What's In That Wood Pile?

Identifying 3 groups of trees found in Minnesota wood piles

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Overview

Photo: Joseph O'Brien , USDA Forest Service

Figure 1: Oak tree infected with oak wilt

Firewood identification and quarantine has been one of the important tactics for managing oak wilt (OW) (Figure 1) and Dutch elm disease (DED) (Figure 2) in the Upper Midwest. Both of these fungal diseases can spread from standing dead and dying trees to healthy trees by insect vectors that are attracted to healthy trees, or fresh pruning wounds in the case of oak wilt. Firewood from these trees may harbor insect vectors (DED) and promote conditions for production of fungal disease spores, which then may attract insect vectors to the fungus (OW). Thus, proper disposal or treatment of firewood from such diseased trees is extremely important.

Photo: Dave Hanson, U of MN/Dept. of Forest Resources

Figure 2: Elm tree infected with Dutch Elm Disease

A relatively new devastating pest has been killing both urban and rural trees - the emerald ash borer (EAB) (Figure 3). All species of ash in the *Fraxinus* genus (green, black, white…) are susceptible to this aggressive insect and once again, monitoring the movement and storage of firewood is critical to a complete management program. The main way the insect is spreading across the Upper Midwest is through transportation of ash firewood from trees that were killed by the insect and still harbor the borer. States currently affected by EAB include Michigan, Illinois, Indiana, Ohio, Maryland and Ontario, Canada.

Photo: Penn. Dept. of Conservation & Natural Resources

Figure 3: Epicormic sprouting that occurs ~2 years after EAB infestation.

Elm (*Ulmus* species), oak (*Quercus* species), and ash (*Fraxinus* species) have unique wood grain and bark characteristics. Often it is combination of these characteristics that distinguish the exact species, and sometimes even odors and colors help. Very often, firewood piles have wood from both mature tree trunks as well as smaller, younger branches. The bark from tree trunks and tree branches of the same species look very different, so firewood identification from bark samples alone can be difficult and confusing.

When bark is not enough to identify a piece of firewood, a close examination of the end grain is necessary. A sharp knife or a single-blade razor, a 10x hand lens, and a liquid that will enhance the end grain all help the process. Shellac or boiled linseed oil are very effective end grain enhancers. Simply spray or brush the liquid on and the wood features (pores, rays, rings) become much more obvious. Even water works for a short time.

~~~~~~~Please note that seemingly different trees are referred to as groups throughout this fact sheet. Trees within these groups often have similarities among bark, wood, and leaves.~~~~~~~

Identifying Firewood: Types of End Grain

There are three types of end grain used to identify firewood: ring porous, diffuse porous, and semi-ring porous. Of these three types only one type- **ring porous**- is characteristic of firewood that may house a harmful disease or insect in Minnesota. All species in the elm group, oak group and ash group have ring porous wood. Identification by end grain type may be difficult but with enough practice you will be able to distinguish ring porous wood from diffuse and semi-ring porous firewood.
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Identifying Firewood: Types of End Grain *continued*.

Ring Porous. Within an annual growth ring there will be two regions– *springwood* (distinctly larger pores) and *summerwood* (distinctly smaller pores).

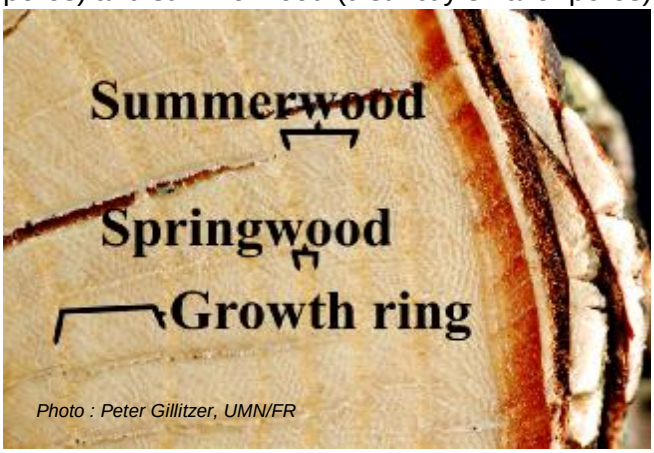

Figure 4: Group examples- oak, elm (including hackberry), and ash

Diffuse Porous. Within an annual growth ring, *springwood* and *summerwood* are not distinctly different. Wood within an annual ring looks uniform.

Figure 5: Group examples- maple (including boxelder), birch, some poplars, basswood (a.k.a. linden), ironwood, buckeye, and black cherry

Elm group (including hackberry)

Figure 6: Summerwood is wavy. Bark resembles bacon strips.

End grain– ring porous: *Summerwood*: small pores arranged in a wavy "tire track" pattern (Figure 6). *Sapwood*: white to tan colored. *Heartwood*: brown to reddish brown.

Figure 7: Leaves of elm group (including hackberry) have an oblique base.

Note: Split sections of American and rock elm can have stringy, long grain wood (Figure 8).

Photo: Gary Johnson, UMN/FR

Figure 8: Stringy firewood characteristic of some elm species.

Bark: Cross-sections of American elm (*Ulmus americana*) and rock elm (*Ulmus thomasii*) bark have alternating bands of dark and light colored tissue that gives the appearance of “bacon strips” (Figure 6). Slippery elm (*Ulmus rubra*) does not have “bacon strip” bark.

Exception: Hackberry, another member of the elm group, also has summerwood pores arranged in a wavy “tire track” pattern. However, it is not susceptible to DED. Also, its bark is characteristically corky and rough (Figure 9).

Photo: Dave Hanson, UMN/FR

Figure 9: Corky hackberry bark.

Oak group

Oak wilt affects all species of oak in Minnesota including the **red oak group** (Figure 10)- Northern red oak (*Quercus rubra*), Northern pin oak (*Q.* ellipsoidalis), Eastern pin oak (*Q. palustris*), and black oak (*Q. velutina*) and the **white oak group** (Figure 11)- white oak (*Quercus alba*), bur oak (*Q. macrocarpa*), and swamp white oak (*Q. bicolor*). Red oak group identification is most important because it is so susceptible to oak wilt and is the firewood most likely to have spore mats under the bark. Firewood from red oaks killed by oak wilt that have bark attached should be completely enclosed with black plastic for 12 months after tree death or until bark sloughs off.

Leaves: Red oak group

Photo: Dave Hanson, UMN/FR

Figure 10: Species of red oaks have pointed leaf margins.

Leaves: White oak group

Photo: Dave Hanson, UMN/FR

Figure 11: Species of white oaks have rounded leaf margins.

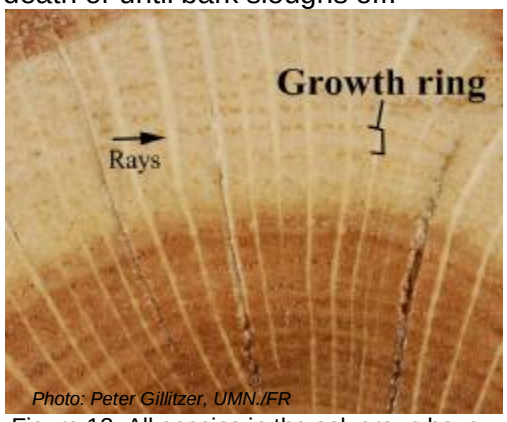

Photo: Peter Gillitzer, UMN./FR

Figure 12: All species in the oak group have rays visible to the unaided eye. The growth ring includes one season of springwood and one of summerwood.

Sodium Nitrite ($NaNO_2$) Test:

Applying a 10% solution of sodium nitrite to the heartwood makes the natural light brown color of the red oak group heartwood only slightly darker (Figure 13). However, it turns the white oak group heartwood yellow-orange, then red-brown, and then dark green or purple to black (Figure 14).

Photo: Rebecca Koetter, UMN/FR

Figure 13: Red oak sprayed with $NaNO_2$. Notice that wood color does not significantly change, not even with time lapse.

Photo: Rebecca Koetter, UMN/FR

Figure 14: White oak sprayed with $NaNO_2$. Left: color change within seconds of application. Right: color change within minutes of application.

End grain– ring porous:

Large wood rays are clearly visible to the naked eye. Within an annual growth ring, *springwood* has distinctly larger pores versus the smaller pores of *summerwood* (Figure 12).

Notes: Freshly cut or split red oak has a very distinct odor– sweet or rancid. *Heartwood* of red oak is light reddish brown versus the light to dark brown *heartwood* of white oak.

Photo: Dave Hanson, UMN./FR

Figure 15: Mature bark of red oak (*Q. rubra*)

Bark: Red oak group- The smaller diameter pieces of wood have flat, gray, and smooth bark. Larger diameter pieces have ridged and furrowed bark (Figure 15).

Bark: White oak group- Bark ranges from gray and platy (*Q. alba*) to deeply ridged and furrowed (*Q. macrocarpa*) (Figure 16).

Photo: Dave Hanson, UMN/FR

Figure 16: Mature bark of bur oak (*Q. macrocarpa)*

Ash group

End grain– ring porous: Within an annual growth ring, *springwood* has large obvious pores with an abrupt transition to *summerwood* that has very small pores (Figure 17).

Photo: Dave Hanson, UMN/FR

Figure 18: Mature bark of green ash

Bark: deeply furrowed, narrow ridges that are diamond to canoe shaped; ash gray to ash brown (Figure 18).

Notes: Unlike the oak group, large visible rays are absent to the naked eye.

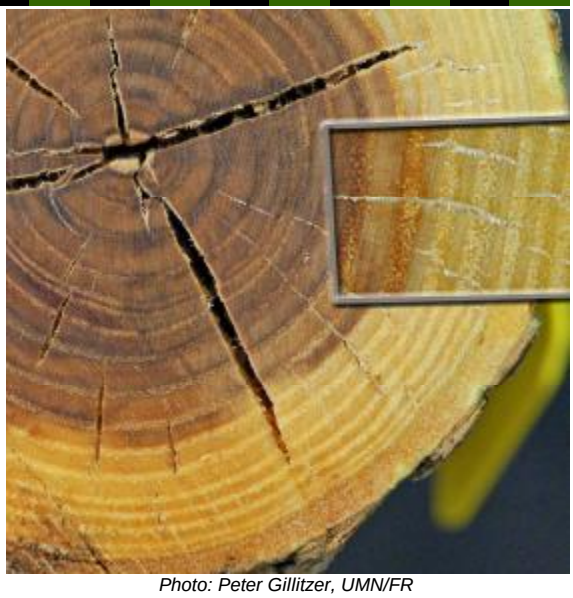

Photo: Peter Gillitzer, UMN/FR

Figure 17: Cross-section of green ash. Notice no obvious wood rays are present.

Glossary

Diffuse porous- all pores are of similar size and can be found evenly distributed throughout the growth rings.

Growth ring- contains two layers (springwood and summerwood) of cells resulting from one year of growth.

Heartwood- nonliving and commonly dark-colored wood in which no water transport occurs; it is surrounded by sapwood.

Ring porous- pore sizes found in springwood and summerwood are very different, forming conspicuous bands.

Sapwood- outer part of the wood of stem or trunk, usually distinguished from the heartwood by its lighter color. Water transport takes place in sapwood.

Springwood- large cells formed when the tree is rapidly growing and are usually visible without a hand lens.

Summerwood- small to tiny cells formed during slower growth period of summer; not usually visible without a hand lens.

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For more information on oak wilt, Dutch elm disease, emerald ash borer and firewood identification visit: http://fr.cfans.umn.edu/extension. Search under Tree Health tab for Management Options and Urban Forestry tab for Firewood Identification.