



# Preparing Wisconsin's Forests for the Emerald Ash Borer

Revised August 2008

The emerald ash borer (EAB), *Agrilus planipennis*, is an exotic insect that was first identified in southeast Michigan in 2002. EAB infests and kills all true ash species (*Fraxinus* spp.) that are native to Wisconsin. Even healthy ash trees decline and die within several years.

**EAB has been detected in Wisconsin.** In August 2008, EAB was detected in northwest Ozaukee County and northeast Washington County (Figure 1).

EAB has also been found in nine other states (Illinois, Indiana, Maryland, Michigan, Missouri, Ohio, Pennsylvania, Virginia and West Virginia) and in two Canadian provinces (Ontario and Quebec). In August 2008, EAB was detected in the western Upper Peninsula of Michigan near Calumet.



Figure 1. EAB detections in Wisconsin as of August 7, 2008. Counties in red are quarantined.

## Regulatory Considerations

**On August 7, 2008, Fond du Lac, Ozaukee, Sheboygan and Washington Counties were quarantined by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP). This quarantine means that the following items cannot be transported out of the quarantined area:**

- The emerald ash borer, *Agrilus planipennis* Fairmaire, in any living stage.
- Ash trees.
- Ash limbs, branches and roots.
- Ash logs, slabs or untreated lumber with bark attached.
- Cut firewood of all non-coniferous species.
- Ash chips and ash bark fragments (both composted and uncomposted) larger than one inch in diameter.
- Any other item or substance that may be designated as a regulated item if a DATCP pest control official determines that it presents a risk of spreading emerald ash borer and notifies the person in possession of the item or substance that it is subject to the restrictions of the regulations.

***DATCP is developing regulations on how quarantined articles must be treated in order to leave the quarantined counties.***

Additional counties will be quarantined as new EAB finds occur. **For a list of quarantined counties and regulations, visit the Wisconsin EAB website <http://www.emeraldashborer.wi.gov>**

## **Response Considerations**

The Wisconsin Department of Agriculture, Trade and Consumer Protection and the Department of Natural Resources have developed a response plan for EAB. For each EAB detection, a delimitation survey will be conducted to determine the extent of the infestation. Following the delimitation, a plan of action will be recommended to manage, control or slow the spread of the infestation. Each infestation will be individually examined and evaluated to determine the most responsible and reasonable course of action, based on the most scientifically sound information available at the time. In addition to collection of the scientific data, site surveys will be conducted to determine environmental sensitivity, endangered resources, and social impacts. These assessments will be done with guidance from the US Fish and Wildlife Service and DNR Endangered Resources. Where appropriate, Traditional Ecological Knowledge will also be taken into consideration. It is unlikely that there is a one-size-fits-all strategy for managing an infestation of EAB. The response plan may be viewed at <http://www.emeraldashborer.wi.gov>

## **Symptoms and Signs**



Figure 2. Infested ash with thin crown.



Figure 3. Epicormic sprouts at the base of an infested ash tree.



Figure 4. S-shaped larval galleries.

Symptoms of EAB infestation include thin foliage and/or dieback in the upper crown, epicormic sprouts on the stem or at the base, S-shaped larval galleries under the bark and 1/8" D-shaped exit holes (Figs. 2-5).



Figure 5. D-shaped exit hole created by an EAB adult beetle.

Adult beetles are approximately 1/2" in length and emerald green (Fig. 6). Collecting a specimen is very important for proper identification; freezing the insect or preserving it in rubbing alcohol will maintain the specimen until an expert can examine it.



Figure 6. EAB adult. Photo by H. Russell, Michigan State University.

## **Reporting Suspects**

Monitor for symptoms of EAB infestation and report suspect trees and insects to the Wisconsin EAB hotline at 1-800-462-2803 or email your observations to [eab@datcp.state.wi.us](mailto:eab@datcp.state.wi.us)

## **Risk of Introduction**

It is likely that there will be additional detections of EAB in Wisconsin due to previous accidental transport of the insect in firewood, nursery stock and unprocessed logs. Campgrounds and urban areas are currently thought to be at highest risk of EAB introduction due to this accidental transport. Landowners should consider the likelihood of introduction in the local area when considering management options. Natural spread of EAB from an introduction site is currently thought to be between 1/2 to 2 miles per year.

## Future Impacts

Early observations have revealed no obvious natural resistance to EAB in the native ash population yet it is too early to dismiss native resistance as a possibility. There are currently no completely effective treatments for eliminating the insect from infested trees. Insecticide treatments are available for yard trees but are not practical for treatment of ash in woodlots.

There is very little data on the impacts of various population levels of EAB on the ash forest. Over time, predicting impact will be based on a better understanding of the insect's population dynamics. Research may reveal new management options, and maintaining an ash component will help to maintain species diversity and other benefits that ash provides.

Landowners should carefully evaluate long-term management options and determine which silvicultural practices are suitable for their stands. Preparing a stand for EAB impacts may allow the stand to remain adequately stocked with non-ash species and able to meet management objectives if all of the ash dies or is harvested. **Removing all ash prior to EAB establishment in the local area is not recommended.** EAB detection in the local area may lead to increased harvesting of ash and thus affect ash stumpage prices. Be aware that EAB impacts may conflict with Managed Forest Law Program requirements.

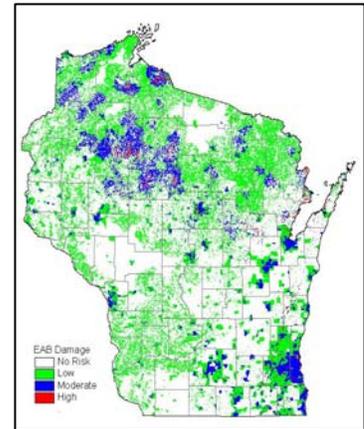


Figure 7. Potential extent of ash mortality from EAB in Wisconsin. The level of ash mortality was predicted by the risk of introduction and number of ash trees.

**It is important that landowners evaluate the potential impacts of EAB. Landowners in the quarantined counties should consult with a forester to determine whether it is appropriate to adjust their management plan. This decision will depend on several factors, including distance from known EAB infestations, stand composition and age, management goals, and markets for the wood. In all cases, sustainable forest management practices should be followed.**

## The Ash Resource in Wisconsin

There are over 700 million ash trees >1" in diameter in Wisconsin's forests, comprising approximately 7% of all forest trees greater than 1" in diameter (Fig. 8). Ash is also a common street and yard tree, comprising an average of 20% of urban street trees and 12% of all urban trees.

White ash (*Fraxinus americana*) is rarely found growing in pure stands but is present throughout the state, occasionally as the dominant component in a forest. White ash grows on a variety of sites but is most frequently found on fertile, well-drained soils.

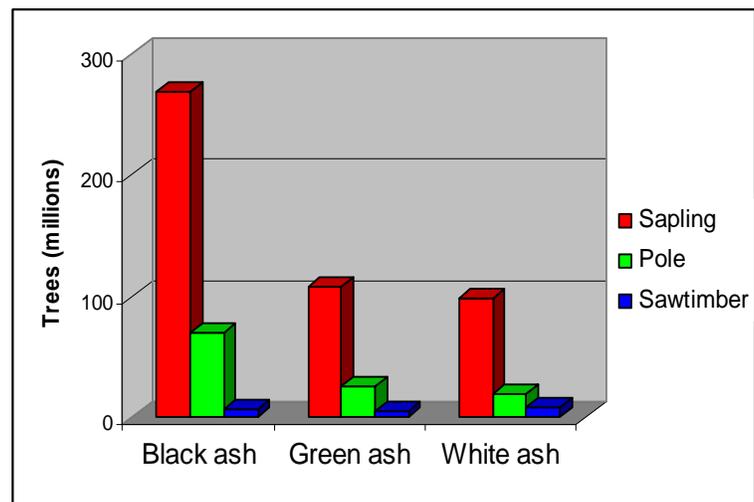


Figure 8. Number of black, green and white ash trees in Wisconsin. Data are from USDA Forest Service Forest Inventory and Analysis plot network.

Green ash (*F. pennsylvanica*) is found throughout the state, but is most common in southern Wisconsin. It may form pure stands or grow in association with black ash, red maple, silver maple, swamp white oak, and elm. It grows as an associate in upland hardwood stands, but is most common in and around stream banks, floodplains, and swamps.

Black ash (*F. nigra*) is distributed over the entire state but is most frequently found in northern Wisconsin. It is most common in swamps, but is also found in other wet forest types.

Blue ash (*F. quadrangulata*) is a threatened species that is currently found only at a few sites in Waukesha County. The species is at the edge of its range in Wisconsin, but is common in states farther south. The species is not of commercial importance.

Mountain ash (*Sorbus americana* and *S. decora*) is not a true ash and is not susceptible to EAB infestation.

**Management in Artificial Regeneration**



**In quarantined counties, planting ash is not recommended. Outside of a quarantined county, limit ash to 10% or less of a new planting.** Planting ash is also not recommended on sites where significant natural ash regeneration is likely. It is unknown where EAB will become established in Wisconsin or how quickly it will spread, but there is a high risk that ash in a new planting will be killed before maturity.

**Management in Natural Regeneration**



**In quarantined counties, consult a forester to determine management options. If outside a quarantined county, continue current management practices in seedling and sapling stands and sites that are naturally regenerating.** If the ash component represents >10% of all regeneration, then reduce the ash component during release and thinning operations, favoring non-ash species. Retain the most vigorous ash stems. Active treatment of ash regeneration through cutting or herbicide may be needed.

Supplemental planting of non-ash species is another option to increase the non-ash component. Where ash regeneration is predominant (>50%), and if feasible, implement practices that discourage young ash and encourage regeneration of non-ash species through natural or artificial techniques.

**Management in Established Stands**

**In quarantined counties, consult a forester to determine appropriate management options.**

Options for preparing forest lands will depend in part on the frequency of ash in the stand (Fig. 9). As the proportion of ash rises, fewer options will be available. The management guidelines have been developed based on three ash basal area levels: 1) ash <20% of the basal area, 2) ash 20-40% and 3) ash >40%.

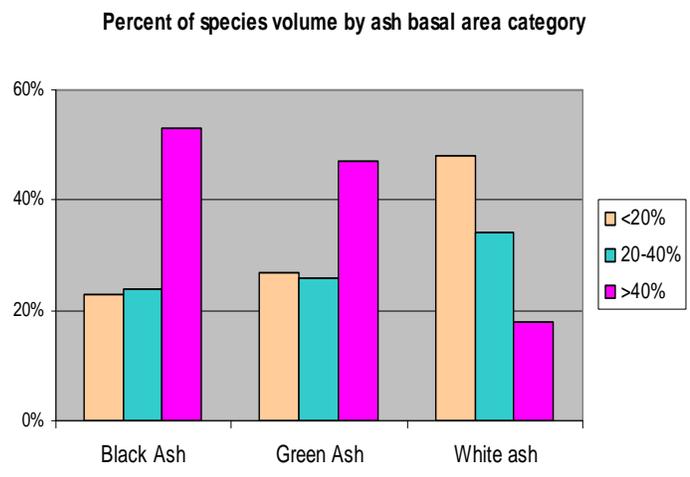


Figure 9. Percentage of species growing stock volume by ash dominance category. In stands in which black ash occurs, over 50% of black ash volume occurs in stands with at least 40% basal area in ash whereas in stands in which white ash occurs, less than 20% occurs in stands with at least 40% basal area in ash.

### **Management in Established Stands Where Ash is a Minor Component (< 20%)**



**If the stand is within a quarantined county, consult a forester to determine appropriate management options. If outside a quarantined county, continue normal long-term management activities.**

In most cases where ash is a minor component, management goals are still met if all of the ash were to die or be removed. If management goals will not be met as a result of ash mortality, reduce the amount of ash in the stand during the next scheduled entry. Keep ash that are of good form and vigor and encourage species diversity.

Follow standard silvicultural guidelines when selecting trees to remove or retain. Removing low vigor and low quality ash will help to slow population buildup in the stand. In northern hardwoods stands, typical silvicultural practices such as creating gaps and shelterwood cuts tend to encourage ash regeneration. Thus, active treatment of ash regeneration through cutting or herbicide application may be necessary to keep the ash component to an appropriate level.

### **Management in Established Stands Where Ash is a Medium Component (20 - 40%)**



**If the stand is within a quarantined county, consult a forester to determine appropriate management options. If outside a quarantined county, continue normal long-term management activities.**

Reduce the proportion of ash during regularly-scheduled entries, aiming for a species composition that would leave the stand adequately stocked and able to meet landowner goals if all of the remaining ash were killed or harvested. Follow standard silvicultural guidelines when selecting trees to remove or retain. Removing low vigor and low quality ash will help to slow EAB population buildup in the stand. Individual trees of other species may also be removed at the same time as EAB management activities if appropriate for the stand's management plan. A mixed-species sale may bring more interest from timber buyers.

These stands are likely to need multiple entries to reduce the ash component to an appropriate level. In many forest types, typical silvicultural practices that create openings in the canopy tend to encourage ash regeneration. Thus, active treatment of regeneration through cutting or herbicide application may be necessary to keep the ash component to an appropriate level.

The non-ash component may be primarily non-merchantable species or suppressed trees of commercial species. In this case, land managers should manage the stand using the recommendations below.

### **Management in Established Stands Where Ash is a Major Component (> 40%)**



**If the stand is within a quarantined county, consult a forester to determine appropriate management options. If outside a quarantined county, continue normal long-term management activities.**

Stands with a large proportion of ash (such as a bottomland, swamp, or plantation) will be heavily impacted by EAB unless the ash component is drastically reduced. When planning harvesting activities, consider two alterations: changing the rotation age and changing what is considered to be a crop tree. If practical, reduce the ash component during regularly-scheduled stand entries, keeping the stand adequately stocked. Removing low vigor and low quality ash will help to slow EAB population buildup in the stand. Individual trees of other species may also be removed at the same time as EAB management activities if appropriate for the stand's management plan. A mixed-species sale may bring more interest from timber buyers. **Because ash is a major component, multiple stand entries will be needed to bring the ash component down to a suitable level where feasible. If the ash-dominated stand is at or near rotation age, consider regenerating the stand with a reduced proportion of ash.**

In upland stands, attempt to reduce the amount of ash so that the residual stand would remain adequately stocked and continue to meet landowner goals if all the remaining ash were killed or removed. Favor non-ash during release and thinning activities. Active treatment of ash regeneration through cutting or herbicide application may be necessary.

In lowland stands, management of EAB will be more difficult because silvicultural options will be limited and stand conversion will frequently be impractical. EAB mortality or excessive harvesting may lead to understocking, conversion to undesirable tree species or non-forest cover, elevated water tables, or an increase in exotic plants such as reed canary grass. In bottomlands, reed canary grass frequently invades openings where established regeneration is absent. Keep the stand adequately stocked and favor species such as red or silver maple, swamp white oak, and swamp conifers during release and thinning treatments. Active treatment of ash regeneration through cutting or herbicide application may be necessary. Consider establishing non-ash regeneration through natural or artificial means.

In many cases it will not be practical to reduce the proportion of ash because of harvesting impacts or lack of sufficient non-ash stems. EAB would still heavily impact the stand even if gradual species conversion were attempted, leaving it understocked and unable to meet landowner objectives. If a stand is in this situation, landowners may decide to:

- ✓ Allow EAB mortality to run its course
- ✓ Alter management to non-timber objectives
- ✓ Wait until rotation age; convert to different species (if possible) prior to EAB establishing in the area. Shortening the rotation age may be appropriate.
- ✓ Wait until EAB establishes in the area; harvest the stand and convert to different species (if possible). Be aware of quarantine restrictions.
- ✓ Wait until EAB impacts the stand; harvest the stand and convert to different species (if possible). Be aware of quarantine restrictions.

**Stand composition and age, management objectives, regulatory quarantines and financial considerations will affect the suitability of each alternative.** Where stand regeneration is chosen, follow the guidelines in the 'Management in Artificial and Natural Regeneration' sections of these guidelines.

Updated management guidelines and maps of EAB distribution will be available at <http://www.emeraldashborer.wi.gov> and <http://www.dnr.wi.gov/invasives> Emerald ash borer is a relatively new pest in North America, and management guidelines will change over time due to changing insect distribution, new research findings, introduction of biological controls, and availability of funding for management.