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Harvest Activity and Residual Pine Stocking on Private Timberland in Arkansas, 1978–88

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SUMMARY

Commercial harvesting, carried out on 39 percent of the privately owned timberland (5.3 million acres) in Arkansas from 1978-88, had a heavy impact on forest industry timberland. On a percentage basis, cutting was heaviest in pine forest types. Fifty-four percent of the heavily cut pine and mixed pine-hardwood stands were at least 60 percent stocked with pine following harvest.

Keywords: clearcut, partial cut, pine regeneration, timber supply.

INTRODUCTION

Pine regeneration has emerged as an important issue confronting the southern forestry community. A poor record of regeneration following harvest on nonindustrial private timberland has been reported to have had a negative impact on the softwood resource southwide (Knight 1987, USDA FS 1988). An earlier study in Arkansas found that only half the harvested pine-site timberland held by nonindustrial private owners was adequately regenerated with pine (Birdsey and others 1981).

The Forest Inventory and Analysis (FIA) unit of the Southern Forest Experiment Station recently completed its fifth full survey of Arkansas' forest resource. The survey revealed some important trends that relate to pine regeneration. To summarize briefly, the area of pine-type timberland and softwood growing-stock volume both decreased slightly, softwood growing-stock growth decreased, and softwood removals now exceed growth (Hines and Vissage 1988). The status of harvested timberland is examined and updated for the two major private ownership classes—forest industry and nonindustrial private—using the latest survey information.

METHODS

Data were collected during the 1988 forest inventory of Arkansas (fig. 1). The study utilizes data for privately owned timberland that had been harvested since the previous measurement in 1978. Sample plots were located on a systematic 3-mile grid and consisted of a cluster of 10 satellite points. At each point, trees greater than 5.0 inches in d.b.h. were selected for measurement using a 37.5 BAF prism; thus, each sample tree represented 3.75 square feet of basal area per acre. Saplings were measured on fixed-radius plots centered around the first three points. Well-established pine seedlings were tallied using mil-acre plots at all points.

Timberland area estimates were based on photo-interpretation and ground checks of sample plots, as well as intensification plots interspersed between the sample plots. Forest type was assigned using the relative stocking of dominant and/or codominant pine and hardwood species. Harvested stands that shifted to nonforest land uses were not included in the sample. Land that reverted from nonforest use, by natural seeding or planting, was also excluded.

Each plot was assigned a code describing any cutting activity since previous measurement. Field crews used existing plot conditions to distinguish between commercial harvest and other management activities such as thinning or stand improvement cuttings. Commercial harvesting included clearcuts, partial cuts, seed tree cuts, shelterwood cuts, and salvage cuts (see Appendix for term definitions). For discussion purposes, salvage cuts were included with partial cuts, as they contribute only a minor percentage of the total harvesting. Also, some heavy thinnings in sawtimber stands may be included as partial cuts because judgments discerning these thinnings from partial cuts can be difficult

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in the field. The intent has been to focus on heavily cut stands that offer pine regeneration opportunities.

HARVESTING

Over the past 10 years, 2 out of 5 acres of privately owned timberland in Arkansas (5.3 million acres) showed evidence of commercial harvest activity (table 1). Over half the harvesting was conducted on nonindustrial private timberland; however, forest industry timberland was more heavily impacted. Fifty-six percent of the forest industry timberland was harvested compared with 31 percent of the nonindustrial timberland.

Harvest activity was distributed relatively evenly by forest type, with pine, mixed pine-hardwood, and hardwood types receiving 39 percent, 20 percent, and 41 percent of the harvesting, respectively. Harvesting was heaviest in pine types, as 3 out of 5 acres of the existing pine stands were cut. Forest industry harvests were heavily oriented toward stands containing pine timber.

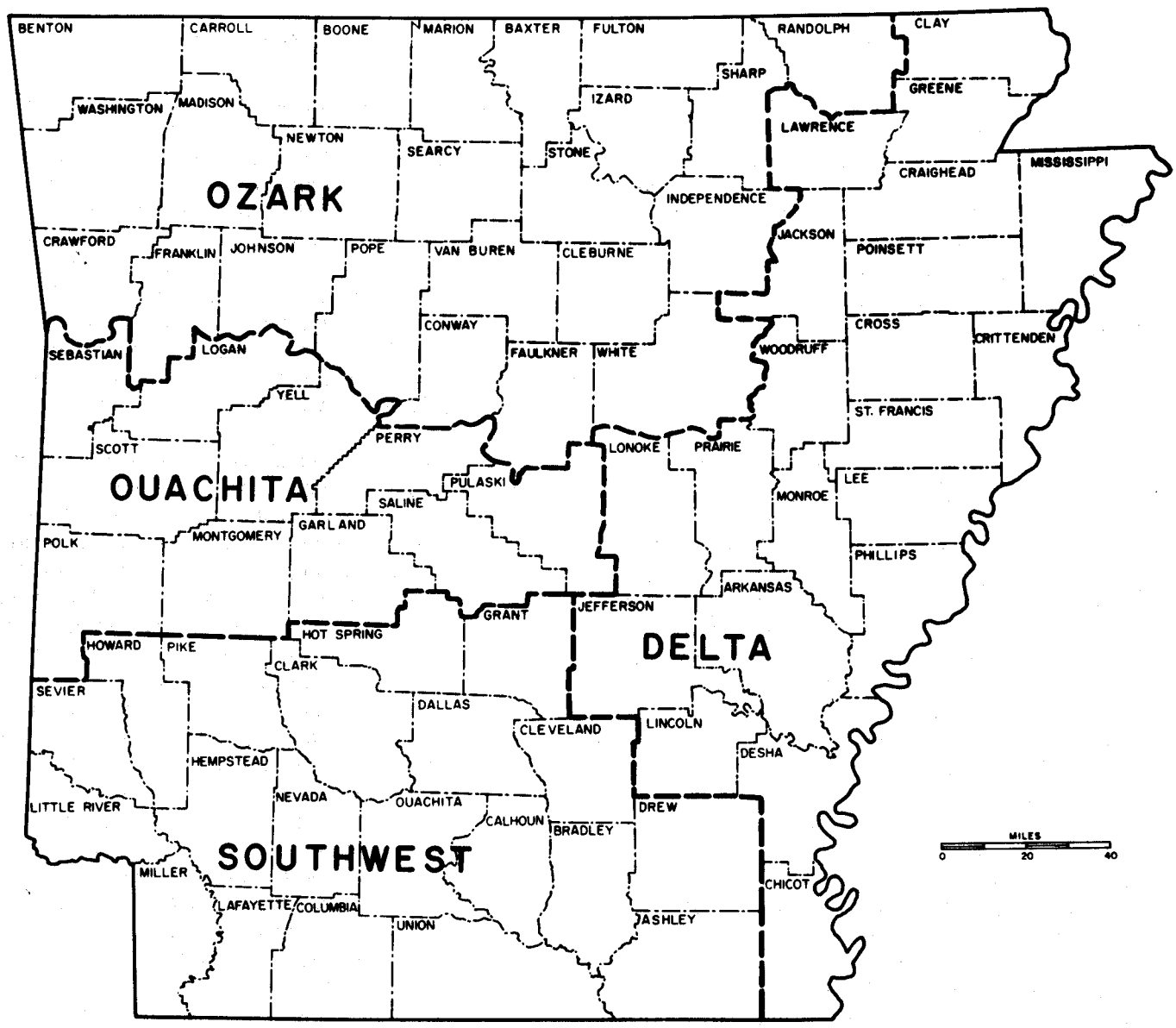

Figure 1.—*The forest survey regions of Arkansas.*

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Nearly three-fourths of their harvest activity was in pine or mixed pine-hardwood stands. This affected 62 percent (1.7 million acres) of such stands on industry land, compared with 45 percent (1.4 million acres) of the nonindustrial pine and mixed pine-hardwood stands that were cut. Just over half the nonindustrial harvesting was in hardwood stands, but this had an impact on only one-quarter of the nonindustrial hardwood forest.

Partial cutting was the most common harvest method, accounting for 70 percent of the harvested timberland. About two-thirds of the partial cutting was evident on nonindustrial private land. Partial cuts were found on 4 out of 5 of the harvested acres held by nonindustrial private owners.

In many cases, partially cut stands are essentially clearcut for a particular product, such as pine sawtimber, with nonproduct trees left standing. These residual trees often meet Forest Service merchantability criteria, hence the classification as partial cut. This classification follows Smith's broad definition of the clearcut method (Smith 1962). Another reason for the high percentage of partially cut acres is that some stands may have been in an intermediate stage of multipass harvest, say with pines cut first and hardwoods cut later.

About one-quarter of the harvesting (1.3 million acres) consisted of clearcuts. Forest industry clearcut about twice the area that nonindustrial private owners clearcut. Forest industry clearcuts tended to provide more complete removal of trees. Classification of clearcuts included a distinction between complete and merchantable clearcuts. Merchantable clearcuts remove only merchantable growing-stock trees, leaving rough and rotten trees on the site. Sixty-one percent of the forest industry clearcuts removed all trees. In contrast, 70 percent of the nonindustrial private clearcuts left rough and rotten trees standing. Some of the acreage with residual trees may receive further clearing through site-preparation activity subsequent to the visit by FIA field crews.

PINE REGENERATION

Stocking is quantified by comparing existing tree stocking, in terms of number of trees or basal area, with the normal stocking standards used by FIA (see Appendix). Inventory plots are characterized as understocked or overstocked in relation to this standard. Pine regeneration on harvested sites is assessed by examining the degree of pine stocking following harvest. Plots are assigned a pine stocking class of high, medium, or low.

Pine stocking classes are useful for examining pine regeneration but should not be used as absolute measures of success or failure because forest management objectives and stand conditions vary among owners. For example, the FIA standard for a fully stocked stand containing only seedlings is 600 well-established trees per acre. Owners practicing intensive management may not require this many pine seedlings if follow-up control measures are scheduled. In this case, as few as 200 well-spaced established seedlings may represent a minimum for success. Alternatively, a landowner prac-

Table 1.—*Area of timberland commercially harvested by ownership class, past forest type, and method of harvest for private owners, Arkansas, 1978–88.*[1]

Ownership class and past forest type	Total past timberland	Total timberland harvested	Method of harvest: Clearcuts	Seed tree and sheltered cuts	Partial cuts[2]
	Thousand acres				
Forest industry					
Pine types	1,830.4	1,217.7	426.0	129.7	662.0
Mixed pine-hardwoods	938.5	494.0	173.0	63.1	257.9
Hardwood types	1,463.7	657.2	250.0	12.1	395.1
Total	4,232.6	2,368.9	849.0	204.9	1,315.0
Nonindustrial private					
Pine types	1,613.9	861.0	180.6	56.7	623.7
Mixed pine-hardwoods	1,527.2	562.3	67.4	22.5	472.4
Hardwood types	6,324.9	1,498.3	186.7	21.4	1,290.2
Total	9,466.0	2,921.6	434.7	100.6	2,386.3
Total private					
Pine types	3,444.3	2,078.7	606.6	186.4	1,285.7
Mixed pine-hardwoods	2,465.7	1,056.3	240.4	85.6	730.3
Hardwood types	7,788.6	2,155.5	436.7	33.5	1,685.3
Total	13,698.6	5,290.5	1,283.7	305.5	3,701.3

[1]Excludes precommercial thinnings, commercial thinnings in poletimber stands, and single-tree selection.

[2]Includes pine-selection, diameter-limit, and salvage cuts. Thinnings in poletimber stands are excluded; some heavy thinnings of dominant and/or codominant trees in sawtimber stands may be included.

ticing less-intensive management may consider 600 seedlings as a minimum for successful pine regeneration.

Future supplies of pine timber depend on the extent that pine is re-established following harvest of pine and mixed pine-hardwood type timberland. Pine regeneration assessment focuses on stands most in need of pine regeneration, that is, heavily cut stands (including clearcuts and partial cuts). Seed tree and shelterwood cuts are excluded from the analysis because the residual seed trees left on the site constitute a significant stand. These stands are assessed after the seed trees are removed.

The data indicate that 54 percent of the heavily cut pine and mixed stands (1.5 million acres) exhibited a high stocking of pine. An additional 30 percent (0.8 million acres) had medium stocking, which in some cases may represent adequate pine regeneration. Forest industry was somewhat more successful at reforesting with pine (fig. 2).

When only clearcuts are examined, 56 percent of the harvested pine and mixed stands had high pine stocking and 20 percent had medium stocking (table 2). Sixty-three percent of industry's clearcut pine and mixed stands had high pine stocking. This compares with 41 percent for clearcuts on nonindustrial private land.

Fifty-three percent of the partially cut pine and mixed stands exhibited high pine stocking, and 34 percent had medium pine stocking (table 3). Overall, pine stocking in partially cut stands tends to be higher than for clearcuts due to the stocking of residual pines and natural seedling from those pines. However, the quality and spacing characteristics of the new stand are often less desirable.

Conversion of clearcut hardwood stands to pine was apparent for both ownerships. Nearly half the clearcut stands classified as hardwood forest types had at least medium pine stocking.

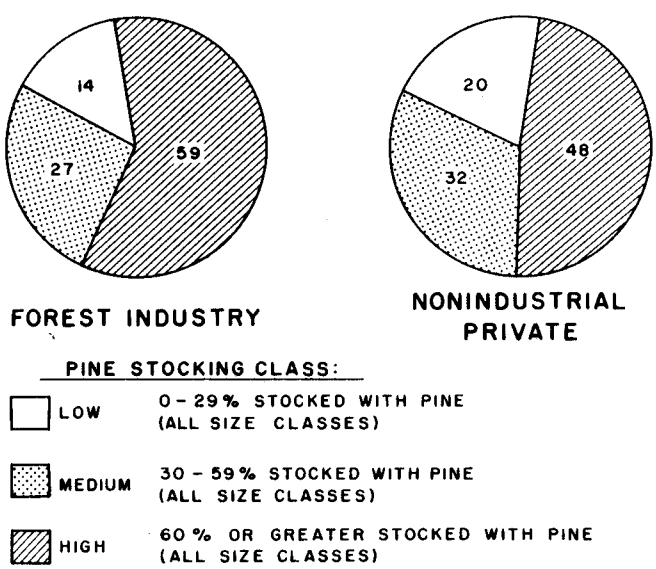

Figure 2.—*Status of pine and mixed pine-hardwood timberland commercially harvested using clearcuts and partial cuts, Arkansas, 1978–88. Numbers on the charts represent the percentage of timberland in a particular stocking class.*

Table 2.—*Area of timberland commercially harvested using clearcuts by ownership class, past forest type, and pine stocking class for private owners, Arkansas, 1978–88.*

Ownership class and past forest type	Total	Pine stocking class[1] Low	Medium	High
	Thousand acres			
Forest industry				
Pine types	426.0	81.6	66.1	278.3
Mixed pine-hardwoods	173.0	27.6	48.5	96.9
Hardwood types	250.0	113.1	45.5	91.4
Total	849.0	222.3	160.1	466.6
Nonindustrial private				
Pine types	180.6	61.8	39.2	79.6
Mixed pine-hardwoods	67.4	28.8	17.0	21.6
Hardwood types	186.7	109.4	50.5	26.8
Total	434.7	200.0	106.7	128.0
Total private				
Pine types	606.6	143.4	105.3	357.9
Mixed pine-hardwoods	240.4	56.4	65.5	118.5
Hardwood types	436.7	222.5	96.0	118.2
Total	1,283.7	422.3	266.8	594.6

[1]Low indicates 0–29 percent stocked with pine (all size classes), medium indicates 30–59 percent stocked with pine (all size classes), and high indicates 60 percent or greater stocked with pine (all size classes).

DISCUSSION

The current status of harvested stands has important implications for the future availability of timber, especially due to the large area harvested. Whereas the results are not directly comparable to the earlier report by Birdsey and others (1981) due to reporting differences, a general observation can be made. The proportion of harvested stands regenerated with pine is about the same, but the total area regenerated is larger because the area harvested has increased. Planting records provide further evidence that pine regeneration has improved. The area planted each year in Arkansas has more than doubled over the 10-year study period (USDA FS 1979–1988).

Short-term effects of extensive harvesting are already evident. The large-scale conversion of older stands to new stands has affected the inventory and growth characteristics of Arkansas' pine forests. Increases in softwood inventory volumes, such as have been apparent in past surveys, have ceased, but a

Table 3.—*Area of timberland commercially harvested using partial cuts[1] by ownership class, past forest type, and pine stocking class for private owners, Arkansas, 1978–88.*

Ownership class and past forest type	Total	Pine stocking class[2]		
		Low	Medium	High
	Thousand acres			
Forest industry				
Pine types	662.0	39.8	172.1	450.1
Mixed pine-hardwoods	257.9	56.7	130.2	71.0
Hardwood types	395.1	343.8	33.3	18.0
Total	1,315.0	440.3	335.6	539.1
Nonindustrial private				
Pine types	623.7	63.1	162.2	398.4
Mixed pine-hardwoods	472.4	113.7	217.3	141.4
Hardwood types	1,290.2	1,147.2	121.0	22.0
Total	2,386.3	1,324.0	500.5	561.8
Total private				
Pine types	1,285.7	102.9	334.3	848.5
Mixed pine-hardwoods	730.3	170.4	347.5	212.4
Hardwood types	1,685.3	1,491.0	154.3	40.0
Total	3,701.3	1,764.3	836.1	1,100.9

[1]Includes pine-selection, diameter-limit, and salvage cuts. Thinnings in poletimber stands are excluded; some heavy thinnings of dominant and/or codominant trees in sawtimber stands may be included.

[2]Low indicates 0–29 percent stocked with pine (all size classes), medium indicates 30–59 percent stocked with pine (all size classes), and high indicates 60 percent or greater stocked with pine (all size classes).

recovery should begin once today's large area of premerchantable stands grows to merchantable size. Also, the size distribution of softwood trees is characterized by decreases in merchantable-sized trees.

The long-term outlook for softwood timber supply depends on the future status of the 1.3 million acres of harvested pine and mixed stands with medium and low pine stocking. Some of the stands with medium stocking (0.8 million acres) will evolve into pure pine stands while others will remain as mixed and hardwood forest types. The stands with low pine stocking (0.5 million acres) could potentially revert to hardwood forest types.

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Appendix

DEFINITION OF TERMS

Commercial Harvest.—A classification assigned to sample plots that have undergone some form of commercial crop-tree removal since the last survey. Precommercial thinnings, commercial thinnings in poletimber stands, and the removal of a small number of trees for firewood, posts, or other products are excluded.

Clearcut: Stands that undergo removal of all utilizable and/or nonutilizable trees.

Seed tree and shelterwood: Heavy cutting of a stand with a small number of crop trees left to provide seed or shade to establish a new stand.

Partial cut: Pine-selection cuts, diameter-limit cutting, high-grading, or any other sawtimber cutting practice that leaves a residual stand of potential crop trees and/or cull trees. Thinnings in poletimber stands are excluded; some heavy thinnings of dominant and/or codominant trees in sawtimber stands may be included.

Salvage: Removal of damaged or salvable dead trees, often leaving a gap in the stand.

D.b.h. (Diameter at breast height).—Tree diameter in inches, outside bark, usually measured at 4 1/2 feet above ground.

FIA.—Forest Inventory and Analysis unit of the U.S. Department of Agriculture, Forest Service. In this paper, references are made to the Southern Forest Experiment Station unit located in Starkville, MS.

Forest type.—A classification of sample plots according to the relative stocking of pine and hardwood trees tallied.

Pine: Forests in which pine species comprise the plurality of all live tree stocking.

Mixed pine-hardwoods: Forests in which pines comprise 25 to 50 percent of the stocking, and hardwood species, singly or in combination, comprise the plurality of all live tree stocking.

Hardwood: Forests in which hardwood species,

singly or in combination, comprise a plurality of all live tree stocking, except where pines comprise 25 to 50 percent of the stocking (see previous definition for mixed pine-hardwoods).

Pine stocking class.—A classification of timberland according to the degree of live pine tree stocking. All size classes are included.

High stocking: 60 percent or greater stocked with pine.

Medium stocking: 30 to 59 percent stocked with pine.

Low stocking: 0 to 29 percent stocked with pine.

Saplings.—Live trees 1.0 to 4.9 inches in d.b.h.

Seedlings.—Live trees less than 1.0 inch in d.b.h. and at least 6 inches in height.

Stocking—A measurement of the extent to which the growth potential of the site is utilized by trees or preempted by vegetative cover. Stocking is determined by comparing the stand density, in terms of number of trees or basal area, with a specified standard. The tabulation below shows the density standard in terms of the number of trees per acre, by size class, required for full stocking.

D.b.h. (inches)	No. of trees (per acre)
seedlings	600
2	560
4	460
6	340
8	240
10	155
12	115
14	90
16	72
18	60
20	51
22	42
24	36
26	31
28	27
30	24

Timberland.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, capable of producing crops of industrial wood. Land that is currently developed for nonforest use or that is withdrawn from timber utilization through statute or administrative regulation is excluded.

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