Water Tupelos Like It Wet

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A search through the uplands for water tupelo is a very unrewarding task, indeed. To find this tree one must leave the piney woods and oaks and set a course for the deep swamps that border lowland rivers of the South. There, in quiet and murky waters, the home of the water moccasin and swamp rabbit, are prime water tupelos reaching skyward for a hundred feet or more. They grow so thick that sunlight barely sifts through their crowns to stimulate growth of under-story plants. Locally known as tupelo gum, gum, or just plain tupelo, water tupelo (*Nyssa aquatica* L.) inhabits sites that are subjected to prolonged flooding. The species not only tolerates flooded conditions, but thrives well under them, producing high-quality saw-timber, often in excess of that possible for pines on many upland sites.

For many years foresters, ecologists, and others have speculated on the water relations of tupelo swamps. Some concluded that the tree grew only in swamps and locations with a similar degree of wetness. They observed it in situations where water flooded the forest as much as 20 feet deep during rainy seasons, and in swamps which remained flooded to depths of 15 feet for relatively long periods of time. The minimum water level fluctuation required by this species is thought to be about three feet, but best water tupelo growth probably occurs where swamp soils remain wet. Some work has shown no damage occurred to water tupelo flooded by two to four feet of water for three growing seasons. And water tupelo probably requires frequent and deep flooding throughout the year in order to maintain high rates of growth. It is unlikely, however, that water tupelo habitats are flooded continuously, because its seed apparently must be germinated in the air during periods when sites are not inundated.

Research conducted in a bottomland forest along the lower reaches of the Santee River in South Carolina has confirmed these needs of water tupelo for swamp situations. A tupelo swamp was sampled by means of 90 randomly located stations at which measurements were taken on elevation, water level, under-story vegetation, and soil. In addition, total height, total age, and radial growth were studied to determine the effects of a number of different soil and site attributes (Fig. 1). Findings showed that taller tupelos occurred where soil and other site conditions were characteristic of poor drainage and long periods of wetness. Flooding also affected diameter growth, with better annual growth occurring during periods when the Santee River was out of its banks and over the swamps. This response occurred from flooding both during the growing season and the preceding winter when trees were dormant. It also appears that seepage into the swamp from adjacent upland areas provides an important moisture supplement when water loss from foliage is highest.

When soils are flooded for long periods of time, carbon dioxide increases in concentration to levels where roots cannot function normally. How then, one may ask, does water tupelo withstand flooded soil conditions and still grow? A number of theories have been advanced to explain the phenomena of fast growing trees on flooded soils. Some hold that because of a shallow rooting habit and very rapid foliar water loss, water levels are lowered rapidly after flooding. Because the root systems are not covered by water for more than a few days at a time, flooding is no problem, according to one point of view. Others think that roots protruding above normal water levels can change gases with the atmosphere. Still a third theory holds that the roots can contribute to life processes with free oxygen. Finally, a combination of these

FIGURE 1.—*A 105-foot tall water tupelo in the Santee River swamp is bored to determine its age.*

theories provides a fourth possibility, suggesting that modification of the roots permits respiration at low oxygen concentrations as well as in the absence of free oxygen, and that some oxygen diffuses internally through the trunk from the crown to the roots. Unfortunately, the exact mechanism is still unknown, but the fact remains that somewhere in the distant past water tupelo adapted to a wet environment.

Water tupelo is not alone in its preference for wet locations. Some of its more common associates include swamp tupelo (*Nyssa sylvatica* var. *biflora* [Walt.] Sarg.), bald cypress (*Taxodium distichum* [L.] Rich.), Carolina ash (*Fraxinus caroliniana* Mill.), red maple (*Acer rubrum* L.), and green ash (*Fraxinus pennsylvanica* Marsh.). Swamp tupelo is a species which requires very wet conditions for best growth and the same appears to be true for bald cypress. Less is known about the site relations of Carolina ash, red maple, and green ash, although our studies do show their abundance decreases rapidly on the deeply flooded sites where water tupelo development is best.

Water level plays an important role in the distribution of vegetation, particularly throughout bottomland swamps where it fluctuates widely. With increasingly intensive management of lowland sites we must pay close attention to water levels if we are to match properly species and site in hardwood regeneration. On your next visit to the bottomlands notice and ponder some of these relations and you will probably agree that water tupelos like it wet.

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