Early Seral Biodiversity in Managed Landscapes:

Introduction to the Intensive Forest Management Study

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The forgotten stage of forest succession: early-successional ecosystems on forest sites

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“Structurally and compositionally diverse early seral forest habitats are now the scarcest habitat in the region” (Thomas et al. 2006 – Cons. Biol.)
BBS Population trends for Oregon

Orange-crowned warbler

Rufous hummingbird
• Plantation forestry creates a steady, uniform and predictable supply of wood-fiber.

• High production on a small land area reduces harvest pressure on other forests.
Research Objective

• Evaluate whether bird abundance, productivity and diversity is correlated with early-seral hardwood cover in plantations
  – *How can plantation management practices advance to produce timber and conserve biodiversity?*
1. Occupancy Thresholds at the Landscape Scale

Little quantitative guidance to managers on thresholds in relation to IFM (Brokerhoff 2008 *Biol. Cons.*).
Vegetation class from GNN - 1996

- Open
- Broadleaf
- Mixed - small
- Mixed - medium
- Mixed - large
- Mixed - very large
- Conifer - small
- Conifer - medium
- Conifer - large
- Conifer - very large
- Nonforest

Each pixel, or ArcGIS grid cell

Attribute table (joined to ArcGIS grid)
1. Point Counts

N=4375

2. Gradient
Nearest Neighbor (GNN)
Thresholds in forest bird occurrence as a function of the amount of early-seral broadleaf forest at landscape scales

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Population trends of ‘early-seral’ species

Betts et al. 2010 Ecol. Apps.
2. Bird abundance thresholds at stand scale
Study Area: Central OR Coast Range
Bird mist-netting and banding
Results

- 6,013 total net captures
- Banded 4,639
- Recaptured 837
- 53 species
Total bird capture rate

Bird capture rate (birds/net hour) vs. Hardwood canopy cover (%)

Hardwood threshold at 6.7% (SE=1.6)

Foliage gleaners = 12.8% (SE=3.5)

Ellis & Betts 2011 For. Ecol. & Management
Critical Questions

1. Bird abundance and **productivity**: Do correlations reflect causation?

2. Does abundance reflect productivity?

3. “So what?” Are there ecosystem consequences to bird decline?

4. Will ‘hidden’ biodiversity be affected?
Why are experiments important?
Did Avas cause the U.S. housing bubble?
A large-scale manipulative study on intensive forest management
<table>
<thead>
<tr>
<th>Study Treatment</th>
<th>Year Post Harvest</th>
<th>Practice</th>
<th>Chemical and Quantity/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>Intermediate</td>
<td>2 (spring)</td>
<td>Herbaceous release 2.66 lbs. Velpar (hexazinone) 32 oz 2-4 D (2,4-dichlorophenoxy acetic acid)</td>
</tr>
<tr>
<td>Heavy</td>
<td>Intermediate</td>
<td>3 (late summer)</td>
<td>Woody veg control 1.5 qt Accord (glyphosate) 20 oz Garlon (triclopyr)</td>
</tr>
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<td></td>
<td></td>
<td>3 (late summer)</td>
<td>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)</td>
</tr>
<tr>
<td>Intensive</td>
<td></td>
<td>1 (late summer)</td>
<td>Site prep 1.5 oz Escort (metsulfuron methyl) 3 qts Accord (glyphosate) 24 oz Chopper (imazapyr) 3 oz Oust (sulfometuron methyl &amp; metsulfuron methyl) 24 oz MSO (methylated seed oil)</td>
</tr>
<tr>
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<td></td>
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<td>Herbaceous control 2.66 lbs. Velpar (hexazinone) 32 oz 2-4 D (2,4-dichlorophenoxy acetic acid)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 (late summer)</td>
<td>Woody veg control follow up (if necessary) Imazapyr (either hack and squirt, or foliar)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 (late summer)</td>
<td>Bigleaf maple sprout control follow up (if necessary) Imazapyr (either hack and squirt, or foliar)</td>
</tr>
</tbody>
</table>

Herbicide Treatments

*Note: *(either hack and squirt, or foliar) indicates a choice between two methods for applying the herbicide.
Intensive Forestry Study Design

Established 2009
1. Bird abundance and population trends

- 96 point count stations
- 3/ stand
- Sampled 4 times/ season

Control
Light
Moderate
Intensive

Bird abundance

2011
Year
2021
2. Bird Demography
Nest Boxes

- 256 Nest boxes installed (8 per stand) in late winter/early spring
3. Ecosystem Processes and Services

Objective #1

Management inputs
- Control
- Light
- Intermediate
- Heavy

Biodiversity outputs
- Birds
- Ungulates
- Pollinators

Ecosystem services
- Tree growth
- Carbon storage
- Pollination
- Soil productivity

Objective #2

Management intensity

A. Ramamurthy
L. Turner
3. ‘Hidden Diversity’: Moths in Intensively Managed Forest
Food web dynamics in Intensively Managed Forests

- Ungulate Density
- Early Seral Vegetation
- Herbicide Intensity
- Avian Abundance & Diversity
- Arthropod Biomass

Relationships:
- Food availability
- Herbivory
- Cover
- Predation
- Pollination

Food web dynamics in Intensively Managed Forests
“Efficiency Frontiers” in early seral forests

Ecosystem service

- Timber production
- Pollination
- Soil productivity
- Carbon storage

Efficiency frontiers

Linear programming

Management intensity

Timber production
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