TAX EFFECTS OF FERTILIZATION

B. Bruce Bare

ABSTRACT

Describes the sensitivity of investment performance when fertilization activities are treated as expensed, capitalized, or amortized expenditures. Current Internal Revenue Service policy favors capitalization, but pending revenue rulings are expected to recommend amortization. The impact of these three alternatives on after-tax cash flows is illustrated by a numerical example for the Douglas-fir zone.

INTRODUCTION

The principal objective of this paper is to address the economics of forest fertilization when viewed from the perspective of a corporate forest landowner. The financial attractiveness of forest fertilization is evaluated on an after-tax cash flow basis, and the implications of treating fertilization activities as expensed, capitalized, or amortized expenditures are examined. Federal income taxes as well as state property taxes are included in the analysis. Because the taxpayer is assumed to be a corporation, no attempt has been made to include estate and gift taxes.

TAX TREATMENT OF FERTILIZATION

The Internal Revenue Service (IRS) currently holds the position that fertilization expenditures should be capitalized and recovered through depletion when the fertilized trees are harvested. If trees are fertilized at the time of planting the fertilization expense is capitalized along with the site preparation and planting costs. In this case fertilization activity is viewed as part of stand establishment. This is often the practice in the South, where phosphate fertilizers with a useful life of 10–20 yr are used at time of planting. When established stands are fertilized, however, some taxpayers believe that the expenditure should be expensed or amortized, rather than capitalized and recovered through depletion. This view holds that the effects of fertilization are relatively short-lived (5–8 yr), and that the fertilization activity has nothing to do with stand establishment—one of the few activities that the IRS requires to be capitalized.

The IRS has been asked to clarify its position in the form of a revenue ruling. Although this ruling has been in the works for several years, no final announcement has been made. Evidence presented to the IRS argues for a short amortization period of 3–5 yr for the fertilization of established stands. This argument applies to urea fertilizers used in the Pacific Northwest; however, it appears that phosphate fertilizers used in the South at time of planting will remain as part of the stand establishment cost and will continue to be capitalized.

Complicating the problem is that some forest products companies currently expense fertilization expenditures while others amortize their fertilization expenditures over a period of 5–10 yr. Such actions are perplexing when the stated IRS position is that fertilization expenditures should be capitalized and recovered through the depletion expense at time of harvest.

AFTER-TAX INVESTMENT ANALYSIS

To appreciate the implication of expensing, capitalizing, and amortizing forest fertilization expenditures when undertaking an investment analysis, the following hypothetical example is considered. In this example the investment criterion is soil expectation value based on an after-tax cash flow. By using this criterion we are able to simulate a corporate taxpayer who: (1) receives capital gains treatment at the time standing timber is harvested, (2) mismatches timber-related income and expenses with nontimber-related income and expenses, and (3) converts ordinary income into capital gains income with an attendant tax rate savings of 18%. Following the Revenue Act of 1978, the tax rate on ordinary corporate income is 46% while the capital gains tax rate (excluding the alternative tax) is 28%. The effective alternative tax rate for timber companies is 1.125%; however this tax is ignored in the sample calculations that follow.

It is assumed that the hypothetical corporate taxpayer has excess ordinary income against which certain timber management activities can be expensed. Included in this category are spraying, precommercial thinning, state yield tax, annual land tax, and other annual costs. It is further assumed that the costs of site preparation and planting are capitalized and recovered through depletion at the time of thinning or final harvest. The unit depletion rate is determined by dividing the sum of these

two costs by the total volume produced over the rotation.

The standard definition of after-tax cash flow is used in this paper. This definition holds that the after-tax cash flow is computed as:

cash flow = after-tax profits + depletion expense − capitalized expenditures + amortization expense

This formula is used to calculate the actual flow of cash through an organization in any given investment period. Depletion and amortization expenses are additive terms because they are not out-of-pocket expenses that require the expenditure of cash; however, they have been deducted when calculating after-tax profits. Capitalized expenditures such as planting and site preparation are subtracted because an actual cash outlay has been made.

This cash flow formula is the basis for the treatment of all expensed, capitalized, and amortized expenditures included in this paper. For those expenditures being expensed against surplus ordinary income the after-tax cash flow is computed as shown below:

$$(S-E)-0.46(S-E)=0.54S-0.54E$$

where S + surplus ordinary income and E + expenditures being expensed against ordinary income. For the investments being considered, S is assumed to exceed E, but the former is not directly included in the analysis because the intent is to determine the profitability of forestry investments. Thus, S is assumed to be zero.

All expenditures being expensed (i.e., spraying, precommercial thinning, state yield tax, annual land tax, and other annual costs) are computed at 54% of their before-tax values when calculating the after-tax cash flow. For capitalized expenditures such as planting and site preparation the after-tax cash flow is calculated at 100% of the before-tax value. This reflects the fact that these expenditures cannot be expensed against surplus ordinary income. Income from a revenue-generating activity such as thinning or final harvest affects the after-tax cash flow as shown below:

$$(T-D)-0.28\,(T-D)+D=0.72T+0.28D$$

where T = timber income from thinning or final harvest and D = depletion expense. For amortized fertilization expenditures the after-tax cash flow is 100% of the before-tax fertilization expenditure and the amortization of the expenditure is computed as:

$$(S-F/n)-0.46(S-F/n)+F/n=0.54S+0.46F/n$$

where S = surplus ordinary income, F = fertilization expenditure, and n = number of years fertilization expenditure is being amortized. All after-tax cash flows are discounted to the present at the appropriate rate of interest to obtain the present value for one rotation. The soil expectation value is then derived by multiplying the present value for one rotation by the infinite rotation adjustment factor $[(1+i)^{rot}/(1+i)^{rot}-1)]$.

DOUGLAS-FIR NUMERICAL EXAMPLE

To illustrate the impact of expensing, capitalizing, or amortizing fertilization expenditures consider the following hypothetical Douglas-fir example. We assume that a corporate forest landowner is considering an investment on a single acre of medium site land (site index 110- to 50-yr basis). Two utilization standards are examined. One specifies that commercial thinnings begin when the average stand diameter reaches 10 in. with trees 11 in. and larger being removed while the second initiates thinning when the average stand diameter reaches 9 in. with trees 8 in. and larger being removed. These two cases are hereafter referred to as the 11- and 8-in. standards, respectively.

Two levels of management intensity are considered in the analysis. Using the precommercial thinning regime the plot is site prepared (broadcast burn) and planted with 2–0 stock following a 1-yr regeneration delay. Brush control (spraying) is undertaken in the fourth year of the investment when the trees are 5 yr old, and precommercial thinning occurs in year 14 when the stand is 15 yr old. In addition to these treatments, under the fertilization regime three fertilizations with 200 lb N commence in year 14 and are repeated in years 24 and 34 when the stand is 25 and 35 yr old, respectively. These fertilizations are not made under the precommercial thinning regime. Commercial thinnings commence under both regimes when the minimum utilization standard is reached.

The Scribner board foot yields for the 11- and 8-in. standards for both management regimes are shown in Table 1, and

Table 1. Scribner board foot yields (32-ft logs) for two utilization standards (site index 110- to 50-yr basis).

	11-in. std		8-in. std	
Age	av dia	fbm yield	av dia	fbm yield
	Precommercial thinning regime			
35			8.1	1,236
40			9.1	5,898
45	11.0	5,088		
50	10.5	30,912	12.2	26,910
	Fertilization regime			
30			8.0	2,840
35	11.0	5,028		
40	11.1	5,747	10.9	6,860
50	13.1	27,170	14.7	30,800

Source: Charles Chambers, Washington State Department of Natural Resources, pers. commun., 21 August 1979.

the economic assumptions are depicted in Table 2. As shown in Table 2, two sets of current price assumptions are used in the analysis. One set reflects current stumpage prices for Douglas-fir as of 1 July 1979 and the other reflects the 10-mo moving average computed as of 1 July 1979. All financial calculations use nominal dollars and a 5% rate of inflation.

A sample worksheet illustrating the calculation of cash flows and soil expectation values for the 11-in. utilization standard using 1 July 1979 prices and amortized fertilization expenditures for the fertilization regime is shown in Table 3. All fertilization expenditures are assumed to be completely amortized over a 3-yr period. The after-tax soil expectation value for this sample acre is $406.68. This is the maximum amount that an investor could spend and earn 12% on his investment. The corresponding before-tax soil expectation value is $566.46/acre.

Table 2. Economic data used in Douglas-fir example.

Stand age (yr)	1 July 1979 11-in. std	1 July 1979 8-in. std	10-mo moving av (1 July 1979) 11-in. std	10-mo moving av (1 July 1979) 8-in. std
Current stumpage prices ($/M m) for precommercial thinning regime				
35		135		56
40		152		77
45	180		109	
50	188	208	114	125
Current stumpage prices ($/M m) for fertilization regime				
30		132		53
35	180		109	
40	180	180	109	109
50	215	229	150	165

Current costs ($/acre)			
Site preparation	85	Planting	100
Spraying	20	Precommercial thinning	80
Fertilization	70	Annual	4
Other economic inputs (%)			
Nominal interest rate	12	Yield tax rate	6.5
Inflation rate	5	Price appreciation rate[a]	7
Cost appreciation rate[a]	8		

[a]Assumed over only one rotation.

Source: Stumpage prices from Charles Chambers, Washington State Department of Natural Resources, pers. commun., 21 August 1979.

ALTERNATIVE WAYS TO TREAT FERTILIZATION EXPENDITURES

The first step in analysis is to compute soil expectation values for the precommercial thinning regime. Following procedures outlined in Table 3, a series of before- and after-tax soil expectation values is calculated for the two utilization standards and stumpage price assumptions. Results of these calculations, shown in Table 4, reveal that an 8-in. utilization standard produces a higher soil expectation value when 1 July 1979 stumpage prices are assumed. Using the 10-mo moving average, there is little difference between the 8- and 11-in. standards.

The next step in the analysis involves the calculation of after-tax soil expectation values for the fertilization regime. Of paramount concern is the sensitivity of the after-tax soil expectation value criterion under alternative means of treating fertilization expenditures. To examine this question, after-tax soil expectation values are calculated for the capitalization, expensing, and amortization options. Results shown in Table 5 illustrate that the expensing option produces the highest soil expectation values with amortization and capitalization second and third highest, respectively. This is not surprising since it is generally agreed that investment performance is highly correlated with the length of time needed to recover capital outlays.

A comparison of after-tax soil expectation values shown in Tables 4 and 5 reveals that the fertilization regime is superior to the precommercial thinning regime under all combinations of stumpage prices and utilization standards. Thus, for this example, we conclude that fertilization is the preferred management regime regardless of the tax treatment of fertilization expenditures. It is important to note that this may not always be the case. That is, the tax treatment of fertilization expenditures could affect the ranking of the fertilization regime, after-tax soil expectation values when compared with the precommercial thinning regime, after-tax soil expectation values.

Another way to express the burden of income taxes is to compute the percentage reduction in before-tax soil expectation values induced by the tax treatment of fertilization expenditures. Termed "site burden," this measure is calculated as:

$$SB = (SEV_b - SEV_a)/SEV_b \cdot 100$$

where SB = site burden, SEV^*b = before-tax soil expectation value, and SEV^*a = after-tax soil expectation value. Site burdens associated with the soil expectation values shown in Table 5 are displayed in Table 6, where it can be observed that expensing produces the lowest percentage reductions in before-tax soil expectation values. It is also interesting to note that expensing produces the most stable set of site burdens when measured across the two sets of price and utilization assumptions.

Another interesting comparison is obtained by calculating

Table 3. Sample worksheet of cash-flow analysis for 11-in. utilization standard, 1 July 1979 stumpage prices, and amortized fertilization expenditures for fertilization regime.

End of year	Activity	Cash flow		Present value single rotation	
		before-tax	after-tax	before-tax	after-tax
1	Site preparation	-91.80	-91.80	-81.96	-81.96
1	Planting	-108.00	-108.00	-96.43	-96.43
4	Spraying	-27.21	-14.69	-17.29	-9.34
14	Precommercial	-234.98	-126.89	-48.08	-25.96
14	Fertilization	-205.60	-205.60	-42.07	-42.07
15-17	Fert. amortization	68.53	31.52		15.49
24	Fertilization	-443.88	-443.88	-29.24	-29.24
25-27	Fert. amortization	147.96	68.06		10.76
34	Thinning	9663.82	6957.95	204.99	147.59
34	Thinning depletion	26.50	7.42		0.16
34	Yield tax	-628.15	-339.20	-13.32	-7.20
34	Fertilization	-958.31	-958.31	-20.33	-20.33
35-37	Fert. amortization	319.44	146.94		7.48
39	Thinning	15488.17	11151.48	186.42	134.22
39	Thinning depletion	30.29	8.48		0.10
39	Yield tax	-1006.73	-543.63	-12.12	-6.54
49	Final harvest	172067.61	123888.68	666.83	480.12
49	Harvest depletion	143.19	40.09		0.16
49	Yield tax	-11184.39	-6039.57	-43.34	-23.41
1-49	Annual	-4.00	-2.16	-89.80	-48.50
	Present value of one rotation			564.26	405.10
	Soil expectation value			566.46	406.68

Table 4. Soil expectation values ($/acre) for precommercial thinning regime.

	Stumpage price assumption			
	1 July 1979		10-mo moving av (1 July 1979)	
	11-in. std	8-in. std	11-in. std	8-in. std
After-tax	283.50	313.52	68.32	68.19
Before-tax	412.01	453.22	118.25	127.33

Table 5. Soil expectation values ($/acre) when fertilization expenditures are capitalized, expensed, or amortized.

Method of treating fertilization expenditures	Stumpage price assumption			
	1 July 1979		10-mo moving av (1 July 1979)	
	11-in. std	8-in. std	11-in. std	8-in. std
Expense	415.14	467.54	170.43	208.46
Amortize	406.68	459.08	161.98	200.01
Capitalize	376.15	428.67	131.45	169.59
Before-tax	566.46	637,99	232.39	284.29

Table 6. Percentage of site burden induced by the tax treatment of fertilization expenditures.

Method of treating fertilization expenditures	Stumpage price assumption			
	1 July 1979		10-mo moving av (1 July 1979)	
	11-in. std	8-in. std	11-in. std	8-in. std
Expense	26.72	26.72	26.66	26.67
Amorize	28.21	28.04	30.30	29.65
Capitalize	33.60	32.81	43.44	40.35

the percentage difference between after-tax soil expectation values when fertilization costs are expensed, with those obtained when fertilization costs are capitalized. These calculations, shown in Table 7, illustrate the significance of the current IRS capitalization position versus the industry-favored option of expensing. Under 1 July 1979 prices, the practice of capitalization reduces after-tax soil expectation values 8%–9%, while reductions of 19%–23% are observed when the 10-mo moving average stumpage price is used. Thus, the tax treatment of fertlization expenditures can be a significant factor in valuing forest lands for assessment or acquisition purposes.

Table 7. Percentage reductions in after-tax soil expectation values when comparing expensing versus capitalization of fertilization expenditures.

Stumpage price assumption			
1 July 1979		10-mo moving av (1 July 1979)	
11-in. std	8-in. std	11-in. std	8-in. std
-9.4	-8.3	-22.9	-18.7

CONCLUSIONS

We have examined the effects of expensing, capitalizing, and amortizing fertilization expenditures on after-tax soil expectation values. It appears that expensing produces higher after-tax soil expectation values when compared with either amortization or capitalization. Amortization produces after-tax soil expectation values slightly lower than those produced by expensing but substantially above those produced by capitalization. Results of the hypothetical Douglas-fir example reveal that amortization should be an acceptable compromise for those taxpayers who favor expensing. Repercussions of higher after-tax soil expectation values on increased state land taxes may dampen some of this advantage; however, a discussion of the interactions between federal income taxes and state property taxes is beyond the scope of this paper.