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# Costs and Cost Component Trends of Hand and Machine Tree Planting in the Southern United States (1952 to 1990)

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*Since 1952, 11 periodic surveys on the costs of forest practices have been published. These surveys provide detailed data on hand and machine tree planting costs by geographical region and quality of planting site. Tree planting costs have increased nearly 5% annually since 1952. Hand planting is generally more expensive (20 to 50%) than machine planting. Hand planting costs have increased much more than the general price index, probably because of the amount of direct labor involved.* Tree Planters' Notes 43(3):89-92:1992.

Current and future costs of forest management practices in the South are essential information for forest managers and planners responsible for capital allocation decisions. In all businesses it is important to understand the characteristics of the capital costs, and forestry is no exception. Forest products companies maintain detailed records on costs and revenues to assist managers in making decisions on forestry projects.

However, comparable information is usually not available to non-industrial private forest landowners or potential forestry investors. Also, forest managers need reliable cost information when considering alternative forest practices where cost records are not available.

Managers concerned with the costs of tree planting operations may not be aware that southern costs and cost trends for the last 40 years are available for analysis and comparison. *Forest Farmer* has published a series on cost estimates for major forest practices since 1952. Researchers at southern universities collected these cost data by surveying individuals, private firms, and public agencies across the Southern United States. Currently the survey is updated every 2 years and published in the *Forest Farmer Manual Edition.* The cost of tree planting by hand and machine is included in each survey.

A chronological description of the surveys will identify the issues of *Forest Farmer* necessary to utilize this time series. Albert C. Worrell reported the original 1952 cost survey in the May 1953 issue of *Forest Farmer* (Worrell 1953). James G. Yoho and Robert B. Fish updated the original survey in early 1961 (Yoho and Fish 1961). The same 1961 survey was examined in more detail in 1963 (Somberg, Eads, and Yoho 1963). Later surveys were completed in 1967 (Yoho, Dutrow, and Moak 1971), 1974 (Moak and Kucera 1975), 1976 (Moak, Kucera, and Watson 1977), 1979 (Moak, Watson, and Van Deusen 1980), 1982 (Moak, Watson, and Watson 1983), 1984 (Straka and Watson 1985), 1986 (Watson, Straka, and Bullard 1987), 1988 (Straka, Watson, and Dubois 1989), and 1990 (Dubois et al. 1991). Moak (1982) provided an analysis of these cost trends for 1952 to 1979. Straka and Watson (1987) provided additional analysis of the 1984 survey data. Dubois, Straka, and Watson (1991) used the survey data to develop a cost index for southern forest practices.

**Tree Planting Cost Trends**

Hand and machine tree planting costs for survey years between 1952 and 1990 are reported in figure 1. Planting costs have been reported on a per-seedling basis, because the most significant factor affecting planting costs is the number of seedlings planted per acre. These costs do not include the cost of the seedlings. Of course, these costs can easily be converted to a total cost per acre basis by multiplying the per-seedling cost by the number of seedlings planted per acre. Hand planting costs usually exceeded machine planting costs by 20 to 50%. Hand planting is more common on rough or cutover land, and this may partially explain the cost difference. However, the cost differential between hand and machine plant-

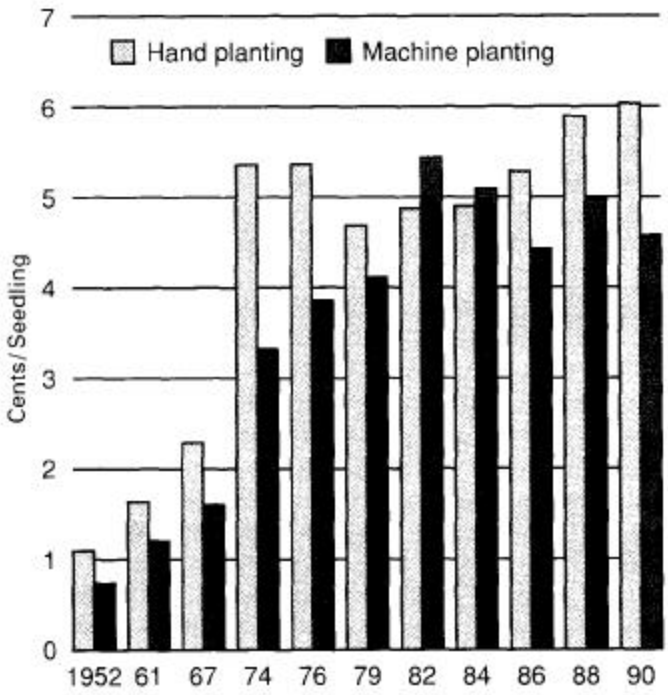


**Figure 1**—*Cost of tree planting in the Southern United States (1952 to 1990) on a per-seedling basis, excluding the cost of the seedlings.*

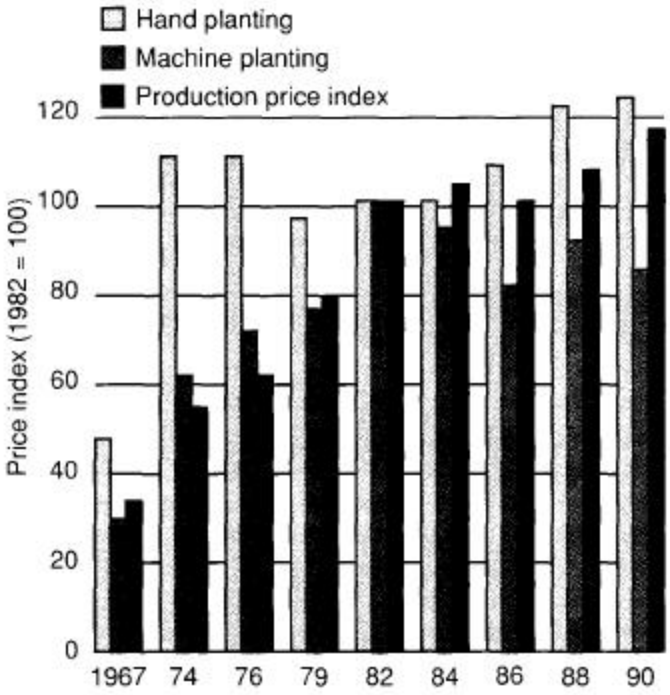


**Figure 2**—*Changes in the cost of tree planting in the Southern United States related to the producer price index (all commodities).*

ing moderates in later surveys. The quality of planting sites generally increased over the 38-year period and hand and machine planting may be occurring on more similar sites.

Average tree planting cost (by either method) increased approximately 5% annually. Figure 2 illustrates tree planting cost increases relative to the general price index from 1967 to 1990. Relative to the producer price index, machine planting costs have decreased over time. However, labor-intensive hand planting costs have consistently exceeded increases in the general price level.

Direct labor costs dominate the cost of both hand and machine planting (figure 3). Indeed, hand planting is one of the most labor-intensive forest practices. Direct labor has averaged over 70% of total hand planting cost and over 40% of total machine planting cost. Machine planting has over 20% of total cost allocated to both supervision and equipment. Direct labor cost even exceeds equipment cost on machine planting operations.

The surveys contain more detail than the numerical results reported here. For example, the surveys showed no trend for labor costs per seedling to decrease as the number of seedlings planted per acre increased. Also, survey results are reported by region (Southern Coastal Plain, Northern Coastal Plain, and Piedmont) and condition of planting site (average, less difficult than average, and more difficult than average).

**Current Cost Trends**

Recent surveys provide additional analyses of the survey results. In 1990, respondents classified planting costs according to planting conditions and methods. In addition to noting if planting was carried out by hand or by machine, respondents noted if seedlings were planted on clearcut or old fields and what type of site preparation treatment was carried out before planting.

There was great diversity in the types of site preparation treatments used in 1990. Thus, in subsequent surveys, site preparation was classified as either intensive mechanical preparation or less intensive nonmechanical preparation. The average size of the tract also was reported.

Most of the planting reported (90%) was carried out following clearcutting operations. The average cost of planting old-field sites and clearcuts following both intensive mechanical site preparation and non-intensive mechanical site preparation is presented in table 1.

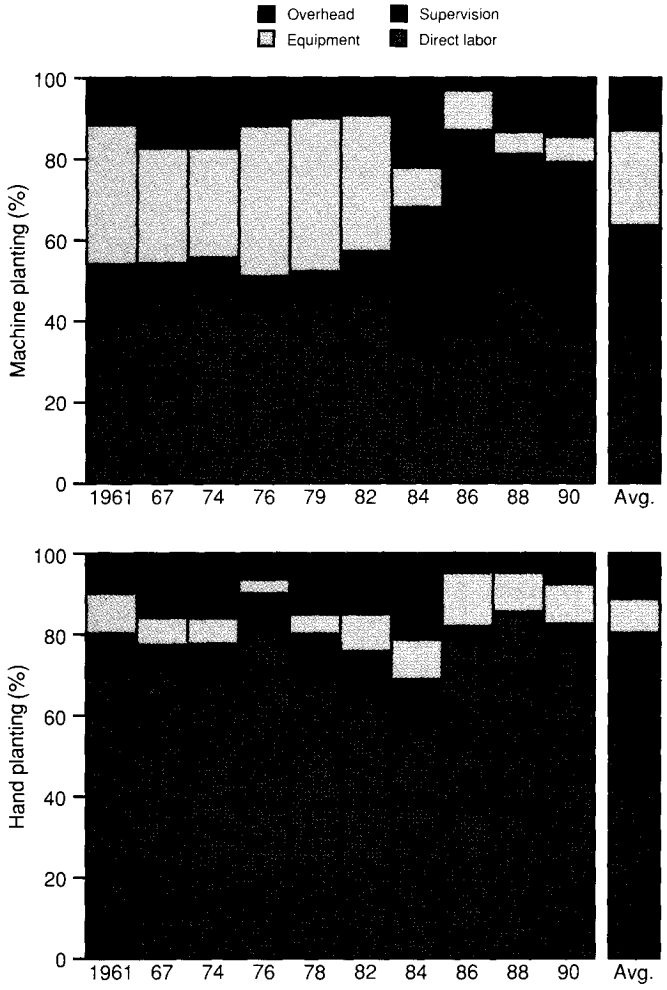


**Figure 3**—*Cost component trends for hand and machine tree planting in the Southern United States (1961 to 1990).*

**Table 1**—*Tree planting costs by type of site and planting method (1990)*

| Type of site | Average cost ($) | Minimum cost ($) | Maximum cost ($) |
|---|---|---|---|
| Old fields | | | |
| Hand | 49.06 | 37.50 | 80.00 |
| Machine | 34.12 | 25.00 | 58.00 |
| Cutover sites | | | |
| Intensive mechanical site preparation | | | |
| Hand | 39.00 | 20.94 | 195.00 |
| Machine | 30.53 | 17.00 | 77.00 |
| Non-intensive mechanical site preparation | | | |
| Hand | 42.80 | 26.40 | 102.00 |
| Machine | ID | ID | ID |

ID = insufficient data. Values are weighted averages by acreage planted.

Table 1 illustrates highly variable cost data. A statistically significant difference in costs between the Piedmont and uplands regions, as compared to the coastal plain, was observed. Also, tract size was negatively correlated with planting cost. The variability is attributed to the appropriate selection of site preparation and planting strategy by land managers for their situation. Intensive wood utilization during logging and/or a costly site preparation treatment should result in a less expensive planting method. Conversely, a site preparation treatment that does not remove debris from the site usually requires more costly planting methods (Straka and Watson 1987).

The 1988 and 1990 surveys included the costs of planting on acreage in the Conservation Reserve Program (CRP) and cost component data by vendor or company operation. Increased planting costs since 1986 may be due to increased competition for planting vendors due to the CRP planting. Most CRP planting was old-field planting and nearly all the acreage was planted by vendors. Overall, about 683 trees per acre were planted in 1988 to 1990, while CRP plantings averaged 781 trees per acre.

The distribution of planting cost components provides an interesting comparison of planting operations. Table 2 shows this distribution by company and vendor operations. Direct labor and equipment costs obviously vary significantly by type of operation. In 1990, 90% of tree planting was performed by vendors, accounting for 98% of the acreage planted.

**Table 2**—*Percentage distribution of planting costs by components and type of operation (1990)*

| Component of cost | Vendor operation | | Company operation | |
|---|---|---|---|---|
| | Hand planting | Machine planting | Hand planting | Machine planting |
| Direct labor | 10.4 | 5.6 | 76.5 | 41.1 |
| Equipment | 3.3 | 2.4 | 5.9 | 38.0 |
| Supervision | 9.1 | 4.9 | 10.0 | 6.1 |
| Overhead | 8.3 | 4.1 | 7.6 | 14.8 |
| Vendor fee | 68.9 | 83.0 | — | — |

Dubois et al. (1991) developed a simple cost index for southern forest practices using these data. This "southern forest practice cost index" is similar to the well-known consumer price index. Table 3 presents the index for seeding and tree planting costs. (The third column in table 3 represents a pro-rated average cost index for a variety of forest management activities that typically occur in southern forestry, such as site preparation, controlled burning, planting, etc. Thus, the indexed cost of seedlings went up from 100 to 116 from

**Table 3**—*Seedling and tree planting (hand and machine, averaged) relative to the southern forest practice cost index, 1982–1984 (base year 1982)*

| Year | Seedlings | Tree planting | Southern forest practice cost index |
|---|---|---|---|
| 1982 | 100 | 100 | 100 |
| 1984 | 116 | 97 | 100 |
| 1986 | 117 | 98 | 108 |
| 1988 | 143 | 113 | 115 |

1982 to 1984, while the cost of planting went down and the overall cost of forestry activities, taken as a whole, remained unchanged.)

The seedling cost index rose from a base level of 100 in 1982 to 117 in 1986. A marked increase in the seedling cost index from 117 in 1986 to 143 in 1988 may be attributable to increased seedling demand resulting from the Conservation Reserve Program established in the Conservation Title of the Food Security Act of 1985. In 11 Southern States, over 900,000 acres of cropland were enrolled in the program for tree planting during fiscal years 1986, 1987, and 1988 (Dicks et al. 1988, Osborn et al. 1989). Furthermore, in a 1988 forest practice cost survey, almost 24% of reported planted acreage was enrolled in the CRP (Straka et al. 1989).

The planting cost index fell from 100 in 1982 to 97 in 1984. The drop in the planting cost index may have resulted from an increased availability of planting contractors. According to Guldin (1983), increased interregional mobility of planting contractors increased the number of competitive bids for planting contracts. Increased competition for planting contracts should have resulted in decreased costs for planting. A rise in the planting cost index by 15% from 1986 to 1988 may be attributable to increased demand for planting vendors resulting from the CRP. Furthermore, a possible reduced labor supply resulting from the Migrant Seasonal Worker Protection Act may have also influenced tree planting cost increases from 1986 to 1988.

## Summary

A series of 11 surveys of forest practices costs provides detailed data on southern tree planting costs since 1952. The surveys are cited chronologically to provide easy access to researchers or managers interested in the costs of tree planting operations. Data are available on actual costs, relative costs, geographical variations, method of planting, quality of planting site, CRP program planting costs, and type of operation (vendor or company).

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