

The Financial Factors Which
Influence The Yield
And Management Of Douglas-Fir

by

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INTRODUCTION

At the present time, very few private timber operators, regardless of the size of their holdings, are making any sincere effort to plant trees. The main reason preventing them from doing this is the uncertainty of ever receiving a profit from any investment which is put into the planting and growing of second growth stands for a future crop. Very little data is available which tends to show it is possible to plant trees and wait over the long period of time usually necessary for a crop of trees to reach merchantable size and still expect a fair return on the original investment.

The purpose of this thesis is to make an analysis of the financial factors which will influence a forest investment where the growing of timber is the main objective. The effects of these factors will be illustrated by examples using second growth stands of Douglas-Fir growing on the McDonald Forest as illustrations. All the steps in managing the timber will be considered as well as the cost of management and the interest involved in the investment of growing timber. Both public and private ownership and management in growing a crop of timber will be illustrated, and the results between private and public investment in the forest enterprise will be contrasted.

PART ONE

WHAT CONSTITUTES A PROFITABLE FOREST ENTERPRISE

Forest production deals entirely with the growing of forest crops. In growing a crop of forest products such as timber, certain expenses or cash outlays are involved. The value of the forest crop at the time of harvest will determine whether the investment in cash outlays or expenses was a profitable business venture. As a general rule, a cycle or rotation in forest production is completed with the sale of the products while still in its original form or on the "stump".

The amount of expected returns must be computed for the length of the period involved in producing a forest crop. This amount of expected returns will indicate to a certain degree, the financial soundness of the forest investment. The rates of interest which can be earned during the period of time necessary for the undertaking of a forest investment will indicate the financial success which can be expected from the investment.

The production of timber is a business enterprise regardless of whether it is publicly or privately conducted, but the principles which apply to the management of public forests and the management of private forests differ in important respects. Private enterprises must strive for profits in excess of costs or else they will become "financially embarrassed". On the other hand, public enterprises

are run for both profit and for maximum public service. The public can afford to wait longer for a crop and can accept a lower interest rate of return than can private owners. Because of this, it is possible for the public enterprise to manage poorer quality lands than can a private enterprise.

why?

The management of public and private forests is similar in one respect in that their efforts should always be toward those forms of management which promise the most profitable or beneficial returns, whether they be of a tangible or an intangible nature.

The most sought after private forest investments are those which promise substantial returns or income within a short period of time. This is the reason why most of the forest investments to date have dealt with stands consisting of nearly-mature to over-mature timber.

Interest is the price paid on capital which is borrowed for use in conducting an enterprise. Net income above the price paid on capital and the original capital is termed profits. Profits being a future consideration in the growing of timber and representing a margin, cannot be appraised with a great degree of accuracy because of the ever present element of risk. The margin for profit contains mainly two elements. Namely, the interest or return on the capital invested, and the return to the

Demanded
OLD RELIABLE BOND

owner of a certain amount as payment for his time and effort, and a reward earned by assuming the risks involved in conducting a forest enterprise. The expected return on capital must equal the average rate of interest which loans for conducting forest enterprises bring or else it will not be conducted. All the capital invested, whether it be borrowed or belongs to the conductor of the enterprise, is entitled to an earning of the same amount. Interest rates are either based on actual earnings as in the case of a completed transaction or on appraisals of future earnings and costs.

market
rates?

The length of the period involved in a forest enterprise will determine to a certain extent the basic rate of interest to be used in capitalizing forest values or in indicating expected earnings. At the end of the period, the total actual investment is limited to the purchase price plus all cash expenses.

THE COSTS OF GROWING A CROP OF TIMBER

The cost per acre of growing timber depends on several main factors:

1. The value of the land.
2. The cost of stocking the land with young trees.
trees.
3. The administration and protection of the young timber.
4. The taxes.
5. The rate of interest.

The actual costs of growing a crop of timber are as follows:

1. The compound interest on the value of the land.
2. The cost of stocking the land with seedlings.
3. The compound interest on this cost from the time of stocking to the time of harvesting.
4. The annual expenses for administration and protection.
5. The compound interest on each annual expense from the time of expenditure to the time of harvesting.
6. The annual taxes.
7. The interest on each annual tax from the time of payment to the time of harvesting.

The cost value includes the amount of compound interest charged against the purchase price plus all other cash outlays or expenses and the total compound interest

charged against them. The total of these costs per acre divided by the average yield per acre gives the cost of producing 1,000 board feet of timber.

LAND

The soil is not used up in the growing of a crop of timber therefore it cannot be charged against the single rotation. Since the depreciation would be negligible, the purchase price or value of the soil would remain the same as long as the land is used for the same purpose. The charge against the growing timber for one rotation is not the soil value but the amount of interest on the soil value for the length of time it takes the crop of timber to grow.

Land which has a value of over \$10.00 per acre should have some agricultural value. In most cases the best land use for land which has a value of \$6.00 or more per acre would not be the growing of timber. This is certainly the case in conducting a private enterprise. The interest charges against a crop of timber growing on Site Quality I land and worth more than \$6.00 per acre is very high. The value of Site Quality I land would be approximately \$6.00 per acre; Site Quality II land about \$4.00 per acre; Site Quality III land about \$2.00 per acre.

Source?

STOCKING

The expense of stocking the land with trees must be repeated every time the timber is cut. This amount plus

the compound interest on it for the length of time necessary to grow the timber must be charged against the crop which is the result of the planting.

Although planting on a bare area will cost very close to \$10.00, few areas need be chosen which do not bear some young growth or contain some seed trees which will assist artificial regeneration to fully stocked the area. A skillful combination of planting with natural regeneration from bordering stands not yet cut or suitable seed trees of low commercial value should result in a cost of about \$5.00 per acre as an average figure.

ADMINISTRATION AND PROTECTION

The annual cost for administration and protection expenses includes office expense, supervision, fire patrol, patrol against trespass, fire insurance, and all other overhead expenses. Compound interest on each annual amount from the time it is expended until the timber is cut must be calculated. (See Table I)

Table I Average future cost per acre per year for the protection and management of National Forest land and public land. (1) *Based on what?*
private?

Activity	Public Administration and Protection costs	Private Administration and Protection costs
	<i>units?</i>	<i>units?</i>
Fire Protection	6.853	6.853
Insect Protection	.125	.125
Disease Protection	.193	.193
Current Administration	.855	.855
Stand Improvement	.954	.954
Uses - Administration	.184	
Wildlife Administration	.185	
Capital Investment	.174	
Lands - Administration	.441	
Improvements	1.872	1.872
Undistributed overhead	.124	
Insurance		5.000
Totals	<u>11.960</u>	<u>15.852</u>

TAXES

In Oregon, land classified as reforestation land is subject to an annual forest fee of 5 cents per acre payable at the same time as the regular property tax. Also at the time any forest crops are removed, a forest yield tax must be paid which amounts to 12.5 percent of the stumpage value of the product.(2)

In the calculation of the cost of taxes, the annual forest fee of 5 cents per acre must be compounded for the length of the rotation and the yield tax of 12.5 percent must be deducted from the stumpage value at the end of the rotation.

Lands owned by the federal, state, and municipal governments are not subject to tax, but the state and municipal governments will lose tax revenue because of withdrawing lands from the tax rolls. The amount lost should be made up from the revenue derived from the forests. A sum of 25 cents out of every dollar collected from the sale of National Forest resources or use of National Forest land is paid to the state for distribution to the counties in which the National Forest is situated. In theory, 25 percent of the gross yield from lands owned and managed by the state and municipal-
why 25%?
ities should be put into their general fund to make up for the sum lost because the lands are not on the tax roll. Also the municipal governments should pay the

state a sum equal to the amount lost by the state because the lands are not taxable and vice versa. For these reasons, in calculating the costs of growing a crop of timber, a yield tax of 25 percent of the final product will be deducted from the federal, state, and municipal figures for gross yield per acre and added to the total costs of growing the crop of timber.

INTEREST RATE

The chief classes of forest owners are the federal government, the state, municipalities, corporations, and individuals. Each class of forest owner is able to borrow capital for use in a business enterprise at a different rate of interest. The following are considered a fair average rate for each class of owner:

Federal Government	3 percent	
State (Oregon)	4 percent	
Municipality	4.5 percent	<i>source?</i>
Large Corporation	5 percent	
Small Corporation and Individuals	6 percent	

No owner will invest in a forest enterprise for profit unless he can make as high a percent on his investment as he will have to pay for borrowed capital. Hence the above rates will be used in the calculations as representing the cost of conducting a forest enterprise.

TIME ELEMENT

The length of time between planting and harvest

ing influences the amount to which the interest charges on the various cost items will accumulate. All available evidence seems to indicate that 60 years would be the maximum time which would yield the highest profits from the use of the soil for private forestry. The federal government and possibly the state government could afford to grow timber for a longer period of time because of being able to borrow capital at a lower rate of interest and having no taxes to pay. However, it is doubtful whether any owner could operate on a rotation length of over 100 years because of the rapid increase in cost due to the compound interest charges. For a basis of comparison between public and private enterprises, a rotation of 60 years will be used in the calculations.

YIELD

Except for the interest on soil value, the cost per acre will not vary widely on different qualities of soil. However the yield per acre on different soil qualities will vary greatly. (See Table II)

Table II The yield of Douglas-Fir on fully stocked acre
at 60 years of age. (3)

Site Class	Site Index	Volume in Cubic Feet. (Trees 7" D.B.H. and larger)	Volume in Board Feet Scribner Rule. (Trees 12"D.B. H. and larger)
I	210	12,960	68,300
	200	12,500	62,000
	190	12,000	55,900
II	180	11,440	49,300
	170	10,840	42,800
	160	10,150	36,200
III	150	9,380	29,600
	140	8,500	23,600
	130	7,480	18,000

STUMPAGE VALUE

The estimated gross returns per thousand feet board measure per acre on private forest land under intensive forestry in the Pacific Coast states is \$3.10. While from intensive forestry practice on public forests, the estimated future gross returns per thousand feet board measure is \$2.33. Both of these figures are for Douglas-Fir stumpage.(4) They are used in computing the total returns per acre from the sale of stumpage from both public and private land. *source?*

DESCRIPTION OF CASE STUDIES

In connection with this thesis, two case studies of second growth Douglas-Fir stands were made. These stands are found on the McDonald forest which is owned by the Oregon State Forestry School. They border the road which connects the Oak Creek Saddle with the Schreiner Cabin. The results obtained from the study of the two stands are found in Table III. (See Table III on Page 15)

From a casual inspection of the two stands it is evident that they both contain a volume which is far above normal. However, a rapid decrease in growth rate is taking place at the present time. This is due mainly to the intense competition which is present because of the large number of trees per acre. A study of the growth rings from increment borings shows that the trees grow very rapidly for about 30 years after which there is a sharp decline in the growth rate. Also a considerable number of the trees have poor crowns and are being ^{sup?} oppressed. These factors will tend to decrease the accuracy of the predicted volume at the end of the rotation.

From the present physical condition of the stands it is evident that the trees should not be allowed to grow longer than the 60 year rotation unless some stand improvement measures are taken. The stands are in need of a thinning operation so that the competition is reduced. If this is done the growth rate of the remaining trees should be

Table III Analysis of experimental stands of Douglas-Fir on the McDonald Forest.

Item	Stand #1	Stand #2
Site Quality	I	III
Site Index	190	150
Number of Stems Per Acre	294	360
Present Age in Years	45	50
Average Diameter in Inches D.O.B.	13.8	12.5
Average Height of Codominant Tree in Feet	120	105
Percent Stocking (In terms of 100% as normal stocking)	130	119
Volume in Cubic Feet	6,175	4,900
Volume in Board Feet Scribner Rule	37,700	20,200
Predicted Volume in Board Feet at the End of 60 Years of Age	72,670	35,200

increased. If a market is available for the thinning products, the stumpage cost on the trees which are cut at the end of the rotation would be reduced, ^{provided} *or returns increased* that the return from the thinning is used to defray annual expenses.

RESULTS

Table IV The estimated average costs per acre and per M. feet B.M. of growing Douglas-Fir on Site Quality I forest soil under a 60 year rotation computed for interest rates applicable to various classes of owners.

Cost Items	Federal	State (Oregon)	Municipality	Large Corporation	Small Corporation and Individual
Estimated interest rates for various owners.	3	4	4.5	5	6
Compound interest on the soil value.	29.35	57.12	78.17	106.07	191.93
Cost of stocking the land with trees.	5.00	5.00	5.00	5.00	5.00
Compound interest on cost of stocking land.	24.46	47.60	65.14	88.40	159.94
Sum of the annual charges for administration and protection.	7.20	7.20	7.20	9.60	9.60
Interest on administration and protection costs.	12.37	21.36	27.54	46.97	75.70
5 cents per acre fee in lieu of property tax.				3.00	3.00
Compound interest on above forest fee.				12.68	21.66
12.5% yield tax on the final stumpage value.				28.29	28.29
25% yield tax on the final stumpage value.	42.52	42.52	42.52		
Total cost per acre.	120.90	180.80	225.57	300.01	495.12
Total cost per M. when the volume equals 73 M. per acre. (McDonald Forest Vol.)	1.66	2.48	3.09	4.11	6.78
Estimated total returns per acre from the sale of stumpage using \$3.10 per M. as the stumpage price on private timber and \$2.33 per M. on public timber.	170.09	170.09	170.09	226.30	226.30

Table V The estimated average costs per acre and per M. feet B.M. of growing Douglas-Fir on Site Quality III forest soil under a 60 year rotation computed for interest rates applicable to various classes of owners.

Cost Items	Federal	State (Oregon)	Municipality	Large Corporation	Small Corporation and Individual
Estimated interest rates for various owners.	3	4	4.5	5	6
Compound interest on the soil value.	9.78	19.04	26.05	35.36	63.98
Cost of stocking the land with trees.	5.00	5.00	5.00	5.00	5.00
Compound interest on cost of stocking land.	24.46	47.60	65.14	88.40	159.94
Sum of the annual charges for administration and protection.	7.20	7.20	7.20	9.60	9.60
Interest on administration and protection costs.	12.37	21.36	27.54	46.97	75.70
5 cents per acre fee in lieu of property tax.				3.0000	3.00
Compound interest on above fee.				12.68	12.68
12.5% yield tax on final stumpage value.				13.56	13.56
25% yield tax on the final stumpage value.	20.39	20.39	20.39		
Total cost per acre.	79.20	120.59	151.32	214.57	352.14
Total cost per M. when the volume equals 35 M. per acre. (McDonald Forest Vol.)	2.26	3.45	4.32	6.15	10.01
Total returns per acre from the sale of stumpage using \$3.10 per M. as the stumpage price on private timber and \$2.33 per M. on public timber.	81.55	81.55	81.55	108.50	108.50

SUMMARY OF PRINCIPAL CONCLUSIONS

1. The chief cost of producing timber is the interest on the capital involved. The range in percent of total cost which is chargeable to interest is from 55 percent if interest is calculated at 3 percent to 91 percent if interest is calculated at 6 percent.

2. It follows from (1) that the interest rate under which the forest owner works to a large extent determines the cost of producing timber to the owner concerned. From the results obtained in Tables IV and V it is indicated that between a 3 and 4 percent charge on capital is the maximum which the crop of timber can bear and still leave a profit.

3. Taxes, though important, are a minor cost as compared with interest charges. They decrease in importance as the interest charge is increased.

4. The costs of production under high interest rates are so great as to bar forest production to those owners who cannot secure money at a rate not much, if any, higher than 4 percent.

5. This makes forest production at a profit possible only to the federal government and those owners exceptionally situated as to the ownership of land for other purposes, such as in connection with farming or mining, etc.

6. Because of the lower yield per acre and the high compound interest charges on the cost of stocking

the land at the beginning of the rotation, natural regeneration might well be the most profitable for sites of lower than Site Quality I.

7. It is obvious that the average figures used in this thesis, no matter how correct, cannot be applied directly to all individual cases.

SUGGESTIONS FOR BETTERMENT OF THE SITUATION

Because of the high percentage of the total cost is due to high interest rates, some method should be found to reduce this cost. This could be done by setting up a system whereby money may be borrowed by forest owners at lower interest rates than are now available to the various private owners.

Forestry is one of the few remaining great industries for which essentially no provision for government sponsored credit has been made. Some system of government subsidy of private ownership should be set up. Very careful organization is necessary which will result in a continuous flow of low cost credit for forest enterprises. The organization should be in the form of a Forest Credit Administration set up under the supervision of the United States Forest Service. Its operation would be similar to that of the Farm Credit Administration which is in operation at the present time. This organization should be part of the federal government because of the low rate at which it can borrow money. A properly organized system of granting forest credits at a low rate of interest would do much to create an adequate flow of investments into forest enterprises. The amount of private capital being invested at the present time in forest enterprises is very small.

cf Omnibus Bill?

One of the major factors in determining the level of interest rates which money can be borrowed at is the cost of long term financing of an investment. This cost is much higher when the financing is done by private interests as compared with the cost which is present when the financing is done by a branch of the federal government. Capital would be available to a federal agency at the same rate as that brought by long term government bonds. Also the borrowing of money by the government agency could be done during the depression years and thereby take advantage of the lower rates of interest which usually accompany a depression.

It would be necessary for the government agency to charge a certain percentage of the total cost of financing forest enterprises to be used as an operating margin by the agency. From experience by the Farm Credit Administration, this operating margin charge should not exceed in any event more than 1 percent. If the government continues to borrow money at between 2.5 percent and 3 percent, the cost of borrowing money for forest enterprises would be only between 3.5 and 4 percent. This would not be too high, especially when an area has been put on a sustained yield basis and a cash income is received annually. The primary need at the present time is making available to the private owner funds at low interest rate so that he can eventually put his forest land on a sustained annual yield basis.

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