



*Damage by two-lined chestnut borer.
Photo courtesy; Steven Katovich,
USDA Forest Service, Bugwood.org*

Extrême weather, defoliation, and attack from insects and diseases can take their toll on trees. All of these factors (stressors) decrease a tree's vigor, sometimes working immediately and sometimes taking several years to fully manifest themselves. Most trees have the ability to weather one drought, one late spring frost, or one defoliation. However, when trees are continually exposed to these conditions year after year or when several of these occur at the same time, the effects can be significant. For example, in 2007, many of our trees have had to face a crippling spring freeze causing defoliation. This was followed by a regional drought. Having to endure multiple stressors can have far-reaching impacts on trees.

To fully understand how stressors affect trees, we must have a good understanding of how a tree works. First, some basic biology. A tree's leaves, like those of all green plants, removes CO₂ (carbon dioxide) from the atmosphere and makes sugar through the process of photosynthesis. During the growing season, this sugar is transported in the inner bark, down the branches into the main stem, and into the roots. Along the way, the tree uses some of the sugar to make wood and bark. Some of the sugar is stored as starch in the sapwood of branches and the main stem. However, a sizable portion of the sugar makes it all the way to the large lateral roots and is converted to starch. Starch is how most trees store sugar for producing new leaves the following year, producing new

Tree Vigor

By Jeff Stringer

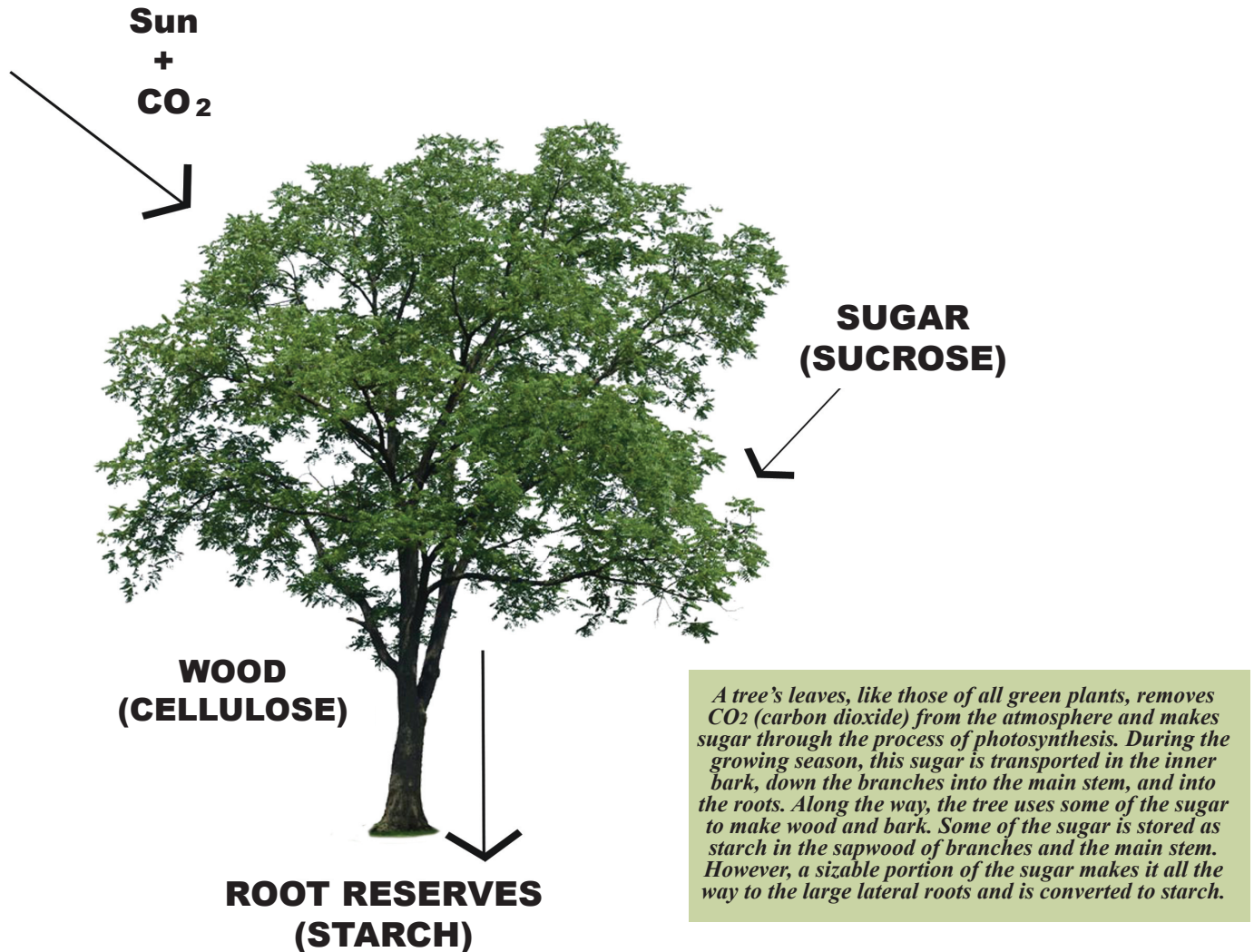
roots during the winter and early spring, and re-foliating itself when something bad happens during the growing season. When stressors like drought occur, they reduce the amount of sugar made in the leaves, resulting in a drop in the energy reserves in the tree. When defoliation occurs either from weather or from insects and disease, it causes the tree to use its sugar reserves to re-foliate. When you combine these stressors or when they keep coming year after year, trees lose their energy reserves, slow their growth, and are susceptible to insects and disease that prey on weakened trees. This is why a bad drought or defoliation or a combination of the two can initiate a downward spiral that may cause trees to die one or more years after a severe drought.

Indications of a weakened tree like branch dieback and small leaves signal that a tree is not in good health. However, because much of the stress effects are internal, sometimes apparently healthy trees can die. For example, the very severe regional drought of 1988 caused many oaks to die that year and for several years after. What directly killed the trees was a small beetle called a two-lined chestnut borer (see photo example above) that lives high in the canopy of the forest. It locates weakened trees because weakened trees literally give off a different scent than healthy ones. The beetles fly to the weakened tree and lay their eggs in the upper branches of the tree. The eggs hatch, and the larva feed under the bark, disrupting sugar flow to the bottom of the tree and, when the larva are large enough, disrupting water flow to the branches. These insects are hardly ever seen at ground level, and in 1988 there were enough weakened trees that the population of two-lined chestnut borer increased and killed trees outright. All of the leaves turned brown in August and the tree died. The problem was not with the borer but with the drought that stressed the trees. Past experience has taught us to watch our trees closely after



*Drought damage to maple leaves. Photo courtesy;
Robert L. Anderson, USDA Forest Service, Bugwood.org*

stressors such as drought or defoliations. In woodlands, once a freeze, drought, or defoliation hits, little can be done to keep low-vigor trees from dying. In some instances, salvaging these trees is the only reasonable option. Woodland owners who actively manage their woods can improve the vigor of the trees, enabling them to weather disturbances such as drought and defoliation.



Sometimes small yard, nut, and fruit trees can be assisted by appropriate watering, mulching, or other practices to make it easier for them to maintain leaf area and photosynthesis. Oftentimes, yard trees are already under some degree of stress due to compacted soils, grass growing under them, and possibly being planted into soils that do not suit them. These factors, when coupled with stressors, often put the tree in peril. Regardless, understanding how trees lose vigor helps you plan for conditions that can weaken your trees. Fortunately, most of our native species have the ability to withstand some disturbance, but too many stressors can weaken a tree to the point where it is prone to die.

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