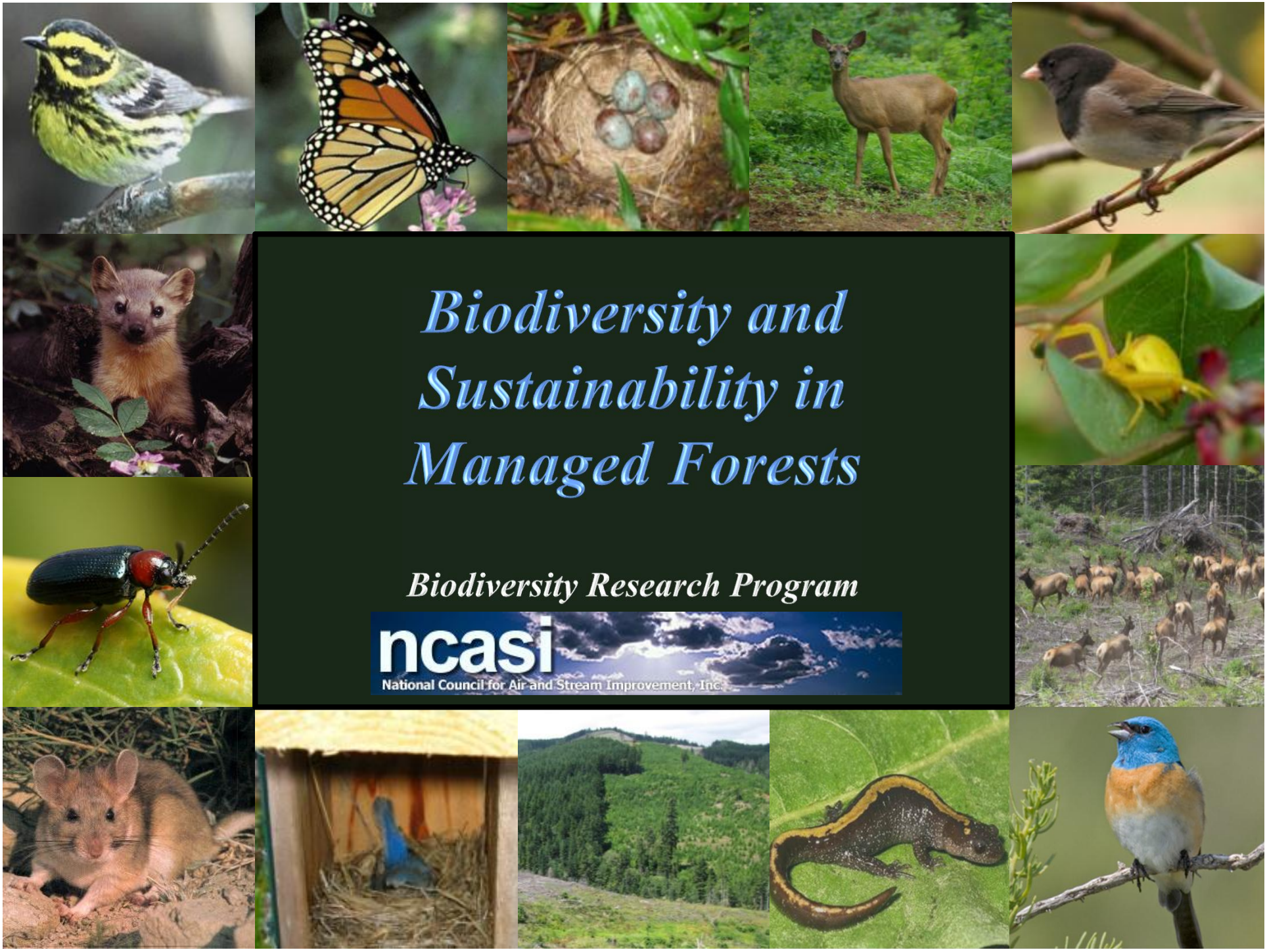

Biodiversity and Sustainability in Managed Forests
Biodiversity Research Program
ncasi
National Council for Air and Stream Improvement, Inc.









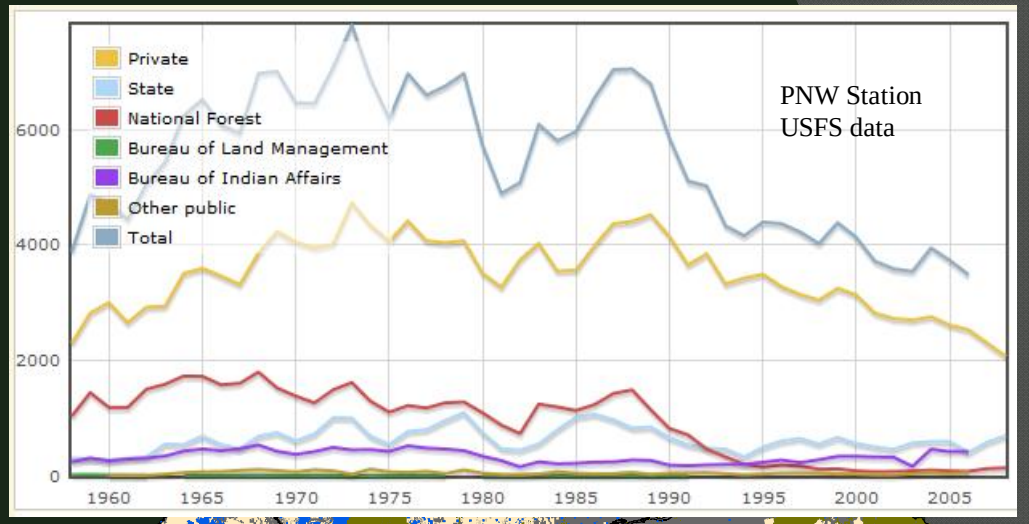


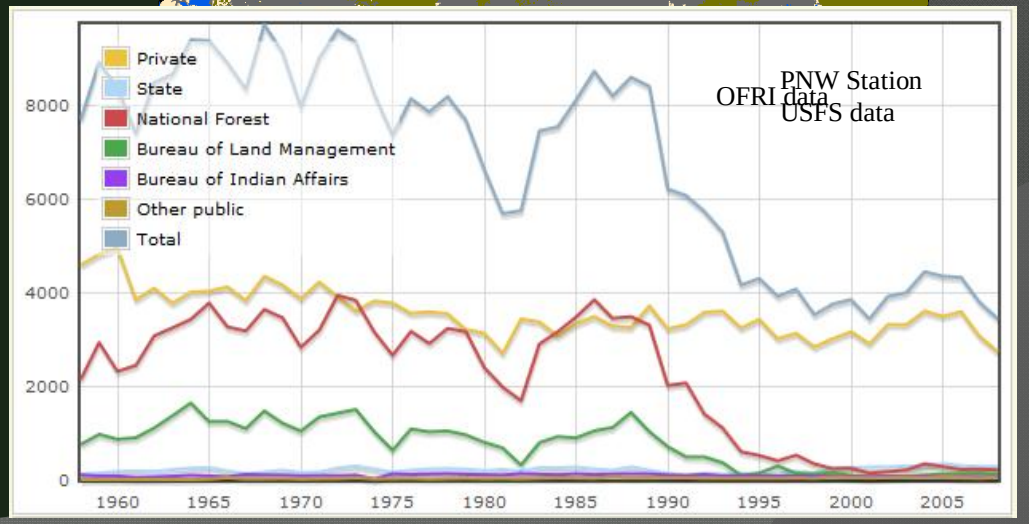



- Managed forests in the PNW
- Biodiversity on PNW managed forests ï an overview
- Challenges for maintaining biodiversity on managed landscapes
- Current research examples
- Future pressures and opportunities

Private Forest Lands in the Pacific Northwest

- 52 million acres of forest lands
- 32 million acres of federal lands
- 15 million acres of private lands
- Approx. 5 million acres of state, other public and tribal forest lands
- Private lands produce >75 % of the total harvest volume annually
- Before 1960 most timber harvest was on private lands peaking at 7.3 billion board feet in 1952
- Harvest on federal lands began to rise at that point until dramatic declines after 1990.
- 96% drop in federal timber harvest in OR from 1989 to 2001



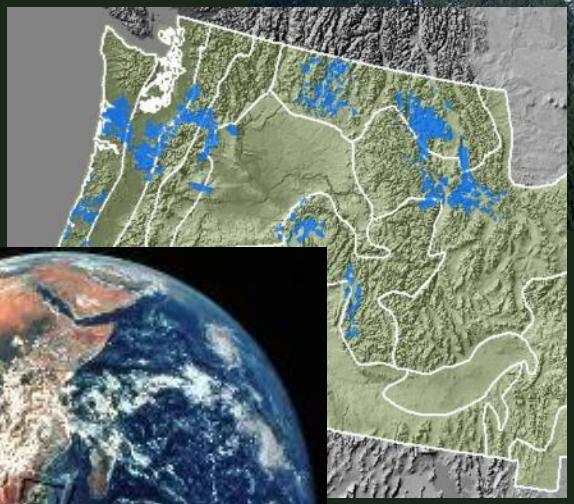


Biodiversity & Managed Forests

- Decades of research clearly indicate biodiversity value of managed landscapes in the PNW
- Strong link between sustainable forestry & biodiversity since the 1980ôs
- Forest certification systems have measures and goals relative to biodiversity (SFI Objective 4)
- Some laws (ESA, CWA) require biodiversity considerations
- The public demands that biodiversity issues be addressed on managed forests

Biodiversity & Managed Forests

- Consideration of the contributions of managed forests to conservation of biodiversity via multiple scales
- Stand scale
- Landscape scale
- Regional scale
- Global scale



Challenges for Maintaining Terrestrial Biodiversity

- Loss of older-seral forests and shorter rotation lengths
- Intensification of forest management
- Structural simplification of early-seral habitat
- Managing for biodiversity within economic and operational constraints

Is the effect of forest structure on bird diversity modified by forest productivity?

Jake Verschuyl

Supporting Authors:
A. J. Hansen, D. B. McWethy, R. Sallabanks, and R. L. Hutto

Primary funding:

Forest Structure as the Primary Driver of Diversity in the Forests of the Northwest

Vertical variation in canopy layering

MacArthur & MacArthur 1961
Franklin and Spies 1991

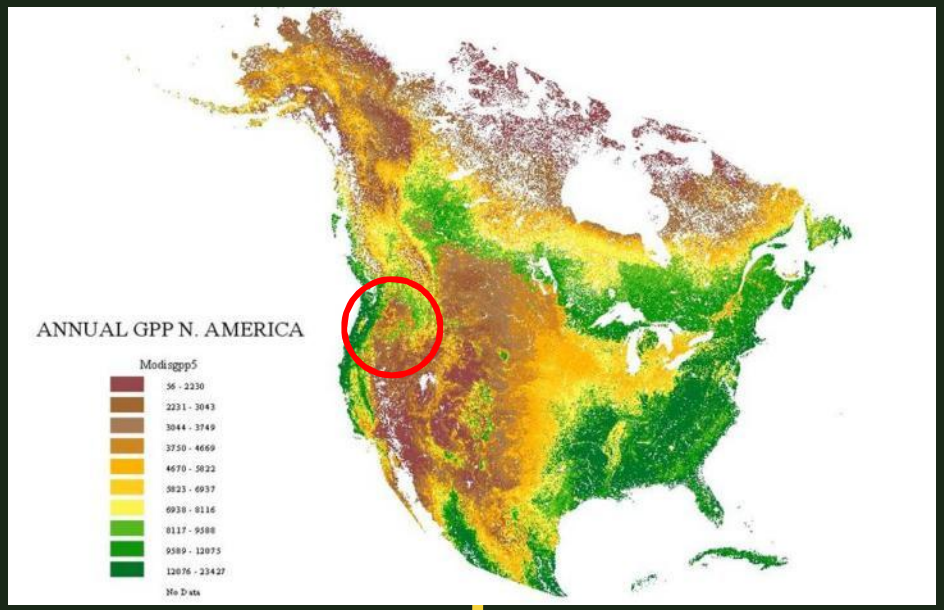
Horizontal variation of patch structure

Zenner and Hibbs 2000
McElhinny et al. 2005

BIODIVERSITY

Available Energy as a Primary Driver of Continental and Global-scale Patterns of Diversity

Hansen & Rotella 1999
Irwin 1999
Waide et al. 1999
Mittelbach et al. 2001
Hurlbert & Haskell 2003



BIODIVERSITY

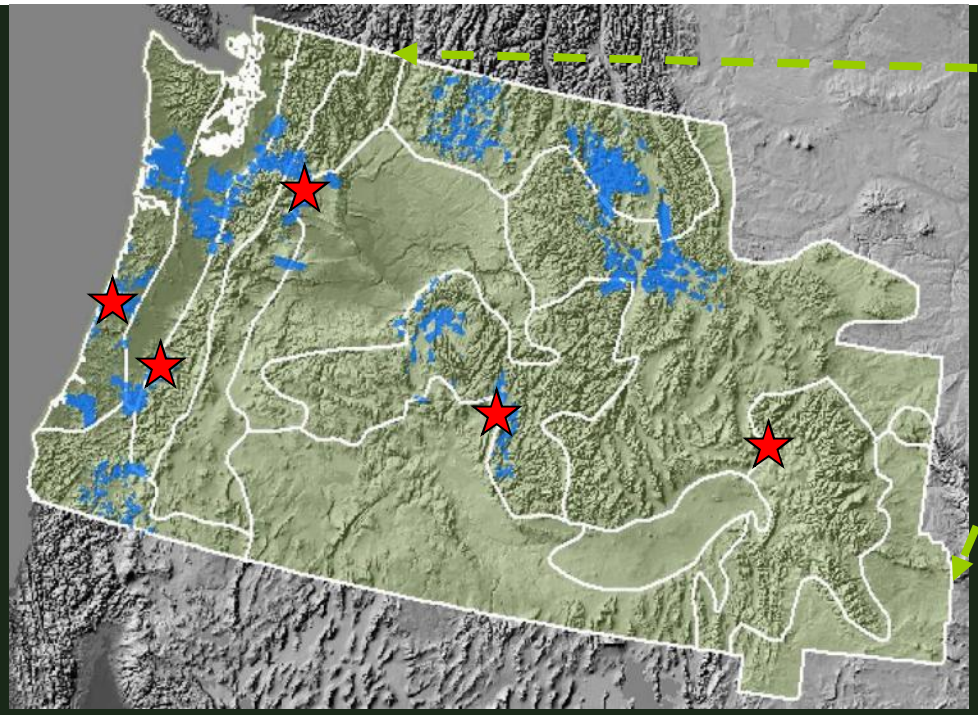
How do forest structure and available energy interact to drive species diversity?

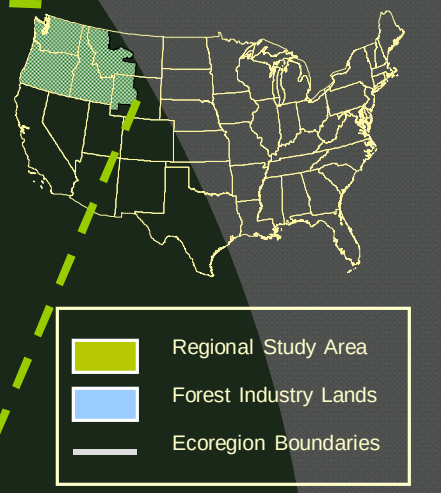
Forest Structural Complexity
(horizontal and vertical)

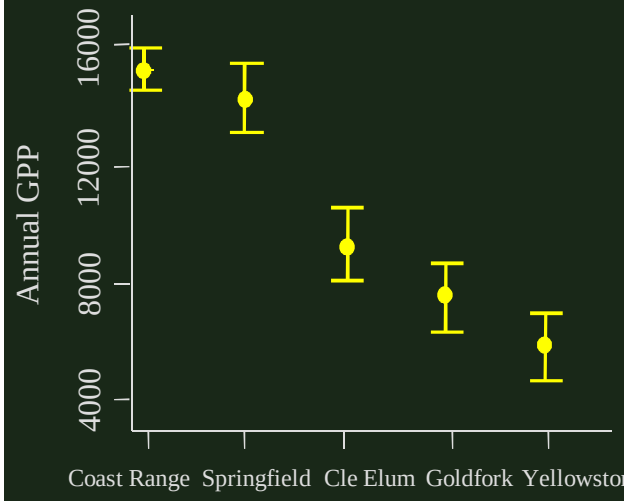
Available Energy
(e.g. ecosystem productivity, heat)

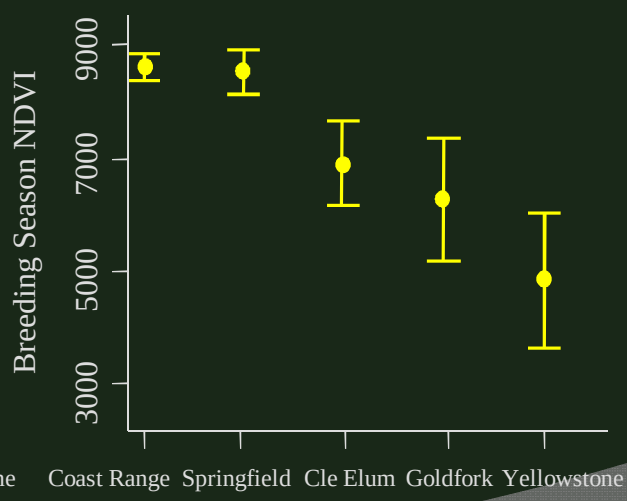
BIODIVERSITY

Regional Study Area







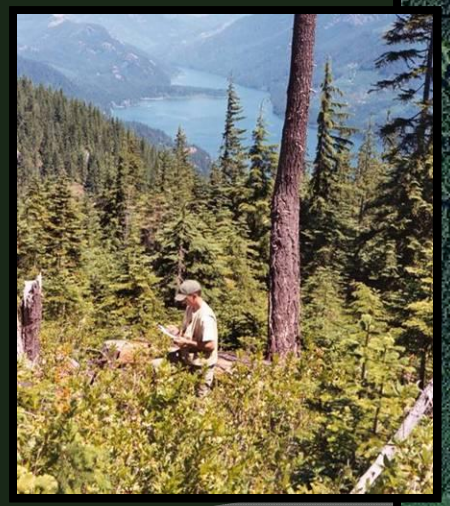


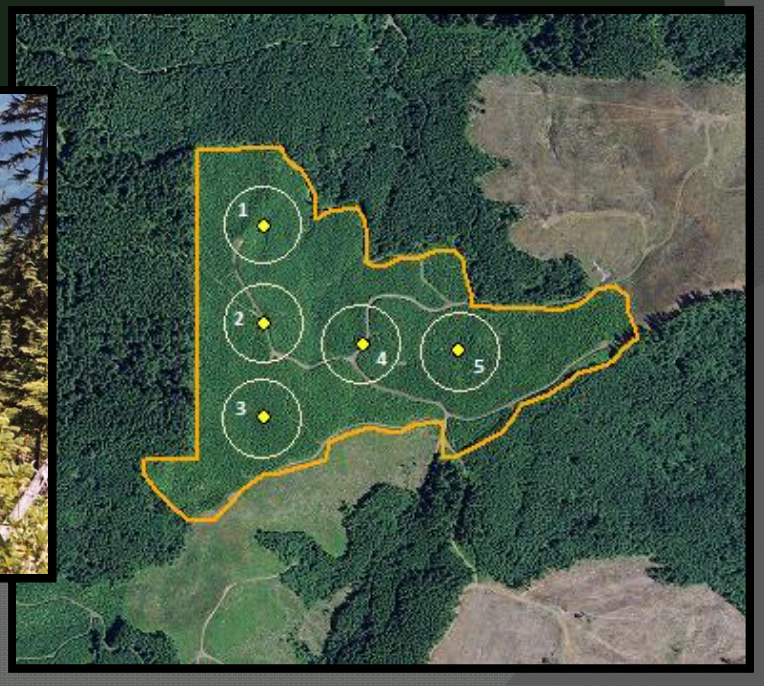
- Distributed across the biophysical gradients of the PINW
- Existing bird and predictor data
- Industry sites with biodiversity management objectives

Data Collection
Bird and Vegetation Sampling Design

- Stratified random sampling matrix
- Standard bird point count methodology (Ralph et al. 1995)
- 4-6 points used to represent a stand

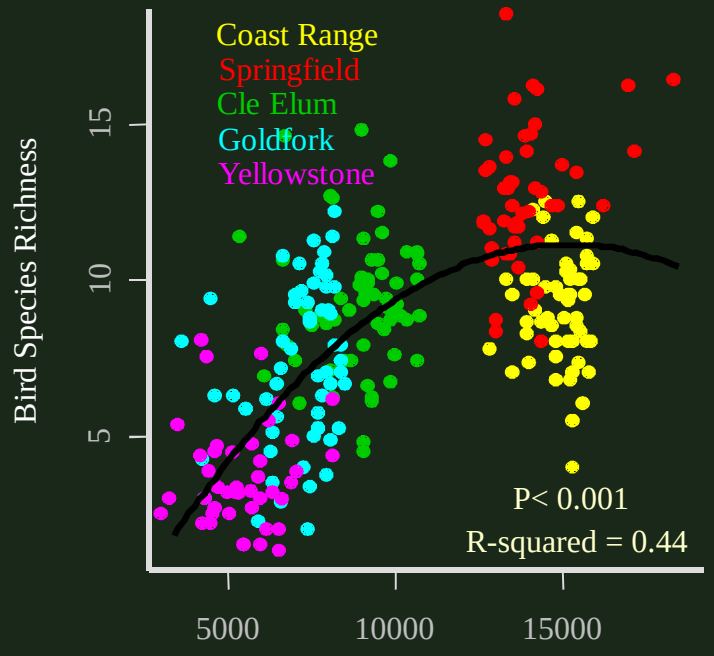
	Forest Structure/Seral Stage Gradient			
Gradient of Energy	Recently Harvested	Pole Timber	Mature Forest	"Old Growth"
Low	x	x	x	x
Medium-low	x	x	x	x
Medium-high	x	x	x	x
High	x	x	x	x

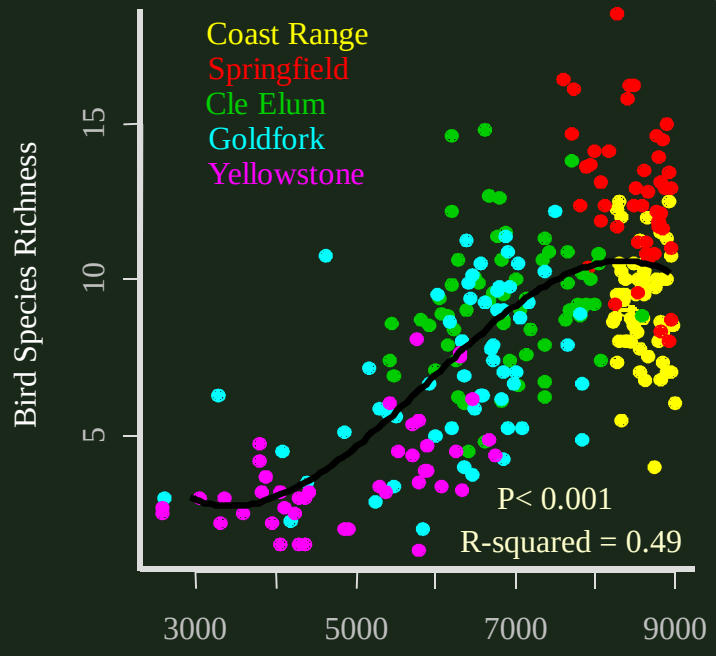


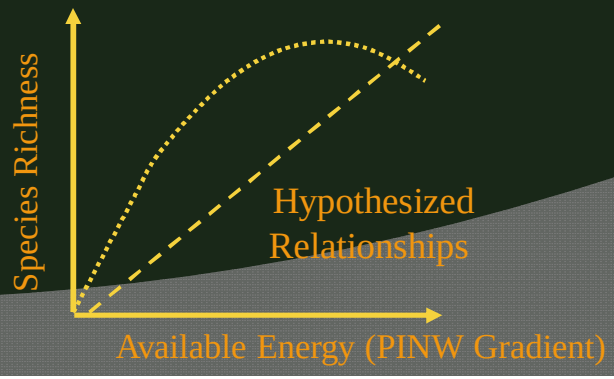


Results Prediction 1:

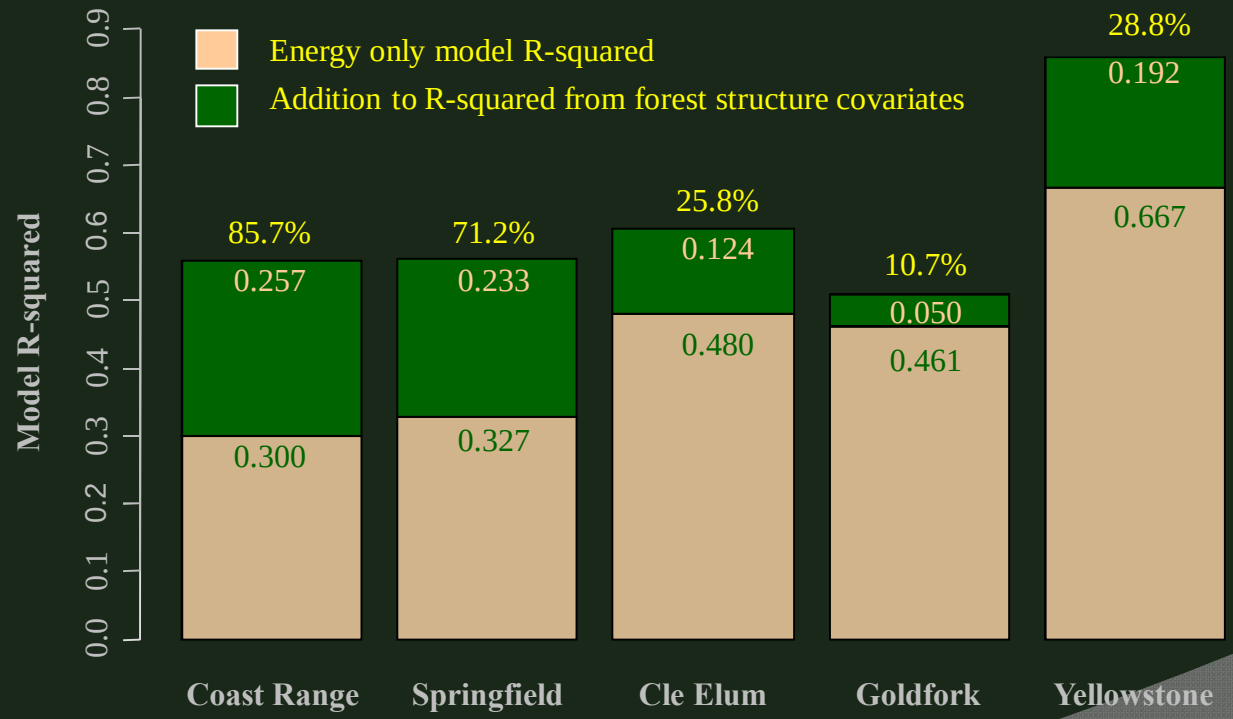
Regional Relationship between BSR & Energy







The Interaction of Forest Structural Complexity and Available Energy in Driving Species Diversity



Management Implications

High Energy Landscapes West of the Cascades

- Forest structure explains more of the variation in bird species richness
- Energy can be negatively correlated with bird species richness
- Disturbance can act to break competitive dominance of plants and young stands can potentially support a greater diversity of bird species
- Diversity is high across most of the landscape, therefore shifting mosaic pattern of harvest may work well
- Hotspot locations are diffuse across the landscape
- Maintain habitat features required by specialist species

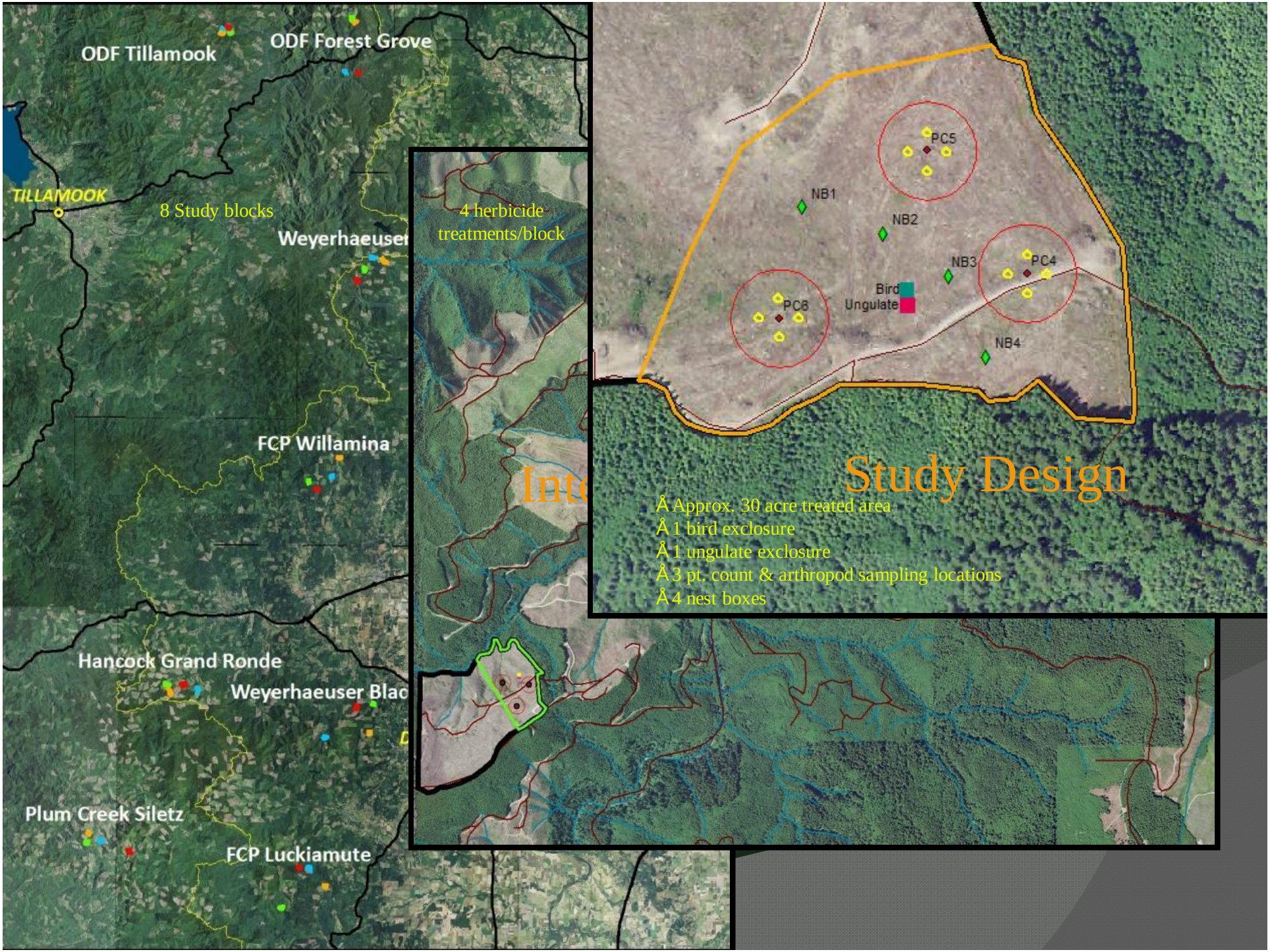
Management Implications

Low Energy Landscapes East of the Cascades

- Bird species richness is driven most strongly by energy
- Structural complexity still plays a role in driving bird species richness
- Biodiversity hotspot locations are concentrated in higher energy portions of the landscape (as is development pressure)
- Identify and carefully manage hotspots areas
- In non-hotspot locations account for the longer rotation periods required to maintain ecological productivity
- Harvest may temporarily decrease diversity; Thus techniques that promote rapid re-colonization of disturbed landscapes may be beneficial

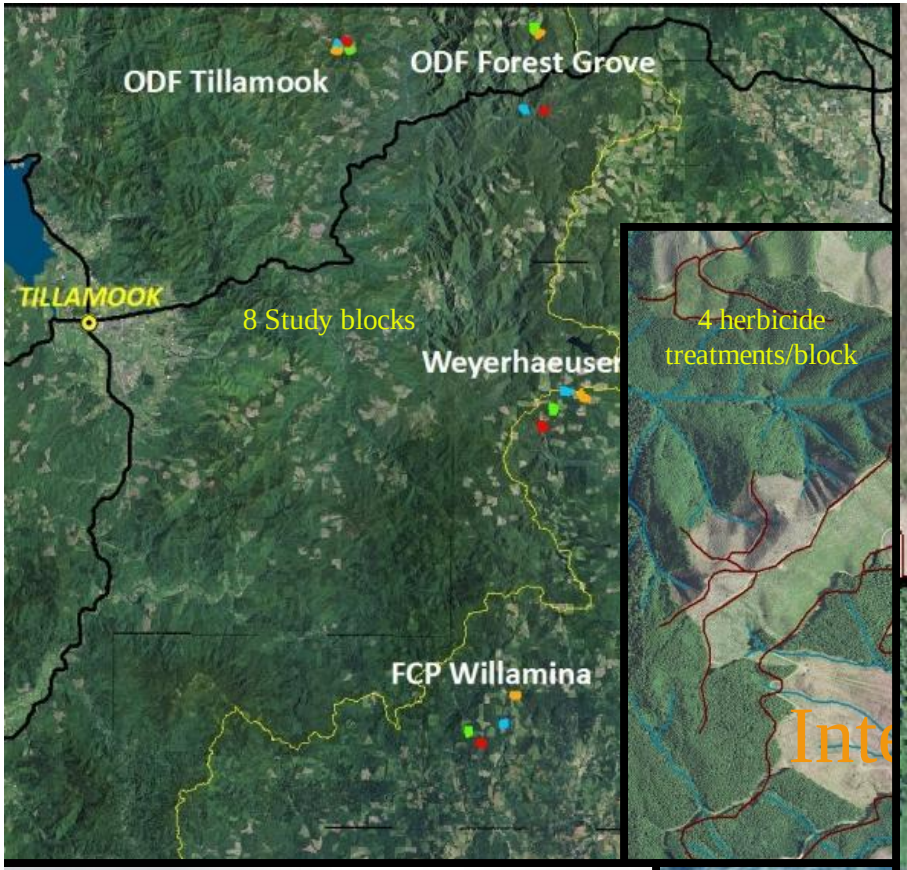
Effects of Intensive Forest Management on Biodiversity and Ecosystem Processes

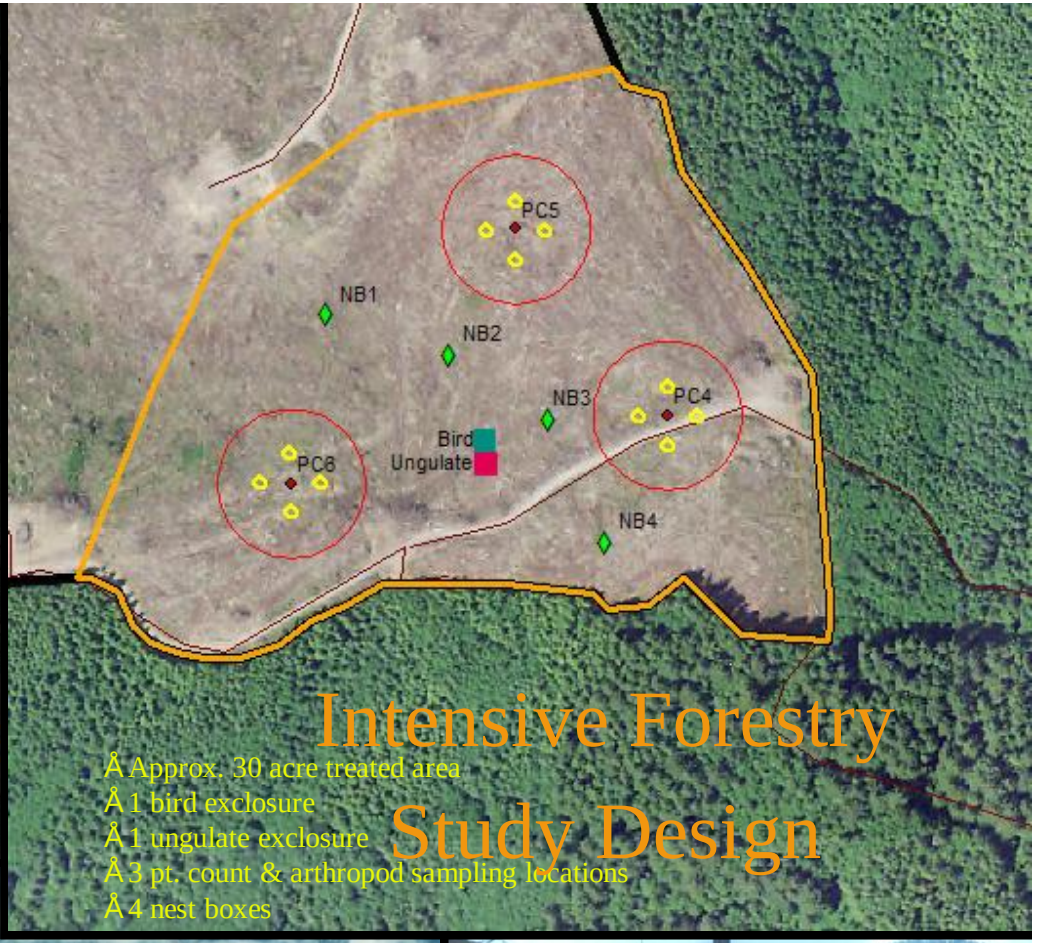
- Effects of intensive forest management on avian diversity, abundance and demography.
- Effects of intensive forest management on biomass and diversity of arthropods.
- Effects of intensive forest management on ungulate browse and food webs in early seral plantations.


ODF Tillamook
ODF Forest Grove
TILLAMOOK
8 Study blocks
Weyerhaeuser
FCP Willamina
Hancock Grand Ronde
Weyerhaeuser Blac
Plum Creek Siletz
FCP Luckiamute
4 herbicide
treatments/block
PC5
NB1
NB2
NB3
PC4
Bird
Ungulate
PC6
NB4
Inte
Study Design
Å Approx. 30 acre treated area
Å 1 bird exclosure
Å 1 ungulate exclosure
Å 3 pt. count & arthropod sampling locations
Å 4 nest boxes

Herbicide Treatments

Study Treatment	Year Post-harvest	Practice	Chemical and Quantity/Acre
Control	1-10	Plant (year 2)	None
Light Intermediate	2 (spring)	Herbaceous release	2.66 lbs. Velpar *(hexazinone)* 32 oz 2-4-D *(2,4-dichlorophenoxy acetic acid)*
	3 (late summer)	Woody veg control	1.5 qt Accord *(glyphosate)* 20 oz Garlon *(triclopyr)*
Heavy Intermediate	1 (late summer)	Site prep	1.5 oz Escort *(metsulfuron methyl)* 3 qts Accord *(glyphosate)* 24 oz Chopper *(imazapyr)* 3 oz Oust *(sulfometuron methyl & metsulfuron methyl)* 24 oz MSO *(methylated seed oil)*
	2 (spring)	Herbaceous control	2.66 lbs. Velpar *(hexazinone)* 32 oz 2-4-D *(2,4-dichlorophenoxy acetic acid)*
	3 (late summer)	Woody veg control	1.5 qt Accord *(glyphosate)* 20 oz Garlon *(triclopyr)*
		Bigleaf maple sprout control (as necessary)	*Imazapyr* (either hack and squirt, or foliar)*
	4 (late summer)	Big-leaf maple sprout control follow-up (if necessary)	*Imazapyr* (either hack and squirt, or foliar)*
Intensive	1 (late summer)	Site prep	1.5 oz Escort *(metsulfuron methyl)* 3 qts Accord *(glyphosate)* 24 oz Chopper *(imazapyr)* 3 oz Oust *(sulfometuron methyl & metsulfuron methyl)* 24 oz MSO *(methylated seed oil)*
	2-10 (spring)	Herbaceous control	2.66 lbs. Velpar *(hexazinone)* 32 oz 2-4-D *(2,4-dichlorophenoxy acetic acid)*
	3-10 (late summer)	Woody veg control *(Annual review with backpack treatments as necessary).*	1.5 qt Accord *(glyphosate)* 20 oz Garlon *(triclopyr)*
	3-10 (late summer)	Big-leaf maple sprout control and follow-up (as necessary)	*Imazapyr* (either hack and squirt, or foliar)*





Intensive Forestry Study Design

- Approx. 30 acre treated area
- 1 bird exclosure
- 1 ungulate exclosure
- 3 pt. count & arthropod sampling locations
- 4 nest boxes

Exclosure building

- Exclosure building began in early March 2011 ï completed August 2011
- 28 of 32 stands have exclosures

Ungulate browse and baseline vegetation sampling

Complete Access

Cervid Only Exclusion

Cervid and bird exclusion

Inside Excl.

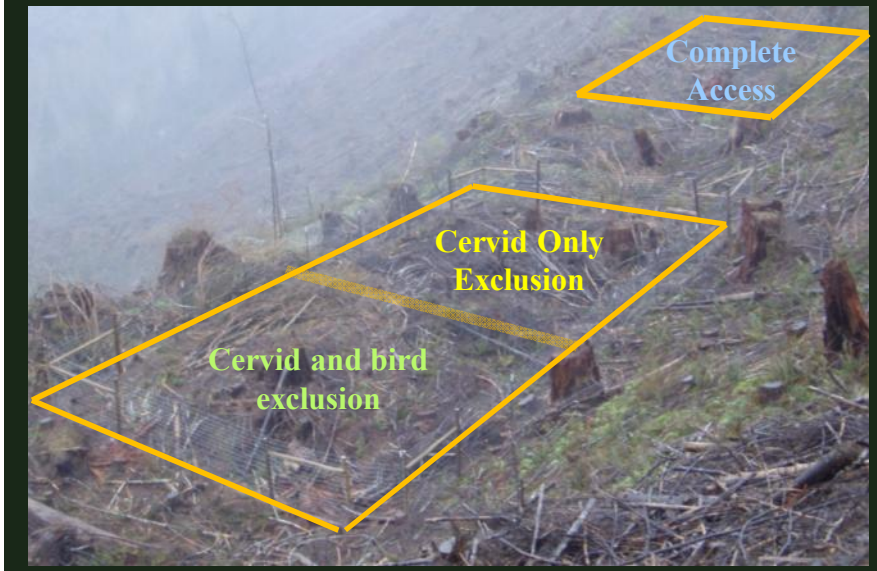
Outside Excl.

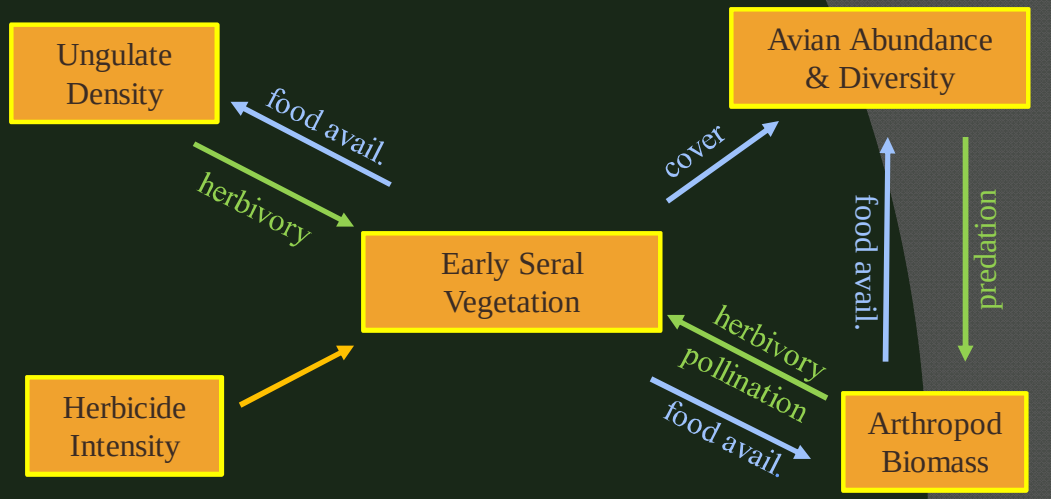
1 m Radius Woody Volume Quadrat

1x1 m Species Cover Quadrat

13 m Transects

15 m





Food Web Dynamics:

What happens to arthropod density & early-seral vegetation when birds are excluded?

Diversity and biomass of nocturnal Lepidoptera

- How do diversity and biomass of moths respond to herbicide treatments and resulting changes in broadleaf vegetation?
- How does biomass of nocturnal Lepidoptera correlate with diurnal arthropod larval stages biomass?
- Is bird diversity a good surrogate for diversity of other taxonomic groups in early seral plantations?

Future Pressures and Opportunities

- New T & E species requirements
- Biomass harvesting and other intensive forestry practices
- Meeting increasing wood demand with less support from federal timberlands
- Development pressure

Conclusions

- Managed forests of the PNW have value for conservation of biological diversity at multiple scales
- Value of any given stand or landscape depends on landscape context, silvicultural regime, and commitment of landowner
- Active management provides opportunities to create or maintain vegetation communities needed for local and regional conservation
- Continued research to understand biodiversity affects of changes in forest condition is critical














Questions?

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