Checklist for Evaluating Management Options in Lowland Ash Forests

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### Growing stock volume (million cu. ft.) by species and region of the state.

<table>
<thead>
<tr>
<th>Species</th>
<th>Central</th>
<th>Northeast</th>
<th>Northwest</th>
<th>Southeast</th>
<th>Southwest</th>
<th>Total</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Ash</td>
<td>84</td>
<td>126</td>
<td>358</td>
<td>32</td>
<td>26</td>
<td>627</td>
<td>43%</td>
</tr>
<tr>
<td>Green Ash</td>
<td>51</td>
<td>63</td>
<td>53</td>
<td>183</td>
<td>26</td>
<td>375</td>
<td>26%</td>
</tr>
<tr>
<td>White Ash</td>
<td>65</td>
<td>121</td>
<td>97</td>
<td>72</td>
<td>85</td>
<td>441</td>
<td>31%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>200</strong></td>
<td><strong>310</strong></td>
<td><strong>508</strong></td>
<td><strong>287</strong></td>
<td><strong>137</strong></td>
<td><strong>1443</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

% of Total: 14%, 22%, 35%, 20%, 10%, 100%

**Data derivation:**

Methodology: Wilson, B.T.; Lister, A.J.; Riemann, R.I. 2012. A nearest-neighbor imputation approach to mapping tree species over large areas using forest inventory plots and moderate resolution raster data.

Map created by: S Dahir WIDNR, PA.
Site and Stand Assessment
New Research and Field Tools
Wetland Forest Habitat Type Classification System for Northern Wisconsin

Soil Moisture Regime

Soil Nutrient Regime

- Very Rich
- Rich
- Medium
- Poor
- Very Poor

- 1 Very Dry
- 2 Dry
- 3 Dry-Mesic
- 4 Mesic
- 5 Very Mesic

- 1 Very Wet
- 2 Wet
- 3 Very Mesic
- 4 Mesic
- 5 Very Wet

- Upland Habitat Types
- Borderline Habitat Types
- Wetland Habitat Types

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- Upland Habitat Types
- Borderline Habitat Types
- Wetland Habitat Types
Swamp Hardwood Silviculture Trials

Iron County – 50’ strip shelterwood  Two years later...
Control
Group Selection
Girdle
Clearcut

Relative Water Table Depth (cm)

1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
13-Oct
28-Oct

Lake States Research
# Lowland Ash Stand Checklist

**Checklist for Evaluating Lowland Ash Stands (WDNR 04/2017):** This checklist/decision tool is for use in lowland ash stands that will potentially be impacted by emerald ash borer (EAB). The checklist is designed to assist with site and stand evaluation prior to developing a prescription. Due to the complex nature of these sites, the checklist results should be considered collectively, along with other stand data, landowner objectives, and professional judgment when evaluating management alternatives.

<table>
<thead>
<tr>
<th>Landowner:</th>
<th>County:</th>
<th>Town:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section-Town-Range:</td>
<td>Cruiser:</td>
<td>Date:</td>
</tr>
<tr>
<td>Compartment:</td>
<td>Stand:</td>
<td>Acres:</td>
</tr>
</tbody>
</table>

### Site Quality and/or Timber Sale Operability:
- **Low**
  - Wetland FHT – very poor to poor (Habitat Type: __________)
  - SI < 40 ft (SI Species / Site Index: __________ / __________)
  - Drainage Class – very poorly drained
  - Soil – deep organic/sphagnum bog
  - Vigor – poor tree and stand vigor
  - Site Volume – limited (e.g., <100 trees or 10 MFB)
  - Site Access – poor
- **Medium to High**
  - Wetland FHT – poor to rich (Habitat Type: __________)
  - SI > 40 ft (SI Species / Site Index: __________ / __________)
  - Drainage Class – poorly drained or better
  - Soil – non-sphagnum organic or organic over mineral
  - Vigor – moderate to good tree and stand vigor
  - Growing Stock Quality – acceptable (evaluate AGS)
  - Tree Volume – acceptable (e.g., >100 trees or 10 MFB)
  - Site Access – fair to good

* It may be difficult to obtain an accurate SI in lowland ash stands. It is not recommended to rely on SI alone for site quality evaluations.

### Potential EAB Impact to Stand Condition:
- **Non-Degraded**
  - ≥ 40 non-ash AGS (Acceptable Growing Stock) trees per acre or ≥ 45% relative density of non-ash AGS
- **Degraded**
  - < 40 non-ash AGS trees per acre or < 45% relative density of non-ash AGS

### Alternate Seed Sources:
- **Good**
  - ≥ 10+ non-ash AGS/seed trees per acre
  - Dominant or codominant crown class
  - Reproductively mature
  - Dispersed
- **Poor**
  - <5 non-ash AGS/seed trees per acre
  - Intermediate and suppressed crown classes
  - Reproductively immature

### Hydrological Risk:
- **Low**
  - Seasonal inundation of limited duration (< 30 days)
  - Depth to water table > 30 cm during majority of growing season
  - Ponding infrequent
  - Drainage Class poorly drained or better, convex surfaces
  - Shallow organic or mineral soils
  - Limited impediments to drainage
- **High**
  - Seasonal inundation common, well into growing season (> 60 days)
  - Depth to water table < 30 cm during majority of growing season
  - Ponding frequent
  - Drainage Class very poorly drained, concave surfaces, limited water flow
  - Deep organic soils / sphagnum bog
  - Impeded drainage due to roads, culverts, other impounding factors

### Advance Regeneration (Non-ash Species):
- **Adequate**
  - Non-ash, desirable species
  - 2000+ stems/acre (advance + projected coppice)
  - ≥ 4 ft tall
  - Distribution > 50% stocking
- **Present but Inadequate**
  - Non-ash, desirable species
  - 200-2000 stems/acre (advance + projected coppice)
  - ≥ 4 ft tall
  - Distribution < 50% stocking, grouped
- **No Potential**
  - Mostly ash or undesirable species
  - <200 stems per acre (advance + projected coppice)
  - ≤ 2 ft tall (e.g., 1 year germinants)
  - Distribution – limited

### Herbivory:
- **Low**
  - Browse severity index 1-3
- **High**
  - Browse severity index 4-6

### Interferring Vegetation:
- **Low**
  - ≤ 25% coverage
  - RCG, buckthorn, elder, other __________
- **High**
  - > 25% coverage
  - RCG, buckthorn, elder, other __________

### Stand Comments:

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**Field Tool**
SITE QUALITY and/or TIMBER SALE OPERABILITY:

Low -
- Wetland FHT – very poor to poor (Habitat Type: _____)
- SI < 40 ft.* (SI Species / Site Index: _____ / _____)
- Drainage Class – very poorly drained
- Soil – deep organic/sphagnum bog
- Vigor – Poor tree and stand vigor
- Sale Volume – limited (e.g., <100 cords or 10 MBF)
- Sale Access - poor

Medium to High –
- Wetland FHT – poor to rich (Habitat Type: _____)
- SI > 40 ft.* (SI Species/ Site Index: _____ / _____)
- Drainage Class – poorly drained or better
- Soil - non-sphagnum organic or organic over mineral
- Vigor – moderate to good tree and stand vigor
- Growing Stock Quality - acceptable (evaluate AGS)
- Sale Volume - acceptable (e.g., >100 cords or 10 MBF)
- Sale Access – fair to good

* It may be difficult to obtain an accurate SI in lowland ash stands. It is not recommended to rely on SI alone for site quality evaluations.
POTENTIAL EAB IMPACT TO STAND CONDITION:

Non-Degraded –
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Degraded –
- < 40 non-ash AGS trees per acre or < 45% relative density of non-ash AGS
ADVANCE REGENERATION (NON-ASH SPECIES):

**Adequate** –
- Non-ash, desirable species
- 2000+ stems/acre (advance + projected coppice)
- 2-4 ft. tall
- Distribution > 50% stocking

**Present but Inadequate** –
- Non-ash, desirable species
- 200-2000 stems/acre (advance + projected coppice)
- 2-4 ft. tall
- Distribution < 50% stocking, grouped

**No Potential** –
- Mostly ash or undesirable species
- <200 stems per acre (advance + projected coppice)
- < 2 ft. tall (e.g., 1st year germinants)
- Distribution – limited
HERBIVORY:

Low –
☐ Browse severity index 1-3

High –
☐ Browse severity index 4-6
INTERFERING VEGETATION:

Low –
☐ <25% coverage
RCG, buckthorn, alder, other __________

High –
☐ ≥25% coverage
RCG, buckthorn, alder, other __________
ALTERNATE SEED SOURCES:

Good -
- □ 5-10+ non-ash AGS/seed trees per acre
- □ Dominant or codominant crown class
- □ Reproductively mature
- □ Dispersed

Poor -
- □ <5 non-ash AGS/seed trees per acre
- □ Intermediate and suppressed crown classes
- □ Reproductively immature
- □ Poorly distributed
Importance of Site Hydrology
# Checklist Elements

## Hydrological Risk:

**Low**
- Seasonal inundation of limited duration (< 60 days)
- Depth to water table > 30cm during majority of growing season
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- Drainage Class poorly drained or better, convex surfaces
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- Seasonal inundation common, well into growing season (> 60 days)
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## Decision Model

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<thead>
<tr>
<th>Site Quality/Operability</th>
<th>EAB Stand Impact</th>
<th>Hydrological Risk</th>
<th>Advance Regeneration</th>
<th>Alternate Seed Sources</th>
<th>Herbivory</th>
<th>Interfering Vegetation</th>
<th>Prescription Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Limited Management Potential - low priority stand, potential for non-timber management objectives (e.g., wildlife habitat)</td>
</tr>
<tr>
<td>Medium-High</td>
<td>Not Degraded</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Alternative Cover Type - Manage for non-ash species according to appropriate cover type guidance</td>
</tr>
<tr>
<td>Medium-High</td>
<td>Degraded</td>
<td>Low</td>
<td>Adequate</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>OSR, TA</td>
</tr>
<tr>
<td>Medium-High</td>
<td>Degraded</td>
<td>Low</td>
<td>Present but Inadequate</td>
<td>Good</td>
<td>Low</td>
<td>Low</td>
<td>OSR (advance regen. sufficient), SCC, SW, GPS, P-O, R-O</td>
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Key to Prescription Alternatives: Overstory Removal (OSR), Strip Clearcut/Coppice (SCC), Two-Age (TA), Shelterwood (SW), Group/Patch Selection (GPS), Supplemental Planting – Optional (P-O), Supplemental Planting – Recommended (P-R), Release – Optional (R-O), Release – Recommended (R-R), Site Preparation for Natural Regeneration – Optional (SP-O), Site Preparation for Natural Regeneration – Recommended (SP-R), Browse Protection (BP)
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Developing Silvicultural Rx Alternatives for Lowland Ash Stands: The following guidance is based on current research and silvicultural case studies from the Lake States and is specifically directed at ash-dominated lowlands that will be heavily impacted by EAB. Ash-dominated lowlands encompass both the swamp hardwood and bottomland hardwood cover types, where the primary tree species may include black ash, green ash, red maple, silver maple, swamp white oak, and elms. Current silvicultural guidelines for the regeneration of these cover types is tentative and incomplete, due in part to our limited knowledge and experience managing these complex ecosystems for species other than ash. The threat of EAB has increased the urgency to find management strategies that maintain forest productivity and improve forest resilience. This guidance will highlight some of the important stand assessment considerations and regeneration methods that have shown the most promise for increasing species diversity in lowland ash stands. Many of these recommendations are based on lessons learned through a series of 29 swamp hardwood silvicultural trials conducted over the past 40 years in Wisconsin and draws from other emerging research in the Lake States (WDNR 2017). Additional management information can be found in the Swamp Hardwood and Bottomland Hardwood chapters of the Silviculture Handbook.

STAND ASSESSMENT CONSIDERATIONS

Proximity to EAB Infestations – An important consideration affecting the choice of silvicultural alternatives for an ash stand is the proximity to known EAB infestations and the amount of time available for management prior to major ash mortality. EAB was first detected in Wisconsin in 2008 and currently slightly over half of the state’s counties are under quarantine for EAB. Once EAB is detected in an area it may take several more years for the population to build to a level that will cause significant tree mortality. A study using FIA and county-level quarantine data found this lag time to be 7-10 years (Morin et al. 2016). EAB may actually be present in an area for years prior to detection, so the actual lag time between establishment and mortality is likely greater. If mortality is already occurring in a stand, management options may be limited to salvage operations. A management window of several years or longer however will allow for more flexibility, such as the use of alternative regeneration methods and/or multiple stand entries. The goal should not be to remove all ash in every situation, without first carefully considering management time frames and site opportunities to improve future stand conditions.

Site Quality/Wetland Forest Habitat Type – A careful assessment of site quality will help prioritize which stands will respond best to management treatments in terms of growth, regeneration, and hydrology. Low quality sites as defined within the checklist generally have lower productivity and it may not be practical to invest in extensive management treatments. The Forest Habitat Type Classification System has commonly been used in Wisconsin to assess upland site capability based on the floristic composition of plant communities, and now that system has been extended to wetland forests in northern Wisconsin. Based on the swamp hardwood trials, habitat types that are slightly richer in nutrients (e.g., FNAR and FrUb in Regions 3 and 4, respectively) seem most capable of supporting higher proportions of non-ash tree regeneration, but post-harvest shrub competition on these sites is proportionately higher creating the potential need for follow-up release treatments (Psawaro et al. 2016). Less rich habitat types were also found to support moderate to high proportions of non-ash tree regeneration, particularly under the strip clearcut/coppice and strip shelterwood regeneration methods, and generally proportionately lower shrub densities. Site quality of wetland forests may also be reflected in the depth to mineral soil, as well as influenced by the influx of nutrients from adjacent landforms.

Timber Sale Operability – Sale operability considerations are particularly important in ash-dominated lowlands due to both the seasonally saturated soil conditions and the generally low value of associated forest products. Stands with very poor drainage classes, long seasonal inundation periods, deep organic soils, and/or impeded drainage may have limited harvest windows and be more susceptible to site damage due to rutting and swamping. Harvesting during frozen conditions, using logging mats and driving over tops/branches can minimize site damage. Road systems and other infrastructure can have long-lasting impacts on wetland hydrology and site productivity by impeding water flow, and therefore need to be carefully located and constructed. Foresters should also evaluate potential sale volumes relative to local markets when assessing timber sale feasibility. Small stands with difficult access will have limited marketability and may need to be sold with adjacent upland stands or fargo management.

Hydrological Risk – Hydrological risk refers to the risk of “swamping,” or a water table rise following harvest due to tree removal and/or site damage. The risk is considered greatest for clearcutting and overstory removal treatments where all trees and the main sources of evapotranspiration are removed in a single operation, but swamping can occur with other silvicultural treatments as well if site factors are high risk. Swamping was noted in three of the 29 swamp hardwood trials; a clearcut, a 120’ strip clearcut/coppice harvest and a diameter-limit harvest. Swamping can lead to tree regeneration delays, failures, and shifts in the vegetation to wetland obligate species, such as alder and grasses/sedges. A water table response study of black ash wetlands in Minnesota found water table increases greatest in simulated EAB mortality (i.e., girdling down to 4” DBH) and clearcutting treatments, and lowest in group selection treatments (Slesak et al. 2014). Partial harvest treatments will generally mitigate the water table impacts.