

# THE PURDUE LANDSCAPE REPORT

## How do trees use water?

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Water covers approximately 71% of Earth's surface, yet only 3% of the 326 million cubic miles of water on the planet is suitable for growing crops, such as trees. It can be said that water is the single most limiting ecological factor in tree growth and survival. It is a vital "nutrient" that must be available in adequate supply or plants decline and eventually die.

Trees use or lose water by two separate processes. First, water is taken up by tree roots from the soil and evaporated through the pores or stomata on the surface of leaves. Transpiration is a physiological process responding to soil and atmospheric factors. It is a passive movement of water through the tree system which allows columns of water to move great heights. Water movement through a tree is controlled by the tug-of-war between water availability and water movement in soil versus water loss from leaves. For example, water movement in a ring porous tree like a red oak is 92 ft/hr, in a diffuse porous tree like a basswood is 11 ft/hr, and for a pine tree is 6 ft/hr. Trees can absorb between 10 and 150 gallons of water daily, yet of all the water absorbed by plants, less than 5% remains in the plant for growth. They rely on available water in the soil to "rehydrate" during the nighttime hours, replacing the water loss during the daytime hours.



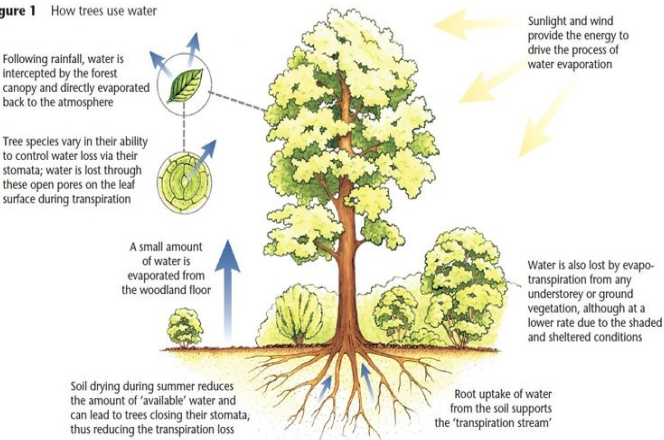
Leaves intercept water to help with stormwater management and cooling.

The second process is the interception of water by the surfaces of leaves, branches and trunks during rainfall, and its following evaporation. Together, these two processes are often referred to as evapotranspiration. Both transpiration and evaporation are strongly affected by the amount of sunlight, the temperature and humidity of the air, as well as wind speed as trees turn water into mist when it releases nearly 95% of the water it absorbs.

Just why does a tree need water? Well, nearly every plant process such as photosynthesis, respiration and transpiration rely on water to function properly. Water is an essential element as important if not more than other nutrients because it is required to put all our other elements into a form usable by the plant. Almost all essential elements are ionic forms dissolved in water, giving them the ability to move to stems, branches, and leaves for energy.

The goal of proper tree management is to prevent or reduce the impacts of water loss. If adequate soil moisture is available, water loss will go unnoticed as it is replaced naturally. Typically, we experience prolonged dry periods without rain, resulting in

Figure 1 How trees use water



How trees use water is essential to determine water needs.

drought. Drought conditions are the result of long periods of time without natural rainfall. During dry conditions, soil moisture content is reduced to the point where tree roots can no longer pull the water molecules from the soil. This results in responses

from the plant such as wilting, early fall color, scorching and other symptoms. Anytime there is a week without significant rainfall of at least one inch, most likely trees will need some assistance from us to supply the much-needed water for a healthy tree.

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