GREEN SPONGE

By Lloyd W. Swift Jr.

While your trees are producing a crop for you, they are cleaning the air and producing oxygen for everyone. They are protecting and improving the soil, and chances are that they are improving the look of the landscape. Depending on where they are and how you manage them, however, they may be green sponges soaking up valuable water.

Trees use a lot of water through transpiration and evaporation. Transpired water moves from the soil into the roots, up the stem, and into the air through openings in the leaves. Water intercepted by foliage during rains often evaporates without ever reaching the ground. As a result, stands of large trees may use considerably more water than bare land or other vegetation.

Can the water used by trees be a problem? Yes, if the water that they consume is needed badly for other purposes. For example, in some parts of the world, forest planting is opposed because of a strong concern that trees will reduce water supplies. In the United States, managers of forested municipal watersheds must be concerned with water consumption by trees, and, as the needs of water for people grow, this concern will also grow.

Elimination of trees seldom is desirable because a forest cover protects the soil and aids the infiltration of rainfall into ground water for future use. But judicious selection of tree species and maintenance of relatively open stands makes sense where water is in short supply. Experiments in the Coastal Plain, Piedmont, and mountains of the Southeastern United States show how choices of plant cover and forest practices can affect streamflow.

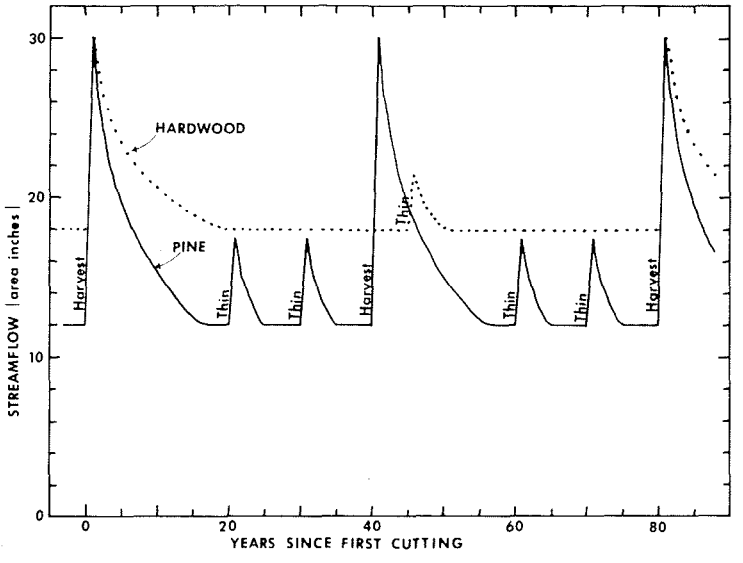
Two experiments at Coweeta Hydrologic Laboratory in North Carolina show that young white pine plantations use more water than mature hardwood stands on the same sites. Thirteen to 18 years after pines were planted, they used 7 to 8 inches more water per year than hardwoods. Much of this extra water use occurred in the winter and was due to greater interception by pine foliage when hardwoods were leafless. Also, because conifers retain their foliage, they transpire some water in winter and transpire much more water on warm spring days before hardwoods leaf out. Thus, converting hardwoods to conifers will reduce streamflow.

Water use is altered by management of the forest. When a tree is cut, its transpiration ceases and if the canopy is removed or the leaves and needles fall, interception is greatly reduced. Thus, thinning or logging a forest or clearing land for tree planting will decrease water use by vegetation, increase soil water content, and increase streamflow. Because conifers use more water than deciduous forests, cutting or thinning a pine stand will release proportionately more water. Conifers generally have shorter rotations, which means they are more often in a low water-using, young age class.

These management systems for the "green sponge" increase average water yields over a cycle by 0.93 area-inches per year for the hardwoods and 2.78 area-inches per year for pines. Even with management total flows from the hardwood stand exceed those from the pine—18.9 versus 14.8 area-inches.

The conclusions are: First, where water production is critical, hardwoods should be favored over pines. Second, the more intensive the management—the more frequently trees are cut—the greater will be the water yield. ♦

Lloyd Swift, Jr. is a research hydrologist with Coweeta Hydrological Laboratory in North Carolina.



The drawing illustrates likely annual streamflows from a good Piedmont timber site when managed for hardwoods or for pine. If the site receives 50 inches of rain each year, streamflow from an undisturbed hardwood forest might average 18 area-inches* per year. Streamflow from an undisturbed mature pine stand might be about 12 area-inches per year. In this illustration, an 80-year cycle with one thinning at age 45, removing 40 percent of the *wood volume*, is assumed for the managed hardwood stand. For the pine plantation, a 40-year cycle is shown with thinnings at ages 20 and 30, and each removing 30 percent of the *volume*. Both stands would be regenerated by clearcutting.

**18 inches over an area of land.*