

GROWTH STUDIES OF CERTAIN BOTTOMLAND SPECIES IN SOUTHERN ILLINOIS

C. J. TELFORD, NATURAL HISTORY SURVEY, URBANA

The study of tree growth has always had a certain scientific interest. Now since we know that the virgin stand of timber amounting to 138,000,000 acres out of an original stand of 822,000,000 acres will be cut out, in all probability, within the next 50 or 100 years and that we must turn to the cut over lands and to plantations as future sources of supply, growth studies assume greater economic importance.

The two great classes of lumber—hardwoods or broad leaved trees and softwoods or conifers—are graded according to different specifications. The hardwoods are graded largely upon appearance and beauty; the softwoods largely upon strength, which in their case can be secured from immature trees, but clear lengths can not, this having been well exemplified in the choice of Sitka spruce for aeroplane stock.

In general, hardwoods require better soil, produce fewer trees to the acre and have a slower rate of growth than conifers. They must be carried over a long interval to produce the desired grades and sell for but little more than softwoods in the market.

Among the hardwoods the growth rate varies widely as to species; within the species also the growth rate varies as to site, but the height growth rate for the same species on similar sites is remarkably uniform, so that it is used in site classification.

The fact that different species grow at different rates is so well known that it needs no proof. That the same species may have a very different growth rate upon upland than upon bottomland sites is brought out in the study of sycamore (*Platanus occidentalis*). At fifty years of age sycamore growing upon the uplands in Randolph county averages sixty feet in height as compared with ninety-two feet for the same age on the Mississippi bottomlands of Union County. The fifty year upland tree has an average diameter on the stump inside the bark of 8 inches and the bottomland tree of 24.2 inches.

That the growth rate in height for the same species on similar sites is very uniform is brought out by study of pin oak (*Quercus palustris*). Measurements were taken in Gallatin county on pin oak growing on gray clay subject to flooding from the Wabash, and in Union county for the same species on drab clay subject to flooding from the Mississippi. The height growth of the average tree for each at 50 years is 68 feet, and at no period between 5 and 65 years is there a variation of more than one foot in the height of the average tree for these widely separated stands.

Comparing the rate of growth in height for the common upland commercial species with that of the bottomland species of the state, the studies show that the upland species grow in height about 70% as fast as the bottomland species and in diameter about 55% as fast. Thus it is apparent that if the growing of hardwood timber crops is going to be profitable anywhere the bottomlands present the more favorable conditions.

Comparing the height growth of the eight bottomland species studied there is a noticeable grouping. The intolerant cottonwood (*Populus deltoides*) and sycamore (*Platanus occidentalis*) show an average annual height growth of more than two feet for the first 50 years. The honey locust (*Gleditsia triacanthos*), soft maple (*Acer saccharinum*), and pin oak (*Quercus palustris*) have an average height growth of 1.4 feet for the same period. The elm (*Ulmus Americana*), ash (*Fraxinus Americana*) and hackberry (*Celtis Mississippensis*) average slightly less than 1 foot per year. Thus in rate of volume growth for average individual trees the listing would be in order of importance, cottonwood, sycamore, pin oak, honey locust, soft maple, ash, elm and hackberry.

Where these studies were made the soils are rich and moisture abundant. Thus the factor controlling both the occurrence of any one species in the mixture and its rate of volume growth is available sunlight. Abandoned river channels generally have seedlings in abundance of several species, but the rapid growth rate of cottonwood and sycamore soon places these above their competitors and results in a belt of these intolerant trees. But the

more tolerant species, while not competing with the overwood of cottonwood and sycamore, will persist at a slower growth rate, or will seed in under the tolerant trees. With the removal of the latter the site will be occupied and held by the elm, maple, oak, hackberry, honey locust and ash.

Within this grouping of the more tolerant species there will be a sharp struggle for crown space, and the check in crown expansion will be reflected in a correspondingly poor diameter growth.

Thus, under the conditions which exist in these all-aged stands, the two species which show unusually rapid growth are the species which must have an abundance of sunlight; therefore they occur locally in the bottomland as an early stage in the transition from the new land to the ultimate forest, and where occurring, make a uniformly high rate of growth.

In attempting to grow either sycamore or cottonwood in pure even-aged stands the average diameter growth would probably be less than that of these same species growing in a mixed stand, for the reason that in the mixed forest the sycamore or cottonwood carry their crowns well up above the other species with consequently more leaf exposure to sunlight. The average diameter growth of the more tolerant species grown in pure even-aged stands probably would be increased, because at no period of their growth would there be an overwood with consequent suppression. In the management of such even-aged stands the suppression resulting from lateral crowding would be modified by thinnings in the plantation.

In the natural grouping of this all-aged virgin bottomland stand the average yield per acre is 15,000 B. F. The average age of the merchantable trees is slightly over 100 years. Cottonwood and sycamore made a diameter growth inside the bark on the stump of 20 inches in 40 years, pin oak in 58, honey locust in 57, soft maple in 59, hackberry in 125, elm in 127, and ash in 150 years.

In conclusion, it seems evident that the highest returns can be secured from a naturally stocked bottomland area by encouraging the sycamore, cottonwood, pin oak

and maple. Probably the honey locust should be considered as a desirable species but hackberry and elm grow altogether too slowly and have no special merit. Ash has an extremely low rate of growth and its encouragement is justified only by the high market value of the wood. The highest returns from artificial plantations would probably be derived from cottonwood and sycamore, but such a plantation requires a cleared field and involves almost prohibitive initial investments except on land which is subject to overflow and is not liable to be for some years in an organized drainage project.

April 26, 1923.