FORESTRY RETURNS EVALUATED
for uneven-aged management in two Appalachian woodlots

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INTRODUCTION

THE FORESTRY PROFESSION holds many theoretical concepts about the economics of forest stand culture and development. However, the literature contains only a limited number of reports showing expected monetary outcomes over time that are based on actual measurements made of applied forest practices in natural hardwood stands. This is such a report.

In this paper we analyze the results of a forest-practices study made on two 31-acre forested areas on the Fernow Experimental Forest near Parsons, West Virginia. These two areas were selected for analysis because they were typical second-growth stands differing primarily in the stage of recovery from being cut and burned-over in earlier years. Further, they are among the few hardwood tracts where measurements for a silvicultural technique have been recorded for an extended period of time. These areas have been managed for 20 years by cutting practices based on individual-tree-selection silviculture. This paper shows, through economic analysis, how well the two tracts performed over the 20-year period.

THE TRACTS AND THEIR PAST TREATMENT

The two forest tracts are located at about 2,600 feet elevation where the average rainfall measures 59 inches annually. Soils are well drained, of medium texture, 3 to 4 feet deep. Both tracts were cut for sawlogs about 40 years before the individual-tree-selection cutting practices were tried. At that time, defective trees, below-sawlog-size stems, and unmerchantable species were left, so that in 1948 the stands were made up of two distinct groups of trees: the old growth left after the original logging, and the second growth that came in afterward.

The stands were typical of the better northern West Virginia Allegheny hardwood area and had a site index for oak of 75 feet at 50 years. Beech, red oak, yellow-poplar, black cherry, and sugar maple were dominant among the sawtimber-size trees.

Although the stands have historically undergone similar natural changes and losses and similar cutting practices, they differed widely in structure and stocking at initiation of management—probably because stand 1 suffered more from fire damage before the study was begun.

More complete accounts of the original conditions and past treatments of the forested areas have been published by Mitchell and Webster (*1961*) and Trimble (*1970*).

The first report was an economic analysis of the two tracts as small woodlots after 10 years of harvest cutting. The latter report was a 20-year analysis of uneven-aged silviculture and its effect on growth, yield, and species composition.

Both stands were cut *in* (but never cut over completely at one time) annually during the first 10 years of the cutting-practice study, and every 2 years during the latter 10 years. One-hundred-percent inventories were made in 1948, 1954, 1958, and 1968. All trees over 5.0 inches d.b.h. were tallied by 2-inch d.b.h. classes (table 1).

Table 1.—Stand physical statistics for the 20-year period of selection cutting

Characteristics		Initial inventory measurement, 1949	First re-inventory measurement, 1954	Second re-inventory measurement, 1958	Third re-inventory measurement, 1968
STAND 1					
Growing stock:					
Merchantable total	trees per acre	192	183	180	166
Poletimber 6—10 inches	trees per acre	160	149	142	115
Sawtimber 12+ inches	trees per acre	32	34	38	51
Cull total	trees per acre	8	1	4	1
Growing volume:					
Total merchantable	cubic feet per acre	1,734	1,706	1,763	2,082
Poletimber 6—10 inches	cubic feet per acre	853	809	796	679
Sawtimber 12+ inches	cubic feet per acre	881	897	967	1,403
Total merchantable					
Poletimber 6—10 inches	cords per acre	12.2	11.6	11.4	9.7
Sawtimber 12+ inches	board feet per acre	4,611	4,605	4,882	7,296
Total cull per acre	cubic feet	144	23	34	18
Cut volume/acre since inventory:					
Poletimber 6—10 inches	cords per acre	—	1.3	.2	1.2
Sawtimber 12+ inches	board feet per acre	—	1,143	862	424
Total	cubic feet per acre	—	295	162	161
STAND 2					
Growing stock:					
Merchantable total	trees per acre	143	140	138	142
Poletimber 6—10 inches	trees per acre	100	93	91	91
Sawtimber 12+ inches	trees per acre	43	47	47	51
Cull total	trees per acre	10	0	4	2
Growing volume:					
Total merchantable	cubic feet per acre	2,186	2,279	2,190	2,462
Poletimber 6—10 inches	cubic feet per acre	569	527	501	489
Sawtimber 12+ inches	cubic feet per acre	1,617	1,752	1,689	1,973
Total merchantable					
Poletimber 6—10 inches	cords per acre	8.1	7.5	7.2	7.0
Sawtimber 12+ inches	board feet per acre	9,227	9,968	9,502	11,274
Total cull per acre	cubic feet	257	0	42	19
Cut volume/acre since inventory:					
Poletimber 6—10 inches	cords per acre	—	.8	.3	.4
Sawtimber 12+ inches	board feet per acre	—	1,728	2,019	1,420
Total	cubic feet per acre	—	341	348	269

EVALUATION RESULTS

The methods used in the economic analysis were built on data developed by Trimble (1970) in his silvicultural analysis of the stands. We had to place a value on the original stands and subsequent inventories and measure the value of the timber harvested since the study began. To do this, we grouped the timber species growing on the study areas into pricing groups by tree grades. The tree grades were based on a previously established relationship to butt-log grades and log height.

The prices shown, except for minor exceptions, are those developed by the USDA Forest Service for stumpage appraisal by butt-log tree grades on the adjacent Monongahela National Forest (table 2). The prices are net sums developed from a careful analysis of grade-lumber recovery values by butt-log tree grades, less total lumber-conversion costs. For low tree grades, tree-conversion costs can exceed tree value and result in negative stumpage values. To avoid negative values in the analysis, all negative stumpage-appraisal prices were assigned positive $1.00 per thousand board foot values. For this reason, all merchantable trees below butt-log grade 3

Table 2.—Stumpage prices used for stand economic evaluation
[In dollars]

Species group number	Species included in group	Per thousand board feet				Pulpwood, cords
		Trees with butt-log grade 1	Trees with butt-log grade 2	Trees with butt-log grade 3	Trees with lower butt-log grades	
1	Pulpwood[1]	—	—	—	—	0.50
2	Sawtimber spp.[2]	6	6	6	1	.50
3	White oak	57	16	1	1	.50
4	Red oak	69	34	12	1	.50
5	Yellow-poplar[3]	58	32	16	1	.50
6	Black cherry	121	75	35	1	.50
7	Sugar maple	87	42	9	1	.50
8	Red maple	72	32	2	1	.50
9	Sweet birch	91	34	1	1	.50
10	Basswood	69	39	17	1	.50
11	White ash	118	56	21	1	.50

[1] Includes American hornbeam, eastern hophornbeam, Fraser magnolia, sassafras, downy serviceberry, pin cherry, black locust, striped maple, flowering dogwood, sourwood, and other species.

[2] Includes hemlock, bigtooth aspen, bitternut hickory, shagbark hickory, American beech, chestnut oak, American elm, slippery elm, rock elm, black gum, and butternut.

[3] Includes cucumbertree.

were arbitrarily grouped and assigned a value of $1.00 per thousand board feet.

To establish values for those merchantable trees below sawlog size, we appraised all trees smaller than the 12-inch d.b.h. class as pulpwood. The stumpage values shown were then used to evaluate all material harvested.

The values for the analysis and evaluation were derived by applying butt-log grade and price information (table 2) to volume of the original and subsequent inventories and to volumes of the timber removed at each harvest.

Costs of 1 cent per diameter inch were used to determine the cost of cull removal. These costs were deducted from the returns as they were incurred.

The per-acre values shown are yearly net summations of inventory value increases, harvest incomes, and cull removal costs.

Many of the harvest cuts would be classed as uneconomic because of the small volumes and values removed during some years. However, we do not believe this procedure invalidates any of our assumptions, because the cuts could have been combined and made at longer intervals. After all, the annual (first 10 years) and the biennial (second 10 years) cuts were rotated about the woodlots so that, in effect, a 10-year cutting cycle was used.

All stumpage prices and costs used in the evaluation were maintained at a constant level. The authors recognize that the values of the harvested products and costs of services have changed since the institution of this study. However, a single price is used to avoid changing money values due to inflation. Thus, value change can be measured without the effects of a change in the purchasing power of the dollar.

Implicit in our assumption is that all products would sell in the market at the quoted prices.

Because forest-owner goals vary so widely, we made no attempt here to determine the advantage of investing in uneven-aged forest improvement-cutting practices. Our primary concern was to show how the two stands responded physically to the cutting practice and performed economically for the 20 years. What might be a satisfactory performance and an attractive investment for one forest owner, and with a particular set of management goals and problems, might not be attractive to another.

We should make it clear at this time that the analyses made here apply only to the 20-year development period of stand management. We do not know how these stands will perform physically or economically in the future as they approach closer to equilibrium with the prescribed sivilcultural system (described in detail by *Trimble 1970*).

To meet the needs and interests of a wide range of ownership situations, five types of evaluations were made:

1. Stand valuation changes from timber growth and stumpage sales.
2. Internal rate of return on investment.
3. Net present worth.
4. Net future worth.
5. Forestry as an investment.

Stand Valuation Changes from Timber Growth and Stumpage Sales

Before a forest owner invests his time and money in a cutting practice to improve his forest, he needs information about the expected economic performance of forest stands subjected to that cutting practice. Our analysis provides case examples of the 20-year performance of a stand on which individual-

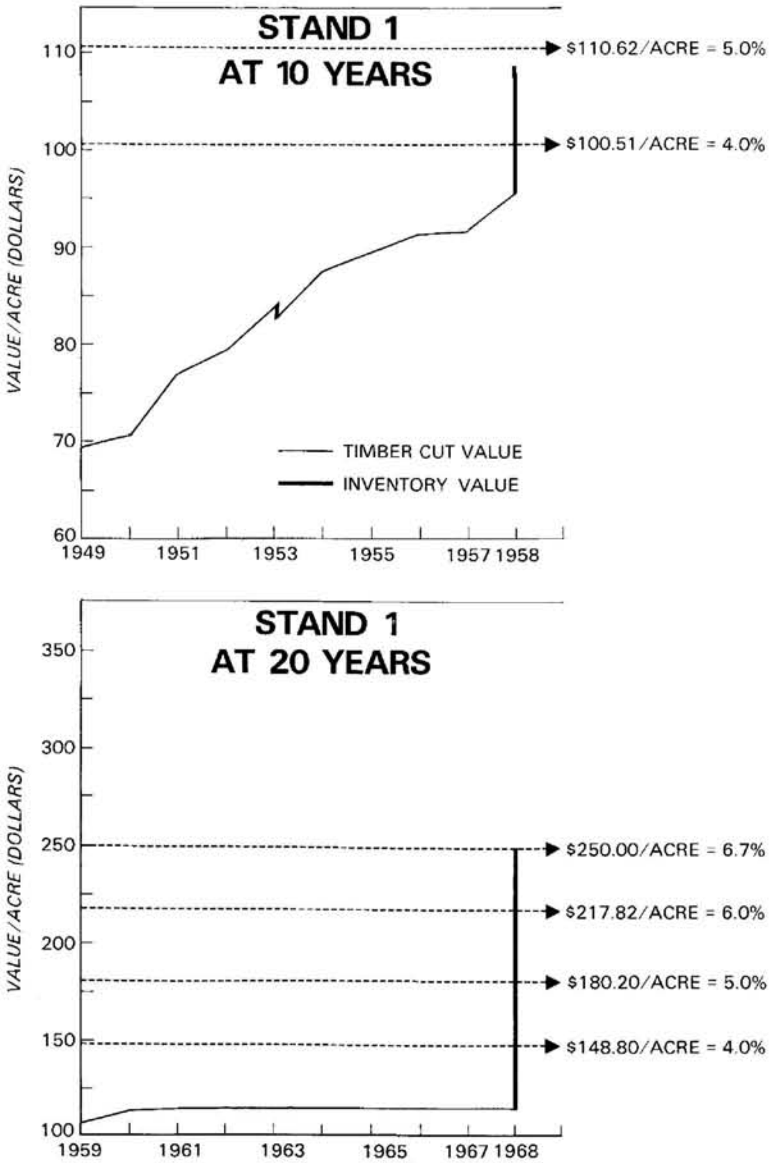
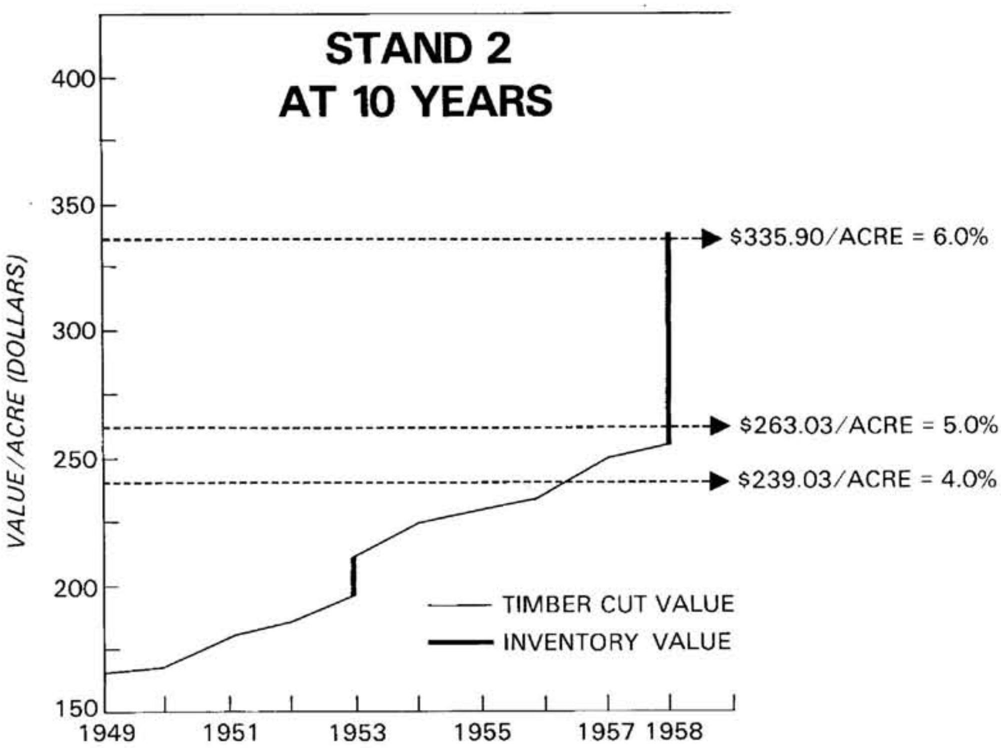


Figure 1.—Stand 1 values and performance.



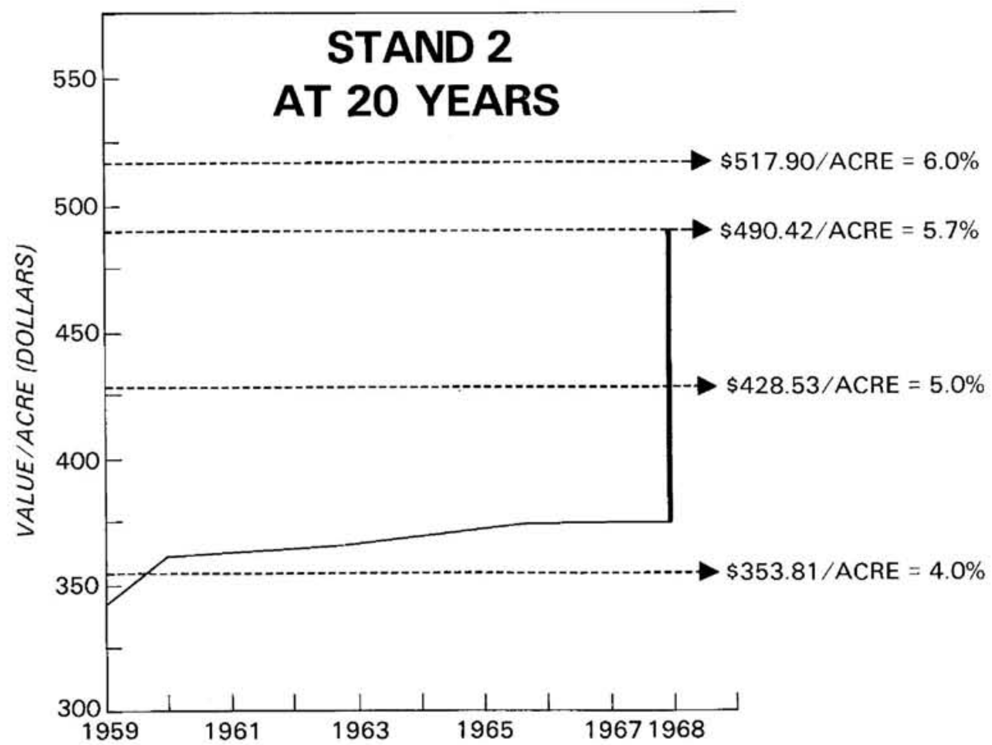


Figure 2.—Stand 2 values and performance.

tree-selection cutting practices have been applied.

The results shown are for the first and second 10-year periods for stands 1 and 2 (figs. 1 and 2). These diagrams show the annual net value increment per acre and the rate of value increase. For example, the initial value of stand 1 was $68 per acre in 1949. Adding in the annual cutting value and ingrowth value increment for the next 10 years increased the stand value to $108 per acre in 1958. In the same way, stand 1 further increased in value to $250 per acre in 1968.

Stand 1 exhibits a higher rate of return for the 20-year period than stand 2, with earnings above 6 percent. Stand 2 shows an opposite trend for the period, earning at a rate of 6 percent for the first 10 years but at a slightly lower rate for the 20-year period. Stated in another way: the rate of value increase is greater for stand 1 in the last 10-year period, even though the per-acre value of stand 2 is more than double that of stand 1.

Internal Rate of Return on Investment

The internal rate of return is that compounded interest rate that equates the present value of a series of costs and incomes to zero—zero net present worth. It is a frequently used measure of the effectiveness of an investment similar to our woodlot investment. If the net income of a stand is increasing quickly, we would expect to find a correspondingly high internal rate of return. For example, stand 1 had its highest internal rate of return—11.2 percent—during the second 10-year period, whereas stand 2 had a higher internal rate of return in the second 5-year period—12.3 percent (table 3). Although stand 2 had a higher per-acre value than stand 1—$490 vs. $250—it also, therefore, represented a greater initial investment. Thus we find that stand 1 had a higher internal rate of return for the 20-year period—8.0 to 7.2 percent.

Net Present Worth

The net present worth of a forest stand is a discounted residual stand value, determined by subtracting the beginning value of a stand investment from the future value of the stand (actual or expected), discounted to the present. In our case, we have actual future value —at the end of the 20-year period.

The net present worth (profit or the residual in our example) is a measure of the effectiveness of forest management and can serve as a basis for decision-making. The greater the rate of interest desired on the investment, the smaller the net present worth and profit to the forest owner at the end of the investment period.

In this case-history study, we show net present worth for a range of interest rates (table 4).

To illustrate what the data show, let's take the situation where for some reason an owner does not demand a high interest return on a forestry investment. As an extreme example, what would be the net present worth of stand 1 if 0 percent interest rate would satisfy the owner? The net present worth per acre, or the profit, would be the difference between the initial value of $68 and the 20-year value of $250, or $182 per acre (table 4).

If, on the other hand, the owner required 4 percent interest on his invested capital, the $250 stand value after 20 years would have a net present worth of $46 per acre. If the owner demanded a 6.7 percent interest rate, the net present worth per acre would be approximately $0, since the discounted value of the

Table 3.—Comparison of internal rate of return for the two stands

Stand	First 5 years, 1949-53	Second 5 years, 1954-58	First 10 years, 1949-58	Second 10 years, 1959-68	20 years, 1949-68
1	4.3	7.2	5.6	11.2	8.0
2	5.9	12.3	8.7	5.3	7.2

Table 4.—Investment in stand: net present worth or profit on investment[1]
[In dollars]

Acceptable rate discount (percent)	Stand value/acre, 1948	Stand[2] value/acre, 1968	Discounted value of 1968 stand in 1948 at indicated rate	Net present worth or profit/acre
		STAND 1		
0	68	250	250	182
2	68	250	168	100
3	68	250	139	71
4	68	250	114	46
5	68	250	94	26
6	68	250	78	10
6.7	68	250	68	0
8	68	250	54	−14
10	68	250	37	−31
		STAND 2		
0	161	490	490	329
2	161	490	330	169
3	161	490	272	110
4	161	490	224	62
5	161	490	185	23
5.7	161	490	162	1
6	161	490	153	−9
8	161	490	105	−56
10	161	490	73	−89

[1] Based on acceptable interest rates at the beginning of the improvement practice.
[2] Stand value does not include earnings from reinvested capital.

1968 stand—$250—would be equal to the actual 1948 value or $68.

Net Future Value

Another economic measure of the effectiveness of management in a forest stand is *net future value.* Here again, this is a measure whose magnitude is related to the interest rate the owner chooses. To compute net future stand value for any given interest rate, subtract: (1) the required end-of-period stand value (required to earn the stated interest rate on initial stand value) from (2) the actual end-of-period stand values (table 5).

The required end-of-period stand value is determined by carrying all costs at the stated interest rate and discounting all income at the same rate. In other words, we can compute the required stand value to the end of the period specified once we have established the interest rate, the cash value of the initial stand, and the subsequent cash flows from such items as timber harvested, cost of timber-stand improvement, stand volume, and quality changes. In our forest stands, the following operations generated cash flows and resulted in net changes in stand cash value: 16 cuttings and 4 inventories. Time period for the evaluation of the initial stands was 20 years. All subsequent cash flows would have a shorter compounding time period.

The net future values generated by stands 1 and 2 have been computed for various rates of interest (table 5). For example, if an owner would accept 0 percent interest for stand 1 (table 5) on an initial investment of $68 per acre, and the stand was still worth that value 20 years later, (its actual value is $250 per acre) then he would expect the net future value (or profit) to be $182 per acre. If the owner would accept no less than 8 percent

Table 5.—Stand performance based on net future value and owner's desired rate of interest on investment

[In dollars]

Rate of interest (percent)	Beginning or initial investment/acre, 1948	Required value in 1968/acre for stand to earn indicated interest rate	20-year results: profit or loss/acre[1] (net future value)
		STAND 1	
0	68	68	182
2	68	101	149
3	68	123	128
4	68	149	101
6	68	218	32
8	68	317	−66
10	68	457	−207
		STAND 2	
0	161	161	335
2	161	240	250
3	161	292	199
4	161	354	137
5.7	161	489	1
6	161	518	−27
8	161	753	−262
10	161	1,750	−1,259

[1] These figures are the difference between the actual stand values in 1968 ($250 for stand 1, $490 for stand 2) and the required stand value in 1968.

return on investment capital, then stand 1 would not make it. The net future value would be a minus $66 per acre at the end of 20 years.

Forestry as an Investment

Many forest owners and individuals interested in forestry like to see economic information expressed in terms so that a timber investment can be compared with some alternative investment. Most of these owners like to see the expected returns from a forestry enterprise under various cost combinations. We made computations from the records for these two stands showing what interest rates would be earned for different (1) land, (2) management-tax, and (3) timber-holding costs. We use the term "management-tax" to express the combined costs of providing the management services of a forester or manager and the annual tax assessment on a timber tract. Management services include making a simple management plan, marking trees for cutting, planning road layout and sale administration—all pro-rated on an annual basis. The values used were realistic for the area in 1949.

The values used in these computations are those generated from timber production alone. Other values and benefits such as wildlife, water, property, and recreation-aesthetic attraction are not included in this investment evaluation.

Investment in timber and land.—Some owners might be interested in an investment where land and timber-holding costs are the only costs to be considered in the investment (table 6).

For stand 1, a 2-percent interest rate could be earned on base land values up to $100 per acre; and 5-percent interest could be earned on base land values through $25 per acre. And if land costs were less than $15 an acre, stand 1 would have produced a 6-percent interest return.

As an example for stand 2, if a man bought land at $50 per acre (and the timber value was $161 per acre, as it was 20 years ago), then, based on the performance of this stand under selection cutting, he could expect to earn about 4 percent on his investment over a

Table 6.—Investment in stand: possible returns after 20 years of uneven-aged cutting at indicated land and timber investment
[In dollars]

Investment/acre			Stand value/acre necessary to earn the indicated interest rate after 20 years[2]				
Initial land cost	Initial timber value	20-year[1] total	2%	3%	4%	5%	6%
			STAND 1				
10	68	78	116	141	171	207	250
15	68	83	123	150	182	220	266
25	68	93	138	168	204	246	298
35	68	103	153	186	225	273	330
50	68	118	175	213	258	313	378
75	68	143	212	258	313	379	458
100	68	168	250	303	368	446	539
			STAND 2				
10	161	171	255	310	376	455	550
15	161	176	262	319	387	468	566
25	161	186	277	337	409	495	598
35	161	196	292	355	431	521	630
50	161	211	314	382	463	561	678
75	161	236	351	427	518	627	758
100	161	261	389	472	573	694	839

[1] Includes initial timber investment plus initial land costs carried at interest to end of the period.

[2] Values and connected interest rates to the right of the heavy lines are unattainable because the maximum value/acre generated after 20 years was $250 for stand 1, $490 for stand 2.

20-year period. A buyer of stand 2 could not expect to earn over 5 percent unless he could buy land for less than $10 per acre.

Investment including timber and management-tax costs only.—For some owners, land cost is not an investment consideration to be charged against timber production. They recognize land costs as real, but consider them chargeable to some other function such as production of water or wildlife, a hedge against a future timber supply, or perhaps aesthetic and recreational values.

For this type of owner, we show only the cost of holding the timber inventory and management-tax charges for maintaining the stand (table 7).

The potential for producing investment income under the costs used is affected little by the inclusion or exclusion of land costs as a cost chargeable to timber production.

We show that forest cutting practice investments that include only timber and management-tax costs could earn as high as 5-percent return annually on the investment capital in stand 1 or 2. As an example, a forest owner could earn 5-percent interest in stand 1 if management-tax assessment does not exceed $2.00 per acre; the investment management-tax charges could not exceed $3.00 per acre annually for him to earn a 4-percent return. If we are looking for higher returns, stand 1 would have to be valued at $347 per acre to earn 6 percent with management-tax costs at $3.50 per acre. These values, although unattainable, illustrate how much higher timber values must be if increasing management-tax costs are to be covered by the increased value of the timber stand.

Investment including management-tax, land, and timber.—The conventional way of looking at an investment in forest practices is that timber returns alone must pay for management of the forest tract, pay the taxes, and absorb the cost of financing the stored timber values. If we accept this viewpoint of a forest investment, we ignore any of the other values

Table 7.—Investment in stand: possible returns after 20 years of uneven-aged cutting at indicated management-tax and timber-investment costs

[In dollars]

Investment/acre			Stand value/acre necessary to earn indicated interest rate after 20 years[2]				
Annual management-tax cost	Initial timber value	20-year[1] total	2%	3%	4%	5%	6%
			STAND 1				
1.00	68	88	125	150	179	213	255
1.50	68	98	137	163	193	230	273
2.00	68	108	150	176	208	246	291
2.50	68	118	162	190	223	263	310
3.00	68	128	174	203	238	279	328
3.50	68	138	186	217	253	296	347
			STAND 2				
1.00	161	181	264	319	384	462	555
1.50	161	191	276	332	398	478	573
2.00	161	201	289	345	413	495	591
2.50	161	211	301	359	428	511	610
3.00	161	221	313	372	443	528	628
3.50	161	231	325	386	458	544	647

[1] Includes initial timber investment plus annual costs carried at interest to end of the period.

[2] Values and connected interest rates to the right of the heavy lines are unattainable because the maximum value/acre generated after 20 years was $250 for stand 1, $490 for stand 2.

Table 8.—Investment in stand: possible returns after 20 years of uneven-aged cutting at indicated management-tax, land, and timber-investment costs

[In dollars]

Investment/acre				Stand value/acre necessary to earn indicated interest rate after 20 years[2]				
Annual management-tax cost	Initial land cost	Initial timber value	20-year[1] total	2%	3%	4%	5%	6%
			STAND 1					
1.00	10	68	98	140	168	201	240	287
1.00	15	68	103	148	177	211	253	303
1.50	25	68	123	175	208	248	296	353
2.00	35	68	143	202	240	285	339	404
2.50	50	68	168	236	280	333	396	470
3.00	75	68	203	285	339	402	478	569
3.50	100	68	238	336	397	472	561	667
			STAND 2					
1.00	10	161	191	279	337	405	488	587
1.00	15	161	196	287	346	416	501	603
1.50	25	161	216	314	377	453	544	653
2.00	35	161	236	341	409	490	587	704
2.50	50	161	261	375	449	538	644	770
3.00	75	161	296	424	508	607	727	869
3.50	100	161	331	474	566	677	810	967

[1] Includes initial land and timber investment plus annual costs carried at interest to the end of period.

[2] Values and connected interest rates to the right of the heavy lines are unattainable because the maximum value/acre generated after 20 years was $250 for stand 1, $490 for stand 2.

and benefits derived and attributable to the forest property such as wildlife, water, aesthetics, and recreation. For those individuals looking at forestry as a timber investment of this type, we have made an appropriate investment analysis (table 8).

These results show that an investment in forest practices under these conditions will return as high as 5 percent in stand 1 if management-tax costs do not exceed $1.00 per acre and land costs do not exceed $10. In stand 2, under the same conditions, these costs also could not exceed $1 and $10 to earn a 5-percent return.

DISCUSSION AND CONCLUSIONS

The records of these two 31-acre tracts over the past 20 years have provided the necessary physical information for an economic evaluation of a timber stand where individual-tree-selection cutting practices were applied.

In this paper, we have converted physical data into useful economic indicators by several methods. The economic performance of these tracts provides an indication of the returns an investor might expect during a 20-year development period by the application of similar practices to comparable areas. Although the sample tracts are small, the authors feel that they are large enough to indicate that the results are applicable to larger forest areas under similar cutting practices and stand conditions.

Although none of the methods of economic appraisal are new, they provide forest owners with a basis for decision-making other than the usual physical relationships.

The economic "goodness" or "badness" of an investment in forestry depends on the objectives of the investor. Because this difference in the objectives exists, we approached the matter of economic evaluation in a number of different ways with the hope that most investors would be able to choose an approach that fits their economic situation.

Certain types of large forest owners, such as corporations or public agencies, might utilize the internal rate of return as a timber-stand evaluation measure. Where there are initial costs or a series of costs in a timber investment, the internal rate of return provides a means of measuring the subsequent returns on the investment.

Determining present net worth and net future value are commonly-used methods for evaluating business investments. In the former, we determine the value now of some value that will occur in the future, using interest as an investment cost. In the latter, we determine the future value of an investment made today. Again, interest is used as a cost of investment.

In the tables we have shown a series of interest rates to illustrate where zero benefits are produced by the timber investment. In some situations a 0 percent interest might be an acceptable rate. A forest owner, such as a pulp industry, might charge 0 percent interest if their investment in forest land is used to insure a continuous supply of wood. Other types of owners might derive multiple benefits from forest land and would charge a low interest rate against timber production alone.

We have shown in our analysis how varying management costs can affect the expected returns on a business investment in timber. The resultant interest rate measures how varying costs, including the cost of holding stored values in timber, affect expected investment returns over time.

Timely inventory and other physical measures can provide useful information for managing volume growth and yield of timber stands in the forest business. These measures are the first step to management. The second measure, economic evaluation, provides the basis for operating the forest as a business.

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APPENDIX

List of common and scientific names of species referred to in this study.

Ash, white	*Fraxinus americana* L.
Aspen, bigtooth	*Populus grandidentata* Michx.
Basswood	*Tilia americana* L.
Beech, American	*Fagus grandifolia* Ehrh.
Birch, sweet	*Betula lenta* L.
Butternut	*Juglans cinerea* L.
Cherry, black	*Prunus serotina* Ehrh.
Cherry, pin	*Prunus pensylvanica* L. f.
Cucumbertree	*Magnolia acuminata* L.
Dogwood, flowering	*Cornus florida* L.
Elm, American	*Ulmus americana* L.
Elm, rock	*Ulmus thomasii* Sarg.
Elm, slippery	*Ulmus rubra* Muhl.
Gum, black	*Nyssa sylvatica* Marsh.
Hemlock, eastern	*Tsuga canadensis* (L.) Carr.
Hickory, bitternut	*Carya cordiformis* (Wangenh.) K. Koch
Hickory, shagbark	*Carya ovata* (Mill.) K. Koch
Hophornbeam, eastern	*Ostrya virginiana* (Mill.) K. Koch
Hornbeam, American	*Carpinus caroliniana* Walt.
Locust, black	*Robinia pseudoacacia* L.
Magnolia, Fraser	*Magnolia fraseri* Walt.
Maple, red	*Acer rubrum* L.
Maple, striped	*Acer pensylvanicum* L.
Maple, sugar	*Acer saccharum* Marsh.
Oak, chestnut	*Quercus prinus* L.
Oak, northern red	*Quercus rubra* L.
Oak, white	*Quercus alba* L.
Sassafras	*Sassafras albidum* (Nutt.) Nees.
Serviceberry, downy	*Amelanchier arborea* (Michx. f.) Fern.
Sourwood	*Oxydendrum arboreum* (L.) DC.
Yellow-poplar	*Liriodendron tulipifera* L.

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