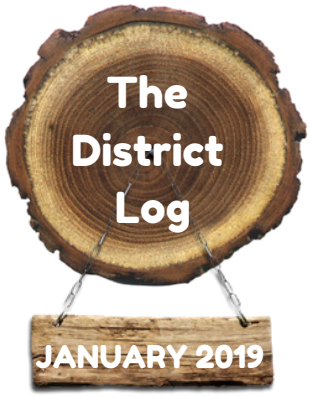
Winter Tree Adaptations

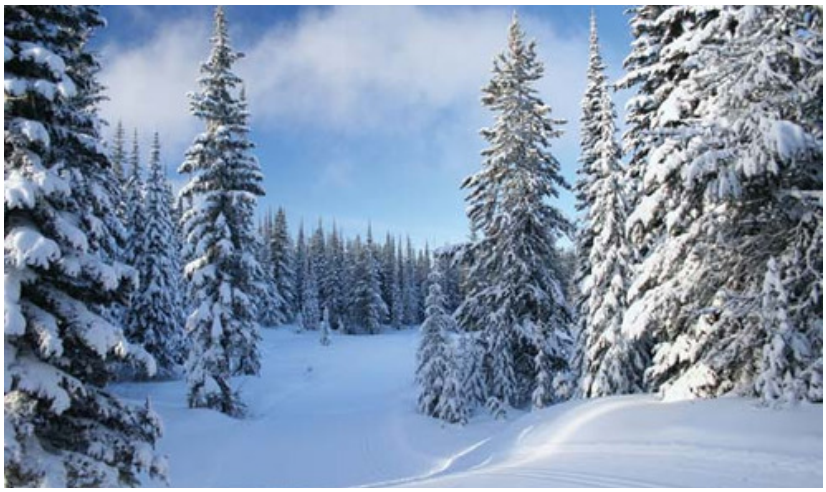


This week's polar vortex-induced cold snap was extreme, even for Michigan. But Michiganders are well-versed in the woes of winter and responded by staying indoors when possible, opening up shelters for those in need, and bundling up for long days of snow plowing and shoveling. Likewise, critters across the landscape sought refuge in their dens and nests to wait out the weather, relying on their remaining fat stores from warmer days. But what about those species that cannot escape? Just how do the trees survive this awful weather? Trees have several fascinating ways of surviving the shorter days, colder temperatures, dry conditions, and the weight of the heavy snowfall accumulation associated with a northern winter.

In the Northern Hemisphere, the sun is at a lower angle in the sky than other times of the year, which means the same amount of light hits more of the earth's surface, making the sunlight received in winter months the weakest. Couple that with winter having the shortest days of the year and it becomes a challenge for plants to get enough light for normal photosynthesis. To deal with this, both conifers and hardwoods become dormant, which is a way of slowing a tree's metabolic activity down so it does not need to use as much energy as during other times of the year. Dormancy looks a bit different in conifers and hardwoods, however. In the fall, broadleaf trees form a thin layer of cells which cuts off the connection from the leaves to the branches, as well as produce the buds for new leaves in the following year. Conifers, on the other hand, can keep their needles on year-round to produce sugars because the small needles are better adapted to continuing photosynthesis in low light conditions than leaves are. This saves conifers the energy of producing new leaves every year, which is one reason why you will see predominately coniferous forests in places with longer, harsher winters.

Varying levels of photosynthesis throughout the seasons mean variations in the new wood cells grown in the tree. You can see the difference of the energy put into growth by looking at the rings of trees. Each ring is one year of growth, the lighter color is the fast summer growth with larger cell size, and the darker line that marks the end of the ring is all the slow winter growth with reduced cell size. Slowing down in the winter also means that trees need less sugar to survive than during the growing season, so excess sugars can be stored until spring. These extra sugars can be stored in buds, roots, and even the sap.

Trees also have adaptations for the extreme temperatures and freezes of the snowy season, which could potentially damage live tissue. Most of a tree is made of dead wood, which means it isn't actively growing, even though it still serves a valuable purpose within the rest of the tree. The bark and heartwood of the tree are considered "dead" but give the tree necessary structural support and protection from the outside world. The bark can help protect the live wood somewhat, particularly the extra thick bark of conifers, but trees also protect their sap from freezing and causing damage. In hardwoods, all the extra sugar in the sap turns it into a sort of antifreeze to help transport nutrients and water throughout the tree when the temperature drops. Conifers produce resins that function similarly as an antifreeze in their sap. Conifers also have specialized cells called tracheids to safeguard against freezing. These strong cells and thin tubes for water transport allow for cells to withstand the pressures of moving viscous pine resin throughout the tree, which has a much lower freezing point than watery sap. Some hardwoods have adapted to force water out of their living tissue during the winter, so if it gets too cold it freezes outside of them. Despite all these adaptive traits, it is still possible for the water inside the wood to freeze, causing "frost cracks", and in extreme cases explosions.



Another struggle that trees face in the winter is the lack of liquid water. Frozen water, in the form of snow, is inaccessible to trees until it melts. The way most trees deal with this is by trying to retain as much water as possible in the cold season.

During the growing season, most water is lost through transpiration, which is gaseous water leaving the tree through leaves. This is another main reason why broadleaf trees drop their leaves in the fall, to limit transpiration in the winter when water is not readily available. Since evergreens do not lose their needles, they prevent water loss by having waxy coatings on their needles. This wax provides a nearly waterproof seal, limiting water loss while still allowing for limited transpiration.

As if all those challenges weren't enough, trees also have to deal with the weight of heavy snowfall and the damage of strong winter winds. Many evergreens have a cone-like shape, which helps them shed snow rather than letting it accumulate. Many spruces and firs have very flexible wood to deal with heavy snow, while hardwoods like oak depend on strong wood fibers to endure the weight.

Michigan is at the Northern range for many hardwood species and can be cold enough to damage even evergreens.

While trees are well-adapted to winter, there are additional ways forest owners can protect their trees from the worst of the elements. If you want to learn more about managing your woodlot, District Forester Ben Savoie can provide on-site assessments and professional referrals at no cost to you. For landowners in Barry County, you can contact Ben at 269-908-4134, or contact directly by sending an email to ben.savoie@macd.org.

This month by the numbers:

5 Site visits - 264 acres
1 FWH Assessment
5 Referrals, 264 acres
1 outreach event
1 newspaper article