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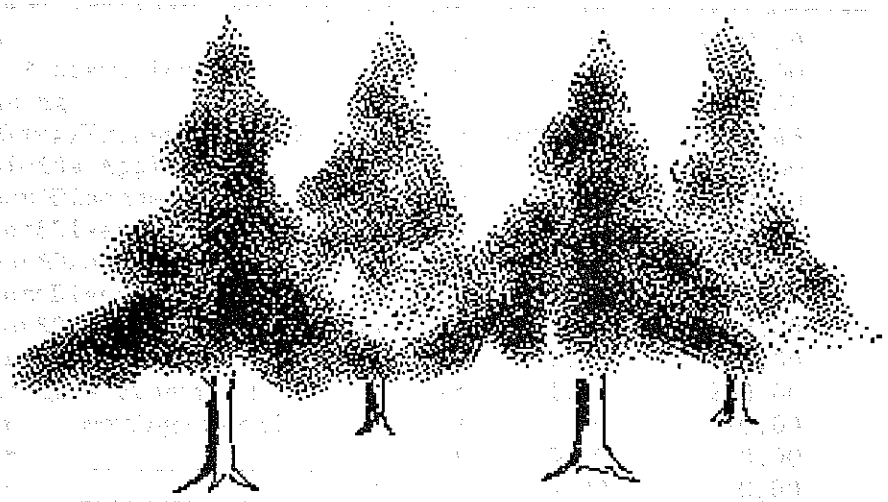
CHRISTMAS TREE ECONOMICS

Net Present Value Analysis Using Lotus 1-2-3



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CHRISTMAS TREE ECONOMICS

Christmas tree production requires land that must be prepared and planted with seedlings. Weeds, insects and diseases must be controlled over a number of years, during which the trees must be sheared and pruned. If you are successful, the receipts from sale of the trees comes ten or more years later. Economists use the term capital investment for such a situation, where costs are incurred over a number of years, followed by returns that are received later.

Capital investment analysis is a complex subject and a number of finance textbooks discuss it in detail. This section is intended only to review points most relevant for analyzing an agricultural enterprise such as Christmas tree production. It is based on Aplin, Casler and Francis, Capital Investment Analysis, Second Edition. The terms "costs" and "returns" are used here instead of "cash flows" used by Aplin et al. to include noncash operator labor and other noncash items as a cost. However, be careful not to include depreciation and interest paid on loans as costs. The discounting procedure incorporates these, so entering them as costs would be double counting.

Evaluating the profit potential of a Christmas tree enterprise (or any capital investment) requires:

a) Determining the amount of capital required to cover the costs of planting, growing and harvesting the trees;

b) Forecasting the returns from sale of the trees and any other products; and

c) Using a realistic method to compare the costs incurred and returns received at different times in view of the availability and cost of capital (interest) and other investment opportunities.

Capital requirements for planting, growing and harvesting should be determined with the assistance of Cooperative Extension agents, foresters or knowledgeable Christmas tree growers, Christmas tree publications and suppliers. The spreadsheet template is helpful only in multiplying input application rates by prices to calculate costs on a per acre and total acreage basis, and totalling individual cost items by year. The template does not tell you what the input rates and prices should or will be. It's up to you to enter appropriate values. Similarly, you enter the number of trees you expect to harvest per year and a forecasted price and the template calculates forecasted returns from there.

Inflation is an important consideration in forecasting tree prices and input costs a number of years into the future. The template allows you to enter an annual inflation rate that you expect to apply generally to all inputs bought and trees and other items sold in future years. Then enter input costs per unit and product prices per unit in today's prices. The template adjusts these prices by the annual inflation rate at the same time as it adjusts for interest costs on capital. The procedure is explained in the next section.

Net Present Value Method of Evaluating a Christmas Tree Enterprise

Is a dollar in hand today worth more than a dollar to be received sometime in the future?

Businessmen would answer "yes" to this question. One reason stems from the investment possibilities for today's dollar. The money on hand today can be invested and therefore will "grow" over a period of time. For example, a dollar invested today at five percent becomes \$1.00 (1+.05) = \$1.05 a year from now. If the interest is compounded annually, after two years, the amount will be \$1.00 (1 + .05)(1 + .05) = \$1.1025; after three years the sum would be \$1.1576; after four years, \$1.2155; and after five years, \$1.2763. The formula for compounded interest is

$$A = P(1+r)^n$$

where A = future accumulated sum,

P = amount of money invested today,

r = interest rate, and

n = number of years (or months, days or other periods).

If we can invest at five percent, then receiving \$1.05 a year from now will make us as well off as having \$1.00 today. Consequently, we can say that \$1.05 one year hence is equivalent to \$1.00 today, and \$1.2763 five years from now is equivalent to \$1.00 today.

Present Value of a Future Sum of Money

Suppose we plan to sell \$10,000 worth of Christmas trees at the end of five years. (Let's assume the trees are now half grown - I know it takes longer than ten years, but I'm trying to keep this simple. What's the equivalent amount of money today, or the present value of \$10,000 five years from now?

If \$1.2763 in five years is equivalent to \$1.00 today, we can calculate that

$$\frac{1.00}{1.2763} \text{ or } \$0.7835$$

today is equivalent to \$1.00 in five years. We can calculate the present value of \$10,000 in five years by dividing \$10,000 by 1.2763, giving \$7,835 as the present value of \$10,000 in five years. The formula for present value is

$$V = \frac{A}{(1+r)^n}$$

where: V = present value of a future sum of money,

A = future sum of money,

r = interest rate

n = number of years (or periods)

In Lotus 1-2-3 notation, this can be entered as shown in Figure 1. The calculation is split into two parts. The first part, in row 4, calculates the present value of $1 received n years from now, discounted at an interest rate of r. We call this number, in cell B4, the discount factor. We can multiply the future sum A by this to get the present value. Note that 1-2-3 uses an asterisk (*) for multiplication and a caret (^) for exponentiation.

Figure 1. Present Value of a Future Sum of Money

```
C5: (T) "+C1*C4                                                    READY
```

	A	B	C
1	Future sum of money A	$10,000	$10,000
2	Interest rate r	5%	5%
3	Number of years n	5	5
4	Discount factor	0.7835	(1+C2)^(-C3)
5	Present value of future sum of money V	$7,835	+C1*C4
6			
7			

Present Value of An Annuity

Now that we have figured out what the trees are worth in present value terms, let's look at costs. A cost item that is incurred in only one year can be discounted using the formula just discussed. But what about a cost that is incurred in each of five consecutive years?

Suppose it will cost us $50 at the beginning of each year, for, say, liability insurance. We can calculate a discount factor for each year, and sum them to get what we call a discount factor for an annuity, or series of constant payments.

Year	Incurred	Discount Factor	Present Value of Cost
1	$50	1.0000	$50.00
2	50	0.9524	47.62
3	50	0.9070	45.35
4	50	0.8638	43.19
5	50	0.8227	41.14
Discount factor (annuity)		4.5459	
Total present value of cost at 5%,			$227.30

Since you are paying the same amount of money each year, we can save some arithmetic by using a table of present value of $1 received per period such as Table III in Aplin, Casler and Francis, or by using a convenient built-in 1-2-3 function, @ PV (pmt,int,term)

@ PV(pmt,int,term)

where: pmt = amount of each year's cost

int = per-year (or per-period) interest rate

term = number of years

Figure 2 shows the way this is done with 1-2-3. One quirk of the @ PV function is that it does not include a payment made at the beginning of the five-year period. The present value of this payment is the same as its future value, since we are discounting to the beginning of the period. Lotus assumes that the costs are incurred or payments received at the end of each period, which is fine for, say, tree sales that come in December, but not for costs that are incurred early in the year. To get around this little problem, we subtract one from the number of years (term) by entering

C17-1

in the last part of the formula in C18; and add one to the @PV formula (C17 is the number of years).

Figure 2. Present Value of An Annuity

A15: 'Amount of each year's cost - pmt READY

	A	B	C
15	Amount of each year's cost - pmt	$50	$50
16	Per year interest rate - int	5%	5%
17	Number of years - term	5	5
18	Discount factor	4.5460	1+@PV(1,C16,C17-1)
19	Present value of cost	$227.30	+C15*C18
20			
21			

Inflation

A second reason for a dollar in hand today being more valuable than a dollar to be received sometime in the future is the likelihood of continued inflation. A dollar in the future will buy less than a dollar today.

Let's go back to the $10,000 worth of trees we'll sell in five years, and assume an annual inflation rate of 2 percent. If the trees are worth $10,000 at today's prices, a year from now they would sell for $10,000 (1 + .02) = $10,200; five years from now, they would sell for

$$\$10,000\ (1.02)^5 = \$11,040$$

or in general,

$$A = S(1+i)^n$$

where: I = the sale value of the trees after n years of inflation,

S = the sale value of the trees at today's prices,

i = the inflation rate, and

n = number of years.

We calculated that selling $10,000 worth of trees five years from now is equivalent to receiving $V = \frac{A}{(1+r)^n} = \frac{\$10,000}{(1+0.05)^5} = \$7,835$ today.

What is our $11,040 worth after discounting to today's present value?

$$V = \frac{A}{(1+r)^n} = \frac{\$11,040}{(1+0.05)^5} = \$8,650.$$

We can combine the discounting calculation with the inflation calculation by substituting for A

$$V = \frac{S(1+i)^n}{(1+r)^n} = \frac{\$11,040}{(1+0.05)^5} = \$8,650.$$

We can simplify this by calling our old interest rate a "nominal" interest rate and using what we call an "inflation-adjusted" or "real" interest rate r'. The "real" interest rate is calculated by

$$r' = \frac{1+r}{1+i} - 1$$

or, for a five percent interest rate and two percent inflation rate,

$$r' = \frac{1+0.05}{1+0.02} - 1 = 0.0294$$

which is not quite what we get from just subtracting inflation from the nominal interest rate, but close. We can use this in our present value formula.

$$V = \frac{\$10,000}{(1+0.0294)^5} = \$8,650$$

Other Considerations

There are three other considerations to think about in choosing an interest rate. First, you may be investing both your own savings (equity capital) and borrowed money in the Christmas tree enterprise. If so, then you should consider what you can earn on your savings as well as the interest on the borrowed capital. A weighted average of the two interest rates, weighted by the proportion of each kind of capital invested, is suggested.

Second, the interest rate should be net of taxes to give an after-tax evaluation of the Christmas tree enterprise. Subtract your marginal

tax rate from the interest rate and include taxes on the Christmas tree enterprise as an expense, in one of the spaces for "Other costs".

Third, growing Christmas trees is likely more risky than keeping your capital in a savings account. There are a number of ways to incorporate increased risk in an investment analysis. One simple method is to increase the interest rate used to discount the risky alternative, compared to the less risky one. Increasing the interest rate reduces the discounted value of returns received farther into the future. However, it is not clear how much to increase the interest rate used in the template over what you can earn in a savings account. Interest rates charged by lenders may provide some guidance, since the lender considers the risk of your not repaying the loan when he sets the rate. Other methods of incorporating risk might be to reduce the Christmas tree market price or reduce the harvest.

Criteria for Evaluating the Net Present Value of Costs and Returns

First, let's consider just a simple decision of whether to grow or not grow Christmas trees. Then we'll consider growing trees under more or less intensive management. The template subtracts the present value of total costs from the present value of total returns for what we call a net present value. If this net present value is positive, meaning that the present value equivalent of the returns is greater than costs, then the enterprise should probably be undertaken. If negative, then you will be better off investing the money elsewhere at the interest rate used.

Under more intensive management, such as if fertilizer is applied, we may be able to harvest the trees a year or two earlier than if managed less intensively. If we compare harvesting earlier to later, we have what financial managers call mutually exclusive investment alternatives with unequal lives. Comparing net present values of alternatives with unequal lives can be misleading, since it neglects the fact that harvesting earlier would let you reinvest your capital elsewhere and provide some additional income.

A better measure for alternatives with unequal lives is to calculate the amount of a constant annual net return or annuity that would give us a net present value the same as the net present value we calculated for growing trees. This is called an annual equivalent return. We calculate it by dividing the net present value by the net present value of $1 per year over the years till completed harvest, discounted at the real interest rate. For example, what is the annual equivalent return for a Christmas tree enterprise harvested in 12 years with a net present value of $1,295? The net present value of $1 per year for 12 years discounted at a real interest rate of 6.76 percent is 8.0439, by the formulas we discussed above. Dividing gives us

$$\frac{\$1,295}{8.0439} = \$161.06$$

meaning that an annual payment of $161.06 for 12 years has the same net present value as the tree enterprise, $1,295.

TEMPLATE USERS MANUAL

An electronic spreadsheet is a popular type of microcomputer software for business and agricultural applications. The name comes from similarity to a paper spreadsheet on which calculating tasks are set up as tables of columns and rows of figures. These rows and columns are titled, cross referenced and manipulated mathematically. An electronic spreadsheet arranges the computer's memory as an "electronic sheet". The computer's screen becomes a "window" which looks at a part of the spreadsheet. A template is a set of spreadsheet instructions to perform a specific task. The instructions are made up of labels, values and formulas.

What You Need to Use the Template

To use a diskette copy of the templates discussed in this paper, you will need

1. A Lotus 1-2-3 electronic spreadsheet program diskette and user manual.

2. An IBM-compatible microcomputer with at least 320K of internal memory, if using version 1A of Lotus 1-2-3.

3. A 132-column printer for producing paper copies.

4. At least two blank diskettes for storing completed budgets (one for the original and one as a backup).

Obtaining a Diskette Copy of the Templates

The templates can be obtained from your county Extension agent or William F. Lazarus, Department of Agricultural Economics, Cornell University, Ithaca, N.Y., 14853. A nominal handling fee may be charged to cover diskette duplicating and mailing costs.

A Word of Caution

Electronic spreadsheets, like other computerized decision aids, perform calculations. They do not eliminate the need for the user to check the results carefully to make sure that the data has been entered correctly and the operations performed in the proper order. Use common sense, print out the results, and spot-check with a calculator.

Care is in order especially when the user modifies the formulas to suit his or her problem. Most of the formulas have been protected from accidental changes, but this protection can be overriden. The user bears responsibility for seeing that any changes are done properly.

Making Backup Copies

Before starting your first CHRTREE session you should protect your CHRTREE program diskette by making a backup copy of it. Making this backup is important for two reasons. One, your original distribution diskette will give you a write protect error if you try to save your work on it. And two, if your diskette develops a fatal error you will always have the original diskette. The original CHRTREE program diskette should be put in a safe location and never used for day-to-day work.

Making a backup copy on a computer with two floppy disk drives is easy when following these simple step-by-step instructions:

1- Put your 1-2-3 Utility Diskette in drive A (left side) and turn the power on. If the power is already on press <CTRL> <ALT> <DEL> keys simultaneously.

2- Label a blank diskette as "CHRTREE - Working Copy" and put this diskette in drive B (right side). For single drive users 1-2-3 will prompt you to appropriately swap disks as needed.

3- Use the arrow keys to select the Disk Manager option and press <ENTER>.

4- Use the arrow keys again to select the Disk Copy option and press <ENTER>.

5- When prompted, remove the Utility Disk from drive A, insert your original CHRTREE program diskette and press the <ENTER> key.

6- When the copy is complete remove the original CHRTREE disk from drive A and put it in a safe location.

7- Use your working copy of CHRTREE as the daily working copy.

Starting Up CHRTREE

Load the CHRTREE template by starting the Lotus 1-2-3 program and inserting the diskette. Use the

/File Directory

command to select the drive containing the template, and

/File Retrieve CHRTREE

(The file name is capitalized here for emphasis, but lower case letters work just as well.) You should see Figure 3 appear on your screen.

Enter a name and location for the analysis, for future reference. The template is menu driven through a number of command bar menus that appear at the top of the screen. They are based on Lotus 1-2-3 macros. Macros take effect when you hold down the [Alt] key located in the lower

left area of the keyboard, and press the proper letter key. To get the first menu, hold down [Alt] and press M, abbreviated as

Alt M

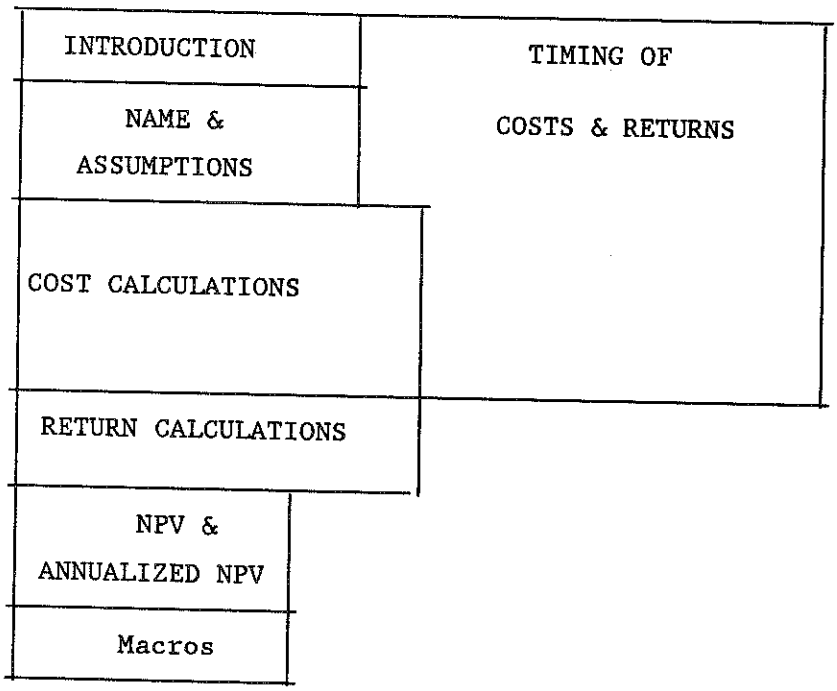
At this time, press Alt M and you should see the menu appear as in the second and third lines of Figure 3.

Figure 3. Introduction

```
                                                                CMD MENU
A1: 'V 2.1
Name  Costs  Returns  NPV  Timing  Print  Quit
Enter name and assumptions
        A          B          C    D      E          F          G
                                                          Apr 2, 1987
1   V 2.2
2
3                          CHRISTMAS TREE ECONOMIC ANALYSIS
4
5   Purpose - Calculates net present value of costs and returns by year
6         and annual equivalent returns (constant annual income with NPV
7         equal to calculated NPV).  Allows consideration of inflation as
8         well as "real" (inflation adjusted) changes in tree and land
9         prices.
10
11             Designed and programmed by William F. Lazarus
12                 Department of Agricultural Economics
13                        Cornell University
14
15                             Press Alt M for menu
16
17
18
19
20
```

The template is divided into seven areas (Figure 4). They can be reached by using the [PgDn], [PgUp] and cursor keys, or by making selections from the menu.

Figure 4. Layout of CHRTREE Template



Input areas of the template are intended for you to enter your own numbers. These areas show up a bit brighter, if you are using a monochrome monitor, or in green on color monitors. Other cells contain text, headings or formulas that are intended to show results. These will be a bit dimmer on a monochrome monitor, or in white on a color monitor.

Name & Assumptions

Press Alt M and select "Name" from the menu. This area is where you enter a name and field identification for the analysis, plus interest and inflation rates (Figure 5). "Rotation - Yrs" is the number of years between when site preparation begins and the trees are completely harvested and ready for site preparation for the next crop. "Acres" is used to convert costs and returns entered on a per acre basis to a total for the field. The "Real" Interest Rate is calculated as described in the previous section, when you press the F9 or [Calc] key, and is protected.

Figure 5. Name and Assumptions

B22: (T) U 'Jane Wiley READY

	A	B	C	D	E	F	G
21	----------						
22	NAME:	Jane Wiley				Date:	24-Mar-87
23	CROP:	Christmas trees					
24							
25	FIELD ID:		3-acre				
26	----------		ASSUMPTIONS		----------		
27	Interest Rate %		10.5%				
28	Rotation - Yrs:		13				
29	Acres:		3				
30	Annual Inflation Rate		3.5%		"Real" Interest Rate		6.76%
31							
32							

Cost Calculations

Select "Costs" from the menu and you should see Figure 6. This section is too large to fit on the screen at one time. Columns A and B contain common activities required for growing trees, with spaces for you to add more items. Enter the year each activity takes place in column C. For activities done every year for several years, enter a starting year and an ending year. Herbicide application, for example, is done six times in the example, starting in year 1 and ending in year 6. For activities that would not normally be done more than once, such as site preparation, the ending year column is protected to prevent you from making entries. The years entered here and in the "Returns" section should not be more than the "Rotation - Yrs" entered under "Name".

Columns E and F are set up for you to enter a rate per acre and a price per unit, as for 1,000 seedlings at $0.45 each. The cost per unit in column F should be today's price, before adjusting for inflation but after adjusting for other changes you expect between now and when you will actually buy it. The cost per acre at today's cost per unit is shown in G, and the cost per acre after adjusting for inflation is shown in columns H and I for the starting and ending years.

Important Note: The template is set for manual recalculation to speed up data entry. Whenever you make an entry, you will see CALC at the lower right of the screen. The calculations will not be updated until you press [Calc].

Another important note: Any of the cost or return items shown can be changed to a zero ($0) in columns E or F if that item is not a cost you incur or want to consider.

Figure 6. Cost Calculations

B46: READY

	A	B	C	D	E	F	G
41							
42	I. Cost Calculations						
43	PER ACRE ITEMS		Years		Rate/	Year 1 Cost/	Cost/ Acre @ Year 1
44	Activity		Start	End	Acre	Unit	Cost/Unit
45	==========						
46	Land		1	0	1.00	$300.00	$300.00
47	Site Preparation		1	0	1.00	75.00	75.00
48	Planting		2	2	1.00	250.00	250.00
49	Seedling/Transplant Stk		2	2	1000.00	0.45	450.00
50	Herbicide Application		2	7	1.00	75.00	75.00
51	Insect&Disease Ctrl 1		5	0	1.00	0.00	0.00
52	Insect&Disease Ctrl 2		5	0	1.00	105.00	105.00
53	Insect&Disease Ctrl 3		7	0	1.00	105.00	105.00
54	Insect&Disease Ctrl 4		9	0	1.00	105.00	105.00
55	Insect&Disease Ctrl 5		11	0	1.00	35.00	35.00
56	Shearing & Pruning 1		3	5	1.00	10.00	10.00
57	Shearing & Pruning 2		6	13	1.00	250.00	250.00
58	Other	mowing-annual	2	3	1.00	90.00	90.00
59	Other	_____	1	1	0.00	0.00	0.00
60	Other	_____	1	1	0.00	0.00	0.00

Use the right cursor key or the tab key to scroll to the right. The discount factor in column J is calculated from the interest and inflation rates and the starting and ending year for each activity. It is multiplied by the cost per acre to calculate the Year 1 Present Value Discounted Cost shown in column K of Figure 7.

The "Land" cost item in row 46 is intended to be a purchase cost of the land for the Christmas tree enterprise, if appropriate for your situation, not an annual rental figure. A land purchase cost of $300 per acre is entered in the example, and can be changed. If you already own the land for other purposes and do not wish to consider its cost in the Christmas tree analysis, change this $300 to $0. If you do enter land purchase as a cost, be sure to also enter a land resale value later in the return calculations (line 87). Entering one but not the other will give you unrealistic results.

In most cases, Christmas trees are not grown on rented land so you will not enter a land rental charge. If you wish to analyze land rental rather than purchase, then set both the land purchase cost (line 48) and resale value (line 87) to zero. Then enter the rental cost per acre in one of the annual cost lines 63 to 65.

Do not enter non-cash cost allocations such as depreciation, or interest paid on loans, as costs in this template. Depreciation in economic terms is merely an allocation of the loss in value of a capital investment as it wears out or becomes obsolete over the years owned. That allocation is not necessary here. Entering a purchase price in the cost section and an ending salvage value in the returns section, discounting both to a present value and converting to an annual equivalent return incorporates this loss in value over the years considered.

Figure 7. Cost Calculations (top right)

G46: (C2) +E46*F46 READY

	A	G	H	I	J	K
41		Cost/	Start	End		Year 1
42	I. Cost	Acreions	Year	Year		Present Value
43	PER ACRE	@ Year 1	Cost/	Cost/	Discount	Discounted
44	Activity	Cost/Unit	Acre	Acre	Factor	Cost
45	==========	==========	==========	==========	==========	==========
46	Land	$300.00	$300.00	xxx	1.0000	$300
47	Site Prep	75.00	75.00	xxx	1.0000	75
48	Planting	250.00	258.75	258.75	0.9367	234
49	Seedling/	450.00	465.75	465.75	0.9367	421
50	Herbicide	75.00	77.63	92.19	4.8016	360
51	Insect&Di	0.00	0.00	xxx	0.7697	0
52	Insect&Di	105.00	120.49	xxx	0.7697	81
53	Insect&Di	105.00	129.07	xxx	0.6753	71
54	Insect&Di	105.00	138.26	xxx	0.5924	62
55	Insect&Di	35.00	49.37	xxx	0.5197	18
56	Shearing	10.00	10.71	11.48	2.4687	25
57	Shearing	250.00	296.92	377.77	4.6385	1,160
58	Other	90.00	93.15	96.41	1.8140	163
59	Other	0.00	0.00	0.00	1.0000	0
60	Other	0.00	0.00	0.00	1.0000	0

Costs incurred annually over the entire rotation can be entered in rows 63 to 65 (Figure 8). Rows 67 to 71 are for lump sum costs not directly based on acres grown, such as machinery purchases and travel and tax preparation fees.

Figure 8. Cost Calculations (bottom left)

	A	B	C	D	E	F	G
41							Cost/
42	I. Cost Calculations					Year 1	Acre
43	PER ACRE ITEMS		Years		Rate/	Cost/	@ Year 1
44	Activity		Start	End	Acre	Unit	Cost/Unit
45	==========	==========	==========	==========	==========	==========	==========
61	Other	_____	1	1	0.00	0.00	0.00
62	Other	_____	1	1	0.00	0.00	0.00
63		Annualinsur,tax,travel		xxx	1.00	20.00	20.00
64		Annual_____		xxx	0.00	0.00	0.00
65		Annual_____		xxx	0.00	0.00	0.00
66	FARM TOTALS FOR ITEMS NOT BASED ON ACRES					Total Cost/Farm	
67		small tractor	2	2	xxx	3,000.00	1,000.00
68	_____		1	1	xxx	0.00	0.00
69	_____		1	1	xxx	0.00	0.00
70	_____		1	1	xxx	0.00	0.00
71	_____		1	1	xxx	0.00	0.00
72	----------	----------	----------	----------	----------	----------	----------
73	Present Value Of All Cost For Rotation						
74							

Press F9 to recalculate, and then scroll right to see the net present value of the costs entered in cell K73, $4,088 in this example (Figure 9).

Figure 9. Cost Calculations (bottom right)

	A	G	H	I	J	K
41		Cost/	Start	End		Year 1
42	I. Cost	Acre	Year	Year		Present Value
43	PER ACRE	@ Year 1	Cost/	Cost/	Discount	Discounted
44	Activity	Cost/Unit	Acre	Acre	Factor	Cost
45	==========	==========	==========	==========	==========	==========
61	Other	0.00	0.00	0.00	1.0000	0
62	Other	0.00	0.00	0.00	1.0000	0
63	Annual	20.00	20.00	30.22	9.0439	181
64	Annual	0.00	0.00	0.00	9.0439	0
65	Annual	0.00	0.00	0.00	9.0439	0
66	FARM TOTALS FOR ITEMS NOT BASED ON ACRES					
67	small t	1,000.00	1,035.00	1,035.00	0.9367	937
68	_____	0.00	0.00	0.00	1.0000	0
69	_____	0.00	0.00	0.00	1.0000	0
70	_____	0.00	0.00	0.00	1.0000	0
71	_____	0.00	0.00	0.00	1.0000	0
72	----------	----------	----------	----------	----------	----------
73	Present Value Of All Cost For Rotation					$4,088
74						

Return Calculations

Figure 10 shows similar calculations for the returns side. Again, rows are provided for per acre costs with starting and ending years, plus row 90 for annual income received each year of the rotation. Rows 92 to 95 are for income items not based directly on acres. Scroll right to see the present values (Figure 11). The present values and inflation adjustments for returns are based on the assumption that the returns come at the end of the year, where the costs are assumed to come at the beginning. For that reason, a year 1 return item gets discounted, while a year 1 cost does not.

When you enter a tree price per unit in cell F86, pay particular attention to trends in new tree plantings and other supply and demand factors that might affect the future price situation you will face at harvest. A small change in price will have a large impact on the economic feasibility of the tree enterprise. Try several prices including something near the low end of the range you think likely, one near the middle and one at the high end.

Figure 10. Return Calculations

B86: READY

	A	B	C	D	E	F	G
81							Return/
82	II. Return Calculations					Year 1	Acre
83	PER ACRE ITEMS		Years		Yield/	Price/	@ Year 1
84	Product		Start	End	Acre	Unit	Price
85	==========						
86	Christmas Trees		11	13	250	$12.00	$3,000.00
87	Land Resale Value		13	0	1.0	300.00	$300.00
88	Other_____		1	1	0	0.00	$0.00
89	Other_____		1	1	0	0.00	$0.00
90	Annual Income		xxx	xxx	0	0.00	$0.00
91	FARM TOTALS FOR ITEMS NOT BASED ON ACRES					Total Return/Yr	
92	Brush (bundles)		11	13	xxx	50.00	$16.67
93	Christmas Wreathes		11	13	xxx	100.00	$33.33
94	tractor salvage value		13	13	xxx	500.00	$166.67
95	_____		1	1	xxx	0.00	$0.00
96	----------						
97	Present Value Of All Returns For Rotation						
98							

Figure 11. Return Calculations (right)

G86: (C2) +E86*F86 READY

	A	G	H	I	J	K
81		Return/	Start	End		
82	II. Retur	Acre	Year	Year		
83	PER ACRE	@ Year 1	Return/	Return/	Discount	Discounted
84	Product	Price	Acre	Acre	Factor	Income
85	==========	==========	==========	==========	==========	==========
86	Christmas	$3,000.00	$4,379.91	$4,691.87	1.3699	$4,110
87	Land Resa	$300.00	469.19	xxx	0.4271	$128
88	Other__	$0.00	0.00	0.00	1.0000	$0
89	Other__	$0.00	0.00	0.00	1.0000	$0
90	Annual	$0.00	0.00	0.00	8.4709	$0
91	FARM TOTALS FOR ITEMS NOT BASED ON ACRES					
92	Brush (bu	$16.67	24.33	xxx	1.3699	$23
93	Christmas	$33.33	48.67	xxx	1.3699	$46
94	tractor s	$166.67	260.66	xxx	0.4271	$71
95	_____	$0.00	0.00	xxx	1.0000	$0
96	----------	----------	----------	----------	----------	----------
97	Present Value Of All Returns For Rotation					$4,377
98						

Net Present Value

The NPV menu option takes you to the Net Present Value and Annualized Net Present Value section (Figure 12). Each is shown on a per acre and total field basis. The annualized calculation is a yearly payment or return over the "Rotation - Yrs" that would be equivalent to the costs and returns you entered, after discounting to a present value, taking into account the real interest rate, the time value of money and inflation.

Figure 12. Net Present Value

A102: 'III. NET RETURNS : READY

	A	B	C	D	E	F	G
102	III. NET RETURNS :						
103							
104	Net Present Value, Per Acre	==========>					$289.42
105	Net Present Value, Total Acres				3	=======>	$868.25
106							
107	Annual Equivalent Returns, Per Acre					=======>	$34.17
108	Annual Equivalent Returns, Total Acres					=======>	$102.50
109							
110	**********						

Timing of Costs and Returns

The last section of the template can be reached be selecting "Timing" from the menu (Figure 13). This totals the cost and return items by year for up to 15 years, based on the starting and ending years you enter. If you enter more than 15 years for the length of the rotation, only the first 15 years are shown. The figures are shown on a total field basis. Column I shows the annual costs, followed by an interest charge on that year's costs plus the cumulative costs from past years, at the nominal interest rate, from cell C27. Column K is the sum of I and J, and L adds each year's cost from column K to the cumulative cost from past years from the previous row of column L. Scrolling right shows the return calculations and net returns, on an annual and cumulative basis (Figure 14).

Figure 13. Timing of Costs and Returns

H1: 'IV. TIMING OF COSTS AND RETURNS : READY

	H	I	J	K	L	M
1	IV. TIMING OF COSTS AND RETURNS :				more==>	
2		Annual	Intrst on	Annual	Cumul.	Annual
3	Year	Cost	on Cum Cost	Costs+I	Cost	Return
4	---	---	---	---	---	---
5	1	$1,185	$124	$1,309	$1,309	$0
6	2	5,853	752	6,605	7,914	0
7	3	627	897	1,523	9,438	0
8	4	349	1,028	1,377	10,815	0
9	5	723	1,211	1,934	12,749	0
10	6	1,229	1,468	2,697	15,446	0
11	7	1,659	1,796	3,456	18,902	0
12	8	1,031	2,093	3,123	22,025	0
13	9	1,481	2,468	3,950	25,975	0
14	10	1,104	2,843	3,947	29,922	0
15	11	1,291	3,277	4,568	34,490	13,359
16	12	1,183	3,746	4,928	39,418	13,826
17	13	1,224	4,267	5,491	44,910	16,500
18	14	0	0	0	0	0
19	15	0	0	0	0	0
20						

Figure 14. Timing of Costs and Returns (right)

N1: READY

	N	O	P	Q	R	S	T
1				Annual	Cumul.		Net Present
2	Intrst on	Annual	Cumul.	Net	Net		Value of
3	on Cum Ret	Return+I	Return	Returns	Returns		Cum Net
4	---	---	---	---	---		---
5	$0	$0	$0	($1,309)	($1,309)		($1,185)
6	0	0	0	(6,605)	(7,914)		(6,482)
7	0	0	0	(1,523)	(9,438)		(6,995)
8	0	0	0	(1,377)	(10,815)		(7,254)
9	0	0	0	(1,934)	(12,749)		(7,739)
10	0	0	0	(2,697)	(15,446)		(8,485)
11	0	0	0	(3,456)	(18,902)		(9,396)
12	0	0	0	(3,123)	(22,025)		(9,909)
13	0	0	0	(3,950)	(25,975)		(10,575)
14	0	0	0	(3,947)	(29,922)		(11,025)
15	0	13,359	13,359	8,791	(21,131)		(7,046)
16	1,403	15,229	28,588	10,301	(10,831)		(3,268)
17	3,002	19,501	48,089	14,010	3,179		868
18	0	0	0	0	0		0
19	0	0	0	0	0		0
20							

Print

This option prints the template. It is set up to print up to 132 characters in compressed print on an IBM or Epson printer. If you are using a different printer, select

/Print Printer Options Setup

from the Lotus menu and enter the compressed or small print code for your printer.

Quit

This just returns you to the Lotus Ready mode from the Alt M menu.

V 2.2 Apr 2, 1987

CHRISTMAS TREE ECONOMIC ANALYSIS

Purpose - Calculates net present value of costs and returns by year and annual equivalent returns (constant annual income with NPV equal to calculated NPV). Allows consideration of inflation as well as "real" (inflation adjusted) changes in tree and land prices.

Designed and programmed by William F. Lazarus
Department of Agricultural Economics
Cornell University

Press Alt M for menu

NAME: Jane Wiley Date: 01-Apr-87
CROP: Christmas trees

FIELD ID: 3-acre

----------ASSUMPTIONS----------

Interest Rate %	10.5%		
Rotation - Yrs:	13		
Acres:	3		
Annual Inflation Rate	3.5%	"Real" Interest Rate	6.76%

I. Cost Calculations PER ACRE ITEMS Activity	Years Start	End	Rate/ Acre	Year 1 Cost/ Unit	Cost/ Acre @ Year 1 Cost/Unit	Start Year Cost/ Acre	End Year Cost/ Acre	Discount Factor	Year 1 Present Value Discounted Cost
Land	1	0	1.00	$300.00	$300.00	$300.00	xxx	1.0000	$300
Site Preparation	1	0	1.00	75.00	75.00	75.00	xxx	1.0000	75
Planting	2	2	1.00	250.00	250.00	258.75	258.75	0.9367	234
Seedling/Transplant Stk	2	2	1000.00	0.45	450.00	465.75	465.75	0.9367	421
Herbicide Application	2	7	1.00	75.00	75.00	77.63	92.19	4.8016	360
Insect&Disease Ctrl 1	5	0	1.00	0.00	0.00	0.00	xxx	0.7697	0
Insect&Disease Ctrl 2	5	0	1.00	105.00	105.00	120.49	xxx	0.7697	81
Insect&Disease Ctrl 3	7	0	1.00	105.00	105.00	129.07	xxx	0.6753	71
Insect&Disease Ctrl 4	9	0	1.00	105.00	105.00	138.26	xxx	0.5924	62
Insect&Disease Ctrl 5	11	0	1.00	35.00	35.00	49.37	xxx	0.5197	18
Shearing & Pruning 1	3	5	1.00	10.00	10.00	10.71	11.48	2.4687	25
Shearing & Pruning 2	6	13	1.00	250.00	250.00	296.92	377.77	4.6385	1,160
Other mowing-annual	2	3	1.00	90.00	90.00	93.15	96.41	1.8140	163
Other _____	0	0	0.00	0.00	0.00	0.00	0.00	1.0000	0
Other _____	0	0	0.00	0.00	0.00	0.00	0.00	1.0000	0
Other _____	0	0	0.00	0.00	0.00	0.00	0.00	1.0000	0
Other _____	0	0	0.00	0.00	0.00	0.00	0.00	1.0000	0
Annualinsur,tax,travel		xxx	1.00	20.00	20.00	20.00	30.22	9.0439	181
Annual_____		xxx	0.00	0.00	0.00	0.00	0.00	9.0439	0
Annual_____		xxx	0.00	0.00	0.00	0.00	0.00	9.0439	0
FARM TOTALS FOR ITEMS NOT BASED ON ACRES				Total Cost/Farm					
small tractor	2	2	xxx	3,000.00	1,000.00	1,035.00	1,035.00	0.9367	937
_____	0	0	xxx	0.00	0.00	0.00	0.00	1.0000	0
_____	0	0	xxx	0.00	0.00	0.00	0.00	1.0000	0
_____	0	0	xxx	0.00	0.00	0.00	0.00	1.0000	0
_____	0	0	xxx	0.00	0.00	0.00	0.00	1.0000	0

Present Value Of All Cost For Rotation $4,088

II. Return Calculations PER ACRE ITEMS Product	Years Start	End	Yield/ Acre	Year 1 Price/ Unit	Return/ Acre @ Year 1 Price	Start Year Return/ Acre	End Year Return/ Acre	Discount Factor	Discounted Income
Christmas Trees	11	13	250	$12.00	$3,000.00	$4,379.91	$4,691.87	1.3699	$4,110
Land Resale Value	13	0	1.0	300.00	$300.00	469.19	xxx	0.4271	$128
Other_____	1	1	0	0.00	$0.00	0.00	0.00	1.0000	$0
Other_____	1	1	0	0.00	$0.00	0.00	0.00	1.0000	$0
Annual Income	xxx	xxx	0	0.00	$0.00	0.00	0.00	8.4709	$0
FARM TOTALS FOR ITEMS NOT BASED ON ACRES				Total Return/Yr					
Brush (bundles)	11	13	xxx	50.00	$16.67	24.33	xxx	1.3699	$23
Christmas Wreathes	11	13	xxx	100.00	$33.33	48.67	xxx	1.3699	$46
tractor salvage value	13	13	xxx	500.00	$166.67	260.66	xxx	0.4271	$71
_____	1	1	xxx	0.00	$0.00	0.00	xxx	1.0000	$0

Present Value Of All Returns For Rotation $4,377

III. NET RETURNS :

Net Present Value, Per Acre	==========>	$289.42
Net Present Value, Total Acres	3 ========>	$868.25
Annual Equivalent Returns, Per Acre	========>	$34.17
Annual Equivalent Returns, Total Acres	========>	$102.50

****

IV. TIMING OF COSTS AND RETURNS : more==>

Year	Annual Cost	Intrst on on Cum Cost	Annual Costs+I	Cumul. Cost	Annual Return	Intrst on on Cum Ret	Annual Return+I	Cumul. Return	Annual Net Returns	Cumul. Net Returns
1	$1,185	$124	$1,309	$1,309	$0	$0	$0	$0	($1,309)	($1,309)
2	5,853	752	6,605	7,914	0	0	0	0	(6,605)	(7,914)
3	627	897	1,523	9,438	0	0	0	0	(1,523)	(9,438)
4	349	1,028	1,377	10,815	0	0	0	0	(1,377)	(10,815)
5	723	1,211	1,934	12,749	0	0	0	0	(1,934)	(12,749)
6	1,229	1,468	2,697	15,446	0	0	0	0	(2,697)	(15,446)
7	1,659	1,796	3,456	18,902	0	0	0	0	(3,456)	(18,902)
8	1,031	2,093	3,123	22,025	0	0	0	0	(3,123)	(22,025)
9	1,481	2,468	3,950	25,975	0	0	0	0	(3,950)	(25,975)
10	1,104	2,843	3,947	29,922	0	0	0	0	(3,947)	(29,922)
11	1,291	3,277	4,568	34,490	13,359	0	13,359	13,359	8,791	(21,131)
12	1,183	3,746	4,928	39,418	13,826	1,403	15,229	28,588	10,301	(10,831)
13	1,224	4,267	5,491	44,910	16,500	3,002	19,501	48,089	14,010	3,179
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0

Reference

Aplin, R. D., G. L. Casler and G. P. Francis. *Capital Investment Analysis: Using Discounted Cash Flows*, Second Edition. Ohio: Grid Publishing Co., 1977.