PLANT COMMUNITIES IN SELECTED LONGLEAF PINE LANDSCAPES ON THE CATAHOULA RANGER DISTRICT, KISATCHIE NATIONAL FOREST, LOUISIANA

James D. Haywood, William D. Boyer, and Finis L. Harris'

Abstract-In Grant Parish, Louisiana, increases in overstory basal area, canopy cover, and development of understory woody plants reduced productivity of herbaceous plants in longleaf pine *(Pinus palustris* Mill.) stands that were managed with fire. Still, the herbaceous plant community can reestablish itself on properly managed upland longleaf pine sites in the West Gulf Region. Management efforts were considered most successful where pinehill bluestem [*Schizachyrium scoparium var. divsrgens* (Hack.) Gould] is the dominant herbaceous plant. The lack of oak *(Ouercus* spp.) and hickory *(Carya* spp.) regeneration on *more* mesic sites was worrisome. Use of nested subplots was the best method for monitoring herbaceous vegetation.

INTRODUCTION

Fire was essential for the formation of many southern pine ecosystems. Today, failure to use prescribed fire in upland longleaf pine landscapes results in encroachment by hardwood trees and shrubs and the loss of native pine and herbaceous vegetation. For example, in Alabama over 90 percent of the green biomass on the forest floor of young unburned longleaf pine stands is woody vegetation, while in periodically burned stands, less than 50 percent of the green biomass on the forest floor is woody vegetation (Boyer 1995). This woody vegetation can form a closed midstory that reduces species richness and productivity of the herbaceous plant community (unpublished field notes).

Only about 5 percent of the pine forest lands in Louisiana is publicly owned (Vissage and others 1992). Given the limited acreage, it makes sense to manage these lands for rare and endangered species, old growth characteristics, and other things that may be beyond the management capability of private landowners. As public lands are managed for these other attributes, monitoring becomes necessary for both legal and practical reasons.

In January 1993, the Kisatchie National Forest and the Southern Research Station began monitoring the effects of operational-scale burning in longleaf pine forests on overstory and midstory trees and shrubs and understory vegetation. In addition, research studies on the Catahoula Ranger District (RD) have provided useful information about the effects of fire. We are reporting on the fire effects from operational-scale burns done on two Ecosystem Management Project (EMP) sites and will compare those results to research findings.

SITES

All sites are on the Catahoula RD, Kisatchie National Forest, Grant Parish, LA. Elevations of the sites range from 53 to 76 meters (m). These sites are within the historical range of the upland longleaf pine forest type of the humid temperate, subtropical, outer coastal plain mixed forest, and are located in the coastal plains and flatwoods Western Gulf Ecoregion of the Southern United States (McNab and Avers 1994). The mean January and July temperatures are 10 and 28 °C, respectively (Louisiana Office of State Climatology 1995). Yearly precipitation averages 143 centimeters (cm) and growing-season precipitation averages 82 cm. The growing season is more than 200 days long: it usually begins before or during early March and ends because of dry weather in October.

The two research sites are as follows:

RES1 : The site is a slightly sloping upland of Metcalf (Aquic Glossudal@ and Cadeville (Albaquic Hapludal@ very fine sandy loams. An existing stand [7,450 stems per hectare (ha)] of 6-year-old lobiolly pine *(Pinus taeda* L.) was clearcut and the debris burned before 0.093-ha study plots were established. For the next 11 years, woody vegetation was controlled by biennial burning and by severing of all woody and blackberry *(Rubus* spp.) stems over 1 m tall. Over the next decade, a pasture of native woody and herbaceous plants became reestablished. We are using data from plots burned biennially in early May from 1982 through 1992.

RES2: The stand is a 17-ha longleaf pine shelterwood with reserves on a gently rolling upland of Ruston and Smithdale (Typic Paleudults) sandy loam soils. The shelterwood was established in 1968 when the initial preparatory cut left a residual basal area of 8.4 m^2 per ha. A seed-tree cut in 1975 left 6.9 m^2 per ha of basal area. The seed trees have been reserved for the management of red-cockaded woodpecker *(Picoides borealis)* habitat. The stand has been prescribed burned 11 times from 1969 through May 1993. Burns were during all seasons of the year.

The two EMP sites are as follows:

EMPL: The stand is a 188-ha longleaf pine forest on a Ruston, Smithdale, and Malbis (Plinthic Paleudult) sandy loam and loamy sand gently rolling upland. The two most recent prescribed burns were in 1990 and

[1] Research Forester, Southern Research Station, USDA Forest Service, 2500 Shreveport Highway, Pineville, LA 71360; Research Forester. Southern Research Station, USDA Forest Service, Devall Dr., Auburn, AL 36849; and Silviculturist, USDA Forest Service, Kisatchie National Forest, 2500 Shreveport Highway, Pineville, LA 71360 (respectively).

Ill: Waldrop, Thomas A., ed. 1998. Proceedings of the ninth biennial southern silvicultural research conference; 1997 February 25-27; Clemson, SC. Gen. Tech. Rep. SRS-20. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. p. 86-91

February 1993. Backing and striphead fires were employed.

EMP2: The stand is a 99-ha longleaf pine forest on a Ruston and Smithdale sandy loam and loamy sand gently rolling upland. The three most recent prescribed burns were in 1990, July 1993, and May 1995. Sacking and flank fires were employed.

PROCEDURES

On RES1, total current-year herbaceous production was determined in February 1994 by clipping the aboveground foliage on 12 systematically located 0.22-m' subplots located within each 0.04-ha plot. Dry matter production (oven-dried at 80 °C for at least 24 hours) was determined after the samples were subdivided' into six taxa: pinehill bluestem; other bluestems-mostly broomsedge (*Andropogon virginicus* L.), Elliott's bluestem (*A. elliottii* Chapm.), big bluestem (*A. gerardii* Vitm.), and slender bluestem (S. *tenerum* Nees); longleaf uniola (Chasmanthium sessiliflorum (Poir) Yates]; other grasses—mostly switchgrass (*Panicum virgatum* L.), yellow indiangrass [*Sorghastrum avenaceum* (Michx.) Nash], low panicums (*Dichanthelium* spp), lovegrass (*Eragrostis* spp.), and threeawn (*Aristida* spp.).; grasslikes-mostly nutrush (Scleria spp.), sedge (Carex spp.), flatsedge (*Cyperus* spp.), spikesedge (*Eleocharis* spp.), rush (*Juncus* spp.), and beakrush (*Rhynchospora* spp.); and forbs. In March 1994, all woody, blackberry, and vine stems were counted and heights and crown spreads estimated on five systematically located 40-m' subplots.

On RES2, EMP1, and EMP2, 0.04-ha plots were established for measuring heights and d.b.h. of the overstory and midstory trees. There were 16 plots on the uplands in RES2 and 10 plots on both EMP1 and EMP2. Inventories were made in May 1996 on EMP1 and EMP2 and in July 1996 on RES2.

Within each 0.04-ha plot, five 4-m^2 subplots were systematically established for identifying and counting understory woody stems, blackberry stems, and vines and for measuring heights and crown cover of the woody and blackberry stems. This brush was inventoried in April 1995 on EMP2, in August 1995 on EMP1, and in August 1996 on RES2.

On RES2, five lines of 20 0.22-m^2 subplots were placed at equal distances apart across the site for inventorying herbaceous plant species. The lines were spaced 80 m apart and the subplots were spaced 16 m apart in each line. Only 86 of the 100 subplots fell on the upland soils. The remaining 14 subplots were in the Guyton (Typic Glossaqual) drainages and were not used. All herbaceous plants with root collars in the subplots were inventoried in July 1996. After the inventories, the herbaceous plants in the subplots were clipped to groundline to determine dry matter production.

Twelve 100-point transacts were permanently located on both EMP1 and EMP2. These were used to inventory herbaceous plants. Each transect was 30 m long and readings were made every 30 cm. Readings were made through a circular loop 2 cm in diameter. The loop was held about 30 cm from the eye and 60 cm above the ground. All herbaceous plants seen through the loop were recorded. Readings were made in April 1995 on EMP2 and in August 1995 on EMP1. In September 1995, current-year herbaceous vegetation was clipped to groundline within seven 0.22-m^2 subplots adjacent to each transect to determine dry matter production on both EMP1 and EMP2.

RESULTS AND DISCUSSION

Overstory and Midstory Vegetation

On RES2, EMP1, and EMP2 total stocking and basal area ranged from 54 to 279 stems per ha and 8.0 to 24.4 m^2 per ha (table 1). Canopy cover was too sparse to measure accurately on RES2 but averaged 67 percent on EMP1 and EMP2. Longleaf pine dominated the overstory on all sites

Table l-Number and basal area of overstory and midstory trees and shrubs and the percentage of the stand in longleaf pine (*Pinus palustris* Mill.)

	Number of stems/ha		Basal area (m^2/ha)			
Stands[a]	Total	Longleaf pine	Total	Longleaf pine	Longleaf pine	Total canopy cover
					..... Percent-	
RES2— sheltetwood with reserves	54	48	8.01	7.67	96	..[b]
EMPl— forest	279	124	24.36	19.85	81	77
EMP2— forest	210	153	24.40	21.89	90	57

[a] RES1 had no overstory or midstory vegetation.
[b] No data for this sparse overstory.

and made up from 81 to 96 percent of the total basal area. These three stands were classed as pure longleaf pine based on basal area (Ford-Robertson 1971).

More species of overstory and midstory trees and shrubs occurred on EMP1 and EMP2 than on RES2. Species other than longleaf pine represented a greater portion of the stand basal area on EMP1 and EMP2 than on RES2 (table 1).

EMP1 had nine common overstory and midstory species: longleaf pine, mockernut hickory [*Carya tomentosa* (Poir) Nutt.], flowering dogwood (*Cornus florida* L.), sweetgum (*Liquidambar styraciflua* L.), loblolly pine, southern red oak (Q. *falcata* Michx.), post oak (Q. *stellata* Wangenh.), black oak (Q. *velutina* Lam.), and sassafras *[Sassafras albidum* (Nutt.) Nees]. The common species on EMP2 were longleaf pine, mockernut hickory, blackgum (*Nyssa sylvatica* Marsh.), lobloily pine, southern red oak, blackjack oak (Q. *marilandica* Muenchh.), post oak, and black oak. On RES2, the common species were longleaf pine, sweetgum, southern red oak, and post oak.

Common Understory Woody Plants

Excluding blackberry, there were 16 tree, 15 shrub, and 15 vine species on EMP1 , and 12 tree, 15 shrub, and 12 vine species on EMP2. Excluding pine seedlings, there were 60,100 tree, shrub, and blackberry stems per ha on EMP1, and 74,100 per ha on EMP2 (table 2). Height of this brush averaged 0.8 m on EMP1 and 0.5 m on EMP2. Vines numbered 86,600 per ha on EMP2 and 71,100 per ha on EMP1.

Excluding blackberry, there. were six tree, nine shrub, and five vine species on RES2 and three tree, six shrub, and three vine species on RES1. Excluding pine seedlings, there were 24,500 tree, shrub, and blackberry stems per ha on RES2, and 9,700 per ha on RES1 (table 2). Vines numbered 27,800 per ha on RES2 and 4,900 per ha on RES1.

The number of longleaf pine seedlings in the grass stage ranged from none on RES1 to 260,000 per ha 21 months after burning oh EMP2. The number of loblolly pine seedlings ranged from 150 per ha 30 months after burning on RES2 to 9,300 per ha on EMP2. However, these small pine seedlings failed to develop because of the presence of overstory trees on RES2, EMP1, and EMP2 or because of continual cutting on RES1. While each successive burn reduced the number of pine seedlings, the population recovered between burns. This cycle should continue until there is either a natural disturbance or a change in management.

Tree species common in the understory were red maple (*Acer rubrum* L.), flowering dogwood, sweetgum, blackgum, black cherry (*Prunus serotina* Ehrh.), southern red oak, post oak, and sassafras, although the stocking and average height of these species varied among sites (table 2). Red maple was not in the overstory on RES2, EMP1, and EMP2. However, red maple is susceptible to fire, and it may be being curtailed by burning on these upland sites (Haywood 1995).

Other hardwoods are also susceptible to fire (Chen and others 1975). Prescribed burning kills back the tops of hardwood stems but the root system is affected less (Silker 1961). This results in an increase in stem numbers, but the regrowth is smaller. However, continual burning-especially on an annual or biennial basis-eventually reduces the numbers and vigor of woody stems (Lotti 1956, Chen and others 1975).

On both EMP1 and EMP2, the overstory species not well represented in the understory were mockernut hickory, black oak and blackjack oak. On RES2, the overstory species not well represented in the understory was post oak. Thus, it appears that oaks and hickories are not completely regenerating.

Shrub taxa in the understory included American beautyberry (*Callicarpa americans* L.), southern bayberry or waxmyrtle (*Myrica cerifera* L.), shining sumac (*Rhus copalina* L.), blackberry, tree sparkleberry *(Vaccinium arboreum* Marsh.), and other blueberries *(Vaccinium* spp.) (table 2). Common vine taxa in the understory were rattanvine [*Berchemia scandens* (Hill) K. Koch], Carolina jessamine *[Gelsemium sempervirens* (L.) Ait. f.], Japanese honeysuckle (*Lonicera japonica* Thunb.), dewberry (*Rubus trivia/is* Michx.), greenbrier *(Smilax* spp.), poison oak [*Toxicodendron toxicarium* (Salisb.) Gillis], and grape *(Vitis* spp.). Vines were most plentiful on EMP1 and EMP2, and numbers of vines varied from 4,900 per ha on RES1 to 86,600 per ha on EMP2.

Common Herbaceous Plants

On all four sites, the most well-distributed plants were pinehill bluestem, low panicums, swamp sunflower (*Helianthus angustifolius* L.), grassleaf goldaster [*Heterotheca graminifolia* (Michx.) Shinners], and bracken fern [*Pteridium aquilinum var. pseudocaudatum* (Clute) Heller].

The total frequency of occurrence for all herbaceous vegetation was 30 percent on EMP1 and 74 percent on EMP2. The total current-year herbaceous production was 452 kilograms (kg) per ha on EMP1 and 753 kg per ha on EMP2.

On RES2, the total frequency of occurrence for all herbaceous vegetation was 805 percent. This high frequency of occurrence resulted partly from use of 0.22-m' subplots, whereas a 2-cm loop was used on EMP1 and EMP2. However, total current-year herbaceous production was 1,859 kg per ha on RES2. So, the plant cover was more abundant where overstory stocking was less, however the measurements were taken. No data on frequency of occurrence were collected on RES1, but total current-year herbaceous production was 3,204 kg per ha. Of this total, 79 percent was in grasses, 6 percent in grasslikes, and 15 percent in forbs.

Common Grasses

There were 19, 26, and 18 taxa of grasses commonly found on RES2, EMP1, and EMP2, respectively. The

Table 2-Number of stems per hectare and average height (ht) in meters of the principal understory trees, shrubs, and blackberry, excluding longleaf and loblolly pine, and number of principal vines per hectare; cover types are pasture of native plants (RES1), longleaf shelterwood with reserves (RES2), and longleaf forests (EMP1 and EMP2)

Taxa	Stands							
	RESI		RES2		EMP1		EMP2	
	Stems	Ht	Stems	Ht	Stems	Ht	Stems	Ht
Trees								
Acer rvbrvm red maple	—[a]	—	1,077	1.8	346	1.3	2,323	0.8
Cornvs florida flowering dogwood	—	—	—	—	2,768	0.7	9,933	0.6
Liqvidambar styraciflva sweetgum	1,235	0.8	2,308	1.2	1,433	1.6	148	0.3
Nyssa *sylvatica* blackgum	—	—	—	—	297	0.6	2,372	1.1
Prvnvs serotina black cherry	—	—	—	—	939	2.1	1,631	0.9
Quercus falcata southern red oak	2,140	0.4	4,769	0.8	2,125	0.7	1,631	0.6
Q. stellata post oak	—	—	—	—	198	0.3	8,896	0.5
Sassafras albidvm sassafras	—	—	769	0.3	2,817	0.6	4,893	0.8
Shrubs and blackberry								
Callicarpa *americana* American beautyberry	—	—	308	0.6	5,387	1.4	3,805	1.2
Myrica cerifera southern bayberry	3,292	0.8	154	1.1	9,489	0.7	7,611	0.3
Rhvs copallina shining sumac	165	0.8	3,077	0.6	3,212	0.9	6,820	0.5
Rvbvs spp. blackberry	329	0.3	4,154	0.3	19,719	0.9	9,390	0.4
Vaccinivm arborevm tree sparkleberry	1,152	0.4	2,615	0.3	544	0.7	1,631	0.6
V. virgatvm, elliottii, and *staminevm* other blueberries	—	—	3,230	0.4	6,870	0.6	6,374	0.2
All trees and shrubs[b]	9,712	0.6	24,462	0.6	60,146	0.8	74,130	0.5
Vines[c]								
Berchemia scandens rattanvine	—		—		10,724		395	
Gelsemivm sempervirens Carolina jessamine	4,115		2,923		15,963		10,625	
Lonicera japonica Japanese honeysuckle	—		—		297		17,989	
Rvbvs trivia/is dewberry	—		11,538		9,340		26,588	
Smilax bona-nox, glavca rotvndifolia, and *smallii* greenbrier	741		3,539		6,030		13,690	
Toxicodendron toxicarivm poison oak	—		9,846		14,282		9,093	
Vitis rotvndifolia and *aestivalis* grape	—		—		5,634		5,337	
All vines[b]	4,856		27,846		71,117		86,632	

[a] Taxon was not present.
[b] Number of stems for all trees and shrubs may also include numbers for taxa not reported in the table.
[c] Vine heights were not measured.

grasses that occurred most frequently were pinehill bluestem and low panicums on RES2 and E'MP2 and pinehill bluestem and big bluestem on EMP1 (table 3). Spreading panicum (*Panicum* anceps Michx.) was also common on these three sites. On RES1, pinehill bluestem made up 58 percent, other bluestems 14 percent, and all of the other grasses 7 percent of the total current-year herbaceous production.

Other Herbaceous Plants

The grasslike plant most common on all uplands was nutrush. There were 22, 9, and 22 species or genera of composites on RES2, EMP1, and EMP2, respectively. The composite most common on these three uplands was grassleaf goldaster. Swamp sunflower was common on RES1, RES2, and EMP2. Both of these species are indicators of well-developed herbaceous plant communities.

Legumes numbered 19, 8, and 14 species or genera on RES2, EMP1, and EMP2, respectively. The frequency of occurrence of the legumes averaged only 2 percent on EMP1 and EMP2, but was 176 percent on RES2. We believe that the method of sampling was a factor in the

Table 3-Grass taxa with frequency of occurrence exceeding either 4 percent on RES2 or 1 percent on EMP1 and EMP2; data on frequency of occurrence were not taken on RES1. Cover types are longleaf shelter-wood with reserves (RES2) and longleaf forests (EMP1 and EMP2)

Taxa	Stands		
	RES2[a]	EMP1	EMP2
	Percent		
Andropogon gerardii big bluestem	1.16	2.67	0.75
A. subtenuis fineleaf bluestem	4.65	—[b]	—
Aristida purpurascens arrowfeather threeawn	23.26	0.08	1.25
Chasmanthium laxum and *C. sessiliflorum* spike and longleaf uniola	—	2.25	2.00
Dichanthelium spp. low panicums	79.07	1.50	12.67
Eragrostis elliotti and E. spectabilis Elliott and purple lovegrasses	4.65	0.25	0.08
Gymnopogon ambiguus bearded skeletongrass	18.60	0.17	1.42
Muhlenbergia expansa cutover muhly	4.65	0.08	—
Panicum anceps spreading panicum	3.49	1.83	1.00
P. virgatum switchgrass	2.33	1.67	—
Schizachyrium scoparium var. *divergens* pinehill btuestem	95.35	7.58	8.08
S. tenerum slender bluestem	12.79	—	—
Sporobolus junceus pineywoods dropseed	4.65	0.17	—
All grasses'	270.94	21.40	30.82

[a] The frequencies of occurrence on RES2 are high partly because the sampling area was a 0.22-m^2 subplot rather than the P-cm-diameter loop used on EMP1 and EMP2.
[b] Taxon was not present.
[c] Frequency of occurrence for all grasses may include frequencies for taxa not reported in table.

difference in legume frequency among sites. On RES2, the legumes that occurred most frequently were showy partridgepea (*Cassia fasiculata* Michx.), littleleaf tickclover [*Desmodium ciliare* (Muhl.) DC.], erect milkpea [*Galactia erecta* (Walt.) Vail], catclaw sensitivebrier (*Schrankia uncinata* Willd.), pencilflower [*Stylosanthes biflora* (L.) BSP.], and Virginia tephrosia [*Tephrosia virginiana* (L.) Pers.].

These findings suggest that it was better to use 0.22-m^2 subplots than the transect method when inventorying herbaceous plant species. Future work should use a nested subplot technique as recommended by the North Carolina Vegetation Survey.[2]

The other forbs numbered 26, 10, and 18 species or genera on RES2, EMP 1, and EMP2, respectively. Texas dutchmanspipe (*Aristolochia reticulate* Nutt.) occurred most frequently on RES2, narrowleaf mountainmint *(Pycnanthemum tenuifolium* Schrad.) occurred most frequently on EMP1, and flowering spurge (*Euphorbia corollata* L.) occurred most frequently on EMP2. Bracken fern represented 97 percent of the total fern population on RES2, EMP1, and EMP2.

Effects of the Overstory on Herbaceous Vegetation

The amount of current-year herbaceous production on each site was partly associated with overstory and midstory basal area, canopy cover, and number and size of understory trees and shrubs. EMP1 had the greatest canopy cover, the tallest understory vegetation, and the least current-year herbaceous production. RES1 had no overstory, the fewest understory woody stems, and the greatest herbaceous production.

Continual prescribed burning can be used to reduce understory woody vegetation beneath forest canopies over a number of years, and this may increase herbage production (Lotti 1956, Silker 1961, Chen and others 1975). However, as a pine canopy closes, shading by the overstory and competition for water and nutrients still limit herbaceous production no matter how effectively fire is used (Grelen 1976). Therefore, development of a herbaceous plant community may have to be judged by plant diversity rather than by herbaceous productivity on forest sites. To this end, indicator plants can be used as barometers of the health of herbaceous plant communities.

If overstory competition and understory brush are controlled, these upland longleaf pine sites can support rich and productive herbaceous plant communities dominated by pinehill bluestem. Also, these results suggest that pinehill bluestem could be used as an indicator of management success in establishing and maintaining herbaceous plant communities on upland longleaf pine sites in the West Gulf Coastal Plain. Examples of other species that could be used as indicators on similar sites are swamp sunflower and grassleaf goldaster.

[2] Peet, R.K.; Wentworth, T.R.; White, P.S. 1990. A flexible, multipurpose method for measuring vegetation. 35 p. Draft document on file with: University of North Carolina, Department of Biology, Chapel Hill, NC.

LITERATURE CITED

Boyer, W.D. 1995. Responses of groundcover under longleaf pine to biennial seasonal burning and hardwood control. In: Edwards, M.B., comp. Proceedings of the eighth biennial southern silvicultural research conference; 1994 November 1-3; Auburn, AL. Gen. Tech. Rep. SRS-1. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 512-516.

Chen, **M.Y.; Hodgkins, E.J.; Watson, W.J.** 1975. Prescribed burning for improving pine production and wildlife habitat in the hilly coastal plain of Alabama. Bulletin 473. Auburn, AL: Auburn University, Alabama Agricultural Experiment Station. 19 p.

Ford-Robertson, F.C., ed. 1971. Terminology of forest science, technology practice and products. Washington, DC: Society of American Foresters. 349 p.

Grelen, H.E. 1976. Responses of herbage, pines, and hardwoods to early and delayed burning in a young slash pine plantation. Journal of Range Management. 29: 301-303.

Haywood, J.D. 1995. Prescribed burning and hexazinone herbicide as release treatments in a sapling hardwood-loblolly pine stand. New Forests. 10: 39-53.

Lotti, T. 1956. Eliminating understory hardwoods with Summer prescribed fires in coastal plain loblolly pine stands. Journal of Forestry. 54: 191-l 92.

Louisiana Office of State Climatology. 1995. Louisiana monthly climate review. Baton Rouge, LA: Louisiana State University.

McNab, W.H.; Avers, P.E., comps. 1994. Ecological subregions of the United States: section descriptions. Admin. Pub. WO-WSA-5. Washington, DC: U.S. Department of Agriculture, Forest Service. 267 p.

Silker, T.H. 1961. Prescribed burning to control undesirable hardwoods in southern pine stands. Bulletin 51. Austin, TX: Texas Forest Service. 44 p.

Vissage, J.S.; Miller, P.E.; Hartsell, A.J. 1992. Forest statistics for Louisiana Parishes-l 991. Resour. Bull. SO-168. New Orleans, LA: U.S. Department of Agriculture. Forest Service, Southern Forest Experiment Station. 65 p.