Which vertebrate wildlife species were historically (are currently) associated with fire-dependent ecosystems of the LSFSC area?

What is current status of published papers on these species?

What is the past and current research being conducted on these ecosystems and related species on Seney NWR lands in UP and nLP?

Future directions?
Fire-Dependent Ecosystems of the Lake States Fire Science Consortium (LSFSC)

- Fire-dependent: an ecosystem type in which the alteration of fire regime affects composition, structure, and processes;
- In the LSFSC area: fire-dependent ecosystems include forests (e.g., xeric pine, lowland conifers, etc.) and wetlands (e.g., fen, bog, etc.);
- Each ecosystem type has unique fire behavior, FRI, fire rotation, seasonality, etc.;
- Vegetation often uniquely adapted (e.g., serotiny), as are wildlife species (e.g., Kirtland’s Warbler vs Red Crossbill).
J. Miesel (Michigan State Univ.) conducted gap analysis based on published literature (see LSFSC website for searchable database);

Findings suggest that the vast majority of literature centers around vegetation (52% of all are pine studies), fewer wildlife studies;

Corace et al. (2015) looked at State Wildlife Action Plans for MN, WI, and MI and interviewed biologists. Fire rarely mentioned in northern forest ecosystem relative to prairie ecosystems; differences exist among biologists in perceptions re: role of fire in northern ecosystems;

In the case of Kirtland’s Warbler, a compiled database of literature with >1,300 records has “fire” as a keyword in ~185 (<14%).
US Distribution of Jack Pine
(*Pinus banksiana*)

World Breeding Distribution of Kirtland’s Warbler
(*Setophaga kirtlandii*)

~98% of all breeding Kirtland’s Warbler found in xeric, outwash plains of nLP of Michigan
Land Ownership Among Agencies: How Does the National Wildlife Refuge System (NWRS) Compare?

Department of Interior Lands

• National Park System (NPS) = 85 million acres
• National Wildlife Refuge System (NWRS) = 150 million acres
• Bureau of Land Management = 253 million acres

Department of Agriculture Lands

• National Forest System = 190 million acres
Kirtland's Warbler (KIWA) Annual Census Results: 1971-2008

Year

Total # Singing Male KIWA
0 200 400 600 800 1000 1200 1400 1600 1800 2000

Recovery Plan Objective = 1,000 singing males⁻¹yr

>>2,000 singing males in 2016
Stand Age Distributions in Management Areas

Pre-settlement  
Current

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*** (Passerina cyanea)</td>
<td>Kirtland’s Warbler*** (Dendroica kirtlandii)</td>
<td>Eastern Wood-Pewee*** (Sayornis phoebe)</td>
</tr>
<tr>
<td>Eastern Bluebird*** (Sialia sialis)</td>
<td>Nashville Warbler*** (Vermivora ruficapilla)</td>
<td>Hermit Thrush*** (Catharus guttatus)</td>
</tr>
<tr>
<td>Field Sparrow*** (Spizella pusilla)</td>
<td>Eastern Towhee*** (Pipilo erythrophthalmus)</td>
<td>Ovenbird*** (Seiurus aurocapilla)</td>
</tr>
<tr>
<td>Lincoln’s Sparrow*** (Melospiza lincolnii)</td>
<td>Brown Thrasher** (Toxostoma rufum)</td>
<td>Rose-breasted Grosbeak*** (Pheucticus ludovicianus)</td>
</tr>
<tr>
<td>Black-billed Cuckoo* (Coccyzus erythropthalmus)</td>
<td>Alder Flycatcher** (Empidonax alnorum)</td>
<td>Red-breasted Nuthatch*** (Sitta vireo)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* $P &lt; 0.05$; ** $P &lt; 0.01$; *** $P &lt; 0.001$.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Some other ecosystem type other than agric. land is important for UPSA habitat in MI…pine barrens or related.
It All Doesn’t Burn: Biological Legacy Patches!
Quantify Wildfire-Induced Structural Patterns Using Chronosequence of Aerial Imagery

Stringers (biological legacy patches)

1 km

Cullinane-Anthony et al. 2014 *FEM* 331:93-103
Change in Mixed-Pine Dominated Forests (~1850 – 2000)

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.

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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).
<table>
<thead>
<tr>
<th>Reference (PIF Score)</th>
<th>$p$-value</th>
<th>Altered (PIF Score)</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<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></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>

Aggregate treatment
Dispersed treatment
Regeneration of target species

Significantly higher eastern white pine seedlings in treated stands, little red pine response

No significant differences in response between spatial patterns of retention

Biological Legacies

• Snags play important roles in ecosystems
  – Resources released (light, moisture, nutrients)
  – Provide structure to shelter and feed wildlife
  – Habitat for decomposers
  – Dead material in forests can contain high proportions of living cells (e.g., fungi)
Wildlife implications across snag treatment types in jack pine stands in eastern Upper Michigan

How do snag characteristics and the method of snag creation relate to the intensity of wildlife use?

OBJECTIVES
1. Build on past research regarding snag development in eastern Upper Michigan characterizing snag decay class patterns in jack pine.
2. Understand how the method of snag creation can influence the use of a snag by subcortical insects and woodpecker excavators.

METHODS
35 snags sampled each from three treatments and a control.
Variables on snag characteristics, past woodpecker activity and past insect activity were measured in 2014 and 2016.

WOODPECKER EXCAVATIONS

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>Girdled (n=35)</th>
<th>Topped (n=35)</th>
<th>Fire (n=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cavity excavations</td>
<td>Foraging excavations</td>
<td>Depth per snag (cm)</td>
</tr>
<tr>
<td>Range</td>
<td>0</td>
<td>0 - 33</td>
<td>0 - 5.560</td>
</tr>
<tr>
<td>Sum</td>
<td>0</td>
<td>152</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>0</td>
<td>4.343</td>
<td>1.165</td>
</tr>
<tr>
<td>SD</td>
<td>0</td>
<td>7.989</td>
<td>1.437</td>
</tr>
</tbody>
</table>

Entrance and Exit Holes at Three Heights

Gallery Cover at Three Heights

PAST INSECT ACTIVITY
Future Directions of Fire-Wildlife Efforts in LSFSC

- Upcoming webinars from LSFSC: wood turtle monitoring (March 19, 2017), pine snags and wildlife, brushland wildlife and fire, fire and moose (all winter 2017-2018, pending funding);

- Provide an ecological context to aspen management (2017+, pending funding);

- Evaluate monitoring protocols: Sharp-tailed Grouse and Black-backed Woodpecker (2017+, pending funding);

- Evaluate potential shifts in distribution of fire-dependent bird species in Michigan (2017+, pending funding).
Fire-Dependent Mixed-Pine Ecosystems, Biological Legacies, and Wildlife: A Summary of Past and Current Research at Seney National Wildlife Refuge

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