1986

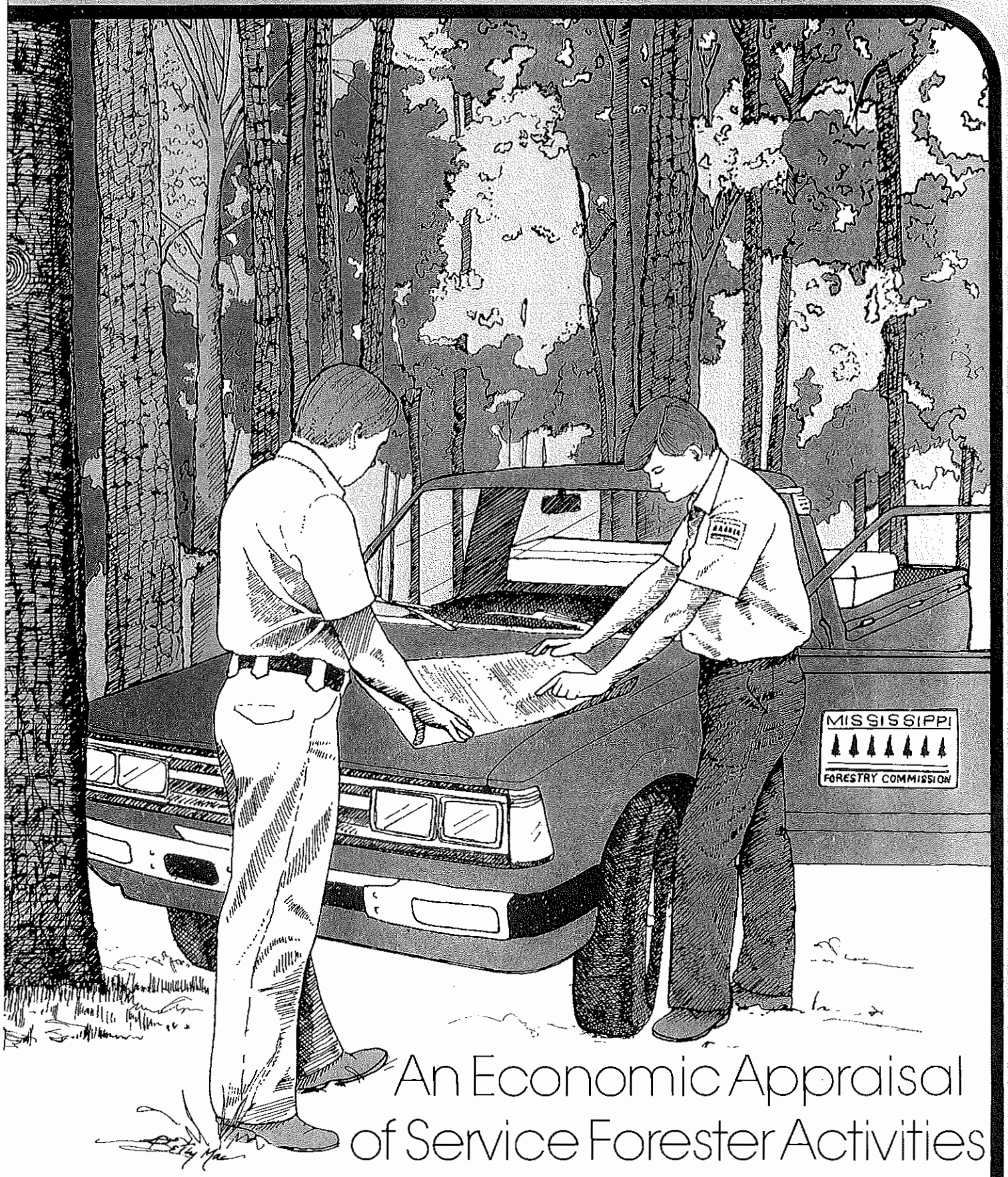
Economic appraisal of service forester activities in Mississippi

Thomas J. Straka

Walter C. Anderson

Steven H. Bullard
Stephen F. Austin State University, Arthur Temple College of Forestry and Agriculture, bullardsh@sfasu.edu

Technical Bulletin 137 September 1986



An Economic Appraisal of Service Forester Activities

MAFES
MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION R. Rodney Foil, Vice President and Director
Donald W. Zacharias, President Mississippi State University, Mississippi State, MS 39762

An Economic Appraisal of Service Forester Activities in Mississippi

Thomas J. Straka, Assistant Forester
Mississippi Agricultural and Forestry Experiment Station

Walter C. Anderson, Principal Economist (retired)
USDA Forest Service
Southern Forest Experiment Station

Steven H. Bullard, Assistant Forester
Mississippi Agricultural and Forestry Experiment Station

This study was financed in part by cooperative agreement number 19-82-055 between the Mississippi Agricultural and Forestry Experiment Station and the USDA Forest Service, Southern Forest Experiment Station, New Orleans, Louisiana. Forest Service funding was supplied by Forest Resource Economics Research, Washington, D.C., and State and Private Forestry, Southern Region, Atlanta, Georgia. The Mississippi Forestry Commission was responsible for the Mississippi Service Forester Project and cooperated extensively in this evaluation of its effectiveness.

Contents

An Economic Appraisal of Service Forester Activities in Mississippi

Introduction

The importance of nonindustrial private forest (NIPF) lands to national timber output potential is well-documented (USDA Forest Service 1981, 1982; Wall 1981). The NIPF sector controls 58 percent of the Nation's commercial forest area, compared to 14 percent in forest industry holdings, and 28 percent in public forests (Figure 1). Approximately 71 percent of the commercial forest area in the eastern United States is held by the NIPF sector.

In 1977, the NIPF supplied 30 percent of the softwood and 78 percent of the hardwood harvest. Nearly 23 percent of the softwood and 70 percent of the hardwood inventory is controlled by NIPF landowners. Softwood timber output is expected to increase by 1.3 percent annually to the year 2030 for the NIPF sector and hardwood timber output by 1.1 percent. NIPF capacity for increased timber growth is considered large, with apparent management opportunities that are more cost-effective in terms of potential growth increases than those of the National Forests (USDA Forest Service 1982).

USDA Forest Service (1982) projections indicate there may be a nationwide wood shortage in the offing. Demands for timber are rising faster than they can be supplied at present levels of forest management. The prospective imbalance between the quantity of timber that consumers want and that growers are willing to provide is largest for softwoods. A substantial rise in prices will be necessary to balance demand and supply unless timber production is increased.

Much of the nation's future timber will be drawn from the South, which has two-fifths of the country's commercial woodland. The region enjoys an almost incomparable climate for growing timber. The South's importance as a source of softwood timber has been expanding. It currently provides half of the wood used by the pulp and paper industry, a third of that used by the lumber industry, and two-fifths of that used by the veneer and plywood industry. Most of the expansion in the nation's forest products industries in the next few decades is expected to be based on southern timber resources. Expansion of southern forest industries may be hindered by a decrease in southern softwood inventory (Peterson 1986). Softwood timber removals are beginning to rise above net annual growth of timber.

NIPF lands are the principal source of raw material for the southern forest products industry. About three-quarters of the commercial forest land in the South is controlled by NIPF landowners (Wall 1981) and the NIPF's supply about 64 percent of the South's timber

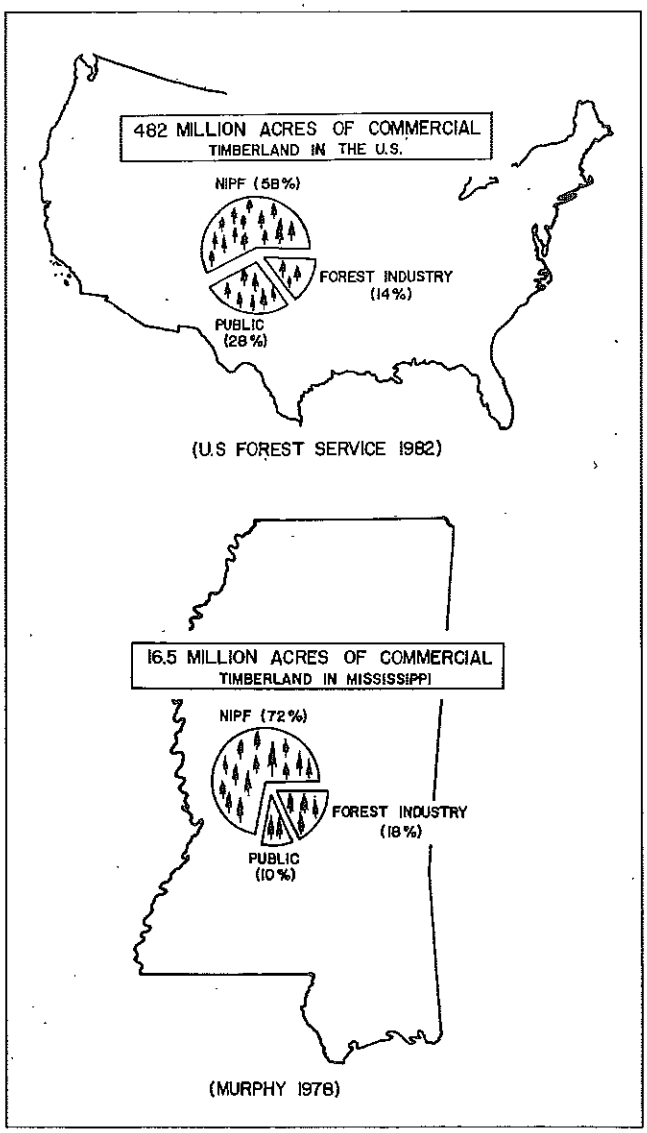
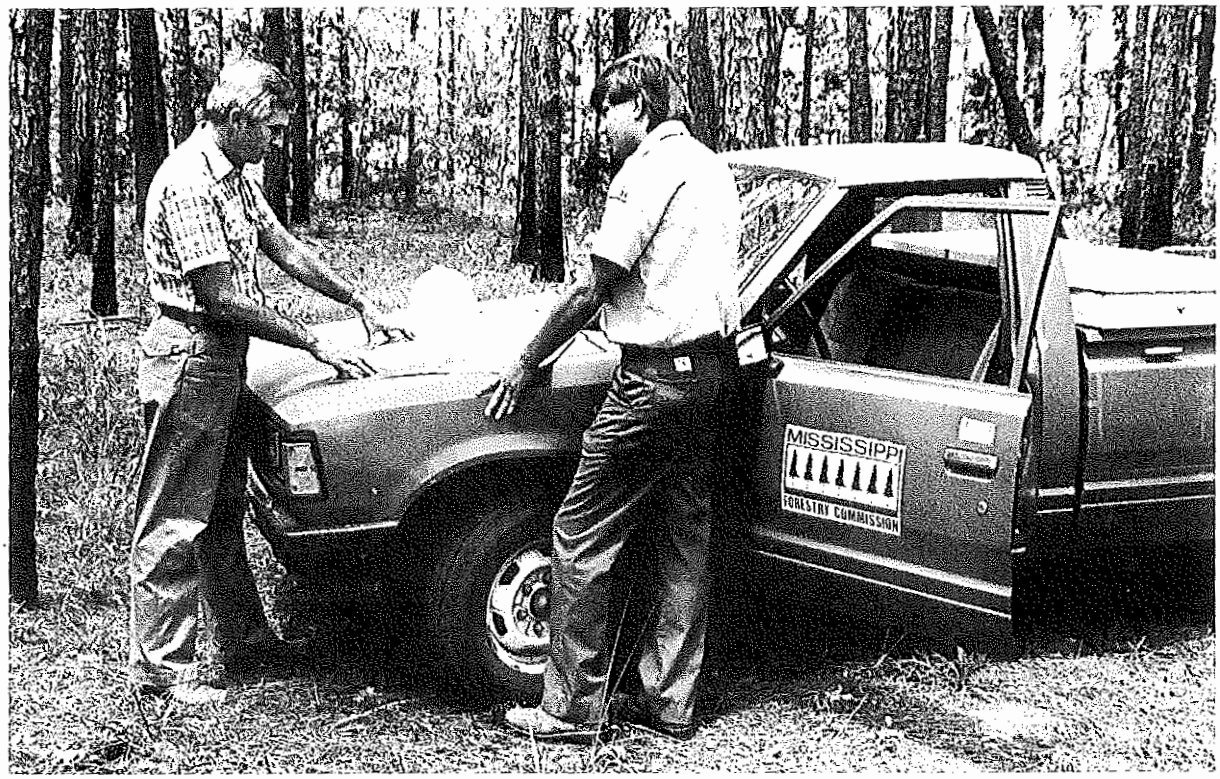


Figure 1. Ownership of commercial timberland in the United States and Mississippi, 1977.



Service foresters provide on-the-ground assistance of many types to nonindustrial private landowners in Mississippi.

harvest (USDA Forest Service 1980). Furthermore, the Forest Service projects a 40 percent increase in harvests from these lands, and only a 10 percent increase from all other ownerships (USDA Forest Service 1982).

The South is capable of doubling its timber production in the next 20 years, yet development of the region's potential rests on the actions of NIPF land owners. Their forests are characterized by a level of productivity much below that of other commercial forests due to mismanagement or neglect. Further, they have been reluctant to invest in timber-growing practices.

An important program for overcoming owners' reluctance to practice forestry is the state service forester program of technical assistance. At the Regional Private Nonindustrial Forestry meeting held in Atlanta a few years ago—one of a series of regional conferences sponsored by the National Association of State Foresters—technical assistance, or the need for it, accounted for 32 percent of the ideas generated by southern tree farmers (Murphy 1980). For many years a number of states have employed "service" foresters to work directly with private landowners in managing their woodlands. Such assistance, although often of limited scope, has been free. Traditionally, these service forestry programs have been partially financed by the Federal Government.

The National Forest Products Association is presently advocating an orderly phase-out of all Federal funding of cooperative forestry assistance, including service forestry. Others are also questioning whether the service forester program is necessary. The issue of the program's effectiveness is being raised at a time when most observers are of the opinion that it is more urgent than ever to increase productivity levels on nonindustrial private forest lands. This study evaluated the economic efficiency of intensive efforts by Mississippi service foresters to inform NIPF landowners about the availability of technical assistance.

Literature Review

That the NIPF sector is undermanaged and makes a disproportionately low contribution to the national timber supply has been considered a forestry problem since the beginning of this century. More than 60 percent of the South's commercial forest area possesses economic opportunities for increasing timber supplies (earning at least 4 percent in real terms), and over three-fourths of these opportunities occur on NIPF lands (USDA Forest Service 1981).

Early NIPF studies identified factors that influence private forest management decisions. One of the earliest NIPF studies found a major factor influencing owners' decisions on forest management to be a "lack of knowledge regarding cutting, transportation and

marketing of forest products" (Stoddard 1942). A few years later in Mississippi another NIPF study noted the same problem (Chamberlain et al. 1945):

"Based on the facts of the investigation, it is evident that there is a real lack of understanding among the non-industrial landowners as to what constitutes proper management. Very few of them seem to realize that a periodic income can be had every 10 or 15 years from properly managed forest land. To them, a timber sale is something to be made once in a lifetime. Here, we feel, is one of the outstanding opportunities for improving forest practices by increased education and well-placed and well-advertised demonstrations of proper forest cutting."

Later studies continued to stress the importance of information to NIPF landowners. Another Mississippi NIPF landowner study, for example, noted that *"the fact that more than half the owners have inadequate or wholly erroneous concepts of what timber management is, points up a clear need for education"* (James et al. 1951). A 1977 Mississippi NIPF study (Porterfield et al. 1978) found that many landowners perceived forest management as being "too complex" and unprofitable. Lack of information can still be considered a major impediment to more intensive forest management in Mississippi.

Relatively few NIPF studies concern public assistance programs. A thumbnail history of such programs, from those of the USDA Bureau of Forestry at the turn of the century to those emanating from the 1950 Cooperative Forest Management Act, is presented by Faulkner (1980).

Evaluating public assistance programs in the northern counties of Michigan's Lower Peninsula, Yoho and James (1958) found that 11 district foresters spent an average of 9 percent of their time on service forestry programs. The time spent varied from 27 percent in one district to less than 5 percent in six other districts. In the Northeast—the states within the area from Maine to Maryland to Missouri to Minnesota—service foresters spent an average of 10 hours on each case. Two-thirds of the cases required fewer than 10 hours while a few required 50 hours or more (Gansner and Herrick 1980).

Although technical assistance programs have operated for many years, NIPF owners' lack of knowledge of these programs is disappointing. From a mail survey, Baumgartner (1980) concluded that most forest landowners in Washington are unaware of the potential help available or the services that a forester can provide. This conclusion is supported by landowner surveys of the Northeastern Forest Experiment Station. Faulkner (1980) found that in New Hampshire and Vermont, where 63 percent of the owners held their land for 5 years or more, 51 percent did not know where to go for forestry assistance. In New Jersey, where 84 percent of the owners held their land for 5 years or more, 66 percent did not know where to go for forestry assistance.

Slusher (1980), extension forester at the University of Missouri, who has been involved with private woodlands for 22 years, both as a service forester for two state forestry divisions and as an extension forester for two land grant universities, said, *"...we have done a creditable job reaching and working with the top 10 percent of the woodland owners. However, I don't think we have properly communicated with the other 90 percent..."* Part of Slusher's statement may be questioned. Yoho and James (1958), for example, found that landowner reactions to on-the-ground forestry assistance were not always favorable. Most believed the assistance was sound but impractical.

Who were the landowners that were familiar with forestry assistance programs? Yoho and James (1958) found that large landowners were better informed, as were absentee landowners. Similarly, Webster and Stoltenberg (1957) found "acreage of forest land owned" and "asset value of owners' property" were the only two variables positively correlated with response to public programs.

One way to improve the effectiveness of state technical assistance would be to discriminate among forest landowners. Webster and Stoltenberg suggested that if timber production at minimum cost is the objective, forestry assistance might well be concentrated with well-to-do landowners. Trokey and Kurtz (1982) would target owners for technical assistance on the basis of their motivations and objectives. Of the four owner types they identified (timber agriculturalist, timber conservationist, forest environmentalist, and range pragmatist), timber agriculturalists—who believe timber must be managed like a crop—and forest environmentalists—who hold forest land for the enjoyment of being close to the natural environment—used advice from professional foresters much more than the other two types.

Several studies have evaluated the results of public forestry incentive programs. Mills and Cain (1978) evaluated the financial performance of the 1974 Forestry Incentive Program; Risbrudt and Ellefson (1983) evaluated the 1979 Forestry Incentive Program. Gregersen et al. (1979) evaluated forestry cost-sharing in Minnesota, and Dunn and Beese (1977) included a benefit-cost analysis in their evaluation of the forestry incentives program in South Carolina.

Of the few studies of technical assistance programs and the delivery of forestry assistance to NIPF landowners, only a few evaluated them in terms of effectiveness or efficiency. Cubbage et al. (1985) evaluated timber sale assistance of the Georgia Rural Forestry Assistance Program and found that forested tracts harvested with the advice of professional foresters produced higher stumpage prices for forest landowners

and had larger residual softwood volumes than those harvested without such advice. Utz (1977) calculated the value of Cooperative Forest Management (CFM) assistance in the Southeast, and estimated average annual accomplishments that could be expected from a full-time CFM forester.

Mississippi Service Forester Project

The Mississippi Forestry Commission provides a wide range of services to Mississippi residents, most often through country forester offices. The Mississippi Service Forester Project (MSFP) was a 2-year evaluation project to determine the benefits of adding a service forester to a county. The additional forester was responsible for promoting forestry and helping landowners implement forest management practices. Much of the forester's time was spent on one-to-one contacts demonstrating the feasibility of forestry investments and the value of following recommended forest management practices.

The MSFP provided an opportunity to evaluate the economic effectiveness of technical assistance to NIPF landowners by service foresters. In Mississippi, service foresters working under the CFM program—a joint effort between the U. S. Forest Service and the Mississippi Forestry Commission—develop forest management plans for NIPF landowners and assist them in carrying out the plans' recommendations. They also help transmit fiscal incentives to NIPF owners by determining the need for particular practices and certifying that they were properly performed. Cost-sharing between NIPF owners and the Federal Government is available for tree planting and timber stand management costs under the Forestry Incentives Program. Cost-sharing is also available to Mississippi landowners under the state's Forest Resource Development Program.

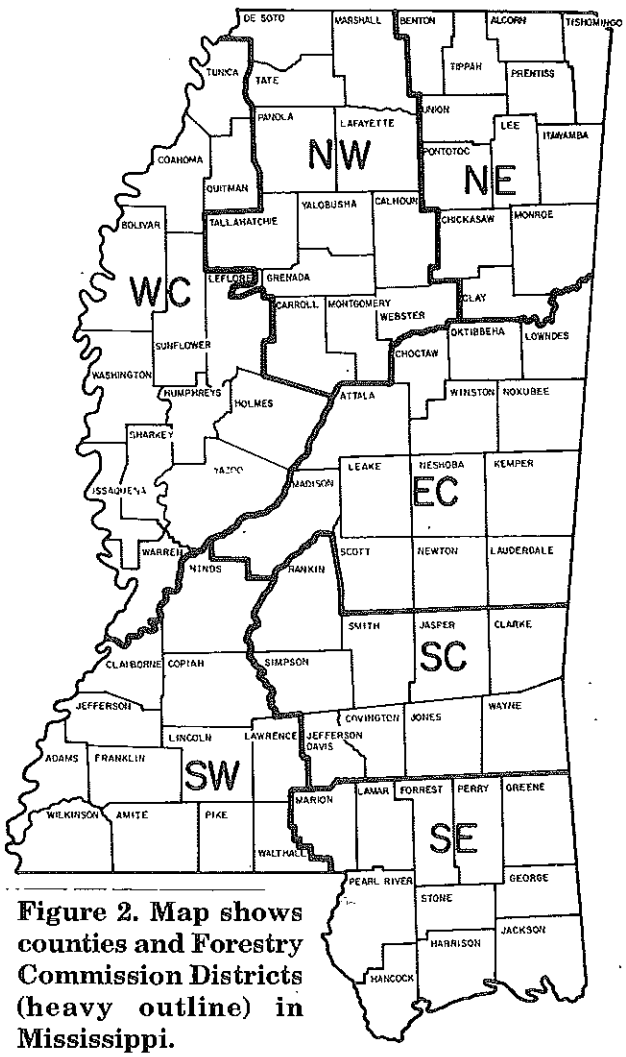


Figure 2. Map shows counties and Forestry Commission Districts (heavy outline) in Mississippi.

The MSFP was conducted in two Mississippi counties—Lauderdale County in the east central Mississippi Forestry Commission district and Forrest County in the southeast district (Figure 2). These counties provide a variety of forest landowners, markets, management needs, and previous forestry accomplishments. The Lauderdale County service forester was assigned to the project from July 1, 1982, to June 30, 1984, and the Forrest County service forester was assigned to the project September 1, 1982, to August 31, 1984.

Both service foresters were carefully selected, since they were critical to the success of the project in each assigned county. They were trained to sell forestry, and were given materials on the economic benefits of forestry practices to use in contacts with NIPF landowners. Further, they were allowed to spend full-time promoting forestry, with no other responsibilities in the state's forestry organization.

The service foresters' responsibility for reaching NIPF landowners included media and civic group contacts, mailing promotional material and questionnaires to all county landowners, contacting landowners, and providing them with technical assistance. They also made follow-up contacts to verify accomplishments.

Administratively, each service forester reported to the district office, but operated from the county forester's office. Each county received only a normal allotment of cost-assistance funds, and service foresters had to promote forestry to landowners on investment values alone. An important responsibility of each service forester was to keep accurate records for evaluating the program. The service forester received intensive training in office and field procedures, including record keeping.

Management cases developed by each service forester were separate and above the normal county management work load. The State Forester decided that the county forester would continue to operate as

in the past. If the county forester received more requests than could be handled, extra requests were referred to the service forester. The service and county foresters allowed no improvement work to be delayed due to the extra workload. The MSFP therefore represented the strongest possible effort to inform NIPF landowners of forest management opportunities, and to provide technical assistance.

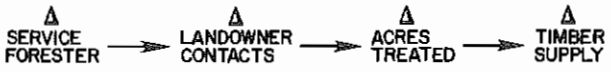
One variable not recognized in this study was the Mississippi Cooperative Extension Service. When a service forester is assigned to a Mississippi county, the State Forester, through the Extension Service, requests area extension foresters to refer clients to service foresters. Extension foresters operated in these counties during the project and their impact was not explicitly recognized in referrals to the service forester.

Objectives

The purpose of the MSFP study was to evaluate the economic effectiveness of the MSFP. The study was therefore concerned with identifying the benefits and costs of placing an additional service forester in a county. Specific objectives were (1) to evaluate the direct economic effects of the MSFP, and (2) to estimate the indirect economic impacts of the MSFP on Mississippi's forest economy.

Methods and Procedures

The MSFP began in late 1982 and ended in late 1984. Costs of the project were expected to be relatively easy to establish, but the benefits difficult to measure. A major concern was that many of the benefits would be "carried-over" past 1984. The simple model shows the problem:



The diagram shows that a change (Δ) in service forester input first results in a change in landowner contacts, then changes in acres treated and timber supply. Secondary effects may thus extend beyond the promotional period, probably up to 2 years.

Carry-over proved not to present a problem in measuring economic benefits. During the first year of the project, virtually every forest landowner was contacted in each county. Both service foresters spent more than 90 percent of their time during the first 6 months simply making landowners aware that forestry assistance was available. After a few months, when the county forester's workload had increased to a point where the time he and his crew could spend on forest management activities was fully utilized, promotional work was reduced because additional work had to be performed by the service forester himself. In the second 6 months, promotional work by the service foresters dropped to less than 30 percent of their time. Consequently, it appeared that rather than estimate carryover, it was safe to assume that each service forester had reached a "steady-state" between promotional activities and forestry field work by the second year, and that the second year's effort represented a typical year of service forester activity after start-up.

Identification of Benefits

One major benefit the MSFP provided can be measured: by extending technical assistance to NIPF landowners, their knowledge of recommended forest management practices was increased. The number of NIPF landowners provided with technical assistance was thus a key measurement, as were the decisions which these individuals made regarding forest management.

Some activities of service foresters, by themselves, do not result in measurable economic benefits. Examples include (1) requests for assistance regarding management plans, (2) information on financial returns, (3) information on how to accomplish various practices, and (4) information on forest consultants and industry landowner assistance programs and cost-share programs. Since such contacts may move forward to produce measurable economic benefits by monitoring these landowners, the contacts can be used to establish later accomplishments.

Initially, the base level of forestry activity in each pilot county and the adjacent counties was to be established as a standard against which additional landowner contacts and acres treated could be measured. The level of forestry activity in the affected counties (pilot counties and those counties subject to "spillover effects") was to be projected over the 2 years using the statewide average of forestry activity for the unaffected counties. This procedure would make it possible to compare actual activity levels in the affected counties with levels that might have occurred without the MSFP.

Fortunately, monitoring was unnecessary. Both service foresters felt they could identify 99 percent of all *direct* and *indirect* landowner contacts. Cooperation from the county forester in each county was excellent, as was communication between the service forester and county foresters in each of the adjacent counties. All service forester-generated forest management activities were therefore estimated with extreme accuracy, without the need for monitoring.

Costs

The cost of the MSFP included all the public costs of placing an additional service forester in a county.

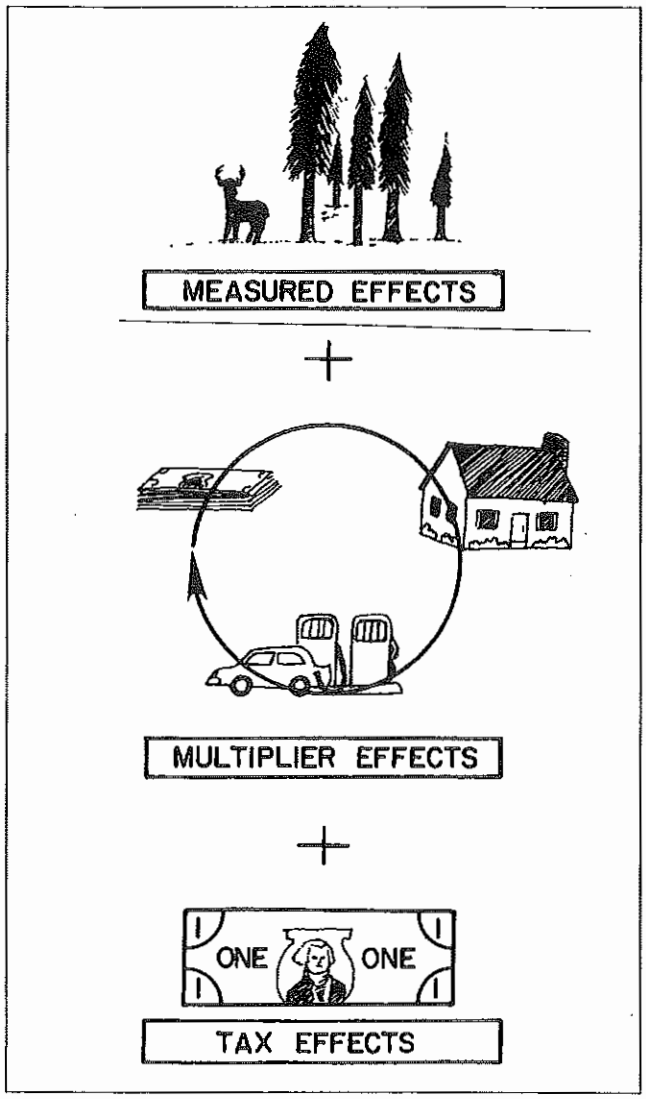


Figure 3. The Mississippi Service Forester Program provides three types of benefits to the state.

Costs of implementing recommended treatments were not included in MSFP costs, but were subtracted from projected revenues to estimate the *net* value of benefits from the program. MSFP service forester costs were available directly from the Mississippi Forestry Commission. The Commission isolated service forester costs in its standard accounting procedures.

Economic Effects

Three categories of economic impact were measured for each affected area (Figure 3). The first pertained to *direct* economic benefits; the second and third pertained to *indirect* economic benefits. First, the areas treated due to service forester landowner contacts were recorded. Major treatments included site preparation, planting, prescribed burning, improvement cuts, pre-commercial and commercial thinnings, in addition to the preparation of management plans. Each treatment influences future timber supply and Mississippi's forest economy.

Second, tax contributions were projected. Increased economic activity from additional timber supply was expected to positively affect timber severance tax receipts, road haul taxes, state income taxes, and state and county sales taxes.

Third, induced capital through public funds was measured. This included such items as landowner payments for seedlings, equipment, and the services of a consulting or industry technical assistance forester. Payments by vendors for new equipment or personnel due to the increased forest management workloads traceable to the activities of the service foresters were also considered.

Yield and Revenue Data

Thrapp (1978) and Moak (1979) described the yields that could be expected from loblolly pine plantations in northern and central Mississippi. Yields and revenue for a one-acre loblolly pine plantation on a medium-to-high pine site in Central Mississippi were estimated to be as shown in Table 1.

It was assumed that yields would be obtained from NIPF lands *in the absence of* artificial regeneration. A naturally-regenerated stand would probably occur on the land, with stand quality being lower than the managed natural stands that resulted from service forester accomplishments. Based on average stand conditions in central Mississippi, the incremental yields resulting from artificial regeneration were derived by subtracting natural yields from Burkhart et al. (1972(b)) from plantation yields in Burkhart et al. (1972(a)). Based on this calculation, revenue in Table 2 is reduced by 40 percent from Table 1 estimates.

Table 1. Estimated intermediate and final harvest yields for a loblolly pine plantation being grown on a medium-to-high site in Central Mississippi (adapted from Thrapp (1978)).

	Volume (Cubic Feet/Acre)	Revenue ($/acre)
First Thinning (Year 17)		
Pulpwood	1,240	$315.48
Second Thinning (Year 24)		
Pulpwood	634	
Sawtimber	433	
Total	1,067	$526.93
Final Harvest (Year 30)		
Pulpwood	614	
Sawtimber	2,216	
Total	2,830	$2,073.55

Table 2. Incremental present value of a loblolly pine plantation on medium-to-high sites in Central Mississippi at 4, 7, and 10 percent real discount rates.

	Current Dollar Incremental Revenue ($/acre)	Present Value ($/acre)		
		4%	7%	10%
First Thinning	$ 189.29	$ 97.18	$ 59.92	$ 37.45
Second Thinning	316.16	123.34	62.33	32.10
Final Harvest	1,244.13	383.59	163.44	71.30
Net Present Value		$604.11	$285.69	$140.85

To value the incremental yields, average stumpage prices for pine pulpwood and sawtimber during the study period were obtained from the Mississippi Cooperative Extension Service's monthly Forest Product Market Bulletin. Pine pulpwood averaged $0.17 per cubic foot and pine sawtimber $0.57 per cubic foot. Real price increases for pine pulpwood and sawtimber were based on projections from a timber situation study for Mississippi published by Resource Information Systems, Inc., and Resource Economics International (1985). The average real price increase for pine pulpwood was projected to be 2.4 percent annually and for pine sawtimber 1.3 percent annually. The incremental present value of the one acre of loblolly pine plantation is presented in Table 2 for real discount rates of 4, 7, and 10 percent. Row et al. (1981) recommend a 4 percent discount rate for calculations of this type, but higher discount rates may also be of interest (Cubbage et al. 1985).

Summary of Costs and Accomplishments

Average annual costs of placing a service forester in a Mississippi county for 1983-84 are presented in Table 3. Cost categories are those used by the Mississippi Forestry Commission. Commodities are items such as gasoline and office and general supplies. Contractuals are telephone, utilities, and other contracted services. Overhead and secretary charges are incremental costs incurred due to the addition of the service forester.

Table 3. Average annual costs to place a service forester in a Mississippi county, 1983-1984.

Overhead (State and District Office) Item	Annual Average Cost
Salary & fringe benefits	$20,356.75
Travel	162.50
Commodities	4,347.00
Contractuals	977.50
Equipment	365.00
Secretary (local)	1,890.50
Overhead (State and District Office)	1,432.50
Total	$29,531.75

Site preparation for planting or seeding pines may involve chemical or mechanical applications followed by controlled burning.

Accomplishments by county and year are shown in Tables 4 and 5. Year 1 represents the start-up period for each forester. About one-half of this time was spent on promotional activity. Each forester contacted virtually every landowner in his county. The Lauderdale County service forester enclosed a promotional letter in 10,000 local bank statements and the Forrest County service forester mailed a questionnaire to every landowner in his county. Year 1 was also largely devoted to management plan preparation.

Year 2 represents a "steady-state" level of service forester activity. Only about 5 percent of this time was devoted to promotional activity. Promotional efforts were largely one-to-one contacts resulting from Year 1 promotions or referrals from landowners the forester was currently assisting. Promotion proved to be a "self-feeding" process after the first 6 months, as current contacts led to new contacts. Table 6 summarizes average service forester activity for year 2 only. While year 2 was more of a "steady-state" condition than year 1, the indicated activity levels are likely conservative. No doubt improved efficiency would result from addi-

Table 4. Summary of service forester accomplishments, Lauderdale County, Mississippi.

Activity Category	Year 1		Year 2		Total	
	Number of Landowners Assisted	Resultant Acres Treated	Number of Landowners Assisted	Resultant Acres Treated	Number of Landowners Assisted	Resultant Acres Treated
1. MANAGEMENT PLANS PREPARED	41	6,743	35	7,063	76	13,806
2. SITE PREPARATION						
a. Heavy Mechanical	2	98	2	80	4	178
b. Light Mechanical	1	80	12	591	13	671
c. Aerial Chemical	0	0	1	120	1	120
d. Burn	3	100	13	814	16	914
	6	278	28	1,605	34	1,883
3. ARTIFICIAL REGENERATION						
a. Machine-planting	2	143	9	494	11	637
b. Hand-planting	0	0	10	395	10	395
c. Direct Seed	1	36	6	434	7	470
	3	179	25	1,323	28	1,502
4. NATURAL REGENERATION ESTABLISHED	1	169	0	0	1	169
5. PRESCRIBED BURNING	6	420	8	336	14	756
6. TIMBER STAND IMPROVEMENT	0	0	4	238	4	238
7. MULTIPLE-USE PRESCRIPTIONS						
a. Recreation and Aesthetics	0	0	0	0	0	0
b. Wildlife Habitat Prescriptions	5	26	2	131	7	157
c. Water	1	1	0	0	1	1
d. Firewood	2	14	0	0	2	14
	8	41	2	131	10	172
8. REFERRALS						
a. Consultants	3	1,638	3	913	6	2,551
b. Industry Landowner Assistance	1	375	0	0	1	375
	4	2,013	3	913	7	2,926
9. FINANCIAL & TAX ADVICE	9	1,975	6	533	15	2,508
10. TIMBER SALE MARKETING ASSISTANCE						
a. Cruising	6	534	5	213	11	747
b. Marking	4	244	5	165	9	409
	10	778	10	378	20	1,156
11. HARVESTING						
a. Clearcut	2	223	7	870	9	1,093
b. Thinning	3	186	15	575	18	761
c. Seed-tree	1	169	0	0	1	169
	6	578	22	1,445	28	2,023

tional years of experience in each county. Also, since the data in Table 6 are from a single year, they may be slightly biased by such factors as weather.

An average of three landowners per county per year were referred to county foresters in adjacent counties. Both service foresters felt that, in terms of promotional activity, one service forester could handle three to four counties. This would allow the service foresters to generate interested forest landowners for several county foresters. Both foresters found landowner contacts via mass media to be of minimal value; virtually all worthwhile contacts resulted from personal contacts.

The Forestry Incentives Program and the Mississippi Forest Resource Development Program apparently did not affect the results shown in Table 6. Throughout the two-year study period, both programs operated at low levels in both counties.

Calculation of Benefits from Measured Results

Valuing program returns is discussed in detail in Cubbage et al. (1985). In terms of possible accounting

Table 5. Summary of service forester accomplishments, Forrest County, Mississippi.

Activity Category	Year 1		Year 2		Total	
	Number of Landowners Assisted	Resultant Acres Treated	Number of Landowners Assisted	Resultant Acres Treated	Number of Landowners Assisted	Resultant Acres Treated
1. MANAGEMENT PLANS PREPARED	45	5,099	23	3,251	68	8,350
2. SITE PREPARATION						
a. Heavy Mechanical	0	0	5	183	5	183
b. Light Mechanical	0	0	5	345	5	345
c. Aerial Chemical	0	0	1	160	1	160
d. Burn	1	146	5	181	6	327
	1	146	16	869	17	1,015
3. ARTIFICIAL REGENERATION						
a. Machine-planting	0	0	4	334	4	334
b. Hand-planting	1	32	10	590	11	622
	1	32	14	924	15	956
4. NATURAL REGENERATION ESTABLISHED	0	0	1	56	1	56
5. PRESCRIBED BURNING	8	903	9	467	17	1,370
6. TIMBER STAND IMPROVEMENT	5	110	1	60	6	170
7. MULTIPLE-USE PRESCRIPTIONS						
a. Recreation and Aesthetics	1	30	3	70	4	100
b. Wildlife Habitat Prescriptions	11	229	6	227	17	456
c. Water	2	88	0	0	2	88
d. Firewood	13	170	2	43	15	213
	27	517	11	340	38	857
8. REFERRALS						
a. Consultants	5	10,166	8	2,811	13	12,977
b. Industry Landowner Assistance	1	80	0	0	1	80
	6	10,246	8	2,811	14	13,057
9. FINANCIAL & TAX ADVICE	9	1,124	3	70	12	1,194
10. TIMBER SALE MARKETING ASSISTANCE						
a. Cruising	3	168	3	252	6	420
b. Marking	8	338	4	295	12	633
	11	506	7	547	18	1,053
11. HARVESTING						
a. Clearcut	3	188	4	248	7	436
b. Thinning	3	178	11	1,238	14	1,416
c. Seed-tree	1	56	0	0	1	56
	7	422	15	1,486	22	1,908

Table 6. Average annual accomplishments for a service forester placed in a Mississippi county.

Activity	Number of Landowners Assisted	Resultant Acres Treated
1. MANAGEMENT PLANS PREPARED	29	5,157
2. SITE PREPARATION		
a. Heavy Mechanical	4	132
b. Light Mechanical	9	468
c. Aerial Chemical	1	140
d. Burn	9	498
	23	1,238
3. ARTIFICIAL REGENERATION		
a. Machine-planting	7	414
b. Hand-planting	10	493
c. Direct Seeding	3	217
	20	1,124
4. NATURAL REGENERATION ESTABLISHED	1	28
5. PRESCRIBED BURNING	9	402
6. TIMBER STAND IMPROVEMENT	3	149
7. MULTIPLE-USE PRESCRIPTIONS		
a. Recreation and Aesthetics	2	35
b. Wildlife Habitat Prescriptions	4	179
c. Firewood	1	22
	7	236
8. REFERRALS		
a. Consultants	6	1,862
9. FINANCIAL & TAX ADVICE	5	302
10. TIMBER SALE MARKETING ASSISTANCE		
a. Cruising	4	233
b. Marking	5	230
	9	463
11. HARVESTING		
a. Clearcut	6	559
b. Thinning	13	907
	19	1,466

stances, this study measures social efficiency. The estimated benefit/cost ratios are conservative because nonmarket benefits and the multiplier effects on the local economy were difficult to fully capture.

Management Plans Prepared. In a typical year a service forester will prepare about 29 management plans for forested tracts averaging 178 acres in size. Such plans define future forest management goals and activities. In a sense, they are overhead for later physical accomplishments. This study, in order to avoid a double-counting of benefits, followed the procedures of Utz (1977) and did not assign an economic value to management plan preparation. *Financial and tax advice* was treated in the same manner.

Site Preparation. During the study period, typical costs for various site preparation practices were (Straka and Watson 1985):

	Total Costs Per Acre
Heavy Mechanical	$110
Light Mechanical	52
Aerial Chemical	80
Burn	4

The cost of the 1,238 acres that were site prepared per county was $52,048.

Artificial Reforestation. A service forester accounts for an average of 1,124 acres of artificial reforestation annually. Table 7 shows how net present values for this activity were calculated. As indicated, timber incomes were taken from Table 2, annual management costs were set at $2.00 per acre, and site preparation costs were set at $68 per acre (a weighted average of the heavy mechanical, light mechanical, and aerial chemical techniques). Planting costs are from Straka and Watson (1985). Given these assumptions, the average net present values of the artificial reforestation from one year of service forester effort were $509,768; $162,834; and $6,774 for 4, 7, and 10 percent interest rates, respectively.

Natural Regeneration. Table 8 shows a similar analysis for natural regeneration. Yield, cost, and price data are from the same sources used in the Table 7 analysis; however, natural yields are estimated to be two-thirds of artificial regeneration yields. Annual natural regeneration was 28 acres per forester. The average net present values of the annual natural regeneration output were $10,196; $4,526; and $1,989 for 4, 7, and 10 percent interest rates, respectively.

Prescribed Burning. On an annual basis, the service foresters averaged 402 acres of prescribed burning. While this practice clearly produces a tangible benefit by controlling understory vegetation and reducing the risk of uncontrolled wildfires—it is difficult to value. A timber management regime that includes prescribed burning will have higher expected yields than one that does not (due to reduced loss of timber growth from wildfire). Timber management regimes prescribed by a service forester would likely include prescribed burning, and, to a degree, pine plantation yields reflect this type of activity. To be conservative, this study did not adjust the yields to reflect prescribed burning, assuming plantation yields already accounted for this activity.

Timber Stand Improvement. Service foresters averaged 149 acres of timber stand improvement annually. Utz (1977) projected an increased yield of usable wood of 20 cubic feet per acre per year from timber stand improvement carried for 20 years, or a total increase of 400 cubic feet. Table 9 shows the analysis of these benefits. Value per cubic foot is a

weighted average of pulpwood and sawtimber prices at year 30. Timber stand improvement was assigned an initial cost of $29 per acre (Straka and Watson 1985).

Multiple-Use Prescriptions. Service foresters averaged 236 acres of multiple use prescriptions annually (recreation, wildlife, water, and firewood). Using the conservative assumptions of Utz (1977), $2 per acre per year of benefits were assumed for these prescriptions. In the region, the $2 per acre benefit is now easily obtainable for hunting leases alone. This implies they are equivalent to an annual payment of $472. Discounted for 30 years, the net present values of these benefits at various interest rates are: $8,161.84 at 4 percent, $5,857.07 at 7 percent; and $4,449.50 at 10 percent.

Timber Sale Marketing. In an average year the service forester will mark and/or cruise 463 acres. However, when the county forester's assistance is included, 907 acres of thinning and 559 acres of timber harvests result. By product type, from actual harvest records, the timber volumes arising from these activities are: pine sawtimber, 3,128 MBF (Doyle); pine pulpwood, 3,258 cords; hardwood sawtimber, 479 MBF, (Doyle); and hardwood pulpwood, 2,732 cords.

As Utz (1977) assumed, landowners can be expected to harvest most of this volume without service forester assistance. Technical assistance only results in im-

Table 7. Average net present value of one year of service forester reforestation output at 4, 7, and 10 percent interest rates.

	Real Interest Rate		
Item	4%	7%	10%
Present value of added timber income(per acre)	$604.11	$285.69	$140.85
Present value of annual management costs (per acre)	-34.58	-24.82	-18.85
Site preparation and planting (per acre)	-116.00	-116.00	-116.00
Net present value (per acre)	$453.53	$144.87	$6.00
Acres planted	1,124	1,124	1,124
Total net present value	$509,767.72	$162,833.88	$6,744.00

Table 8. Average net present value of one year of service forester natural regeneration output at 4, 7, and 10 percent interest rates.

	Real	Interest	Rate
	4%	7%	10%
Present value (per acre)	$402.74	$190.46	$93.90
Present value of annual costs (per acre)	-34.58	-24.82	-18.85
Regeneration costs	-4.00	-4.00	-4.00
Net present value (per acre)	$364.16	$161.64	$71.05
Acres regenerated	28	28	28
Total net present value	$10,196.48	$4,525.92	$1,989.40

Table 9. Average net present value of one year of service forester timber stand improvement output at 4, 7, and 10 percent interest rates.

	Present Value		
	4%	7%	10%
Increased yield (cu. ft.)	400	400	400
Acres improved	149	149	149
Total incremental yield (cu. ft.)	59,600	59,600	59,600
Value per cubic foot (yr. 30)	$0.73	$0.73	$0.73
Future worth of increase	$43,508.00	$43,508.00	$43,508.00
Present value of increase	13,414.33	5,715.52	2,493.38
Present value of costs	-2,919.11	-2,196.58	-1,665.93
Net present value	$10,495.22	$3,518.94	$827.45

Service forester activities ultimately result in increased timber production.

proved marketing and utilization. A reasonable assumption is that 10 percent of the total volume produced is the increment attributable to the service forester. Value was assigned to this incremental volume as follows: pine sawtimber, 313 MBF @ $180, $56,340; pine pulpwood, 326 cords @ $12, $3,912; hardwood sawtimber, 48 MBF @ $55, $2,640; and hardwood pulpwood, 273 cords @ $4, $1,092. Total value of the volume attributed to the service forester was thus $63,984.

Referrals. Each year a service forester, as noted earlier, drew up management plans for an average of 5,157 acres of timberland. In addition, six individuals controlling 1,862 acres of forest land were referred to private consultants. A reasonable assumption is that these latter landowners will manage their timberland at least as intensively as the service forester's non-referred clients. This suggests that a service forester will actually affect the management of 7,019 acres (5,157 + 1,862) and that the economic benefits attributable to his activities should be expanded by a factor of 1.36 (i.e., 5,157 × 1.361 = 7,019). Consultant referrals are certainly a result of service forester promotional activity. However, in order to maintain a conservative benefit/cost approach, these accomplishments will not be valued in this analysis. If referrals were included, the net present value of the accomplishments and benefit/cost ratios would increase by about one-third.

Benefit/Cost Ratios

Using Tables 3 and 10, discounted benefit/cost ratios can be obtained by dividing the present value of ex-

Table 10. Summary of economic benefits.

Activity	Present Value		
	4%	7%	10%
Artificial regeneration	$509,767.72	$162,833.88	$6,744.00
Natural regeneration	10,196.48	4,525.92	1,989.40
Timber stand improvement	10,495.22	3,518.94	827.45
Multiple-use prescriptions	8,161.84	5,857.07	4,449.50
Timber sale marketing	63,984.00	63,984.00	63,984.00
Net present value	$602,605.26	$240,719.81	$77,994.35

Table 11. Benefit/Cost ratios for one year of service forester activity at 4, 7, and 10 percent interest.

Rate	Ratio
4%	20.4
7%	8.2
10%	2.6

pected future benefits by the present value of expected future costs (Gunter and Haney 1984). Projects having a benefit/cost ratio greater than 1:1 will earn at least the stated interest rate. The higher the benefit/cost ratio the more benefits exceed costs, considering the time value of money. The benefit/cost ratios for one year of service forester activity are given in Table 11 for interest rates of 4, 7, and 10 percent.

Multiplier Effects on the State Economy

The last full analysis of the Mississippi forest economy was performed by Porterfield et al. (1978). The primary data used in the study were supplied from a detailed input-output model. A current input-output model shows that the output, income, and employment multipliers used in the 1978 study are still basically accurate (Lee 1986). This discussion of the indirect economic impacts produced by service forester promotional activity will be based on the analysis of Porterfield et al. (1978), including slight modification with current data from Lee (1986).

An average acre of Mississippi timberland has the capacity to produce 100 cubic feet of wood per acre per year. Currently, this average acre is only producing at two-thirds of its capacity, or about 65 cubic feet per acre per year (Thomas and McWilliams 1985). Promotional activities of service foresters serve to close this productivity gap.

Increased forest productivity does not automatically equate to increased economic output. However, current USDA Forest Service projections show demands for most timber products continuing to increase (USDA Forest Service 1982). It is expected that increased forest productivity will be necessary to maintain or raise Mississippi's forest industry output. For each $100,000 output increase by the forest industry sector, $356,000 of output can be expected as a statewide response. Also, 12 jobs will result along with a $90,000 increase in household income (Porterfield et al. 1978). The costs of the forestry practices to landowners generated by a service forester over a year, based on the activities listed in Table 6 and average costs in Straka and Watson (1985), are approximately $250,000.

Based on multipliers from Lee (1986), this equates to about $500,000 of statewide economic activity generated annually by a service forester (in salaries, wages, vendor costs, equipment purchases, etc., considering the multiplier effect). The actual economic impact is extremely difficult to establish, but $500,000 annually represents a conservative estimate.

Tax Effects

Increased economic activity resulting from greater long-run timber supply from service forester efforts is certain to increase tax revenues. Such tax effects, however, are difficult to measure with certainty. This study considered the immediate, direct impact of forestry activities on three of the major taxes: severance, sales, and income taxes.

The "timber sale marketing" section of this bulletin outlined the incremental annual harvest volumes resulting from a service forester. The implied increment in severance tax receipts was estimated as shown in Table 12. Ninety percent of these funds are allocated to Mississippi's forestry incentive program and 10 percent to the local county. Unit tax rates are from Mississippi State Tax Commission (1985).

Table 12. Severance tax increases attributable to service forester activities.

Product	Incremental volume	Unit tax	Tax
Pine sawtimber	313 MBF	$1.00	$313.00
Pine pulpwood	326 cords	0.30	97.80
Hardwood sawtimber	48 MBF	0.75	36.00
Hardwood pulpwood	273 cords	0.225	61.43
Severance tax generated			$508.23

Many of the activities generated by the service forester produced labor income that was subject to the state's income tax. With labor components of these practices as described by Straka and Watson (1985), and an average marginal state income tax rate for this type of labor of 3½ percent, the resultant increase in income tax receipts was estimated as shown in Table 13.

The same activities that produce labor income require forestry equipment which, in Mississippi, is subject to a 3 percent sales tax (replacement parts are subject to the full 6 percent tax). By assuming that

Table 13. Increase in state income tax receipts attributable to service forester activities.

Practice	Annual Cost	Labor Component	Income Tax Generated
Site preparation	$52,048	$12,049	$421.72
Artificial reforestation	53,952	23,928	837.48
Prescribed burning	2,010	975	34.13
Timber state improvement	7,221	4,434	155.19
			$1,448.52

Table 14. Increase in state sales tax receipts attributable to service forester activities.

Practice	Annual Cost	Equipment Component	Sales Tax Generated
Site preparation	$52,048	$30,292	$908.76
Artificial reforestation	53,952	17,373	521.19
Prescribed burning	2,010	430	12.90
Timber stand improvement	7,221	780	23.40
			$1,466.25

equipment purchases for each forestry practice were directly related to the equipment component costs described by Straka and Watson (1985), it was possible to estimate the probable increase in sales tax revenues. These calculations are summarized in Table 14.

The total for the three taxes is $3,423. However, this is just the "tip of the iceberg." Computing the taxes generated is extremely complex. The $3,423 represents only the direct taxes generated from specific forestry practices. Obvious secondary taxes, like the income tax on the service forester's salary, are omitted. The figures in the tables illustrate that significant state tax revenue is generated by service forester activity.

Conclusions

Service forester promotional activities can be very effective. This project showed that within 6 months such activity will produce more requests for service than both a service forester and a county forester can handle. Indeed, it seems clear that one service forester's promotional activity can encompass 3 or 4 counties. The most effective type of contact appears to be one-to-one communication with individual landowners. Essentially, all forestry activity in the counties can be traced back to this type of contact.

Ignoring indirect local economic impacts and increased tax revenues, service forester promotional activity produced significant benefit/cost ratios at real discount rates of 4, 7, and 10 percent. These ratios were 20:1, 8:1, and 3:1, respectively. Ratios of this magnitude indicate substantial returns for each dollar of public funds invested in a service forester.

Irland (1983) noted that: *"Rigorous benefit-cost analyses are made difficult by the extremely long periods until timber is cut, the uncertainty about future prices, dispute about appropriate discounting procedures, and uncertainty about future retention of treatments and the physical yield enhancement due to them."* Since the assumptions and numerical procedures that were used to determine benefits in this study have been clearly specified, the effects of a change in any relevant parameters can be quickly evaluated. The conservative nature of the assumptions, however, probably minimizes opportunities to reduce expected benefits.

The impact on the local economy was large, $500,000 considering the multiplier effect, but ignoring the future impact on forest industry development. This economic impact was not included in the benefit/cost ratio calculation, mainly because some double-counting of benefits would result. This omission supports the conservativeness of the estimated ratios.

An additional benefit not included in the benefit/cost analysis was the increased tax revenues generated. Without considering the multiplier effect, state taxes generated from specific forestry practices were projected to rise by $3,423 per year.

In summary, the study results indicate that the economic benefits attributable to the promotional activities of a service forester are significant. This was borne out by very high benefit/cost ratios. One service forester per 3-4 counties would use all the available state forestry personnel in those counties. This study illustrates the effectiveness of such promotional activity in forestry.

Literature Cited

Baumgartner, D. M. 1980. Nonindustrial private forest landowners, Stevens County, Washington. *In:* Town Meeting Forestry–Issues for the 1980's. Proceedings of the 1979 Convention of the Society of American Foresters, p. 266-268.

Burkhart, H. E., R. O. Parker, M. R. Strub, and R. G. Oderwald. 1972(a). Yields of old-field loblolly pine plantations. Virginia Polytech. Inst. and State Univ., Div. of For. and Wildl. Resour., Publ. FWS-3-72, 51 p.

Burkhart, H. E., R. O. Parker, and R. G. Oderwald. 1972(b). Yields for natural stands of loblolly pine. Virginia Polytech. Inst. and State Univ., Div. of For. and Wildl. Resour., Publ. FWS-2-72, 63 p.

Chamberlain, H. H., L. A. Sample, and R. W. Hayes. 1945. Private forest land management in the loblolly-shortleaf type in southern Arkansas, northern Louisiana, and central Mississippi. Louisiana Agric. Exp. Stn. Bull. 393, 46 p.

Cubbage, F. W., T. M. Skinner, and C. D. Risbrudt. 1985. An economic evaluation of the Georgia Rural Forestry Assistance Program. Univ. of Georgia Agric. Exp. Stn. Res. Bull. 322, 59 p.

Dunn, B. A., and M. J. Beese. 1977. Structure, characteristics of participants, and effectiveness of the forestry incentives program in South Carolina. Clemson Univ. Dept. For. Res. Ser. No. 31, 26 p.

Faulkner, C. R. 1980. How can state, federal, and private foresters improve communications with woodlot owners? *In:* Town Meeting Forestry–Issues for the 1980's. Proceedings of the 1979 Convention of the Society of American Foresters, p. 270-271.

Gansner, D. A., and O. W. Herrick. 1980. Cooperative forestry assistance in the Northeast. USDA For. Serv. Res. Paper NE-464, 8 p.

Gregerson, H., T. Houghtalling, and A. Rubinstein. 1979. Economics of public forestry incentive programs: a case study of cost-sharing in Minnesota. Univ. of Minnesota Agric. Exp. Stn. Tech. Bull. 315, 65 p.

Gunter, J. E., and H. L. Haney, Jr. 1984. Essentials of forestry investment analysis. Oregon State Univ., Corvallis. 337 p.

Irland, L. C. 1983. Evaluating public incentives for resource management: the case of forestry (Draft). State of Maine, State Planning Office. Mimeo. 47 p.

James, L. M., W. P. Hoffman, and M. Payne. 1951. Private forest landownership and management in central Mississippi. Mississippi Agric. Exp. Stn. Tech. Bull. 33, 38 p.

Lee, K. C. 1986. A study of the Mississippi input-output model. Mississippi Research and Development Center, Jackson, MS.

Mills, T. J., and D. Cain. 1978. Timber yield and financial return performance of the 1974 Forestry Incentives Program. USDA For. Serv. Res. Paper RM-204, 56 p.

Mississippi Cooperative Extension Service. 1982-1984 (Monthly). Forest Product Market Bulletin. Extension Marketing Department, Mississippi State University, Mississippi State, MS.

Mississippi State Tax Commission. 1985. Timber severance tax law. Title 27, Chapter 25, Article 1, Mississippi Code of 1972. Jackson, MS.

Moak, J. E. 1979. Public incentives for pine timber production in Mississippi. Paper presented at Southern Economic Association Annual Conference, November 7-9, 1979, Atlanta, Georgia. 15 p.

Murphy, H. E. 1980. Report–southern landowner forum. *In:* Proc. of the Natl. Private Nonindustrial For. Conf., USDA For. Serv., Gen. Tech. Rep. WO-22, p. 7-12.

Murphy, P. A. 1978. Mississippi forests: trends and outlook. USDA For. Serv. Resour. Bull. S0-67, 32 p.

Peterson, R. M. 1986. Southern timber supply now and in the future. Forest Industries 113(1):28-29.

Porterfield, R. L., T. R. Terfehr, and J. E. Moak. 1978. Forestry and the Mississippi economy. Mississippi Agric. and For. Exp. Stn. Bull. 869, 51 p.

Resource Information Systems, Inc., and Resource Economics International. 1985. The timber situation in 12 southern states: projections of forest area, inventory, growth, harvest, and prices through 2015. Beford, Mass., and Corvallis, Ore.

Risbrudt, C. D., and P. V. Ellefson. 1983. An economic evaluation of the 1979 Forestry Incentives Program. Univ. of Minnesota Agric. Exp. Stn. Bull. 550, 55 p.

Row, C., H. F. Kaiser, and J. Sessions. 1981. Discount rate for long-term Forest Service investments. J. For. 79(6):367-369, 376.

Slusher, J. P. 1980. Some thoughts about communicating with woodland owners. *In:* Town Meeting Forestry–Issues for the 1980's. Proceedings of the 1979 Convention of the Society of American Foresters, p. 272.

Stoddard, H., Jr. 1942. Future of private forest land ownership in the northern Lake States. J. Land and Public Utility Econ. 18(3):267-283.

Straka, T. J., and W. F. Watson. 1985. Costs of forestry practices. Forest Farmer 44(5):16-22.

Thomas, C. E., and W. H. McWilliams. 1985. Midcycle survey of Mississippi's forest resources. USDA For. Serv. Resour. Bull. SO-101, 37 p.

Thrapp, G. R. 1978. An economic analysis of loblolly pine plantations established with FIP cost-share funds in seventeen Mississippi counties. M. S. Thesis, Department of Forestry, Mississippi State University. 99 p.

Trokey, C. B., and W. B. Kurtz. 1982. Increasing timber management through a better understanding of nonindustrial private forest owner's motivations and objectives. The Consultant 27(3):57-59.

USDA Forest Service. 1981. An assessment of the forest and range land situation in the United States. USDA For. Serv. For. Resour. Rep. No. 22, 352 p.

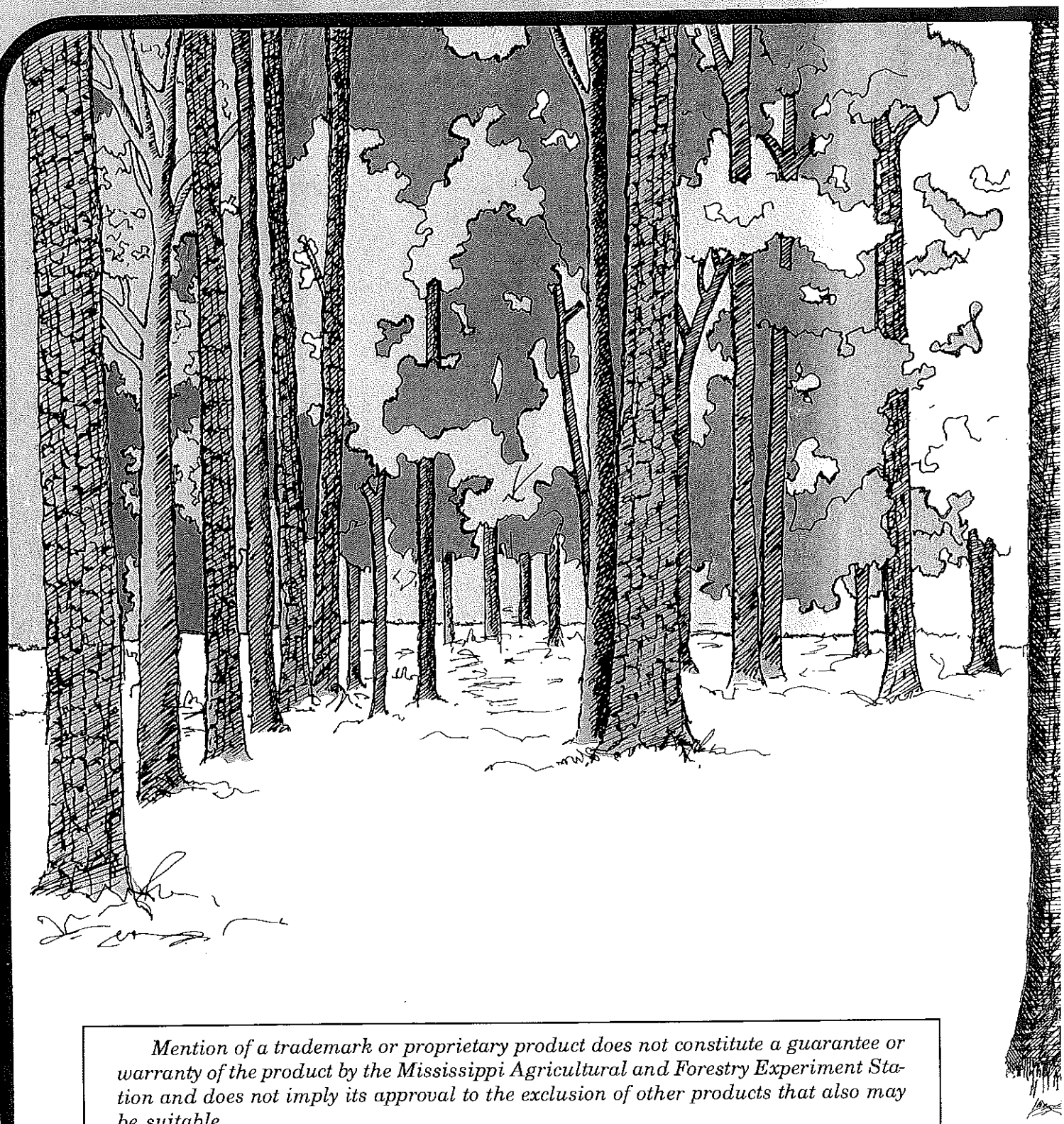
USDA Forest Service. 1982. An analysis of the timber situation in the United States, 1952-2030. USDA For. Serv., For. Resour. Rep. No. 23, 499 p.

Utz, K. 1977. A cost-effective, economic analysis of the Cooperative Forest Management (CFM) program in the Southeastern Area. USDA For. Serv., Southeastern Area State and Private Forestry, 12 p.

Wall, B. R. 1981. Trends in commercial timberlands area in the United States, by state and ownership, 1952-1977, with projections to 2030. USDA For. Serv. Gen. Tech. Rep. WO-31, 28 p.

Webster, H. H., and C. H. Stoltenberg. 1959. What ownership characteristics are useful in predicting response to forestry programs? Land Econ. 35(3):292-295.

Yoho, J. G., and L. M. James. 1958. Influence of public assistance programs for forest landowners in northern Michigan. Land Econ. 34(4):357-364.



Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the Mississippi Agricultural and Forestry Experiment Station and does not imply its approval to the exclusion of other products that also may be suitable.

27922/1.5M