# FINANCIAL ANALYSIS OF CHRISTMAS TREE INVESTMENTS

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CM-CA-90

## Introduction

Christmas tree production is a business and requires an adequate return on investment to justify continued participation. A person who is considering Christmas trees is wise to carefully evaluate the potential costs and returns before getting started to determine if returns, cash flow constraints, risk, and capital requirements are consistent with an individual's own financial objectives. A procedure will be presented below to evaluate the profitability of different management strategies in relationship to other potential investments.

The first step to is to list all costs and returns which are likely to be encountered, and the year in which they will occur. It is important to include the costs of planting, shearing, fertilization, advertising, transportation, taxes, land rent, pest control and other costs which your Christmas tree plantation is likely to incur. The list below gives you the kinds of practices you need to consider in evaluating Christmas tree investments.

*Site Preparation*
- Rip
- Disking
- Chemical preparation
- Fire

*Seedling Purchase*
- Bare root:
  - 1-0
  - 2-0
  - 1-1
- Container

*Planting Method*
- Hand Planting:
  - Planting bar
  - Dibble
  - Hoe
  - Shovel
- Machine Planting:

*Irrigation*
- Timing
  - Annually
  - 1st Year Only
- Acre feet of water added annually
- Irrigation equipment
  - Sprinkler
  - Drip
  - Furrow

*Shearing/Pruning*
- Year top pruning begins
- Year side shearing begins

*Fertilization*
- Materials added (Nitrogen, Phosphorus, etc.)
- Pounds per acre added
- Year(s) for fertilization
- Application methods
  - Helicopter
  - Hand
  - Tractor

*Insects/Disease*
- Insect/Disease
- Treatment
- Cost
- % Annual Loss

*Marketing*
- Type of marketing operation:
  - Choose and Cut
  - Retail Lot
  - Roadside (wholesale)
  - Association Marketing
  - Roadside (retail)
  - Stumpage
- Tree species and size marketed
  - Less than 4'
  - 4-6'
  - 6-7'
  - Over 7'
- Tree percentage sold by years since planting
  - Less than 4 years
  - 5 years
  - 6 years
  - 7 years
  - 8 years
  - 9 years

*Harvest*
- Costs incurred
  - Cutting
  - Hauling
  - Loading
  - Sorting
  - Storage
  - Security
  - Permits
  - Tally

*Tools/Equipment*
Planting bars/dibbles
Saws
Sprayer
Tractor
Trailer
Pick-up truck
Fencing
Buildings

Use your experience with other agricultural investments to develop these cost and return figures, or check with a neighbor or experienced Christmas tree grower. Your local Cooperative Extension Farm Advisor's office has several Christmas tree cost of production studies to help you to customize the costs to your own situation. Table 1 below is a sample cost of production sheet for a white fir wholesale Christmas tree plantation. Figure 1 shows the percentage breakdown of the various cost categories.

**Figure 1.** White fir Christmas tree management costs

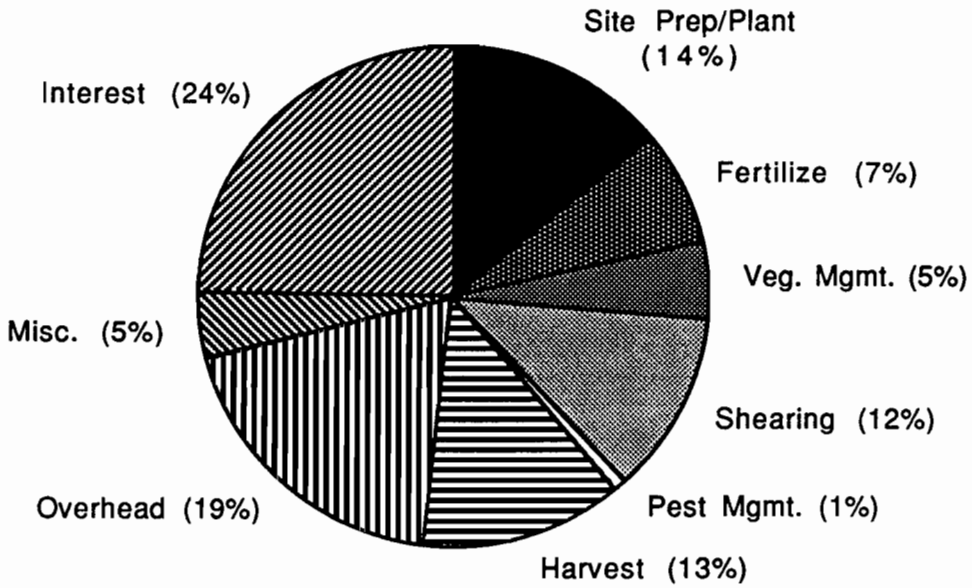

**Table 1.** White Fir Wholesale Christmas Tree Plantation

| | | | |
|---|---|---|---|
| Selling Price/Tree= | 10.5 | | |
| Number of Trees/Ac= | 2500 | | |
| Mortality Rate %= | 0.20 | # Marketed Trees= | 2000 |
| Real Interest Rate= | 0.06 | | |

| YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **INCOME** | | | | | | | | | | |
| % Trees Harvested | | | | | | | | 0.25 | 0.50 | 0.25 |
| # Trees Harvested | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 500 | 1000 | 500 |
| **EXPENSES** | | | | | | | | | | |
| **Cultural Costs** | | | | | | | | | | |
| Clear & Rip | 300 | | | | | | | | | |
| Planting | 670 | | | | | | | | | |
| Fertilizer | 75 | | | | | | | | | |
| Shading | 35 | | | | | | | | | |
| Herbicide | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Brush Control | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 30% Replant | | 212 | | | | | | | | |
| Shearing | | | | | | 189 | 189 | 189 | 189 | |
| Fertilization | | | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Transportation | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Insect & Disease | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Basal Pruning | | | | | 250 | | | | | |
| Misc. | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| **Harvest Costs** | | | | | | | | | | |
| Harvest | | | | | | | | 190 | 380 | 190 |
| Load | | | | | | | | 65 | 130 | 65 |
| Security | | | | | | | | 26 | 26 | 26 |
| **Overhead Costs** | | | | | | | | | | |
| Land Rent | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Depreciation | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 |
| **Total Costs/Ac.** | 1333 | 465 | 321 | 321 | 571 | 510 | 510 | 791 | 1046 | 602 |
| **Total Returns/Ac.** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5250 | 10500 | 5250 |
| **Discount Factor** | 0.94 | 0.89 | 0.84 | 0.79 | 0.75 | 0.70 | 0.67 | 0.63 | 0.59 | 0.56 |
| **Present Value/Ac** | | | | | | | | | | |
| Costs | 1258 | 414 | 270 | 254 | 427 | 360 | 339 | 496 | 619 | 336 |
| Returns | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3294 | 6215 | 2932 |

| | |
|---|---|
| **Net Present Value=** | 7668 |
| **Present Value/Tree=** | 3.83 |
| **Land Exp. Value=** | 17365 |
| **Ann. Equiv. Income=** | 1042 |

Data collected by: Art Scarlett & Gary Rush

## The Time Value of Money

Since the costs and returns associated with Christmas tree investments occur over a long period of time, it is important that the time costs of money are considered. To illustrate the time cost of money, suppose you are offered a choice: Accept $1 today, or accept it a year from now. You will probably choose the $1 today for one of three different reasons.

(1) $1 could be put it in the bank today and earn 6 percent interest, which would make it worth $1.06 in 1 year from now versus just $1 if you waited a year to receive the money. The effect is known as the *opportunity cost* of capital, and takes into account the opportunity you have to take $1 and earn interest in an alternative investment.

(2) Inflation decreases purchasing power, so you will need more than $1 a year from now to have today's purchasing power. An inflation rate of 3 percent will require needing $1.03 in a year to have today's purchasing power with $1. This effect, known as the *inflation cost* of capital, considers the effect of inflation on future decreased purchasing power.

(3) Based on my past promises to give you money, you know that I only follow through 95 percent of the time. This means chances are 1 in 20 that I will renege on my offer to give you $1 later, making the sure receipt of $1 today worth more than the uncertain receipt of $1 a year from now. This effect is known as *risk* and considers the probability that an investment may not pay off in the future.

Each of these three "time costs" of money show why $1 received today does not have the same value as $1 received in the future. A methodology that takes into account these time costs allows you to compare costs and returns that occur at different periods of time.

To consider the opportunity cost of capital, inflation, and risk, costs and returns must be compared at a constant point in time. For the example above, the opportunity cost is 6 percent, the inflation cost is 3 percent, and the risk cost is 5 percent. The net effect of these three time costs of capital is approximately equal to the sum of these three interest rates, or 14 percent. This means that to receive the same purchasing power of $1 today, we will need to receive $1.14 in one year.

## Discounting

In evaluating Christmas tree investments, you know the future value of a cost or return, and you need to find out what that value will be worth today, considering the time costs of money. In *discounting*, the present value of an investment at a given interest rate is calculated. The discount factor used to calculate the present value is given in Table 2 for different interest rates and years in which a cost or return will occur.

For example, suppose you know that you will receive a payment of $1000 for the sale of Christmas trees in 8 years, and your real interest rate reflecting the opportunity cost of capital is 6 percent. The discount factor for 8 years and a 6 percent real interest from Table 2 is 0.63.

Present Value = $1000 x 0.63 = $630

This means that the $1000-per-acre benefit which we would receive in 8 years is worth only $630 per acre today at a 6 percent interest rate. This is the maximum amount of money you should invest today to still earn at least a 6 percent.

## The Present Net Worth Framework

The concepts described on the time cost of money, interest rates, and discounting, are all important for assessing costs and returns from Christmas tree investments. The framework for analysis used here to take all of these into consideration is called the *present net worth* (PNW) or the *net present value* (NPV). The PNW is the difference between all costs discounted to the present and all returns discounted to the present for one production period. The PNW shows the net value of production today at a given interest rate. The PNW of several management alternatives is calculated. The alternative with the highest PNW is chosen as the best strategy. A negative PNW indicates the net return on the investment is less than the alternative rate of return.

For the white fir example in Table 1, the costs and returns are summed up and multiplied by the appropriate discount factor for that year. For example, the total costs in year 3 of the rotation is shown in Table 3 to be $321 per acre. The discount factor for 3 years and 6 percent interest rate is found in Table 2, and is 0.84. Multiplying these two together gives a total discounted cost for year 3 of $270 per acre.

The PNW is determined by summing up the discounted returns and discounted costs, and

subtracting them from each other. For these costs and returns, the PNW for this management strategy given the 6 percent real interest rate and a 10 year rotation length is $7,668 per acre, which gives the value today of the entire series of costs and returns that occur over the 10 year rotation.

There are many cases where you would like to compare management strategies with unequal production periods. For example, suppose we compare an 8 year rotation with a 10 year rotation. Can the additional cost necessary to shorten the rotation by two years (i.e. fertilization, irrigation, larger planting stock) be justified by a shorter rotation? Comparing the PNWs for the two productions would underestimate the benefit of the shorter rotation length. After 8 years, the shorter rotation strategy can be planted while you are still waiting for the first rotation.

To correct for the bias that results from production periods of different lengths, you must remove the effect of time altogether by converting the PNW for a single production cycle to the PNW for an infinite series of production periods. This is referred to as the *land expectation value* (LEV), and is defined as the net discounted present value of an infinite series of production periods. Table 3 can be used to give the multiplying factor to convert from a single production period to this timeless LEV.

The LEV compares management strategies of different lengths to each other directly; it also gives the theoretical value of bare land using a certain management strategy.

For the example in Table 1, the LEV multiplying factor for a 10 year rotation and a 6 percent interest rate is found in Table 3, and is 2.26. Multiplying this factor times the PNW ($7,668) gives the land expectation value of this Christmas tree investment (differences due to rounding off).

$7,668 x 2.26 = $17,365 per acre

A way to compare your Christmas tree investment to investments that have annual returns is to calculate the *annual equivalent income*. This gives the annual income which will just equal the present net worth of an investment over the rotation period, or the land expectation value of an infinite series of rotations at a given interest rate. The annual equivalent income is calculated by multiplying the interest rate times the land expectation value. For our white fir example in Table 1, the annual equivalent income is:

$17,365 x 0.06 = $1042 per acre per year

## Comparing Different Investments

As an example, suppose you can shorten the rotation length of your white fir plantation by planting larger seedlings (2-1 transplants). This will increase the cost of seedlings from $120 per thousand seedlings to $300 per seedling, and the cost of planting by $390 per acre to $1060 per acre. Table 4 shows the new costs and returns for this new 9 year rotation period. As this shows, the extra cost in larger seedlings to reduce the rotation length can be justified. The LEV increased to $19,989.

## Conclusion

Christmas tree management can be an enjoyable part-time activity for the entire family to work together or it can be a large-scale business enterprise. In both cases, it is important to assess the labor and capital requirements for growing Christmas trees. In general, Christmas tree production needs more labor and capital than other forestry investments, however, well-managed Christmas tree plantations can give a very high economic return. This return must be compared with returns from other potential investments to determine if Christmas tree management gives you the most efficient use of your capital. Use of the present net worth, land expectation value, and annual equivalent income frameworks presented here will give the tools necessary for evaluating your investment.

**Table 2.** Discount factor for different interest rates and years

| | INTEREST RATE (PERCENT) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 |
| 1 | 0.98 | 0.97 | 0.96 | 0.95 | 0.94 | 0.93 | 0.93 | 0.92 | 0.91 |
| 2 | 0.96 | 0.94 | 0.92 | 0.91 | 0.89 | 0.87 | 0.86 | 0.84 | 0.83 |
| 3 | 0.94 | 0.92 | 0.89 | 0.86 | 0.84 | 0.82 | 0.79 | 0.77 | 0.75 |
| 4 | 0.92 | 0.89 | 0.85 | 0.82 | 0.79 | 0.76 | 0.74 | 0.71 | 0.68 |
| 5 | 0.91 | 0.86 | 0.82 | 0.78 | 0.75 | 0.71 | 0.68 | 0.65 | 0.62 |
| 6 | 0.89 | 0.84 | 0.79 | 0.75 | 0.70 | 0.67 | 0.63 | 0.60 | 0.56 |
| 7 | 0.87 | 0.81 | 0.76 | 0.71 | 0.67 | 0.62 | 0.58 | 0.55 | 0.51 |
| 8 | 0.85 | 0.79 | 0.73 | 0.68 | 0.63 | 0.58 | 0.54 | 0.50 | 0.47 |
| 9 | 0.84 | 0.77 | 0.70 | 0.64 | 0.59 | 0.54 | 0.50 | 0.46 | 0.42 |
| 10 | 0.82 | 0.74 | 0.68 | 0.61 | 0.56 | 0.51 | 0.46 | 0.42 | 0.39 |
| 11 | 0.80 | 0.72 | 0.65 | 0.58 | 0.53 | 0.48 | 0.43 | 0.39 | 0.35 |
| 12 | 0.79 | 0.70 | 0.62 | 0.56 | 0.50 | 0.44 | 0.40 | 0.36 | 0.32 |
| 13 | 0.77 | 0.68 | 0.60 | 0.53 | 0.47 | 0.41 | 0.37 | 0.33 | 0.29 |
| 14 | 0.76 | 0.66 | 0.58 | 0.51 | 0.44 | 0.39 | 0.34 | 0.30 | 0.26 |
| 15 | 0.74 | 0.64 | 0.56 | 0.48 | 0.42 | 0.36 | 0.32 | 0.27 | 0.24 |

**Table 3.** Multiplying factor to convert the present net worth for a certain rotation length to the land expectation value for an infinite series of investments

| | INTEREST RATE (PERCENT) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 |
| 1 | 51.00 | 34.33 | 26.00 | 21.00 | 17.67 | 15.29 | 13.50 | 12.11 | 11.00 |
| 2 | 25.75 | 17.42 | 13.25 | 10.76 | 9.09 | 7.90 | 7.01 | 6.32 | 5.76 |
| 3 | 17.34 | 11.78 | 9.01 | 7.34 | 6.24 | 5.44 | 4.85 | 4.39 | 4.02 |
| 4 | 13.13 | 8.97 | 6.89 | 5.64 | 4.81 | 4.22 | 3.77 | 3.43 | 3.15 |
| 5 | 10.61 | 7.28 | 5.62 | 4.62 | 3.96 | 3.48 | 3.13 | 2.86 | 2.64 |
| 6 | 8.93 | 6.15 | 4.77 | 3.94 | 3.39 | 3.00 | 2.70 | 2.48 | 2.30 |
| 7 | 7.73 | 5.35 | 4.17 | 3.46 | 2.99 | 2.65 | 2.40 | 2.21 | 2.05 |
| 8 | 6.83 | 4.75 | 3.71 | 3.09 | 2.68 | 2.39 | 2.18 | 2.01 | 1.87 |
| 9 | 6.13 | 4.28 | 3.36 | 2.81 | 2.45 | 2.19 | 2.00 | 1.85 | 1.74 |
| 10 | 5.57 | 3.91 | 3.08 | 2.59 | 2.26 | 2.03 | 1.86 | 1.73 | 1.63 |
| 11 | 5.11 | 3.60 | 2.85 | 2.41 | 2.11 | 1.91 | 1.75 | 1.63 | 1.54 |
| 12 | 4.73 | 3.35 | 2.66 | 2.26 | 1.99 | 1.80 | 1.66 | 1.55 | 1.47 |
| 13 | 4.41 | 3.13 | 2.50 | 2.13 | 1.88 | 1.71 | 1.58 | 1.48 | 1.41 |
| 14 | 4.13 | 2.95 | 2.37 | 2.02 | 1.79 | 1.63 | 1.52 | 1.43 | 1.36 |
| 15 | 3.89 | 2.79 | 2.25 | 1.93 | 1.72 | 1.57 | 1.46 | 1.38 | 1.31 |

**Table 4.** White fir wholesale plantation with 9 year rotation

| | | | |
|---|---|---|---|
| Selling Price/Tree= | 10.5 | | |
| Number of Trees/Ac= | 2500 | | |
| Mortality Rate %= | 0.20 | # Marketed Trees= | 2000 |
| Real Interest Rate= | 0.06 | | |

| YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| **INCOME** | | | | | | | | | |
| % Trees Harvested | | | | | | | 0.25 | 0.50 | 0.25 |
| # Trees Harvested | 0 | 0 | 0 | 0 | 0 | 0 | 500 | 1000 | 500 |
| **EXPENSES** | | | | | | | | | |
| **Cultural Costs** | | | | | | | | | |
| Clear & Rip | 300 | | | | | | | | |
| Planting | 1060 | | | | | | | | |
| Fertilizer | 75 | | | | | | | | |
| Shading | 35 | | | | | | | | |
| Herbicide | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Brush Control | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 30% Replant | | 212 | | | | | | | |
| Shearing | | | | | 189 | 189 | 189 | 189 | |
| Fertilization | | | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Transportation | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Insect & Disease | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Basal Pruning | | | | | 250 | | | | |
| Misc. | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| **Harvest Costs** | | | | | | | | | |
| Harvest | | | | | | | 190 | 380 | 190 |
| Load | | | | | | | 65 | 130 | 65 |
| Security | | | | | | | 26 | 26 | 26 |
| **Overhead Costs** | | | | | | | | | |
| Land Rent | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Depreciation | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 |
| **Total Costs/Ac.** | 1723 | 465 | 321 | 321 | 760 | 510 | 791 | 1046 | 602 |
| **Total Returns/Ac.** | 0 | 0 | 0 | 0 | 0 | 0 | 5250 | 10500 | 5250 |
| **Discount Factor** | 0.94 | 0.89 | 0.84 | 0.79 | 0.75 | 0.70 | 0.67 | 0.63 | 0.59 |
| **Present Value/Ac** | | | | | | | | | |
| Costs | 1625 | 414 | 270 | 254 | 568 | 360 | 526 | 656 | 356 |
| Returns | 0 | 0 | 0 | 0 | 0 | 0 | 3492 | 6588 | 3107 |

| | |
|---|---|
| **Net Present Value=** | 8158 |
| **Present Value/Tree=** | 4.08 |
| **Land Exp. Value=** | 19989 |
| **Ann. Equiv. Income=** | 1199 |

Data collected by: Art Scarlett & Gary Rush