

# Factors affecting tree growth

## Climate

New Mexico generally receives significantly less rain than many other ecosystems in the United States. Our trees grow slower and, on some sites, do not grow at all due to this lack of water. Over the past decade our state has experienced an even drier period. With our forests overgrown due to fire suppression (starting in the 1900s) and lack of harvesting (starting in the 1980s), many small trees are competing for limited moisture and resources. As a result, stressors such as insects and diseases have had a greater impact than they would in healthy forests.

## Insects

There are many native pests in the southwest that cycle through forested ecosystems and naturally thin out the less healthy trees. A recent example is the outbreak of the piñon *Ips* *sp.* bark beetle that caused severe mortality across thousands of acres in northern New Mexico. The Western balsam bark beetle, fir looper, and fir engraver are three major pests affecting our forests today.

## Diseases

Recent surveys have found white pine blister rust, a fungus that impacts white pine species, in the Sacramento Mountains of southern New Mexico. Dwarf mistletoe is prolific across the entire West in conifers. In New Mexico you find it primarily in ponderosa pine but there are species that infect all the other conifers. A variety of True mistletoe is found in cottonwoods and other hardwood species. Mistletoe is a parasitic fungus that lives within the tree, stealing nutrients and weakening the health of the tree so that it is more susceptible to drought and other insects and diseases. Severe infestations of mistletoe, which look like witches-brooms on the branches, will eventually kill a tree.

Several fungi are seen in the high-elevation aspen forests. Black cankers and conchs are found on aspen trunks and indicate where rot has set in and will eventually damage the tree. Root rot fungus, often in spruce-fir forests where there is more moisture in the soil, will weaken the anchoring roots and result in wind throw or blow down.

## Wildlife

There is a symbiotic relationship between forests and wildlife that assists in the regeneration of specific species. For example, the Clark's nuthatch gathers pine seeds and hides them for the winter in small caches. They often lose some of these caches and the seeds will germinate in the spring when the snow melts. Without the nuthatch to break open the cones, pull out the seeds, and plant them, some pine species would have limited regeneration.

The aspen tree, on the other hand, is hindered in its regeneration by elk and other ungulates that eat the saplings down to the ground. Elk populations have risen in the mountains of NM, resulting in rising pressure on the re-growth of aspen stands.

In riparian ecosystems, beavers kill trees and shrubs for their dams and houses. Some landowners despise the presence of beavers because they alter the water delivery systems.

### **Microorganisms**

Microorganisms in the soil assist in breaking down the leaf and pine needle litter and dead and downed woody material. They decompose and release the nutrients contained in the dead materials back into the soil. This is a crucial part of the nutrient cycle. They are the best recyclers on the planet. Without them, the forest would be littered with fuel on the ground, and the soil would eventually be depleted of all nutrients needed for future growth.

## **How Does a Tree Grow?**

A tree functions much like your body with individual parts performing different functions that all work together so that the tree lives and grows. There are many species of trees and shrubs but they basically have the same parts that perform the same functions. In areas where trees go dormant for the winter there are tree rings that can be seen and counted to determine the age of the tree. If a tree lives in a temperate climate where there is no dormant season then the rings are not as easily seen and other methods may have to be used to determine the age of the tree.

### **Healthy Trees**

What do trees need to grow and be healthy? All plants need sun, food, water, air and space in varying degrees. Some trees need a lot of direct sunshine to stay healthy. Others grow best in the shade of other plants. All plants need water, but some can stand having their roots in water all of the time while others grow better if they only get watered from occasional rains.

Space is also important for trees to stay healthy. They need room to stretch out their branches and limbs above ground and their roots below ground. Giving trees enough space also helps prevent the spread of insects and diseases and helps prevent fires from spreading in the crowns of the trees.

### **Trunk**

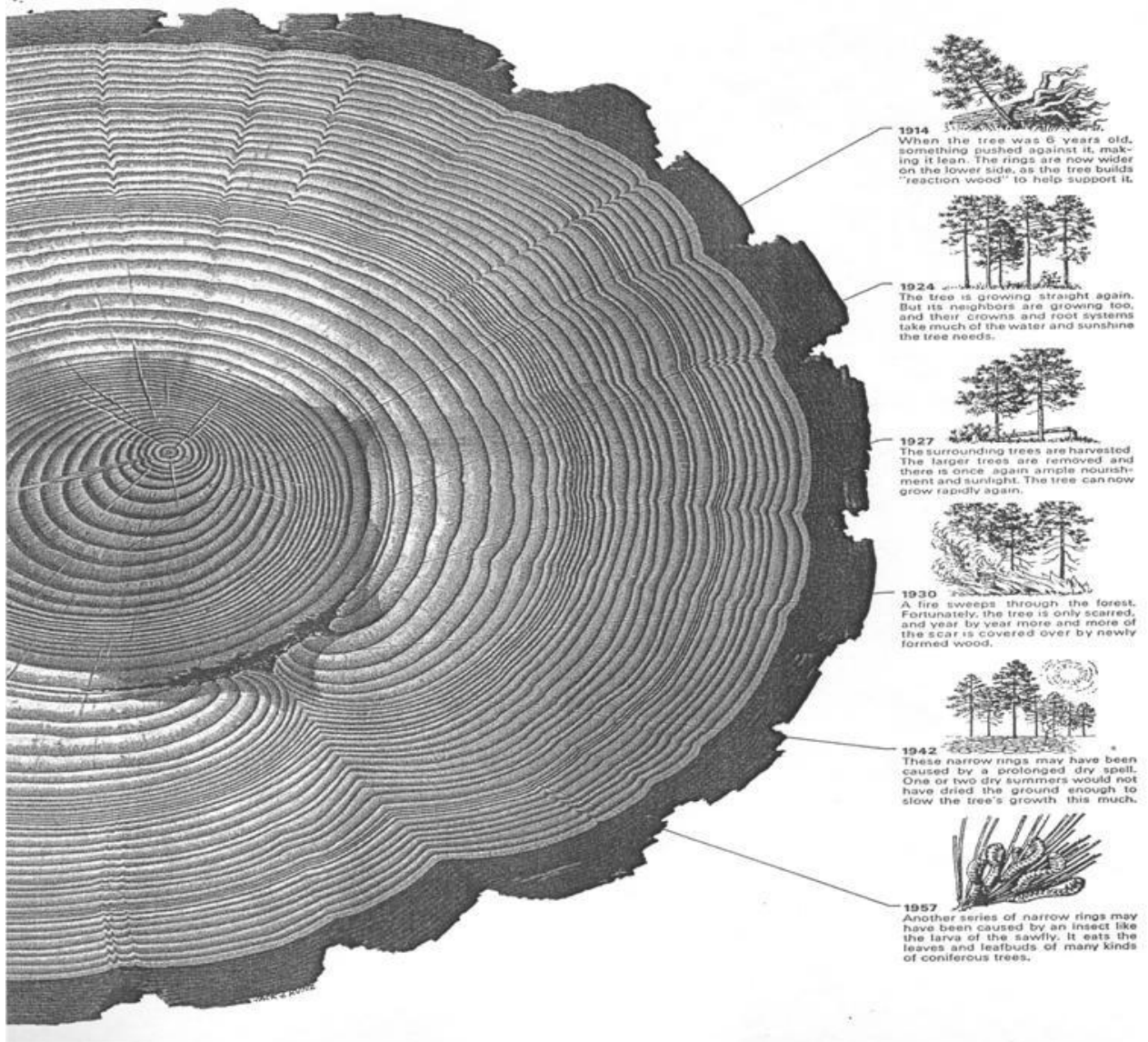
The trunk provides the support for the branches of the tree much like the bones in your body. The trunk also contains other necessary parts that perform specific functions for the tree.

- A) Heartwood—The heartwood is the center-most part of the tree trunk. It consists of dead wood and provides the strength of the tree.
- B) Sapwood—Transports water and nutrients up from the roots to the leaves. Sapwood contains the xylem. This tissue becomes heartwood as it ages and the tree forms more layers of sapwood around it.
- C) Cambium—This is what forms the rings in the trunk that we count when we want

to know how old a tree is. It is a very thin layer of growing tissue where new xylem, phloem or cambium are formed. The rings of a tree give us information about the age of the tree, its health, and the climate conditions during each year of its growth.

D) Inner Bark—This thin layer contains the phloem and it is responsible for transporting the sap from the leaves to the other parts of the tree.

E) Outer Bark—This is the outside covering of the tree. It provides protection from animals including insects, other plants, disease, weather and fire. It is an important winter ID feature. Older trees may have plates, scales, ridges, or lenticels that distinguish them from other species,



## **Tree Growth**

Trees increase in diameter as a ring of many cells of xylem is laid down by division of the cambium layer. The rate of growth depends on many factors such as: species, spacing, overabundant rainfall or drought years and site quality. Wood formed in the spring consists of light-colored, thin-walled cells; later in the season, the cells formed are smaller, darker, and have heavier walls (summer wood). The alternate layers of spring and summer wood causes the annual ring.

Height growth -- Occurs by elongation from the terminal bud. Twigs and branches go through the same process. General height growth is completed quite early in the year by the end of June. In many trees, all cell division for next year's growth is completed in the bud by this time. The next season's growth takes place mostly by elongation of bud cells formed in the previous year. Lateral buds-twigs and branches are formed from the lateral buds.

There are three methods by which trees reproduce: by seed, by sprouts, and by suckers. Most trees reproduce themselves by seed. Broad-leaved trees sprout profusely, while needle-leaved trees usually do not. Suckering is the sending up shoots from underground roots.

## **Fruit**

Two common types of fruit may be found on hardwood trees.

Simple Fruit consist of a single enlarged ovary with which some other flower parts may be incorporated. They may be divided into two major groups: fleshy fruits and dry fruits. Compound Fruit may be divided into two major groups: aggregate fruit and multiple fruit.

Aggregate Fruit -- Such fruit is a cluster of ripened fruits produced from a single flower containing numerous pistils inserted on a common receptacle. Examples are Magnolia and Yellow Poplar.

Multiple Fruit -- A cluster of fruit of separate flowers crowded together and forming what appears to be a single fruit. Examples are Sycamore balls and mulberries.

## **Leaves**

Leaves are where the food is produced to feed the tree. Using a process called photosynthesis the leaves use energy from the sun to convert carbon dioxide and water into oxygen and sugar.

The green pigment in the leaves, called chlorophyll, captures the energy from the sun. Stomata are tiny holes on the under surface of the leaves that allow the carbon dioxide to enter the leaf before photosynthesis takes place and the oxygen to exit the leaf afterward. Water vapor also leaves the leaf through the stomata during transpiration.

In the fall the leaves turn colors when the twig shuts off the tubes that transport water, nutrients and food to the tree. The chlorophyll fades from the leaf revealing the other pigment colors in the leaves. The type of tree dictates what color the leaves will turn. Generally maple trees have red and orange pigments in the leaves, and aspen and

cottonwood leaves have yellow pigments.

### **Roots**

The roots of the tree anchor the tree in the ground and absorb water and nutrients from the soil. Trees have lateral roots and many have tap roots. The lateral roots spread out and away from the tree. Many times the lateral roots spread out as far as the crown of the tree or even up to three times the extent of the crown. The tap root grows down into the ground almost as an extension of the trunk. As the tap root and lateral roots grow away from the tree they branch out into smaller and smaller roots and finally into small rootlets that are covered in root hairs. More than 90 percent of the water and nutrients that the tree uses is absorbed by the roots.