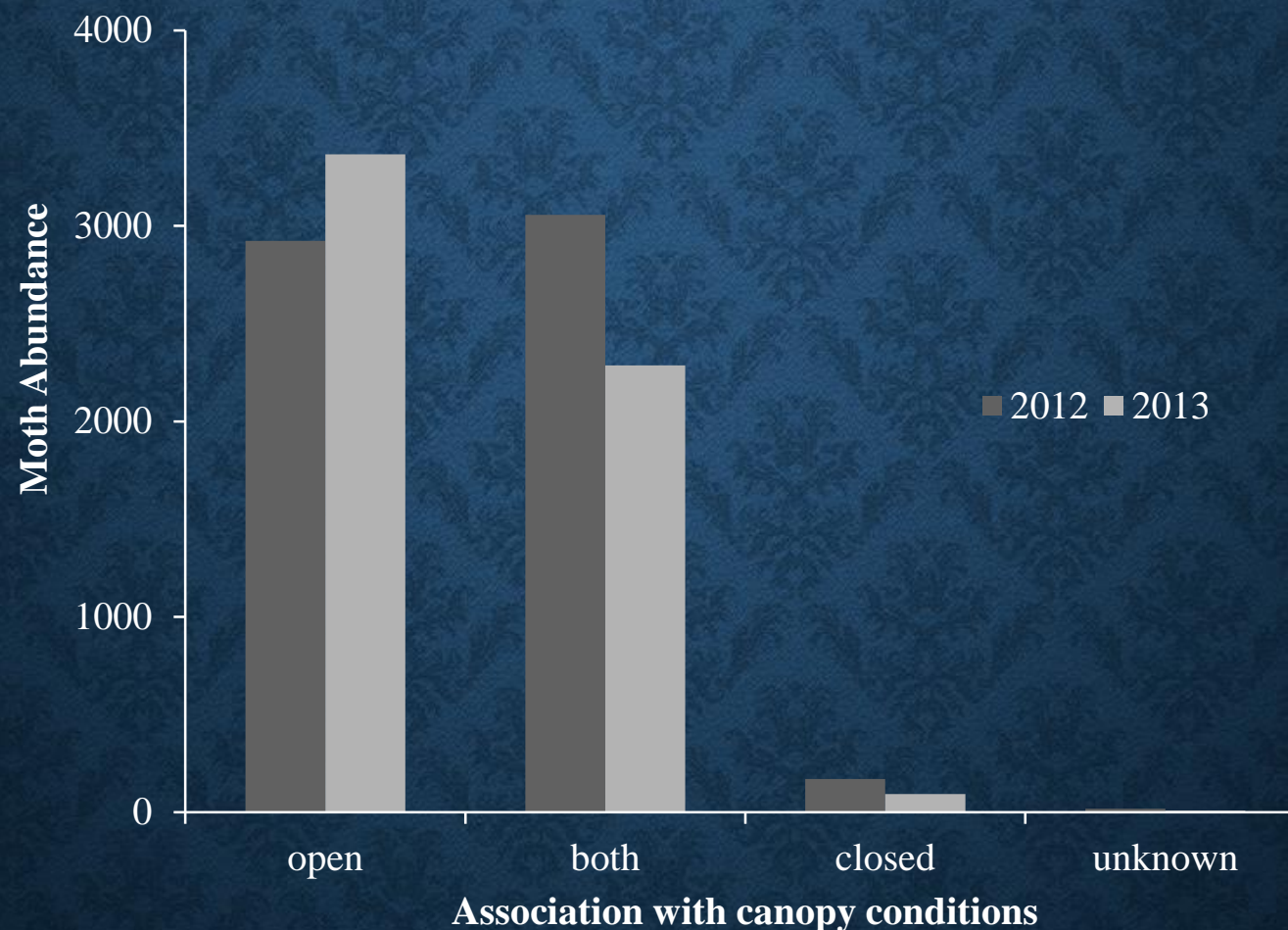


# Were Moths Drawn in From Adjacent Stands?





# Were Moths Drawn in From Adjacent Stands?



Very few of the moths captured were species typically associated with closed canopy forest (2.7% and 1.6% in 2012 and 2013)



# Conclusions

- Moth diversity was exceptional; high numbers of species seen only once suggest additional diversity may remain to be discovered
- Early seral moth community is unique in the Coast Range and will only be sustained by the continuous availability of newly disturbed habitat
- Taki et al (2010) found Japanese plantations supported fewer moth species than naturally regenerated forests
- The lack of treatment effect on species' abundances was unexpected; effect of site/block is stronger than the treatment
- Spatial variation in species composition has been shown to be substantial across sites with similar vegetation at regional scales (all Ohio; Summerville 2001)





Questions?