KEYNOTE ADDRESS

STIMULATE THE USE OF SILVICULTURE IN HARDWOOD FORESTS

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Abstract.--The most effective way to use knowledge, technological innovations, and research findings in hardwood forests is to stimulate the systematic culture of forests to enhance the benefits perceived by landowners to be in their self-interest.

Additional keywords: Landowner attitudes, increased growth, increased timber quality, multiple benefits.

A keynote presents issues, identifies at least one crucial element, proposes ideas, but presents no solutions.

The specific issues for this symposium are known only to you and I'll know them after your papers are given. Therefore, I'll direct my attention to the second part of the definition. Can I identify a crucial element of immediate concern? Is there an element with the eminence of decisive change in the use of knowledge and technology in hardwood forests?

There is no lack of important issues. There are many technological questions in regeneration, genetics, soils, wildlife, growth and yield, recreation, wilderness, and other subjects. I want to link these important issues to a common element that is crucial to the use of knowledge and technology in hardwood forests. I argue that a purposeful use of silviculture did not bring about the present state of hardwood forests.

Some forests are systematically cultured. Methodical systems for culturing hardwood forests are found on lands owned by forest industries, the public, and a few individuals. In most of the hardwood forests it is difficult to find the regular use of silviculture to produce one or more benefits (Kingsley and Birch 1980).

Why does this information concern you? We observe how methodical investments, such as the culture of corn and wheat, greatly increase the use of technological innovations and research findings. The presence or absence of silviculture in more than three-fourths of the hardwood forests has the eminence of decisive change in the use of technology and research findings. Around this crucial element I develop the keynote.

First I'll present some information about the hardwood forests; then I'll offer some ideas.

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HARDWOOD FORESTS

A comprehensive survey of the forest resources of the United States was completed in 1952 (USDA Forest Service 1958). The typical report for areas of hardwood forests describes many millions of acres covered with small diameter trees. These second-growth stands originated mostly between 1880 and 1920 when the majority of the original hardwood forests in the Eastern United States was harvested (Boyce and McClure 1978, U.S. Department of Commerce 1960). The small diameter, second-growth hardwoods were considered "low quality" for sawtimber. Many hardwood species were labeled "low quality" because of marketing and processing standards before 1950.

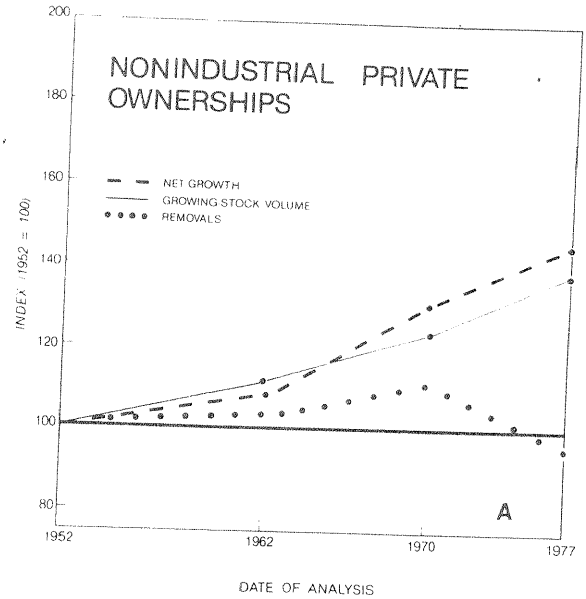
Forty years ago Tom Lotti and Tom Evans (1943) described the mountain hardwood forest of Virginia: "In comparison with the original forest present yield from the woodland is small. This is primarily due to a disproportionately large acreage stocked with small trees, an excessive quantity of cull volume, a small amount of growing stock per acre and an overabundance of inferior species."

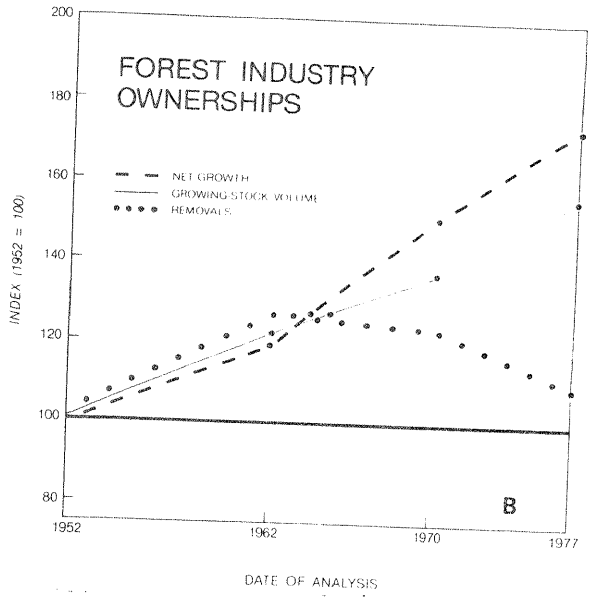
Cruikshank (1941) described the hardwood forests in the North Carolina Mountains 40 years ago: "The original mountain forests contained timber of high quality but now only a few scattered stands of old growth remain. Repeated cutting and forest fires have hindered the development of good-quality second-growth and at present over one-half of the forest land is stocked with young stands below sawtimber size, containing a high proportion of cull trees and low quality species. At present the yield of merchantable wood from the forest is small because of the large area stocked with small timber, the high proportion of cull volume in the stand, and the small amount of growing stock per acre."

Since 1940 enormous numbers of young hardwoods have exceeded the 5-1/2-inch diameter for growing-stock volume. These trees continue to increase in diameter. Today we have a large accumulated hardwood resource in the eastern United States (USDA Forest Service 1980). Eastern hardwoods represent one-third of the total growing-stock volume in the United States. The volume of hardwoods in nonindustrial private forest (NIPF) ownerships in the East represents 24 percent of the Nation's total growing-stock volume. The latest inventories indicate that this NIPF hardwood resource continues to grow with little use of silviculture (Boyce and Knight 1979, 1980).

Practically every forest survey report since 1950 records an increase in the growing-stock volume of eastern hardwoods, and an increase in net annual growth. Since 1970 records show a reduced rate of hardwood removals (Fig. 1). These trends are found to be similar for 37 states. The trends are similar for three ownership classes: public, forest industries, and NIPF. The smallest rates of increase in growing-stock volume and the fastest rates of removal are found in parts of the Mississippi Delta and the Ozarks where there is extensive land clearance for agriculture. The consistency of the trends in 37 states is accepted as substantial evidence that real differences are occurring.

Since 1952 the amount of growing-stock volume that qualifies as sawtimber increases for trees in the 16-, 18-, and 20-inch diameter classes (fig. 2). These trends are consistent for the 37 states except where forest lands are





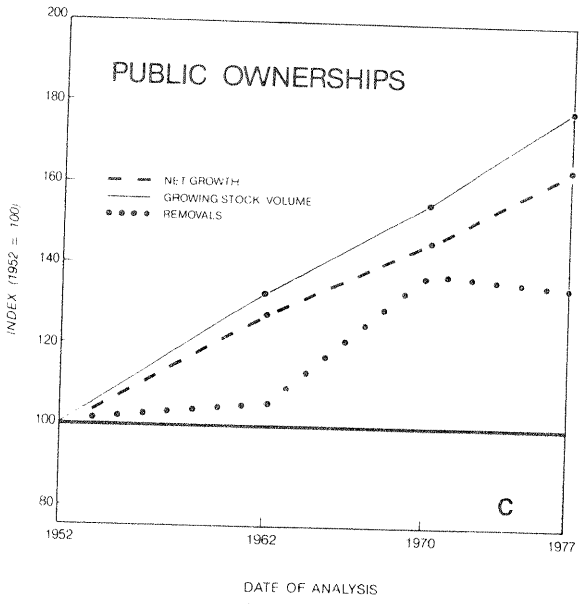


Figure 1.--Index of change since 1952 in growing-stock volume, net growth, and removals of hardwood trees on commercial forest lands in 37 eastern States in 1962, 1970, and 1977 for A, nonindustrial private ownerships; B, forest industry ownerships; and C, public ownerships. (Data from USDA Forest Service, in press).

cleared for other uses.

An increasing accumulation of growing stock in large diameter trees (fig. 2) signals an increase in the quality of hardwood growing stock. The single most important indicator of hardwood timber quality is for the butt log of a tree to have a scaling diameter of 13 inches or more (Vaughan et al. 1966). Trees larger than 15.5 inches in diameter at 4.5 feet with sawtimber volume meet this requirement. Further, the data for figure 2 is net volume which equals growing stock volume in board feet, International 1/4-inch rule, less deductions for rot, sweep, and other defects that affect the use of logs for lumber. These data are accepted as substantial evidence for an improvement in the quality of hardwood sawtimber.

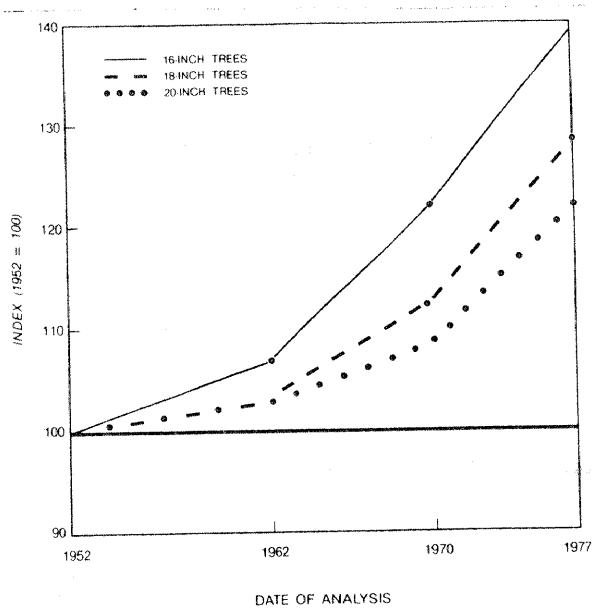


Figure 2.--Index of change since 1952 in net volume of hardwood sawtimber in 37 eastern States in 1962, 1970, and 1977 for three diameter classes (Data from USDA Forest Service, in press).

I find no evidence for relating these increases in growing-stock volume, growth rate, and wood quality to a widespread use of silviculture. About 73 percent of the hardwood growing stock is in NIPF ownerships. Altruistic motives are attributed to these landowners by many persons concerned with forestry; that is, the performance of NIPF owners leads to the greatest public good rather than to the welfare of the individual (Royer 1979). Changes in the forest resource during the past 25 years suggest the exact opposite.

The majority of NIPF owners, by pursuing their best interest in social and economic situations, passively permits the natural development of hardwood forests (Boyce and Knight 1980). Most of these lands remain in forest not because the owner is investing in silviculture to grow timber but because he has other motives. Timber is harvested. Most hardwood timber harvested from NIPF lands grows incidentally to activities other than investments in silviculture. Perhaps the land is held for long-term capital gains, for speculation, as a hedge against inflation, for recreation, for esthetic values, and for some kind of emotional satisfaction. Large amounts of timber and other benefits are derived from NIPF lands without investment in silviculture.

Economic dislocations in agriculture; regional changes in industrialization; land turnover rates; rates of home construction; changes in processing technology; and changes in consumer products, tax policies, and markets are important elements in the economic and political forces. Elements in the social area include changing attitudes toward forestry, concern for the environment, concern for intangible benefits, the attitudes of nonlandowners, and shifts in the kinds of NIPF owners. All of these variables act as sources of information and as economic and social constraints to shape each landowner's perception of what is in their best interest.

Recent studies (Kingsley and Birch 1980) indicate that about 2 percent or less of the NIPF owners give investments in timber productions as the primary reason for owning forest lands. Less than 1 percent of NIPF owners who har-

vest timber say they do so as part of a cultural treatment for their stands. An important point is that only about 2 percent of the landowners report that they receive general forest management assistance. This proportion should be about 70 percent if the use of silviculture is increasing growing-stock volumes and improving timber quality.

About three-fourths of the hardwood growing stock, which represents about one-fourth of the total growing stock for all species, is owned by people who apparently have little interest in making systematic investments in silviculture for economic returns from timber or to increase the production of other forest benefits. Your technological innovations and research findings can aid both landowners and nonlandowners to achieve more of what is wanted from these forests.

I offer some ideas.

SOME IDEAS

Why is my initial argument crucial? We seem to have a surplus of hardwood timber that is increasing in quality (fig. 1).

Before 1920, a large accumulated hardwood resource in the eastern United States was harvested in only 40 years (1880 to 1920) (U.S. Department of Commerce 1960). Accumulation of the present growing stock volume required 60 (1920 to 1980) to 100 (1880 to 1980) years. This accumulation is about equal to the volumes harvested before 1920 (Boyce and McClure 1978). Increased rates of utilization for timber, wildlife habitat, recreation, and fuel without complementary increases in silviculture could again rapidly deplete this resource or limit its productivity. This alone justifies stimulating the use of silviculture for any and all benefits.

Another reason to stimulate the use of silviculture is that forest biomass is part of everyone's day-to-day activities. An increasing number of people derive a livelihood from the use of forest biomass in the form of lumber, boxes, bags, and paper. Consumer benefits include forest biomass used in newspapers, perfumes, clothing, detergents, plastics, paints, and building materials.

Most people who benefit from forest biomass are nonlandowners. Yet the beliefs and values expressed by these nonlandowners have an important effect on the social and political forces that determine how forests are used. Apparently an increasing number of nonlandowners base their beliefs not on their day-to-day dependence on some form of forest biomass but on their perceptions of nature and intangible forest benefits (Theobald 1979, Schwartz 1979).

There is evidence that large segments of the population have great reverence for nature and desire many intangible forest benefits. Silviculture can enhance these intangible benefits. The factors in social and personal decisions for forestry seem to be changing in relation to these desires. For many NIPF landowners, the integration of all relevant factors into an economic analysis for monetary returns alone is only one of many criteria for investing in silviculture. This is especially true for landowners whose livelihood does not depend directly on forestry enterprises.

Max Young, State Forester, Tennessee Division of Forestry, calls attention to a 60-acre woodland from which timber could be harvested. The owner was advised; trees were marked; no timber was sold. No self-interest in harvesting the stand was perceived by the owner, a former timber harvester (Young 1979).

The purpose for stimulating silviculture is to enhance the benefits perceived by landowners to be in their self-interest. Growing timber has a low investment value for most NIPF owners who do not participate in profits derived from industrial processing (Boyce 1979). The maintenance of timber production on a majority of NIPF lands apparently depends on the use of timber harvesting to enhance both timber and other values desired by the owner. These values may not include timber as the primary benefit. The harvest of timber is certainly stimulated by desires for money. But harvesting timber must return more benefits to landowners than just the monetary value of stumpage.

Obviously the widespread use of silviculture calls for judgment, insight, experience, opinion, and a participation of many parties with diverse interests. Diverse interests and changes in value judgments require flexibility in the rules for silviculture; and is no place for hard and fast constraints. Dynamic response of landowners to economic and social forces is essential for a high level of forest productivity and for keeping the benefits congruent with desires. The processes of decision and control must be the responsibility of the landowner.

The processes of decision and control in forestry involve the use of data in combination with experience, insights, and value judgments. What may pass as facts and values in the decision process almost invariably are specifications resulting from the integration of data and subjective judgments. These perceptions derive from information flows that originate from social, economic, special interest, and governmental activities. Most of these sources of information influence opinions and attitudes toward forestry from outside the disciplines for professional forestry.

Specialists in natural resources can aid the person who makes the decisions. The decisionmaker is the landowner who acts on perceptions of personal interest. Many of these perceptions, which originate outside of forestry, are influenced by nonlandowners' attitudes that flow through numerous publications, clubs, and associations. These perceptions of personal interest are more important to the landowner than any "forestry opportunities" presented by a professional forester, wildlife biologist, forest economist, or other resource specialist.

Professional aid must integrate quantifiable technology with the landowner's subjective opinions and value judgments. Whatever the opinions and attitudes of the landowner, the chore of the professional is to harmoniously and explicitly interlock the subjective and the quantifiable elements to achieve what landowners perceive to be in their self-interest. This integrated approach is essential if we are to increase the use of silviculture for any and all benefits.

One way to help both landowners and nonlandowners improve their use of decision and control techniques is to provide more reliable sources of infor-

mation and better ways to develop alternatives. Landowners could use explicit alternatives that integrate data with their experience, insight, and value judgments. Nonlandowners could personally benefit from these sources of information. Existing simulation and decision models have too many "black boxes" and are too costly in time and dollars, for owners of 60 acres of forest. Some kind of technology is needed to improve communication with millions of landowners and nonlandowners. Another aid for landowners would be relatively simple ways to control forests once decisions are taken. Most current control methods consist of passively permitting the forest to accumulate biomass between periods of timber sales. Important increases in production of many benefits could result from the simple procedure of scheduling rates of harvest and sizes of openings to bring about certain states of forest organization (Boyce 1977). This could be the simple control structure that paves the way for increased technological innovations and research findings.

Another idea is to increase basic knowledge and insights into the biological dynamics of hardwood forests. We need more of the basic biological principles that underlie silviculture for any and all benefits. We need more knowledge about all endemic and naturalized species and the behavior of these species in relation to culture. Improved decision and control methods can be developed on the basis of an improved understanding of the dynamics of the forest.

New knowledge and technology can help to retain natural stands of hardwoods and avoid the unnecessary conversion of natural, hardwood forests to other uses. Most of our future supplies of hardwood timber and many other forest benefits are likely to be derived, as in the past, from the natural dynamics of the hardwood forests. Silviculture is a way to use the dynamics of these natural forest systems to reduce the cost for producing benefits. Silviculture in natural hardwood forests takes advantage of many unique biological mechanisms. For example, hardwood stands are harvested and naturally regenerated without 80-year investments in site preparation and planting.

Another idea, not new, is to learn to manufacture useful and desirable products from the kinds of biomass that are most efficiently accumulated in natural hardwood forests. Changing the technology of processing is more efficient economically than changing the biology of the forests to produce biomass for today's technology. Attempts to make silviculture of hardwoods dependent on producing timber for today's technology usually require 80- to 100-year investments in land, labor, capital, and fossil fuels. When the biomass is ready for processing, the processing technology has changed.

We can assume that large-diameter trees with straight stems will always have high value. But who among us is wise enough to predict timber-quality standards and species composition of forests for a society 80 years from now? For what purposes will forests and trees be valued 80 years from now?

The use of silviculture does not need to depend on removing the natural forest because of low productivity and poor timber quality. The phrase "poor timber quality" defines our inability to convert different kinds of biomass to useful products economically. Silviculture in hardwood forests should rarely mean removing the original forest, preparing the site, adding fertilizers, planting genetically different and superior trees, and protecting the trees with herbicides and pesticides to meet today's manufacturing standards.

The final idea, and likely the most important of all, is to improve markets for any and all kinds of biomass from hardwood forests. The decline in the rates of removal since 1970 seems real (fig. 1). Improved markets could eliminate the phrases "poor timber quality" and "green junk." Increasing markets increase opportunities to schedule harvests and control the size of openings. The ability of landowners to market any and all biomass increases their control over states of forest organization, and this increases production of any and all forest benefits.

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