Forest Management Intensity: A Comparison of Timber Investment Management Organizations and Industrial Landowners in Mississippi

W. Rhett Rogers *and* **Ian A. Munn,** *Department of Forestry, Forest and Wildlife Research Center, Mississippi State University, Box 9681, Mississippi State, MS 39762.*

ABSTRACT: *All timberland investment management organizations (TIMOs) and industrial landowners in Mississippi were surveyed during 1998 and 1999 to determine their annual forest management practices and related expenditures. The response rate was 65%, and respondents accounted for approximately 90% of the timberland owned by these two landowner groups. For analysis purposes, industrial landowners were separated into two categories: large (>10,000 ac) and small (<10,000 ac). Pine plantations represented 66% of TIMOs' timberland base compared to 55% for large industrial landowners and less than 50% for small industrial landowners. Over the 2 yr study period, TIMOs and large industrial landowners invested heavily in site preparation and planting as well as midrotation chemical release and fertilization. In contrast, small industrial landowners relied on natural regeneration to a much greater extent and conducted few, if any, midrotation treatments. As a group, TIMOs and industrial landowners spent approximately $20/ac annually on their Mississippi timberlands. Overhead represented slightly over 40% of this total, with silvicultural treatments accounting for the remainder. Property taxes represented the largest overhead expense. In total, these landowners spent $67 million in 1998 and $54 million in 1999 to maintain and manage their Mississippi timberlands. South. J. Appl. For. 27(2):83–91.*

Key Words: TIMOs, industrial landowners, forest management activities, expenditures.

Detailed information about forest management activities that forest landowners conduct annually is important for a variety of reasons. Landowners need information about the activities and costs of others as benchmarks for their own management decisions. Timber supply modelers need information about the type and intensity of management practiced by various landowner groups in order to improve predictions of future timber availability (Adams et al. 1982). Policy makers need accurate information concerning what practices are being implemented, on how many acres, by whom, and at what cost, in order to develop appropriate policies and/or legislation.

There is limited information detailing the types of forest management activities implemented annually, how many acres are treated, and at what cost. Until recently, the only available wide-scale information about forest management activities was provided by a series of articles that reported Southwide costs for various silvicultural and management activities (e.g., Dubois et al. 1995, 1997, 1999, 2001). Recently, Arano et al. (2002) addressed the forest management activities of nonindustrial private forest landowners (NIPF) as well as the total expenditures associated with each activity, but did not determine treatment costs per acre or total acres treated. To our knowledge, no comprehensive study has been conducted that determines forest management activities implemented annually, number of acres treated, costs per acre, or expenditures for any landowner group in any geographic area.

This article investigates forest management activities of two landowner groups known for practicing intensive management: timberland investment management organizations (TIMOs) and industrial landowners. The USDA Forest Service Forest Inventory and Analysis (FIA) classifies TIMOs as nonindustrial private corporate forest landowners (USDA 1998). TIMOs are a subset of NIPF landowners and comprise several forms of ownership, including corporations, limited partnerships, limited liability companies, and real estate investment trusts. These organizations pool capital from institutions and individuals and use this capital to acquire and

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manage timberland (Zinkhan 1993). Industrial forest landowners are defined as individuals or companies that own timberland and have at least one wood-processing facility (USDA 1998).

Institutional investment in timberland is increasing (i.e., Binkley et al. 1996, Caufield 1994, 1998, Donegan 1999, and Rinehart 1985). In 1998 and 1999, more than three million ac were transferred from industrial to institutional landowners (Diamond et al. 1999, Drafan 1999, and Sewall 1999) in the United States. This has compounded the need to better understand this landowner group. Many industrial landowners are divesting their land holdings to focus operations on their value-added processing facilities. These divestitures represent new potential investments for institutional landowners and others.

This study examines the management practices for TIMOs and industrial forest landowners during 1998 and 1999. Specifically, the objectives of the study were to determine, by landowner group, the

1. amount of land controlled (fee or lease) and its composition by forest type,
2. area treated annually—by silvicultural treatment and in total,
3. per acre treatment costs for silvicultural activities,
4. overhead costs per acre owned,
5. total annual expenditures associated with timberland management and ownership, and
6. differences in management intensity between landowner groups.

Methods

Data Collection

Mississippi mirrors ownership patterns for much of the South. Of the approximately 17 million ac of timberland in Mississippi, NIPF landowners own 70%, industrial landowners 19%, and federal, state, and local government account for the remainder. While industrial landowners own a relatively small percentage of Mississippi's timberland, they account for 33% of the total volume harvested (Powell et al. 1994).

All TIMOs and industrial landowners in Mississippi were surveyed to determine their forest management activities for 1998 and 1999. Five TIMOs and 27 industrial landowners owned timberland in Mississippi during 1998. One of these sold its timberlands in 1999 in an effort to focus its energies on "value-added processing." A sixth TIMO acquired land in Mississippi during mid-1999. Neither of these two firms were included for 1999 because their activities and expenditures were representative of only a partial year. Due to the small population size, all TIMOs and industrial landowners were asked to participate in the study. Land managers for these companies were contacted by telephone and asked to participate. Those who agreed to participate were asked to complete the survey by any of the following methods: (1) mail, (2) telephone, or (3) personal interview at their place of employment.

The survey instrument was designed by the Social Science Research Center, Mississippi State University, using Dillman's (1978) total design method. The survey solicited three types of information: (1) property data, (2) silvicultural practices, and (3) expenditures. Property data included the acreage owned or leased in total and by forest type. Information on silvicultural practices included the types of practices implemented and the number of acres treated for each. Additional information was requested for harvesting and regeneration practices. For harvesting practices, harvest type (final, intermediate, or uneven-age harvests) and method (e.g., final harvest could be clearcut, seed tree, or shelter wood) were solicited. For regeneration practices, species regenerated, planting density, and method of regeneration were also requested. Expenditures data included total expenditures for each silvicultural activity implemented and overhead and other annual expenditures not associated with silvicultural activities, such as ad valorem taxes.

Data Analysis

Preliminary inspection of industrial landowners' responses revealed marked differences by size of ownership. Consequently, industrial landowners were partitioned into two size groups: large (>10,000 ac) and small (<10,000 ac). With one exception, the large industrial landowners were fully integrated, national or international forest product firms. Conversely, the small industrial landowners were local firms, typically sawmills, which rarely owned land outside Mississippi. Failing to stratify industrial landowners by size, *a priori*, may have masked important differences within this group.

The area controlled (fee and lease lands) by respondents was reported by landowner group for 1998 and 1999. Similarly, the number of acres treated by respondents was reported by silvicultural activity and year. Responses were extrapolated to generate acres controlled and treated at the state level.[1] Differences in management intensity between landowner groups and between years were examined by conducting an analysis of variance where *% of ownership treated annually* was the dependent variable and *survey year* and *ownership class* were the "treatments." A general linear model that adjusted for unbalanced treatment effects was employed. Differences in forest type may account for treatment differences; therefore, we also tested for differences in the forest type by ownership.

Average annual, per-acre treatment costs were computed for 1998 and 1999. We computed the average cost per acre for the various silvicultural treatments by dividing each firm's expenditures by the number of acres treated. Only firms that reported both expenditures and acres treated were included in the per-acre cost calculations. The average treatment costs per acre reported are the arithmetic averages of those firms who participated in the activity. In computing the average, costs were not weighted by acres treated because doing so assumes that treatment costs of firms that treated more acres are more representative than the treatment costs of firms that

treated fewer acres. Overhead costs were computed on a per-acre-owned basis. Average overhead costs reported were also arithmetic averages and not weighted by acres owned.

Respondents' expenditures were summed by silvicultural activity and overhead category. These expenditures were then extrapolated to the state level.

Results

In general, both industrial landowners and TIMOs were willing to participate in the survey; however, respondents were slow to complete surveys. Most respondents took 3–6 months to complete the questionnaires, with some taking as long as 1 1/2 yr. Those that did not participate indicated they were unwilling to disclose financial information. The overall response rate averaged 65% for both years of the study; however, response rates varied by landowner group. All TIMOs ($N = 5$) returned questionnaires for both years. Large industrial landowners returned eight questionnaires for 1998 ($N = 10$) and eight for 1999 ($N = 9$). Small industrial landowners ($N = 17$) returned eight surveys in 1998 and seven in 1999.

Property Data

In aggregate, respondents owned or leased approximately 2.8 million ac in 1998 and 2.9 million ac in 1999 (Table 1). To extrapolate responses to the state level, the number of acres owned or leased statewide were derived by landowner group. All TIMOs participated in the survey, so no extrapolation was necessary for this landowner group. Two large landowners did not participate in 1998, and one large landowner did not participate in 1999. Both, however, reported the acres they owned or leased either in the initial contact phone call or in subsequent followup calls; therefore, no extrapolation was necessary for this group as well. In 1998, the two nonparticipating large industrial landowners owned 270,000 ac. In 1999, the one nonparticipating large industrial landowner owned 20,000 ac. For the small industrial landowner category, the average ownership size of respondents in this group was multiplied by the number of nonrespondents and added to the reported acres to derive the state estimate for this landowner group. Using this technique, we estimated that nonparticipating small industrial landowners owned 15,822 ac in 1998 and 15,734 ac in 1999. Overall, we estimated that TIMOs and industrial landowners controlled slightly more than 3 million ac in Mississippi 1998, which decreased by roughly 3% to less than 3 million ac in 1999. Based on these estimated totals, our respondents represented over 90% of the land controlled by TIMOs and industrial landowners in Mississippi. Within landowner groups, the changes were much more dramatic. TIMO ownership increased by almost 70% from 1998 to 1999, while large and small industrial ownerships decreased by approximately 10% each.

Published forest statistics for Mississippi provide a check on our projections. According to Forest Inventory Analysis (FIA) estimates, forest industry owned 3.3 million ac in Mississippi in 1994 (Hartsell and London 1995), which is 18% greater than our estimate for industry-owned land in 1998. Some of this difference is undoubtedly due to industry divestitures during the interim period, but the difference also suggests that we may underestimate the number of acres owned in Mississippi by small industrial landowners. A similar comparison is not possible for TIMOs as FIA lumps them into the corporate landowner category.

Silvicultural Activities—Acres Treated

Statewide estimates for the area treated by the various silvicultural treatments were developed from the survey responses as follows. One respondent reported total expenditures for each silvicultural activity but did not report the acres treated. For that respondent, we estimated the acres treated by dividing the expenditures by the average cost/acre of other firms engaged in each activity. For each treatment, the areas treated by respondents were summed by landowner class and converted to a percentage of the area owned by that landowner class. To derive estimates of the number of acres treated by nonrespondents for the various treatments, these percentages were multiplied by the acres owned by nonrespondents for each landowner category. We assumed that nonrespondents treated roughly the same percentage of their lands as the respondents in the same category. These estimates were then added to the area treated by respondents to arrive at the estimated number of acres treated statewide.

Site Preparation Information

Industrial landowners and TIMOs utilized a wide range of techniques to prepare sites for planting during the study period (Table 2). Aerially-applied, chemical site preparation was the most common site preparation technique, both in terms of estimated acres treated (139,970 ac) and number of respondents employing the technique (13 in 1998 and 8 in 1999). Chopping, historically an industry staple, was used only sparingly. Ripping, bedding, and shearing/piling were common mechanical treatments, indicating a willingness to treat areas intensively if needed. In 1998, site preparation fertilization, another treatment synonymous with intensive management, was applied to 124,797 ac, the greatest acreage treated for any activity in a single year.

Table 1. Area controlled (fee and lease land) by TIMOs and industrial respondents, and the estimated area controlled for all TIMOs and industrial landowners in Mississippi, 1998–1999.

	1998		1999		
Landowner group	Reported	State estimate	Reported	State estimate	% change*
	(ac)				
TIMO	271,702	271,702	460,598	460,598	+69.5
Small ind.	14,117	29,999	11,014	26,748	–10.8
Large ind.	2,507,681	2,777,681	2,472,043	2,492,043	–10.3
Total	2,793,500	3,079,382	2,943,655	2,979,389	–3.2

* Based on state estimates.

Table 2. Area treated by TIMOs and industrial respondents, and the estimated acres treated for all TIMOs and industrial landowners in Mississippi, 1998–1999.

Silvicultural activity	1998			1999		
	n	Reported	State estimate	*n*	Reported	State estimate
		(ac)			(ac)	
Site preparation						
Mechanical treatments						
Chopping	4	1,504	1,600	4	1,636	1,932
Ripping	4	11,176	12,358	4	10,391	10,472
Bedding	8	10,722	11,455	7	9,962	10,032
Disking	2	3,468	3,815	1	1,345	1,356
Shear/pile (windrow)	7	8,512	9,434	8	11,670	11,742
Shear and rake	3	1,962	1,962	1	1,600	1,600
Subsoil	3	4,911	5,433	2	860	866
Other	4	7,958	7,958	9	14,761	14,761
Chemical treatments						
Aerial application	13	77,420	85,679	8	53,916	54,291
Ground application	2	297	321	3	3,225	3,535
Injection	1	10	10	0	0	0
Burning						
Aerial	2	399	645	4	4,581	4,611
Ground	10	44,029	48,720	5	24,374	24,536
Fertilization	7	114,797	124,678	6	23,162	23,289
Regeneration						
Planting	16	99,849	109,936	14	76,126	76,916
Natural regeneration	5	6,741	7,917	3	2,999	3,797
Harvesting						
Even age						
Final	13	67,433	74,558	11	122,690	124,000
Intermediate	13	52,055	57,712	11	78,303	79,663
Uneven age—select	6	28,095	31,879	4	23,414	24,378
Midrotation treatments						
Prescribed burn	8	10,332	10,783	4	3,803	3,826
Fertilization	3	84,971	91,088	8	106,835	107,440
Prune	1	10,700	10,700	3	24,089	24,282
Chemical release	7	66,084	72,074	7	51,755	52,161
Precommercial thin.	3	4,733	5,225	2	8,795	8,866
Timber stand improve.	2	5,987	6,632	3	10,095	10,177
Total treated		724,145	792,572		670,390	678,529

Midrotation Treatment Information

Industrial landowners and TIMOs also applied midrotation treatments to over 400,000 ac during the 2 yr study period. Fertilization (198,528 ac) and chemical release (124,235 ac) accounted for most of this total. Burning was utilized by more landowners than any other treatment except chemical site release but was applied to only 14,609 ac. Pruning, precommercial thinning, and timber stand improvement were used by only a handful of landowners to treat a relatively small number of acres.

Regeneration Information

Planting was the predominant regeneration method employed, accounting for 94% of the 107,000 ac regenerated by respondents in 1998 and 96% of the 79,000 ac regenerated in 1999 (Table 3). Loblolly pine (*Pinus taeda* L.) was planted on 88% of the area regenerated in 1998 and 94% in 1999. Average planting density for both years was approximately 640 trees/ac. Other species planted included slash pine (*P. elliotti*), longleaf pine (*P. palustris*), shortleaf pine (*P.echinata*), and a variety of hardwood species. Natural regeneration was the most common method utilized to regenerate hardwoods. During the study period, respondents regenerated hardwoods on 10,519 ac. Natural regeneration accounted for 66% of this total.

Harvest Information

Respondents harvested 371,990 ac during the study period (Table 4). Clearcutting, the predominant harvest method, accounted for 50% of the area harvested. First thinnings of all types accounted for 30%. Group selection was the most common uneven age harvest method—accounting for 12% of the total area harvested and 84% of the area harvested using uneven age harvest methods. Second thinnings, shelterwood and seed tree regeneration cuts, and single tree selection cuts accounted for the remaining 8% of the area harvested.

Respondents harvested 5.3% of their landbase in 1998 and 7.5% in 1999. The area clearcut almost doubled, and the area of first thinnings increased by 50% from 1998 to 1999. Second thinnings also increased substantially. Uneven age harvests, in contrast, decreased from 1998 to 1999.

Table 3. Regeneration information for TIMOs and industrial respondents in Mississippi, 1998–1999.

	1998				1999			
Regeneration method	*n*	trees/ac	ac	$/ac	*n*	trees/ac	ac	$/ac
Planting								
Loblolly	16	646	93,939	65.50	14	635	74,562	68.83
Slash	1	600	200	65.00	1	600	200	60.00
Loblolly/slash*	1	605	3,168	67.46	—	—	—	—
Shortleaf	1	691	50	72.00	—	—	—	—
Longleaf	—	—	—	—	1	605	306	71.00
Oak	3	316	2,469	107.00	3	275	1,058	117.16
Ash	1	302	23	107.00	—	—	—	—
Natural								
Pine	2	n/a	674	—	3	n/a	1,897	—
Hardwood	3	n/a	5,867	—	3	n/a	1,102	—
Pine/hardwood	1	n/a	200	—	—	—	—	—
Total	18		106,590		15		79,125	

* This respondent reported planting both species but did not have separate totals.

Table 4. Harvest information for TIMOs and industrial respondents in Mississippi, 1998–1999.

	1998			1999		
Method of harvest	*n*	ac	% of harvest	*n*	ac	% of harvest
Final harvest						
Clearcut	14	66,133	44.8	10	121,090	54.0
Shelterwood	2	1,140	0.8	1	1,200	0.5
Seed tree	1	160	0.1	1	400	0.2
Intermediate harvest						
1st thinning—row	6	38,781	26.3	5	50,944	22.7
1st thinning—marked	2	200	0.1	0	—	—
1st thinning—operator select	6	5,783	3.9	5	16,150	7.2
2nd thinning—marked	2	2,735	1.9	2	989	0.4
2nd thinning—operator select	3	4,556	3.1	5	10,220	4.6
Uneven age harvest						
Group selection	2	23,373	15.8	3	19,662	8.8
Single tree selection	4	4,722	3.2	1	3,752	1.7
Total harvests	16	147,583	100.0	15	224,407	100.0

Differences Between Landowner Groups

Management Intensity

To examine differences in management intensity, we computed the percentage of total ownership treated for each of the various silvicultural treatments and tested for significant differences between landowner groups. In light of the small number of observations, we used a 0.15 significance level as the criterion for statistical significance. [2]

As measured by the percent of ownership treated, there were significant differences in management intensity between landowner groups for all site preparation treatments evaluated (Table 5). TIMOs and large industrial landowners used a combination of mechanical and chemical site preparation techniques, while small industrial landowners relied more heavily on chemical treatments, particularly in 1998. There were also significant differences in the amount planted between landowner groups. TIMOs and large industrial landowners planted approximately 3.5% of their land base in 1998 compared to only 2.5% for small industrial landowners. Similarly, in 1999, TIMOs and large industrial landowners planted 2.5% versus 1.8% for small industrial landowners. In contrast, small industrial landowners naturally regenerated slightly more than 3% of their land base in 1998 and 1999 compared to less than 0.5% for TIMOs and large industrial landowners, although the difference was not statistically significant at the 0.15 level.

There were also dramatic differences in midrotation treatments. Differences between landowner groups for prescribed burning, fertilization, chemical release, and timber stand improvement were significant. In particular, TIMOs and large industrial landowners utilized chemical release and fertilization liberally, while none of the small industrial landowner respondents applied any mid-rotation treatments.

Interestingly, there was not a statistically significant difference between landowner groups for any type of harvesting, despite dramatically different means. There was, however, substantial variation within landowner groups, which undoubtedly contributed to this lack of significance.

Forest Type

There were significant differences in the forest type composition of the land bases between landowner groups, specifically planted pine, pine/hardwood, and nontyped lands (Table 6), which may account for some of the differences in management intensity. TIMOs' landholdings were approximately

Table 5. Percentage of ownership treated by silvicultural activity for TIMOs, small, and large industrial respondents in Mississippi, 1998–1999.

	1998			1999		
Silvicultural activity	Small ind.	Large ind.	TIMO	Small ind.	Large ind.	TIMO
Site preparation						
Mechanical treatments*	0.19	1.63	2.65	1.82	1.64	2.01
Chemical treatments*	4.23	2.83	2.37	1.82	2.00	1.62
Burning*	2.00	1.71	0.46	0.00	0.96	1.13
Fertilization* †	0.14	3.65	8.54	0.00	0.64	1.62
Subtotal†	6.57	9.82	14.02	3.63	5.23	6.38
Regeneration						
Planting*	2.50	3.59	3.50	1.82	2.52	2.96
Natural	3.19	0.25	0.03	4.95	0.10	0.00
Subtotal	5.69	3.84	3.53	6.76	2.62	2.96
Midrotation treatments						
Prescribed burning* †	0.00	0.17	2.26	0.00	0.11	0.22
Fertilization*	0.00	2.27	10.36	0.00	3.02	6.97
Prune	0.00	0.43	0.00	0.00	0.97	0.05
Release*	0.00	2.19	3.85	0.00	2.03	0.35
Precommercial thinning	0.00	0.18	0.06	0.00	0.36	0.00
Timber stand impr.*	0.00	0.24	0.00	0.00	0.41	0.00
Subtotal*	0.00	5.47	16.53	0.00	6.89	7.59
Harvesting						
Final	4.39	2.38	2.62	2.72	4.41	2.92
Intermediate	1.31	2.02	0.46	4.95	2.91	1.27
Uneven age	5.28	1.09	0.00	4.95	0.93	0.00
Subtotal	10.99	5.48	3.08	12.62	8.24	4.19
Total	23.24	24.62	37.16	23.02	22.99	22.3

* Differ significantly by ownership type ($Pr > F \leq 0.15$).
† Differ significantly by year ($Pr > F \leq 0.15$).

Table 6. Forest type as a percentage of total acreage owned/leased for TIMOs and industrial landowners in Mississippi, 1998–1999.

	1998			1999		
Forest type	Small	Large	TIMOs	Small	Large	TIMOs
	(% of total)					
Planted pine *	34.1	54.7	66.2	47.4	56.2	67.6
Natural pine	19.8	11.5	10.6	15.9	10.0	10.8
Hardwood/pine *	7.8	5.6	4.1	17.8	4.9	9.5
Hardwood	35.5	20.2	12.1	13.0	21.0	7.1
Nontyped *	3.5	8.6	6.9	5.8	6.0	7.4

* Differ significantly by ownership type ($Pr > F \leq 0.10$).

67% planted pine compared to 55% for large industrials and less than 50% for small industrials. Higher proportions of planted pine present greater opportunities for intensive management on the one hand. On the other, higher proportions of planted pine are largely the results of more intensive management in the past, particularly by large industrial landowners. Also, two industrial landowners specialized in hardwood management with correspondingly greater amounts of hardwood timberland, which may have contributed to this difference in forest types.

Silvicultural Activities—Treatment Costs

Only firms reporting both acres treated and the related expenditures were included in the derivation of average per acre treatment costs (Table 7). Although the resulting sample sizes are small, for the most part they represent the large majority of respondents participating in the practice as well as the majority of the acres treated. Furthermore, the average treatment costs reported here are consistent with Southwide costs reported by Dubois et al. (1999).[3] For example, the 1998 cost per acre for chopping reported here is $73.13 compared to $80.15 reported by Dubois et al. (1999). Similarly, chemical (aerial application) site preparation costs averaged $84.46/ac compared to $94.87/ac. Chemical release, fertilization (site prep. and midrotation), burning, and precommercial thinning costs were all similar to those reported by Dubois et al. (1999).

Overhead Expenditures

Overhead expenditures were computed on a per-acre-owned basis. Reported property taxes averaged $2.59/ac owned in 1998 and $2.79/ac owned in 1999 (Table 8). This

Table 7. Costs per acre treated of silvicultural activities conducted by TIMOs and industrial respondents in Mississippi during 1998–1999.

Silvicultural activity	1998				1999			
	n	Mean	Median	σ	*n*	Mean	Median	σ
		($/ac)				($/ac)		
Site preparation								
Mechanical treatments								
Chopping	3	73.13	80.00	14.89	4	70.63	68.75	10.21
Ripping	3	64.58	60.00	9.04	3	63.32	61.00	10.71
Bedding	6	78.02	67.50	35.73	6	93.05	75.00	59.90
Disking	1	21.80	n/a	n/a	0	n/a	n/a	n/a
Shear and pile (windrow)	6	118.19	128.00	18.02	7	178.44	140.00	86.86
Shear and rake	2	135.48	135.48	0.68	1	168.00	n/a	n/a
Subsoil	1	133.50	n/a	n/a	2	139.45	139.45	36.70
Other mechanical site prep*	3	70.53	40.00	69.43	7	116.71	116.19	44.95
Chemical treatments								
Aerial application	12	84.46	84.82	11.80	7	95.31	94.75	5.41
Ground application	1	71.82	n/a	n/a	2	25.07	25.07	28.38
Injection	1	66.50	n/a	n/a	0	n/a	n/a	n/a
Burning								
Aerial ignition	0	n/a	n/a	n/a	5	18.03	15.00	7.05
Ground ignition	7	15.14	15.00	6.10	3	32.40	24.00	26.93
Fertilization	7	53.11	54.70	21.28	6	42.54	38.25	15.75
Regeneration								
Planting	14	69.32	70.00	12.29	13	65.48	67.37	12.87
Intermediate treatments								
Prescribed burning	8	10.13	8.60	6.33	4	20.95	7.97	9.26
Fertilization	2	56.20	56.20	28.01	8	58.99	60.41	15.36
Pruning	1	77.94	n/a	n/a	2	63.10	63.10	13.26
Chemical release	6	70.23	74.12	16.98	7	68.61	71.99	17.16
Precommercial thinning	3	81.61	80.00	7.79	2	77.89	77.89	10.05
Timber stand improvement	2	32.68	32.68	17.64	3	54.95	56.92	28.08

* Other mechanical site preparation activities consisted of treatments unique to a specific company, and were not reported individually for confidentiality purposes.

Table 8. Mean overhead expenditures per acre-owned for TIMOs and industrial respondents in Mississippi during 1998–1999.

Overhead activity	1998				1999			
	n	Mean	Median	σ	*n*	Mean	Median	σ
		($/ac)				($/ac)		
Property taxes	16	2.59	2.43	0.66	15	2.79	2.52	0.74
Professional fees								
Consulting forester fees	4	2.60	1.80	2.15	3	1.45	1.51	0.48
Attorney fees	2	0.06	0.06	0.04	4	0.03	0.02	0.03
Accountant fees	7	0.40	0.40	0.48	2	0.11	0.11	0.06
Surveyor fees	4	0.09	0.08	0.02	6	0.09	0.05	0.12
Routine or ongoing expenses								
Property line maintenance	13	0.49	0.19	0.61	12	0.34	0.15	0.60
Protection (Insects, fire, disease, etc.)	8	0.20	0.15	0.18	11	0.16	0.07	0.19
Road maintenance	11	0.76	0.39	1.00	12	0.89	0.56	0.94
Animal damage control	4	0.07	0.07	0.03	11	0.11	0.05	0.13
Supervision and administration	11	2.45	2.42	1.66	12	1.49	1.11	1.27
Hunting & wildlife management								
Hunting revenues*	17	2.69	2.50	1.21	15	3.02	3.02	2.60
Associated expenses	8	0.24	0.12	0.24	8	0.51	0.33	0.40
Miscellaneous expenses								
Equipment & assoc. expenses	4	0.40	0.18	0.44	3	0.44	0.15	0.57
Road construction	7	1.49	0.95	2.08	9	1.60	0.84	2.48
Timber sales †	8	1.39	1.17	1.26	9	1.35	1.48	0.87
Total overhead expenditures‡	21	6.05	5.09	3.53	19	5.74	5.34	2.80

* Hunting revenues are not included in total overhead expenditures.
† Some firms included timber sale expenses in supervision and administration.
‡ Columns do not sum because of varying *n* sizes by row.

increase is consistent with the 10% increase in assessed land values over the same period (Mississippi State Tax Commission 1999 and 2000). Perhaps coincidentally, average revenues from hunting leases were very close to property taxes on a per-acre-owned basis. Hunting revenues averaged $2.69/ac owned in 1998 and $3.02/ac owned in 1999. Hunting revenues, however, were partially offset by related expenses, which averaged $0.24/ac owned in 1998 and $0.51/ac owned in 1999.

Consulting foresters fees and supervision and administration costs constituted the next largest overhead categories averaging approximately $2.50/ac owned in 1998 and $1.50/ac owned in 1999. It was generally true, however, that firms employing consulting firms were TIMOs and firms reporting supervision and administration costs were industrial landowners with little overlap between the two groups. Road construction, road maintenance, and timber harvesting expenses were also major overhead categories, all averaging over $0.75/ac owned for those firms that incurred such expenses. Timber harvesting expenses are likely understated here. Not all firms that harvested timber during the survey period reported harvesting expenses. For these firms, timber-harvesting expenses were included as consulting fees or supervision and administration expenses. In total, firms averaged $6.05/ac owned in 1998 and $5.74/ac owned in 1999 for overhead expenses.

Total Expenditures

Statewide estimates for total expenditures by TIMOs and industrial landowners were developed from the survey responses as follows. Some respondents reported the acres treated for an activity but did not report their expenditures. For these respondents, their expenditures were estimated by multiplying their acres treated by the average cost/ac of other firms engaged in that activity. Respondents' expenditures were summed and average expenditures/ac owned were computed by landowner class. To derive estimates of total expenditures by nonrespondents, average expenditures/ac owned were multiplied by the acres owned by nonrespondents for each landowner category. This assumes that nonrespondents spent roughly the same amount per acre as respondents in the same category. These estimates were then added to the expenditures by respondents to arrive at the estimated total expenditures statewide.

Total management expenditures exceeded $67 million in 1998 but decreased substantially in 1999 to slightly less than $53 million (Table 9). This averages $19.95/ac for the 2 yr study period. Of this total, silvicultural activities accounted for approximately 57%, and overhead activities the remaining 43%.

Discussion

This study examined forest management activities and expenditures of TIMOs and industrial landowners in Mississippi during the period 1998–1999. Sixty-five percent of TIMOs and industrial landowners in Mississippi participated in the survey. The respondents represented more than 90% of the timberland owned by these two landowner groups.

Perhaps the most obvious and straightforward benefit of this study is that it provides benchmark information on the costs and activities for industrial landowners and TIMOs. The costs and activities reported here are representative of firms that intensively manage their forestlands. This information should be particularly interesting for comparison purposes to other industrial landowners and TIMOs throughout the South, as well as large NIPF landowners. The treatment costs/ac reported here are consistent with Southwide treatment costs provided by Dubois et al. (1999). What differences do occur may be attributable to different sample populations.

Another benefit of this study is that it supplies key information needed by timber supply modelers. Timber

Table 9. Annual expenditures reported by TIMOs and industrial landowners, and the estimated annual expenditures for all TIMOs and industrial landowners in Mississippi, 1998–1999.

	1998		1999	
Expenditure category	Reported	State estimate	Reported	State estimate
	($)			
Silvicultural activities				
Site prep.—mechanical	4,004,856	4,301,746	4,704,833	4,742,002
Site prep. —chemical	7,024,918	7,781,333	5,183,648	5,221,233
Site prep. —burning	842,782	939,047	746,033	751,065
Site prep. —fertilization	6,298,944	6,835,371	1,148,802	1,156,283
Planting	6,751,727	7,428,706	5,078,129	5,126,307
Midrotation treatments	10,496,366	11,334,898	12,453,550	12,540,897
Subtotal	35,419,594	38,621,100	29,314,994	29,537,788
Overhead				
Property taxes	7,305,385	8,191,763	8,271,525	8,544,547
Professional fees	760,922	806,061	358,023	361,253
Routine/ongoing expenses	13,981,820	15,767,407	11,890,767	12,661,230
Wildlife management	351,306	387,093	335,425	344,324
Miscellaneous expenses	3,080,229	3,315,709	1,740,444	1,780,346
Subtotal	25,483,662	28,468,033	23,143,107	24,244,480
Grand total	60,903,256	67,089,133	52,458,101	53,782,268

supply projections depend in large part on assumptions concerning relative management intensities by landowner class. Surveying landowners is a relatively inexpensive method of supplying this information when compared to on-the-ground field sampling or satellite telemetry. This study identifies the silvicultural practices and quantifies the areas treated, employed by two landowner classes: TIMOs and industrial landowners. Furthermore, within the industrial landowner class, the study further refines the results for large and small landowners. With additional research, the type and scope of silvicultural practices employed by a landowner class could substantially improve our ability to forecast timber production. As functional relationships between silvicultural practices and timber supply are refined, periodic landowner surveys can provide essential information to predict changes in supply over time and between landowner classes.

Current expenditures information, such as that collected in this study, may also prove useful in predicting timber supply. All else being equal, greater expenditures indicate more intensive forest management. Hence, periodically monitoring forest management related expenditures might provide crude indicators of future timber supply trends, for example, continuously increasing expenditures (adjusted for inflation) suggest increasing timber supply in the future.

Finally, the information provided by this study can be particularly useful in the policy arena. Policy makers need accurate information concerning what practices are being implemented, on how many acres, by whom, and at what cost in order to develop appropriate policies and/or legislation. For example, legislation affecting forest landowners may be influenced by the fact that these landowners have substantial impacts on state and local economies. In Mississippi, industrial landowners and TIMOs spend $50–60 million annually to maintain and manage their forestlands. Coupled with $122 million spent annually by NIPF landowners (Arano et al. 2002), these expenditures represent a substantial input to the state's rural economies. Property tax policies, as a specific example, may be influenced by accurate expenditures information.

Another useful aspect of this method of data collection is its potential to identify trends in forest management in a cost efficient manner. Repeated studies encompassing larger areas (e.g., the southeast United States) could provide insight into regional forestland management practices and how forest landscapes are changing over time.

Forestry is a dynamic field, requiring readily available and current information for decision-makers. As this field continues to evolve, the need for better information will persist. This study has shown that surveying landowners is an effective method for obtaining low-cost, reliable forest practices information that can supplement other, more costly methods.

Endnotes

[1] Extrapolation procedures varied depending on the type of information being extrapolated, related information available to the researchers, and how the responses varied among landowner categories. For each extrapolation, specific procedures are described in detail in the Results section.

[2] Only three treatments with significant differences between landowner groups by this standard exceeded the $P \leq 0.10$ threshold: chemical site preparation, site preparation burning, and mid-rotation fertilization with P values of 0.1005, 0.1107, and 0.1092, respectively.

[3] Dubois et al. (1999) reports costs for silvicultural practices implemented in 1998, one of the years of our study. Although Dubois et al. (2001) is more current, it does not match up as well with our survey dates.

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