Characterizing Wildlife Communities of Fire-Dependent Ecosystems of the Northern Lake States and Exchanging Research, Inventory, and Monitoring Knowledge and Ideas

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Presentation Outline

• Examples of fire-dependent ecosystems of the northern Lake States?

• Need, goals and objectives of this work: which vertebrate species are fire-dependent?

• Potential applications and next steps.
The focus of the Lake States Fire Science Consortium is on the fire-dependent ecosystems that occur across the Lake States region, from western New York and Ontario in the east to central Minnesota in the west. The boundaries of the Consortium follow those of The Nature Conservancy’s Great Lakes (47) and Superior Mixed Forest (48) Ecoregions.

There are few ecosystems within the region that were not influenced in some way by fire, and as a result we classify those ecosystems that were maintained in some way by fire as fire-dependent. In both ecoregions there are a variety of upland-savanna, forest, and wetland ecosystems that are influenced by wildfire and/or are managed using prescribed burning. Nomenclature for these ecosystems varies widely depending on the state or province, or by organization.

Quick links to different ecosystem types:

- Woodlands-Savannas
- Forests
- Wetlands

**Woodlands - Savannas**

Below is a list of fire-dependent woodland-savanna and forest ecosystems within the Consortium boundaries using the LANDFIRE Rapid Assessment Vegetation Models:

- Great Lakes Pine Barrens
- Jack Pine-Openlands
- Northern Oak Savannas

**Forests**

Below is a list of fire-dependent woodland-savanna and forest ecosystems within the Consortium boundaries using the LANDFIRE Rapid Assessment Vegetation Models:

- Conifer Lowland Forests (embedded in fire-prone ecosystem)
- Conifer Lowlands Forests (embedded in fire-resistant ecosystem)
- Eastern White Pine-Eastern Hemlock Forests
Fire-Dependent Ecosystems Differ In:

- Composition of plant and animal species and ecosystem function;
- Fire regime characteristics such as FRI, rotation, seasonality, severity, intensity, etc. (Whitney 1986/1987; Freligh 2002; Cleland et al. 2004)

Important linkages exist with fire and other ecological processes (e.g., hydrology in wetlands, insect herbivory in forests, etc.).

Relative to much of the U.S. few studies have described fire effects on wildlife in the northern Lake States (J. Miesel MSU In Prep.).
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Refuge Land Management

Refuge System Policy- Refuge Legislation

Ownership

Land Cover

Planning & Mgmt.

Ecosystem Capabilities-Disturbance Patterns-Function

Corace et al. 2012. EnvMgmt.

Corace et al. 2012. EnvMgmt.

Drobychev et al. 2008a,b CJFR and FEM
Objectives Wildlife-Fire Project:

1. Improve our publically accessible wildlife-fire literature citation database, especially theses and dissertations;

2. Evaluate documents as appropriate and consult with state-level experts to identify vertebrate species with high affinity for fire-dependent ecosystem;

3. Identify individuals and organizations that are conducting related inventory, monitoring, research and management and communicate this information with other interested parties;

4. Promote information exchange related to the above at one or more professional events (webinar and/or conference and/or field trips); and

5. Use all the above to draft a research needs statement that will be presented to JFSP through the LSFSC.
LSFSC Publication Database

For peer-reviewed scientific literature and agency publications addressing fire science topics focused on the Lake States region.
Fire Dependent Birds (Examples)

- Open Wetlands: Yellow Rail, American Bittern, King Rail, LeConte’s Sparrow
- Conifer Swamps: Connecticut Warbler, Spruce Grouse
- Dry Coniferous Forest: Kirtland’s Warbler, Pine Warbler, Eastern Bluebird
- Barrens: Upland Sandpiper, Sharp-tailed Grouse, Short-eared Owl

For many species, multiple fire-dependent ecosystem types are used, but fire effects knowledge and other literature lacking.
Fire Dependent Mammals (Examples)

- Open Wetlands: moose, American beaver
- Conifer Swamps: snowshoe hare, bobcat, Canada lynx
- Dry Coniferous Forest/Barrens: American badger, elk, pygmy shrew

For many species, multiple fire-dependent ecosystem types are used, but fire effects knowledge and other literature lacking.
For many species, relatively few fire-dependent ecosystem types are used, but fire effects knowledge and other literature still lacking.

Seney National Wildlife Refuge

Fire Dependent Herps (Examples)

Open Wetlands: Eastern massasauga, Blanding’s turtle
Conifer Swamps: five-lined skink
Dry Coniferous Forest/Barrens: gopher snake
Fire-dependent Mammals (n=15) and Ecosystem Type

- Dry Forest: 60%
- Wetland: 35%
- Mesic Forest: 25%
- Wet Forest: 20%
Fire-dependent Birds (n=46) and Ecosystem Type

- Wetland: 50%
- Dry Forest: 40%
- Wet Forest: 30%
- Mesic Forest: 10%
WI Fire-dependent Bird Conservation (n=43)

Number of Species

Conservation Status

- SGCN
- SC
- THR
- END
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US Distribution of Jack Pine
(Pinus banksiana)

World Distribution of Kirtland’s Warbler
(Setophaga kirtlandii)

~98% of all Kirtland’s Warbler found in xeric, outwash plains of nLP of Michigan
Table 1. Indicator species for young (< 5 years), KW (5-23 years), and old (> 23 years) jack pine stands at KWWMA.

<table>
<thead>
<tr>
<th>YOUNG</th>
<th>KW</th>
<th>OLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigo Bunting***</td>
<td>Kirtland’s Warbler***</td>
<td>Eastern Wood-Pewee***</td>
</tr>
<tr>
<td>(<em>Passerina cyanea</em>)</td>
<td>(<em>Dendroica kirtlandii</em>)</td>
<td>(<em>Sayornis phoebe</em>)</td>
</tr>
<tr>
<td>Eastern Bluebird***</td>
<td>Nashville Warbler***</td>
<td>Hermit Thrush***</td>
</tr>
<tr>
<td>(<em>Sialia sialis</em>)</td>
<td>(<em>Vermivora ruficapilla</em>)</td>
<td>(<em>Catharus guttatus</em>)</td>
</tr>
<tr>
<td>Field Sparrow***</td>
<td>Eastern Towhee***</td>
<td>Ovenbird***</td>
</tr>
<tr>
<td>(<em>Spizella pusilla</em>)</td>
<td>(<em>Pipilo erythrophthalmus</em>)</td>
<td>(<em>Seiurus aurocapilla</em>)</td>
</tr>
<tr>
<td>Lincoln’s Sparrow***</td>
<td>Brown Thrasher**</td>
<td>Rose-breasted Grosbeak***</td>
</tr>
<tr>
<td>(<em>Melospiza lincolnii</em>)</td>
<td>(<em>Toxostoma rufum</em>)</td>
<td>(<em>Pheucticus ludovicianus</em>)</td>
</tr>
<tr>
<td>Black-billed Cuckoo*</td>
<td>Alder Flycatcher**</td>
<td>Red-breasted Nuthatch***</td>
</tr>
<tr>
<td>(<em>Coccyzus erythropthalmus</em>)</td>
<td>(<em>Empidonax alnorum</em>)</td>
<td>(<em>Sitta vireo</em>)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Red-eyed Vireo***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(<em>Vireo olivaceus</em>)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Black-capped Chickadee**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(<em>Poecile atricapillus</em>)</td>
</tr>
</tbody>
</table>

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Corace et al. 2010. NAJ.
Kirtland's Warbler Distribution Across Eastern UP Ecoregions (Albert 1995) and Habitat Types (Burger & Kotar 2003)
Ecological Considerations for Forest Restoration Based on Soils, Disturbances, and Resulting Composition and Structure

*Pinus strobus/Vaccinium angustifolium- Epigaea repens* (PVE) Habitat Type

Major and/or frequent ecological disturbances (e.g., crown fire) push stands to earlier seral stages, minor and/or infrequent disturbances (e.g., surface fire) to later seral stages.

Fig. 2. Time span of each of the 49 fire history sites within SNWR. Each chronology is based on a mean of five samples. Fires are recorded as “points” and blank spaces indicate a hiatus in a chronology (i.e., stand was not recording during that period).
Corace et al. 2013. _Res. Ec._
<table>
<thead>
<tr>
<th>Diversity Metric</th>
<th>Mean (±1SD)</th>
<th>T</th>
<th>P-value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reference</td>
<td>Altered</td>
<td></td>
</tr>
<tr>
<td>Overall Species Richness</td>
<td>16.08 (2.86)</td>
<td>15.66 (2.65)</td>
<td>-0.56</td>
</tr>
<tr>
<td>Forest Species Richness</td>
<td>7.40 (2.48)</td>
<td>6.14 (2.28)</td>
<td>-1.93</td>
</tr>
<tr>
<td>Generalist Species Richness</td>
<td>4.56 (1.16)</td>
<td>4.86 (1.73)</td>
<td>0.76</td>
</tr>
<tr>
<td>Forest-Generalist Richness</td>
<td>11.96 (2.84)</td>
<td>11.00 (2.51)</td>
<td>-1.31</td>
</tr>
<tr>
<td>Wetland Species Richness</td>
<td>4.12 (2.03)</td>
<td>4.66 (3.27)</td>
<td>0.73</td>
</tr>
<tr>
<td>Overall H'</td>
<td>1.16 (0.08)</td>
<td>1.15 (0.08)</td>
<td>-0.52</td>
</tr>
<tr>
<td>Forest H'</td>
<td>0.81 (0.19)</td>
<td>0.73 (0.18)</td>
<td>-1.63</td>
</tr>
<tr>
<td>Generalist H'</td>
<td>0.62 (0.13)</td>
<td>0.64 (0.17)</td>
<td>0.36</td>
</tr>
<tr>
<td>Forest-Generalist H'</td>
<td>1.03 (0.12)</td>
<td>1.00 (0.11)</td>
<td>-1.17</td>
</tr>
<tr>
<td>Wetland H'</td>
<td>0.53 (0.24)</td>
<td>0.53 (0.32)</td>
<td>-0.09</td>
</tr>
<tr>
<td>Habitat Class Forest-Generalist H'</td>
<td>0.43 (0.06)</td>
<td>0.40 (0.07)</td>
<td>-1.51</td>
</tr>
<tr>
<td>Nest Location Forest-Generalist H'</td>
<td>0.41 (0.08)</td>
<td>0.39 (0.07)</td>
<td>-0.87</td>
</tr>
<tr>
<td>Nest Type Forest-Generalist H'</td>
<td>0.32 (0.14)</td>
<td>0.39 (0.12)</td>
<td>2.07</td>
</tr>
<tr>
<td>Forage Type Forest-Generalist H'</td>
<td>0.55 (0.08)</td>
<td>0.52 (0.10)</td>
<td>-1.42</td>
</tr>
<tr>
<td>Reference (PIF Score)</td>
<td>$p$-value</td>
<td>Altered (PIF Score)</td>
<td>$p$-value</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------</td>
<td>---------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Hairy Woodpecker (11)</td>
<td>0.07</td>
<td>American Robin (9)</td>
<td>0.03</td>
</tr>
<tr>
<td>Yellow Warbler (11)</td>
<td>0.01</td>
<td>Pileated Woodpecker (11)</td>
<td>0.06</td>
</tr>
<tr>
<td>American Redstart (12)</td>
<td>0.00</td>
<td>Song Sparrow (12)</td>
<td>0.07</td>
</tr>
<tr>
<td>White-throated Sparrow (12)</td>
<td>0.02</td>
<td>Ruffed Grouse (14)</td>
<td>0.06</td>
</tr>
<tr>
<td>Least Flycatcher (13)</td>
<td>0.02</td>
<td>None are considered fire-dependent! Fire-dependent species are found, but at too low an abundance for analysis: BBWO, SPGR, RECR, etc. Still little resolution on fire relationships.</td>
<td></td>
</tr>
<tr>
<td>Nashville Warbler (13)</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chestnut-sided Warbler (14)</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veery (16)</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Corace et al. 2014. FEM.
Seney National Wildlife Refuge

White pine
Red pine

Jack pine possibly with the following:
Red oak
Pin oak
White pine
Red pine

Jack pine barrens

Pine Warbler
Red-eyed Vireo
Red Crossbill
Spruce Grouse

Pine Warbler
Red-eyed Vireo
Kirtland’s Warbler
Spruce Grouse

Kirtland’s Warbler
Common Nighthawk
Pine Warbler
Spruce Grouse

Sharp-tailed Grouse
Upland Sandpiper
Kirtland’s Warbler
Common Nighthawk
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Lake States Fire Science Consortium
Next Webinar:

April 17, 2014 at 2:00 PM Eastern (1:00 PM Central)

Incorporating Principals of Natural Disturbance into Development and Evaluation of Forest Management Guides for the Boreal Forest Region of Ontario

Rob Rempel (Ontario Ministry of Natural Resources)