



Why Do Some Tree Species Live Longer Than Others?

by Marilyn Loser

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I often hear that cottonwood and aspen trees are considered to be short-lived species while bristlecone pines are long-lived. While life span estimates vary, individual cottonwoods can live to be more than 150 years old while the related aspen rarely lives more than 100 years. Bristlecones may only reach maturity after 200 years and expect to live to be more than 300 years old. The oldest bristlecone, located in eastern California, is more than 4,800 years old.

There are a few bristlecones in Alamosa. However, most bristlecones grow in isolated groves, just below tree line, under harsh conditions. “Because of cold temperatures, dry soils, high winds, and short growing seasons, the trees grow very slowly,” says Wikipedia.org. “The wood is very dense and resinous, and thus resistant to invasion by insects, fungi, and other potential pests. The tree's longevity is due in part to the wood's extreme durability. While other species of trees that grow nearby suffer rot, bare bristlecone pines can endure, even after death, often still standing on their roots, for many centuries. Rather than rot, exposed wood, on living and dead trees, erodes like stone due to wind, rain, and freezing, which creates unusual forms and shapes.”

In general, there is a correlation between growth speed and longevity. Fast growing trees don't tend to live as long as trees that grow more slowly. And many trees live longer than do human beings. Researchers have observed that for many vertebrates that longevity increases when rates of metabolism decline and the size of an organism increases. Some suspect this is true for trees. However, rates of metabolism in trees have not been reported as calculations depend on the size of the entire organism and it's difficult to measure the size of tree root systems.

“Trees endure as long as they do basically because they're nonhierarchical organisms,” according to Cecil Adams of straightdope.com. “In animals, all vital functions are controlled by the central nervous system, the guiding element of which is the brain. When the brain dies, so does the animal. By contrast, vital functions in trees are decentralized. A large part of the tree can die, and indeed routinely does die, without killing off the tree as a whole. Most of a mature tree is dead except for a few layers under the bark.”

Cottonwoods and aspens grow quickly and have a propensity for weak wood. The heartwood of the tree rots over time, weakening limbs and branches. Storms and high winds may break the branches, leaving holes in the trees.

But why is the wood weaker? “In hardwood trees fibers function almost exclusively as mechanical supporting cells,” according to Alex Wiedenhoef in his publication ‘Wood Handbook.’ He reports that the thickness of the fiber cell wall is the major factor governing density and mechanical strength of

hardwood timbers. Species with thin-walled fibers, such as cottonwood, have low density and strength; species with thick-walled fibers, such as hard maple and black locust, have high density and strength.

If a tree loses too many branches and leaves, it can't produce enough energy to continue living. This is what is happening to some of the cottonwoods on the southwest side of Cole Park in Alamosa. The large, tall trunks have only a few tufts of leaves at the tips.

Aspens are known to be susceptible to a number of diseases which also weakens a tree. C. Loehle writes in the 'Canadian Journal of Forestry Research' that, "wood classified as decay resistant was always found in tree species that are long lived. Trees that lived for exceptionally long periods appear to have extremely effective defense mechanisms that limit pathology imposed by fungi and insects."

The longest-lived trees are also capable of intense shade tolerance and an ability to tolerate extreme variation in resource supply and competition from other trees. When the competition is eliminated or resource supply increases, the growth rates of the trees then increase sharply.

Tree species such as aspen require lots of sun and are not tolerant of shade. That's part of the reason stands of these species tend to be all about the same age. Seeds of these species that germinate under a canopy of shade do not survive.

This column was inspired by questions from Emily and Marc Hopkins. Inquiring minds want to know!

"Trees are your best antiques." Alexander Smith