FORESTRY FACTS

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When To Harvest Timber? Now…, Or Later?

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Some forestland owners decide to harvest timber at a particular time because they are approached by a timber buyer with an offer that looks too good to pass up. Others simply might need money to tide them over a difficult time or to finance an emergency need. Decisions taken under these circumstances are not always optimal, but they do reinforce the point that the decision about "when to harvest" is controlled more by economics than by almost any other factor. If the trees are old enough to reproduce by either seeds or sprouts, it might not matter biologically whether you harvest a stand today or wait 10 years. On the other hand, mature aspen on poor to medium sites might deteriorate rapidly if not harvested in a timely manner. As a general rule, the timing of a harvest may make a big difference to your financial picture.

For most species, letting trees grow larger means they will be worth more, not just because they add merchantable volume but also because log quality can improve. In addition, the real stumpage price of some species tends to increase over time. See Forestry Facts No. 97 for more discussion of the determinants of timber price.

Although large trees (particularly hardwood species) may indeed be worth more than smaller trees, there is a cost incurred by postponing the harvest. If you harvest today and receive the money now, you could invest the dollars elsewhere. If you postpone the harvest, you essentially have made a decision to keep your money invested in the trees and you forego other investment opportunities. When the rate of return on investments such as stocks and bonds is relatively low (as in 2001-2003), you don't really sacrifice much in alternative earnings by letting the trees grow. When alternative investments are producing large rates of return, the opportunity cost of not harvesting is higher. Thus, what constitutes an "acceptable rate of return" will differ among landowners and over time.

To make a determination whether to harvest now or later, you need to answer the question, "Will the increased size and value of the trees that I can realize by waiting outweigh the cost of waiting for the number of years for the growth to occur?"

To guide your decision, you need to estimate the financial rate of return you would earn if you let the trees grow and harvest them later. Compare this rate to the expected rate of return you could get from an alternative investment. That is, what could you expect to earn if you harvest today and invest the income elsewhere? If the rate of return for growing your stand another 5, 10 or more years is greater than your alternative rate, you should postpone the harvest; if it is less, you should harvest now.

To estimate the rate of return from growing your trees another 5, 10 or more years, you will need several items of information, including: present and expected future volume, present and expected future price. and length of the growth period. The example using Worksheet 1 on page 2 shows how to use the information to estimate your rate of return. A clean worksheet is found on page 3 and instructions for using the worksheet are found on pages 4-5. Values can be per acre or for the entire stand but whichever you use, be consistent.

Example 1

A stand of mixed oak currently has 8,000 board feet per acre (8 MBF/A), and is valued at an average price of $350 per MBF. Should the owner harvest now, or wait 5 years when the stand would likely next be entered?

1. Present volume per acre (cords/A or MBF/A)		8
2. Present stumpage price ($/cord or $/MBF)		$350
3. Present stumpage value ($/cord or $/MBF) [Line 1 x Line 2]		$2,800
4. Growth period (years)		5
5. Annual volume growth (cords/A/yr or MBF/A/yr)	0.2	
6. Total volume growth over growth period (cords/A or MBF/A) [Line 4 x Line 5]		1
7. Expected future volume (cords/A or MBF/A) [Line 1 + Line 6]		9
8. Rate of inflation rate (%/year)	0	
9. Rate of real price increase (%/year)	3	
10. Add Lines 8 and 9		3
11. Price adjustment factor [from Table 1, using data from Lines 4 and 10 above]		1.16
12. Expected future stumpage price [Line 2 x Line 11]		$406
13. Expected future stumpage value [Line 7 x Line 12]		$3,654
14. Ratio of Future Value to Present Value [Line 13 divided by Line 3]		1.3
15. Expected rate of return earned over growth period [from Table 2, Table 2, using data from Lines 4 and 14 above]		5.4%/year

Calculations:

The estimated present value of the stand is $2,000 per acre (8 MBF x $350/MBF).

The owner expects the stand to grow an average of 200 board feet per acre per year (0.2 MBF/A/yr) over the 5 years. This 5-year growth of 1,000 board feet (1 MBF) is added to present volume to obtain the future volume of 9 MBF/acre.

The owner ignores inflation, but expects the real stumpage price to increase by 3 percent per year over the 5 years. Using Table 1, an adjustment factor of 1.16 is found and multiplied by the present price of $350 to obtain the expected future price of $406/MBF.

The expected future value of the stand is $3,654 per acre (9 MBF x $406/MBF).

Dividing the expected future value by the estimated present value (FV ÷ PV) yields a result of 1.3 ($3,654 ÷ $2,800). Then, from Table 2, we see that a ratio of 1.3 for a 5-year growth period corresponds to an annual real rate of return of 5.4%. This rate must be compared to the owner's best alternative rate to see whether the harvest should be postponed.

Worksheet 1. Estimating the Rate of Return for a Growth Period

1. Present volume per acre (cords/A or MBF/A) .... ________________
2. Present stumpage price ($/cord or $/MBF) .... ________________
3. Present stumpage value ($/cord or $/MBF) [Line 1 x Line 2] .... ________________
4. Growth period (years) .... ________________
5. Annual volume growth (cords/A/yr or MBF/A/yr) .... _____________
6. Total volume growth over growth period (cords/A or MBF/A)
   [Line 4 x Line 5] .... ________________
7. Expected future volume (cords/A or MBF/A) [Line 1 + Line 6]......... ________________
8. Rate of inflation rate (%/year).................................... _____________
9. Rate of real price increase (%/year) .... _____________
10. Add Lines 8 and 9 .... ________________
11. Price adjustment factor [from Table 1, using data from
    Lines 4 and 10 above].. ________________
12. Expected future stumpage price [Line 2 x Line 11]........................... ________________
13. Expected future stumpage value [Line 7 x Line 12]......................... ________________
14. Ratio of Future Value to Present Value [Line 13 divided by Line 3] ________________
15. Expected rate of return earned over growth period [from
    Table 2, using data from Lines 4 and 14 above]............. __________%/year

Explanation for Using Worksheet 1

Line 1…

Determine present stand volume in either cords <u>or</u> thousands of board feet (MBF). This can be per acre <u>or</u> for the entire stand. Volume should be from a timber inventory conducted by a forester (or you can do it yourself if you have the skill). Volume can be for a single species <u>or</u> all species combined.

Line 2...

Obtain the present stumpage price for the product you have in either $/cord <u>or</u> $/MBF. This can be for a single species <u>or</u> all species combined. Price can be obtained by talking with mills, timber buyers, foresters or county extension agents.

Line 3...

Compute estimated present value of the stand by multiplying the present volume by the present stumpage price. Deducting sale expenses is probably unnecessary since severance taxes, consultant's fees and other costs will likely be the same percentage of future sale income. Therefore, your estimate of rate of return will be the same with or without sale costs.

Line 4...

Enter the number of years in the proposed growth (investment) period in round numbers such as 5, 10, 15, 20, 25 or 30 years.

Line 5…

Estimate the annual volume growth for your woodland, in either cords/year or MBF/year. This may be per acre <u>or</u> for the entire stand. <u>This is the difficult part</u>, but there are a couple of options:

a) The best approach is to talk with your forester and get some advice about <u>local</u> growth rates. This information will be most relevant to your growing conditions. Your forester will probably want to know something about the site quality, stand density and age of the trees in your woodland. The forester may also want to check past diameter growth by taking increment cores from several trees.

b) A second approach is to use average growth information from various regional studies. A summary of average growth rates for some species in the Lake States is provided in Table 3 on page 8. However, these are broad averages and should therefore be used as <u>guidelines only.</u>

Line 6...

Estimate total volume growth for the growth period by multiplying the annual growth by the number of years in the growth period.

Line 7...

Estimate the future volume by adding expected total volume growth to present volume.

Line 8...

Choose an appropriate average annual rate of inflation rate) for the growth period. This is <u>optional</u> and you may leave it blank (zero) if you want to estimate a <u>real</u> rate of return.

Line 9...

Choose an appropriate average annual rate of real stumpage price increase to reflect any quality improvements, increased demand, etc. during the growth period. This is optional and you may leave it blank (zero) if you don't expect such changes in the future.

Line 10...

Determine the total rate of expected price increase by adding the inflation and real rates together. *Note: this may be zero if you ignore inflation and assume no real price increase.*

Line 11...

Determine the price adjustment factor from Table 1 on page 6. Use the values on Lines 4 and 10 of Worksheet 1. *Note, if Line 10 is zero, the adjustment factor is 1.*

Line 12...

Estimate the future stumpage price for the product you expect to sell by multiplying the present stumpage price by the price adjustment factor. *Note, if the adjustment factor (Line 11) is 1, future price will equal present price.*

Line 13...

Calculate the expected future stumpage value of the stand by multiplying the expected future volume by the expected future stumpage price.

Line 14...

Divide the expected future stand stumpage value by the estimated present stand stumpage value.

Line 15...

Determine the expected annual rate of return (in percent/year) from Table 2 on page 7. Use the values on Lines 4 and 14 from Worksheet 1. If you used a rate of inflation other than zero, the rate of return (Line 15) will be a nominal rate. If you used a rate of inflation of zero, the rate of return (Line 15) will be a real rate.

What to Do With your Rate…

Now that you have estimated a rate of return for postponing your harvest, what does it mean? As mentioned on page 1, you need to compare this rate to the rate you could earn if you harvest now and invest the money elsewhere.

Let's return to the example on page 2. Suppose the owner could invest money received today (the $2,800/acre) at a maximum real rate of 5 percent per year. This is less than the expected real rate of 5.4 percent if the harvest is postponed 5 years. Therefore, the best financial decision in this example would be for the landowner is to postpone the harvest for 5 more years.

Table 1. Price adjustment factors for various growth periods and rates of return.

Annual rate of increase (from Worksheet 1, Line 10) (%/year)	Years in the growth period (from Worksheet 1, Line 4):					
	5	10	15	20	25	30
0.0%	1.00	1.00	1.00	1.00	1.00	1.00
0.5%	1.03	1.05	1.08	1.10	1.13	1.16
1.0%	1.05	1.10	1.16	1.22	1.28	1.35
1.5%	1.08	1.16	1.25	1.35	1.45	1.56
2.0%	1.10	1.22	1.35	1.49	1.64	1.81
2.5%	1.13	1.28	1.45	1.64	1.85	2.10
3.0%	1.16	1.34	1.56	1.81	2.09	2.43
3.5%	1.19	1.41	1.68	1.99	2.36	2.81
4.0%	1.22	1.48	1.80	2.19	2.67	3.24
4.5%	1.25	1.55	1.94	2.41	3.01	3.75
5.0%	1.28	1.63	2.08	2.65	3.39	4.32
5.5%	1.31	1.71	2.23	2.92	3.81	4.98
6.0%	1.34	1.79	2.40	3.21	4.29	5.74
6.5%	1.37	1.88	2.57	3.52	4.83	6.61
7.0%	1.40	1.97	2.76	3.87	5.43	7.61
7.5%	1.44	2.06	2.96	4.25	6.10	8.75
8.0%	1.47	2.16	3.17	4.66	6.85	10.06
8.5%	1.50	2.26	3.40	5.11	7.69	11.56
9.0%	1.54	2.37	3.64	5.60	8.62	13.27
9.5%	1.57	2.48	3.90	6.14	9.67	15.22
10.0%	1.61	2.59	4.18	6.73	10.83	17.45
10.5%	1.65	2.71	4.47	7.37	12.14	19.99
11.0%	1.69	2.84	4.78	8.06	13.59	22.89
11.5%	1.72	2.97	5.12	8.82	15.20	26.20
12.0%	1.76	3.11	5.47	9.65	17.00	29.96
12.5%	1.80	3.25	5.85	10.55	19.00	34.24
13.0%	1.84	3.39	6.25	11.52	21.23	39.12
13.5%	1.88	3.55	6.68	12.59	23.71	44.66
14.0%	1.93	3.71	7.14	13.74	26.46	50.95
14.5%	1.97	3.87	7.62	15.00	29.52	58.10
15.0%	2.01	4.05	8.14	16.37	32.92	66.21

Table 2. Rates of return for various growth periods and price adjustment factors.

Ratio of future value to present value (from Worksheet 1, Line 14)	Years in the growth period (from Worksheet 1, Line 4):					
	5	10	15	20	25	30
1	0%	0%	0%	0%	0%	0%
1.2	3.7%	1.8%	1.2%	0.9%	0.7%	0.6%
1.3	5.4%	2.7%	1.8%	1.3%	1.1%	0.9%
1.4	7.0%	3.4%	2.3%	1.7%	1.4%	1.1%
1.5	8.4%	4.1%	2.7%	2.0%	1.6%	1.4%
1.6	9.9%	4.8%	3.2%	2.4%	1.9%	1.6%
1.7	11.2%	5.4%	3.6%	2.7%	2.1%	1.8%
1.8	12.5%	6.1%	4.0%	3.0%	2.4%	2.0%
1.9	13.7%	6.6%	4.4%	3.3%	2.6%	2.2%
2.0	14.9%	7.2%	4.7%	3.5%	2.8%	2.3%
2.1	16.0%	7.7%	5.1%	3.8%	3.0%	2.5%
2.2	17.1%	8.2%	5.4%	4.0%	3.2%	2.7%
2.3	18.1%	8.7%	5.7%	4.3%	3.4%	2.8%
2.4	19.1%	9.1%	6.0%	4.5%	3.6%	3.0%
2.5	20.1%	9.6%	6.3%	4.7%	3.7%	3.1%
2.6	21.1%	10.0%	6.6%	4.9%	3.9%	3.2%
2.7	22.0%	10.4%	6.8%	5.1%	4.1%	3.4%
2.8	22.9%	10.8%	7.1%	5.3%	4.2%	3.5%
2.9	23.7%	11.2%	7.4%	5.5%	4.4%	3.6%
3.0	24.6%	11.6%	7.6%	5.6%	4.5%	3.7%
3.2	26.2%	12.3%	8.1%	6.0%	4.8%	4.0%
3.4	27.7%	13.0%	8.5%	6.3%	5.0%	4.2%
3.6	29.2%	13.7%	8.9%	6.6%	5.3%	4.4%
3.8	30.6%	14.3%	9.3%	6.9%	5.5%	4.6%
4.0	32.0%	14.9%	9.7%	7.2%	5.7%	4.7%
4.2	33.2%	15.4%	10.0%	7.4%	5.9%	4.9%
4.4	34.5%	16.0%	10.4%	7.7%	6.1%	5.1%
4.6	35.7%	16.5%	10.7%	7.9%	6.3%	5.2%
4.8	36.9%	17.0%	11.0%	8.2%	6.5%	5.4%
5.0	38.0%	17.5%	11.3%	8.4%	6.6%	5.5%
5.2	39.1%	17.9%	11.6%	8.6%	6.8%	5.6%
5.4	40.1%	18.4%	11.9%	8.8%	7.0%	5.8%
5.6	41.1%	18.8%	12.2%	9.0%	7.1%	5.9%
5.8	42.1%	19.2%	12.4%	9.2%	7.3%	6.0%
6.0	43.1%	19.6%	12.7%	9.4%	7.4%	6.2%
6.2	44.0%	20.0%	12.9%	9.6%	7.6%	6.3%
6.4	45.0%	20.4%	13.2%	9.7%	7.7%	6.4%
6.6	45.9%	20.8%	13.4%	9.9%	7.8%	6.5%
6.8	46.7%	21.1%	13.6%	10.1%	8.0%	6.6%
7.0	47.6%	21.5%	13.9%	10.2%	8.1%	6.7%
7.2	48.4%	21.8%	14.1%	10.4%	8.2%	6.8%
7.4	49.2%	22.2%	14.3%	10.5%	8.3%	6.9%
7.6	50.0%	22.5%	14.5%	10.7%	8.5%	7.0%
7.8	50.8%	22.8%	14.7%	10.8%	8.6%	7.1%
8.0	51.6%	23.1%	14.9%	11.0%	8.7%	7.2%

Table 3. Average annual net volume growth per acre for several Wisconsin tree species.

Red pine, 40-80 years old

Site index (feet)	Stand density (square feet of basal area per acre):					
	60	120	180	60	120	180
	(---------------cords/ac/yr ---------------)			(---------------MBF/A/yr----------------)		
75	1.7	2.2	2.3	0.9	1.2	1.2
65	1.3	1.7	1.8	0.7	0.9	0.9
55	0.9	1.3	1.4	0.5	0.7	0.7
45	0.6	0.9	1.0	0.3	0.5	0.5

Sugar maple (northern hardwoods):

a. Young stands (40-50 years old), small sawtimber, site index 65: 0.30 MBF/A/yr.

b. Older stand of mature sawtimber

Site index (feet)	Stand density (square feet of basal area per acre):			
	30	50	70	90
	(– – – – – – – – – – – – – MBF/A/yr– – – – – – – – – – – – – – –)			
60-70	0.18	0.20	0.24	0.21

Aspen

Site index (feet)	Stand density (square feet of basal area per acre):			
	30	40	50	60
	(– – – – – – – – – – – – – cords/ac/yr – – – – – – – – – – – – – – –)			
50-80	2.5	2.0	1.5	1.0

Oak, basal area of 60-100 square feet per acre

Site index (feet)	Stand age (years):				
	70	80	90	100	110
	(– – – – – – – – – – – – – – – – MBF/A/yr– – – – – – – – – – – – – – – – –)				
85	0.30	0.24	0.22	0.21	0.20
75	0.33	0.24	0.20	0.18	0.17
65	0.31	0.26	0.20	0.16	0.15
55	0.21	0.20	0.18	0.14	0.12

Note: Site index measures land productivity for growing trees. See UWEX Publ. G3361, Lake States Woodlands: Estimating and Interpreting Site Index.