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TREE CLASSES IN THE UNMANAGED FORESTS OF SOUTHERN ILLINOIS AND APPLICATION TO FOREST MANAGEMENT

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(Maintained in cooperation with Southern Illinois University)

The purposes of this paper are to propose the use of tree classes as an aid in understanding the problems of woodland management, to give the occurrence of the classes in the present unmanaged woodlands of southern Illinois, and to show how this knowledge can be applied to management of forests. The tree classes are based on the characteristics of individual trees in the forest. The objective of the classification is to determine how each tree should be treated under good forestry practice.

The "typical" southern Illinois woodland tract probably has less than 40 acres and is situated on land unsuited for crops or pasture. Many of the bigger and better trees have been cut and some of the present timber has been so damaged by fire that butt rot is common. Good reproduction may be sparse. Many of the present trees are unmerchantable or are of low quality (King and Winters, 1952).

The data in this paper were collected over a period of 8 years and are based on a 100% tree inventory of 22 experimental forest areas totaling 420 acres. Half the areas were in the mixed hardwood type and half in the oak-hickory type. Mixed hardwoods occur on more moist sites such as coves, lower slopes, and northerly slopes. The oak-hickory type occurs on drier sites, including upper slopes, southerly slopes, and ridgetops.

The upland stands studied are judged to be typical for southern Illinois. The species composition and the tree-size distribution are shown graphically (Fig. 1). A general feature is the presence of numerous cull trees (unmerchantable now or in the future) among all species and all sizes.

Tree Classes

In a complete and realistic evaluation of unmanaged woodlands, the actual condition and quality of individual trees in the forest must be considered. Tree quality refers to soundness, straightness, clearness and, in general, that which makes a tree presently or potentially valuable as a producer of usable wood. Over a period of years the following tree classes have been found useful in making analyses of woodlands:

Class 1.—Good-growing, stock trees—high quality and vigorous; the ultimate goal of forest management. These trees are an excellent capital investment.

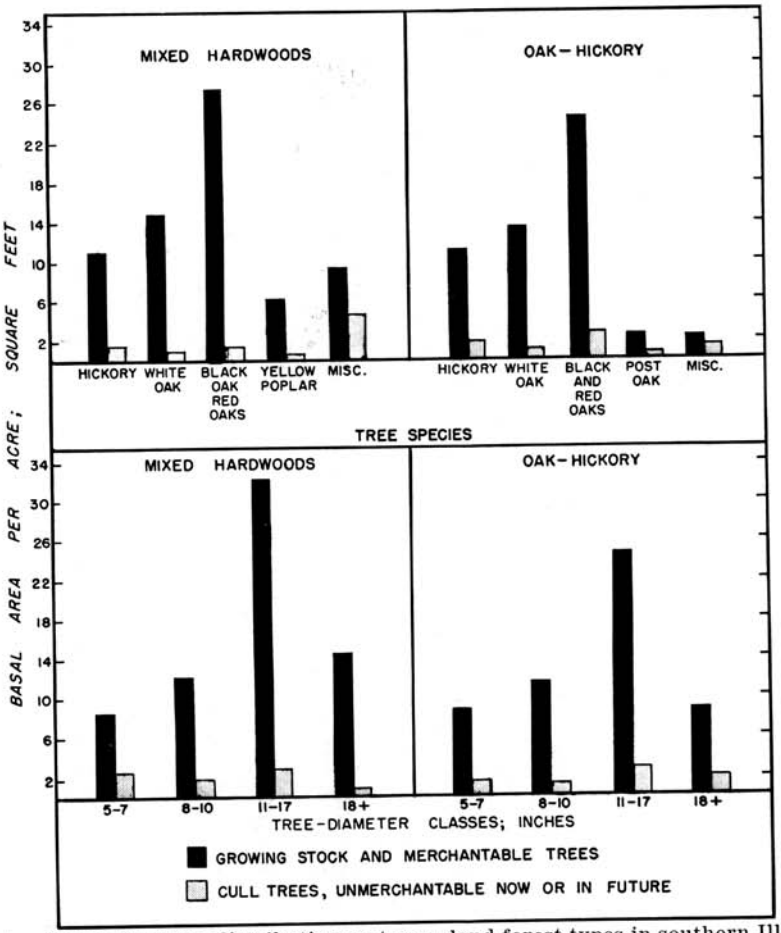

FIG. 1.—Species and size-distribution on two upland forest types in southern Illinois. Basal area is total cross-sectional area outside bark of all trees, 4.5 feet above ground.

Class 2.—Acceptable-growing, stock trees—fair quality; making good net growth. These trees are a good capital investment.

Class 3.—Mature trees — good quality and sound. Annual value increment has fallen below an acceptable percentage, usually three or four percent.

Class 4.—Sound, low-quality trees —merchantable trees with misshapen or abnormally short trunks.

Class 5.—Over-mature trees—merchantable trees past maturity size; often defective; may have low or negative net growth; apt to be lost by death or windthrow.

Class 6.—Defective, low-quality trees — merchantable

trees below maturity size; of low quality because of rot or other defect; poor risk in stand.

Class 7.—Cull trees—trees unmerchantable now or in the future.

The above classes logically fall into four groups: (a) classes 1 and 2 are growing stock to be left in the stand; (b) classes 3 and 4 are contributing less than a proportionate share of the growth, are interfering with growing stock trees and reproduction, but they are not apt to be lost; (c) classes 5 and 6 are making a small or negative growth contribution to the stand and are a poor risk; and (d) class 7, cull trees are occupying growing space and making no contribution.

Occurrence of Tree Classes in Unmanaged Stands

The data collected on tree classes show the approximate nature and extent of the rehabilitation job in stands of typical central hardwoods (Figs. 2, 3, and 4). The classified trees serve as a basis for deciding what to cut, what to kill, and what to leave for future growth.

In the mixed hardwood forests only about half of the pole-sized trees are good or acceptable growing stock. The remaining trees are mature, over-mature, sound low-quality, defective, or culls. Only about 58% of the small sawtimber trees and 38% of the large sawtimber trees are growing stock. Less than 7 of 44 sawtimber-sized trees per acre are classed as good, growing stock.

In oak-hickory stands, a little more than half of the pole-sized trees should be kept for future growth. Only about 45% of the small sawtimber trees and 20% of the large sawtimber trees are growing stock. About 1 of 34 sawtimber-sized trees per acre is classed as good, growing stock.

A complete rehabilitation cut (leaving only the growing-stock

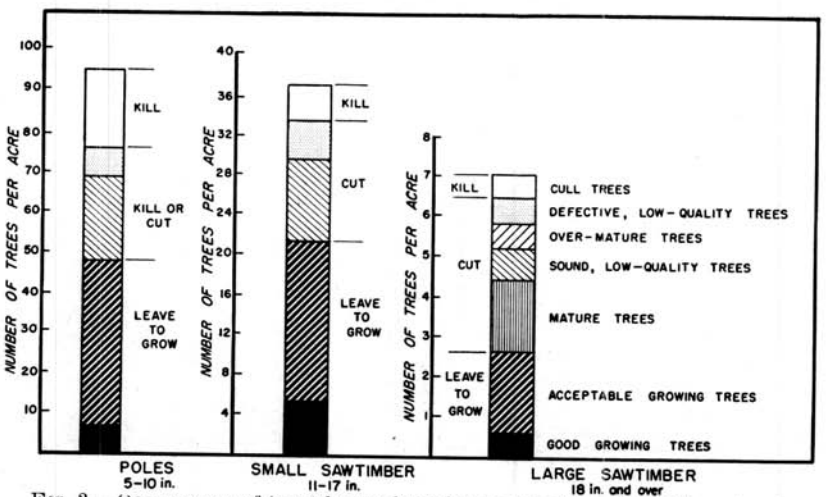

Fig. 2.—Occurrence of tree-classes in upland, mixed hardwood forests of southern Illinois.

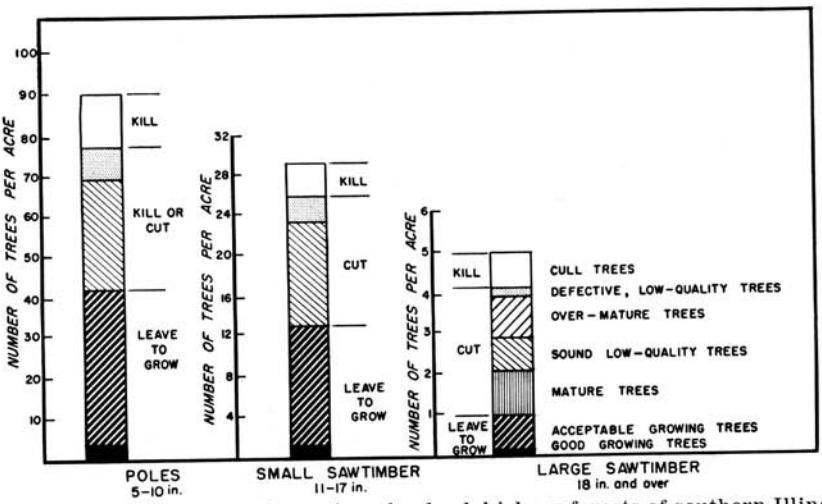

FIG. 3.—Occurrence of tree-classes in upland oak-hickory forests of southern Illinois.

trees) in these upland, mixed hardwoods would mean harvesting about 2,000 board-feet per acre. The residual stand after cutting would contain about 2,100 board-feet of small sawtimber and 800 board-feet of large, sawtimber, growing stock, or a total of 2,900 board-feet. In oak-hickory stands, a similar cut would take about 1,800 board-feet, and leave 1,400 feet of growing stock. In both instances all good pole-sized trees would also be left.

INDICATED APPROACH TO MANAGEMENT OF WOODLANDS

The optimum number and size distribution of trees in well-managed stands are not yet adequately known by foresters, although approxima-

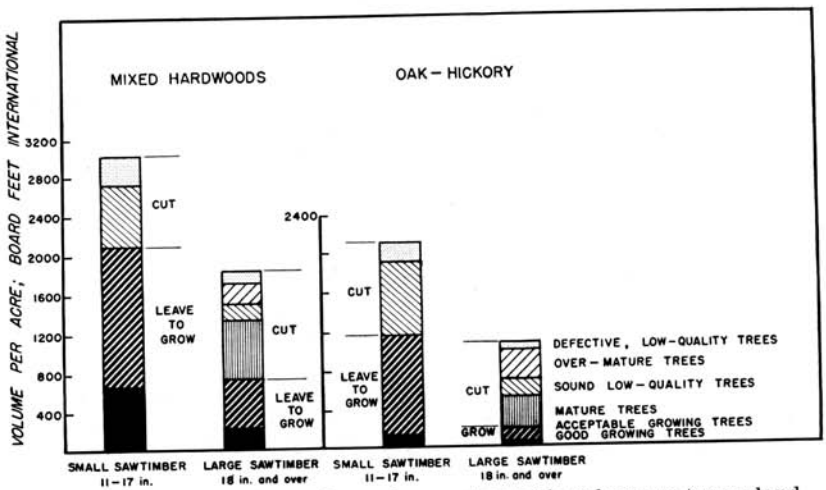

FIG. 4.—Occurrence of tree classes by merchantable volume on two upland forest types of southern Illinois.

tions are available (Ill. Tech. Forestry Assoc., 1950). Perhaps as pressing a problem as proper stocking in most woodlands of the central region is rehabilitation of the existing forests. The data already given on tree classes show that more than half the trees are not suitable to leave. All the tree classes, except growing stock, must be harvested or killed before the woodlands can attain maximum production. This improvement cutting can be done on different time schedules. For example (1) cut only the poor-risk, merchantable trees (defective and over-mature classes) and kill the culls. This would remove less than half of the nongrowing-stock trees. The sound, low-quality and mature trees would be "stored on the stump" for future cutting. Or (2) cut all merchantable tree classes, except growing-stock trees, and kill the culls. Each of these two courses has certain advantages that will be pointed out later.

Effects of Improvement Cutting on Woodlands

An improvement cutting that removes all or a portion of the unwanted tree classes has a significant and often profound effect upon the forest. Almost at once the forest is changed from a relatively static to a dynamic plant community. From a silvicultural standpoint there are two significant results: (1) growing-stock trees left in the stand begin to grow faster because of reduced competition for light and moisture; and (2) reproduction increases because cutting provides more light on the forest floor, and logging exposes the mineral soil favorable to germination of tree seeds.

Numerous examples on the Kaskaskia Experimental Forest show that improvement cutting increases net growth (Minckler, 1954). In a typical stand, net annual growth after all tree classes, except growing stock, were removed was 334 board-feet per acre. Estimated net growth before the cut was 144 board-feet.

The increase in reproduction as a result of cutting treatments involves species composition as well as rapidity of seedling growth. The desirable upland timber species, such as yellow-poplar (*Liriodendron tulipifera* L.), white oak (*Quercus alba* L.), black oak (*Q. velutina* Lam.), and red oak (*Q. rubra* L.) are relatively intolerant and require about 50% of full sunlight for good development of seedlings. The less desirable species such as blackgum (*Nyssa sylvatica* Marsh.), hickory (*Carya* spp.), sugar maple (*Acer saccharum* Marsh.), and beech (*Fagus grandifolia* Ehrh.) will thrive under more shade. These considerations are very important if continuous yields of quality species are to be obtained.

Summary: Use of Tree Classes in Forest Management

The nature and extent of the rehabilitation job in the woodlands of southern Illinois may be determined by recognizing and using the tree classes discussed. The cull, low-quality, mature, and over-mature classes of trees must be removed from the stand. Doing this job in one operation has several advantages: (1) maximum growth of good trees left; (2) maximum space and

light for successful reproduction of desirable species; and (3) better chance to market the usually low-grade sawtimber because some mature and sound trees are included in the sale.

In the absence of fire and grazing, such relatively heavy cuts do not normally result in site deterioration or reduced quality of runoff water from the watershed. Light cuts that remove only the merchantable, over-mature, and defective trees and that kill the culls spread the work over a longer period. This may be an advantage to a farmer who does his own work. The same result can also be obtained by doing the complete improvement job on a portion of the woodland each year or two.

One key to good management of existing depleted woodlands lies in recognizing the tree classes present, the significance of each, and the application of the information in improvement cutting. This knowledge will help answer these questions about each tree: shall it be cut, killed, or left to grow? Generally, the size distribution, species composition, and number of trees per acre of the residual stands, after a rehabilitation cut, are such that a good growth response is obtained. The increased light obtained on the forest floor is essential for successful reproduction of good timber species.

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