WHAT ARE THE ECONOMIC IMPLICATIONS OF USING OFF-SOURCE SEED?

George R. Staebler[1]

Complete classification of the off-source seed problem must include the possibility of both gain and loss--a better stand or a poorer stand--or none at all. I will develop only the loss possibility because I think that's probably all we have in mind when we talk about the off-source seed problem. If there happens to be a gain from off-source seed, we are more likely to pat ourselves on the back and ascribe it to a superior ability to identify superior parent trees, rather than saying--perhaps honestly--that we had an off-source seed. However, the reasoning which I propose to develop applies equally well to gains, and I will have something to say about that later.

In thinking about the economics of the off-source seed problem, I was a little disappointed because I couldn't really put my finger on anything unique, anything particularly esoteric, that would cast the problem, and hence geneticists and silviculturists, in some special light. As far as economics knows, an acre which fails to produce forest crops always goes into the valuation formulae the same way, whether the failure to produce is the result of fire, rabbits, brush, flooding, trampling by recreationists, or off-source seed.

I divided the problem into two categories, with subdivisions, as follows:

(1) Failure of the off-source seed to produce a crop with any merchantable value. The failure may be discovered at any time after planting, but to quantify the problem assume that discovery comes after

   (a) 10 years. This might be due simply to failure of the seedlings to survive; or they freeze off as soon as they get their heads above the annual vegetation.

   (b) 25 years. This might come about because the trees are particularly susceptible to disease or to the especially severe frost which occurs only four times per century. This could be a problem of more serious proportions than the last, if the trees looked particularly good in the early stages and, as a result, stimulated extensive plantings. Also the off-site species comes in this class; for example, loblolly pine planted beyond its normal range.

(2) Production of a below-value crop due either to reduced quantity or quality. This is no different from reduction due to over- or understocking, or failure to thin, or competition with inferior species.

---

[1] Silviculturist, Weyerhaeuser Forestry Research Center, Centralia, Wash.

Economic evaluation of the problems must of necessity be based on a model with hypothetical, but realistic, values.

Assume these values and conditions:

(a) Rotation 60 years

(b) Stumpage value at harvest $2,000 per acre, equivalent to 60 M bd. ft. at $33.33 per M; typical of site II Douglas-fir.

(c) Ad valorem taxes, protection, and administration cost $1 per acre per year.

(d) Reforestation costs $40 per acre

(e) Income taxes are 50%

(f) Interest rate is 5%

The simplest case for problem (1), where use of off-source seed results in no merchantable crop at all, would be simply to figure our losses on a lengthened rotation. If we discovered our error on a particular acre after 10 years and then corrected it, we would produce a 60-year crop in 70 years; if we discovered it after 25 years, it would take 85 years to produce a 60-year crop. The following calculations are shown in table 1.

A $2,000 crop coming in 60 years is worth today $107.07 at 5% interest, from which we must subtract (a) $40 required to establish the crop and (b) the present value of $1 per year to be spent until harvest, or $18.93. The value of the acre is then $48.14.

If the same crop comes only after 70 years because we used the wrong seed (or for any other reason), the future crop is worth $65.73; the annual payments for 70 years cost $19.34; first reforestation $40, and presumably the re-reforestation 10 years later also $40, worth now $24.56. The acre is worth a <u>minus</u> $18.17 at the time of first planting. This is $66.31 less per acre than the value of an acre when success was achieved at first try. If we don't recognize our error for 25 years, the acre is worth a minus $39.87, or $88.01 less than our successful acre. We will have made money on our less successful acres, but will have failed by a wide margin to have earned 5% on our investment. But even with a reduced interest rate, the margin between the success-at-first-try acres and the delayed-return acres would still be of the same order of magnitude.

There is another way of placing a monetary value on the results of these hypothetical situations; one that I like better. Acres do not really stand by themselves; they are part of an operating property which has a value different from the sum of the individual acres of which it is composed.

Table 1.--Present worth calculation for 1 acre

	Income or expense		Present worth
60 years			
Harvest	$2,000		$107.07
Plant	40	40.00	
Taxes, etc.	60	18.93	
			58.93
		Total value	$ 48.14
70 years			
Harvest	$2,000		$ 65.73
Plant	40	40.00	
Replant	40	24.56	
Taxes, etc.	70	19.34	
			83.90
		Total value	$-18.17
Loss $48.14 - ($-18.17) = $66.31			
85 years			
Harvest	$2,000		$ 31.62
Plant	40	40.00	
Replant	40	11.81	
Taxes, etc.	85	19.68	
			71.49
		Total value	$-39.87
Loss $48.14 - ($-39.87) = $88.01			

For this look at the financial implications of using off-source seed, assume a fully regulated 60-acre forest on a 60-year rotation with one acre of 60-year-old trees, one of 59-year-old trees, etc., to the last acre with 1-year-old seedlings. Calculations are in table 2. Each year we cut and sell the trees on one acre bringing us $2,000. We paid out $60 for protection, land taxes, and administration, and $40 to reforest the acre from which the timber was just harvested. Net income before taxes is $1,900, half of which must be paid in income tax, and the after-tax profit is $950. This is expected to go on in perpetuity, so the capitalized value of the business at 5% is $19,000: $950 divided by .05.

Table 2.--Capitalized value calculation

Regulated forest		
Annual income		$ 2,000
Annual expenses		
Taxes, etc.	$60	
Plant	40	
		100
Net, before income tax		1,900
Income tax		950
Net, after taxes		950
Capitalized value		$19,000
Adjusted regulation		
1st year income (5/6 x 2,000)	$1,667	
60th year income (5/6 x 2,437)	2,031	
Avg. income (60 years)		$ 1,849
Annual expenses		
Taxes, etc.	60	
Plant (5/6 x 40)	33	
		93
Net, before income tax		1,756
Income tax		878
Net, after taxes		878
Present value of 60 incomes	$16,620	
Present value of $19,000 in 60 years	1,017	
Total present value		17,637
Plant 10 acres		400
Capitalized value		$17,237
Loss $19,000 -17,237 = $1,763		

After 10 years we discover that someone, certainly not the geneticist, sold us a bill of goods--we used the wrong seed and now have 10 unregenerated acres. We are committed to sustained yield and must set up a new regulation scheme. There are several ways this might be done, but we elect to cut only 5/6 acre per year in order to make our 50 acres last 60 years when our problem 10 acres will support 60-year-old timber.

In year one, we cut 5/6 of an acre of timber worth $2,000 per acre bringing us $1,667. In year two, we cut 1/6 acre of 61-year-old timber, which I will assume is worth 2% more than 60-year-old timber and 4/6 of an

acre of 60-year-old timber. In year 60, we will cut 5/6 of an acre of 70-year-old timber, which having increased in value at 2% per year is now worth $2,437 per acre and our cut is valued at $2,031.

To simplify the calculations, I have said that the average annual income for the next 60 years is the average of the first and last year's, or $1,849. From this we must spend $60 for taxes, protection, and administration and $33 to reforest 5/6 of an acre, leaving net income before taxes at $1,756. Income taxes take half, leaving $878. Sixty annual incomes of $878 have a present value of $16,620. Although the forest is not fully regulated after this period, I have given it the value just calculated for a fully regulated forest, or $19,000. The present value of $19,000 coming in 60 years is $1,017. The total value is $17,637 from which we must subtract $400 required to re-reforest our 10 acres. The business, then, is worth $17,237.

This figure represents 8.3% reduction from the value of the smoothly-running regulated forest. The difference in dollars is 1,763, or $176 per acre for those acres on which the mistake was made.

There are other ways of altering the regulation than the one I have illustrated, but they would involve cutting timber less than 60 years old somewhere in the schedule. The most undesirable, from a purely sustained yield standpoint, would be to go on cutting one acre per year for 50 years and then cutting the first acre of the 10, with timber then 51 years old. Even delaying the day of reckoning 50 years reduces the value of the business by 2.7% or $52 per acre for the 10 acres.

Failure to recognize the ultimate total loss of a crop for 25 years would be very much more serious and could not be remedied except by drastic alteration of the regulatory scheme. Actually, I think it would bankrupt a conventionally financed business.

The conclusions from this analysis are obvious:

1. Losses from using off-source seed are evaluated the same as any total or partial loss of a crop.

2. A lengthened rotation without a compensatory increase in yield is surprisingly expensive.

3. Losses are even more serious when mistakes disrupt a going business.