

Whether it's forests or backyard trees, keeping them healthy is a priority for any landowner. For someone who grows trees for harvest, perception of tree health might be influenced by whether or not trees are growing at an acceptable rate per acre to produce a marketable product such as sawlogs. However, for someone who wants an ornamental backyard tree, perception of tree health might be more aligned with a pleasing appearance and provision of shade, privacy, flowers in the spring or fruit in the summer.

But what does the term "tree health" actually mean? Although each person's objective for growing a tree might be different, assessing whether a tree is healthy requires examination of the same tree features.

Like any green plant, trees need carbon dioxide and oxygen from the air to conduct photosynthesis and respiration. Trees also need sunlight for energy to convert carbon dioxide into sugar, a warmer than freezing temperature, water, and nutrients. Of all these factors, a landowner can basically only influence how much light, water, and nutrients a tree can obtain. Capturing sunlight is the primary reason a tree grows tall and also helps determine the shape of its crown. Although some tree species can tolerate shade (such as maples, lindens and

true firs) all prefer full sun and will grow crowns in the direction that maximizes access to light. When shaded by other trees, buildings or topography, trees will develop very one-sided or crooked crowns, which reduces growth, and can predispose them to wind and snow damage. The healthiest tree is one that has at least $\frac{1}{2}$ to $\frac{2}{3}$ of its total height cloaked in leaves or needles, and is symmetrically-shaped like an umbrella, lollipop, or cone.

Deciduous or broadleaf trees tend to grow into an umbrella shape, which is why they are preferred as backyard shade trees. Common Montana broadleaf trees that include native and introduced species are ashes, maples, lindens, poplars, horsechestnuts, and flowering crabapples. Evergreen conifer species common in Montana include spruces, pines, junipers, and arborvitae. These trees produce a dense crown of needles which are held year-round, making them common planting choices for privacy, noise and wind screens. Conifers are also better able to conserve water and survive on sites that suffer summer drought, which is why the majority of species in our native forests are conifers.

A tree's root system plays the critical role of acquiring nutrients and water, but this portion of the tree is not accessible to observe directly to assess health. The tree crown, alternatively, is fairly easy to view and reflects the overall condition of the tree. A well-shaped crown is the first indicator of health and reflects that the tree is growing well.

The condition of the leaves and needles is the second indicator for tree health. Leaves and needles should be dark green in color, unless it is a species that has been specifically cultivated for purple or red leaves—of which most are in the maple, ash or crabapple family. "Thin" looking crowns can indicate poor leaf or needle retention, a condition often appearing in the top of the tree first (Figure 1). Drought stress often appears first at the tips of branches and the upper crown of the tree because they are the furthest

What makes a healthy tree?



FIGURE 1. A well-developed crown with full leaves and good dark green color are indicators of a healthy tree (left). Discolored or browning leaves and dead branches on the top of the tree (right) are indicators of some type of stress—typically water stress due to drought or a stem injury.

from the water source at the roots. Prolonged drought often causes significant crown dieback.

Drought symptoms can be caused by a lack of water in the soil, root dieback from improper planting or soil disturbance, or some disruption in the water flow from the roots to the leaves. Examining the stem of the afflicted tree for injuries should be part of the health diagnosis. Basal injuries from a lawnmower or string trimmer are commonly found at the base of trees exhibiting crown dieback (Figure 2, middle). Another similar injury around the tree stem results from rope or cable tied and forgotten, which eventually inhibits stem growth and water transport. Stem-boring insects or diseases can also cause a thinning crown, though their damage can be more difficult to recognize and diagnose. Similarly, root diseases or injury can cause drought-like symptoms in the crown because the afflicted roots have a diminished ability to absorb and transport water. Root-related issues are often hypothetically diagnosed because of the absence of any other kind of injury to the stem or leaves. Treating root diseases is difficult because of limited diagnostic opportunities and the complexity of soil chemistry and structure.

Finally, chronic leaf or needle discoloration (Figure 3, right) is often caused by soil chemistry that does not allow for adequate nutrient absorption by the root system. Alkaline soils are often the culprit, which is very difficult to remedy. If you consider a volume of soil the size of a phone book, the surface area of the soil particles is at least as large as the surface area of all the pages of the phone book. All or the majority of this surface area (phone book pages) would need to be altered to change the chemistry of the soil.

In conclusion, the crown of a tree, based on shape, growth rate, and leaf density/color, is a good indicator of tree health. Some conditions affecting tree health can be modified such as watering backyard trees or thinning an overly dense forest, whereas other conditions such as genetic predisposition are difficult to change. For new planting projects, the first step toward tree health is to make sure you have selected the right species for your climate, soil and desired site function. The second step is to make certain you get healthy seedlings (good color, not root-bound in the container, and a balanced shoot-to-root ratio). The third is to plant trees correctly; they should be dormant, have roots properly located into the soil, and not be planted too shallow or too deep. ■

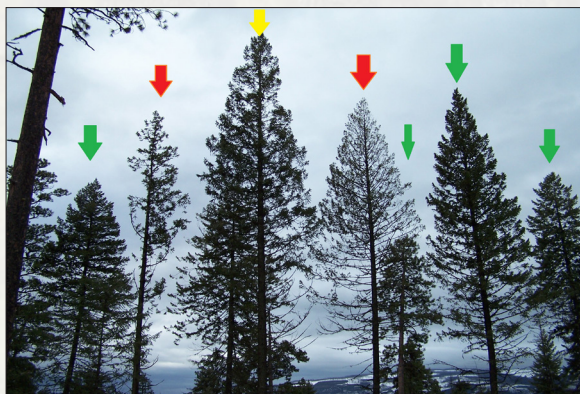


FIGURE 3. The photo on the left shows conifer crowns indicating different levels of health. Green arrows show normal 3-5 year needle retention of healthy trees. A tree that is starting to show stress is losing older needles after 2-3 years and appears thinner (yellow arrow) and trees dropping prolific branches or needles indicate severe stress (red arrows), and imminent death. In the photo on the right, poor needle color and retention (second tree in row) is an indicator of genetic maladaptation (a harmful trait) or severe soil nutrient issues and is difficult to remedy - though trees can often persist with this condition for many years.

FIGURE 2. A dead top on a tree can indicate (top) drought; (center) stem injury from a lawnmower ding; or (bottom) other stem injury such as a rope or cable wrapped around the stem.

PHOTOS BY PETER KOLB