Forest Insect and Disease Management: Implications for Biomass Production

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Average Annual Mortality, 1990-2002 Census

Includes timber lost due to adverse weather, insects, diseases, senescence, competition, fire and human and animal activities. It does not include harvesting or land clearing.

- 1.8% of the volume or 272M cubic ft.
- Compared to:
  - 1.3% in 1990 & 1.2% in 1977
  - .9% in WI & .8% in IA

2003, Annual Average Growing Stock Mortality

In the 1990 census, Jack pine ranked the highest in volume lost

Highest mortality seen among pioneer species

1994, Average Annual Mortality Causal Agents

- 46% due to disease agents
- 7% due to insect damage
- 22% due to fire, animal & weather related injuries combined
- 25% due to other causes
Growth losses vary by ownership and locale

- Natl forests lost 2.1%
- State & local govt lost 1.9%
- Private lands lost 1.5%

A non-forest mask was used to fairly reflect growth losses.

Pests Causing Significant Growth Losses

- Defoliators
- Wood Rotters – more lost to wood rot than to any other pest organism – so don’t wound tree roots or stems
- Canker Diseases
- Dwarf mistletoe (spruce)

Jack pine budworm

- Native insects
- Caterpillar causes defoliation
- Pollen cones are necessary for survival and population build-ups

Jack pine is a short-lived species reaching maturity at 45 to 55 years

Jack pine forests are perpetuated by fire and insects - particularly budworms
Current JPBW outbreak:

- 2002
- 2003
- 2004
- 2005

Defoliation on some red pine stands too!

**JPBW Mortality Factors**

- Frequency & severity of defoliation
  - Stand composition
  - Cone production
- Tree Vigor
  - Age
  - Crown class
  - Stocking

**Pests Causing Significant Tree Mortality**

- Decline complexes
- Wilt diseases
- Exotic invasives

**Pine Bark Beetle**

- Pitch tubes
- Exit holes
- Frass/sawdust
- Galleries

Ips & Turpentine Beetles
Contributing Factors:
- Budworm defoliation
- Over-crowding
- Drought stress
- Mechanical damage
- Soil compaction

Predisposing Factors
- Inciting Factors
- Contributing Factors

Tree Decline
Manion, 1981

DEAD

Mgmt practices can be a inciting factor

Tree Declines
- Small undersized leaves
- Sparse tufted growth
- Sucker sprouts
- Branch die-back
- Eventual death

Involve a combination of stressors that combine to overwhelm natural defenses. The condition is usually fatal.

Tree Declines 2004 & 2005

<table>
<thead>
<tr>
<th>Tree</th>
<th>Declines 2004</th>
<th>Declines 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash</td>
<td>31,114</td>
<td></td>
</tr>
<tr>
<td>Aspen</td>
<td>410,565</td>
<td></td>
</tr>
<tr>
<td>Oak</td>
<td>1,023</td>
<td></td>
</tr>
<tr>
<td>Birch</td>
<td>3,200</td>
<td></td>
</tr>
</tbody>
</table>
Ash Decline

- Native defoliator
- Cyclic outbreaks
- Aspen & hardwoods

Forest tent caterpillar

- Native defoliator
- Cyclic outbreaks
- Aspen & hardwoods

Oak Decline & Two-lined Chestnut Borer

- Serpentine larval galleries
- D-shaped exit holes

Armillaria spp.

- Rhizomorphs
- Mycelium
- Armillaria on pine
- Mushroom assoc. with root wound
Oak Wilt

• Rapid wilting & die-back
• Leaf drop & discoloration
• Wood streaks
• Expanding pockets of dead trees

Oak Wilt spreads two ways:

Below ground via root grafts – spread averages 25’ per yr
Above ground via sap feeding beetles – spread averages 1500’ per yr

Extent of Oak Wilt in 2004

Active oak wilt
Inactive/treated oak wilt
Oak forest types
Releaf/OW grantees
Counties with confirmed OW

OAK WILT MANAGEMENT

• Root graft disruption
• Tree removal to prevent overland spread
• Wound prevention and treatment
New Pests Capable of Causing significant Losses

- Gypsy Moth
  - Current infestation in Cook Co
- Emerald ash borer
  - Not yet known to be in MN

Gypsy Moth Biology

- Egg mass (Jul-Apr)
- Pupae (Jun-Jul)
- Caterpillars (Apr-Jun)
- Adults (Jul-Sept)

Preliminary Gypsy Moth Trap Catch, 2005

- 1310 moths compared to 396 in ‘04
- 1068 in Cook Co. compared to 198 in ‘04

Proposed Treatments:
- Pheromone flakes 136K acres
- Btk 2100 acres
- Total 138K acres
Defoliation Factors:

**Host Preferences**

<table>
<thead>
<tr>
<th>Category</th>
<th>Overstory Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred</td>
<td>Oak, aspen, basswood, white and river birch, larch, willow, mountain-ash, alder and apple</td>
</tr>
<tr>
<td>Less-preferred</td>
<td>Yellow birch, boxelder, butternut, black walnut, cherry, eastern cottonwood, elm, hackberry, hickory, red and sugar maples, pine, spruce</td>
</tr>
<tr>
<td>Avoided</td>
<td>Ash, cedar, fir, silver maple, catalpa, mulberry and many urban species</td>
</tr>
</tbody>
</table>

- Avoided those rarely fed on
- Preferred those eaten by all larvae
- Less-preferred those eaten by older larvae

- Avoided those rarely fed on

<table>
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<tr>
<th>Category</th>
<th>Understory Spp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred</td>
<td>Hawthorn, hazelnut, hop hornbeam, hornbeam, serviceberry, witch-hazel</td>
</tr>
<tr>
<td>Less-preferred</td>
<td>Blueberries, pin cherry, chokecherry, sweet fern</td>
</tr>
<tr>
<td>Avoided</td>
<td>Dogwood, elderberry, grape, greenbrier, juniper, raspberry, viburnum</td>
</tr>
</tbody>
</table>

Mortality Factors

- Frequency & severity of defoliation
  - Species composition
  - Disease & predation
- Tree vigor
  - Site suitability
  - Stand history
  - Tree age
- Opportunistic pests
  - TLBC
  - Armillaria root rot

Emerald Ash Borer

Note there are native borers on ash in the US

Emerald Ash Borer galleries similar to TLCB

EAB larvae, the damaging stage
Sprouts associated with EAB can look like Ash Yellows

Callus growth around young galleries produces numerous bark cracks

Firewood & raw wood products can spread insects & diseases

- Be familiar with state quarantines
- Don’t move infested wood off site
- If you have to move it, dispose of it before April
- Know where your supplier got theirs or be sure its certified pest free

Thanks