PINE

Fire in Longleaf Pine Stand Management: An Economic Analysis

Rodney L. Busby, and Donald G. Hodges

ABSTRACT: A simulation analysis of the economics of using prescribed fire as a forest management tool in the management of longleaf pine (*Pinus palustris* Mill.) plantations was conducted. A management regime using frequent prescribed fire was compared to management regimes involving fertilization and chemical release, chemical control, and mechanical control. Determining the cost-effectiveness of the management alternatives was accomplished by estimating the growth response needed to recover the costs associated with the silvicultural treatments and making comparisons among the alternatives. The results show prescribed fire would require the least growth response to pay for the expenses required to implement the alternatives. Fire retained its cost-effectiveness for a range of rotation lengths and sawtimber stumpage values.
KEY WORDS: Fire, economics.

INTRODUCTION AND METHODS

Prescribed fire constitutes one of forestry's most flexible and cost-effective management tools in the management of longleaf pine. Today prescribed fire is utilized extensively in the South to achieve a variety of management objectives, often simultaneously. They include: (1) fuel reduction to minimize the probability and severity of wildfire, (2) site preparation, (3) hardwood competition control, (4) disease control, (5) range or wildlife management, (6) access and aesthetic considerations, (7) pre-commercial thinning, and (8) environmental restoration.

Determining the cost-effectiveness of the various management alternatives was accomplished by estimating the growth response needed to recover the costs associated with four silvicultural treatments. The initial step was to calculate the effect of each management alternative on land expectation value (LEV) using costs only. Land expectation values were used to compare alternatives of differing rotation lengths. Next, the growth response needed to produce the revenue needed to offset the additional cost was estimated.

The management alternatives included in the analysis were: (1) prescribed burning, (2) fertilization and chemical site preparation, (3) mechanical hardwood competition control, and (4) chemical control. The prescribed burning regime entails a site preparation burn at establishment and burns every three years from age six to the end of the rotation. The fertilization and chemical site preparation alternative consists of fertilization in year one and an aerial application of herbicide occurring in year 2. The mechanical alternative consists of removing all woody stems greater than 4.5 feet in height at stand establishment and at ages 3 and 6. The chemical alternative consists of an aerial herbicide application at stand establishment and at ages 3 and 6. Average southern management costs were used in the analysis.

RESULTS, DISCUSSION, AND CONCLUSION

The growth responses needed to pay the costs from the four management alternatives are shown in Table 1. In general, the higher the stumpage value, the lower the physical response

Table 1.–Per acre volume growth response required to cover management expenses, 45 and 60 year rotation lengths, and four levels of stumpage values, at the five percent real discount rate.

	Stumpage values (*dollars/thousand board feet, Scribner*)			
	$220	$280	$340	$400
Forty five year rotation	---------- *Thousand board feet, Scribner/acre* ----------			
Prescribed burning	2.19	1.72	1.42	1.21
Fertilization and Chemical Control	3.51	2.76	2.27	1.93
Chemical Hardwood Control	3.61	2.83	2.33	1.98
Mechanical Hardwood Control	4.09	3.21	2.64	2.25
Sixty year rotation				
Prescribed burning	4.25	3.34	2.75	2.34
Fertilization and Chemical Control	6.29	4.94	4.07	3.46
Chemical Hardwood Control	6.46	5.07	4.18	3.55
Mechanical Hardwood Control	7.32	5.75	4.74	4.03

required to pay for the investments. For example, assuming a $220/thousand board feet (MBF) stumpage price and a 45 year rotation age, an additional 2.19 MBF would be required to pay for the prescribed burning costs; at $400/MBF, only 1.21 MBF would be required to meet the same expenses. Longer rotations would require an increased growth response to pay for management costs. At $400/MBF, it takes 1.21 or 2.34 MBF, respectively, to pay for the prescribed burning over a 45- or 60-year rotations.

However, for each rotation length and stumpage level, prescribed burning requires a lower growth response than the other three management alternatives to control competition in longleaf pine forests. This holds true even though the expenses for burning have increased significantly in recent years.

The approach taken in this analysis of determining the growth response to management to ensure economic viability can be useful for comparing alternative management treatments. The approach was adopted for this study because adequate data on yield differentials between the management alternatives were not available. This is often the case in field applications in which managers must determine which treatment to apply to maximize economic returns with little information on differences in volume production. Managers may have a general idea how the treatments will affect growth, but still be uncertain of how this response will differ among specific treatments. The approach developed allows managers to conduct a sensitivity analysis to evaluate if the treatments being considered will meet the thresholds of not reducing economic returns.

ABOUT THE AUTHORS

Rodney L. Busby, USDA Forest Service, Southern Research Station, New Orleans, LA. Donald G. Hodges, Department of Forestry, Wildlife and Fisheries Science at the University of Tennessee, Knoxville, TN.

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