What’s New in Northern Hardwoods Silviculture -- The Wildlife Habitat Elements

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Soil-Site Relationships

1 = most abundant in climax stands; 2 = second most abundant in climax stands

Modified from: Leak (1982)
Predator-Prey Relationships

Managers create habitat conditions over time across landscapes that influence predator-prey relationships.

Based upon past/present land use – how do we proceed?

- Land-use history – regionally
- 60+ years of breeding bird survey results regionally show sharp declines in early successional bird species
- Mature forest bird species more stable than not
- Is natural disturbance silviculture the answer . . .
Silvicultural Options

- Size of opening influences composition
- Frequency of cut matters – cuts create important ephemeral habitats
- Spatial and temporal patterns influence the reoccupation of these ephemeral habitats

Frequency of Cutting Cycle Matters - Ephemeral Habitats

<table>
<thead>
<tr>
<th>Species</th>
<th>First appear</th>
<th>Common</th>
<th>Decline</th>
</tr>
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<tbody>
<tr>
<td>E. bluebird</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>N. flicker</td>
<td>1</td>
<td>1</td>
<td>7-10</td>
</tr>
<tr>
<td>Willow flycatcher</td>
<td>1</td>
<td>4</td>
<td>7-10</td>
</tr>
<tr>
<td>Winter wren</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Swainson’s thrush</td>
<td>2</td>
<td>4</td>
<td>15*</td>
</tr>
<tr>
<td>Chestnut-sided warbler</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Mourning warbler</td>
<td>2</td>
<td>5</td>
<td>7-10</td>
</tr>
<tr>
<td>Common yellowthroat</td>
<td>2</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>American goldfinch</td>
<td>2</td>
<td>6</td>
<td>7-10</td>
</tr>
<tr>
<td>Cedar waxwing</td>
<td>2</td>
<td>4</td>
<td>7-10</td>
</tr>
<tr>
<td>Veery</td>
<td>3</td>
<td>6</td>
<td>*</td>
</tr>
<tr>
<td>Black-and-white warbler</td>
<td>3</td>
<td>4</td>
<td>15*</td>
</tr>
<tr>
<td>Rose-breasted grosbeak</td>
<td>3</td>
<td>15</td>
<td>*</td>
</tr>
<tr>
<td>Canada warbler</td>
<td>5</td>
<td>15</td>
<td>*</td>
</tr>
<tr>
<td>Ruffed grouse</td>
<td>10</td>
<td>15</td>
<td>*</td>
</tr>
<tr>
<td>Wood thrush</td>
<td>10</td>
<td>15</td>
<td>*</td>
</tr>
<tr>
<td>Ovenbird</td>
<td>10</td>
<td>15</td>
<td>*</td>
</tr>
<tr>
<td>Black-throated blue warbler</td>
<td>15</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Black-throated green warbler</td>
<td>15</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

From: DeGraaf et al. (1992)
So What’s New?

- We’re treating stands with an eye to their patchiness — rather than tree-by-tree
- We’re recognizing the importance of how regeneration is laid out on-the-ground
- We’re paying closer attention to habitat features in managed stands that maintain/enhance wildlife habitat diversity
Uneven-aged Management Concerns

Extensive landscapes managed using single-tree selection only tends to limit horizontal diversity, distribution of browse and early and mid-successional foraging substrates used by herbivores and insectivores alike.

No Vegetation Management Approaches

- No vertebrate old growth-obligates documented in NE to date
- Surveys indicate some bryophyte, mite, and ground-dwelling beetle species may find such stands of interest.
Potential Habitats Available With Broad Management Strategies

From: DeGraaf et al. 2006

A New Look at Uneven-aged Silvicultural Methods and Responses in New England Beech-Birch-Maple Stands

- Surveys conducted from 1992-1998
- 6 study blocks (1992-1996)
- 1 study block (1994-1998)

<table>
<thead>
<tr>
<th>Habitat group</th>
<th>Clearcuts (42)</th>
<th>Group/patch selection (42)</th>
<th>Uncut/mature forest (42)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening size</td>
<td>~20 acres</td>
<td>0.3-2 acres</td>
<td></td>
<td></td>
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<tr>
<td>Early successional sp. (ES)</td>
<td>17</td>
<td>9</td>
<td>3</td>
<td>17</td>
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<tr>
<td>ES observations</td>
<td>2119</td>
<td>452</td>
<td>14</td>
<td>2585</td>
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<td>Generalist species (GEN)</td>
<td>20</td>
<td>19</td>
<td>16</td>
<td>20</td>
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<td>GEN observations</td>
<td>749</td>
<td>1082</td>
<td>1324</td>
<td>3155</td>
</tr>
<tr>
<td>Mid-/later successional species (M/LS)</td>
<td>13</td>
<td>15</td>
<td>15</td>
<td>16</td>
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<td>M/LS observations</td>
<td>410</td>
<td>1372</td>
<td>1098</td>
<td>2880</td>
</tr>
<tr>
<td>Total species</td>
<td>50</td>
<td>43</td>
<td>34</td>
<td>53</td>
</tr>
<tr>
<td>Total observations</td>
<td>3278</td>
<td>2906</td>
<td>2436</td>
<td>8620</td>
</tr>
</tbody>
</table>
Ordination of Avian Similarity for 114 Survey Points, WMNF

- Early successional bird community in new hardwood clearcuts is very different from the mature hardwood bird community.

- Bird community in group selection cuts are mixtures of mature hardwoods and some but not all early successional communities.

BEF Case Study -- Bird Use of Clearcuts, Patches, and Shelterwood

- ES species not present in pre-harvest stands.
- Species richness was similar (ES, Gen, M/LS).
- Higher proportions of ES species and observations in CC and patches than shelterwood.

From: Yamasaki et al. (2014)
**ESH as Post-Fledging Habitat**

- Capture rates of mature forest nesting birds (BLBW, BTBW, BTNW, REVI, SWTH) in ESH > in mature forest during post-fledging period
- ES birds were rarely mist-netted in mature forest habitat
- Generalists use ES habitats also as post-fledging habitat
- Both HY and AHY birds use these openings

From: C. Chandler et al. 2012; Stoleson 2013

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**Post-breeding Habitat and Bird Condition in PA**

- HY as well as AHY birds use clearcut stands
- Mature forest and forest-edge nesting birds use clearcut stands as well as early-successional nesting birds
- Planning/managing bird habitats include nesting as well as post-breeding and pre-migration habitats

From: Stoleson (2013)
**What’s New?**

- We’re treating stands with an eye to their patchiness – rather than tree-by-tree
- We’re recognizing the importance of how regeneration is laid out on-the-ground
- We’re paying closer attention to habitat features in managed stands that maintain/enhance wildlife habitat diversity

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**Bartlett EF – vertebrate richness**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>No. of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphibians</td>
<td>12</td>
</tr>
<tr>
<td>Reptiles</td>
<td>6</td>
</tr>
<tr>
<td>Birds</td>
<td>108</td>
</tr>
<tr>
<td>Mammals</td>
<td>49</td>
</tr>
<tr>
<td>Totals</td>
<td>165</td>
</tr>
</tbody>
</table>
**BEF Vegetative Structure**

- Cover-type -- a good habitat descriptor for some species, not for others -- better with stand structure info
- For species with size-class affinities, interpreting relationships needs stand structure assessment
- Forest bird habitat management needs the finer details of stand structure that neither cover-type nor size-class can provide


**Structure Related Within-Stand Features**

- Soft mast and herbaceous layer
- Regenerating shrub layer
- Midstory layer
- Upland openings
- Vernal pools
**Tree Related Within-Stand Features**

Exposed perches

Cavity trees

Hard mast inclusions

Den trees

Soft snags

From: DeGraaf et al. 2006

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**Retention Areas on Larger Cuts**

Provides:

- resistant beech mast opportunities
- larger diameter tree diversity within cut stand over time
- secure groups of cavity trees (OSHA)
### Within-stand Features Enhanced with Integrated Prescriptions

<table>
<thead>
<tr>
<th></th>
<th>No mgt</th>
<th>Uneven-aged mgt</th>
<th>Even-aged mgt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Canopy closure</td>
<td>Single-tree</td>
<td>Group/patch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tree-sized gaps</td>
<td>Closed</td>
</tr>
<tr>
<td>Exposed perches</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Inclusions</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Large cavity trees</td>
<td>Abundant</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hard mast</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Soft mast</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Midstory</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Shrub layer</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Herb layer</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>CWD</td>
<td>Abundant</td>
<td>Minimal</td>
<td>X</td>
</tr>
</tbody>
</table>

### Selected Examples:

- Seed fall considerations
- Regional small mammal dynamics
- CWD characteristics
- Terrestrial salamanders
- Forest raptor considerations
- Browse considerations
Seed Fall in Old Growth Northern Hardwoods

- SM, YB, and BE account for 98% of seed fall
- On average 1/3 of the crop was available for regeneration
- Seed production is highly variable
- Wildlife consumption estimated at 2-16%; BE consumption at 8%

From: Graber and Leak 1992

Beech Seed Fall in Managed Stands

- Production increases with age/size and percent of BE basal area
- Seed production is highly variable
- Filled seed averaged 74 to 88%
- Avian consumption ranged from 0 to 11%
- Rodents consumed 0 to 9%
- Heavy seed production occurs about 1 in 3 years

From: Graber and Leak 1992; Leak and Graber 1993
SM/BE Seed Fall -- 1996-2016, HBEF

- Also highly variable – associated with the prior 2 summer temp differences and a prior season nut crop
- SM mast events – 4 times in 20 yrs
- BE mast events – 5 times in 20 yr

From: Cleavitt and Fahey 2017

WMNF/BEF Small Mammals – looking for SYBO

- In the process, describe the small mammal communities across the WM region
- n = 108 sites across WMNF
- focused on 2 ELTs (6E and 115A)
- 9 sites/ELT; snap sets and pitfall set at each site
- 18 sites sampled per year
- 50+ WMNF employees involved in this project

From: Stephens et al. doi: 10.1111/ecog.02233
WMNF/BEF Small Mammals – looking for SYBO

- 22 species of small mammals in the White Mountains region
- 6 species represent 90-96 percent of the catch
- Raw captures without differential corrections

<table>
<thead>
<tr>
<th>Species</th>
<th>1995</th>
<th>1996</th>
<th>1997</th>
<th>Total</th>
</tr>
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<tr>
<td>Sorex cinereus</td>
<td>1731</td>
<td>172</td>
<td>872</td>
<td>2975</td>
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<tr>
<td>Nanaeopus fuscus</td>
<td>234</td>
<td>781</td>
<td>606</td>
<td>1513</td>
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<tr>
<td>Myodes gapperi</td>
<td>1102</td>
<td>60</td>
<td>241</td>
<td>1492</td>
</tr>
<tr>
<td>Blarina brevicauda</td>
<td>302</td>
<td>14</td>
<td>631</td>
<td>947</td>
</tr>
<tr>
<td>Peromyscus maniculatus</td>
<td>529</td>
<td>31</td>
<td>149</td>
<td>709</td>
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<tr>
<td>Peromyscus leucopus</td>
<td>287</td>
<td>15</td>
<td>185</td>
<td>487</td>
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<tr>
<td>Sorex tameus</td>
<td>77</td>
<td>23</td>
<td>44</td>
<td>144</td>
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<td>Sorex hoyi</td>
<td>37</td>
<td>10</td>
<td>39</td>
<td>86</td>
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<tr>
<td>Microtus pennsylvanicus</td>
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<td>2</td>
<td>22</td>
<td>44</td>
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<tr>
<td>Sorex dispar</td>
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<td>3</td>
<td>11</td>
<td>39</td>
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<tr>
<td>Zapus hudsonius</td>
<td>18</td>
<td>10</td>
<td>7</td>
<td>35</td>
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<tr>
<td>Synaptomys cooperi</td>
<td>19</td>
<td>1</td>
<td>6</td>
<td>26</td>
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<tr>
<td>Tamias striatus</td>
<td>10</td>
<td>5</td>
<td>8</td>
<td>23</td>
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<tr>
<td>Sorex palustris</td>
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<td>5</td>
<td>6</td>
<td>20</td>
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<tr>
<td>Microtus chrotorhinus</td>
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<td>2</td>
<td>13</td>
<td>18</td>
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<tr>
<td>Clausonia sabrinus</td>
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<td>6</td>
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<tr>
<td>Clausonia victoria</td>
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<td>1</td>
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<td>Tamiasciurus hudsonicus</td>
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<td>Condylura cristata</td>
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<td>3</td>
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<td>Microtus pinetorum</td>
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<td>Pseudosorex brevior</td>
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<tr>
<td>Synaptomys bororali</td>
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<tr>
<td>Total</td>
<td>4504</td>
<td>1341</td>
<td>2935</td>
<td>8780</td>
</tr>
</tbody>
</table>

From: Stephens et al. doi: 10.1111/ecog.02233

WMNF/BEF Small Mammals – looking for SYBO

- Across the WM region, small mammal community metrics in hardwoods, mixedwood, and softwood habitats were similar
- Yearly captures account for a majority of the variability

From: Stephens et al. doi: 10.1111/ecog.02233
WMNF/BEF Small Mammals – looking for SYBO

- Model tested against BEF long-term data for the same years and show concordance
- Trap year accounted for 50% of the variation
- Small mammal community composition is highly variable and not well described by overstory composition

CWD – Structural Habitat Elements

Large cavity and den trees
Large hollow logs
Cull, slash, and brush piles
Species That Benefit from CWD Presence

BEF Snag Longevity – Dense Hardwoods

From: Yamasaki and Leak (2006)
BEF – Large Snags (> 16 in dbh)

BEF – Evidence of Woodpecker Use
BEF CWD Piece Size Distribution
midpoint diameter (in)

Terrestrial Salamanders

- Cover boards placed across an edge gradient 40 m to either side
- Checked every 2 wks after a rain event
- Structure and cover described
- Number of RBS counted

From: DeGraaf and Yamasaki (2002)
Terrestrial Salamanders

From: DeGraaf and Yamasaki (2002)

Northern Goshawk (*Accipiter gentilis*)

Birds of NA
Forest Landscape Compositions

Goshawks Maintain 1 to 8 Nests Within a Territory
Goshawk Nest Territories

- Occur in forest-dominated landscapes
- Often a component of managed stands
- Occur on lands with history of agricultural activity or prior cutting

Nest Site Characteristics

- Often near upland openings, woods roads and trails
- Most often at the bottom of lower slope positions at elevations less than 1500 ft
Nest Site Characteristics

Goshawks in this region use white pine stands or mixed stands of spruce/fir and hardwoods

Nest Site Characteristics

- More sawtimber-sized trees and higher softwood basal areas in nest sites compared to random sites
Nest Tree Characteristics

White Pine
Mean DBH = 19.5 in

Hardwoods
Mean DBH = 14.8 in

BEF Patches

2001
2013
BEF Patches

From: Jacobs (1969)

Advanced Regeneration Can Recover from Severe Browsing

From: Trimble (1968)

From: Jacobs (1969)
**Browse Pressure Effects**

- Heavy browsing on BF can favor RS
- Can increase softwood composition on the right site
- Can be severe in localized areas – moose wintering areas

**Physical Obstacles to Limit Browse Impacts?**

- Resist lopping all tops
- Consider leaving more tops on-site
- Consider regenerating larger stands
- On small openings -- consider strategic brush fencing
What Has BEF Taught Us About the Practice of Silviculture in the Northeast

• Variety is important -- there is no ‘one-size fits all’ solution
• Landownership size can influence size of openings
• Working forest landscapes can produce many quality products (wood, habitat, recreational opportunities, visually appealing landscapes) over time with good planning and implementation
• It’s important to keep an open mind