



## Two-Lined Chestnut Borer

Oaks continue to wilt and die in many parts of northern Minnesota due to stress and attack by an insect called the two-lined chestnut borer (TLCB). TLCB attack and kill oaks stressed by forest tent caterpillar defoliation and drought. Recent disturbances such as road and house construction also add to the stress leading to attack by TLCB.

The two-lined chestnut borer, *Agrilus bilineatus*, is an opportunistic insect that attacks weakened oak trees. It is a native beetle known to attack all oak species found in Minnesota, red oak being its preferred host. When trees and stands are healthy, TLCB confines its attack to low-vigor trees or broken branches. When drought stress, construction and/or defoliation have reduced tree vigor, oaks are predisposed to TLCB attack. Under severe stress conditions, widespread outbreaks of TLCB can occur.

The best management against TLCB is prevention; keeping trees healthy and vigorous will allow them to fight off invading borers on their own. Do this through proper watering if possible. Also avoid causing any type of disturbances that causes stress. Avoid compacting the soil, changing the soil grade or water drainage pattern, damaging the bark, allowing significant amounts of defoliation by insects or anything else that may stress the tree. Anything that stresses trees and weakens tree health encourages borers.

Adult beetles seek out and lay eggs on weakened oaks in late May and June. From June to August, larvae feed on the inner bark of live branches and stems. This destroys nutrient and water conducting tissues causing the foliage to turn brown and hang on the branches. Larvae create meandering galleries on the surface of the wood, which are visible if patches of bark are cut off infested branches or stems. Larvae are white with an enlarged head and slender segmented body, are about 1 and 1/4 inch long when fully grown, and have two spines at the tip of their abdomens. Larvae pupate under the bark where they overwinter. They emerge as adults through D-shaped exit holes in the bark the next May and June.

In mid-July, the first visible symptoms of TLCB infestation occur. Infested oaks may be recognized by the sparse, small and discolored foliage, which is followed by the dieback of branches. Leaves of infested branches turn uniformly red-brown. The leaves on non-infested branches remain green. Infested oaks often have a distinctive pattern of dead and live leaves on them. Branches in the upper crown are dead and leafless; branches in the middle



crown are dying and have red-brown wilted leaves; branches in the lower crown are alive and have green leaves. In other words, TLCB infested oaks have a ~~dead, red and green~~ pattern from the top of the tree down its branches. Other times, when stress levels are very high as we are seeing now the entire tree may wilt and die quickly.

By the time branch flagging becomes fully evident in August and September, the attack is finished for the year. The dead, brown leaves usually remain attached to the tree, even after normal leaf drop in the fall. When a tree is killed, surrounding oaks are often attacked by TLCB and Armillaria root disease and killed in the following year, which creates a pocket of dead trees.

#### **Management Options**

There's a big difference in how you deal with the TLCB infestation depending on whether the trees are in your woodlot or whether they are in your back yard. In either case, we recommend replanting oaks to replace the ones that were lost.

#### **Forested Stands**

Basically anything that causes additional stress in stands is going to make matters worse. Oak stands that have been stressed by drought and defoliation are vulnerable to damage and mortality caused by two-lined chestnut borers and Armillaria root disease. Management options for these stressed stands should be limited to (1) postponement of any activities in the stand, or, (2) salvage of high-value, damaged trees to reduce economic impact. The choice of option to use depends on the potential for continuation of stress due to drought, defoliation or pest infestation and the volume and quality of wood in the stand, and the land managers objectives.



#### **Management activities should cease when oaks are under severe stress from drought and/ or defoliation**

since any stand disturbance will further open up the stand and cause additional stress on the trees. Management activities could begin during the winter after a growing season with more normal precipitation patterns. However, oaks would be vulnerable to TLCB for a few years after the drought and defoliation ended as the trees slowly regain their vigor.

**Salvaging does not control borers in outbreak situations, but it does reduce the economic impact by recovering timber while it still has its greater value.** Salvaging is an option if the dead oak and the oak with at least 50% dieback have a great enough volume to make a merchantable sale and the quality is high enough to produce veneer and grade lumber. Salvage the stand during the winter. Trees should be marked for salvaging during the leaf-on period since dead trees and trees with severe dieback will be impossible to identify during the dormant season. When salvaging, do not extend the harvest into areas of the stand untouched or lightly damaged by TLCB.

**If the main product is firewood, delay any salvaging for at least a year after the oaks have died.** Firewood quality will not deteriorate during this delayed period. This gives the borer larvae time to become adults and leave the tree and dead firewood will not be reinfested. If infested firewood is moved into a backyard with oaks, the TLCB population will spread into the backyard oak trees.

**Thinning will not control TLCB during an outbreak situation. In fact, thinning should be avoided during a TLCB outbreak,** particularly if the outbreak has been triggered by drought. Thinning will open up the stand to drying winds that will increase the drought stress on the residual oaks. Thinning can also mechanically wound trees and cause serious damage to the tree roots. Even if thinning reduces stocking to optimum levels, the trees will not benefit from the reduced competition for a number of years until the roots and crowns are able to occupy the spaces created during thinning.

Thinning will also produce additional food supply for the Armillaria root disease fungus. Fresh stumps and roots of cut trees will provide an additional food base for this fungal pathogen. It would be best to delay thinning for a few years until the oaks are more vigorous. Even at that time, thinning should be kept light; do not remove more than 30% of the basal area.

Sanitation will not be effective in controlling damage during an outbreak. **A sanitation harvest simply cannot remove enough of the insect population to prevent future damage to the residual oak trees.** During an outbreak, there are vast numbers of low vigor, vulnerable oaks that will perpetuate the outbreak. The best practice is to postpone all management activities until the conditions that caused stress have ended.

Remember, **stump sprouting will be virtually non-existent in borer-infested stands.** In effect, the low vigor that created the TLCB problem will also decrease sprouting and enhance vulnerability to Armillaria root disease. To ensure future oak regeneration, count on advanced regeneration or oak planting stock, not stump sprouts.

Armillaria root disease, caused by an opportunistic soil borne fungus, attacks the root systems of weakened trees and will often lead to tree mortality. If Armillaria root disease is involved in damaging the root system, a white mat of fungal tissue growing between the bark and wood of the roots and root collar can be found. These white mats, however, may not be found until after the tree is completely dead.

### **Yard Trees**

Yard trees are high value and homeowners may want to take additional measures to prevent infestation of their oak trees. Here is what to do:

**If dry conditions continue, water healthy and declining oaks** on a regular basis during the growing season. Many homeowners cannot adequately water all the trees in their yard. They need to pick the trees they most want to live and keep them well watered. It does no good to give all the trees an inadequate amount of water. It also does no good to water a dead tree. If the entire crown of an oak tree has wilted and turned brown that tree is now dead. Trees, with less than 50% dieback, may be saved by heavy watering during droughty weather. If rainfall is inadequate, make sure trees get at least one inch of water per week in May through September. Water so that the entire root system receives this amount of moisture and so it soaks deep into the soil. Remember the absorbing roots also occur beyond the dripline. Keep the soil moist now until it freezes.



**Strictly avoid using fertilizers and/or herbicides** on lawns and gardens within 50 feet of an oak tree. Fertilizers will only hurt an ailing tree and herbicides kill tree roots too, leading to more root system loss.

**Avoid practices that destroy or smother roots.** Root loss will drastically affect tree vigor. Practices which damage roots include trenching or burying utility lines which sever the roots; compacting the soil around the roots by driving and parking of vehicles on root systems; smothering roots by paving or temporarily storing excavated soil over the root system; or, by changing soil grade, either adding or removing soil.

**Control other insects that cause defoliation** before 60% of the foliage is lost. Once defoliation reaches this level, the trees may refoliate and this decreases tree vigor further. Develop and implement spray plans if heavy

defoliation is predicted to occur for the second or third consecutive year. The forest tent caterpillar population is declining but there will still be some areas with high populations and heavy defoliation this year.

**The question of whether dead trees should be removed before next spring is more difficult.** If you have live trees and you want to keep those trees alive you want to avoid causing any disturbance around those trees. Removing neighboring dead trees usually causes some disturbance and adds stress to the remaining live trees and they already have too much stress. You may be able to reduce TLCB populations by cutting and removing infested trees before the start of the growing season. However, realistically, if a lot of trees in your neighborhood are infested with TLCB removing only a few trees is unlikely to reduce the overall population. You would need to remove not only the tree stem but also dispose of the branches. If you decide to remove trees, remove the oaks that completely died last year and oaks with more than 50% crown dieback. Remember, TLCB larvae can survive in cut and split wood and a new crop of adult beetles will emerge next spring, so the complete removal of infested logs and branches should be done by May 1<sup>st</sup>.

**The preferred methods of wood and slash disposal** are removal to an approved landfill or sale of the trees for lumber. If any woody materials, larger than 1 inch in diameter, remains pile and burn them before May 1<sup>st</sup>. If you want to keep the wood for firewood, cover the woodpile with a heavy plastic tarp and bury the edges of the tarp in the soil for an airtight covering. Keep the firewood covered from May 1<sup>st</sup> until at least July 30<sup>th</sup>. After that time the wood can be moved or burned as you like.

**Avoid bringing fresh oak firewood into your yard.** Bringing more infested wood into an area will only compound the problem.

**Chemical insecticides are usually not used against TLCB** because of difficulties with timing and obtaining thorough coverage on large trees. However, certified arborists or commercial pesticide applicators may be able to treat high value shade trees. Insecticides cannot replace good tree health. If trees continue to be stressed, insecticides will not save them from TLCB.

## References

Haack, R.A. 1985. Management prescriptions for the two-lined chestnut borer. In: Proceedings of Challenges in Oak Management and Utilization. Madison, WI. J. Johnson (Editor). Wisc.Coop. Extension Service, Univ. of Wisc., Madison, WI. Pp.43-54.

Haack, R.A. and D.M. Benjamin. 1982. The biology and ecology of the two-lined chestnut borer, *Agrilus bilineatus* (Coleoptera: Buprestidae), on oaks, *Quercus* spp., in Wisconsin. The Canadian Entomologist 114 : 385-396.

Hall, D., D. Mahr and G. Worf. 1986. Oak Disorder: Two-lined chestnut borer. Univ. of Wisc. Extension Service, Madison, Wi. In: Urban phytonarian Series, # A2909. 3pp.

Sander, I.L. 1977. Manager=s Handbook for Oaks in the North Central States. USFS Gen. Tech. Rpt. NC-37. 35pp.