

Initial Effects of Intensive Forest Management on Birds and Arthropods

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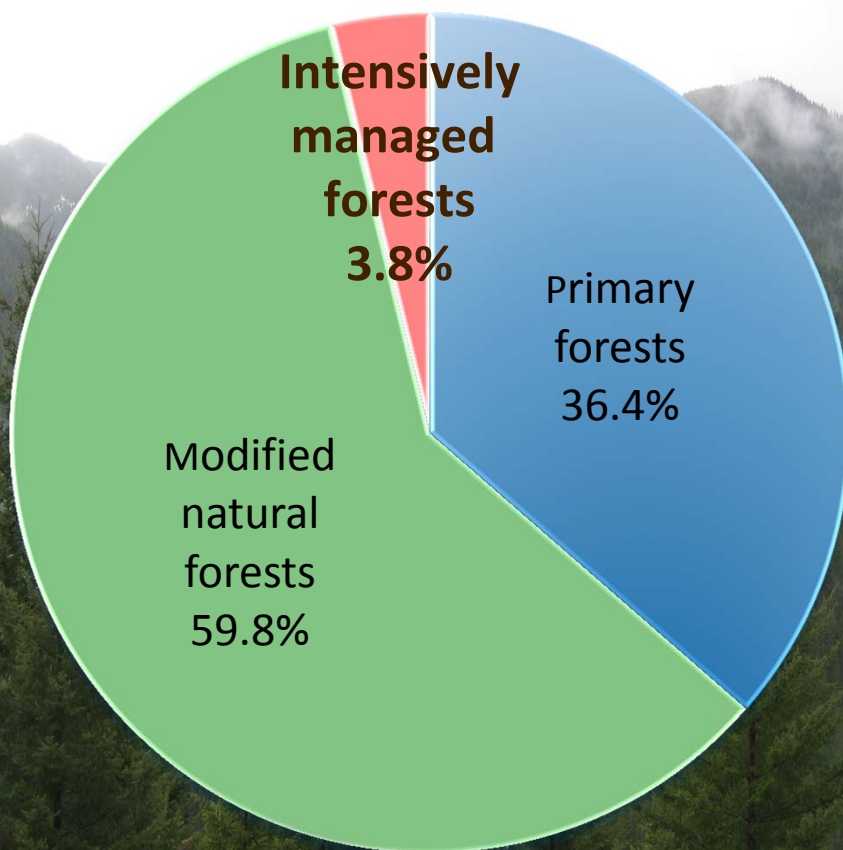
Jack Giovanini, Weyerhaeuser

Thomas Stokely, Oregon State University

Andrew Kroll, Weyerhaeuser

Global role of intensively managed forests

World Forest Composition



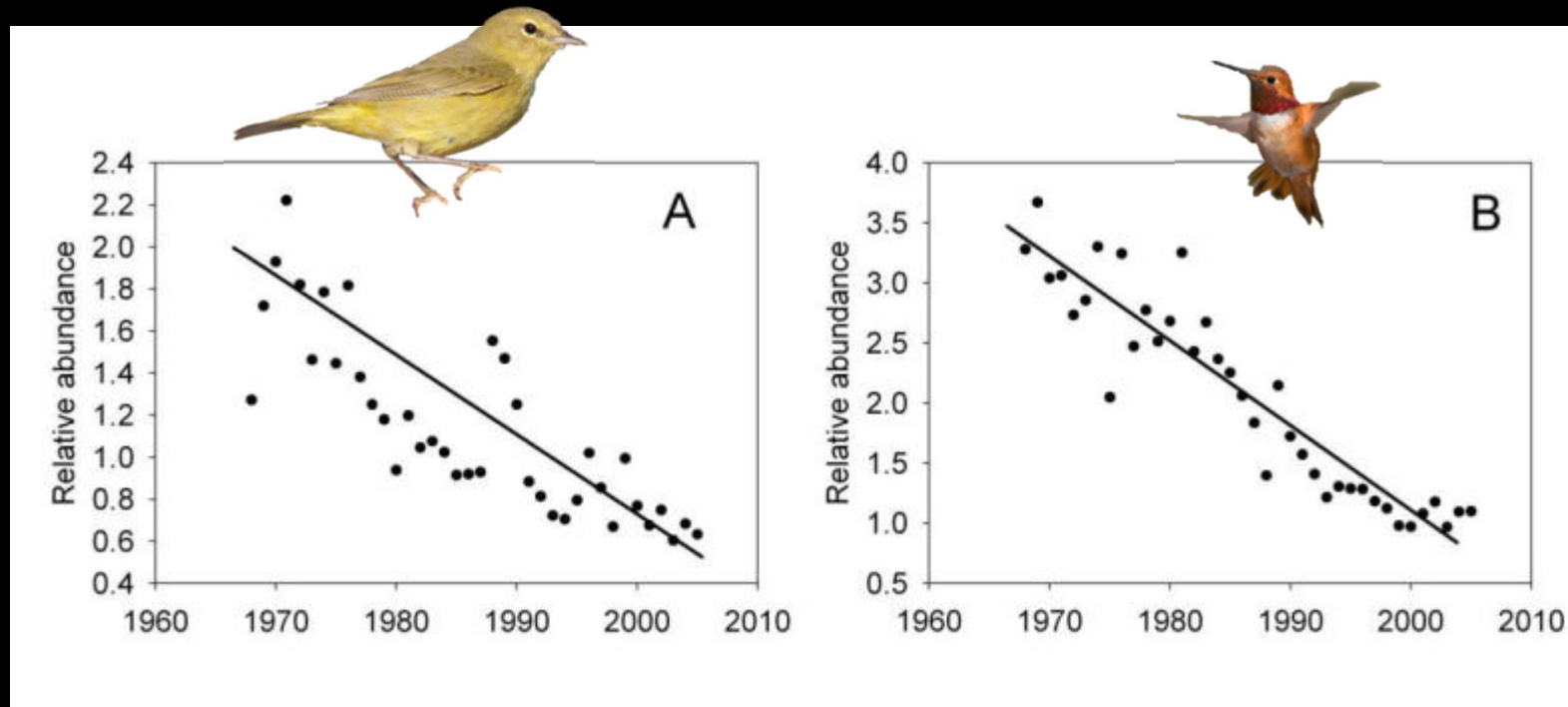
- Produced 35% global industrial wood in 2000
- Expected increase to 45% by 2030

Benefits of Intensive Forest Management



- Intensive forestry creates a steady, uniform and predictable supply of wood-fiber.
- High production on a small land area reduces harvest pressure on other forests.

BBS Population trends for Oregon



Orange-crowned warbler

Rufous hummingbird

“Hot” Topic?

Early seral hardwood vegetation increases adult and fledgling bird abundance in Douglas-fir plantations of the Oregon Coast Range, USA

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PRACTICE OF FORESTRY

policy

A Restoration Framework for Federal Forests in the Pacific Northwest

Jerry F. Franklin and K. Norman Johnson

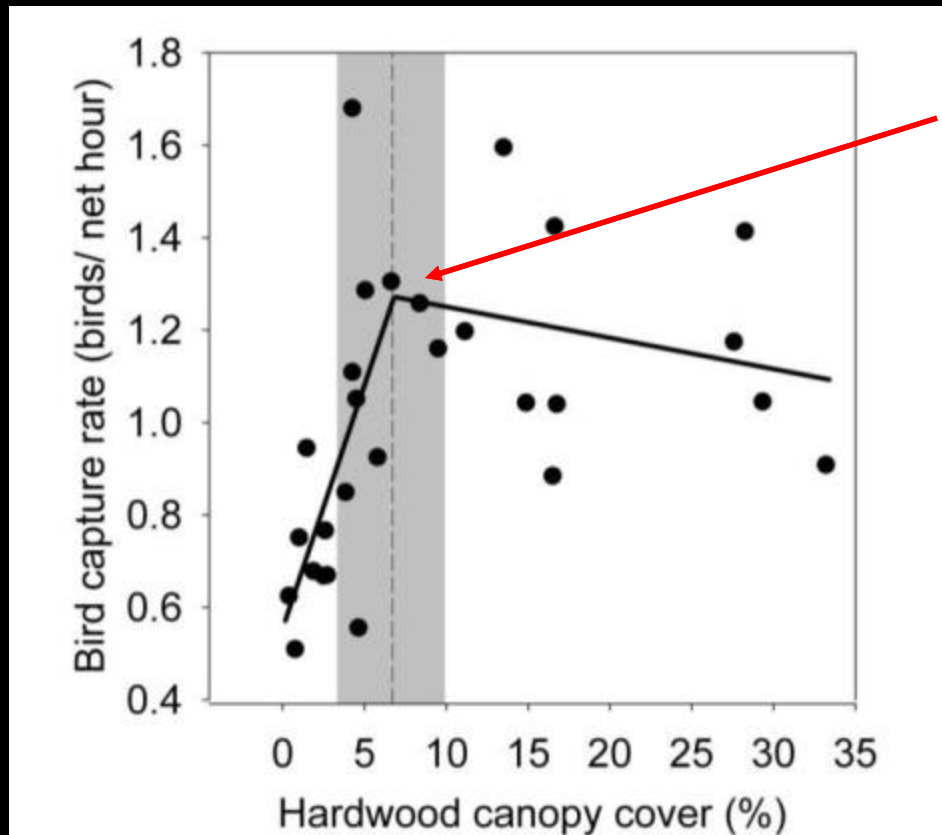
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- Simplification of early-seral on private lands
- Loss of early seral on federal lands

Total bird capture rate

Ellis and Betts 2011
Forest Ecology & Management



*Hardwood
threshold at
6.7 %
(SE=1.6)*



Collaborators



Matt Betts



Paul Hammond



A.J. Kroll



Melissa Scherr



Jim Rivers



Thomas Stokely



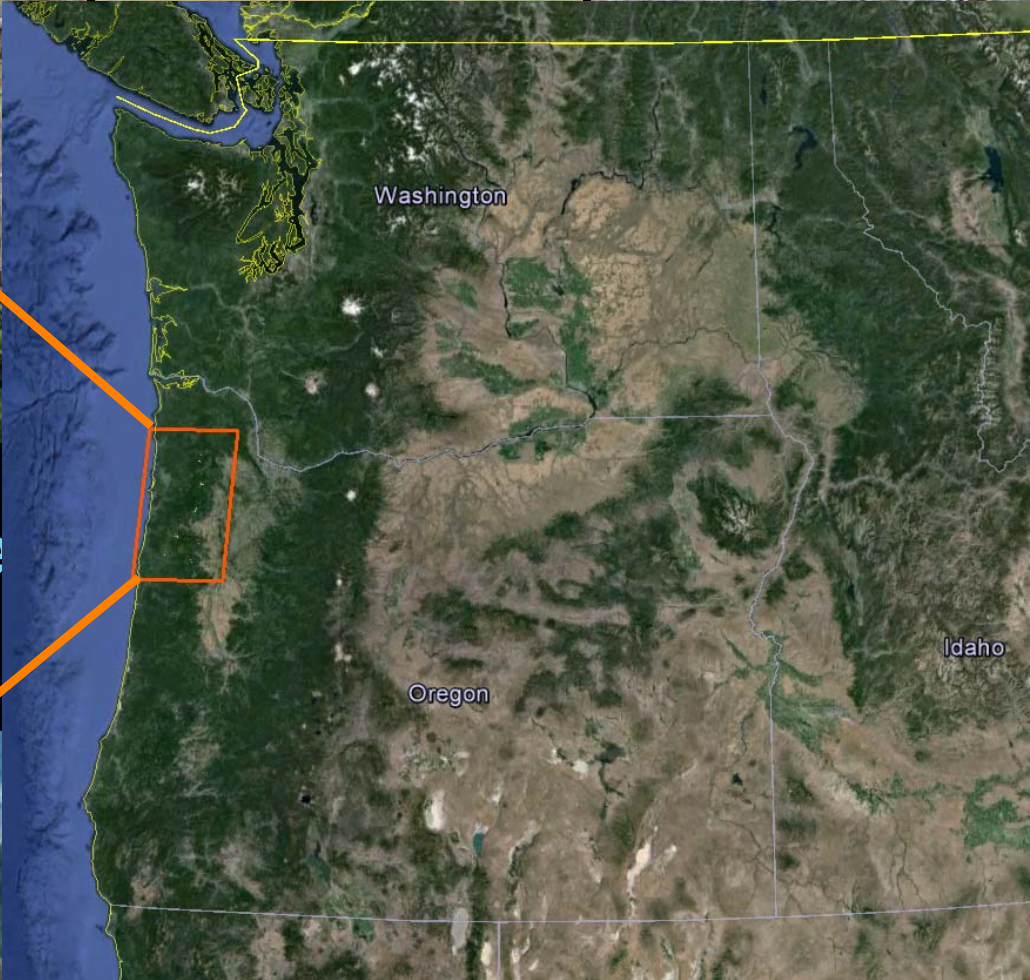
Jake Verschuyf

Research Objectives

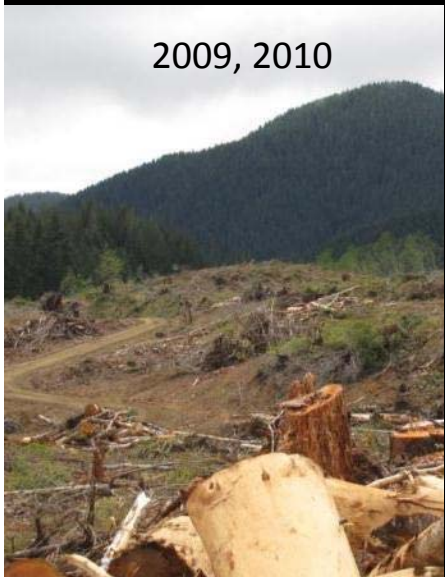
Evaluate how bird and arthropod abundance and diversity varies across a gradient in management intensity

How can plantation management practices maintain biodiversity while still producing timber?

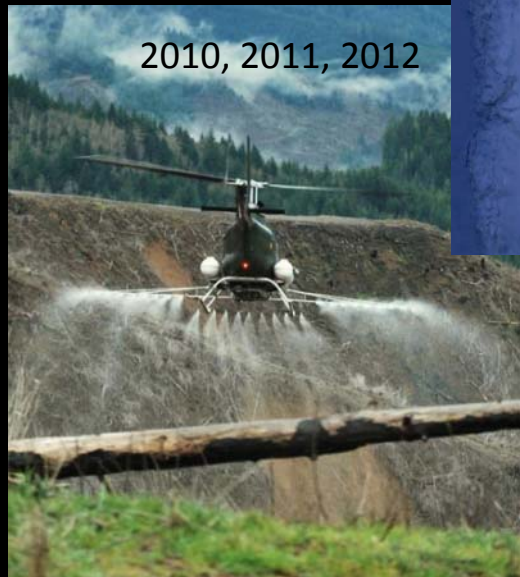




Intensive Forest



2009, 2010



2010, 2011, 2012



Study Area

Herbicide Treatments

Study Treatment	Year Post-harvest	Practice	Chemical and Quantity/Acre
Control	1-10	Plant (year 2)	None
	2 (spring)	Herbaceous release	2.66 lbs. Velpar (<i>hexazinone</i>) 32 oz 2-4-D (<i>2,4-dichlorophenoxy acetic acid</i>)
Light	3 (late summer)	Woody veg control	1.125 qt Accord (<i>glyphosate</i>) 20 oz Garlon (<i>triclopyr</i>)
	1 (late summer)	Site prep	1.5 oz Escort (<i>metsulfuron methyl</i>) 3 qts Accord (<i>glyphosate</i>) 24 oz Chopper (<i>imazapyr</i>) 3 oz Oust (<i>sulfometuron methyl & metsulfuron methyl</i>) 24 oz MSO (<i>methylated seed oil</i>)
Moderate	2 (spring)	Herbaceous control	2.66 lbs. Velpar (<i>hexazinone</i>) 32 oz 2-4-D (<i>2,4-dichlorophenoxy acetic acid</i>)
	3 (late summer)	Woody veg control	1.5 qt Accord (<i>glyphosate</i>) 20 oz Garlon (<i>triclopyr</i>)
		Bigleaf maple sprout control (as necessary)	<i>Imazapyr</i> (either hack and squirt, or foliar)*
	4 (late summer)	Big-leaf maple sprout control follow-up (if necessary)	<i>Imazapyr</i> (either hack and squirt, or foliar)*
Intensive	1 (late summer)	Site prep	1.5 oz Escort (<i>metsulfuron methyl</i>) 3 qts Accord (<i>glyphosate</i>) 24 oz Chopper (<i>imazapyr</i>) 3 oz Oust (<i>sulfometuron methyl & metsulfuron methyl</i>) 24 oz MSO (<i>methylated seed oil</i>)
	2-10 (spring)	Herbaceous control	2.66 lbs. Velpar (<i>hexazinone</i>) 32 oz 2-4-D (<i>2,4-dichlorophenoxy acetic acid</i>)
	3-10 (late summer)	Woody veg control (<i>Annual review with backpack treatments as necessary</i>).	1.125 qt Accord (<i>glyphosate</i>) 20 oz Garlon (<i>triclopyr</i>)
	3-10 (late summer)	Big-leaf maple sprout control and follow-up (as necessary)	<i>Imazapyr</i> (either hack and squirt, or foliar)*

2013 CONTROL:
NO SPRAY



2013 LIGHT:
1 HERBACEOUS
SPRAY (2011);
1 WOODY VEG
SPRAY



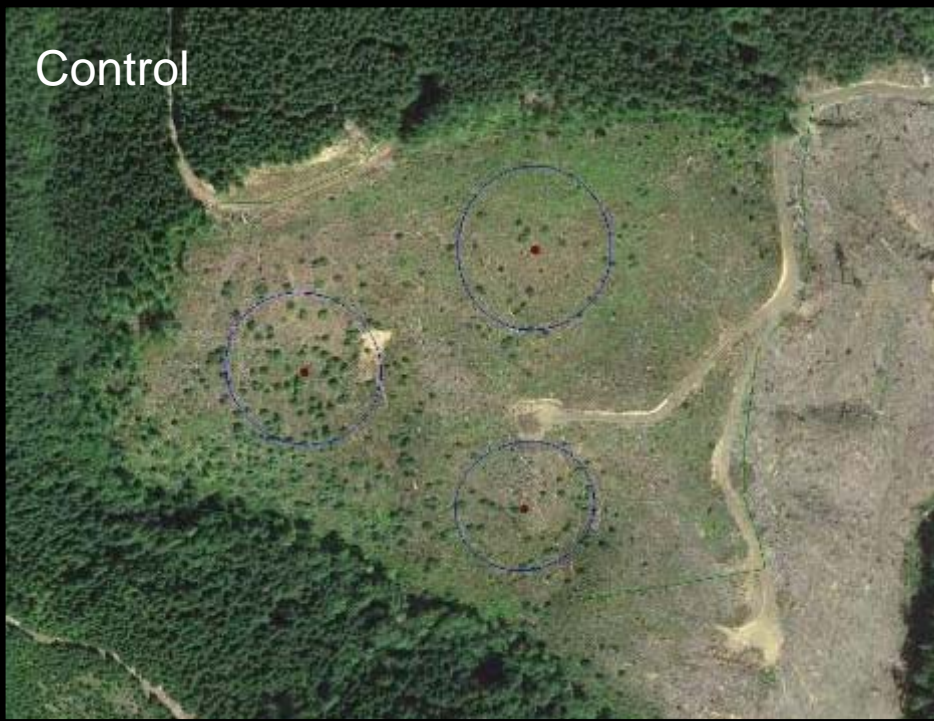
2013 MODERATE:
1 SITE PREP WOODY
SPRAY (2010);
1 HERBACEOUS
SPRAY (2011)



2013 MODERATE:
1 SITE PREP WOODY
SPRAY (2010);
3 HERBACEOUS SPRAYS
(2011, 2012, 2013);
2 WOODY RELEASE
SPRAYS (2011, 2012)



Control



Light



Moderate



Intensive



Point Count Sampling

- Observations from census locations taken 4 times during the breeding season for 2 years (2011, 2012)
- 96 point count stations
- 10 minute sampling (Ralph et al. 1995)
- 50-m fixed radius for analysis



Bird point count data analysis

N-mixture model (Royle 2004) to estimate detection probabilities and abundance

- spatially and temporally replicated counts
- unmarked individuals

Model assumptions

- population closure
- independence of counts across sites
- assumed distribution of plot-level abundance across sites

Royle, J. A. 2004. *N-mixture models for estimating population size from spatially replicated counts*. *Biometrics* 60:108-115.

Bird point count data analysis

The model

- N-mixture models allow the simultaneous estimation of covariates on both abundance and detection probability.
- Let n_{it} be the number of animals counted at site i and time t , where $i=1,\dots,24$ and $t=1,2,3$. Let N_i be the unobserved site level abundance. Then our model is:

$$N_i \sim \text{Poisson}(\lambda_i)$$

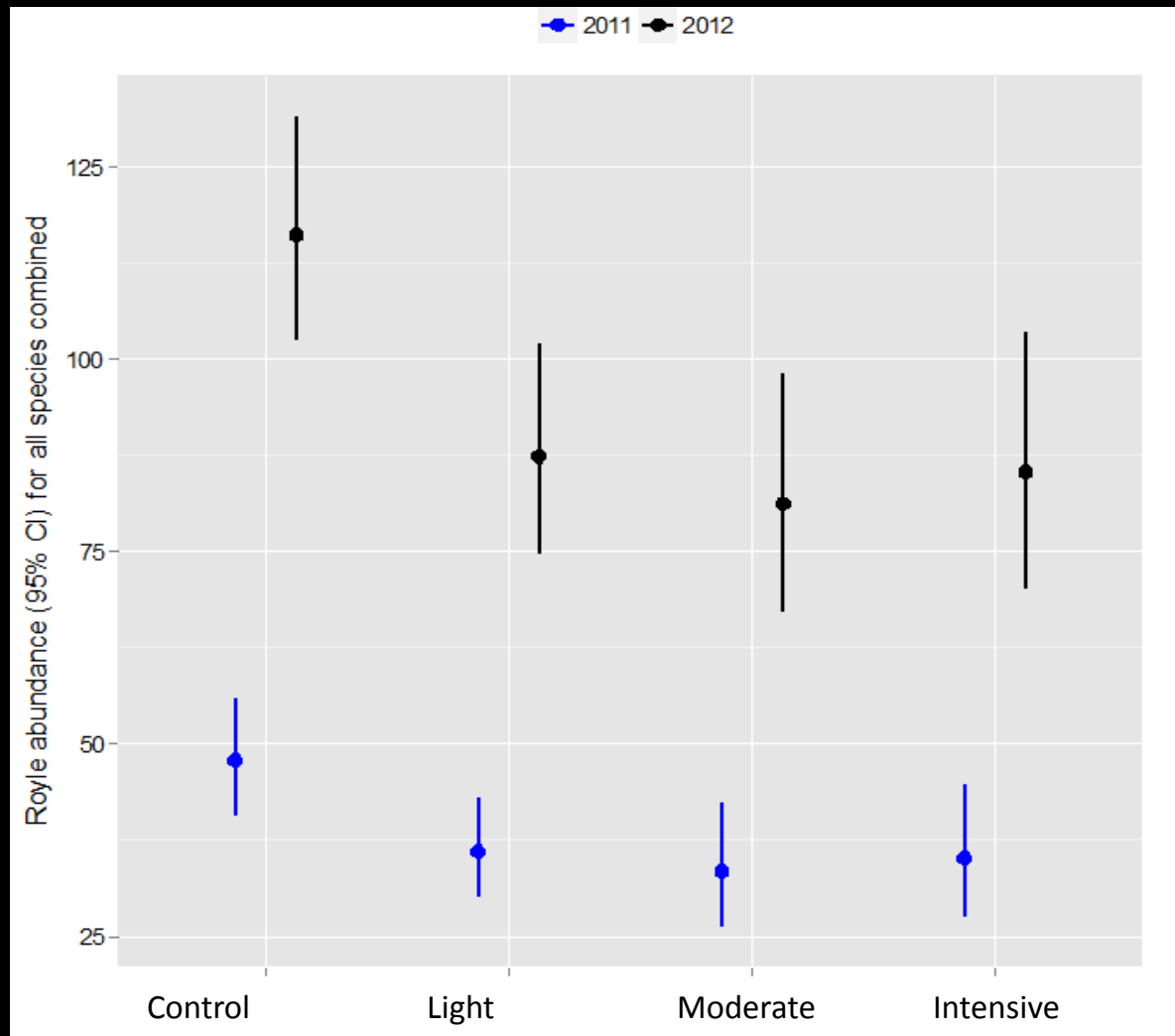
$$n_{it} \sim \text{Binomial}(N_i, \theta_i)$$

$$\log(\lambda_i) = \beta_0 + \beta_1 \text{Year} + \beta_2 \text{Treatment} + \beta_3 \text{Elevation}$$

$$\text{logit}(\theta_i) = \alpha_0 + \alpha_1 \text{Percent Broadleaf Cover} + \alpha_3 \text{Julian Date} + \alpha_4 \text{Julian Date}^2$$

Abundance for 13 most common species

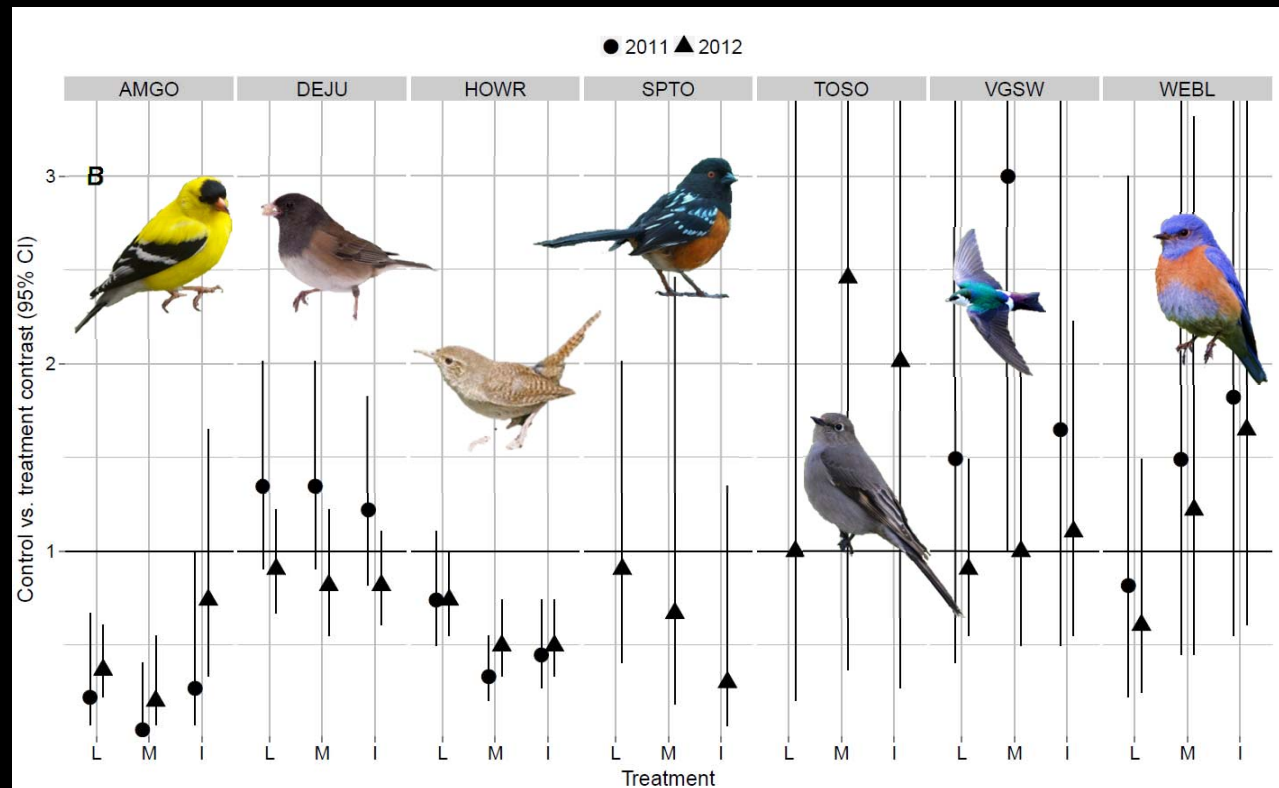
- House Wren
- Dark eyed junco
- White-crowned sparrow
- Violet-green swallow
- American goldfinch
- Western bluebird
- Song sparrow
- Wilson's warbler
- Rufus hummingbird
- Spotted towhee
- Swainson's thrush
- Townsend's solitaire
- Orange-crowned warbler



Abundance for most common species: Habitat generalists

Control vs. Treatment Contrasts

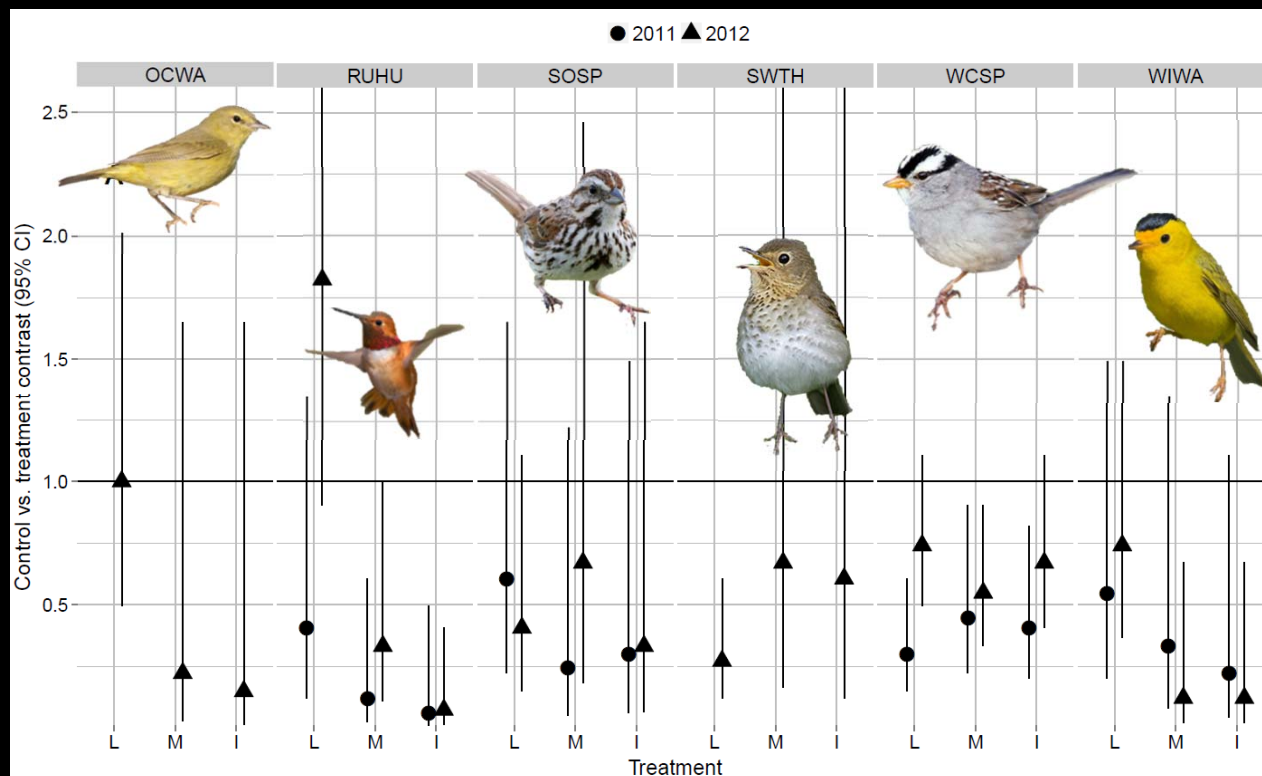
- House Wren; HOWR
- Dark eyed junco; DEJU
- White-crowned sparrow; WCSP
- Violet-green swallow; VGSW
- American goldfinch; AMGO
- Western bluebird; WEBL
- Song sparrow; SOSP
- Wilson's warbler; WIWA
- Rufus hummingbird; RUHU
- Spotted towhee; SPTO
- Swainson's thrush; SWTH
- Townsend's solitaire; TOSO
- Orange-crowned warbler; OCWA



Abundance for most common species: Early-seral specialists

Control vs. Treatment Contrasts

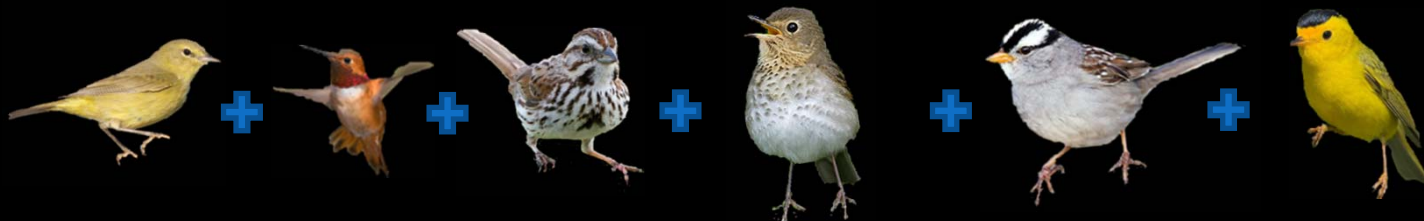
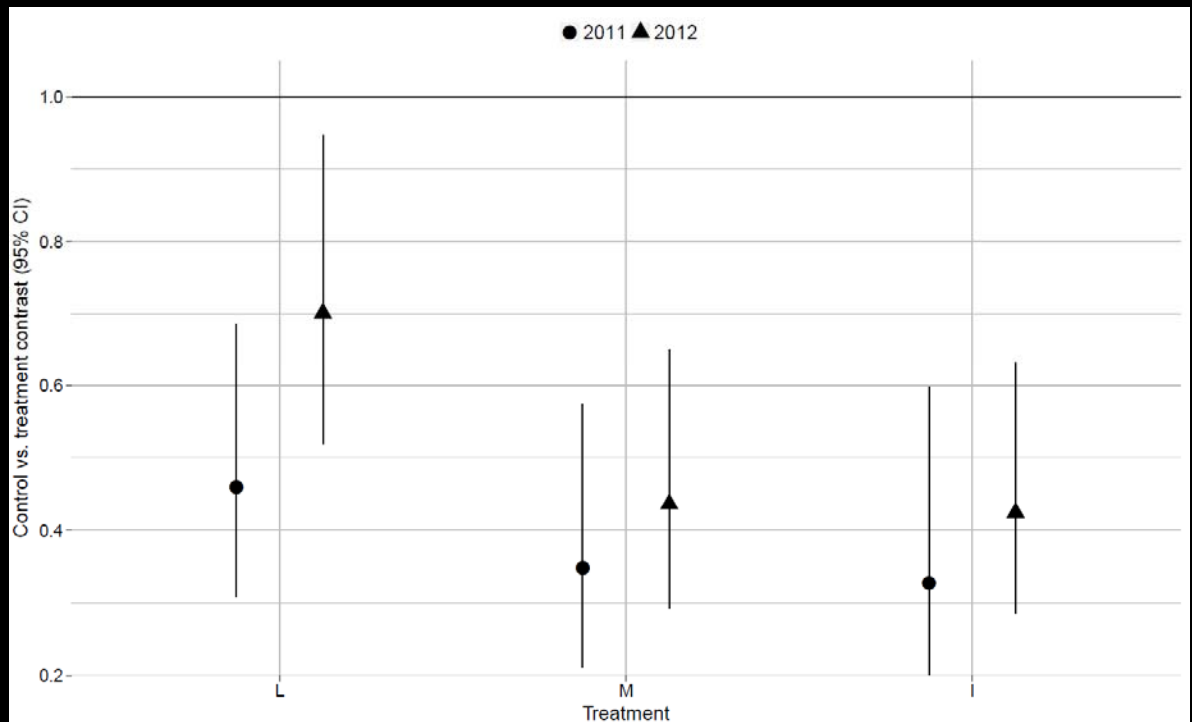
- House Wren; HOWR
- Dark eyed junco; DEJU
- **White-crowned sparrow; WCSP**
- Violet-green swallow; VGSW
- American goldfinch; AMGO
- Western bluebird; WEBL
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- **Swainson's thrush; SWTH**
- Townsend's solitaire; TOSO
- **Orange-crowned warbler; OCWA**



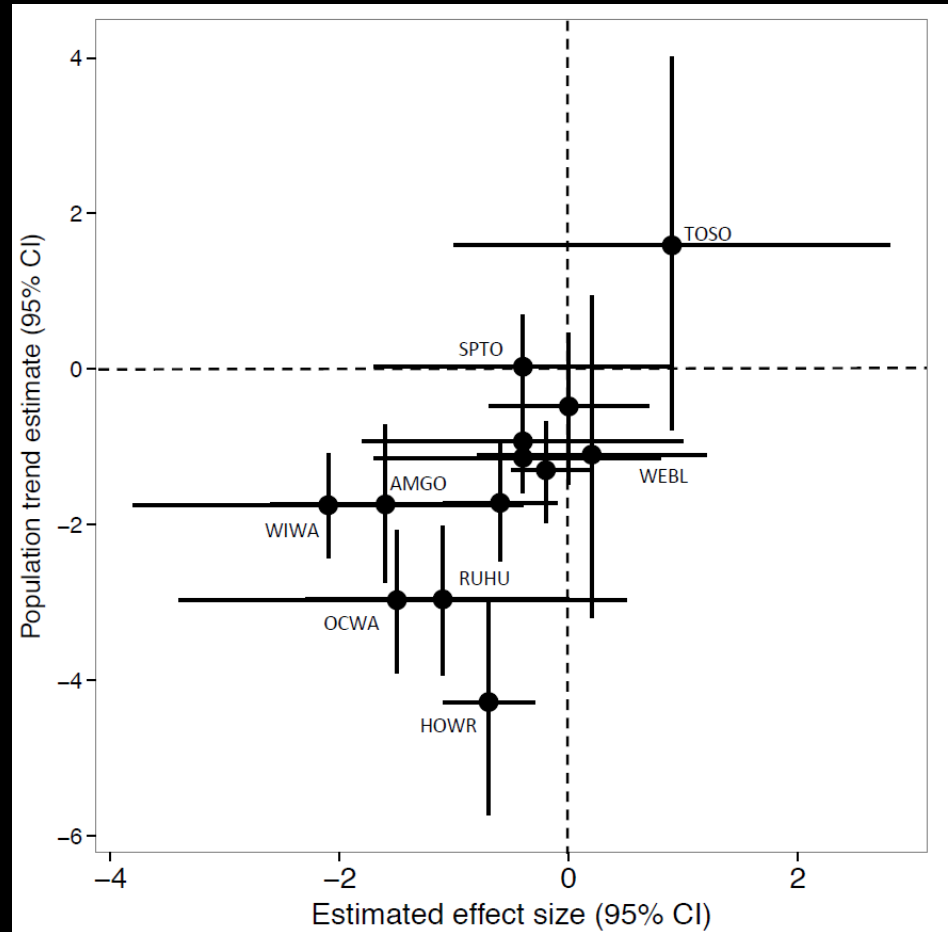
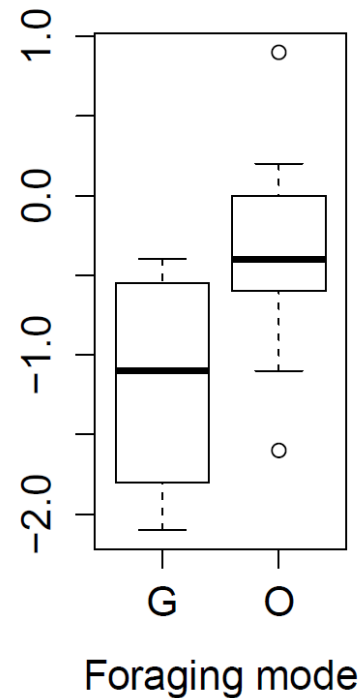
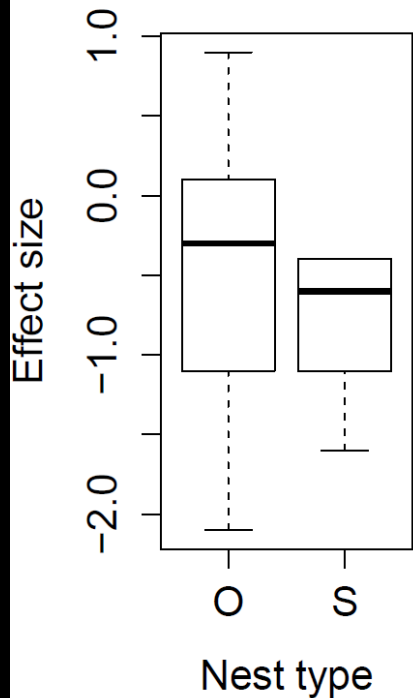
Control vs. treatment contrasts for abundance of 6 early-seral associated species

- White-crowned sparrow
- Song sparrow
- Wilson's warbler
- Rufus hummingbird
- Swainson's thrush
- Orange-crowned warbler

Control vs. Treatment Contrasts



Characteristics of species responding to herbicide treatments



Conclusions

- Large colonization effect between 2011 and 2012
- Abundance for six of thirteen bird species was reduced in at least one of the herbicide treatments in relation to the Control
- Shrub nesters and insectivorous birds tended to be more negatively influenced by our heavier treatments
- Dichotomy between Control and Light vs. Moderate and Intensive may reflect incomplete treatments
- Conifer nesting species yet to colonize
- Tree growth data first collected in 2012

Diversity within other taxonomic groups



- Moth biomass and species richness by treatment
- Adult biomass ~~Back light with blue light~~ (bird food)? stand near point count locations
- Is bird diversity a good surrogate for diversity of other taxonomic groups in early seral plantations?

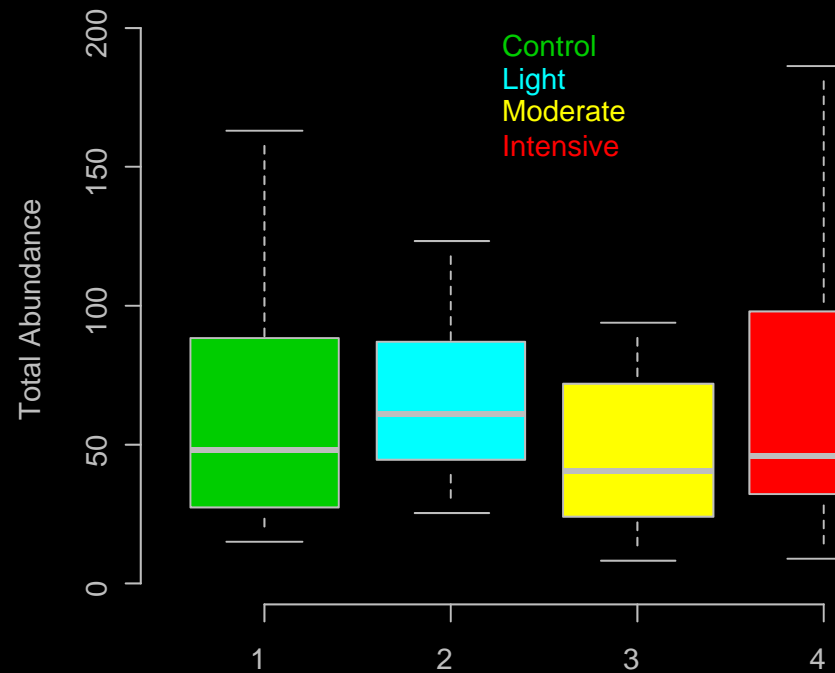
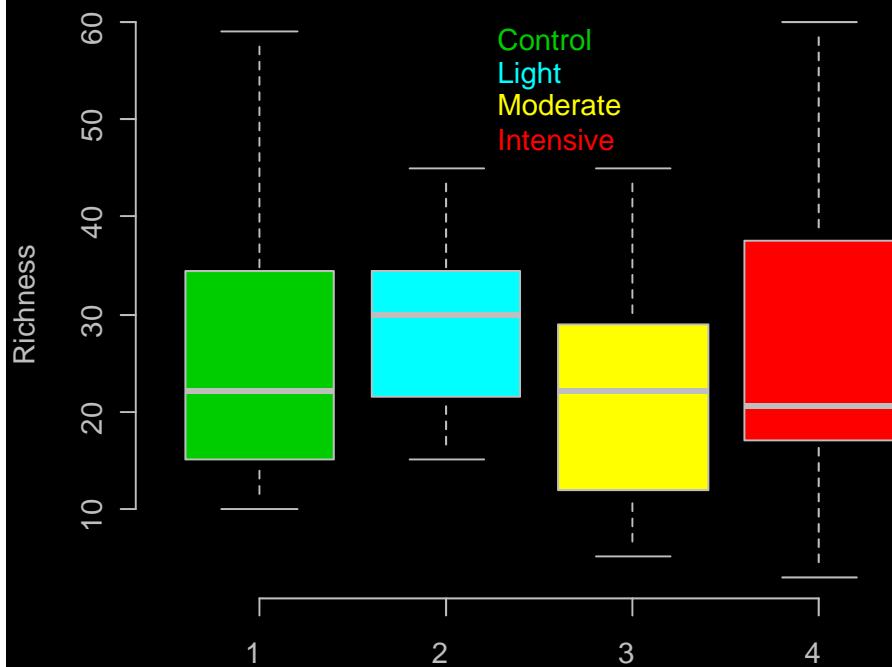


Diversity within other taxonomic groups

- Black light traps placed 3 per stand near point count locations
- 1 trap night per month May- August
- Samples ID'd by Paul Hammond (OSU)
- 6432 moths from 269 species & 9 families



Moth richness and abundance by treatment



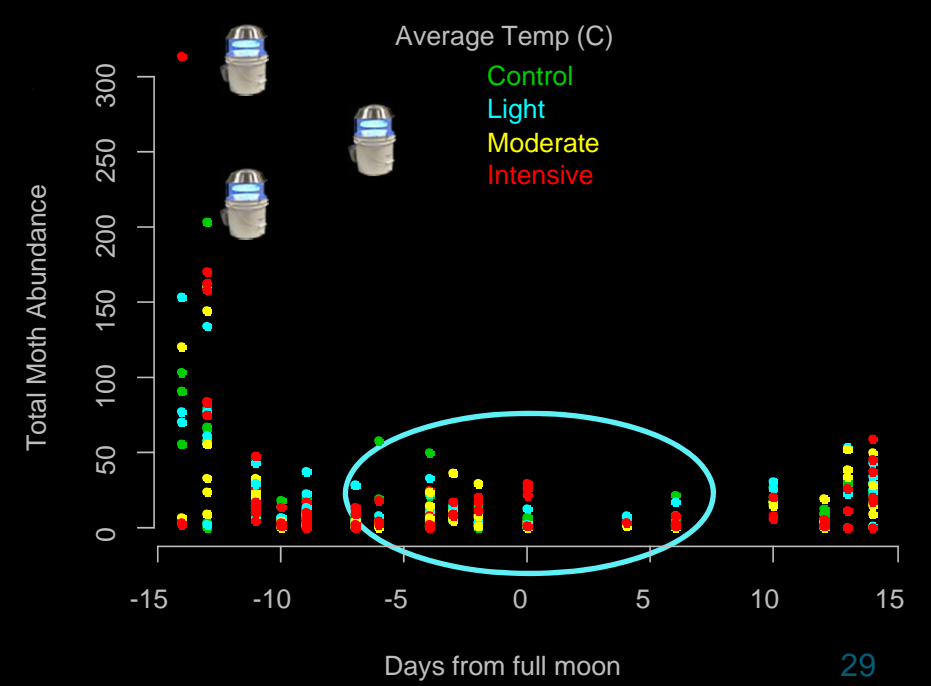
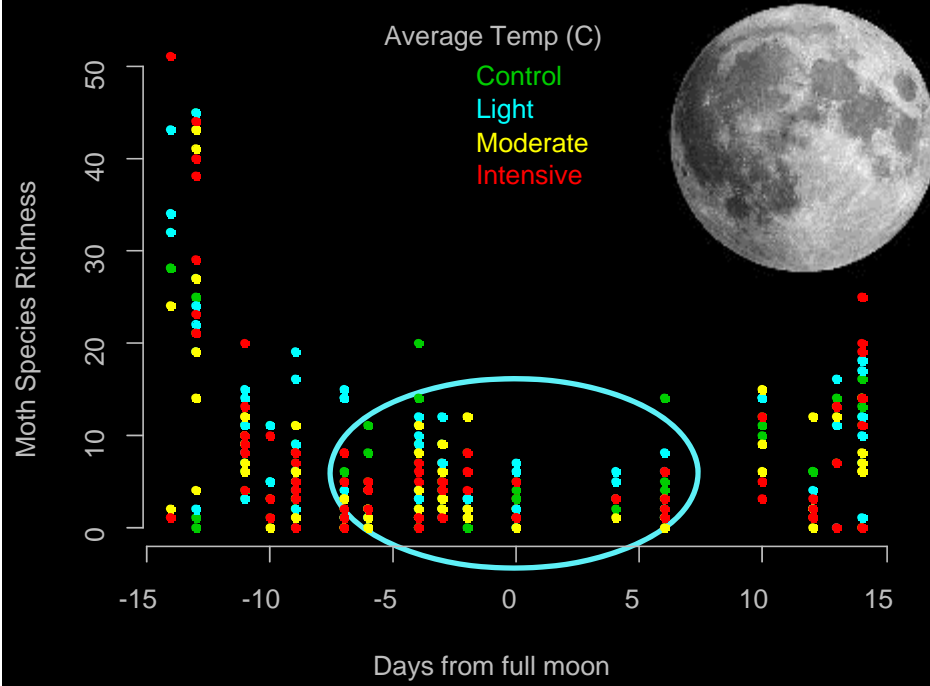
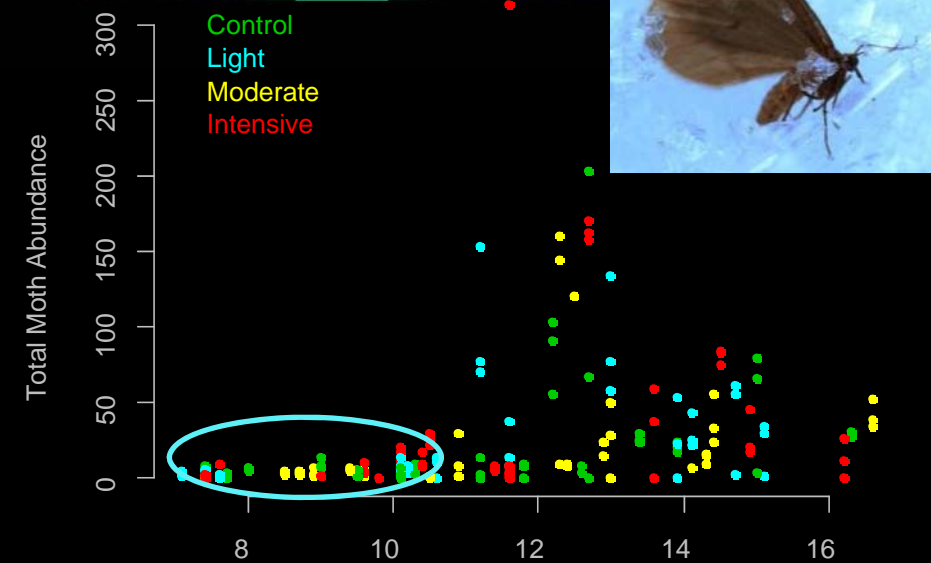
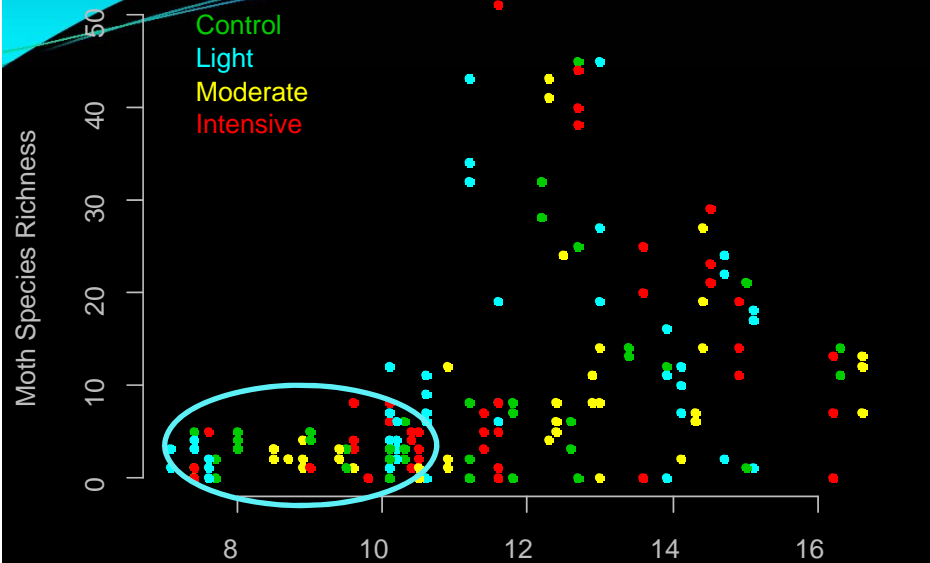
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Sampling Variation



Diversity within other taxonomic groups



- Black light traps placed 3 per stand near point count locations
- 1 trap night per month May- August
- Samples ID'd by Paul Hammond (OSU)
- 6432 moths from 269 species & 9 families
- Results highly dependent on weather, moon phase
- Functional group analysis forthcoming



Thanks

Funders:

- NCASI
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- Noble Fund
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- Weyerhaeuser

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- Don Irons and Jeff Light – Plum Creek
- Erick Finnell, Tona Mortensen, Mitch Taylor and Joe Travers – Oregon Dept. of Forestry

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- 2012 : Sean Clawson, Amy Comstock, Stephanie Doorley, and Kyle Pritchard





Questions?