production from natural sources; (c) to nurture current growing stock to maximum size and quality wherever it occurs; (d) to adjust to changing market conditions.

(2) The system is particularly adapted to small ownerships, because it permits frequent harvests of high-value timber from natural forests.

(3) Its broad application would conserve the remaining aggregate of growing stock to bridge the imminent scarcity of quality timber.

(4) It allows harvest of forest while providing maximum range of stand conditions in contiguous patches for recreation, for game, and for site protection.

COMMENTS ON J. S. McKNIGHT'S PAPER:

Application of Uneven-Aged Silviculture to Southern Hardwood Forests

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My friend from Mississippi has suggested the place for uneven-aged silviculture in the management of hardwoods here in the South.

Since your next speaker will be extolling the virtues of even-aged management, I will try to limit my comments to those that are germane to uneven-aged forests, and more specifically, to look at some of Sid McKnight's arguments favoring the uneven-aged system.

When we talk about systems in silviculture, semantics always seems to become involved. But let us try to break through this word-meaning roadblock by looking at several descriptions of the uneven-aged forest. One definition has this forest with all age classes intermixed in a limited area so that a separate, single age class cannot be recognized. Another definition considers a forest uneven-aged if it contains an intricate mixture of small, even-aged stands arising from clearcutting small patches.

Sid has conceded that the single tree selection method (or my first definition) does not have a place in managing hardwoods in the South because the most valuable species are intolerant and will not regenerate or develop in small openings or under shade. I must wholeheartedly agree with him on this point. Apparently, the second definition better fits our discussion, and its key-phrase is "mixture of small, even-aged stands arising from clearcutting small patches." How large can these patches be before we designate the system as even-aged? Sid implies 1 to 2 acres is the text book answer, but in his paper he has suggested that they may "range in size from patches to many acres."

What his argument seems to boil down to is that he thinks it is more logical to manage hardwoods in a patchwork of small- and even large-sized areas of age classes. What governs this patchwork, in a large part, is the condition of the stand at the time management is applied. In some respects this is logical because management must start with what is on the ground, whether it be a ragged stand of residuals containing the Roach-Chapman "lonely hearts," whether it be a well-stocked stand, or whether it be a mixture of stands between these extremes. However, to base our future management system on the current stands seems to be committing ourselves to the past mistakes made in these stands, and compounding these mistakes into the future.

The advantages cited for the uneven-aged system he describes seem to hinge on opening size, and since he is willing to accept any size from a patch to many acres, his system seems to be more even- than uneven-aged. If this is so, then most of these advantages could be given to the even-aged system.

Let me comment on a few advantages that seem to be oriented more to small openings, or
trees in a group are the most desirable growing stock until maturity. However, owner policy and biological maturity must guide the harvest.

Advantages of the System

The most noteworthy advantage of the system is its flexibility and adaptability to many natural stands. Frequent changes in site, causing variable responses by species, often demand changes in stand treatment if maximum production is to be achieved on each unit of forest area.

Coupled with these natural relationships is usually the heterogeneity of stand conditions created by cutting practices used before management was started.

Here again selection silviculture is advantageous, because it allows retention of growing stock of all sizes or ages. For the next several decades lumber and veneer plants are going to have to operate on trees that are now of or near pole size. For individual ownerships, it may not be important to eke out the supply of such trees. But for the South as a whole it may be vital to insure a supply of native logs to the general market. A number of circumstances, but mainly the advent of a large-scale market for hardwood pulpwood, suggests that the South may be on the eve of a manifold expansion of the hardwood acreage that is under an adequate degree of management. If so, the traditional hardwood industry can look forward to improved supplies some decades hence. The length of the waiting period, and the degree of stress that will have to be endured, will depend partly on the use that managers make of trees that are already in the woods.

Through patch treatment of biologically delineated areas, better control of regeneration may be achieved than through treatment of more arbitrarily delineated areas, except where areas are to be regenerated by planting trees of one or several species. Advantage can be taken of existing stands, seed trees, and regeneration to a greater extent than where control is on the basis of area alone.

There may be additional benefits of selection silviculture. One is avoidance of clear-cutting in forests of high aesthetic value or where recreation is an overriding consideration --near cities, for example. Selection silviculture can be used to provide maximum site protection in many such cases.

Some wildlife biologists consider the selection forest of mixed hardwood species, with its range of habitats in relatively close proximity, as ideal for most game species. Although this may not be true for all circumstances, it holds for some sites, particularly in bottom lands.

The owner of a small forest may find the system of considerable advantage. Harvests of mature timber from the entire property would provide frequent income, and each harvest would be a convenient occasion for intensive thinning and salvage. As with other systems of silviculture, the many services provided by extension and industry foresters would have to be utilized.

Despite these advantages, selection silviculture finds disfavor among some administrators and silviculturists because of very real problems associated with its use. Control or regulation of cut to achieve a truly managed forest or sustained yield is difficult. Only through frequent inventories can the condition of stands be ascertained to guide plans for treatment and harvest. Without such plans it is impossible to come even close to the ideal of balance between increment and fellings of the highest quality timber. This apparent disadvantage further stresses the need for intensive forestry if the maximum benefits are to be achieved.

Yet, from the practical viewpoint, variable-group selection--and with condition of individual trees as a guide--is adapted to intensification on a particular property as markets broaden for hardwoods of almost all sizes and qualities. At the same time it provides for the maximum retention of half-grown, potentially high-quality trees.

In summary, the following points seem to particularly favor selection forestry in southern hardwoods:

1) If properly applied, the system allows maximum flexibility (a) to take advantage of naturally evidenced site-species relationships in broad areas where soils change in kaleidoscopic fashion; (b) to control re-
what is closer to the text book treatment of the group selection method.

The notion that the uneven-aged system is a better one, in that it will allow the re-
tention of growing stock, needs discussion. The underlying philosophy seems to be that the
imminent scarcity gap of high quality timber will be bridged by retaining growing stock that
might not be retained economically under the even-aged system. There seems to be a bit of
altruism here of which landowners accepting the uneven-aged system may not be aware. The
retention of such growing stock may result in a growth reduction if such stands are not ade-
quately stocked. To think that under uneven-aged management you would want to retain a
stand that might have individual trees growing at a rapid rate, but on an area basis only be
growing a fraction of the potential, is rather unrealistic to say the least.

On aesthetic values, let me say that it has been my rather casual observation that many
forested recreational areas are even-aged, and that where recreation is an overriding con-
sideration, that area might be best handled outside of a timber management plan, whatever the
management system. We all admire old-growth stands, but this does not mean that we will not
accept and admire vigorous, growing young stands. Quite often contrasts are aesthetically
very pleasing.

Two questions--

How effective will regulation by volume be when openings of any size are permitted?

Why will an owner of a small forest find the system more advantageous than an owner
of a large forest?--

were especially perplexing to me and I have no comment, except to pose them for your own con-
sideration.

Let me close by saying that Sid has presented a good case for an uneven-aged system of
managing hardwoods. His system is undoubtedly adaptable to many land ownerships. It pro-
vides for reproduction by small or large patches, for sustained yield by volume control, for
efficient use of site productivity by altering the patches to fit the site, and by retaining
growing stock to its financial maturity. Whether it is the most efficient way of managing
hardwoods depends. it seems to me, oh how much better it meets the individual owner's
objectives than does the alternative system.

### Hardwood Management under the Even-Aged System of Silviculture

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According to the Timber Trends Report issued by the Forest Service in 1965, hardwood
forest types, as of 1963, occupied about 60 percent--120 million acres in round figures--of
all commercial forest land in the South Atlantic and Gulf Coast States! The Report also
predicted total area of hardwood forest types would increase to 124 million acres by the year
2000. I suspect there may be some here today who might debate that prediction; in view of
such negative factors as the rising tide of permanent water impoundments, conversion of hard-
wood types to softwoods, and land-clearing for pasture and row crops in prime hardwood-
growing bottomlands such as the Mississippi Delta. Nonetheless, it is likely hardwood forest
types will continue to occupy the greater portion of the total commercial forest land in the
South for the foreseeable future.

Now that we have hardwoods in the limelight, let's turn our attention to a question which
has plagued many foresters for quite some time--under what silvicultural system should hard-
wood stands be managed in order to yield the quantity, size, and quality of wood products
desired from the land for the minimum amount of investment? Without further preamble, we can
say the choice boils down to one of two basic regeneration systems--SELECTION (either by

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