



Deriving

FAIR INCENTIVES

*for Management of
Hardwood Timber Stands*

by David A. Gansner
Owen W. Herrick
David N. Larsen

USDA FOREST SERVICE RESEARCH PAPER NE-263
1973

FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE
NORTHEASTERN FOREST EXPERIMENT STATION
6816 MARKET STREET, UPPER DARBY, PA. 19082
WARREN T. DOOLITTLE, DIRECTOR

The Authors

DAVID A. GANSNER is leader of the Northeastern Forest Experiment Station's Regional Production Economics Research Work Unit at Upper Darby, Pa. He received his degree in forestry from the University of Missouri in 1958, a master's degree in agricultural economics from Ohio State University in 1968, and a master's degree in regional science from the University of Pennsylvania in 1970. He has been with the U. S. Forest Service since 1958.

OWEN W. HERRICK received his bachelor of science degree at Iowa State University and a master of forestry degree at Yale University. He has done graduate study in regional systems analysis at The Pennsylvania State University. At present he is a research forester in the Regional Production Economics Work Unit at the Northeastern Forest Experiment Station, Upper Darby, Pa.

DAVID N. LARSEN received his bachelor of science degree in forestry from Washington State University in 1964, a master of science degree in forest economics from Michigan State University in 1967, and a master of arts degree in regional science from the University of Pennsylvania in 1971. He joined the Northeastern Forest Experiment Station at Upper Darby, Pa., in 1967 and is a research forester in the Regional Production Economics Work Unit.

MANUSCRIPT RECEIVED FOR PUBLICATION 16 OCTOBER 1972

Deriving

FAIR INCENTIVES

*for Management of
Hardwood Timber Stands*

ABSTRACT

The authors present a practical method for deriving timber-management incentive payments and demonstrate its application in forest stands of upland hardwoods. The suggested incentive payment is based on the differences between discounted costs and returns of deliberate forest management and the "harvest and let grow" option.

TODAY WE ARE witnessing new interest in action programs designed to improve the timber productivity of private non-industrial forests. But small private woodland owners remain an apathetic clientele. Few of them believe that investments in forestry are worthwhile. As John R. McGuire (3), Chief of the Forest Service, recently said:

A wealth of research studies and practical experience has made clear the fact that most owners of small forest tracts are not motivated or not able to make the investments needed to improve their forest resources. . . . The competition for the landowner's disposable income is keen—the payoffs he gets from forestry investments to meet his objectives are long delayed, and investments for some practices that would benefit the public as a whole may not necessarily appeal to the individual landowner at all. These factors preclude any likelihood of substantial progress or a high level of investment without some form of financial incentives.

Cash incentive payments apparently offer a means for persuading these owners to practice good timber management. But what constitutes a fair incentive payment? We offer

a practical approach to this problem and can demonstrate its application in forest stands of upland hardwoods.

APPROACH

"Harvest and let grow" is probably the most common approach to timber management by the private non-industrial woodland owner. If markets for his timber exist, he can sell the merchantable volume in his stand, put the money into his best capital earning opportunity—or spend it—and depend on nature to grow him a new stand of trees.

Few foresters condone this practice. But they must admit to certain undeniable advantages that it has over most recommended systems of management. The woodland owner reaps an immediate cash income, incurs no out-of-pocket costs, and foregoes the problems of risk and uncertainty associated with long-term investments in timber growing. No wonder the practice is appealing.

Because of its inherent appeal, the "harvest and let grow" option provides a logical standard for gaging the relative worth of other timber-producing alternatives. The net return to the landowner from any recommended system of timber production should be at least as great as that from the "harvest and let grow" method. If not, the owner should receive a cash payment to make up the difference. Only then would we expect him to consider the recommended system.

In this paper we consider only timber-producing alternatives and make no attempt to evaluate the potential impact of these alternatives on wildlife habitat, water yields, aesthetics, and other products and services. In cases where gains or losses in the output of other products and services are considered important and can be quantified, they should be incorporated into the calculation of incentive payments.

APPLICATIONS

Case examples will demonstrate the use of the fair incentive payment approach. Consider these two typical situations:

- Mr. A owns a tract of upland hardwood exhibiting a history of poor timber management. Much of the stand is stocked with old cull and defective trees that are

not worth managing. Without treatment, noticeable improvements in stand condition cannot be expected for several years. Mr. A's best market opportunity for capital investment is the local savings and loan association, where he earns a compound rate of return of 6 percent on deposits.

- Mr. B owns a stand of upland hardwood that is fully stocked, mainly with sound immature trees of desirable species. Proper treatment could result in a substantial increase in the yield of high-value timber. Mr. B's best market opportunity for capital investment is the local bank, which pays a compound rate of 5 percent on savings.

Suppose Mr. A and Mr. B are approached by the local service forester. This public agent wants both of them to use proven methods of sound silviculture to improve the condition and productivity of their forest tracts.

He tells Mr. A that his stand of trees is not fully utilizing its site and cannot be expected to do so for many years. The tract should therefore be regenerated as soon as possible. The resulting new stand should then be cleaned and periodically thinned so as to maximize yields and promote the rapid growth of timber to a mature stage of development.

He advises Mr. B to make an improvement

Table 1.—Management schedule for Mr. A: treatments, costs, yields, and returns per acre

Year	Treatment	Treatment costs	Timber removals	Sawtimber included in timber removals	Value of removals
		<i>Dollars</i>	<i>Cords</i>	<i>MBF</i>	<i>Dollars</i>
0	Regeneration cut	13	8.6	1.6	76
10	Cleaning	21	0	0	0
30	Commercial thinning	—	5.0	0	12
42	Commercial thinning	—	5.0	0	13
52	Commercial thinning	—	5.1	0.9	25
62	Commercial thinning	—	5.8	1.8	53
70	Harvest	—	29.9	12.0	674
	Total	34	59.4	16.3	853

Table 2.—*Management schedule for Mr. B: treatments, costs, yields, and returns per acre*

Year	Treatment	Treatment costs	Timber removals	Sawtimber included in timber removals	Value of removals
		<i>Dollars</i>	<i>Cords</i>	<i>MBF</i>	<i>Dollars</i>
0	Improvement cutting	16	1.0	0	0*
12	Commercial thinning	—	5.0	0	12
22	Commercial thinning	—	5.0	1.1	14
32	Commercial thinning	—	5.0	1.8	23
42	Commercial thinning	—	5.1	2.1	55
50	Harvest	—	33.7	15.1	750
	Total	16	54.8	20.1	854

* Cut at year 0 is not operable and therefore has no market value.

cutting on his fully stocked stand immediately to provide adequate growing space for potential crop trees. The stand should then be thinned periodically to promote the rapid development and maturity of high-quality timber.

The service forester prepares a management plan for each tract. It includes a schedule of specific treatments and provides estimates of per-acre costs, yields, and returns. The examples used here are actual cases from a current study of opportunities for intensive timber management in upland hardwood stands of the Northeast.

If Mr. A follows the forester's advice, he (or his descendants) can expect to cut sound timber worth \$853 from each acre of his forest tract during the next 70 years (table 1). He would spend \$34 on each acre for regeneration cuttings and pre-commercial thinnings. The present net value from this proposed action, at Mr. A's best opportunity for capital investment (6 percent), would be \$69 per acre.

If Mr. B adheres to the management plan, he can expect to harvest timber worth \$854 from each acre of his forest tract during the next 50 years (table 2). He would spend \$16 per acre for improvement cutting. The present net value from this action, at Mr. B's best opportunity for investment (5 percent), would be \$73 per acre.

Now suppose each owner chooses to ignore the service forester's advice and decides instead to harvest and sell all the merchantable volume on his tract and let nature develop a new stand of timber.

If Mr. A follows this "harvest and let grow" strategy, he would reap an immediate cash income of \$76 per acre. The projected value of his new stand, 70 years hence, would be \$146 per acre. The present net value from "harvest and let grow", at Mr. A's best opportunity for capital investment (6 percent), would be \$78 per acre.

If Mr. B follows the "harvest and let grow" strategy, he would receive \$82 per acre now. And the projected value of his new stand, 50 years hence, would be \$100 per acre. The present net value from this action, at 5 percent, would be \$91 per acre.

For both woodland owners, the present net value from the "harvest and let grow" option would exceed the present net value from the management strategy recommended by the service forester. Thus if Mr. A and Mr. B are expected to follow the recommended forestry strategies, both should receive an incentive payment. The amount of that payment would equal the difference in net value between "harvest and let grow" and the recommended forestry strategy:

Strategy:	<i>Present net value per acre to—</i>	
	<i>Mr. A</i>	<i>Mr. B</i>
Harvest and let grow	\$78	\$91
Recommended forest management	<u>69</u>	<u>73</u>
Difference = suggested incentive	\$ 9	\$18

Mr. A would receive a cash payment of \$9 per acre, and Mr. B would receive a payment of \$18 per acre. In cases where the net value of the recommended forestry action exceeded the net value of "harvest and let grow", no incentive payment would be warranted.

DISCUSSION

This is a practical method for deriving fair timber-management incentive payments. On-the-ground application of this technique would require realistic estimates of costs, yields, and returns for each case encountered in the field. Accurate estimates of short-run cash flows would be especially important. A small error in the estimate of a receipt (or expenditure) expected in the next few years might be critical, whereas a large error in the estimate of a receipt (or expenditure) expected several decades from now might be relatively insignificant. For example, at a discount rate of 6 percent, the present net value of a \$10 error in the estimate of a value expected 10 years from now would be \$5.58. But the present net value of a \$100 error in the estimate of a value expected 70 years from now would be only \$1.69.

The incentive payments yielded by this approach can be considered fair, at least in a strict economic sense. But there is no guarantee that these payments would induce woodland owners to practice forestry. The individual's decision to follow recommended systems of timber production will depend on a number of factors, not the least of which

are his willingness to wait for a return on his investment and his willingness to produce a stand of high-quality trees for future generations.

Receipts forthcoming in the far distant future are likely to have little impact on his decision to manage. If Mr. A decided to "harvest and let grow", he would receive an immediate income of \$76 per acre. If he chose instead to follow the management schedule proposed by the service forester, he would still get the \$76. But he would also spend \$13 per acre for regeneration cuttings. When the incentive payment of \$9 is added, his net return at the outset of this venture would be \$72 per acre, which approaches but still falls short of the \$76 that would be yielded by the "harvest and let grow" strategy. A short-run analysis of Mr. B's alternatives produces a similar outcome.

In any case, the incentive payment would enhance the economic desirability of the recommended forestry strategy. And the woodland owner who practices good silviculture can look forward (with a high degree of certainty) to substantial improvements in the quality and productivity of his timber tract.

SELECTED REFERENCES

1. Gingrich, Samuel F.
1971. MANAGEMENT OF YOUNG AND INTERMEDIATE STANDS OF UPLAND HARDWOODS. USDA Forest Serv. Res. Paper NE-195. 26 p. NE. Forest Exp. Station, Upper Darby, Pa.
2. Gingrich, Samuel F.
1967. MEASURING AND EVALUATING STOCKING AND STAND DENSITY IN UPLAND HARDWOOD FORESTS IN THE CENTRAL STATES. Forest Sci. 13(1):38-53.
3. McGuire, John R.
1972. MOTIVATING FOREST FARMERS; THE NEED FOR TEAMWORK. Forest Farmers Assoc. 1972 S. Forest Conf., Savannah, Ga., May 4, 1972. 5 p.
4. Roach, Benjamin A., and Samuel F. Gingrich.
1962. TIMBER MANAGEMENT GUIDE FOR UPLAND CENTRAL HARDWOODS. U. S. Forest Serv. Central States Forest Exp. Sta. 33 p., illus.



THE FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.