



Citizens guide to Emerald Ash Borer

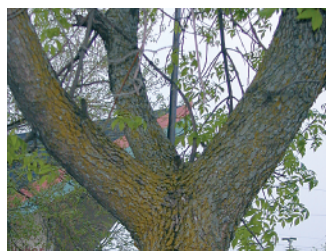
Saving our shade one tree at a time.

Ash Tree Identification

Ash species attacked by emerald ash borer include green (*Fraxinus pennsylvanica*), white (*F. americana*), black (*F. nigra*), and blue (*F. quadrangulata*), as well as horticultural cultivars of these species. Green and white ash are the most commonly found ash species in the Midwest with blue ash being rare.

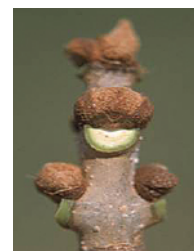
While other woody plants, such as mountainash and pricklyash, have "ash" in their name, they are not true ash, or *Fraxinus* species. Only true ash are susceptible to attack by emerald ash borer.

To properly identify ash trees, use the following criteria:



Branch and Bud Arrangement

Branches and buds are directly across from each other and not staggered. When looking for opposite branching in trees, please consider that buds or limbs may die; hence not every single branch will have an opposite mate.



Diane Brown-Rytlewski

Leaves

Leaves are compound and composed of 5-11 leaflets. Leaflet margins may be smooth or toothed. The only other oppositely branched tree with compound leaves is boxelder (*Acer negundo*), which almost always has three to five leaflets. White ash (on left) and green ash (on right)



*Paul Wray, Iowa State University

Bark

On mature trees (left), the bark is tight with a distinct pattern of diamond-shaped ridges. On young trees (right), bark is relatively smooth.



*Paul Wray, Iowa State University

Seeds

When present on trees, seeds are dry, oar-shaped samaras. They usually occur in clusters and typically hang on the tree until late fall, early winter.

MICHIGAN STATE
UNIVERSITY
EXTENSION



**Emerald
Ash Borer**

Tree Species Resembling Ash

Boxelder (*Acer negundo*)

Exhibits opposite branching and compound leaves. However, has 3 to 5 leaflets (instead of 5 to 11) and the samaras are always in pairs instead of single like the ash.



*Paul Wray, Iowa State University



*Bill Cook, Michigan State University

European Mountainash (*Sorbus aucuparia*)

Leaves are compound with alternate (staggered) branching. Tree bears clusters of creamy white flowers in May. Fruits are fleshy, red-orange berries.



Diane Brown-Rytlewski



*Boris Hrasovec, University of Zagreb

Shagbark Hickory (*Carya ovata*)

Leaves are compound with 5 to 7 leaflets, but the plant has an alternate branching habit. Fruit are hard-shelled nuts in a green husk.



*Paul Wray, Iowa State University



*Paul Wray, Iowa State University

Elm (*Ulmus species*)

Branching is alternate and the leaves are simple with an unequal leaf base.



*Paul Wray, Iowa State University



*Paul Wray, Iowa State University



*Paul Wray, Iowa State University

Black Walnut (*Juglans nigra*)

Leaves are compound with 9 to 15 leaflets, but the plant has an alternate branching habit. Fruit is a large dark brown nut inside a green husk.



*Paul Wray, Iowa State University

Authors: Kimberly Rebek and Mary Wilson

*www.forestryimages.org

Signs and Symptoms of the Emerald Ash Borer

Mary Wilson, MSU Extension. Eric Rebek, Michigan State University Dept. of Entomology

Adult



Michigan State University



Michigan State University

- Bright, metallic green (Figs. A, B).
- 1/2 inch long, flattened back (Figs. A, B).
- Purple abdominal segments beneath wing covers.

Larva



D. Cappaert, MSU

- Creamy white, legless (Fig. C).
- Flattened, bell-shaped body segments (Fig. C).
- Terminal segment bears a pair of small appendages.

Canopy Dieback



E. Rebek, MSU



E. Rebek, MSU

- Begins in top one-third of canopy (Fig. D).
- Progresses until tree is bare (Fig. E).

Epicormic Shoots



J. Smith, USDA APHIS PPQ



J. Smith, USDA APHIS PPQ

- Sprouts grow from roots and trunk (Figs. F, G).
- Leaves often larger than normal.



MICHIGAN STATE
UNIVERSITY
EXTENSION



Bark Splitting



J. Smith, USDA APHIS PPQ



A. Storer, Mich. Tech. Univ.

- Vertical fissures on bark (Fig. H) due to callous tissue formation (Fig. I).
- Galleries exposed under bark split.

Serpentine Galleries and D-shaped Exit Holes



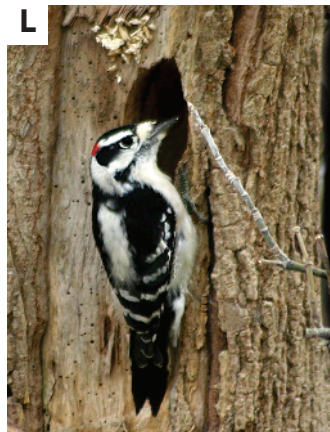
D. Cappaert, MSU



D. Cappaert, MSU

- Larval feeding galleries typically serpentine (Fig. J).
- Galleries weave back and forth across the woodgrain.
- Packed with frass (mix of sawdust and excrement).
- Adults form D-shaped holes upon emergence (Fig. K).

Increased Woodpecker Activity/Damage



D. Cappaert, MSU



Karen D'Angelo, MSUE

- Several woodpecker species (Fig. L) feed on EAB larvae/pupae.
- Peck outer bark while foraging (Fig. M).
- Create large holes when extracting insects (Fig. M).

Emerald Ash Borer: Homeowner Guide to Insecticide Selection, Use, and Environmental Protection



Before Using an Insecticide Consider the Following

✓ Identify if EAB is Near

Start insecticide treatments only when your property is within 15 miles of an EAB infestation, or if you are within a county that is quarantined for EAB. Check [MDA's Interactive EAB Survey Map](#) for current infestations in Minnesota.

✓ Remove and Replace Ash Trees on Your Property

It may be more cost effective to replace a small or struggling ash tree than to pay the cost of ongoing treatments. In addition, trees in poor health are not likely to respond well to treatments. Do not treat trees showing more than 50 percent canopy decline; these ash trees are unlikely to recover even if treated.

✓ Treatment Requires a Long-Term Commitment

Once EAB arrives in an area, it will remain a constant threat to ash trees. It is likely that protective insecticide treatments will be needed for the rest of the tree's life at a potentially significant cost.

✓ Check Your Calendar – Timing is Everything

To ensure the insecticide is in the leaves by the time adults emerge to feed in early June, products are most effective when applied mid-April until the end of June.

RECOMMENDED TREATMENT DATES ARE SHADED

APRIL							MAY							JUNE						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
				1	2	3							1			1	2	3	4	5
4	5	6	7	8	9	10	2	3	4	5	6	7	8	6	7	8	9	10	11	12
11	12	13	14	15	16	17	9	10	11	12	13	14	15	13	14	15	16	17	18	19
18	19	20	21	22	23	24	16	17	18	19	20	21	22	20	21	22	23	24	25	26
25	26	27	28	29	30		23	24	25	26	27	28	29	27	28	29	30			
							30	21												

✓ Contact a Certified Arborist or City Forester to Evaluate Treatment Options

When contacting a professional, consider the following:

- Your city or township may have requirements or prohibitions related to the treatment of EAB, especially for ash trees located on city property, which may include trees planted on or near boulevards or sidewalks. Check with your city's park and recreation or forestry departments.
- Many effective products are best administered by professionals. If hiring a professional, check to make sure that they are licensed in Minnesota as a Commercial Pesticide Applicator for category "E: Turf and Ornamentals."

✓ Have a Professional Treat Large Ash Trees

There are homeowner treatment options for small ash trees, though these require careful application to avoid unintended environmental impacts. Homeowners wishing to protect trees larger than 48 inches in circumference (as measured 4½ feet above ground level) should have their trees professionally treated.

Insecticide Treatment Options

Professionals have access to some products that are not available to homeowners.
This document does not endorse the listed insecticide products over other options.

Products Marketed to Professionals and Arborists				
Insecticide Active Ingredient	Examples of Products	Treatment Frequency	Application Methods	Environmental Profile
Emamectin benzoate	TREE-age <i>Restricted Use Pesticide</i> Any person using this product is required to be a licensed or certified pesticide applicator.	Every 2 years	Trunk injection	Persistent in tree tissue, relatively immobile in the environment.
Azadirachtin, (neem tree seed oil)	TreeAzin	Once per year	Trunk injection	Classified as a biopesticide, minimal or no exposure or risk to non-target organisms, habitats or water.
Dinotefuran	- Safari - Transtect	Once per year (bark spray) 1 – 2 times per year (other methods)	Bark spray, soil injection, soil-applied drench	- Strong potential to leach to shallow groundwater. - Potential exposure to adjacent water bodies through spray drift and runoff events.
Imidacloprid	- Merit products - Xytect 2F - Ima-jet	1 - 2 times per year	Trunk injection, soil injection, soil-applied drench	- Highly toxic to aquatic life. - Potential to leach to shallow groundwater or be transported in runoff when using soil injection or drench.

Products Marketed to Homeowners				
Insecticide Active Ingredient	Examples of Products	Treatment Frequency	Application Methods	Environmental Profile
Dinotefuran	Green Light Tree and Shrub Insect Control with Safari	Once per year	Granular soil-applied product	- Strong potential to leach to shallow groundwater. - Potential exposure to adjacent water bodies through runoff events.
Imidacloprid	- Bayer Advanced Tree and Shrub Insect Control - Bonide Tree and Shrub Insect Control - Ferti-lome Systemic Insect Drench - Ortho Max Tree and Shrub Insect Control	Once per year ¹	Soil-applied drench	- Highly toxic to aquatic life. - Potential to leach to shallow groundwater or be transported in runoff.
Imidacloprid	Bonide Systemic Insect Spray	Check with an arborist, may not be practical for trees > 20-25 ft. in height ²	Insecticide spray to tree canopy or bark	- Highly toxic to aquatic life. - Tree canopy (foliar) sprays can lead to drift, posing risks to surface water, children, pets and nearby flowering plants (with potentially toxic affects to bees and other pollinators).

1. Recommended only for trees less than 48 inches in circumference (as measured 4½ feet above ground level)

2. Due to the chances of insecticide drift to other areas during a canopy or bark spray, they are best applied by professionals.
Additionally, there is little research to support the efficacy of canopy spray products.

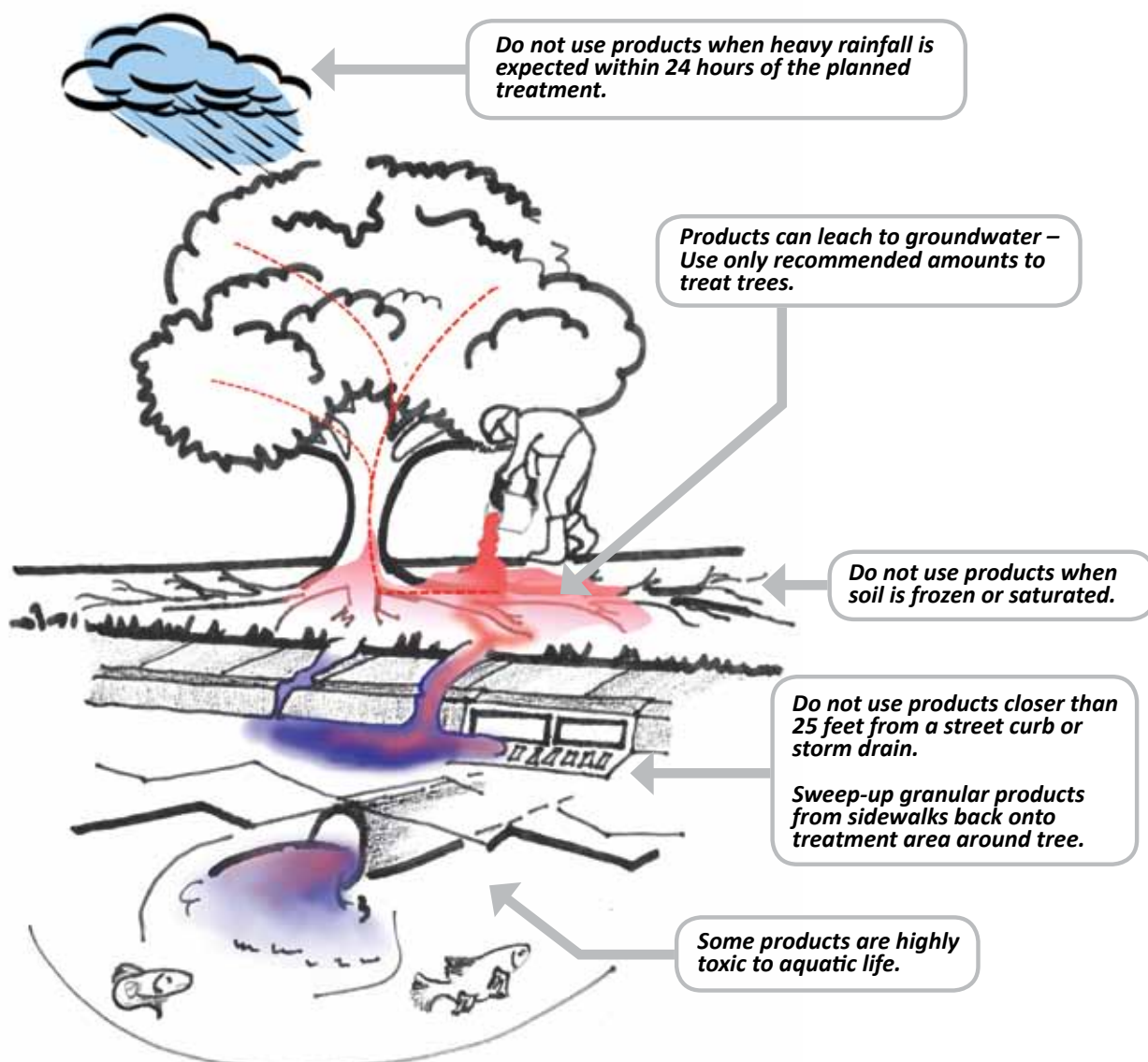
Follow These Recommendations to Protect Water Quality

Generally, professionally applied tree injections have significantly fewer concerns for water quality.

For soil-applied products, bark sprays or sprays applied to tree canopies, the following considerations are important:

- Do not use within 25 feet of water bodies; such as, streams, lakes, ponds, wetlands or conduits to surface water or groundwater such as street curbs, storm drains, sumps, or well heads.
- Do not apply when heavy rainfall is expected within 24 hours of the planned treatment.
- Do not allow sprays to drift. Avoid spraying trees when there is wind. These sprays pose exposure risks to surface water, children, pets and nearby flowering plants (with potentially toxic affects to bees and other pollinators).

Avoid situations that could cause insecticides to wash away or leach, potentially contaminating water resources



Making Sense of EAB Insecticide Labels

Read the Label! It is your legal responsibility to read, clearly understand, and follow all current label directions for the specific insecticide product being used.

Selecting an Insecticide:

- Look for products marketed to control emerald ash borer (see table in this guide).
- Read the *Environmental Hazard Statements* on the insecticide label. Products applied as a canopy spray are likely to result in a considerable amount of insecticide drift, even when conditions are ideal.

Using an Insecticide:

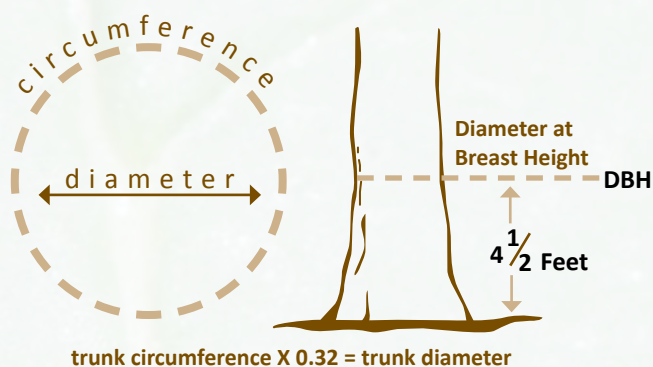
- To facilitate uptake, soil-applied insecticides should be applied when the soil is moist but not saturated or excessively dry.
- For soil drenches remove or rake any mulch or dead leaves, then pour the insecticide solution directly onto soil.
- Do not allow children and pets to re-enter treatment area until sprays or drenches have dried.
- Store insecticides where children cannot reach them.
- Many homeowner products only allow one soil drench application per year.

Disposing an Insecticide:

- When using the last of a liquid insecticide container, triple-rinse before disposal, then apply the rinse water as you would apply the insecticide.
- Unusable and unwanted insecticides must be disposed of according to the label directions, or at a county household hazardous waste disposal event.
- It is illegal to bury or burn a insecticide.

Measure your Ash Trees

Soil-applied insecticide treatments available to the general public are most effective on smaller trees, less than 48 inches in circumference.



CONVERSION TABLE

Tree Measurements at 4½ Feet Above Ground Level

Circumference – Inches	Diameter at Breast Height (DBH) – Inches
15	5
20	6
25	8
30	9.5
35	11
40	13
45	14
> 48 inches 	> 15 inches 
Large trees should be treated by a professional	

Additional Resources

For more information on this publication, contact the “Arrest the Pest” Hotline at 651-201-6684 or 888-545-6684.

Pesticide Disposal

For more information about disposing of unusable or unwanted pesticides, visit MDA online at www.mda.state.mn.us/chemicals/spills/wastepesticides/schedule.aspx or 651-201-6562.

Reporting and Investigating Pesticide Spills and Misuse

Complaints can be reported to the Minnesota Duty Officer at 800-422-0798.

MDA staff will evaluate the information provided and if a pesticide misuse is suspected, an MDA inspector will be assigned. More information is available online at www.mda.state.mn.us/chemicals/pesticides/complaints.aspx

Emerald Ash Borer Online Resources

- Minnesota Department of Agriculture – <http://www.mda.state.mn.us/eab>
- University of Minnesota Extension – www.extension.umn.edu/issues/eab
- USDA-APHIS – www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b
- Minnesota Department of Natural Resources – www.dnr.state.mn.us/invasives/terrestrialanimals/eab
- City of St. Paul – www.stpaul.gov/index.aspx?NID=2495
- Minneapolis Park and Recreation Board – www.minneapolisparke.org/default.asp?PageID=1059
- EAB Multi-State Site – www.emeraldashborer.info

Insects in Minnesota That May Be Confused With Emerald Ash Borer

Jeff Hahn, University of Minnesota Extension
Val Cervenka, Minnesota Department of Natural Resources

PRODUCED BY

UNIVERSITY OF MINNESOTA

EXTENSION

extension.umn.edu



dnr.state.mn.us

WITH SUPPORT FROM



mda.state.mn.us

emerald ash borer



bronze



birch borer

twolined chestnut borer



polydrusus weevil



halictid bee



blow fly



flatheaded apple tree borer



Buprestis metallic Woodboring beetle



blister beetle



japanese beetle



dogbane beetle



bark gnawing beetle



Poecilus ground beetle



sixspotted tiger beetle



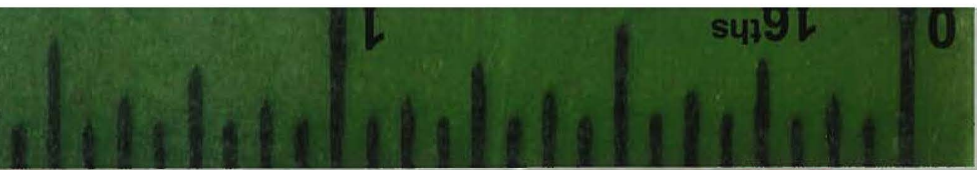
annual cicada

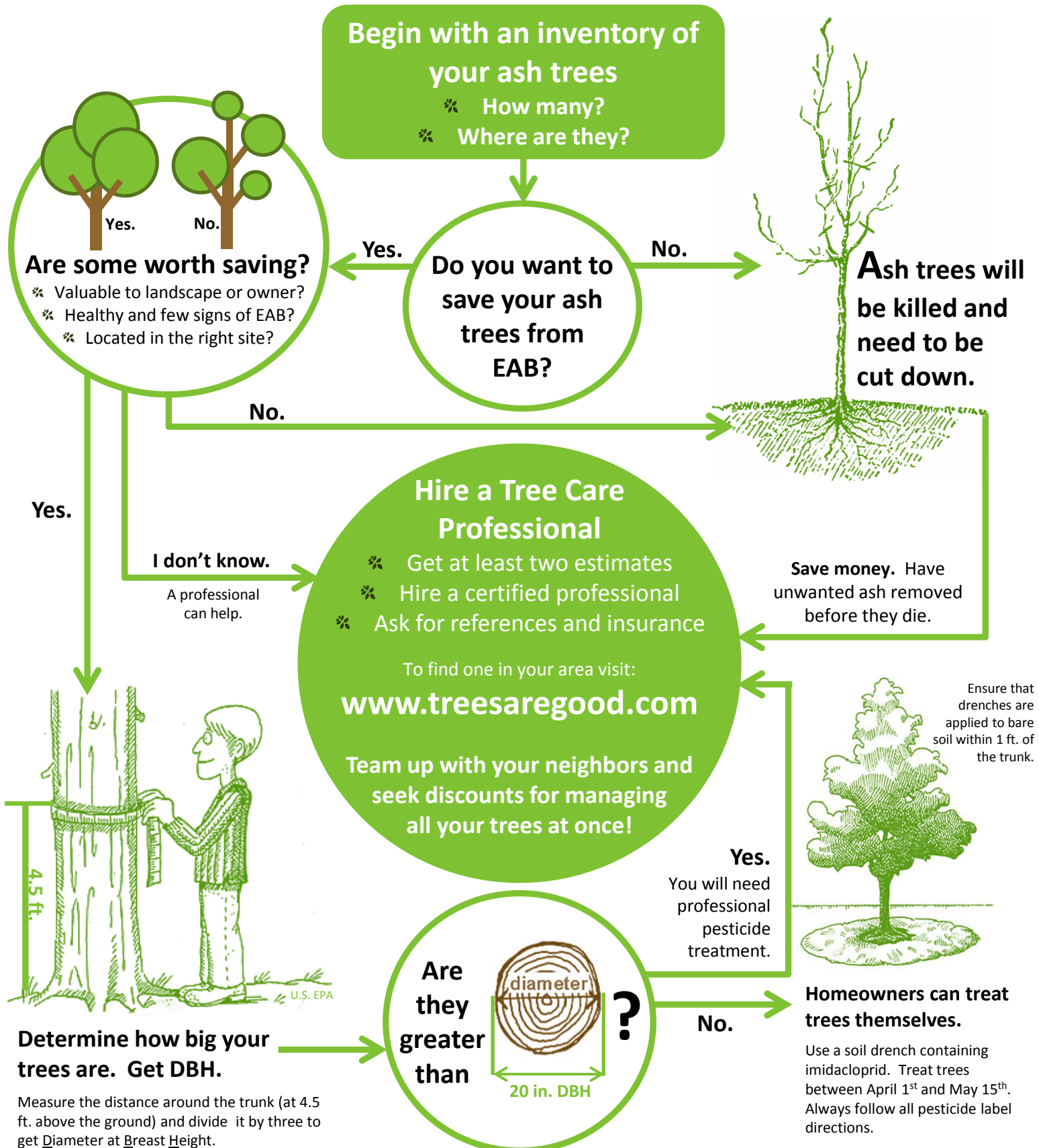


green stink bug



Chlaenius ground beetle





Which trees can be saved?

Trees CAN be saved if they are:

- **Healthy** and vigorously growing, with more than half their leaves.
- Enhancing the landscape.
- Valuable to the owner.
- Showing only few outward signs of EAB infestation.



These ash trees are healthy, have all of their leaves, and provide shade and beauty to the landscape. They would be good treatment candidates.

Trees should NOT be saved if they are:

- **Unhealthy**, with more than half of their leaves missing.
- Planted in poor sites or are not important to the landscape.
- Showing many outward signs of EAB infestation, such as woodpecker damage, bark splits, and water sprouts at the tree base.



These ash trees are too unhealthy to be effectively treated.



This ash tree is not planted on the right site. It will require maintenance to keep it clear of power lines.

Contact your city forester about local ordinances before performing any tree work!

What are the treatment options?

Homeowners can protect healthy ash trees:

- With a trunk **less than 20 in.** Diameter at Breast Height (see reverse for DBH measurement).
- With over the counter soil drench products containing 1.47% imidacloprid. These products are most effective when applied between April 1st and May 15th.

Professionals can protect ash trees:

- With a trunk **greater than 20 in.** DBH.
- Later in the year, using specialized equipment to apply pesticides that contain imidacloprid, dinotefuran, or emamectin benzoate.

Want more information on hiring a professional to treat your larger trees?

Visit: www.treesaregood.com

Which new trees should be planted?

The tree species you choose should match the conditions of the site. Remember that some trees can become very large. Contact your city forester, or your local garden center or nursery for advice on choosing a good replacement.

For a list of replacement trees, visit:
www.eabindiana.info



REMEMBER: Choose Diversity!

Replant with several different tree species to increase your neighborhood's resilience to future pest problems.