Alternative Species for Restoration of Black Ash Ecosystems Under Threat from Emerald Ash Borer
MI Upper Peninsula and northern WI study sites

Kathryn Hofmeister, University of Wisconsin-Oshkosh
A big thanks to everyone involved in these projects!


• Ottawa National Forest, Chequamegon-Nicolet national Forest, Lake Superior National Estuarine Research reserve, Michigan Tech University, University of Michigan Biological Station

• Any questions, please contact me – Kathryn Hofmeister, hofmeisterk@uwosh.edu
Ottawa National Forest Study Sites
Ottawa National Forest Study Sites

12 Black Ash Wetlands
- 0.23-1.19 ha
- High percentage ash
- 66% of basal area
- Deep muck soils

Fall 2020 - EAB detected in ONF
Experimental Design – Ecosystem Disturbance

• 3 treatments applied winter 2012-2013
  • Control: no EAB infestation
  • Girdle: short-term stand mortality, 3-4 years after infestation
  • Ash Cut: long-term ecosystem disturbance, widespread ash mortality
Ecosystem Responses to Disturbance

**Biota**
- Decrease in total basal area due to ash loss
- Increase in herbaceous MI cover
- Poor outlook for co-occurring woody species

**Water level**
- Elevated water table levels and delayed drawdown

**Biogeochemistry**
- Soil C, N pool sizes and concentrations don’t change but gas fluxes and indices of cycling do respond
Potential restoration of black ash wetlands with alternative species

- 10 alternative species planted in 2013 in all treatments
- Seedlings planted in pairs in high (hummock) and low (hollow) microsites

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Currently in Wetland Overstory?</th>
</tr>
</thead>
<tbody>
<tr>
<td>American elm</td>
<td>Ulmus Americana</td>
<td>Yes</td>
</tr>
<tr>
<td>balsam fir</td>
<td>Abies balsamea</td>
<td>Yes</td>
</tr>
<tr>
<td>basswood</td>
<td>Tilia americana</td>
<td>Yes</td>
</tr>
<tr>
<td>black spruce</td>
<td>Picea marina</td>
<td>No, within habitat range</td>
</tr>
<tr>
<td>bur oak</td>
<td>Quercus macrocarpa</td>
<td>No, outside habitat range</td>
</tr>
<tr>
<td>northern white cedar</td>
<td>Thuja occidentalis</td>
<td>Yes</td>
</tr>
<tr>
<td>red maple</td>
<td>Acer rubrum</td>
<td>Yes</td>
</tr>
<tr>
<td>silver maple</td>
<td>Acer saccharinum</td>
<td>No, within habitat range</td>
</tr>
<tr>
<td>tamarack</td>
<td>Larix laricina</td>
<td>No, within habitat range</td>
</tr>
<tr>
<td>yellow birch</td>
<td>Betula alleghaniensis</td>
<td>yes</td>
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</table>
Species Survivorship

Top Surviving Species in 2020:
1. Silver maple (48%)
2. American elm (28%)
3. Basswood (22%)
4. Northern white cedar (14%)
5. Bur oak (9%)
**Take away:** Better seedling survival on higher elevation points (hummocks)
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But... Species selection matters more for survival than planting position
• Growth from 2013-2020
• Better growth rates at higher elevation points for most top surviving species
Importance of light availability for seedling growth

• Seedling growth was greatest at *ash cut* > *girdle* > *control* sites

• Increased *canopy openness* and *light availability* likely fueling increased seedling growth at treatment sites

• Elevated water levels at ash cut and girdled sites do not appear to reduce seedling growth
Summer 2022: Chequamegon-Nicolet and Ottawa National Forest Seedling Plantings

- 8 ash-alternative species planted in black-ash dominated lowland wetlands
  - Drainways and lowland wetlands

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<td>Bur oak</td>
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</tr>
<tr>
<td>Cottonwood</td>
<td><em>Populus deltoides</em></td>
<td>Edge of range</td>
</tr>
<tr>
<td>Red maple</td>
<td><em>Acer rubrum</em></td>
<td>Within range</td>
</tr>
<tr>
<td>River birch</td>
<td><em>Betula nigra</em></td>
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<tr>
<td>Silver maple</td>
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</tr>
<tr>
<td>Swamp white oak</td>
<td><em>Quercus bicolor</em></td>
<td>Outside range</td>
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<td><em>Larix laricina</em></td>
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Seedling survival after 1 year: Same trends, different time, different place

- **Winners:** Bur oak, Red maple, River birch, Silver maple, Swamp white oak
- **Losers:** black spruce, cottonwood, tamarack
- Similar results to prior ONF planting study
Seedling survival after 1 year: Same trends, different time, different place

- Microsite does influence survival, but not as much as species
- Some new species seem promising (river birch) and some not so much (cottonwood)
- Similar growth rate trends
  - Indications that red maple, black spruce are slow growing in these wetlands too
Consider planting species to address goals at different timescales

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- **Survives well and grows fast** = ‘hold the lines’ species
  - Help maintain canopy, thermal cover, control water level responses
- **Survives well and grows slowly** = ‘long game species’
  - Lends diversity as stand matures
- **Survives poorly and grows fast** = plant for some structural and species diversity
- **Survives poorly and grows slowly** = don’t bother with these
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**Climate considerations:** Some species from outside current habitat ranges appear to survive well
- river birch, bur oak, swamp white oak
Management Considerations

• Light availability drives seedling growth → Consider opening canopy with targeted removals
  • Shelterwood effect of girdled sites supports relatively high growth and survival for a variety of species
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  • Plant native shrubs and grasses, focus on invasive species removal
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• Consider hydrologic connectivity between wetland hydrology and regional groundwater system
  • Target places where hydrology can be controlled by management or is more locally influenced
  • Coupled upland/wetland management strategies can help minimize wetland water level rise

Buffer of trees around seasonal pond
Thank you!
Project papers:
- Davis et al., 2017. Vegetation responses to simulated emerald ash borer infestation in Fraxinus nigra dominated wetlands in Upper Michigan, USA. *Canadian Journal of Forest Research* 47 doi:10/1139/cjfr-2016-0105