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LONG-TERM STUDIES ON DEVELOPMENT OF LONGLEAF PINE PLANTATIONS

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ABSTRACT: The U.S. Forest Service's Laboratory at Pineville, LA has established and maintained over 250 permanent plots in longleaf pine plantations. This database represents a range of sites in south-central United States. Some of these plots represent over 50 years of stand development in plantations currently over 65 years old. All of the plots have recorded 20 years or more of stand development. These plots are being used to develop a model to predict the growth and development of longleaf plantations. This model will be a valuable tool for managers of longleaf plantations. In addition to these valuable, historic plots, the Pineville laboratory is currently establishing new permanent plots in young longleaf pine stands, representing operational plantations on a variety of sites.

The poster will describe the individual studies comprising the longleaf pine database, and will provide growth trends observed on some individual plots. Furthermore, this will provide an opportunity to initiate cooperation of the Pineville laboratory with others interested in the development of longleaf pine plantations.

THE LEGACY

For over 50 years, the USDA Forest Service's Laboratory at Pineville, LA has been conducting research on the growth and development of longleaf pine plantations. We have seven long-term studies scattered throughout the Gulf Coastal Plain. These studies have explored the effects of spacing and thinning on longleaf plantations; most of the studies have been thinned several times. Each of the studies has recorded 20 years or more of stand development in longleaf pine plantations. Our database consists of 267 permanent plots.

THE LEGACY CONTINUES

Most of our plots were established more than 20 years ago. While this provides us with an invaluable long-term database, we have lost the ability to determine how applicable this data is to current cultural and environmental factors, as current conditions are not reflected. Therefore, we are initiating a new study that will establish permanent plots in young, operational plantations (this work will involve not only longleaf, but also loblolly and slash pines). Given sufficient support and cooperation, this work will embrace a wide range of sites, practices, and geography. We seek cooperators reflecting all ownerships of forestlands including governmental agencies, industrial forest landowners, and non-industrial forest landowners. This data will allow development of forest models that reflect the range of current practices.

FULLFILLMENT OF THE LEGACY

Although the data represent an interesting record of the development of longleaf pine plantations, the ultimate benefit from this legacy of effort to establish, maintain, and regularly remeasure these plots will be obtained in the construction of a model that will describe the growth and development of longleaf plantations for specified site quality, spacing and thinning. A growth and yield model for unthinned plantations was developed about 20 years ago (Lohrey and Bailey 1977). Since that time, most of our plots have been remeasured several times. This more-recent data will provide much more evidence concerning how older plantations develop. Bernie Parresol of the Biometrics unit at Asheville has conducted some further modeling work emphasizing unthinned plantations and height growth models. Dan Leduc of our laboratory has conducted some interesting work in using neural networks to model diameter distributions of unthinned longleaf plantations (Leduc et al. 1999). The "grass stage" that is often exhibited by longleaf pine provides an interesting challenge to modeling diameter distributions; often the diameter distribution is bi- or multi-modal. This bimodality may be maintained well past the grass stage, as longleaf saplings and poles often persist in subordinate crown positions. We plan to complete an entire growth and yield model for longleaf pine around this time next year. This will allow managers to project the growth and development of longleaf plantations, including the effects of initial spacing, thinning, and site quality. As our database is limited to stands of less than 70 years, and this is less than the planned rotation age of longleaf for some managers, we plan to constrain our model so that it will give reasonable results for projections up to age 100 or 120. We anticipate subsequent modeling efforts that will incorporate the effects of establishment techniques/stock

types, fire, and fertilizer, and predict understory community development, and also provide a merchandising processor that will segregate volume into several product classes, including poles.

FORETASTE OF THE LEGACY

In anticipation of the results of our more-formal modeling efforts, we present yield tables for unthinned plantations. These yield tables (tables 1-3) represent the average per-acre values across all our plots. Thus, the progression of values over age or across site are not necessarily smooth. The tables were produced by calculating mean values for each age and site class. Overall, we had 877 observations. The cell for medium sites at age 20 is based on 66 observations; this is the most for any cell. The cell based on the fewest observations is for medium sites at age 5; only 5 observations were available. We feel the table provides a "reality check" for expectations of yield of longleaf pine plantations. Although these plantations were established before current establishment practices for longleaf were devised, the plantations represent well-cared-for forests whose establishment was much more prompt than many plantations that were established at the time. Thus, we suspect that this table may adequately reflect the expectations for current operational plantations.

Table 1. Average Number of Trees Per Acre

	Site Class		
Age Class	Low $SI_{25} < 50$	Medium $50 \geq SI_{25} < 60$	High $SI_{25} \geq 60$
5		569	786
10		427	722
15	326	510	815
20	248	466	718
25	158	565	591
30	136	530	514
35	124	477	442
40	128	363	384
45	120	320	293
50	89	279	215
55	87	242	
60	86	187	
65	82	169	

Table 2. Basal Area (ft^2) per acre

	Site Class		
Age Class	Low $SI_{25} < 50$	Medium $50 \geq SI_{25} < 60$	High $SI_{25} \geq 60$
5		5	14
10		23	40
15	26	59	109
20	39	82	129
25	44	118	150
30	55	140	166
35	62	156	174
40	77	157	178
45	85	164	163
50	88	163	142
55	94	172	
60	100	171	
65	104	177	

Table 3. Volume (total ft^3 outside bark) per acre

Age Class	Site Class		
	Low	Medium	High
	$SI_{25} < 50$	$50 \geq SI_{25} < 60$	$SI_{25} \geq 60$
5		43	156
10		316	581
15	412	1104	2304
20	770	1853	3280
25	956	3057	4331
30	1348	4175	5372
35	1711	5049	6097
40	2328	5375	6556
45	2724	5941	6243
50	2993	6166	5640
55	3328	6710	
60	3647	6808	
65	3887	7234	

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