NON-TRADITIONAL PINE/HARDWOOD MANAGEMENT FOR PRIVATE LANDOWNERS AND PUBLIC LANDS IN ARKANSAS AND OKLAHOMA

By

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CHAPTER I

INTRODUCTION

Nationwide approximately 58 percent of all commercial forest land is owned by nonindustrial private landowners (NIPF). In Oklahoma, forest land in NIPF ownership approaches 74 percent (Lewis and Goodier 1990). Increasing pressures on public lands for non-commodity resources and more stringent environmental guidelines will increase the burden on NIPF ownership in the South to provide our nation's wood supply. The effects of this have already been witnessed in the Pacific Northwest, where harvesting has been reduced due to concerns for protection of old growth forests and the endangered spotted owl, and lumber prices have sharply increased in recent years.

At the same time, pressures on NIPF ownerships indicate less interest by private landowners towards timber harvest. Fragmentation of ownerships reduces effective land management capabilities while increased federal and state regulations make it more difficult and more expensive to harvest timber. In addition, many new NIPF landowners perceive timber harvest to be in conflict with other objectives for their land; these include recreation, wildlife, and aesthetics. Non-traditional methods of forest regeneration and management are needed to meet the diverse goals of NIPF landowners. An adequate future timber supply will depend upon landowners being provided with management options that address these goals.

In recent years the USDA Forest Service has been conducting experiments in ecosystem management to investigate different types of regeneration cuttings which result in various residual forest stands with different residual pine and hardwood basal areas.

These experiments include both even-aged and uneven-aged stands, and both traditional regeneration cutting treatments as well as some non-traditional approaches to forest management. Interest has also been shown in comparing forest growth of timber management zones (TMZ) where silvicultural practices are applied to streamside management zones (SMZ) along streams and rivers where no management practices are applied (Guldin, et al. 1993).

Objectives of the Study

The objectives of this study are:

1. to quantitatively measure individual-tree growth and stand-level growth for midstory and overstory woody vegetation;
2. to determine if "non-traditional" reproduction cutting methods, with retention of midstory and overstory hardwoods, can produce acceptable levels of growth and yield in the residual stand; and
3. to determine the impact of hardwood retention on pine growth and yield.

CHAPTER II

LITERATURE REVIEW

Ecosystem Management

Ecosystem management, in very simple terms, is the idea that what we leave on the land is as every bit important as what we remove (Salwasser 1992). It can be more formally defined as saving, restoring, and perpetuating all of the ecological pieces of the landscape. Some of these ecological pieces include species, plant and animal communities, and the processes of natural disturbances. It also includes processes which link together communities such as nutrient and water cycling, plant production, and decomposition (Hedrick 1992). Robertson (1992) stated that ecosystem management has been defined by the USDA Forest Service as:

> "... using an ecological approach to achieve the multiple-use management of national forests and grasslands by blending the needs of people and environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems."

This represents a revolution in both strategy and tactics from the manner in which National Forests have been managed over the past four decades. The strategic shift can be seen in the idea that commodities will be produced as a byproduct of ecologically-based interventions in landscapes rather than for the capital value they represent.

Tactical shifts are simply seen in the adaptation of existing forestry practices to better emulate ecological patterns and processes (Guldin 1996).

In June of 1992, the adoption of ecosystem management as a policy for the USDA Forest Service was announced. Four guiding principles have been identified in the policy statement on the implementation of ecosystem management. These include the use of an ecological approach to multiple-use management, the formation of partnerships to achieve shared goals, participation of all individuals involved in Forest Service decisions and activities, and the use of the best scientific knowledge in making decisions (National Silviculture Workshop 1993).

The use of an ecological approach to resource management must take into account the connection between the well-being of people and the health of the environment. This interdependency is reflected increasingly in the Forest Service's stewardship of national forests and grasslands. Ecosystems are constantly changing, existing in a balance of disturbance and recovery processes. Natural disturbances and human induced disturbances can drastically affect the composition, structure, and function of ecosystems. Both excessive disturbance and inadequate disturbance can shift ecosystems away from their historical range of variability. The fact that ecosystem boundaries rarely coincide with administrative boundaries must also be considered when utilizing an ecological approach to resource management (Thomas 1996).

Previous forest management systems were based on the assumption that management can mimic natural processes, especially disturbance. This view characterizes the forest as very resilient, regenerating after harvests and maintaining the essence of the existing natural ecosystem. The forest is seen as a renewable resource and its production can be utilized without threatening long-term productivity. On the other hand, ecosystem management views the forest as less resilient. Management induced disturbance is viewed as more drastic, and the forest resources are considered less renewable than in the previous management systems. It looks to maintain the integrity of the ecosystem and then to adjust human needs to the outputs coinciding with the maintenance of the ecosystem. Forest condition becomes the objective of management in this ecologically based system (Sedjo 1996).

Ecosystem management can benefit NIPF landowners as well as public lands. The objectives of these landowners are often varied and involve more than just timber production. Wildlife management, aesthetics, and watershed management are some examples of NIPF landowner objectives in addition to timber management. Multiple-use goals of NIPF landowners can be met with the application of ecosystem management strategies, much like these goals are accomplished on public lands.

Forest Growth and Yield

Structure and growth of the tree component of ecosystems has a significant influence on forest values and on how those forests are managed. Growth of trees and stands and production of forest products is important to society on many forested acres as a source of economic gain. Forest growth is expressed in two ways: tree growth and stand growth. Tree growth is defined as the enlargement of the stem over time; this reflects overall performance and individual tree vigor. Tree growth is usually measured in diameter or volume units. Stand growth, which is usually determined by forest inventory, is the measure of the productivity of a given area of land. Stand growth is usually expressed in terms of volume or basal area and is used in management as a predictor of yields (Gingrich 1978).

Natural Pine Stands

Natural pine stands can be classified on the basis of age-class composition. Even-aged stands have a range of ages no more than 20% of the rotation age of the stand. Rotation age is defined as the age at which the stand is to be harvested and regenerated. Uneven-aged stands have at least three distinct age classes present and usually gaps are present in the age-class distribution (Daniel et al. 1979). Due to the fact that even-aged stands contain a single age class, foresters tend to manage them as single units and apply a single treatment throughout the entire stand. On the other hand, management of uneven-aged stands is more complex; several treatments are often applied in a single uneven-aged stand (Nyland 1996).

Schumacher (1960) stated that the growth of even-aged natural pine stands is a function of site quality, age, and stocking percentage, which can be expressed as the degree of site utilization. Site quality is directly measured by the site index, which is defined as the height of the dominant stand at some specified base age, usually 50 years. The average total age of the dominant and codominant trees in the stand is obtained by counting the annual rings at breast-height of several trees in these classes. Two years should be added to the number of annual rings observed to estimate total age allowing for two years to reach breast height (Schumacher 1960).

Barrett (1995) stated that in the southern pine region well-stocked, natural even-aged loblolly (*Pinus taeda* L.) and shortleaf (*Pinus echinata* Mill.) stands with 780 trees per acre on sites of index 70, common to the Ouachita Mountains, yield approximately 18 cords per acre at age 20, with an annual growth of almost one cord. These same stands at age 60 with 330 trees per acre produce almost 400 board feet per year (1.2 cords) and could yield over 2500 cubic feet.

Uneven-aged stand structures are typically defined in terms of basal area, maximum diameter, and a quotient termed "q." This quotient is the ratio of the number of trees in a diameter class to the adjacent larger diameter class. Of the three variables, "q" is the least amendable to management. A stand can be easily cut to a specified basal area, and maximum diameter is not difficult to achieve, but "q" is not easily changed. As with even-aged stands, site quality also influences growth and yield (Murphy and Shelton 1994).

Uneven-aged management research in the Ouachita Mountains in western Arkansas implemented on natural shortleaf pine stands has added insight on this silvicultural system. Murphy et al. (1991) reported the findings of a study in the Ouachita Mountain region. Residual stands were adjusted to 60 ft^2/ac of basal area, a maximum diameter of 18 inches, and a "q" value of 1.2 for one-inch diameter classes. The average annual per acre growth of the residual stand was 2 ft^2 of merchantable basal area in the first six-year management period. Average annual per acre merchantable volume growth was 57 ft^3, and sawtimber growth was 157 board feet for the Doyle rule, 231 board feet for the Scribner rule, and 274 board feet for the International ¼-inch rule. Basal area and merchantable volume growth met expectations, but sawtimber growth was less than expected.

Williston (1978) described some of the advantages and disadvantages of uneven-aged management. Some advantages are:

1. Most efficient use of both understocked and well stocked uneven-aged stands.
2. Provides a holding reserve of larger timber ever available to take advantage of high stumpage prices or provide assets in times of financial straits.
3. More acceptable to the general public because it is more aesthetically pleasing, especially along roadsides and scenic areas.
4. Better adapted to fragile soils, steep slopes, high water tables, and very dry sites.
5. Provides periodic income to the landowner without interruption for stand regeneration.
6. Little or no capital investment required.
7. Costly site preparation is not required.
8. Maintains genetic variability.
9. Continually upgrades the stand by favoring fast-growing, high-quality trees, resulting in the production of high quality sawlogs or poles.
10. Provides habitat diversity for wildlife needs.
11. Is not as vulnerable as young, even-aged stands to complete destruction by fire.

Some disadvantages of uneven-aged management are:

1. Lower timber yields and higher technical management costs than in even-aged management.
2. More difficult to regulate the cut on an even-flow basis.
3. Requires extreme care during harvests so not to damage residual growing stock.
4. Requires that each harvest include thinning and cultural treatments to promote growth of residuals and the development of regeneration in the openings.

5. Provides little opportunity to introduce genetically superior trees.
6. Competition for light and space in both the understory and overstory slows the early development of the younger trees.
7. Produces less pulpwood.
8. Is more difficult to utilize prescribed burning.

Pine/Hardwood Mixed Stands

The objectives of many nonindustrial private forest (NIPF) landowners require mixed stands rather than the monoculture pine stands often found in industrial forests. These landowners desire diverse, aesthetically pleasing forests which have a variety of resources to offer. Management of even-aged plantations is a well known science; meeting the objectives of many NIPF landowners requires that more objectives than timber production be taken into account.

If the objectives of the landowner include production of timber as a major commodity, the diversity of the stand must be weighed against growth and yield levels of the timber producing species. More species present will provide greater biological diversity for wildlife habitat and will provide a more aesthetically pleasing forest, but growth and yield of each species will suffer due to competition presented by other plants. Reduced growth and yield in the timber producing species presents economic losses as well. A balance between diversity and sustainable economic production must be achieved.

Competition

The definition of competition given by Nyland (1996) is negative interactions related to the shortage of resources in and around the physical space occupied by adjacent plants or interference with use of even abundant resources. Competition may involve a single resource such as light or multiple resources such as light, soil moisture, and nutrients. Interference by plants of the same species is termed intraspecific competition, while interference by plants of different species is interspecific competition. A species which is a successful competitor is one that has an adequate seed source, adequate growing conditions, and no major susceptibility to disease, insects, or animal damage that would hamper survival. Species differ in the range of conditions under which they grow best and in the adaptations which give them a competitive advantage over other plants. Competition usually provides that the survivor is best adapted to the site and growing conditions unless factors other than the ability to compete influence the final competition (Daniel et al. 1979).

Ross (1986) found that herbaceous and woody vegetation can affect survival and growth of young pine seedlings in two ways. Competition can limit the availability of essential resources required for proper physiological functioning of the seedlings. Without an adequate amount of moisture, light, nutrients, and space, seedlings may grow at a rate well below their optimum or even die. Secondly, certain competing vegetation types may create a suitable habitat for insect and animal pests with the potential to damage or kill the pine regeneration. Research throughout the range of certain western conifers has shown that effective vegetation control increases site resources available to conifers and reduces damage caused by destructive pests.

Cain (1988) stated that in 75-80 year-old southern pine stands located in southern Arkansas, control of competing hardwoods has greatly improved natural pine regeneration. Stem injection, soil application of herbicide, and rotary mowing were used to eradicate hardwood competition from study plots in the pine stands. These treated plots showed much higher amounts of pine regeneration than plots without hardwood control after a three year period. The high density and larger size of pine seedlings on the treated plots gave those seedlings a competitive advantage over re-invading hardwoods.

Quicke, et al. (1996) found that late summer and spring application of herbicide to hardwoods competing with three-year-old loblolly pine in Arkansas greatly improved pine growth. They concluded that even with relatively low levels of hardwood competition, good pine growth responses are possible from chemical release treatments. In a similar study reported by Bacon and Zedaker (1987), eight competition control levels were applied to three ages of loblolly pine stands in Virginia. The competition control levels were removal of all, two-thirds, one-third, or none of the hardwood stems either with or without herbaceous weed control. After three growing seasons, significant increases in pine diameter and volume growth with competition control were seen. Better pine growth was noted in treatments combining woody and herbaceous control than in the same treatments containing only woody control after three growing seasons in the two youngest stands. Two-thirds woody control combined with herbaceous control resulted in a 100% increase of pine volume growth over the plots with no competition control at the beginning of the second growing season.

In Georgia, a 65-year-old mixed stand of hardwood and pine was subjected to total hardwood control (McMinn 1988). This stand, which was composed of approximately 50% shortleaf pine and 50% hardwood, had all hardwoods present felled. Plots were established in areas where the felled hardwoods were left lying at the stump, and plots were put in where hardwoods were totally removed in a whole-tree harvesting system. After five years, residual pines responded to both treatments in basal area growth, but there was no significant difference between the two treatments.

Management Effects Due to Partial Harvest

Partial harvests are commonly done to improve the health and quality of the residual stand, therefore increasing potential economic yield of the stand. Partial harvests are also implemented to encourage regeneration of the forest stand. These reproduction cuttings are a common way to naturally regenerate southern pine stands. There is little research published on growth and yield of residual stands after reproduction cuttings are applied.

One of the most popular forms of partial harvests is thinning, which is removing a portion of the stand so the residual trees will have less competition for available resources. A basic idea of thinning is the concentration of growth on the better trees and general improvement in product quality (Parker 1979). Thinning is a very valuable tool in a forester's management options in both even-aged and uneven-aged stands.

Wittwer, et al. (1996) stated that thinning programs are often associated with intensive silvicultural systems utilizing artificial regeneration. In overstocked naturally regenerated stands density manipulation can be important as well. Thinning has a great impact on sawtimber production but can also influence forage, wildlife habitat, and stand appearance.

Wittwer, et al. concluded that thinning in dense, previously unthinned 24-28 year-old natural stands of shortleaf pine results in rapid growth response of the residual stand. These natural stands in the Ouachita Mountains of southeastern Oklahoma have the capacity to respond to thinning delayed well past the ideal thinning age. In southwest Louisiana, thinning of young natural stands of longleaf pine (*Pinus palustris* Mill.) had little effect on height growth, but diameter growth was improved (Sparks, et al. 1980). Increased economic value is seen in higher quality residual trees, as well as value acquired from the sale of the harvested material in the thinning operation.

In some cases, total volume produced in an unthinned stand at the time of harvest has been more than the total volume produced in a thinned stand. This higher amount of volume is usually of lesser quality than the wood produced in the thinned stand, and is of equal or lesser economic value than the wood from the thinned stand. For example, the unthinned stand might produce large amounts of pole-size trees, while the thinned stand produces fewer, but more economically valuable, sawlog-size trees. The total value of the sawlogs would be much greater than that of the poles, even though there were larger amounts of pole-size timber.

Actual Residual Basal Area vs. Target Residual Basal Area

In thinning or reproduction cutting prescriptions, residual stands are reduced to an expected, or target level. After the prescription is applied, the residual basal area which is actually present in the stand is referred to as an observed or actual residual basal area level. In a study on the Ouachita and Ozark National Forests, Guldin, et al. (1995) found that actual residual basal area and target residual area levels were significantly different. Uneven-aged methods were found to have the greatest deviation from the target levels because they are more difficult to impose and adjust when marking. These deviations were also analyzed by species group. Basal area deviations were found to vary from -3.39 ft^2/ac in the pine group selection method to 14.14 ft^2/ac in the low-impact single tree selection method. Among all treatments hardwood basal area deviation was greater than that of conifers. Single-tree selection and group selection both had total hardwood basal area deviations greater than 10 ft^2/ac.

Volume Tables

A volume table is a tabulation that provides the average contents for standing trees of various sizes and species (Avery and Burkhart 1994). Volume units most commonly employed are board feet, cubic feet, or a weight expression such as green tons. Volume tables that are based on the single variable of dbh are referred to as local volume tables; those that require the user to also obtain tree height and possibly form or taper are referred to as standard volume tables. These labels are often misleading; they tend to imply that local volume tables are somehow inferior to standard volume tables. This assumption is not necessarily true, particularly when the local volume table in question is derived from a standard volume table.

Volume tables, whether local or standard, may also be classified as species tables or composite tables. Species tables are constructed for an important timber species or small group of similar species. The main disadvantage of this type of volume table is the large number of species encountered in most regions. Composite tables are intended for application to diverse species, often including both conifers and hardwoods. These tables tend to be less accurate than species tables because they are generalized to apply to many different species.

Construction of Local Volume Tables

Local volume tables based on the single variable of dbh may be constructed from existing standard volume tables or from the dbh and height measurement of standing trees. Construction of volume tables based on dbh alone presumes that a definitive height-diameter relationship exists for the species under consideration; trees of a given diameter class are assumed to be of similar form and height. If this is true, all trees in a given diameter class can be logically assigned the same average volume. Thousands of sample trees may be represented in some local volume tables. From 30 to 100 samples are usually considered a minimum number for small tracts, depending on the range of diameter classes to be included in the final table (Avery and Burkhart 1994).

CHAPTER III

DATA DESCRIPTION

This study is incorporated under the study plan entitled "Ecosystem Management Research on the Ouachita/Ozark National Forests: Silviculture Research" developed by the USDA Forest Service (Guldin, et al. 1993). Both "traditional" and "non-traditional" even-aged and uneven-aged reproduction cutting methods have been implemented and evaluated in an attempt to (1) establish and/or maintain stands comprised of a mixture of pines and hardwoods, (2) provide for a good balance of timber and non-timber resources, and (3) respond to public concern regarding forest management on the Ouachita and Ozark National Forests in southeastern Oklahoma and western Arkansas. The term "traditional" refers to partial cutting methods (seed-tree, shelterwood, group selection, and single-tree selection) in which the residual overstory is composed only of shortleaf pine and in which intensive competition control measures are applied. The non-traditional cutting methods will retain a significant component of midstory and overstory hardwoods throughout the stand for the enhancement of visual, wildlife, recreation, water, and biodiversity values (Guldin, et al. 1993).

Statistical Design Structure

The statistical design structure used in this study is a split-plot within a randomized complete block design with a 13 x 2 factorial treatment structure. The whole-plot treatment is reproduction cutting method, of which there are 13 treatments including two controls. The sub-plot treatment is physiographic zone, which includes two zones. Sample stands are located on all Ranger Districts on the Ouachita National Forest except the Tiak district in the coastal plain of extreme southeastern Oklahoma and the Winona district located on the eastern edge of the forest in central Arkansas. The Ozark National Forest, located in northwestern Arkansas, has sample stands only within the Pleasant and Magazine Ranger Districts along the southern edge of the forest.

Ecoregions

The location of the study is blocked by four ecoregions. Thirteen stands in each of the four ecoregions were selected for treatment. These blocks are as follows:

a) Arkansas Rivers and Valleys (NORTH)

b) western half of the Central Ouachita Mountains (WEST)

c) eastern half of the Central Ouachita Mountains (EAST)

d) South Fork subregion of the Central Ouachita Mountains (SOUTH)

Treatments

Thirteen reproduction cutting treatments including two controls were applied in each ecoregion for a total of 52 research stands. The two controls are:

a) clearcutting, not split (CCNS)

b) unmanaged control, not split (UC)

The inclusion of clearcutting in the study as a control treatment is similar in scientific justification to the inclusion of the unmanaged control, to evaluate the extremes in reproduction cutting intensity. Clearcutting will anchor one end of the study as the most intensive, and possibly the most site-disturbing, of the reproduction cutting methods once commonly imposed in the region. The unmanaged control will anchor the other extreme of the study in that it represents minimum human-induced disturbance (Guldin, et al. 1993).

A separate site preparation study is being conducted on the 52 research stands. Treatments labeled "split" have had different site preparation techniques applied to quadrants of the stand, while those labeled "not split" have had a uniform site preparation method applied to the whole stand. This site preparation study involves stand regeneration rather than growth of the residual stand after treatments are applied.
Five even-aged treatments were implemented in the study. They are as follows:

a) seed-tree pine, split (STP)

b) seed-tree pine/hardwood, split (STPH)

c) shelterwood pine, split (SWP)

d) shelterwood pine/hardwood, split (SWPH)

e) shelterwood pine/hardwood, not split (SWW)

Six uneven-aged treatments were also implemented. They include:

a) group selection pine, not split (GSP)
(no trees retained in group openings, pines and hardwoods between group openings)

b) group selection pine/hardwood, not split (GSPH)
(hardwoods retained within group openings, pines and hardwoods between group openings)

c) single-tree selection pine, split (STSP)

d) single-tree selection pine/hardwood, split (STSH)

e) single-tree selection pine/hardwood, not split (STSW)

f) single-tree selection pine/hardwood, low impact, split (STSL)

Treatments labeled "pine" have minimal retention of midstory and overstory hardwoods after reproduction cutting is applied to the stand. Those treatments labeled "pine/hardwood" have some retention of midstory and overstory hardwoods after cutting is applied (Table I). After treatments were applied actual basal area residual levels for pine and hardwoods were recorded (Table II). The single-tree selection treatment in the uneven-aged methods labeled "low impact" utilizes reproduction cutting openings in the forest canopy less than 50 feet in diameter.

TABLE I

LIST OF TREATMENTS WITH TARGET RESIDUAL BASAL AREA LEVELS FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

TREAT-MENT	SHORTLEAF PINE BASAL AREA PER ACRE ($FT.^2$)	HARDWOOD BASAL AREA PER ACRE ($FT.^2$)
CCNS	0	0 - 5
GSP	50	10
GSPH	50	10
STP	20	0 - 5
STPH	10	10
STSH	50	10
STSL	60	10
STSP	60	0 - 5
STSW	50	10
SWP	40	0 - 5
SWPH	30	10
SWW	30	10
UC	*	*

* Residual basal areas of unmanaged control stands are the same as pre-treatment conditions.

TABLE II

LIST OF TREATMENTS WITH ACTUAL POST-TREATMENT RESIDUAL BASAL AREA LEVELS FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

TREAT-MENT	SHORTLEAF PINE BASAL AREA PER ACRE ($FT.^2$)	HARDWOOD BASAL AREA PER ACRE ($FT.^2$)
CCNS	1	5
GSP	52	24
GSPH	54	26
STP	18	10
STPH	12	10
STSH	58	14
STSL	74	20
STSP	64	11
STSW	57	13
SWP	38	11
SWPH	32	14
SWW	34	13
UC	98	29

Physiographic Zone

Each of the 52 research stands were split into two physiographic zones. The first is the timber management zone (TMZ) where reproduction cutting treatments were applied. The other is the streamside management zones (SMZ) along streams within the stand where no cutting treatments have been applied.

Selection of Sample Stands

In the summer and fall of 1991 52 natural stands, 13 in each of the four ecoregions, on the Ouachita and Ozark National Forests were selected for use in this study, and the treatment to be applied to each one of these stands was randomly selected. These stands were selected from a list of stands on the two National Forests which were to be harvested soon. Each of these stands selected is at least 35 acres in size, had pre-treatment shortleaf pine basal areas between 60 - 110 ft^2/ac, and pre-treatment hardwood basal areas between 20 - 50 ft^2/ac. Implementation of reproduction cutting treatments occurred between May 15 and September 15, 1993.

Measurement of Sample Stands

Measurement Dates

Quantitative measurement of shortleaf pine and hardwoods on each of the 52 stands was conducted in the dormant season of 1993-94, immediately following application of the reproduction cuttings. These measurements are referred to as the postharvest year 0 measurements. The stands were measured again following the same procedures in the dormant season of 1995-96, two years after the postharvest year 0 measurements were taken. This second measurement is referred to as postharvest year 2.

Measurement Procedures

All measurements utilized in this study were taken by crews from the USDA Forest Service Southern Research Station work unit located in Hot Springs, Arkansas. Within each of the 52 sample stands, 14 measurement plots were permanently located for a total of 728 measurement plots for the whole study. Twelve of these plots are located in the timber management zones (TMZ) of each stand, and the remaining two are located in the streamside management zones (SMZ) within the stand. Fixed radius 0.1 ac plots were utilized. All trees within the 37.24 ft. radius of the fixed plot were identified to species, measured for dbh to the nearest 0.1 in. with a diameter tape, and mapped for location from plot center by compass azimuth, distance, and slope. During the postharvest year 0 measurement, numbered metal tags were placed at the base of each tree within the plot.

Measurements of each plot began at a compass azimuth of 0 degrees magnetic, and proceeded clockwise around the plot.

A subsample of both midstory and overstory shortleaf pines was selected on each plot for height measurements. The subsample of trees on each plot chosen for height measurement were selected as follows:

Even-aged Treatments Using the tree tag numbers, the first shortleaf pine was selected for measurement of total height and height to base of live crown to the nearest 0.1 ft. and dbh to the nearest 0.1 in. These height measurements were repeated on the 4th and 7th pines located on the plot. If this selection process resulted in fewer than three pines per plot, the process was repeated beginning with the 2nd pine, proceeding to the 5th and 8th pines.

Uneven-aged Treatments Using the tree tag numbers, the first shortleaf pine was selected for measurement. These measurements were repeated on the 4th, 7th, and 10th pines located on the plot. If this selection process resulted in fewer than four pines per plot, the process was repeated beginning with the 2nd pine, proceeding to the 5th, 8th, and 11th pines.

Within the 624 plots located in TMZ zones, 1643 pines were selected for height measurement. Among the 104 plots located in SMZ zones, 330 pines were selected for the height subsample. These tree measurements were placed into two separate datasets; one for trees within TMZ's and the other dataset for trees within SMZ's.

Calculation of Stand Tables

Postharvest year 0 shortleaf pine stand tables based on measurement of plots within TMZ's for each of the 52 stands were calculated using the postharvest year 0 TMZ measurement data. Stand tables based on plots within SMZ zones were calculated for each stand at postharvest year 0 also. These stand tables consisted of pine trees per acre and pine basal area per acre by one-inch diameter classes for each research stand. Postharvest year 2 shortleaf pine stand tables based on both TMZ and SMZ plots were calculated for each stand following the same procedure.

CHAPTER IV

ANALYSES AND RESULTS

Development of Local Volume Tables

Two local volume tables were developed to predict shortleaf pine volume on the Ouachita / Ozark National Forests. One table was developed to predict volumes within timber management zones, while another was developed to predict volumes within streamside management zones. The height subsample dataset from plots within TMZ's was used to develop the TMZ volume table, and the height subsample dataset from plots within SMZ's was used to develop the SMZ volume table.

Murphy and Farrar's (1987) volume prediction equations for natural shortleaf pine were applied to each tree within the TMZ and SMZ height subsample datasets. These equations use tree dbh, total height, and height to the base of live crown as input variables. These equations generate live crown ratio, individual tree basal area ($ft.^2$), total cubic volume ($ft.^3$), sawlog cubic volume ($ft.^3$), scribner board foot volume, and total weight in green tons for each tree in the datasets.

SAS (1997) was used to develop regression equations based on the predictions generated by Murphy and Farrar's equations. PROC REG was used to regress the natural logarithm of total cubic volume (TCV) on the natural logarithm of individual tree basal area. This was also done for sawlog cubic volume (SCV), scribner board foot volume (SBF), and total weight in green tons (TON). By using this procedure, separate regression equations for TCV, SCV, SBF, and TON were created based on the trees measured in both TMZ and SMZ height subsamples. The TMZ and SMZ equations and their corresponding fit indexes can be found in Tables III and IV.

The SMZ regression equations were compared to the corresponding TMZ regression equations by the use of indicator variables. The slope of the SMZ sawlog cubic volume equation was found to be significantly different ($p = 0.0001$) than the slope of the TMZ sawlog cubic volume equation. The slope of the SMZ scribner board foot volume equation was also found to be significantly different ($p = 0.0001$) than the slope of the TMZ scribner board foot volume equation. These significant differences justify the need for separate local volume tables to estimate volumes within TMZ's and SMZ's.

Individual tree basal area for each one-inch diameter class ranging from four to twenty-seven was entered into each TMZ regression equation to develop the TMZ local volume table (Table V). For example, to develop the volume estimation for a tree which falls within the ten-inch diameter class, the individual basal area of a tree which has a dbh of 10.0 in. (0.54542 $ft.^2$) was entered into the TCV regression equation, SCV equation, SBF equation, and the TON equation. This tree which falls within the ten-inch diameter class contains 14.046 $ft.^3$ TCV, 11.651 $ft.^3$ SCV, 49.010 SBF, or 0.507 TON of merchantable wood. The SMZ local volume table (Table VI) was developed using the same procedures that were used in development of the TMZ local volume table.

TABLE III

EQUATION[1] AND FIT INDEX[2] OF EACH VOLUME ESTIMATION USED TO CREATE TIMBER MANAGEMENT ZONE VOLUME TABLE

ESTIMATION	EQUATION	FIT INDEX
TOTAL VOL. ($FT.^3$)	$\exp(3.467464 + 1.361109 \times \ln BA)$ n = 1643 MSE = 0.024	0.953
SAWLOG VOL. ($FT.^3$)	$\exp(3.302348 + 1.397012 \times \ln BA)$ n = 951 MSE = 0.017	0.950
SCRIBNER VOL. (BD. FT.)	$\exp(4.887563 + 1.642242 \times \ln BA)$ n = 951 MSE = 0.027	0.949
TOTAL TONS (GREEN)	$\frac{\exp(7.705619 + 1.293416 \times \ln BA)}{2000}$ n = 1643 MSE = 0.019	0.966

[1] lnBA = Natural log of individual basal area ($ft.^2$) of trees within timber management zones.

[2] Fit index for each equation was calculated within timber management zone height subsample dataset, and is equal to 1 - uncorrected sum of squares of residuals / corrected sum of squares of dependent variable.

TABLE IV

EQUATION[1] AND FIT INDEX[2] OF EACH VOLUME ESTIMATION USED TO CREATE STREAMSIDE MANAGEMENT ZONE VOLUME TABLE

ESTIMATION	EQUATION	FIT INDEX
TOTAL VOL. ($FT.^3$)	exp (3.487289 + 1.352662 × lnBA) n = 330 MSE = 0.025	0.955
SAWLOG VOL. ($FT.^3$)	exp (3.305453 + 1.526473 × lnBA) n = 262 MSE = 0.023	0.939
SCRIBNER VOL. (BD. FT.)	exp (4.891052 + 1.805774 × lnBA) n = 262 MSE = 0.036	0.933
TOTAL TONS (GREEN)	$\frac{\exp(7.722917 + 1.298020 \times \ln BA)}{2000}$ n = 330 MSE = 0.020	0.961

[1] lnBA = Natural log of individual basal area ($ft.^2$) of trees within streamside management zones.

[2] Fit index for each equation was calculated within streamside management zone height subsample dataset, and is equal to 1 - uncorrected sum of squares of residuals / corrected sum of squares of dependent variable.

TABLE V

SHORTLEAF PINE VOLUME TABLE[1] OF TOTAL CUBIC VOLUME[2], SAWLOG CUBIC VOLUME[3], SCRIBNER BOARD FEET[3], AND TOTAL GREEN TONS[4] BY ONE-INCH DIAMETER CLASSES FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

DBH CLASS	TOTAL VOL. ($FT.^3$)	SAWLOG VOL. ($FT.^3$)	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
4	1.159	.	.	.047
5	2.128	.	.	.084
6	3.496	.	.	.135
7	5.319	.	.	.201
8	7.651	.	.	.285
9	10.543	.	.	.386
10	14.046	11.651	49.010	.507
11	18.206	15.207	67.020	.649
12	23.072	19.392	89.190	.812
13	28.689	24.252	116.010	.999
14	35.102	29.831	147.990	1.210
15	42.355	36.173	185.620	1.447
16	50.489	43.321	229.450	1.710
17	59.549	51.317	280.010	2.000
18	69.574	60.203	337.830	2.319
19	80.606	70.020	403.480	2.667
20	92.685	80.810	477.520	3.045
21	105.850	92.612	560.520	3.455
22	120.141	105.467	653.050	3.897
23	135.595	119.414	755.710	4.372
24	139.479	133.274	823.210	4.859
25	154.447	147.868	928.410	5.381
26	170.265	163.292	1038.560	5.931
27	186.933	179.547	1154.500	6.512

[1] Volume table is based on dbh and total height measurements of 1643 shortleaf pine trees in timber management zones scattered throughout the Ouachita / Ozark National Forests. Murphy and Farrar's (1987) volume prediction equations for natural shortleaf pine were applied to these trees, volume table is based on these predictions.

Merchantability specifications:

pulpwood minimum tree dbh: 3.5 in.
pulpwood top diameter: 2 in. (outside bark)
pulpwood stump height: 6 in.

TABLE V

Merchantability specifications (continued):

sawlog minimum tree dbh: 9.6 in.
sawlog top diameter: 7 in. (inside bark)
sawlog stump height: 12 in.
sawlog minimum log length: 8 ft.
sawlog trim allowance: 3.6 in.

[2] Total cubic volume is an inside bark estimation.

[3] Sawlog cubic volume and scribner board feet estimations are only applicable to trees 9.6 in. dbh and larger.

[4] Total green tons includes only merchantable stem wood.

TABLE VI

SHORTLEAF PINE VOLUME TABLE[1] OF TOTAL CUBIC VOLUME[2], SAWLOG CUBIC VOLUME[3], SCRIBNER BOARD FEET[3], AND TOTAL GREEN TONS[4] BY ONE-INCH DIAMETER CLASSES FOR STREAMSIDE MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

DBH CLASS	TOTAL VOL. ($FT.^3$)	SAWLOG VOL. ($FT.^3$)	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
4	1.207	.	.	.048
5	2.208	.	.	.085
6	3.616	.	.	.137
7	5.487	.	.	.204
8	7.874	.	.	.288
9	10.829	.	.	.391
10	14.400	10.805	44.540	.514
11	18.636	14.455	62.840	.659
12	23.582	18.853	86.040	.826
13	29.284	24.072	114.880	1.016
14	35.784	30.183	150.130	1.232
15	43.128	37.260	192.610	1.474
16	51.355	45.374	243.170	1.742
17	60.508	54.600	302.690	2.039
18	70.627	65.009	372.090	2.366
19	81.751	76.677	452.330	2.722
20	93.920	89.675	544.390	3.110
21	99.617	94.407	566.100	3.472
22	112.070	106.550	648.240	3.905
23	125.356	119.504	734.840	4.368
24	139.480	133.274	823.210	4.859
25	154.448	147.869	928.410	5.381
26	170.265	163.292	1038.560	5.931
27	186.933	179.547	1154.500	6.511

[1] Volume table is based on dbh and total height measurements of 330 shortleaf pine trees in streamside management zones scattered throughout the Ouachita / Ozark National Forests. Murphy and Farrar's (1987) volume prediction equations for natural shortleaf pine were applied to these trees, volume table is based on these predictions.

Merchantability specifications:

pulpwood minimum tree dbh: 3.5 in.
pulpwood top diameter: 2 in. (outside bark)
pulpwood stump height: 6 in.

TABLE VI

Merchantability specifications (continued):

sawlog minimum tree dbh: 9.6 in.
sawlog top diameter: 7 in. (inside bark)
sawlog stump height: 12 in.
sawlog minimum log length: 8 ft.
sawlog trim allowance: 3.6 in.

[2] Total cubic volume is an inside bark estimation.

[3] Sawlog cubic volume and scribner board feet estimations are only applicable to trees 9.6 in. dbh and larger.

[4] Total green tons includes only merchantable stem wood.

Volume Estimations

The TMZ and SMZ local volume tables were applied to each of the 52 TMZ and SMZ postharvest year 0 stand tables provided by the USDA Forest Service Southern Research Station. This created two stock tables for each of the 52 research stands which contain an estimation of shortleaf pine TCV, SCV, SBF and TON per acre for each one-inch diameter class present. The postharvest year 0 TMZ and SMZ stand tables were summarized into total trees per acre and total basal area ($ft.^2$) per acre for each research stand. The postharvest year 0 TMZ and SMZ stock tables were also summarized into TCV, SCV, SBF, and TON per acre for each research stand (Appendix B).

The postharvest year 2 volume estimations were generated using the exact procedure described above, except the postharvest year 2 stand tables were substituted in place of the postharvest year 0 stand tables used before. TMZ and SMZ stand and stock summary tables for postharvest year 2 were also calculated (Appendix C).

Calculation of Growth

Trees per acre, basal area per acre, TCV, SCV, SBF, and TON per acre growth of each stand for the two-year period (Appendix D) was calculated by subtracting the postharvest year 0 estimates from the postharvest year 2 estimates. Mean trees per acre and basal area per acre growth by reproduction cutting treatment were calculated (Table VII). Mean TCV, SCV, SBF, and TON growth per acre was calculated by physiographic zone (Table VIII), ecoregion (Table IX), and by reproduction cutting treatment (Table X).

TABLE VII

SHORTLEAF PINE TREES PER ACRE CHANGE AND BASAL AREA PER ACRE GROWTH[1] TREATMENT MEANS IN THE OUACHITA / OZARK NATIONAL FORESTS

TREAT-MENT	TREES PER ACRE CHANGE	BASAL AREA ($FT.^2$) PER ACRE GROWTH
CCNS	-8	-2
GSP	-2	0
GSPH	-7	3
STP	-3	1
STPH	-5	0
STSH	-5	2
STSL	-4	2
STSP	-6	1
STSW	-4	1
SWP	-5	1
SWPH	-3	2
SWW	-1	2
UC	-8	1

[1] Growth is for the 2-year period between postharvest year 0 and postharvest year 2 measurements.

TABLE VIII

SHORTLEAF PINE TOTAL CUBIC, SAWLOG CUBIC, AND SCRIBNER BOARD FOOT VOLUME GROWTH[1] AND TOTAL GREEN TON GROWTH[1] PER ACRE PHYSIOGRAPHIC ZONE MEANS IN THE OUACHITA / OZARK NATIONAL FORESTS

PHYSIO-GRAPHIC ZONE	TOTAL VOL. ($FT.^3$) GROWTH	SAWLOG VOL. ($FT.^3$) GROWTH	SCRIBNER BD. FT. VOL. GROWTH	TOTAL TON (GREEN) GROWTH
TMZ	64.4	68.5	381	2.08
SMZ	42.6	55.8	322	1.35

[1] Growth is for the 2-year period between postharvest year 0 and postharvest year 2 measurements.

TABLE IX

SHORTLEAF PINE TOTAL CUBIC, SAWLOG CUBIC, AND SCRIBNER BOARD FOOT VOLUME GROWTH[1] AND TOTAL GREEN TON GROWTH[1] PER ACRE ECOREGION MEANS IN THE OUACHITA / OZARK NATIONAL FORESTS

ECO-REGION	TOTAL VOL. ($FT.^3$) GROWTH	SAWLOG VOL. ($FT.^3$) GROWTH	SCRIBNER BD. FT. VOL. GROWTH	TOTAL TON (GREEN) GROWTH
NORTH	56.5	59.8	342	1.83
EAST	49.1	59.2	323	1.57
SOUTH	31.0	46.7	274	0.93
WEST	77.5	83.0	468	2.54

[1] Growth is for the 2-year period between postharvest year 0 and postharvest year 2 measurements.

TABLE X

SHORTLEAF PINE TOTAL CUBIC, SAWLOG CUBIC, AND SCRIBNER BOARD FOOT VOLUME GROWTH[1] AND TOTAL GREEN TON GROWTH[1] PER ACRE TREATMENT MEANS[2] IN THE OUACHITA / OZARK NATIONAL FORESTS

TREAT-MENT	TOTAL VOL. ($FT.^3$) GROWTH	SAWLOG VOL. ($FT.^3$) GROWTH	SCRIBNER BD. FT. VOL. GROWTH	TOTAL TON (GREEN) GROWTH
CCNS	-68.5	-47.7 a	-224 a	-2.43
GSP	12.4	29.6 abc	132 ab	0.41
GSPH	124.7	136.3 d	718 c	4.11
STP	25.1	30.3 abc	174 ab	0.83
STPH	19.9	20.9 ab	119 ab	0.62
STSH	99.0	107.9 bcd	573 bc	3.27
STSL	82.6	88.7 bcd	488 bc	2.70
STSP	44.9	63.8 bcd	363 bc	1.39
STSW	50.1	56.2 bcd	326 bc	1.58
SWP	19.5	22.3 ab	157 ab	0.56
SWPH	87.8	90.6 bcd	468 bc	2.94
SWW	99.6	93.6 bcd	591 bc	3.23
UC	98.4	115.6 cd	688 c	3.10

[1] Growth is for the 2-year period between postharvest year 0 and postharvest year 2 measurements.

[2] Treatment means within the same column with the same letter were found to be not significantly different at the alpha = 0.10 level by Fisher's Least Significant Difference (LSD) procedure.

Analyses of Growth

SAS was used to analyze the growth of each physiographic zone within each of the research stands. PROC MIXED was used to analyze TCV, SCV, SBF, and TON growth per acre. Within each analysis least squares comparisons of reproduction cutting treatment means were also conducted. In each of the analyses, the physiographic zone by reproduction cutting treatment interaction did not affect growth significantly (p-values range from 0.4939 to 0.5564). Physiographic zone also did not significantly affect shortleaf pine growth (p-values range from 0.3405 to 0.5826). in any of the four analyses.

Conclusions on the effect of hardwood retention on pine growth cannot be drawn in this study due to the inaccuracy of residual hardwood basal area adjustments. After reproduction cutting treatments were applied residual hardwood basal area level differences between treatments labeled "pine" and those labeled "pine/hardwood" were almost nonexistent. Actual residual hardwood basal area levels for treatments labeled "pine/hardwood" tended not to deviate greatly from the target level of 10 $ft.^2$/ac., but actual hardwood residual basal area levels of treatments labeled "pine" deviated greatly from the target level of 0-5 $ft.^2$/ac (Table XI). In these treatments, the actual levels were very similar to those of "pine/hardwood" treatments.

The TCV and TON analyses both found that reproduction cutting treatment had a moderately significant effect on pine growth (p-values of 0.1153 and 0.1030). Treatments utilizing uneven-aged management (GSP, GSPH, STSH, STSL, STSP, STSW) yielded an average of about 70 $ft.^3$ of TCV per acre or 2.2 TON per acre. The GSPH treatment

TABLE XI

LIST OF TREATMENTS WITH POST-TREATMENT RESIDUAL BASAL AREA DEVIATION FROM TARGET LEVELS FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

TREAT-MENT	SHORTLEAF PINE BASAL AREA PER ACRE ($FT.^2$)	HARDWOOD BASAL AREA PER ACRE ($FT.^2$)
CCNS	+1	+1
GSP	+2	+14
GSPH	+4	+16
STP	-2	+5
STPH	+2	0
STSH	+8	+4
STSL	+14	+10
STSP	+4	+6
STSW	+7	+3
SWP	-2	+5
SWPH	+2	+4
SWW	+4	+3
UC	0	0

displayed the highest growth rate of the uneven-aged management stands. Even-aged treatments (STP, STPH, SWP, SWPH, SWW) on the average had the slowest growth rates at approximately 50 $ft.^3$ of TCV per acre or 1.6 TON per acre. Of the even-aged treatments, the SWW cutting grew at the highest rate. In both analyses the UC grew at higher rates than the means of both uneven and even-aged treatments, with approximately 100 $ft.^3$ of TCV per acre or 3.1 TON per acre.

The SCV and SBF analyses both found that cutting treatment had a significant effect (p-values of 0.0854 and 0.0724) on shortleaf pine growth per acre. It seems that cutting treatment had a slightly more significant effect on sawtimber size trees than it did on smaller, pulpwood size timber. Least squares comparisons of treatment means by Fisher's Least Significant Difference (LSD) method found four groups of means which were significantly similar at the alpha = 0.10 level in the SCV analysis. In the SBF analysis, three groups were identified. As in the TCV and TON analyses, the UC exhibited higher per acre growth rates than the means of both uneven and even-aged treatments, with 115 $ft.^3$ of SCV per acre or 688 SBF per acre. Uneven-aged treatments as a whole produced approximately 80 $ft.^3$ of SCV or 430 SBF of per acre growth. The GSPH treatment produced the highest growth rate of the uneven-aged treatments. As a whole, the slowest growth rates in terms of SCV and SBF were observed with even-aged management applications. As above, the fastest growing even-aged treatment was the SWW.

In terms of silvicultural systems, in this case uneven-aged management produced higher growth rates per acre than even-aged management did ($p = 0.0923$). This agrees with uneven-management strategies which involve regenerating small openings in the forest stand while at the same time increasing standing volume of residual trees in the rest of the stand. In some even-aged practices such as seed-tree cuts, the most important objective is regeneration of the stand, while significant increases in volume of the residual seed trees is not expected. Very low per acre growth rates of seed-tree treatments seen in this study are due to low numbers of trees per acre, and the fact that residual trees left for seed production are generally large mature to over-mature individuals. Other even-aged strategies such as shelterwood treatments rely upon residual overstory pines to regenerate the stand while increasing in volume themselves. In this study, shelterwood treatments produced moderate to high growth levels very similar to those levels observed in uneven-aged, single-tree selection treatments.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The results of this study will be useful to managers of public forest land and private landowners in Arkansas and Oklahoma. Foresters managing the Ouachita / Ozark National Forests with ecosystem management strategies will find this information useful as a guide to predict yields of various forest stands with silvicultural treatments similar to those implemented in this study. This study could also serve as an example when forest researchers plan and implement more long-term growth and yield studies in this region of Arkansas and Oklahoma.

Forest stands within timber management zones and streamside management zones exhibited similar growth rates in the region involved in the study. The short growth period of two growing seasons analyzed in this study did find significant differences among reproduction cutting treatments, but a longer growth period will more likely identify larger differences in growth characteristics of the residual stand. It is not uncommon to see little response to silvicultural treatments the first growing season after implementation of the prescription. Future studies in this area could use the same procedures as this study, but over longer periods of time.

In order to effectively study the effect of hardwoods retained in the midstory and overstory of the forest canopy on pine growth and yield, careful implementation of residual hardwood basal areas must be practiced. Care must taken as stands are marked for basal area reductions, as well as when partial harvests are implemented. Frequent checking of hardwood basal area with prisms as basal area reductions are being applied is one way to help address the problem of actual residual basal area vs. target residual basal area deviation. Improving marking accuracy in forest stands may require progress in silvicultural theory, and greater emphasis in continuing education and forestry curricula (Guldin, et al. 1995).

Although there is much literature on forest stand response to basal area reduction, mid-rotation thinning studies are the most common. There is little information on response of residual stands to implementation of reproduction cuttings, especially in even-aged silviculture systems. Studies on this response are more common in uneven-aged systems where forest regeneration and residual stand growth are of equal importance at a given time. Forest managers have many options when considering silvicultural systems and management prescriptions to allow for adequate forest regeneration and growth of the residual stand at the same time. While this study is limited by a short frame of time in which forest growth was analyzed, it can contribute in helping managers make wise decisions in the future.

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APPENDIXES

APPENDIX A1

LIST OF COMPARTMENT / STANDS WITH TARGET RESIDUAL BASAL AREA LEVELS FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	SHORTLEAF PINE BASAL AREA PER ACRE (FT.^{2})	HARDWOOD BASAL AREA PER ACRE (FT.^{2})
45816	CCNS	NORTH	0	0 - 5
106715	CCNS	EAST	0	0 - 5
129202	CCNS	WEST	0	0 - 5
165805	CCNS	SOUTH	0	0 - 5
1418	GSP	NORTH	50	10
110609	GSP	EAST	50	10
128619	GSP	WEST	50	10
164801	GSP	SOUTH	50	10
3542	GSPH	SOUTH	50	10
4618	GSPH	NORTH	50	10
6206	GSPH	WEST	50	10
112411	GSPH	EAST	50	10
45810	STP	NORTH	20	0 - 5
84506	STP	WEST	20	0 - 5
108407	STP	EAST	20	0 - 5
164608	STP	SOUTH	20	0 - 5
24806	STPH	WEST	10	10
103617	STPH	NORTH	10	10
111922	STPH	EAST	10	10
165106	STPH	SOUTH	10	10
42802	STSH	NORTH	50	10
107310	STSH	EAST	50	10
131416	STSH	WEST	50	10
165416	STSH	SOUTH	50	10
6208	STSL	SOUTH	60	10
23117	STSL	WEST	60	10
36704	STSL	NORTH	60	10
107719	STSL	EAST	60	10
104403	STSP	NORTH	60	0 - 5
112505	STSP	EAST	60	0 - 5
128401	STSP	WEST	60	0 - 5
165816	STSP	SOUTH	60	0 - 5
7010	STSW	NORTH	50	10
24817	STSW	WEST	50	10

COMP. / STAND	TREAT-MENT	ECO-REGION	SHORTLEAF PINE BASAL AREA PER ACRE ($FT.^2$)	HARDWOOD BASAL AREA PER ACRE ($FT.^2$)
60909	STSW	EAST	50	10
164913	STSW	SOUTH	50	10
3541	SWP	SOUTH	40	0 - 5
44303	SWP	NORTH	40	0 - 5
89501	SWP	WEST	40	0 - 5
109706	SWP	EAST	40	0 - 5
21811	SWPH	WEST	30	10
45609	SWPH	NORTH	30	10
109404	SWPH	EAST	30	10
166006	SWPH	SOUTH	30	10
2701	SWW	SOUTH	30	10
45712	SWW	NORTH	30	10
83301	SWW	WEST	30	10
111921	SWW	EAST	30	10
2310	UC	SOUTH	*	*
28411	UC	NORTH	*	*
60505	UC	EAST	*	*
89607	UC	WEST	*	*

* Residual basal areas of unmanaged control stands are the same as pre-treatment conditions.

APPENDIX A2

LIST OF COMPARTMENT / STANDS WITH ACTUAL POST-TREATMENT RESIDUAL BASAL AREA LEVELS FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	SHORTLEAF PINE BASAL AREA PER ACRE ($FT.^2$)	HARDWOOD BASAL AREA PER ACRE ($FT.^2$)
45816	CCNS	NORTH	0	5
106715	CCNS	EAST	0	4
129202	CCNS	WEST	4	7
165805	CCNS	SOUTH	0	4
1418	GSP	NORTH	58	15
110609	GSP	EAST	32	48
128619	GSP	WEST	54	13
164801	GSP	SOUTH	62	20
3542	GSPH	SOUTH	54	22
4618	GSPH	NORTH	36	45
6206	GSPH	WEST	71	19
112411	GSPH	EAST	54	18
45810	STP	NORTH	18	9
84506	STP	WEST	19	8
108407	STP	EAST	16	10
164608	STP	SOUTH	18	12
24806	STPH	WEST	12	11
103617	STPH	NORTH	16	11
111922	STPH	EAST	6	9
165106	STPH	SOUTH	12	8
42802	STSH	NORTH	60	18
107310	STSH	EAST	61	10
131416	STSH	WEST	57	15
165416	STSH	SOUTH	52	12
6208	STSL	SOUTH	88	27
23117	STSL	WEST	78	14
36704	STSL	NORTH	64	18
107719	STSL	EAST	65	21
104403	STSP	NORTH	50	10
112505	STSP	EAST	65	10
128401	STSP	WEST	68	6
165816	STSP	SOUTH	71	17
7010	STSW	NORTH	59	13
24817	STSW	WEST	63	12

COMP. / STAND	TREAT-MENT	ECO-REGION	SHORTLEAF PINE BASAL AREA PER ACRE (FT.^{2})	HARDWOOD BASAL AREA PER ACRE (FT.^{2})
60909	STSW	EAST	65	7
164913	STSW	SOUTH	39	20
3541	SWP	SOUTH	30	8
44303	SWP	NORTH	35	11
89501	SWP	WEST	38	12
109706	SWP	EAST	48	11
21811	SWPH	WEST	31	8
45609	SWPH	NORTH	33	15
109404	SWPH	EAST	32	9
166006	SWPH	SOUTH	31	22
2701	SWW	SOUTH	34	12
45712	SWW	NORTH	33	11
83301	SWW	WEST	32	18
111921	SWW	EAST	35	11
2310	UC	SOUTH	89	22
28411	UC	NORTH	90	39
60505	UC	EAST	120	20
89607	UC	WEST	94	34

APPENDIX A3

LIST OF COMPARTMENT / STANDS WITH POST-TREATMENT RESIDUAL BASAL AREA DEVIATION FROM TARGET LEVEL FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	SHORTLEAF PINE BASAL AREA PER ACRE ($FT.^2$)	HARDWOOD BASAL AREA PER ACRE ($FT.^2$)
45816	CCNS	NORTH	0	0
106715	CCNS	EAST	0	0
129202	CCNS	WEST	+4	+2
165805	CCNS	SOUTH	0	0
1418	GSP	NORTH	+8	+5
110609	GSP	EAST	-18	+38
128619	GSP	WEST	+4	+3
164801	GSP	SOUTH	+12	+10
3542	GSPH	SOUTH	+4	+12
4618	GSPH	NORTH	-14	+35
6206	GSPH	WEST	+21	+9
112411	GSPH	EAST	+4	+8
45810	STP	NORTH	-2	+4
84506	STP	WEST	-1	+3
108407	STP	EAST	-4	+5
164608	STP	SOUTH	-2	+7
24806	STPH	WEST	+2	+1
103617	STPH	NORTH	+6	+1
111922	STPH	EAST	-4	-1
165106	STPH	SOUTH	+2	-2
42802	STSH	NORTH	+10	+8
107310	STSH	EAST	+11	0
131416	STSH	WEST	+7	+5
165416	STSH	SOUTH	+2	+2
6208	STSL	SOUTH	+28	+17
23117	STSL	WEST	+18	+4
36704	STSL	NORTH	+4	+8
107719	STSL	EAST	+5	+11
104403	STSP	NORTH	-10	+5
112505	STSP	EAST	+5	+5
128401	STSP	WEST	+8	+1
165816	STSP	SOUTH	+11	+12
7010	STSW	NORTH	+9	+3

COMP. / STAND	TREAT-MENT	ECO-REGION	SHORTLEAF PINE BASAL AREA PER ACRE ($FT.^2$)	HARDWOOD BASAL AREA PER ACRE ($FT.^2$)
24817	STSW	WEST	+13	+2
60909	STSW	EAST	+15	-3
164913	STSW	SOUTH	-11	+10
3541	SWP	SOUTH	-10	+3
44303	SWP	NORTH	-5	+6
89501	SWP	WEST	-2	+7
109706	SWP	EAST	+8	+6
21811	SWPH	WEST	+1	-2
45609	SWPH	NORTH	+3	+5
109404	SWPH	EAST	+2	-1
166006	SWPH	SOUTH	+1	+12
2701	SWW	SOUTH	+4	+2
45712	SWW	NORTH	+3	+1
83301	SWW	WEST	+2	+8
111921	SWW	EAST	+5	+1
2310	UC	SOUTH	0	0
28411	UC	NORTH	0	0
60505	UC	EAST	0	0
89607	UC	WEST	0	0

APPENDIX B1

POSTHARVEST YEAR 0 SHORTLEAF PINE STAND TABLE OF TREES PER ACRE AND BASAL AREA PER ACRE BY COMPARTMENT / STAND FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
45816	CCNS	0	0
106715	CCNS	2	0
129202	CCNS	15	4
165805	CCNS	0	0
1418	GSP	116	58
110609	GSP	47	32
128619	GSP	127	54
164801	GSP	88	62
3542	GSPH	98	54
4618	GSPH	46	36
6206	GSPH	120	71
112411	GSPH	133	54
45810	STP	33	18
84506	STP	12	19
108407	STP	25	16
164608	STP	25	18
24806	STPH	26	12
103617	STPH	24	16
111922	STPH	6	6
165106	STPH	18	12
42802	STSH	93	60
107310	STSH	90	61
131416	STSH	113	57
165416	STSH	110	52
6208	STSL	149	88
23117	STSL	180	78
36704	STSL	150	64
107719	STSL	103	65
104403	STSP	76	50
112505	STSP	130	65
128401	STSP	153	68
165816	STSP	113	71
7010	STSW	119	59
24817	STSW	70	63

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
60909	STSW	124	65
164913	STSW	54	39
3541	SWP	31	30
44303	SWP	51	35
89501	SWP	37	38
109706	SWP	55	48
21811	SWPH	57	31
45609	SWPH	54	33
109404	SWPH	52	32
166006	SWPH	36	31
2701	SWW	39	34
45712	SWW	34	33
83301	SWW	32	32
111921	SWW	36	35
2310	UC	117	89
28411	UC	112	90
60505	UC	217	120
89607	UC	198	94

APPENDIX B2

POSTHARVEST YEAR 0 SHORTLEAF PINE STOCK TABLE OF TOTAL CUBIC VOLUME, SAWLOG CUBIC VOLUME, SCRIBNER BOARD FEET, AND TOTAL GREEN TONS PER ACRE BY COMPARTMENT / STAND FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	TOTAL VOL. ($FT.^3$)	SAWLOG VOL. ($FT.^3$)	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
45816	CCNS	0	0	0	0
106715	CCNS	4.5	0	0	.18
129202	CCNS	104.6	73.0	365	3.71
165805	CCNS	0	0	0	0
1418	GSP	1645.6	1073.8	5317	58.02
110609	GSP	988.6	754.2	3765	34.37
128619	GSP	1471.9	904.1	4477	52.19
164801	GSP	1856.3	1427.2	6974	64.84
3542	GSPH	1598.5	1165.2	5814	55.88
4618	GSPH	1137.5	873.5	4454	39.33
6206	GSPH	2049.0	1474.2	7137	72.08
112411	GSPH	1531.3	984.0	5037	53.89
45810	STP	596.1	486.5	2573	20.40
84506	STP	722.9	623.0	3526	24.09
108407	STP	537.0	447.1	2358	18.35
164608	STP	610.8	497.5	2556	21.01
24806	STPH	356.0	279.0	1430	12.35
103617	STPH	470.4	363.6	1797	16.40
111922	STPH	208.1	169.3	889	7.10
165106	STPH	394.6	321.1	1735	13.44
42802	STSH	1848.6	1390.3	7089	64.12
107310	STSH	1876.6	1406.2	7096	65.18
131416	STSH	1646.9	1166.5	5776	57.82
165416	STSH	1474.5	933.0	4717	51.93
6208	STSL	2596.9	1929.2	9503	90.89
23117	STSL	2118.8	1342.9	6579	75.17
36704	STSL	1817.3	1298.2	6508	63.81
107719	STSL	1895.8	1389.3	6707	66.61
104403	STSP	1563.0	1180.7	5968	54.27
112505	STSP	1848.8	1276.7	6186	65.29
128401	STSP	1857.1	1177.7	5704	65.92
165816	STSP	1996.6	1428.2	6733	70.57

COMP. / STAND	TREAT-MENT	TOTAL VOL. ($FT.^3$)	SAWLOG VOL. ($FT.^3$)	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
7010	STSW	1695.9	1164.5	5852	59.48
24817	STSW	2066.6	1694.3	8737	70.91
60909	STSW	1913.7	1396.4	7032	66.81
164913	STSW	1189.4	870.3	4350	41.44
3541	SWP	1026.8	864.6	4541	34.98
44303	SWP	1129.9	935.9	4793	38.86
89501	SWP	1329.8	1127.3	5985	45.15
109706	SWP	1469.7	1232.8	5936	51.17
21811	SWPH	901.0	720.5	3479	31.58
45609	SWPH	1008.5	816.9	4014	35.11
109404	SWPH	926.4	741.5	3503	32.57
166006	SWPH	1001.3	821.0	4102	34.61
2701	SWW	1193.4	997.3	5254	40.65
45712	SWW	1132.0	960.1	5082	38.48
83301	SWW	1168.3	993.0	5456	39.32
111921	SWW	1147.2	970.3	4879	39.49
2310	UC	2912.3	2386.0	12229	100.17
28411	UC	2967.5	2346.8	12335	101.73
60505	UC	3476.6	2404.6	11812	122.25
89607	UC	2582.9	1710.8	8392	91.35

APPENDIX B3

POSTHARVEST YEAR 0 SHORTLEAF PINE STAND TABLE OF TREES PER ACRE AND BASAL AREA PER ACRE BY COMPARTMENT / STAND FOR STREAMSIDE MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
45816	CCNS	100	50
106715	CCNS	200	76
129202	CCNS	120	66
165805	CCNS	80	67
1418	GSP	35	24
110609	GSP	30	40
128619	GSP	105	53
164801	GSP	30	20
3542	GSPH	200	68
4618	GSPH	15	12
6206	GSPH	105	50
112411	GSPH	100	77
45810	STP	190	87
84506	STP	65	64
108407	STP	185	82
164608	STP	135	39
24806	STPH	170	61
103617	STPH	95	46
111922	STPH	115	68
165106	STPH	110	44
42802	STSH	145	102
107310	STSH	150	78
131416	STSH	210	103
165416	STSH	90	33
6208	STSL	95	51
23117	STSL	190	114
36704	STSL	60	49
107719	STSL	110	66
104403	STSP	80	49
112505	STSP	70	49
128401	STSP	115	53
165816	STSP	45	39
7010	STSW	35	15
24817	STSW	110	40

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
60909	STSW	70	34
164913	STSW	30	19
3541	SWP	100	57
44303	SWP	180	93
89501	SWP	80	41
109706	SWP	125	85
21811	SWPH	260	99
45609	SWPH	190	64
109404	SWPH	130	70
166006	SWPH	35	38
2701	SWW	50	58
45712	SWW	120	69
83301	SWW	75	61
111921	SWW	20	23
2310	UC	45	50
28411	UC	65	71
60505	UC	100	77
89607	UC	95	83

APPENDIX B4

POSTHARVEST YEAR 0 SHORTLEAF PINE STOCK TABLE OF TOTAL CUBIC VOLUME, SAWLOG CUBIC VOLUME, SCRIBNER BOARD FEET, AND TOTAL GREEN TONS PER ACRE BY COMPARTMENT / STAND FOR STREAMSIDE MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	TOTAL VOL. ($FT.^3$)	SAWLOG VOL. ($FT.^3$)	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
45816	CCNS	1405.0	965.4	4493	49.54
106715	CCNS	2162.5	1284.1	6554	76.04
129202	CCNS	1902.2	1368.6	6398	66.84
165805	CCNS	2119.3	1712.1	8361	73.44
1418	GSP	737.2	551.8	2718	25.62
110609	GSP	1538.2	1378.8	7810	51.78
128619	GSP	1561.2	1048.0	5297	54.50
164801	GSP	698.5	556.4	3167	23.84
3542	GSPH	1653.7	625.6	2963	59.51
4618	GSPH	382.2	308.9	1435	13.34
6206	GSPH	1435.1	952.7	4489	50.62
112411	GSPH	2568.5	2070.8	10729	88.37
45810	STP	2285.3	1324.5	6014	81.20
84506	STP	2105.3	1732.8	8846	72.38
108407	STP	2257.8	1166.9	5613	80.06
164608	STP	970.4	395.0	1764	35.01
24806	STPH	1575.3	740.7	3538	56.27
103617	STPH	1446.1	995.1	5292	50.14
111922	STPH	1910.8	1351.8	6237	67.27
165106	STPH	1226.3	732.3	3754	43.09
42802	STSH	3217.5	2514.2	12662	112.30
107310	STSH	2125.9	1408.8	6365	75.30
131416	STSH	2947.8	1970.8	9911	103.22
165416	STSH	908.2	574.9	2802	32.08
6208	STSL	1413.3	862.9	4091	49.80
23117	STSL	3519.3	2652.2	13313	122.26
36704	STSL	1610.0	1312.5	6751	55.41
107719	STSL	2004.4	1512.6	7404	69.88
104403	STSP	1538.3	1196.7	5913	53.45
112505	STSP	1483.9	1059.4	5236	51.70
128401	STSP	1527.2	953.3	4876	53.48
165816	STSP	1302.4	1015.1	5660	44.43

COMP. / STAND	TREAT-MENT	TOTAL VOL. (FT.^{3})	SAWLOG VOL. (FT.^{3})	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
7010	STSW	424.1	280.6	1393	14.90
24817	STSW	1042.6	532.1	2500	37.21
60909	STSW	973.6	579.7	2923	34.18
164913	STSW	568.7	409.9	1947	19.92
3541	SWP	1700.4	1213.9	5906	59.47
44303	SWP	2941.6	2207.5	11395	101.92
89501	SWP	1206.3	840.5	4226	42.10
109706	SWP	2584.9	1954.3	9729	89.87
21811	SWPH	2459.9	1105.1	4929	88.28
45609	SWPH	1702.0	1052.9	4882	60.53
109404	SWPH	2079.4	1547.1	7420	72.71
166006	SWPH	1292.6	1116.0	5810	44.21
2701	SWW	2069.5	1806.8	9685	70.39
45712	SWW	1989.4	1415.0	6741	69.74
83301	SWW	2145.8	1793.1	9692	73.19
111921	SWW	839.4	730.6	4052	28.42
2310	UC	1701.6	1470.8	7716	58.08
28411	UC	2575.9	2220.6	12074	87.55
60505	UC	2593.4	2105.5	11457	89.61
89607	UC	2733.3	2210.5	11538	93.86

APPENDIX C1

POSTHARVEST YEAR 2 SHORTLEAF PINE STAND TABLE OF TREES PER ACRE AND BASAL AREA PER ACRE BY COMPARTMENT / STAND FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
45816	CCNS	0	0
106715	CCNS	1	0
129202	CCNS	13	4
165805	CCNS	0	0
1418	GSP	106	54
110609	GSP	42	26
128619	GSP	123	55
164801	GSP	90	68
3542	GSPH	89	64
4618	GSPH	50	42
6206	GSPH	113	68
112411	GSPH	121	64
45810	STP	31	19
84506	STP	11	18
108407	STP	19	15
164608	STP	22	18
24806	STPH	22	9
103617	STPH	24	17
111922	STPH	6	6
165106	STPH	14	12
42802	STSH	93	63
107310	STSH	85	63
131416	STSH	114	61
165416	STSH	105	53
6208	STSL	135	88
23117	STSL	177	81
36704	STSL	147	66
107719	STSL	100	68
104403	STSP	73	53
112505	STSP	123	68
128401	STSP	142	70
165816	STSP	107	72
7010	STSW	113	59
24817	STSW	68	65

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
60909	STSW	127	67
164913	STSW	47	38
3541	SWP	25	27
44303	SWP	50	37
89501	SWP	36	40
109706	SWP	53	50
21811	SWPH	56	33
45609	SWPH	52	35
109404	SWPH	52	34
166006	SWPH	34	33
2701	SWW	38	36
45712	SWW	32	33
83301	SWW	32	34
111921	SWW	35	37
2310	UC	109	91
28411	UC	102	89
60505	UC	198	120
89607	UC	190	96

APPENDIX C2

POSTHARVEST YEAR 2 SHORTLEAF PINE STOCK TABLE OF TOTAL CUBIC VOLUME, SAWLOG CUBIC VOLUME, SCRIBNER BOARD FEET, AND TOTAL GREEN TONS PER ACRE BY COMPARTMENT / STAND FOR TIMBER MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	TOTAL VOL. ($FT.^3$)	SAWLOG VOL. ($FT.^3$)	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
45816	CCNS	0	0	0	0
106715	CCNS	1.8	0	0	.07
129202	CCNS	110.2	78.9	402	3.88
165805	CCNS	0	0	0	0
1418	GSP	1541.7	974.8	4904	54.26
110609	GSP	781.7	576.5	2821	27.37
128619	GSP	1467.8	941.7	4570	52.12
164801	GSP	2064.3	1636.3	7989	71.96
3542	GSPH	1958.8	1516.1	7680	67.87
4618	GSPH	1337.5	1073.8	5386	46.26
6206	GSPH	1980.4	1445.4	7027	69.56
112411	GSPH	1932.4	1351.3	7002	67.24
45810	STP	629.4	514.8	2737	21.49
84506	STP	707.3	620.7	3540	23.79
108407	STP	527.4	443.9	2403	17.87
164608	STP	595.8	495.1	2545	20.45
24806	STPH	266.1	204.0	1025	9.30
103617	STPH	514.9	406.2	2028	17.87
111922	STPH	224.6	190.9	1002	7.64
165106	STPH	421.0	348.4	1912	14.23
42802	STSH	1977.1	1518.9	7781	68.39
107310	STSH	1984.7	1533.4	7771	68.71
131416	STSH	1815.2	1316.1	6583	63.46
165416	STSH	1508.8	1004.0	5036	53.05
6208	STSL	2627.1	1998.9	9890	91.65
23117	STSL	2242.2	1464.8	7252	79.22
36704	STSL	1895.3	1353.3	6828	66.41
107719	STSL	2023.9	1525.1	7424	70.84
104403	STSP	1657.3	1259.8	6436	57.33
112505	STSP	1943.3	1367.6	6685	68.35
128401	STSP	1946.2	1296.0	6298	68.78
165816	STSP	2034.0	1492.7	7081	71.67

COMP. / STAND	TREAT-MENT	TOTAL VOL. (FT.^{3})	SAWLOG VOL. (FT.^{3})	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
7010	STSW	1750.2	1227.9	6206	61.20
24817	STSW	2190.2	1797.4	9360	74.93
60909	STSW	2049.6	1524.2	7734	71.34
164913	STSW	1195.4	907.1	4593	41.40
3541	SWP	921.5	779.7	4103	31.35
44303	SWP	1215.7	1007.8	5228	41.66
89501	SWP	1420.2	1206.1	6480	48.06
109706	SWP	1560.7	1313.3	6418	54.11
21811	SWPH	994.5	795.8	3900	34.70
45609	SWPH	1083.5	891.0	4425	37.57
109404	SWPH	1018.9	823.4	3943	35.67
166006	SWPH	1044.8	875.5	4383	36.03
2701	SWW	1240.3	1036.5	5494	42.18
45712	SWW	1218.3	1037.9	5596	41.19
83301	SWW	1278.6	1088.4	6065	42.86
111921	SWW	1229.5	1043.5	5299	42.19
2310	UC	3028.9	2502.4	12921	103.86
28411	UC	2988.0	2395.1	12638	102.16
60505	UC	3512.8	2489.2	12265	123.17
89607	UC	2751.8	1859.9	9255	96.85

APPENDIX C3

POSTHARVEST YEAR 2 SHORTLEAF PINE STAND TABLE OF TREES PER ACRE AND BASAL AREA PER ACRE BY COMPARTMENT / STAND FOR STREAMSIDE MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
45816	CCNS	90	51
106715	CCNS	175	75
129202	CCNS	120	68
165805	CCNS	55	46
1418	GSP	35	25
110609	GSP	30	41
128619	GSP	105	57
164801	GSP	30	21
3542	GSPH	180	67
4618	GSPH	15	13
6206	GSPH	105	52
112411	GSPH	90	77
45810	STP	190	90
84506	STP	60	58
108407	STP	180	86
164608	STP	135	42
24806	STPH	170	64
103617	STPH	85	45
111922	STPH	110	69
165106	STPH	90	43
42802	STSH	140	106
107310	STSH	140	77
131416	STSH	200	106
165416	STSH	85	34
6208	STSL	90	53
23117	STSL	185	116
36704	STSL	60	50
107719	STSL	110	69
104403	STSP	75	46
112505	STSP	70	51
128401	STSP	100	54
165816	STSP	45	39
7010	STSW	35	16
24817	STSW	100	40

COMPARTMENT / STAND	TREAT-MENT	TREES PER ACRE	BASAL AREA PER ACRE ($FT.^2$)
60909	STSW	65	35
164913	STSW	25	18
3541	SWP	95	60
44303	SWP	170	98
89501	SWP	75	42
109706	SWP	115	78
21811	SWPH	260	103
45609	SWPH	180	67
109404	SWPH	125	73
166006	SWPH	35	39
2701	SWW	50	61
45712	SWW	110	71
83301	SWW	80	65
111921	SWW	20	24
2310	UC	45	51
28411	UC	60	71
60505	UC	95	79
89607	UC	85	85

APPENDIX C4

POSTHARVEST YEAR 2 SHORTLEAF PINE STOCK TABLE OF TOTAL CUBIC VOLUME, SAWLOG CUBIC VOLUME, SCRIBNER BOARD FEET, AND TOTAL GREEN TONS PER ACRE BY COMPARTMENT / STAND FOR STREAMSIDE MANAGEMENT ZONES IN THE OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	TOTAL VOL. (FT.^{3})	SAWLOG VOL. (FT.^{3})	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
45816	CCNS	1452.2	1031.4	4881	50.98
106715	CCNS	2138.5	1302.3	6646	75.01
129202	CCNS	2001.3	1456.9	6866	70.18
165805	CCNS	1446.6	1151.7	5582	50.22
1418	GSP	769.7	582.4	2895	26.69
110609	GSP	1550.1	1378.8	7810	52.20
128619	GSP	1722.8	1284.1	6428	59.98
164801	GSP	698.5	556.4	3167	23.84
3542	GSPH	1663.5	697.9	3277	59.68
4618	GSPH	382.2	308.9	1435	13.34
6206	GSPH	1488.4	1000.8	4749	52.41
112411	GSPH	2610.4	2151.1	11246	89.55
45810	STP	2504.4	1499.4	6971	88.60
84506	STP	1954.4	1607.3	8231	67.16
108407	STP	2343.5	1285.3	6225	82.88
164608	STP	1024.4	449.0	1987	36.92
24806	STPH	1693.4	794.4	3842	60.33
103617	STPH	1405.6	995.1	5292	48.65
111922	STPH	1945.6	1392.0	6445	68.40
165106	STPH	1275.2	789.0	4074	44.58
42802	STSH	3361.5	2694.1	13588	117.08
107310	STSH	2142.0	1466.1	6693	75.66
131416	STSH	3110.9	2101.8	10655	108.64
165416	STSH	938.1	593.2	2893	33.08
6208	STSL	1486.1	973.6	4634	52.21
23117	STSL	3626.6	2754.3	13922	125.76
36704	STSL	1672.1	1378.4	7140	57.44
107719	STSL	2063.1	1561.4	7672	71.87
104403	STSP	1364.4	1045.8	5162	47.47
112505	STSP	1578.5	1190.1	5951	54.82
128401	STSP	1560.0	1025.5	5190	54.53
165816	STSP	1392.4	1120.7	6373	47.29

COMP. / STAND	TREAT-MENT	TOTAL VOL. (FT.^{3})	SAWLOG VOL. (FT.^{3})	SCRIBNER BD. FT. VOL.	TOTAL TONS (GREEN)
7010	STSW	493.8	347.2	1790	17.19
24817	STSW	1037.6	558.2	2644	36.90
60909	STSW	1017.3	605.8	3068	35.63
164913	STSW	541.2	409.9	1947	18.90
3541	SWP	1777.3	1285.0	6335	61.99
44303	SWP	3046.9	2307.9	12067	105.29
89501	SWP	1286.4	933.2	4767	44.67
109706	SWP	2317.0	1722.4	8372	80.84
21811	SWPH	2636.2	1309.7	5899	94.31
45609	SWPH	1804.3	1181.2	5509	63.93
109404	SWPH	2140.6	1599.6	7713	74.75
166006	SWPH	1350.5	1169.6	6114	46.14
2701	SWW	2274.1	2019.0	11124	76.97
45712	SWW	2065.6	1491.8	7132	72.27
83301	SWW	2257.6	1891.3	10337	76.88
111921	SWW	917.7	807.3	4526	30.99
2310	UC	1772.1	1538.9	8129	60.40
28411	UC	2603.6	2266.7	12371	88.36
60505	UC	2668.9	2216.2	12000	92.09
89607	UC	3004.9	2511.8	13473	102.54

APPENDIX D1

SHORTLEAF PINE TREES PER ACRE CHANGE AND BASAL AREA PER ACRE GROWTH BETWEEN POSTHARVEST YEAR 0 AND POSTHARVEST YEAR 2 FOR TMZ AND SMZ ZONES BY COMPARTMENT / STAND IN OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TREES PER ACRE CHANGE	BASAL AREA. ($FT.^2$) GROWTH
45816	CCNS	NORTH	TMZ	0	0
45816	*	NORTH	SMZ	-10	1
106715	CCNS	EAST	TMZ	-1	0
106715	*	EAST	SMZ	-25	-1
129202	CCNS	WEST	TMZ	-2	0
129202	*	WEST	SMZ	0	2
165805	CCNS	SOUTH	TMZ	0	0
165805	*	SOUTH	SMZ	-25	-20
1418	GSP	NORTH	TMZ	-10	-4
1418	*	NORTH	SMZ	0	1
110609	GSP	EAST	TMZ	-5	-6
110609	*	EAST	SMZ	0	1
128619	GSP	WEST	TMZ	-4	1
128619	*	WEST	SMZ	0	3
164801	GSP	SOUTH	TMZ	2	6
164801	*	SOUTH	SMZ	0	1
3542	GSPH	SOUTH	TMZ	-9	9
3542	*	SOUTH	SMZ	-20	-1
4618	GSPH	NORTH	TMZ	4	6
4618	*	NORTH	SMZ	0	0
6206	GSPH	WEST	TMZ	-7	-3
6206	*	WEST	SMZ	0	2
112411	GSPH	EAST	TMZ	-12	10
112411	*	EAST	SMZ	-10	0
45810	STP	NORTH	TMZ	-2	1
45810	*	NORTH	SMZ	0	4
84506	STP	WEST	TMZ	-1	-1
84506	*	WEST	SMZ	-5	-6
108407	STP	EAST	TMZ	-6	-1
108407	*	EAST	SMZ	-5	4
164608	STP	SOUTH	TMZ	-3	0
164608	*	SOUTH	SMZ	0	3
24806	STPH	WEST	TMZ	-4	-2

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TREES PER ACRE CHANGE	BASAL AREA. $(FT.^2)$ GROWTH
24806	*	WEST	SMZ	0	3
103617	STPH	NORTH	TMZ	0	1
103617	*	NORTH	SMZ	-10	0
111922	STPH	EAST	TMZ	0	0
111922	*	EAST	SMZ	-5	2
165106	STPH	SOUTH	TMZ	-4	0
165106	*	SOUTH	SMZ	-20	-1
42802	STSH	NORTH	TMZ	0	3
42802	*	NORTH	SMZ	-5	4
107310	STSH	EAST	TMZ	-5	2
107310	*	EAST	SMZ	-10	-1
131416	STSH	WEST	TMZ	1	4
131416	*	WEST	SMZ	-10	3
165416	STSH	SOUTH	TMZ	-5	1
165416	*	SOUTH	SMZ	-5	1
6208	STSL	SOUTH	TMZ	-14	-1
6208	*	SOUTH	SMZ	-5	2
23117	STSL	WEST	TMZ	-3	3
23117	*	WEST	SMZ	-5	2
36704	STSL	NORTH	TMZ	-3	2
36704	*	NORTH	SMZ	0	2
107719	STSL	EAST	TMZ	-3	3
107719	*	EAST	SMZ	0	2
104403	STSP	NORTH	TMZ	-3	3
104403	*	NORTH	SMZ	-5	-3
112505	STSP	EAST	TMZ	-7	2
112505	*	EAST	SMZ	0	2
128401	STSP	WEST	TMZ	-11	2
128401	*	WEST	SMZ	-15	1
165816	STSP	SOUTH	TMZ	-6	1
165816	*	SOUTH	SMZ	0	1
7010	STSW	NORTH	TMZ	-6	0
7010	*	NORTH	SMZ	0	1
24817	STSW	WEST	TMZ	-2	2
24817	*	WEST	SMZ	-10	1
60909	STSW	EAST	TMZ	3	3
60909	*	EAST	SMZ	-5	0
164913	STSW	SOUTH	TMZ	-7	-2
164913	*	SOUTH	SMZ	-5	-1
3541	SWP	SOUTH	TMZ	-6	-3
3541	*	SOUTH	SMZ	-5	3

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TREES PER ACRE CHANGE	BASAL AREA. (FT.^{2}) GROWTH
44303	SWP	NORTH	TMZ	-1	2
44303	*	NORTH	SMZ	-10	4
89501	SWP	WEST	TMZ	-1	2
89501	*	WEST	SMZ	-5	1
109706	SWP	EAST	TMZ	-2	2
109706	*	EAST	SMZ	-10	-7
21811	SWPH	WEST	TMZ	-1	2
21811	*	WEST	SMZ	0	4
45609	SWPH	NORTH	TMZ	-2	2
45609	*	NORTH	SMZ	-10	3
109404	SWPH	EAST	TMZ	0	2
109404	*	EAST	SMZ	-5	3
166006	SWPH	SOUTH	TMZ	-2	1
166006	*	SOUTH	SMZ	0	1
2701	SWW	SOUTH	TMZ	-1	2
2701	*	SOUTH	SMZ	0	3
45712	SWW	NORTH	TMZ	-2	1
45712	*	NORTH	SMZ	-10	2
83301	SWW	WEST	TMZ	0	2
83301	*	WEST	SMZ	5	3
111921	SWW	EAST	TMZ	-1	2
111921	*	EAST	SMZ	0	1
2310	UC	SOUTH	TMZ	-8	2
2310	*	SOUTH	SMZ	0	1
28411	UC	NORTH	TMZ	-10	-1
28411	*	NORTH	SMZ	-5	0
60505	UC	EAST	TMZ	-19	-1
60505	*	EAST	SMZ	-5	1
89607	UC	WEST	TMZ	-8	3
89607	*	WEST	SMZ	-10	2

* No silvicultural treatments are applied within streamside management zones (SMZ).

APPENDIX D2

SHORTLEAF PINE TOTAL CUBIC VOLUME GROWTH PER ACRE BETWEEN POSTHARVEST YEAR 0 AND POSTHARVEST YEAR 2 FOR TMZ AND SMZ ZONES BY COMPARTMENT / STAND IN OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TOTAL VOL. (FT.^{3}) GROWTH
45816	CCNS	NORTH	TMZ	0
45816	*	NORTH	SMZ	47.2
106715	CCNS	EAST	TMZ	-2.7
106715	*	EAST	SMZ	-24.0
129202	CCNS	WEST	TMZ	5.6
129202	*	WEST	SMZ	99.2
165805	CCNS	SOUTH	TMZ	0
165805	*	SOUTH	SMZ	-672.7
1418	GSP	NORTH	TMZ	-103.9
1418	*	NORTH	SMZ	32.5
110609	GSP	EAST	TMZ	-206.9
110609	*	EAST	SMZ	11.9
128619	GSP	WEST	TMZ	-4.1
128619	*	WEST	SMZ	161.6
164801	GSP	SOUTH	TMZ	208.0
164801	*	SOUTH	SMZ	0
3542	GSPH	SOUTH	TMZ	360.3
3542	*	SOUTH	SMZ	9.8
4618	GSPH	NORTH	TMZ	200.0
4618	*	NORTH	SMZ	0
6206	GSPH	WEST	TMZ	-68.5
6206	*	WEST	SMZ	53.2
112411	GSPH	EAST	TMZ	401.1
112411	*	EAST	SMZ	41.9
45810	STP	NORTH	TMZ	33.3
45810	*	NORTH	SMZ	219.0
84506	STP	WEST	TMZ	-15.6
84506	*	WEST	SMZ	-150.8
108407	STP	EAST	TMZ	-9.6
108407	*	EAST	SMZ	85.7
164608	STP	SOUTH	TMZ	-15.0
164608	*	SOUTH	SMZ	54.0
24806	STPH	WEST	TMZ	-90.0

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TOTAL VOL. ($FT.^3$) GROWTH
24806	*	WEST	SMZ	118.1
103617	STPH	NORTH	TMZ	44.5
103617	*	NORTH	SMZ	-40.4
111922	STPH	EAST	TMZ	16.5
111922	*	EAST	SMZ	34.9
165106	STPH	SOUTH	TMZ	26.4
165106	*	SOUTH	SMZ	49.0
42802	STSH	NORTH	TMZ	128.5
42802	*	NORTH	SMZ	144.0
107310	STSH	EAST	TMZ	108.1
107310	*	EAST	SMZ	16.0
131416	STSH	WEST	TMZ	168.3
131416	*	WEST	SMZ	163.2
165416	STSH	SOUTH	TMZ	34.4
165416	*	SOUTH	SMZ	29.9
6208	STSL	SOUTH	TMZ	30.2
6208	*	SOUTH	SMZ	72.8
23117	STSL	WEST	TMZ	123.4
23117	*	WEST	SMZ	107.3
36704	STSL	NORTH	TMZ	78.0
36704	*	NORTH	SMZ	62.2
107719	STSL	EAST	TMZ	128.0
107719	*	EAST	SMZ	58.7
104403	STSP	NORTH	TMZ	94.2
104403	*	NORTH	SMZ	-173.9
112505	STSP	EAST	TMZ	94.5
112505	*	EAST	SMZ	94.7
128401	STSP	WEST	TMZ	89.1
128401	*	WEST	SMZ	32.9
165816	STSP	SOUTH	TMZ	37.5
165816	*	SOUTH	SMZ	90.0
7010	STSW	NORTH	TMZ	54.3
7010	*	NORTH	SMZ	69.7
24817	STSW	WEST	TMZ	123.7
24817	*	WEST	SMZ	-5.0
60909	STSW	EAST	TMZ	135.9
60909	*	EAST	SMZ	43.7
164913	STSW	SOUTH	TMZ	6.0
164913	*	SOUTH	SMZ	-27.4
3541	SWP	SOUTH	TMZ	-105.2
3541	*	SOUTH	SMZ	77.0

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TOTAL VOL. (FT.^{3}) GROWTH
44303	SWP	NORTH	TMZ	85.8
44303	*	NORTH	SMZ	105.3
89501	SWP	WEST	TMZ	90.4
89501	*	WEST	SMZ	80.1
109706	SWP	EAST	TMZ	90.9
109706	*	EAST	SMZ	-267.8
21811	SWPH	WEST	TMZ	93.5
21811	*	WEST	SMZ	176.3
45609	SWPH	NORTH	TMZ	75.0
45609	*	NORTH	SMZ	102.3
109404	SWPH	EAST	TMZ	92.5
109404	*	EAST	SMZ	61.2
166006	SWPH	SOUTH	TMZ	43.5
166006	*	SOUTH	SMZ	57.9
2701	SWW	SOUTH	TMZ	46.9
2701	*	SOUTH	SMZ	204.6
45712	SWW	NORTH	TMZ	86.3
45712	*	NORTH	SMZ	76.2
83301	SWW	WEST	TMZ	110.3
83301	*	WEST	SMZ	111.8
111921	SWW	EAST	TMZ	82.3
111921	*	EAST	SMZ	78.3
2310	UC	SOUTH	TMZ	116.5
2310	*	SOUTH	SMZ	70.5
28411	UC	NORTH	TMZ	20.5
28411	*	NORTH	SMZ	27.7
60505	UC	EAST	TMZ	36.2
60505	*	EAST	SMZ	75.6
89607	UC	WEST	TMZ	168.9
89607	*	WEST	SMZ	271.6

* No silvicultural treatments are applied within streamside management zones (SMZ).

APPENDIX D3

SHORTLEAF PINE SAWLOG CUBIC VOLUME GROWTH PER ACRE BETWEEN POSTHARVEST YEAR 0 AND POSTHARVEST YEAR 2 FOR TMZ AND SMZ ZONES BY COMPARTMENT / STAND IN OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	SAWLOG ($FT.^3$) GROWTH
45816	CCNS	NORTH	TMZ	0
45816	*	NORTH	SMZ	65.9
106715	CCNS	EAST	TMZ	0
106715	*	EAST	SMZ	18.3
129202	CCNS	WEST	TMZ	6.0
129202	*	WEST	SMZ	88.3
165805	CCNS	SOUTH	TMZ	0
165805	*	SOUTH	SMZ	-560.4
1418	GSP	NORTH	TMZ	-99.0
1418	*	NORTH	SMZ	30.6
110609	GSP	EAST	TMZ	-177.6
110609	*	EAST	SMZ	0
128619	GSP	WEST	TMZ	37.6
128619	*	WEST	SMZ	236.1
164801	GSP	SOUTH	TMZ	209.1
164801	*	SOUTH	SMZ	0
3542	GSPH	SOUTH	TMZ	351.0
3542	*	SOUTH	SMZ	72.3
4618	GSPH	NORTH	TMZ	200.3
4618	*	NORTH	SMZ	0
6206	GSPH	WEST	TMZ	-28.7
6206	*	WEST	SMZ	48.1
112411	GSPH	EAST	TMZ	367.4
112411	*	EAST	SMZ	80.3
45810	STP	NORTH	TMZ	28.3
45810	*	NORTH	SMZ	174.8
84506	STP	WEST	TMZ	-2.3
84506	*	WEST	SMZ	-125.6
108407	STP	EAST	TMZ	-3.1
108407	*	EAST	SMZ	118.4
164608	STP	SOUTH	TMZ	-2.4
164608	*	SOUTH	SMZ	54.0
24806	STPH	WEST	TMZ	-75.0

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	SAWLOG ($FT.^3$) GROWTH
24806	*	WEST	SMZ	53.6
103617	STPH	NORTH	TMZ	42.6
103617	*	NORTH	SMZ	0
111922	STPH	EAST	TMZ	21.6
111922	*	EAST	SMZ	40.2
165106	STPH	SOUTH	TMZ	27.3
165106	*	SOUTH	SMZ	56.7
42802	STSH	NORTH	TMZ	128.6
42802	*	NORTH	SMZ	179.9
107310	STSH	EAST	TMZ	127.2
107310	*	EAST	SMZ	57.4
131416	STSH	WEST	TMZ	149.6
131416	*	WEST	SMZ	131.1
165416	STSH	SOUTH	TMZ	71.0
165416	*	SOUTH	SMZ	18.3
6208	STSL	SOUTH	TMZ	69.7
6208	*	SOUTH	SMZ	110.7
23117	STSL	WEST	TMZ	121.9
23117	*	WEST	SMZ	102.1
36704	STSL	NORTH	TMZ	55.1
36704	*	NORTH	SMZ	65.9
107719	STSL	EAST	TMZ	135.8
107719	*	EAST	SMZ	48.8
104403	STSP	NORTH	TMZ	79.1
104403	*	NORTH	SMZ	-150.9
112505	STSP	EAST	TMZ	91.0
112505	*	EAST	SMZ	130.6
128401	STSP	WEST	TMZ	118.3
128401	*	WEST	SMZ	72.3
165816	STSP	SOUTH	TMZ	64.5
165816	*	SOUTH	SMZ	105.6
7010	STSW	NORTH	TMZ	63.4
7010	*	NORTH	SMZ	66.7
24817	STSW	WEST	TMZ	103.1
24817	*	WEST	SMZ	26.1
60909	STSW	EAST	TMZ	127.7
60909	*	EAST	SMZ	26.1
164913	STSW	SOUTH	TMZ	36.7
164913	*	SOUTH	SMZ	0
3541	SWP	SOUTH	TMZ	-84.9
3541	*	SOUTH	SMZ	71.1

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	SAWLOG ($FT.^3$) GROWTH
44303	SWP	NORTH	TMZ	71.9
44303	*	NORTH	SMZ	100.4
89501	SWP	WEST	TMZ	78.8
89501	*	WEST	SMZ	92.8
109706	SWP	EAST	TMZ	80.6
109706	*	EAST	SMZ	-231.9
21811	SWPH	WEST	TMZ	75.2
21811	*	WEST	SMZ	204.6
45609	SWPH	NORTH	TMZ	74.1
45609	*	NORTH	SMZ	128.2
109404	SWPH	EAST	TMZ	81.9
109404	*	EAST	SMZ	52.5
166006	SWPH	SOUTH	TMZ	54.5
166006	*	SOUTH	SMZ	53.6
2701	SWW	SOUTH	TMZ	39.2
2701	*	SOUTH	SMZ	212.2
45712	SWW	NORTH	TMZ	77.7
45712	*	NORTH	SMZ	76.7
83301	SWW	WEST	TMZ	95.3
83301	*	WEST	SMZ	98.2
111921	SWW	EAST	TMZ	73.1
111921	*	EAST	SMZ	76.7
2310	UC	SOUTH	TMZ	116.4
2310	*	SOUTH	SMZ	68.1
28411	UC	NORTH	TMZ	48.3
28411	*	NORTH	SMZ	46.1
60505	UC	EAST	TMZ	84.7
60505	*	EAST	SMZ	110.7
89607	UC	WEST	TMZ	149.1
89607	*	WEST	SMZ	301.3

* No silvicultural treatments are applied within streamside management zones (SMZ).

APPENDIX D4

SHORTLEAF PINE SCRIBNER BOARD FOOT VOLUME GROWTH PER ACRE BETWEEN POSTHARVEST YEAR 0 AND POSTHARVEST YEAR 2 FOR TMZ AND SMZ ZONES BY COMPARTMENT / STAND IN OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	SCRIBNER BD. FT. VOL. GROWTH
45816	CCNS	NORTH	TMZ	0
45816	*	NORTH	SMZ	389
106715	CCNS	EAST	TMZ	0
106715	*	EAST	SMZ	92
129202	CCNS	WEST	TMZ	37
129202	*	WEST	SMZ	468
165805	CCNS	SOUTH	TMZ	0
165805	*	SOUTH	SMZ	-2779
1418	GSP	NORTH	TMZ	-412
1418	*	NORTH	SMZ	176
110609	GSP	EAST	TMZ	-944
110609	*	EAST	SMZ	0
128619	GSP	WEST	TMZ	94
128619	*	WEST	SMZ	1131
164801	GSP	SOUTH	TMZ	1015
164801	*	SOUTH	SMZ	0
3542	GSPH	SOUTH	TMZ	1867
3542	*	SOUTH	SMZ	314
4618	GSPH	NORTH	TMZ	932
4618	*	NORTH	SMZ	0
6206	GSPH	WEST	TMZ	-110
6206	*	WEST	SMZ	260
112411	GSPH	EAST	TMZ	1964
112411	*	EAST	SMZ	517
45810	STP	NORTH	TMZ	165
45810	*	NORTH	SMZ	957
84506	STP	WEST	TMZ	14
84506	*	WEST	SMZ	-615
108407	STP	EAST	TMZ	45
108407	*	EAST	SMZ	612
164608	STP	SOUTH	TMZ	-11
164608	*	SOUTH	SMZ	223
24806	STPH	WEST	TMZ	-405

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	SCRIBNER BD. FT. VOL. GROWTH
24806	*	WEST	SMZ	304
103617	STPH	NORTH	TMZ	231
103617	*	NORTH	SMZ	0
111922	STPH	EAST	TMZ	114
111922	*	EAST	SMZ	208
165106	STPH	SOUTH	TMZ	177
165106	*	SOUTH	SMZ	320
42802	STSH	NORTH	TMZ	691
42802	*	NORTH	SMZ	926
107310	STSH	EAST	TMZ	675
107310	*	EAST	SMZ	328
131416	STSH	WEST	TMZ	807
131416	*	WEST	SMZ	744
165416	STSH	SOUTH	TMZ	318
165416	*	SOUTH	SMZ	92
6208	STSL	SOUTH	TMZ	387
6208	*	SOUTH	SMZ	543
23117	STSL	WEST	TMZ	673
23117	*	WEST	SMZ	609
36704	STSL	NORTH	TMZ	320
36704	*	NORTH	SMZ	389
107719	STSL	EAST	TMZ	717
107719	*	EAST	SMZ	268
104403	STSP	NORTH	TMZ	468
104403	*	NORTH	SMZ	-751
112505	STSP	EAST	TMZ	499
112505	*	EAST	SMZ	715
128401	STSP	WEST	TMZ	595
128401	*	WEST	SMZ	314
165816	STSP	SOUTH	TMZ	348
165816	*	SOUTH	SMZ	713
7010	STSW	NORTH	TMZ	353
7010	*	NORTH	SMZ	397
24817	STSW	WEST	TMZ	623
24817	*	WEST	SMZ	144
60909	STSW	EAST	TMZ	702
60909	*	EAST	SMZ	144
164913	STSW	SOUTH	TMZ	243
164913	*	SOUTH	SMZ	0
3541	SWP	SOUTH	TMZ	-438
3541	*	SOUTH	SMZ	429

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	SCRIBNER BD. FT. VOL. GROWTH
44303	SWP	NORTH	TMZ	435
44303	*	NORTH	SMZ	673
89501	SWP	WEST	TMZ	495
89501	*	WEST	SMZ	541
109706	SWP	EAST	TMZ	482
109706	*	EAST	SMZ	-1357
21811	SWPH	WEST	TMZ	421
21811	*	WEST	SMZ	970
45609	SWPH	NORTH	TMZ	411
45609	*	NORTH	SMZ	627
109404	SWPH	EAST	TMZ	440
109404	*	EAST	SMZ	292
166006	SWPH	SOUTH	TMZ	280
166006	*	SOUTH	SMZ	304
2701	SWW	SOUTH	TMZ	240
2701	*	SOUTH	SMZ	1439
45712	SWW	NORTH	TMZ	514
45712	*	NORTH	SMZ	391
83301	SWW	WEST	TMZ	609
83301	*	WEST	SMZ	645
111921	SWW	EAST	TMZ	420
111921	*	EAST	SMZ	474
2310	UC	SOUTH	TMZ	692
2310	*	SOUTH	SMZ	414
28411	UC	NORTH	TMZ	303
28411	*	NORTH	SMZ	298
60505	UC	EAST	TMZ	453
60505	*	EAST	SMZ	543
89607	UC	WEST	TMZ	863
89607	*	WEST	SMZ	1935

* No silvicultural treatments are applied within streamside management zones (SMZ).

APPENDIX D5

SHORTLEAF PINE TOTAL GREEN TON GROWTH PER ACRE BETWEEN POSTHARVEST YEAR 0 AND POSTHARVEST YEAR 2 FOR TMZ AND SMZ ZONES BY COMPARTMENT / STAND IN OUACHITA / OZARK NATIONAL FORESTS

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TOTAL TON (GREEN) GROWTH
45816	CCNS	NORTH	TMZ	0
45816	*	NORTH	SMZ	1.44
106715	CCNS	EAST	TMZ	-.11
106715	*	EAST	SMZ	-1.03
129202	CCNS	WEST	TMZ	.17
129202	*	WEST	SMZ	3.34
165805	CCNS	SOUTH	TMZ	0
165805	*	SOUTH	SMZ	-23.22
1418	GSP	NORTH	TMZ	-3.76
1418	*	NORTH	SMZ	1.08
110609	GSP	EAST	TMZ	-7.00
110609	*	EAST	SMZ	.42
128619	GSP	WEST	TMZ	-.07
128619	*	WEST	SMZ	5.48
164801	GSP	SOUTH	TMZ	7.12
164801	*	SOUTH	SMZ	0
3542	GSPH	SOUTH	TMZ	11.99
3542	*	SOUTH	SMZ	.17
4618	GSPH	NORTH	TMZ	6.93
4618	*	NORTH	SMZ	0
6206	GSPH	WEST	TMZ	-2.52
6206	*	WEST	SMZ	1.79
112411	GSPH	EAST	TMZ	13.36
112411	*	EAST	SMZ	1.17
45810	STP	NORTH	TMZ	1.09
45810	*	NORTH	SMZ	7.40
84506	STP	WEST	TMZ	-.30
84506	*	WEST	SMZ	-5.22
108407	STP	EAST	TMZ	-.48
108407	*	EAST	SMZ	2.82
164608	STP	SOUTH	TMZ	-.56
164608	*	SOUTH	SMZ	1.91
24806	STPH	WEST	TMZ	-3.05

COMP. / STAND	TREAT- MENT	ECO- REGION	PHYSIO- GRAPHIC ZONE	TOTAL TON (GREEN) GROWTH
24806	*	WEST	SMZ	4.06
103617	STPH	NORTH	TMZ	1.48
103617	*	NORTH	SMZ	-1.49
111922	STPH	EAST	TMZ	.54
111922	*	EAST	SMZ	1.13
165106	STPH	SOUTH	TMZ	.80
165106	*	SOUTH	SMZ	1.49
42802	STSH	NORTH	TMZ	4.27
42802	*	NORTH	SMZ	4.78
107310	STSH	EAST	TMZ	3.53
107310	*	EAST	SMZ	.36
131416	STSH	WEST	TMZ	5.64
131416	*	WEST	SMZ	5.42
165416	STSH	SOUTH	TMZ	1.12
165416	*	SOUTH	SMZ	1.00
6208	STSL	SOUTH	TMZ	.76
6208	*	SOUTH	SMZ	2.41
23117	STSL	WEST	TMZ	4.05
23117	*	WEST	SMZ	3.50
36704	STSL	NORTH	TMZ	2.61
36704	*	NORTH	SMZ	2.03
107719	STSL	EAST	TMZ	4.23
107719	*	EAST	SMZ	1.99
104403	STSP	NORTH	TMZ	3.07
104403	*	NORTH	SMZ	-5.97
112505	STSP	EAST	TMZ	3.06
112505	*	EAST	SMZ	3.12
128401	STSP	WEST	TMZ	2.86
128401	*	WEST	SMZ	1.04
165816	STSP	SOUTH	TMZ	1.11
165816	*	SOUTH	SMZ	2.86
7010	STSW	NORTH	TMZ	1.72
7010	*	NORTH	SMZ	2.30
24817	STSW	WEST	TMZ	4.02
24817	*	WEST	SMZ	-.30
60909	STSW	EAST	TMZ	4.53
60909	*	EAST	SMZ	1.45
164913	STSW	SOUTH	TMZ	-.04
164913	*	SOUTH	SMZ	-1.02
3541	SWP	SOUTH	TMZ	-3.63
3541	*	SOUTH	SMZ	2.52

COMP. / STAND	TREAT-MENT	ECO-REGION	PHYSIO-GRAPHIC ZONE	TOTAL TON (GREEN) GROWTH
44303	SWP	NORTH	TMZ	2.80
44303	*	NORTH	SMZ	3.37
89501	SWP	WEST	TMZ	2.91
89501	*	WEST	SMZ	2.57
109706	SWP	EAST	TMZ	2.94
109706	*	EAST	SMZ	-9.04
21811	SWPH	WEST	TMZ	3.12
21811	*	WEST	SMZ	6.03
45609	SWPH	NORTH	TMZ	2.46
45609	*	NORTH	SMZ	3.40
109404	SWPH	EAST	TMZ	3.11
109404	*	EAST	SMZ	2.05
166006	SWPH	SOUTH	TMZ	1.43
166006	*	SOUTH	SMZ	1.93
2701	SWW	SOUTH	TMZ	1.53
2701	*	SOUTH	SMZ	6.58
45712	SWW	NORTH	TMZ	2.71
45712	*	NORTH	SMZ	2.52
83301	SWW	WEST	TMZ	3.54
83301	*	WEST	SMZ	3.69
111921	SWW	EAST	TMZ	2.70
111921	*	EAST	SMZ	2.56
2310	UC	SOUTH	TMZ	3.69
2310	*	SOUTH	SMZ	2.32
28411	UC	NORTH	TMZ	.43
28411	*	NORTH	SMZ	.80
60505	UC	EAST	TMZ	.92
60505	*	EAST	SMZ	2.48
89607	UC	WEST	TMZ	5.50
89607	*	WEST	SMZ	8.67

* No silvicultural treatments are applied within streamside management zones (SMZ).

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