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# Costs and Cost Trends

## For Forestry Practices in the South

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Cost estimates of practicing forestry in the South during 1986 and cost changes during the 1952-1986 period are presented in this report. Albert C. Worrell reported the original cost study in *Forest Farmer* in May 1953. His work was updated by James G. Yoho and Robert B. Fish in the November 1961 issue of *Forest Farmer*. Other revisions include James G. Yoho, George F. Dutrow, and James Moak (*Forest Farmer*, 1971); James Moak and Jim Kucera (*Forest Farmer*, 1975); James Moak, James Kucera, and W.F. Watson (*Forest Farmer Manual*, 1977); James Moak, W.F. Watson, and Paul Van Deusen (*Forest Farmer Manual*, 1980); James Moak, W.F. Watson, and Mark Watson (*Forest Farmer Manual*, 1983); and Thomas J. Straka and William F. Watson (*Forest Farmer Manual*, 1985). The present study is based on the results of a survey completed in 1986 and reports current costs for most forestry practices covered by previous surveys. It also provides tables with cost changes from 1952 to 1986 for specific commercial practices common in the South.

### Methods and Results

The tables are based solely on responses to a questionnaire like those used in past surveys, and the accuracy of the report reflects the accuracy of the responses as well as sampling error. A total of 250 individuals, private and firms, and public agencies from 12 southern states were asked to participate. Each respondent was

requested to provide a detailed breakdown of his total costs by practice.

Seventy usable returns were received. We believe the results provide a reasonable representation of existing costs and cost changes for the various forestry practices. Comparisons between these data and the general economic activity are indicative of the general forestry cost/price situation.

In Tables 1-9, we summarize each forestry practice considered. Average total cost data are presented by regions together with overall cost data on each component. The latter figures are expressed as percentages of the total. All costs are reported on a per acre basis, except those for planting, which are also on a per seedling basis. In Tables 10-12, we summarize the general cost trends from 1952-1986.

We used two physiographic regions within the area surveyed (Figure 1): (1) the Coastal Plain, which includes the area south and east of the fall line in the 12 southern states; and (2) the Piedmont, which includes the region in the Southeast between the fall line and the mountains plus the upland areas from Alabama westward through Arkansas. Earlier reports separated the Coastal Plain into northern and southern regions. This separation did not statistically reduce variation in total cost in the 1986 survey and was not used.

**Mechanical site preparation.** Mechanical site preparation is usually performed in one or more operations. Single operations are often combined to form a specific site-preparation treatment. In the past, respondents were asked to report costs separately for each individual operation. Since 1984, the respondents were requested to report costs for the actual site preparation treatments used on their woodlands. Therefore, less detail on individual operations, but more realistic site preparation treatment information is included in the 1984 and 1986 reports.

These costs are presented in Table 1a. Table 1b shows the overall distribution of site preparation costs by component for 1986. Equipment costs remain the largest component (61.5 percent) of total costs. The overall average cost per acre of mechanical site preparation increased from \$90.23 to \$94.21 over the last two years. Forty-six percent of all reported site preparation was performed on a contract basis in 1986.

**Planting.** Hand planting is one of the most labor-intensive forestry practices. Consequently, direct labor costs continue to dominate the total cost of hand planting (Table 2b). Nearly three-quarters of the total cost of hand planting is the cost of direct labor.

Machine planting on old field sites had the lowest per acre cost of \$26.79, while cutover land following less intensive site preparation had the highest per acre cost at \$38.78 (Table 2a). These costs do not include the cost of seedlings.

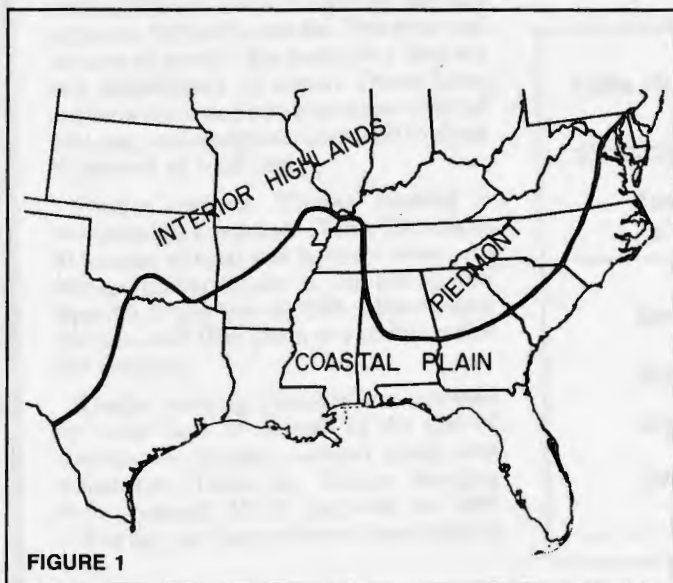


FIGURE 1

Machine planting was also found to be rather labor intensive (Table 2b). Direct labor costs averaged 36 percent of total costs. Equipment costs were half of total costs on cutover land. Machine planting is less costly than hand planting on cutover sites. (Table 2a).

Respondents reported planting about 675 trees per acre on the average. Ninety-five percent of hand planting was performed by contractors and 86 percent of machine planting was performed by contractors. Again, costs do not include the cost of seedlings.

*Prescribed burning.* Prescribed burning is labor-intensive (Table 3b). Direct labor and equipment costs dominate the total cost of this practice, accounting for over 80 percent of the total. As in 1984, the Coastal Plain had the lowest cost of prescribed burning. Aerial ignition systems were included in the survey for the first time in 1986.

*Chemical treatment.* Chemical treatment includes the various application methods of herbicides for deadening undesirable trees. Costs for chemical treatment are included in Tables 4a and 4b. The total costs for chemical treatment increased slightly over the last two years.

Ground spraying with a backpack sprayer and injection are rather labor intensive while the chemical cost is the main component of total cost for aerial spraying and mobile ground spraying of herbicides.

*Fertilization.* The cost of fertilization application was included in the survey for the first time in 1984. Application of fertilizer during site preparation was least costly. Aerial applications were most costly (Table 5b). The cost of the fertilizer was by far the major component of total cost for any application method.

*General fire protection.* The total cost per acre by region and the components of the cost for 1986 are shown for general fire protection in Tables 6a and 6b. The total cost per acre of general fire protection does not vary significantly by region. Direct labor continued to constitute about one-third of total cost, and equipment increased to about 40 percent of total cost.

*Timber cruising.* Timber cruising is dominated by labor costs (Table 7b). About 80 percent of total cost is direct labor. An average timber cruise in our survey cost about \$3.27 per acre in 1986. Line cruising was less costly than prism or variable radius plot cruising.

*Timber marking.* Direct labor accounted for more than 70 percent of the cost of marking for thinning natural stands and plantations (Table 8b). Timber marking costs averaged \$10.57 per acre in 1986 (Table 8a), so these costs are lower than in 1984.

*Precommercial thinning.* The total cost of precommercial thinnings increased to \$52.44 per acre in 1986 (Table 9). The practice is labor-intensive, but precommercial thinning costs are dominated by equipment cost. Equipment cost accounts for nearly one-half of total cost.

**Changes, 1952-1986**

*Changes reflected in current dollars.* The cost of major forestry practices for the years, 1952, 1961, 1967, 1974, 1976, 1979, 1982, 1984, and 1986 are presented in Table 10. The costs for 1984 and 1986 are reported for all practices except release cutting of young growth and seedbed preparation, costs which are not available.

Mechanical seedbed preparation is included in 1967, 1974, 1976, 1979, and 1982. Precommercial mechanical thinning cost is reported for 1976, 1979, 1982, 1984, and 1986.

Fertilization costs were included for the first time in 1984. These are average dollar costs from each survey and are based on observations for all regions of the South. All costs are presented on a per acre basis except those costs for planting, which are also on a per seedling basis.

Average cost for each of the practices has increased significantly since 1952. Cost increases have ranged from a 470 percent increase for hand planting to over 2,300 percent for prescribed burning. It should be noted, however, that these values include

**Table 1a. Mechanical site preparation treatments, total costs per acre, 1986.**

| Site Preparation Treatment | Acres Reported | Regional Costs |          | Overall Average |
|----------------------------|----------------|----------------|----------|-----------------|
|                            |                | Coastal Plain  | Piedmont |                 |
| -----dollars-----          |                |                |          |                 |
| Shear, Rake, and Pile      | 52,677         | 129.90         | 123.06   | 125.81          |
| Shear, Rake, Pile, & Bed   | 30,467         | 138.86         | 195.67   | 173.94          |
| Shear, Rake, and Disk      | 5,747          | 120.00         | 124.31   | 121.21          |
| Shear Only                 | 44,934         | 51.54          | 59.23    | 57.20           |
| Disk Only                  | 3,431          | *              | *        | 60.22           |
| Bed Only                   | 35,240         | 19.46          | *        | 24.97           |
| Single Chop                | 113,687        | 46.01          | 70.51    | 52.96           |
| Double Chop                | 47,107         | 71.24          | *        | 83.79           |
| Chop and Bed               | 33,960         | 90.17          | *        | 84.23           |
| Shear and Bed              | 15,200         | 123.31         | *        | 125.29          |
| Chop and Disk              | 500            | *              | *        | 105.20          |
| Overall                    | 416,734        |                |          | 94.21           |

\* Insufficient data for further refinement of the results.

**Table 1b. Overall distribution of mechanical site preparation costs by component, 1986.**

| Component of Cost | Overall Average |           |
|-------------------|-----------------|-----------|
|                   | 1986            | (Percent) |
| Direct Labor      |                 | 29.0      |
| Equipment         |                 | 61.5      |
| Supervision       |                 | 4.5       |
| Overhead          |                 | 5.0       |

inflation. The average unweighted cost increase for the seven practices included in our surveys was over 1,300 percent.

Because cost changes in recent years deserve additional attention, percentage changes in seven major forestry practices from 1984 to 1986 are presented in Table 11. Some costs were not available for 1984. Cost decreases occurred in four of nine practices while increases occurred in five. Changes in forestry practices costs ranged from a decrease of 32 percent for prescribed burning to a 45 percent increase in timber cruising cost.

Price changes related to price changes. Presented in Table 12 are changes in forestry costs over the last six surveys, 1974 through 1986. These changes are related to the general price level at wholesale, and also to southern pine lumber prices.

Price indexes provide a basis for comparing the costs of selected forestry practices with both forest product prices and with general economic trends. Southern pine lumber prices were used instead of stumpage prices because the lumber price index is the broadly based and may give a more realistic picture of price trends.

When comparing the costs of selected forestry practices with the price indexes, we found that five of the seven major forestry practices experienced cost increases greater than increases in the producer price index. The practices with the highest indexes (removing undesirable trees with an index of 645, timber cruising with 492, and site preparation with 407) are well over the producer price index of 300 and southern pine lumber index of 300.

The costs of five of seven major practices have more than tripled since 1967. Costs of all practices increased until 1976, but four practices dropped in cost between 1976 and 1979. Only one practice, seedbed preparation, dropped from 1979 to 1982.

Costs of four practices increased from 1984 to 1986 (removing undesirable trees, timber cruising, mechanical site preparation, and hand planting). Prices in general decreased from 1984 to 1986. However, only three of seven forest practices followed the trend.

In the early surveys, rising labor cost was the most significant factor. Then in the 1976 survey, escalating equipment costs and the energy shortage became key causes. In the 1979 survey, rising equipment costs, including energy price rises, made the equipment component the number one cause of escalating total costs.

Labor cost continues to push total practice costs up. In 1986 the one trend that stands out is an increase in the amount of forestry practices performed on a contract basis. Roughly 90 percent of planting and 50 percent of mechanical site preparation were performed by contractors in 1986. This is up significantly from prior years.

**Table 3b. Distribution of burning costs by components, 1986.**

| Component of Cost | Ground Drip Torch   | Aerial Ignition System |
|-------------------|---------------------|------------------------|
|                   | ----- percent ----- |                        |
| Direct Labor      | 52.0                | 36.7                   |
| Equipment         | 32.9                | 51.2                   |
| Supervision       | 8.4                 | 6.2                    |
| Other Overhead    | 6.7                 | 5.9                    |

**Table 4a. Chemical treatments, total costs per acre,\*\* 1986.**

| Manner in Which Chemical was Applied | Acres   | Coastal Plain       | Piedmont | Overall Average |
|--------------------------------------|---------|---------------------|----------|-----------------|
|                                      |         | ----- dollars ----- |          |                 |
| Aerial Spray                         | 89,818  | 89.84               | 66.12    | 77.29           |
| Ground Spray with Backpack Sprayer   | 5,060   | 80.93               | 60.12    | 64.07           |
| Ground Spray with Mobile Sprayer     | 2,440   | *                   | *        | 110.51          |
| Injection                            | 44,431  | 37.72               | 44.22    | 41.11           |
| Spot Gun                             | 8,505   | *                   | *        | 58.34           |
| Overall                              | 150,254 |                     |          | 65.61           |

\* Insufficient data for further refinement of the results.  
 \*\* Includes the cost of chemicals.

**Table 4b. Components of cost for chemical treatment, 1986.**

| Component of Cost | Aerial Spray        | Ground Spray (Backpack) |
|-------------------|---------------------|-------------------------|
|                   | ----- percent ----- |                         |
| Labor             | 3.6                 | 20.8                    |
| Equipment         | 11.5                | 2.5                     |
| Supervision       | 5.1                 | 1.2                     |
| Overhead          | 8.5                 | 4.2                     |
| Chemical Cost     | 71.3                | 71.3                    |

**Table 5. Fertilization, total costs per acre,\*\* 1986.**

| Method of Application                                     | Acres Reported | Coastal Plain       | Piedmont | Overall Average |
|---|----------------|---------------------|----------|-----------------|
|   |                | ----- dollars ----- |          |                 |
| Aerial  | 61,243         | 37.14               | *        | 36.54           |
| Ground distributor attached to site preparation equipment | 23,238         | *                   | *        | 34.69           |
| Overall   | 84,481         |                     |          | 36.03           |

\* Insufficient data for further refinement of results.  
 \*\* Includes the cost of fertilizer.

**Table 11. Changes in the costs of forest practices in the South from 1984 to 1986.**

| Forest Practice                         | Overall Average Percent Change 1984-1986 |
|---|--|
| Prescribed burning                      | - 32                                     |
| Removing undesirable trees (chemically) | + 1                                      |
| Timber cruising                         | + 45                                     |
| Marking trees for harvesting            | - 28                                     |
| Mechanical site preparation             | + 4                                      |
| Planting by hand                        | + 8                                      |
| Planting by machine                     | - 13                                     |
| Precommercial thinning                  | + 21                                     |
| Fertilization                           | - 11                                     |

All practices have substantial labor costs, and the two practices which had the highest cost increases between 1982 and 1986 were highly labor intensive. In addition to equipment, energy and labor, another factor which continues to influence the cost of site preparation and planting is that in many areas managers have already treated their less difficult area first, and are moving now into more difficult areas.

It is encouraging that forest practices costs on the average have leveled off in terms of cost increases. Labor costs and a shift to contractors seem to be major contributing factors, but, obviously, a decrease in general price levels also must be considered to have a major impact. Such signs may hint at a tapering off in the rates of increasing costs of good forest management in the South. □

**Table 12. Changes in the costs of forestry practices in the South related to forest products prices and the general price level 1967, 1974, 1976, 1979, 1982, 1984, and 1986.**

| Specific Forestry Practice                          | 1967                                   | 1974 | 1976 | 1979 | 1982 | 1984 | 1986 |
|---|--|------|------|------|------|------|------|
|   | -----Cost Index (1967 = 100)-----      |      |      |      |      |      |      |
| Controlled (Prescribed) Burning                     | 100                                    | 157  | 228  | 184  | 258  | 448  | 303  |
| Removing Undesirable Trees (Chemically)             | 100                                    | 225  | 230  | 396  | 400  | 637  | 645  |
| Timber Cruising (10%)                               | 100                                    | 139  | 159  | 239  | 295  | 305  | 442  |
| Marking Trees for Harvesting                        | 100                                    | 161  | 261  | 231  | 454  | 473  | 342  |
| Mechanical Site Preparation (shear, rake, and burn) | 100                                    | 204  | 312  | 396  | 485  | 384  | 401  |
| Planting by Hand                                    | 100                                    | 234  | 234  | 204  | 212  | 213  | 230  |
| Planting by Machine                                 | 100                                    | 208  | 242  | 257  | 340  | 318  | 276  |
| Release Cutting of Young Growth                     | 100                                    | 229  | 289  | —    | —    | —    | —    |
| Seedbed Preparation                                 | 100                                    | 199  | 232  | 209  | 185  | —    | —    |
|   | ----- (Price Index (1967 = 100)) ----- |      |      |      |      |      |      |
| Producer Prices All Commodities*                    | 100                                    | 160  | 183  | 236  | 299  | 310  | 300  |
| Wholesale Price Southern Pine Lumber*               | 100                                    | 185  | 218  | 324  | 286  | 320  | 300  |

\* Source: U.S. Bureau of Labor Statistics as reported in Producer Prices and Price Indexes Data. Price indexes for 1986 are based on preliminary estimates.

**Table 6a. General fire protection, total costs per acre, 1986.**

| Region          | Average Cost        |
|-----------------|---------------------|
|                 | ----- Dollars ----- |
| Coastal Plain   | 0.867               |
| Piedmont        | 0.607               |
| Overall Average | 0.788               |

**Table 7b. Components of cost for timber cruising, 1986.**

| Component of Cost | Line Plot           | Prism or Point |
|-------------------|---------------------|----------------|
|                   | ----- percent ----- |                |
| Direct Labor      | 84.7                | 81.1           |
| Equipment         | 7.7                 | 10.2           |
| Supervision       | 3.8                 | 5.5            |
| Overhead          | 3.8                 | 3.2            |

**Table 6b. Components of cost for general fire protection, 1986.**

| Component of Cost | Percent of Cost |
|-------------------|-----------------|
| Labor             | 36.1            |
| Equipment         | 39.3            |
| Supervision       | 13.8            |
| Overhead          | 10.8            |

**Table 8a. Timber marking, total costs per acre, 1986.**

| Type Marking            | Coastal Plain       | Piedmont | Overall Average |
|-------------------------|---------------------|----------|-----------------|
|                         | ----- Dollars ----- |          |                 |
| Regeneration Cuts       | *                   | *        | 17.00           |
| Thinning Plantations    | *                   | *        | 10.64           |
| Thinning Natural Stands | 7.46                | 4.67     | 6.70            |
| All Types               |                     |          | 10.57           |

\*Insufficient data for further refinement of results.

**Table 7a. Timber cruising, ten percent, total cost per acre, 1986.**

| Type           | Acres Reported | Coastal Plain       | Piedmont | Overall Average |
|----------------|----------------|---------------------|----------|-----------------|
|                |                | ----- Dollars ----- |          |                 |
| Line Plot      | 132,188        | 1.42                | *        | 1.35            |
| Prism or Point | 411,094        | 6.27                | *        | 6.19            |
| All types      | 543,282        |                     |          | 3.27            |

\*Insufficient data for further refinement of results.

**Table 8b. Components of cost for timber marking, 1986.**

| Component of Cost | Percent of Cost |
|-------------------|-----------------|
| Direct Labor      | 73.3            |
| Equipment         | 14.0            |
| Supervision       | 6.3             |
| Overhead          | 6.4             |