WILDLIFE RESPONSES TO FOREST STRUCTURAL RETENTION

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Forest Practices Rules require retention

Green Trees

Snags

Downed wood

Requirements per harvested acre:

- 2 snags or green trees ≥ 30 ft tall and ≥ 11 in. DBH
- 2 down logs ≥ 6 ft long with a total volume of ≥ 10 ft^3; logs ≥ 20 ft^3 count as 2 logs

Structural Retention

Recent Research Topics

- Structural retention
  - What is out there on the landscape?
  - Bird structure use and response to patch size
- Effects of environmental gradients on structure use
  - Bird response to snag density and down wood across a productivity gradient
- Structural enrichment
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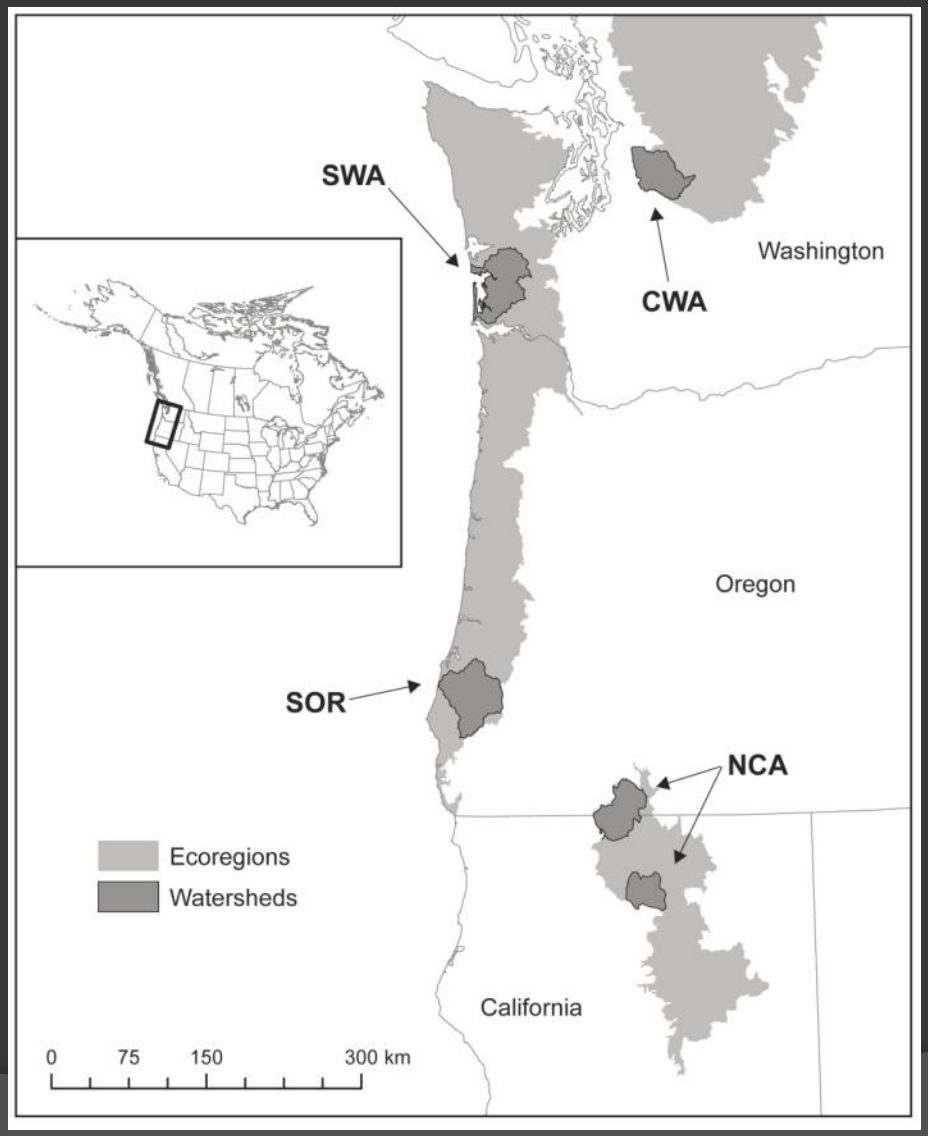
Dr. A.J. Kroll

Dr. Dan Linden

Dr. Gary Roloff

Structural Retention

Response of avian species richness to operational practices



- California (*n*=23), Oregon (*n*=20), and Washington (*n*=42); 2008-09
- Stand size (ha)
  - CA, 9 (4-11)
  - OR, 40 (22-61)
  - CWA, 8 (4-12)
  - SWA, 37 (24-57)
- Structural retention
  - Number of green trees
  - Number of snags
  - Distance to edge

Objectives

1) Quantify the physical characteristics of retained structures found in clearcut harvest units

2) Summarize stand-level bird communities that use clearcut harvest units

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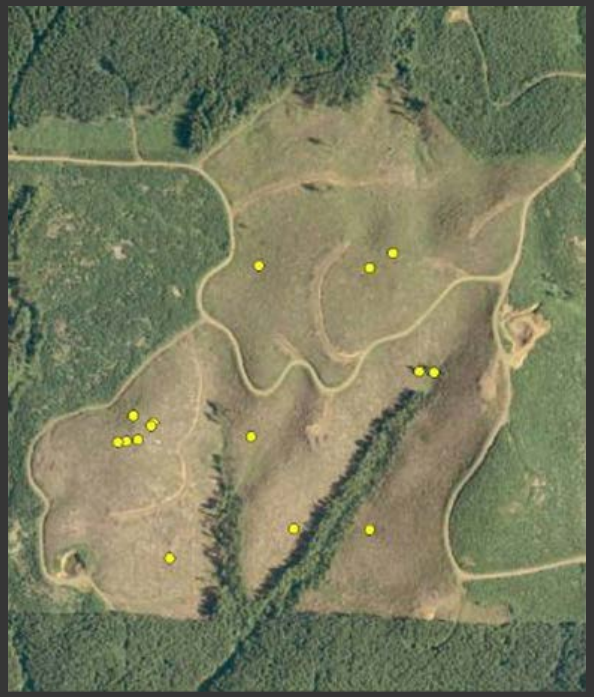
Selecting Structures for Sampling

Photo Mapping

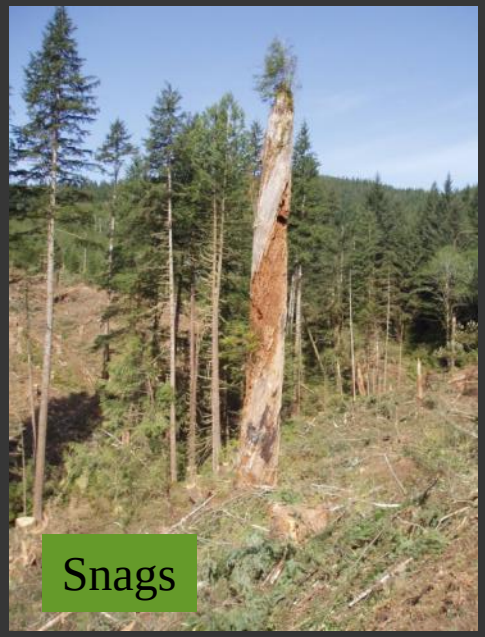


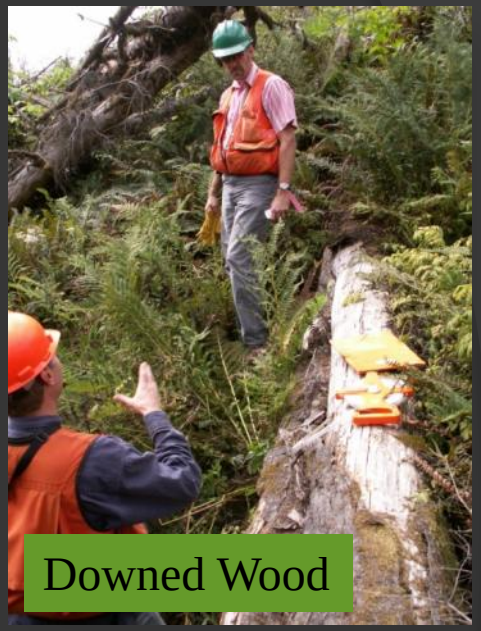
Field Reconnaissance

Sample

Types of Structures


Green Trees


Snags


Downed Wood


Single


Patches

Quantity

- Patches (includes green trees and snags)*
  - Range = 0.25 to 4.9 patches/ac (0.1 to 2.0 patches/ha)
  - Average size = 0.75 ac (range = 0.25 to 10.9 ac)
    (0.3 ha [range = 0.1 to 4.4 ha])

* Only includes patches isolated from adjacent forest and riparian zones

Quantity (Stand-level)

- Patches (includes green trees and snags)*
  - Range = 0.25 to 4.9 patches/ac (0.1 to 2.0 patches/ha)
  - Average size = 0.75 ac (range = 0.25 to 10.9 ac)
    (0.3 ha [range = 0.1 to 4.4 ha])
- Single Green Trees
  - Range = 0.25 to 2.5 trees/ha (0.1 – 1.0 trees/ha)

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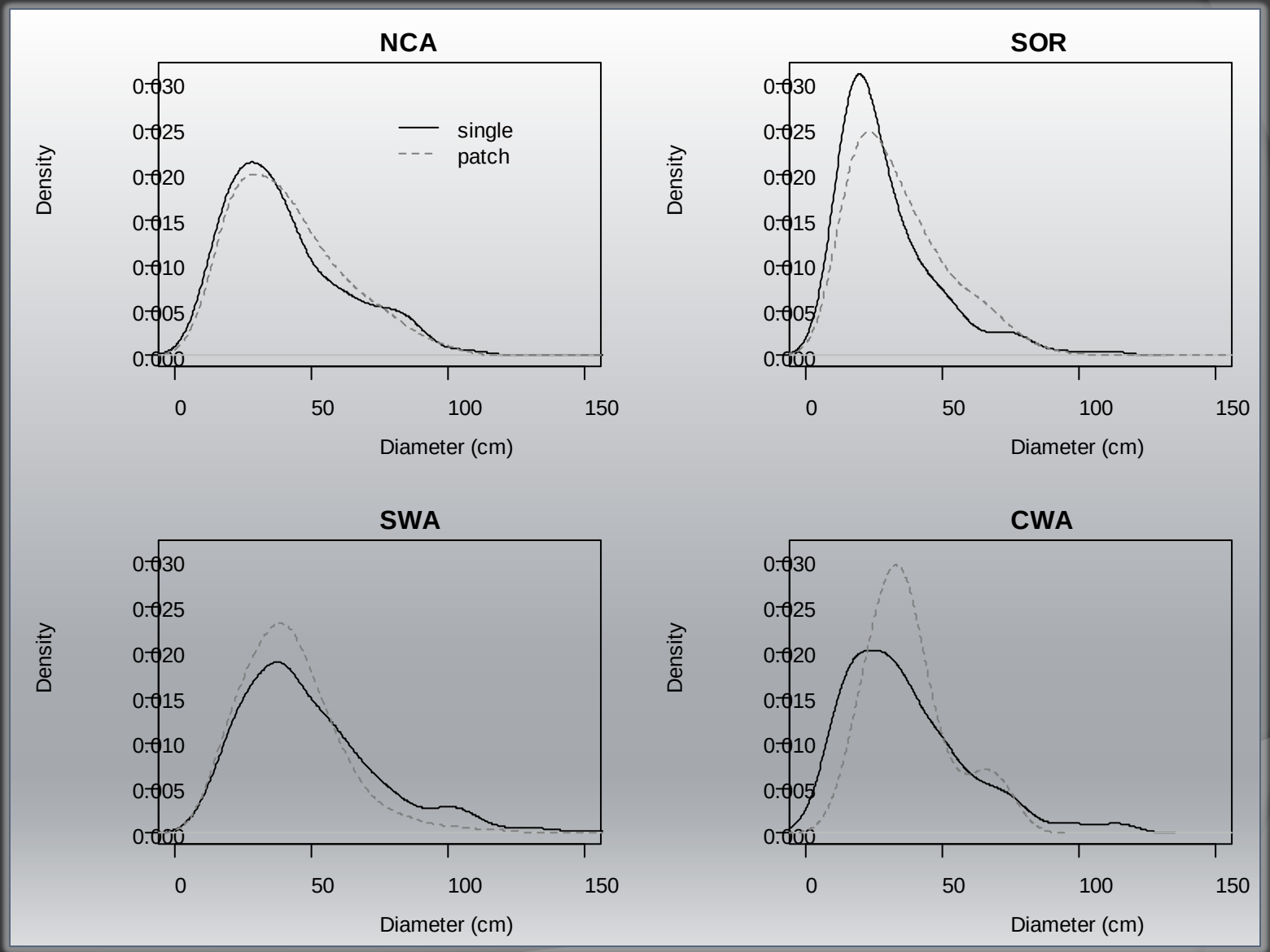
- Single Green Trees
  - Range = 0.25 to 2.5 trees/ha (0.1 – 1.0 trees/ha)
- Snags
  - Range = 0.25 to 1.7 snags/ac (0.1 – 0.7 snags/ha)

Green Trees


NCA
SOR
SWA
CWA
single
patch
Density
Diameter (cm)
0.030
0.025
0.020
0.015
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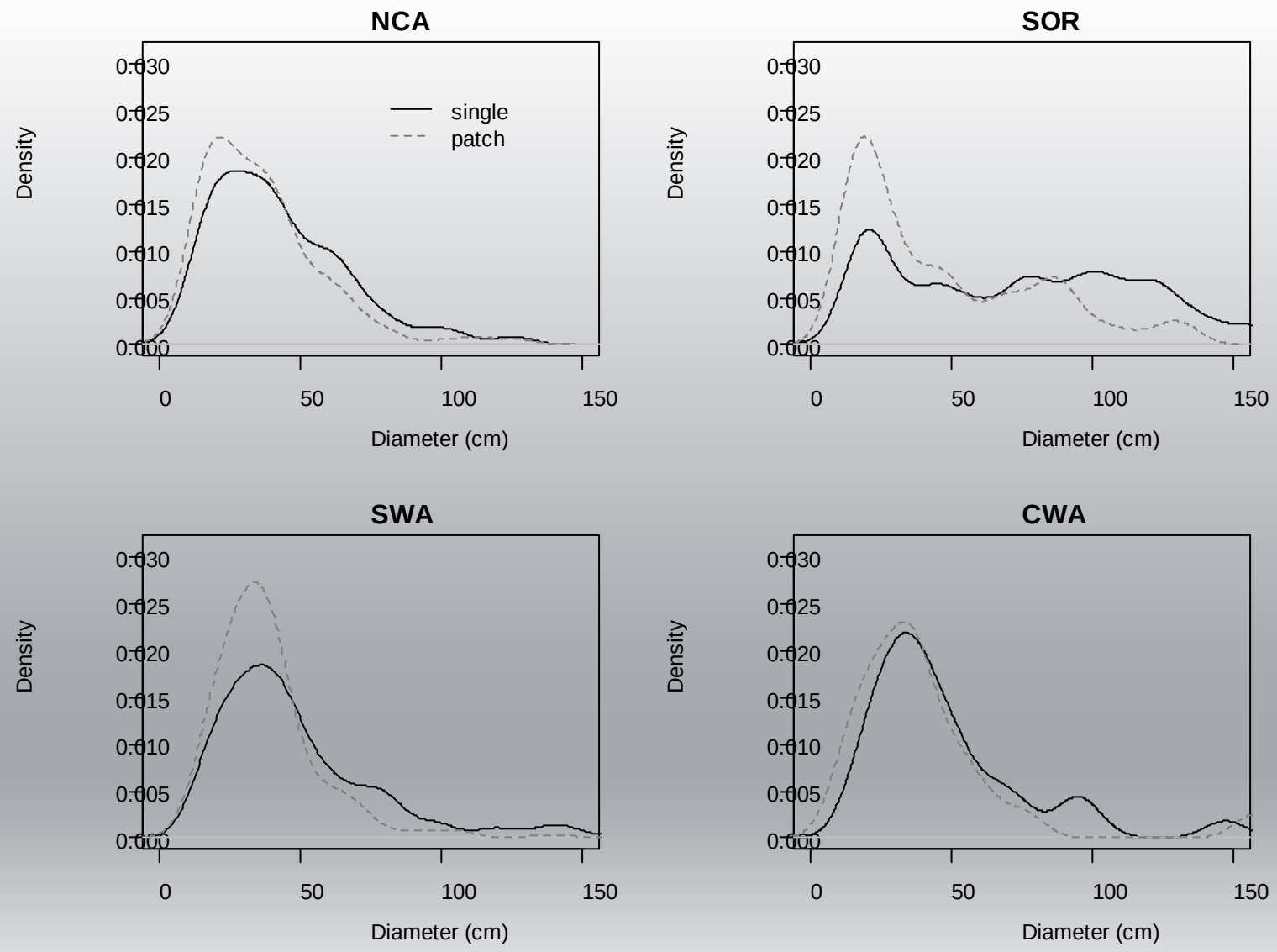
0.005
0.000
0
50
100
150

Snags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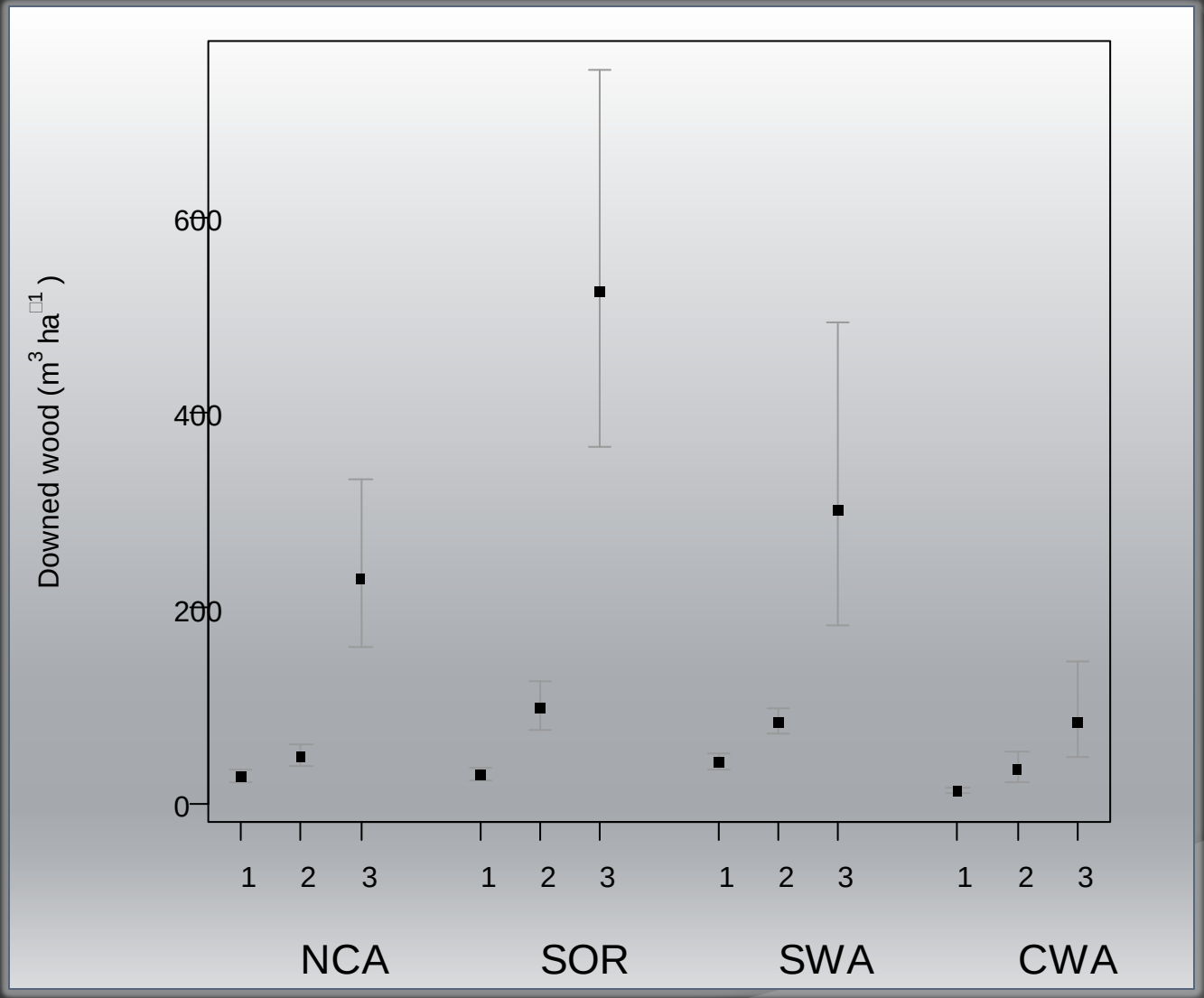
Downed Wood



1: 10 – 25 cm, 2: 26 – 51 cm, 3: >51 cm

Objective 1 - Summary

- Structures do not occur at high densities
- Trees and snags encompass a range of sizes
  - 10 to >125 cm (4 to >49 in) dbh, with majority <51 cm (< 20 in)
- Subtle differences between patches and single structures
- Legacy structures present
- Abundant downed wood

Objectives

1) Quantify the physical characteristics of retained structures found in clearcut harvest units

2) Summarize stand-level bird communities that use clearcut harvest units

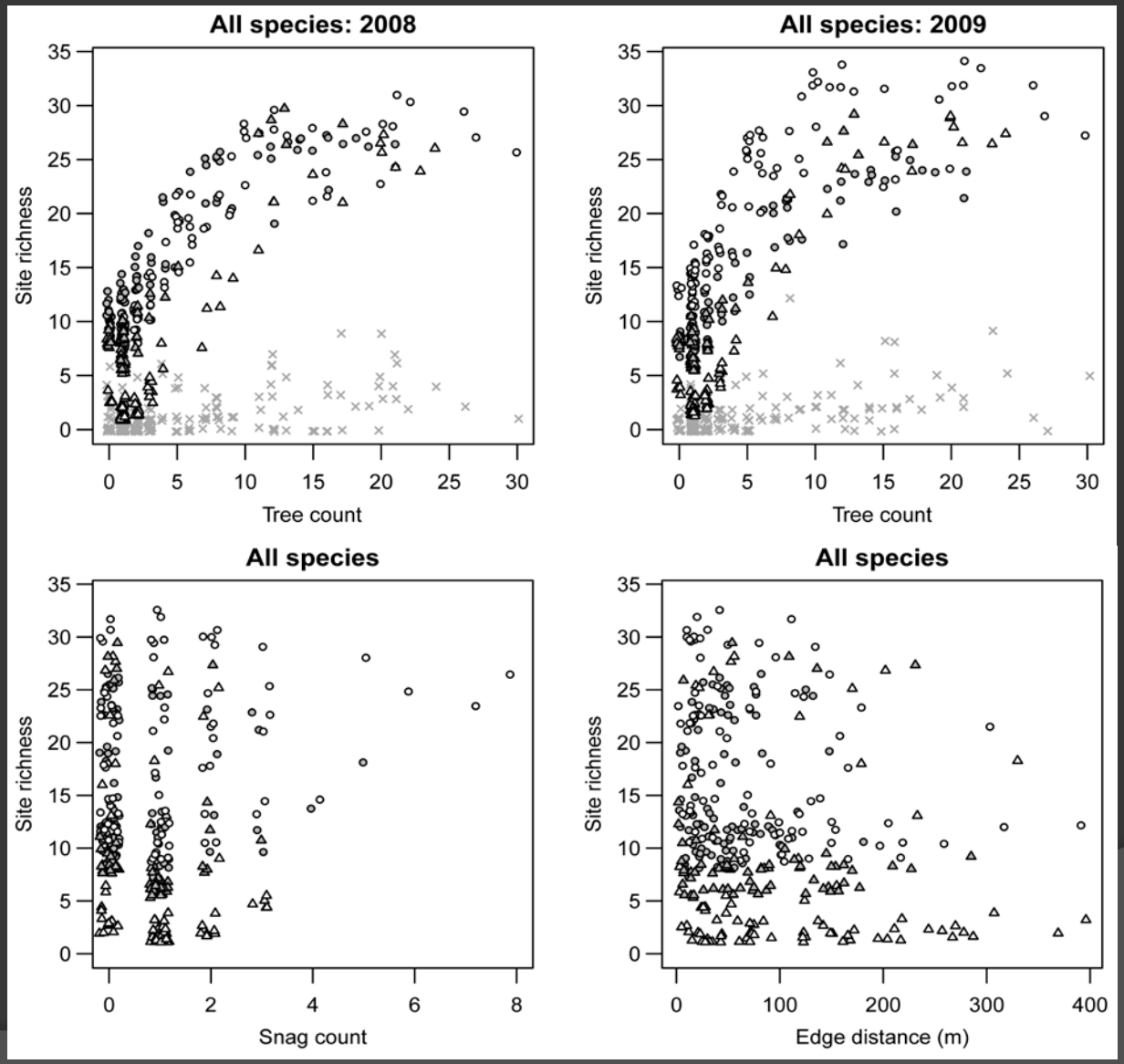
Analytical Methods

- Estimate species richness at *individual structures* or *patches of structures* within each harvest unit

Linden, D.W., G.J. Roloff, and A.J. Kroll. 2012. *Forest Ecology and Management* 284:174-184.

Results:

Positive relationship between patch size and species richness



Objective 2 - Summary

- Large number of bird species
- Detection for bird community is complex
- Occupancy for region = no clear pattern with retention
- Within study area occupancy can be linked to retention attributes
- Recent clearcuts are being used by guilds not typically associated with clearcutting

Does energy mediate the relationship between avian functional diversity and within stand structure?

Objective: Investigate the role of available energy in determining the relationship between bird richness and abundance and elements of forest structure and vegetation cover at stand scales.

- Large snag density, coarse wood volume, canopy cover
- Response data: Species richness and species' abundance

Does energy mediate the relationship between avian functional diversity and within stand structure?

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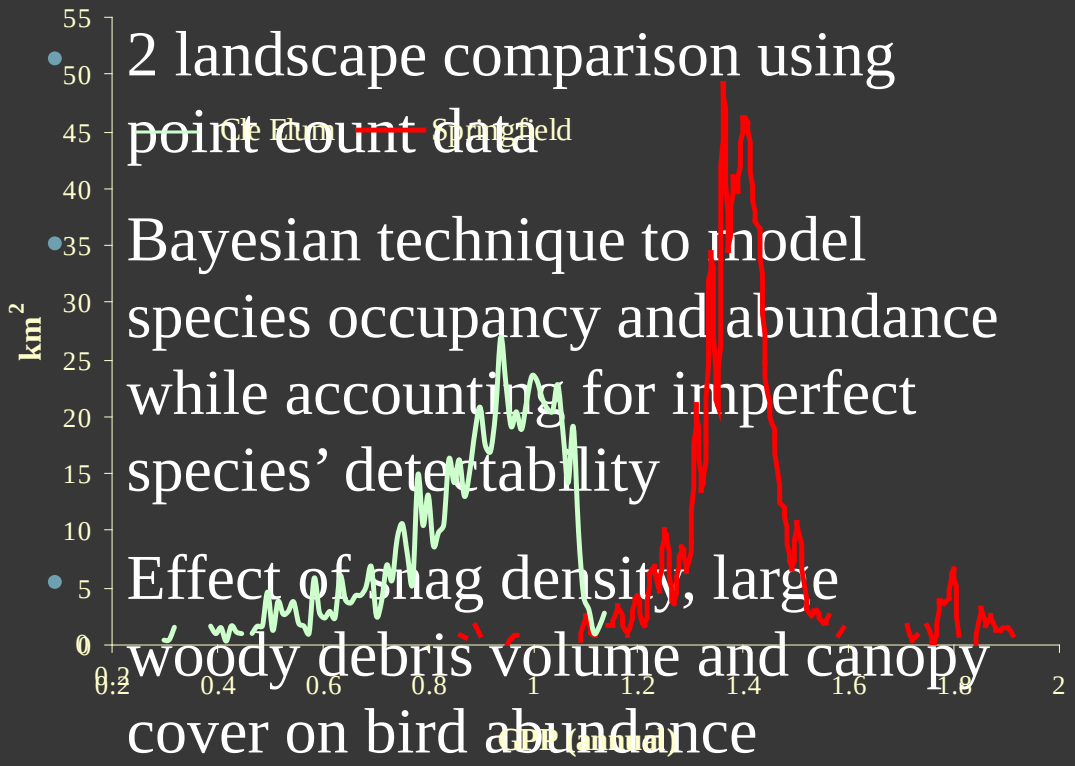
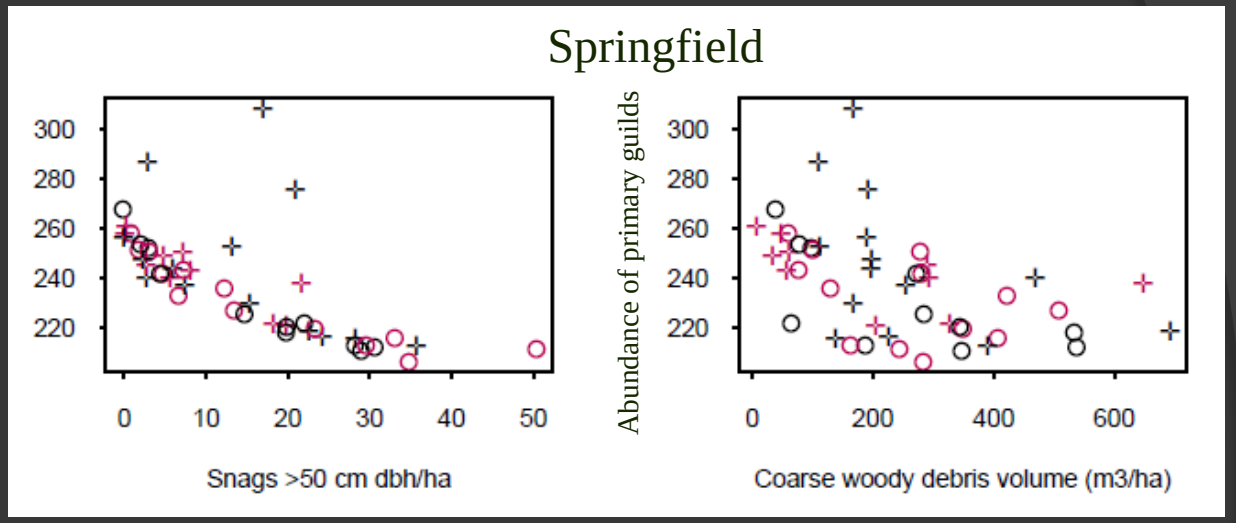
Does energy mediate the relationship between avian functional diversity and within stand structure?

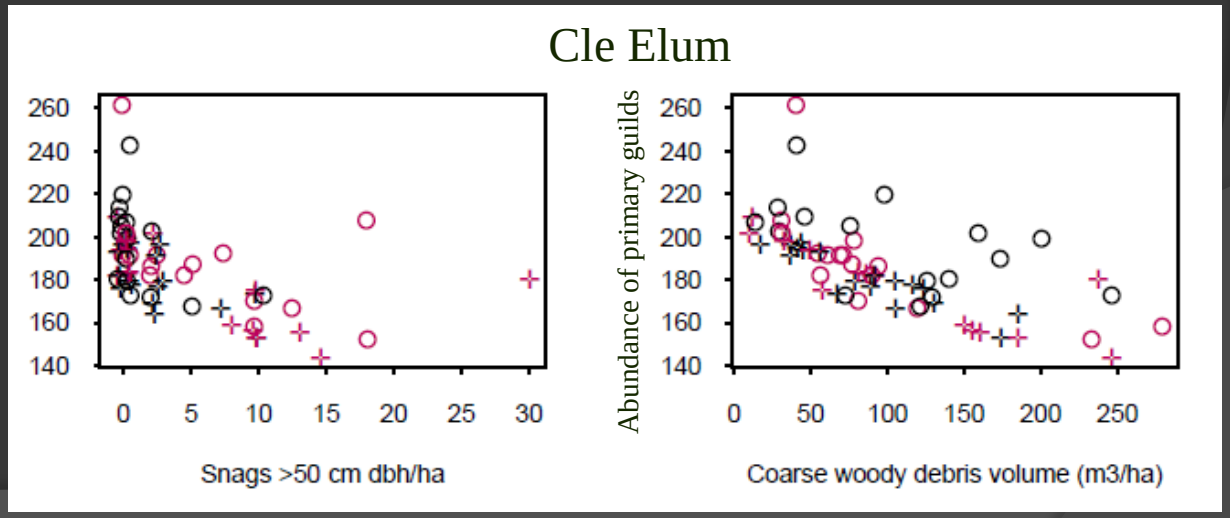


- 2 landscape comparison using point count data
- Bayesian technique to model species occupancy and abundance while accounting for imperfect species' detectability
- Effect of snag density, large woody debris volume and canopy cover on bird abundance

Snags and Coarse Woody Debris

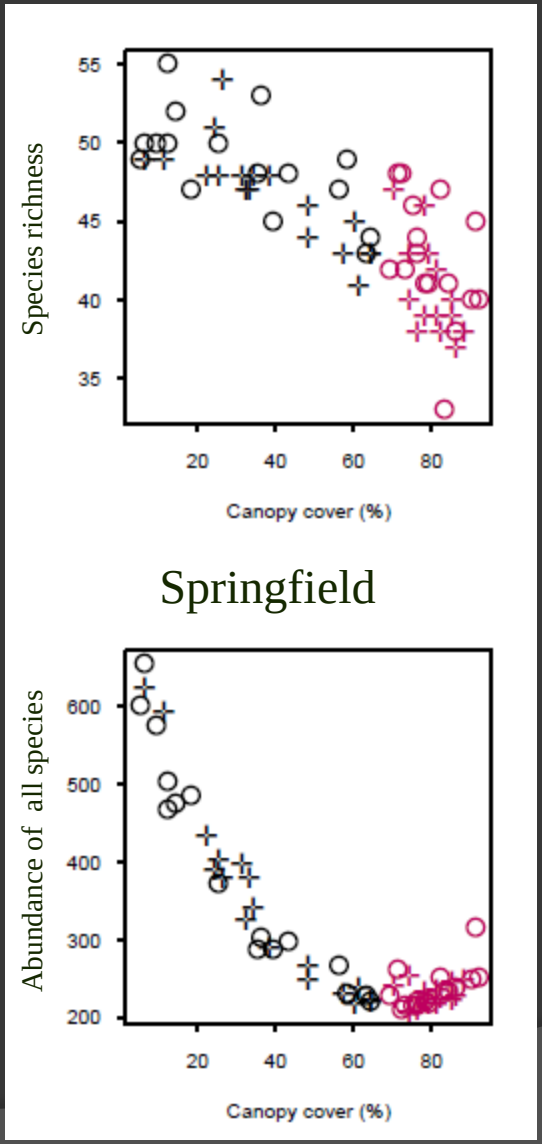
Abundance of primary guilds by snag density and CWD volume

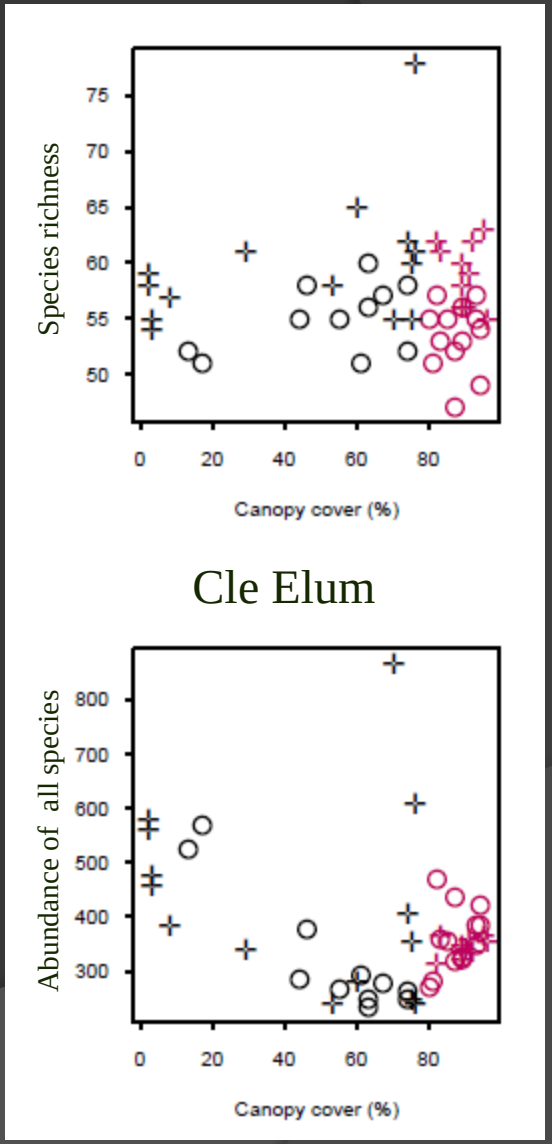




Canopy Cover

Species richness and abundance by canopy cover





Management Implications

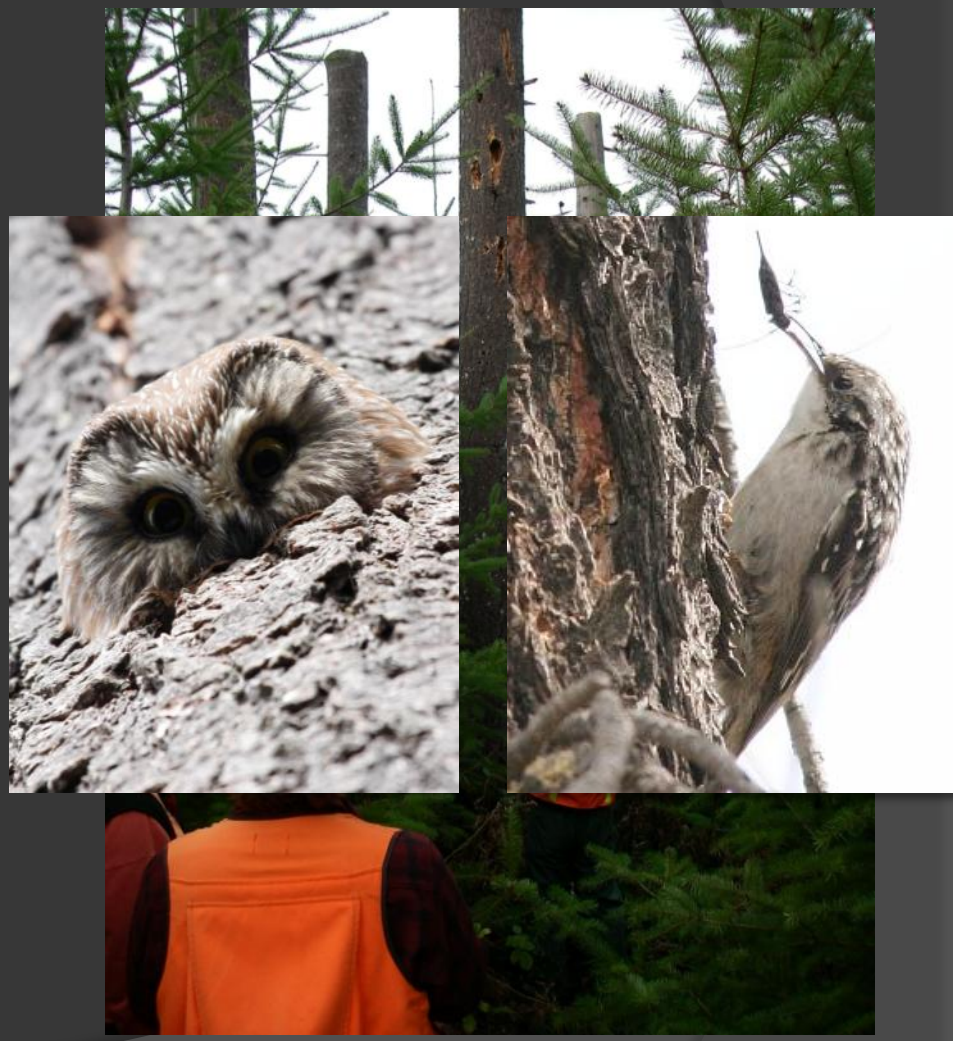
- Avian species respond to variation in density of snags and volume of coarse wood differently on the west and east slopes of the Cascades
- Responses of species' abundance were more defined than species richness in both models
- Canopy closure reduces the abundance of bird species, especially in high energy landscapes
- Many other factors are likely in play

Structural Enrichment

Creating Snags

Created Snags Project

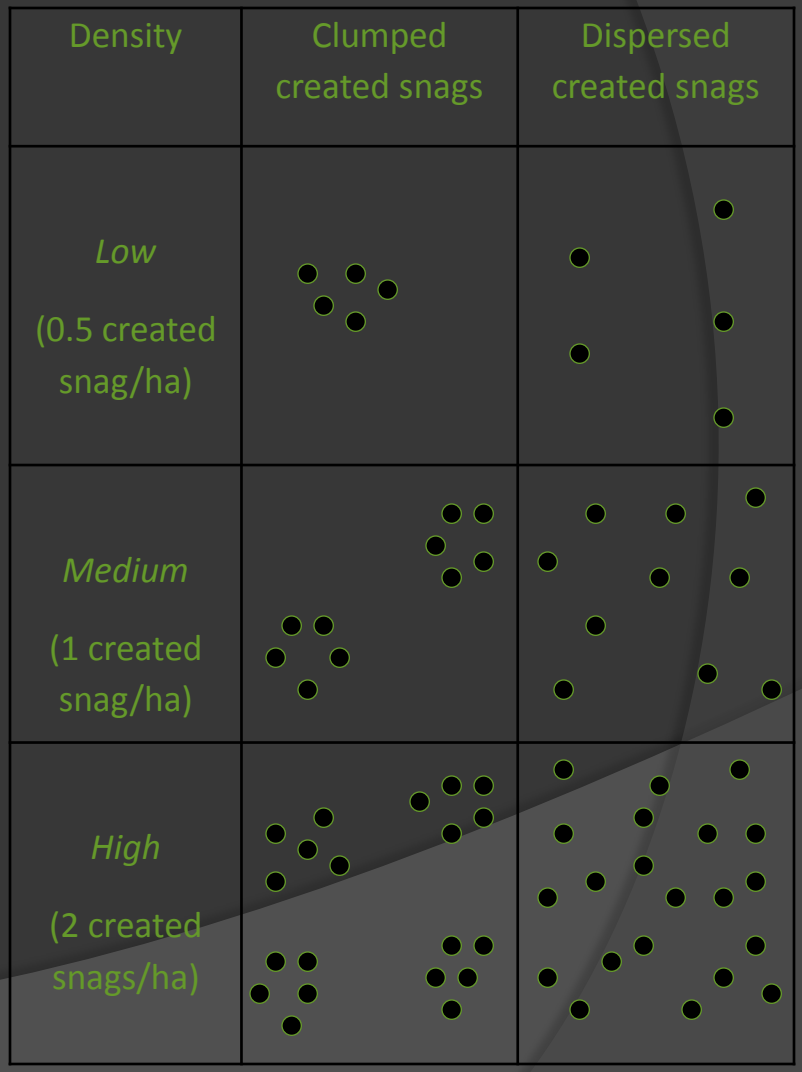
- Initiated 1997→1999
- 1123 snags created & monitored
- 5 year revisit / 10 year revisit complete: 20 year revisit planned
- Monitoring use by wildlife
- Examining how spatial distribution & landscape context influences use



Methods

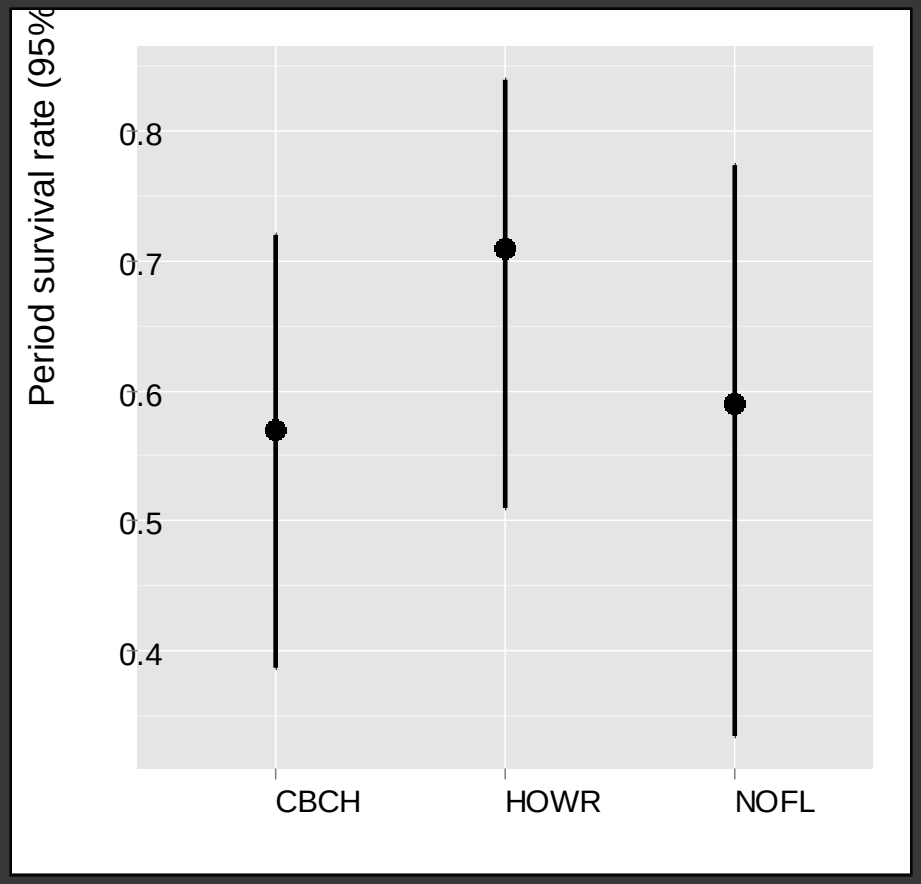
Experimental Design and Analysis

- Ground-based units, primarily Douglas-fir
- Random assignment to one of 6 treatments: dispersion × density
- ~1,200 snags were created with a harvester on 28 harvest units
- Landscape was characterized in a 1000 m buffer around each stand
- Dispersion as median NN distance



Does enrichment benefit wildlife?

Demographic responses

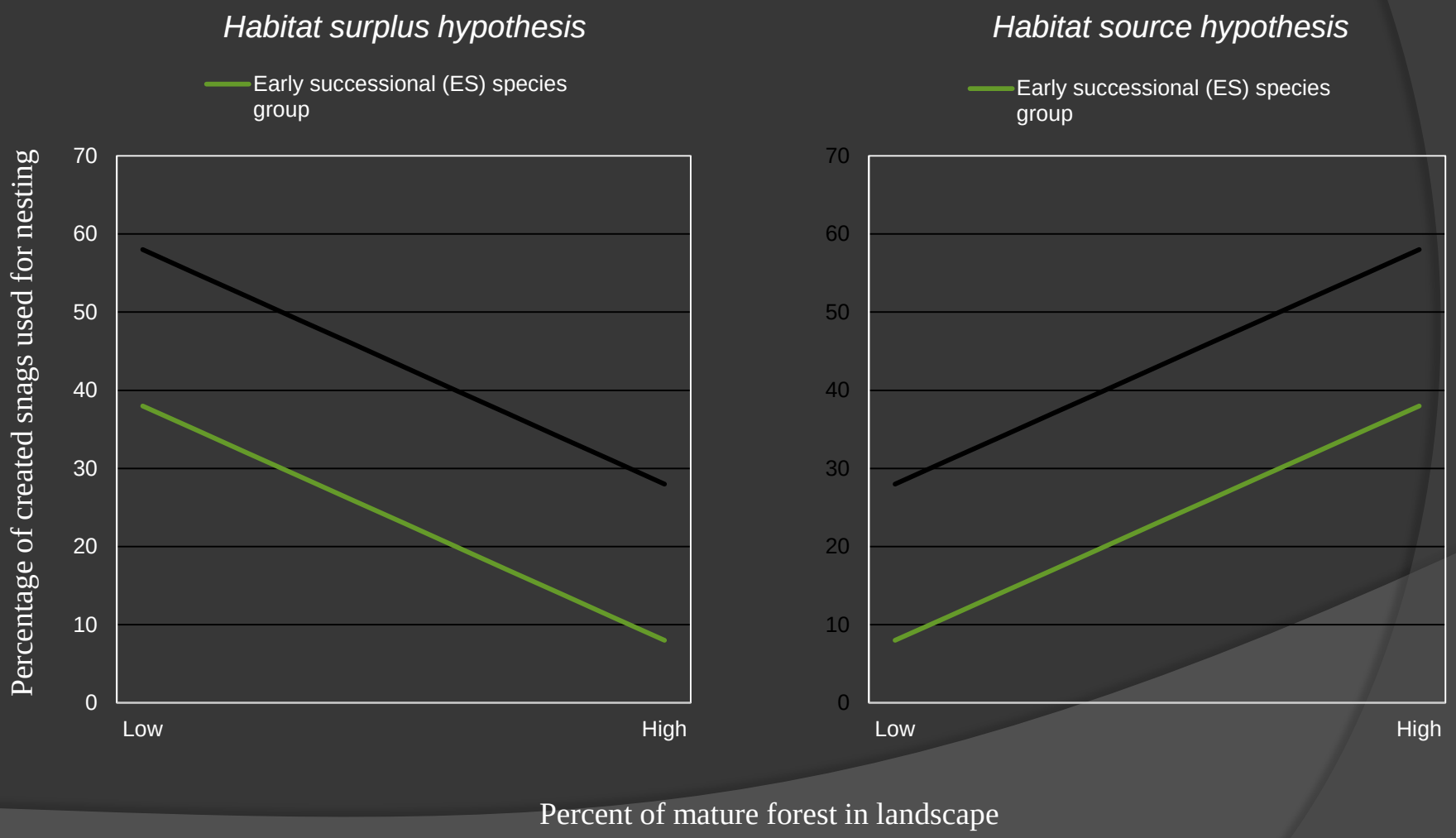


- CBCH
  - <0.50; control and partial harvest; Mahon and Martin (2006)
  - <0.50 ; buffer strips <250 m or > 350 m; Sperry et al. (2008)
- HOWR
  - 0.63 in natural cavities to 0.83 in nest boxes; Finch, 1989, 1990; Li and Martin, 1991; Johnson and Kermott, 1994; Purcell et al., 1997
- NOFL
  - 0.65 in both unlogged burned forests and partially logged burned forests; Saab et al. 2007
  - 0.50 (low severity burn) and 1.0 (high severity burn); Vierling et al. 2008
  - 0.65 in an unmanaged forest; Fisher and Wiebe (2007)
  - 0.41 in unburned forests and 0.80 in burned forests; Kozma and Kroll (2012)

Hane, M.E., A.J. Kroll, J.R. Johnson, M. Rochelle, and E.B. Arnett. 2012. *Forest Ecology and Management* 282:167-14.

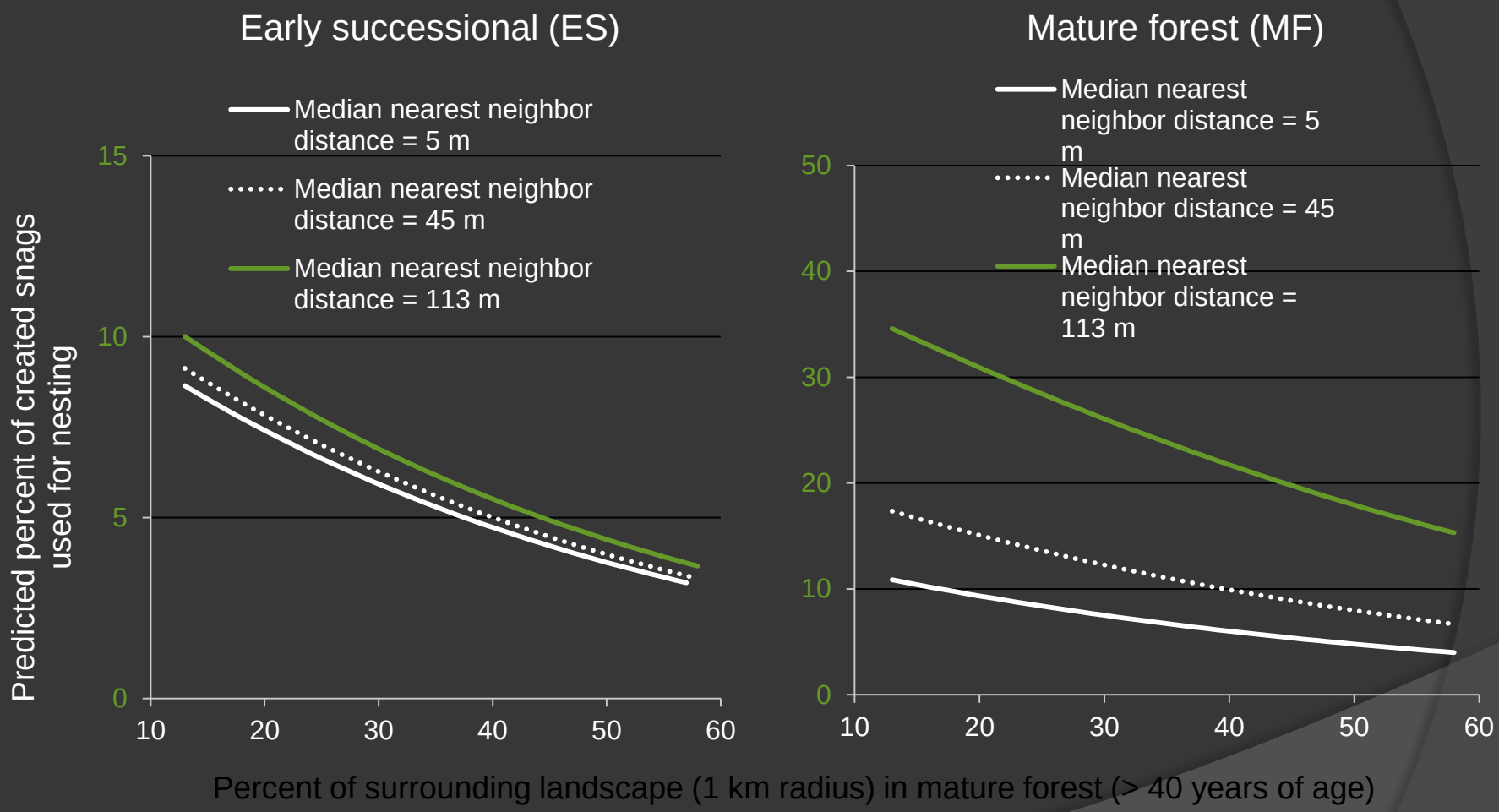
How does landscape composition interact with local structural enrichment?

Habitat surplus and habitat source hypotheses



Results

Support for the habitat surplus hypothesis



Kroll, A.J., S.D. Duke, M.E. Hane, J.R. Johnson, M. Rochelle, M.G. Betts, and E.B. Arnett. 2012. *Biological Conservation* 152:145-151.

Future Research Topics

What other features (e.g., remnant green trees) are required before species will use snags in clearcut stands?

Green tree longevity

How big must retention patches be to promote nesting/roosting occupancy of cavity-dependent species?

Does the proportion of older forest (>80 years old) in the landscape influence the use of snags in harvest units?

Kroll, A.J., M.J. Lacki, and E.B. Arnett. 2012. *Western Journal of Applied Forestry* 27:128-136..

Evaluating Alternative Retention/Enrichment Practices

NCASI and Michigan State University

- Bird and bat responses
- Control for landscape structure
- Retention and enrichment
- Reduce uniformity

Study Objectives

1. Determine the degree to which use of green trees and created snags by birds varies with aggregation and slope position of retained structures.

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“Responses of bat populations
to various forest management
practices… and habitat variables…
are virtually unknown.”

“Conservation of bat species…
should center on preserving
suitable roost sites and foraging
areas, but attaining this goal
is hampered by our rudimentary
knowledge of these requirements.”

Christy and West 1993

Factors Influencing Patterns of Habitat Use by Bats

Amount of clutter

Roost Sites

Use and distribution of water

The Future

Reorganization of the Forest Estate

- Increased upslope retention
  - Modification of unstable slope buffers
- Reduced riparian buffers
  - Reflect regional variation
- Monetization of other values
  - Ecosystem services, including carbon storage and water
- Landscape planning
  - Across jurisdictions

Partners

- AJ Kroll, Weyerhaeuser
- Gary Roloff, Michigan State University
- Dan Linden, MSU and USGS
- Ed Arnett, Theodore Roosevelt Conservation Partnership
- Mike Lacki, University of Kentucky
- Matt Betts, Oregon State University
- Steve Duke, Matt Hane, Josh Johnson, & Mike Rochelle, Weyerhaeuser
- Oregon Forest Industry Council
- NCASI Western Wildlife Task Group