FIELD NOTE[1]

Forest Investment Considerations for Planning Thinnings and Harvests

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In order for the forester to make decisions about when to cut which trees in a forest or stand of trees, there must be a framework for decision-making that reflects the landowner's objectives of ownership—including esthetics, wildlife habitat, recreational uses, and financial objectives. The first three areas of consideration are usually not nearly as available to objective criteria for evaluation as is the last area—the financial. The following discussion will outline some of the factors used in evaluating a forest investment from the economic point of view. (The landowner's cost for the bare land, less its tree value, is left out of this analysis because this factor theoretically has development and recreational values—separate from the land's tree value—which grow according to different sets of potential value criteria.)

Within the constraints of good esthetic, wildlife, and recreation management, the forest landowner may wish to maximize annual volume production, annual value production, or percent rate of return on investment. Annual volume production might be the objective of an owner wishing to use a small woodlot close to the house for fuelwood production. Annual value production might be the objective of an owner who anticipates a special financial need in the not-too-distant future, and who, for tax or other reasons, wishes to maintain an investment in timber. Percent rate of return on investment is the most often applied criterion for the forest landowner who must consider that money could also be invested in stocks, bonds, or other investments and could thereby earn a given "alternative" annual rate of return (Rose et al. 1988).

For the forest owner who views property as an investment choice, the management practices must be directed toward liquidating the value invested in the low potential earning trees, and concentrating the remaining investment value in high potential earners. Therefore each tree must be seen individually as an investment in relation to the landowner's goals, its own potential, and its neighbors' potentials. As will be shown, a tree's investment value depends upon its potential for volume, grade value, and market value increases.

VOLUME GROWTH

Table 1 illustrates volume growth rates for different sizes of trees (dbh = diameter at breast height) growing at different rates (rings per radial inch = rpi). Trees growing very slowly (less than 15 rpi) are poor earners and are likely to be producing poor quality wood in some species. Trees growing very fast are good earners, although extremely fast grown wood (2–4 rpi) may not be marketable for the highest quality products. The same rate of radial growth on a smaller tree is a higher percentage rate than on a larger tree. A 12 in. dbh tree at 8 rpi grows just over 4%/year, but compare the rates for 8 rpi on 6 and 18 in. dbh trees.

A tree's potential rate of growth depends upon its species, age, site, and history of competition—how dominant or suppressed it is. Generally speaking, most vigorous hardwood trees in this area are capable of growing at 6–10 rpi after they have been released from competition (Godman and Mandel 1978, Hibbs and Bentley 1984, Morrow 1981). Softwood trees can grow up to 4–6 rpi (Hibbs and Bentley 1987). Table 1 does not include volume increases from growth in merchantable height. Trees without limitations to merchantable height growth (i.e., large branches, forks, or crooks) will grow at rates about 40% greater than the ones in the table (Godman and Mandel 1978, Morrow 1981). Thus, a 12 in. dbh tree without height limitations growing at 8 rpi would grow in total volume at about 6%/year.

GRADE VALUE GROWTH

The price list in Table 2 shows prices paid for logs delivered at a local sawmill in 1989. (All prices are for logs delivered at the mill yard. To calculate stumpage return to the landowner, subtract approximately $100/mbf for felling, limbing, skidding, bucking, and trucking). It illustrates how trees with high grade potential can grow in value/mbf (grade value) as they grow in volume. For example, if a 10 in. tip diameter red oak butt log in a tree with higher grade potential is now worth $150/mbf as stumpage, and if it takes 16 years for it to add on 4 in. of diameter (at 8 rpi = ¼ in./yr) so that it becomes a 14 in. tip grade log worth $500/mbf as stumpage, then it has grown at 8%/year in grade value (Lundgren 1971).

Usually, however, only about three-quarters of a whole tree's value is capable of growing that much in grade value because the upper, knotty logs have little or no grade potential. Thus, the whole tree might be growing at 6% in grade value. Tree species that don't have high grade potential (beech, red maple, hemlock, etc.) are poorer investments than those that do (oak,

Table 1. Rates of volume growth for trees of different diameters and rings per radial inch (for % multiply by 100).

	Rings per radial inch											
dbh (in.)	4	5	6	7	8	9	10	11	12	13	14	15
4	0.282	0.225	0.188	0.161	0.141	0.125	0.113	0.102	0.094	0.087	0.080	0.075
5	0.220	0.177	0.147	0.126	0.110	0.098	0.088	0.080	0.073	0.068	0.063	0.059
6	0.181	0.145	0.121	0.103	0.091	0.080	0.072	0.065	0.060	0.056	0.052	0.048
7	0.153	0.123	0.103	0.088	0.077	0.068	0.061	0.056	0.051	0.047	0.044	0.041
8	0.133	0.106	0.089	0.076	0.067	0.059	0.053	0.048	0.044	0.041	0.038	0.035
9	0.116	0.093	0.078	0.067	0.058	0.052	0.047	0.042	0.039	0.036	0.033	0.031
10	0.105	0.084	0.070	0.060	0.053	0.047	0.042	0.038	0.035	0.032	0.030	0.028
11	0.095	0.076	0.063	0.054	0.047	0.042	0.038	0.034	0.032	0.029	0.027	0.025
12	0.087	0.070	0.058	0.050	0.044	0.039	0.035	0.032	0.029	0.027	0.025	0.023
13	0.080	0.064	0.053	0.046	0.040	0.035	0.032	0.029	0.027	0.025	0.023	0.021
14	0.074	0.059	0.049	0.042	0.037	0.033	0.030	0.027	0.025	0.024	0.021	0.020
15	0.069	0.055	0.046	0.039	0.034	0.031	0.028	0.025	0.023	0.021	0.020	0.018
16	0.064	0.052	0.043	0.037	0.032	0.029	0.026	0.023	0.021	0.020	0.018	0.017
17	0.061	0.048	0.040	0.035	0.030	0.027	0.024	0.022	0.020	0.019	0.017	0.016
18	0.057	0.046	0.038	0.033	0.029	0.025	0.023	0.021	0.019	0.018	0.016	0.015
19	0.054	0.043	0.036	0.031	0.027	0.024	0.022	0.020	0.018	0.017	0.015	0.014
20	0.051	0.041	0.034	0.029	0.025	0.023	0.020	0.019	0.017	0.016	0.015	0.014
21	0.049	0.039	0.033	0.028	0.024	0.022	0.020	0.018	0.016	0.015	0.014	0.013
22	0.046	0.037	0.031	0.027	0.023	0.021	0.019	0.017	0.015	0.014	0.013	0.012

[1] Edited but nonrefereed contributions from our readers describing useful ideas, shortcuts, and findings for the field forester.

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Table 2. Log prices delivered to a local sawmill in 1989.

	Tip diameter (in.)	Clear faces	Price ($/mbf)			
			Red oak	Cherry & White ash	Sugar maple & Yellow birch[a]	Mixed hardwood
GRADE						
Prime	16	4	725	500	(250)	175
Select	14	4	600	450	(250)	150
1	12	3[2 + (a)]	500	325	250	130
2	10	4[2 + (a)]	400	300	175	120
3	10	3	250	275	110	110
4	10	2	200	200	100	100
Pallet	8	[b]	115	100	100	100

[a] For sugar maple and yellow birch: maximum 1/3 heartwood.
[b] Scaler's discretion—firewood will not be accepted in this category.

ash, cherry, etc.)—compare the log prices for red oak to those for mixed hardwood on the price list. (Specifications and prices for softwood logs are not generally available in western Massachusetts, but the range in value from low to high grades would be about the same as for mixed hardwoods above.) A tree with little or no grade potential will grow only in volume, while a tree with high grade potential will grow in grade value at a rate about equal to its volume growth rate (Godman and Mandel 1978, Hibbs and Bentley 1984, Morrow 1981). But once it reaches its highest potential grade, it no longer grows in grade value.

MARKET VALUE GROWTH

Timber stumpage values have historically increased at about 2% per year in real terms, that is, without including inflation (Rose et al. 1988). Over the past 15 years, however, real values for red oak, white ash, and black cherry stumpage have increased at 6–8% per year, while other species have either maintained the historical rate or decreased in real value (Dennis 1987, Herrick and Gensner 1985). Changes in real timber value are functions of the supply of and demand for timber. The dramatic recent value increases for certain species are mostly a result of expanded markets in Western Europe and Eastern Asia (Dennis 1987).

Table 3 shows average high values for major species in Massachusetts west of the Connecticut River in 1979 and 1989, with and without inflation (Mass. Div. For. and Parks 1979–89). (High values are compared here because they are common to the 1979 and 1989 price reports. Median values have only been available in more recent years.) Whether the rates of real value change indicated for the past 10 years will continue into the future is of course open to speculation. In the past, periods of consumer preference for open-grained woods (oak, ash) have alternated with periods of preference for closed-grained woods (sugar maple, yellow and black birch). If this pattern continues, values of sugar maple and birch are likely to increase faster than in the recent past. The outlook for softwoods and the lower value hardwoods is less optimistic since high value uses for these species are limited.

DISCUSSION

In summary, trees are capable of growing in volume, grade value, and market value all at the same time. Therefore, to determine the rate of total value increase being grown by an individual tree or stand or forest, all three factors must be added together.

Table 3. Approximate real market value stumpage growth rates for major species in western Massachusetts 1979–89.

Species	1979 Nominal (inflated)	1989 Nominal (inflated) $/mbf	1989 Values in 1979 dollars[a]	Annual % of real value change[b]
Red oak	210	590	440	+7 1/2
Ash/cherry	160	405	300	+6 1/2
Sugar maple/yellow & black birch	115	165	125	+1
Red maple/beech	75	80	60	−2 1/2
Red pine	40	70	50	+2 1/2
White pine	75	85	65	−1 1/2
Hemlock	55	60	45	−2

[a] Producer price inflation averaged 3% over the 10-year period (Rose et al. 1988), which translates to a conversion factor of 1.34.
[b] Lundgren 1971.

Trees of course will grow in all the above ways with or without management, but whereas the unmanaged forest might be growing at 2–3%/year in volume, 1–2% in grade value, and 1% in market value for a total of 4–6% (Dennis 1987, Herrick and Gensner 1985), a well-managed forest might grow at twice that rate of total value increase. Exceptional individual trees and stands grow at still higher rates.

It should be kept in mind that all of the foregoing calculations are "real" or "deflated," and that in order to compare a forest investment to an alternative, inflated rate investment, a rate must be assigned to inflation and added onto the forest investment rate or subtracted from the alternative investment rate (Rose et al. 1988). The foregoing calculations do not include a risk factor—for liabilities such as fire, ice, wind, insect, and disease damage. This is a very hard variable to estimate and could range anywhere from 1–5%/yr—risk also being to some extent an inverse function of management since healthy, vigorous forests with good access are less susceptible to risk factors (Guttenberg 1950). Nor do the calculations include carrying and operating expenses (property taxes, management planning, marking and sales administration, etc.), most of which are income tax deductible, but which might account for an annual cost equal to 2–3%/year of the investment value (McCauley and Trimble 1975). Table 4 summarizes all the factors previously discussed.

CONCLUSIONS

The forester should work with the landowner to clarify financial and other objectives of ownership and then to indicate opportunities and liabilities for forest investment management within the context of the overall forest management plan, using the following guidelines. Trees should be cut only if they have low potential for volume, grade value, and market value increases. These trees to cut can be classified as follows: very low vigor trees of any grade or species, large trees which have reached their highest potential grade, and smaller trees with no potential for grade or market value increases. Conversely, any tree that has high potential for volume, grade value and market value increases should be released from competition and left to grow unless, perhaps, it is seriously competing with an equally or more valuable neighbor. These general guidelines should of course be influenced by market conditions; that is, large, high quality timber should be sold when markets are strong,

Table 4. Theoretical real annual value growth rates 1979–89 for major species 12–16 in. dbh after thinnings to release better trees.

Species	% volume	% grade value	% market value	% risk, taxes, & management	% total value
Red oak	4–6	4–6	7–8	(−)3–5	10–17
Ash/cherry	4–6	4–6	6–7	(−)3–5	9–16
Sugar maple/birch	3–5	3–5	1	(−)3–5	2–8
Beech/red maple	3–5	2–3	(−)2–3	(−)3–5	(−)3–3
White pine	8–10	2–3	(−)1–2	(−)3–5	3–9
Red pine	8–10	4–6	2–3	(−)3–5	9–16
Hemlock	7–9	1–2	−2	(−)3–5	1–6

while low quality timber and/or firewood may be sold when markets are weak. □

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