

# Forest Investments:

## Risk and Return

**F**or many people, a forest is the source of a variety of products, services and recreational activities. We derive many benefits from forests. For an increasing number of forest landowners, however, a forest is an investment. For these people, understanding the basics of forest investments is essential in planning for long-term maximum benefits.

A forest is a long-term investment, similar to other types of long-term investments such as retirement funds, stocks, bonds or starting a business. The first fact forest investors must realize is that any investment, long-term or otherwise, has not only the potential for return, but also the potential for risk. Each type of long-term investment has associated levels of risk that correspond to expected levels of return. For example, a United States Savings Bond typically has a very low return on investment, but it is very low in risk. Retirement funds have higher expected returns and corresponding higher levels of potential risk. Starting one's own business can have an unlimited potential, but it can be very risky.

Everyone wants to figure out a way to eliminate risk. The truth is, there are no risk-free investments. All incur some level of risk. The trick for forest investors is to decide on a desired level of return and calculate whether they can tolerate the associated level of risk.

Typically, long-term forest investments fall into two categories: acts of nature and acts of people. Let's examine acts of nature first.



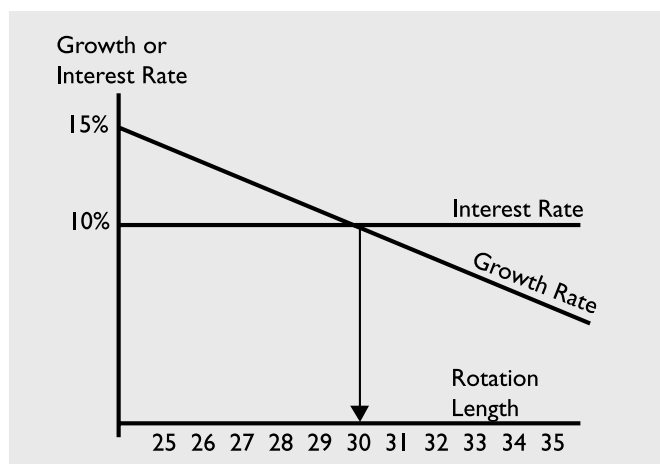
Acts of nature include natural disasters, such as fire, floods, hurricanes and pestilence. On average, losses from fire, disease and other natural occurrences are low, averaging less than 1% in excess of natural mortality. These risks are much like the risks we take when flying on a commercial airliner. Statistics show air travel is far superior in safety to other forms of transportation. If a problem occurs in the air, however, no matter how small the odds, it can be devastating. The same is true of a forest. Odds are small that any natural disaster will affect a forest landowner's forest. But, if a natural disaster does affect a forest, it can devastate it.

There are measures forest landowners can take to minimize the chances of this occurring. For example, a well-managed stand of timber that is properly thinned can greatly reduce the chances of pestilence. Reducing the fuel load by periodic prescribed fire can minimize the chances of destruction from wildfire. Risk still exists because we can't control acts of nature (ice storms, hurricanes, floods, etc.), but we can reduce that risk as much as possible.

Greater risk is likely to originate with society, politics and economic conditions. Public attitudes are volatile and likely to change over time. This can lead to a more or less regulatory environment that can, in turn, affect a forest investment. A major complicating factor is the difficulty in predicting social change. It is almost impossible to predict what the future holds in a free society such as the United States; therefore, it behooves the forest landowner to remain informed about political and social issues and to become involved in political decision-making on the local level.

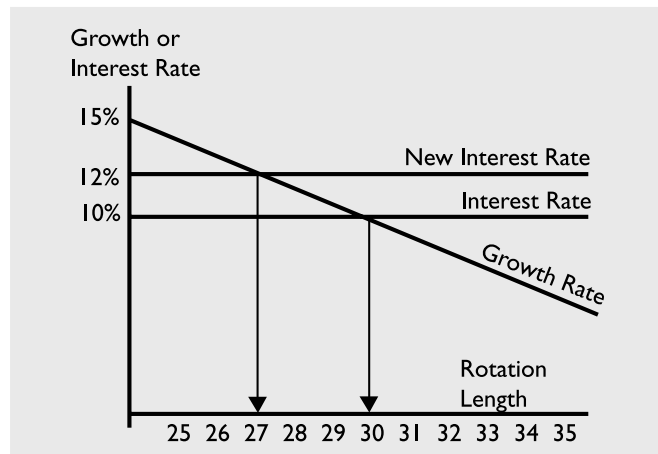
Although social risk is difficult to predict and challenging to manage, economic risk is more manageable. There are three main sources of economic risk: interest rates, inflation and prices.

Interest rates are important determinants of rotation lengths. In general, the higher the interest rate, the shorter the optimal rotation within a product class. For example, let's assume that a forest landowner faces interest rates (or a minimum acceptable rate of return) of 10%. If the landowner is growing sawtimber and prices are stable, then the landowner will maximize revenues at the point at which the average growth rate of the timber stand is equal to the interest rate. The landowner would not want to continue to grow trees if the growth rate was 9% and the interest rate was 10%, because to do so would mean that he or she could make more money (10%) in an alternative investment. Graphically, it looks like this:



In the figure above, the 10% interest rate is represented by the horizontal line and the growth rate is the diagonal line going downward from left to right. A downward sloping growth rate means the trees are still growing, but at a declining rate. For example, in year 25 of the rotation, the growth rate is about 14%; in year 26, it is about 13%; and so on. As long as the growth rate is greater than the interest rate, and provided that saw-timber prices are not fluctuating wildly from year to year, the forest landowner will want to continue to grow trees. But when the growth rate is less than the interest rate, it is time to harvest the trees. The optimal rotation in this example is at year 30.

What would happen if the interest rate increased from 10% to 12%? This is presented graphically below:



Now that the interest rate has increased from 10% to 12%, the new optimal rotation is at year 27. In this situation, if the landowner continued to grow trees beyond year 27 to year 30 as previously, he or she would, in effect, lose the investment income gained by harvesting at year 27 and reinvesting those proceeds at 12% in an alternative investment.

It is critical to stay abreast of interest rate trends and forecasts. If interest rates increase dramatically, the forest landowner will want to seriously consider harvesting timber at an earlier age as long as stumpage prices remain the same or relatively stable. If interest rates decrease, landowners will be able to grow timber for a longer rotation and still earn a minimum acceptable rate of return. This gives the landowner more time in which to wait for the best price to sell timber.

Inflation is another important risk factor in forest investments. No matter how low inflation is, in the long run it will have a dramatic effect on real investment returns. Consider this example. Suppose you know of an investment that will cost you \$25,000 today and will return \$100,000 in 10 years. You wish to make a *real* rate of return of 10%. Current inflation rates are 8% (hypothetically). Would you accept this investment?

To compute your *nominal* rate of return, you would use the following equation:

$$V_n = V_o(1 + i)^n,$$

where  $V_n$  = the ending value of the investment,  $V_o$  = the beginning value of the investment,  $n$  = the number of years of the investment and  $i$  = the interest rate or the minimum acceptable rate of return. This is the standard formula for simple compound interest.

The equation becomes more complicated in this case, however, because we need to determine the value of  $i$ . Algebraically, this becomes a problem of getting  $i$  by itself in the equation. After we manipulate the equation, we have the following:

$$i = \left( \frac{V_n}{V_0} \right)^{\frac{1}{n}} - 1$$

By plugging in the numbers, we come up with:

$$i = \left( \frac{100,000}{25,000} \right)^{\frac{1}{10}} - 1 = 1.1487 - 1 = .1487$$

Above, we have derived the nominal rate of return, which is equal to .1487 or 14.87%. Would you invest?

The 14.87% is a nominal rate of return, not a real return that has been adjusted to account for inflation. Therefore, the 14.87% is not the real return when deflated to current purchasing power. To account for inflation, you must perform the following calculation:

$$R = \left( \frac{1 + i}{1 + I} \right) - 1,$$

where  $R$  = the real rate of return,  $i$  = the nominal rate of return expressed as a decimal (.1487) and  $I$  = the inflation rate expressed as a decimal (.08).

Performing this calculation yields a real rate of return of 6.87%. This is less than the 10% real rate of return that you wanted to make in our hypothetical example. Therefore, you would reject the investment.

We often hear of investments with returns expressed in percentages. Be careful! Often, these are nominal rates and not real rates. The difference can be significant, especially during high inflationary periods.

The third important source of economic risk is price. Product prices are important because they help forest investors decide which products to grow and what rotation to implement. Remember, the value of different forest products classes (pulpwood, chip-n-saw, sawtimber, poles) tends to increase with larger products and longer rotations. The investor, therefore, must balance the expected price to be received for each product that would be harvested in a rotation (pulpwood in a short rotation, chip-n-saw in a medium rotation, sawtimber in a long rotation) with the additional time required to grow larger wood.

Let's look at the following as an example of comparing returns from different rotation lengths. Suppose you have a tract of land on which to grow trees. You must decide whether to grow a pulpwood rotation, a chip-n-saw rotation or a sawtimber rotation. You make these assumptions:

1. Pulpwood rotation: Harvest 6 cords per acre in year 12. Harvest 48 cords per acre in year 18 (final harvest). Management costs: \$180 per acre in year 1 for site preparation, management costs of \$5 per acre per year beginning in year 1.

2. Chip-n-saw rotation: Harvest 6 cords per acre of pulpwood in year 12. Harvest 10 cords per acre pulpwood in year 18, harvest 39 cords of chip-n-saw and 17 cords of pulpwood in year 24 (clearcut). Management costs are the same as for the pulpwood rotation option.
3. Sawtimber rotation: Harvest 6 cords per acre of pulpwood in year 12. Harvest 10 cords per acre pulpwood in year 18. Harvest 13 cords per acre chip-n-saw and 4 cords per acre pulpwood in year 24. Harvest 4 mbf of sawtimber and 3 cords per acre chip-n-saw in year 28 (clearcut). Management costs are the same as for the pulpwood and chip-n-saw rotation options.

**Let's further suppose that anticipated prices for our products are as follows:**

Pulpwood in year 12 = \$31.70 per cord  
 Pulpwood in year 18 = \$33.65 per cord  
 Pulpwood in year 24 = \$35.72 per cord  
 Pulpwood in year 28 = \$37.17 per cord  
 Chip-n-saw in year 24 = \$109.74 per cord  
 Chip-n-saw in year 28 = \$114.20 per cord  
 Sawtimber in year 28 = \$598.54 per cord

Interest rates are 7%.

**Given this set of circumstances and assumptions, we are ready to calculate the net present value (NPV) for each alternative rotation:**

**Alternative I:**

Costs:

- 1) Management: \$5/acre/year for 18 years.  $\$5 \left[ \frac{1-(1+.07)^{-18}}{.07} \right] = \$50.29$  . This is the present value of the annual management cost.
- 2) Site Prep: \$180 in year 1: Present Value in year 1 is equal to current value, therefore => \$180.
- 3) Present Value of Costs: \$180 + \$50.29 = \$230.29

Revenues:

- 1) Year 12: 6 cords per acre = \$31.70 X 6 = \$190.20. Present Value:  $\frac{190.2}{(1.07)^{12}} = \$84.45$
- 2) Year 18 final harvest: 48 cords per acre = \$33.65 X 48 = \$1615.20. Present Value:  $\frac{1615.2}{(1.07)^{18}} = 477.88$
- 3) Present Value of revenues: \$477.88 + \$84.45 = \$562.33. Net Present Value = Present Value of Revenues less Present Value of Costs: \$562.33 - \$230.29 = \$332.04. Therefore, the NPV for Alternative I is \$332.04 per acre.

### **Alternative 2:**

Stand Establishment Costs are the same for Alternative 2 as they are for Alternative 1.

Therefore, the present value of that cost is still \$180.

Management costs are now \$5 per acre per year for 24 years, so we must recalculate the present value of this cost:  $\$5 \left[ \frac{1-(1+.07)^{-24}}{.07} \right] = \$57.35$

Therefore, the present value of all costs are  $\$180 + \$57.35 = \$237.35$

Revenues:

1) Year 12 (Same as Alternative 1): 6 cords per acre = \$190.20. Present Value = \$84.45.

2) Year 18: 10 cords per acre =  $\$33.65 \times 10 = \$336.50$ .

$$\text{Present Value} = \frac{336.50}{(1.07)^{18}} = \$99.56$$

3) Year 24: 39 cords chip-n-saw  $\times \$109.74/\text{cord} = \$4279.86$ .

$$\text{Present Value} = \frac{4279.86}{(1.07)^{24}} = \$843.76$$

**17 cords of pulpwood  $\times \$35.72 = \$607.24$**

$$\text{Present Value} = \frac{607.24}{(1.07)^{24}} = \$119.72$$

The present value of all revenues is  $\$84.45 + \$99.56 + \$843.76 + \$119.72 = \$1147.49$ .

Therefore, the Net Present Value for Alternative 2 is \$910.14 per acre ( $\$1147.49 - \$237.35$ ).

### **Alternative 3**

Costs:

1) Stand Establishment Costs: PV = \$180 (Same as the other alternatives).

2) Management Costs:  $\$5 \left[ \frac{1-(1+.07)^{-28}}{.07} \right] = \$60.69$

The Present Value of all costs is \$240.69 ( $\$180 + \$60.69$ ).

Revenues:

1) Year 12: 6 cords per acre  $\times \$31.70 = \$190.20$ . PV = \$84.45 (See Alternatives 1 and 2).

2) Year 18: 10 cords per acre  $\times \$33.65 = \$336.50$ . PV = \$99.56 (See Alternative 2).

3) Year 24: 13 cords per acre chip-n-saw  $\times \$109.74 = \$1426.62$ .

$$\text{Present Value} = \frac{1426.62}{(1.07)^{24}} = \$281.25$$

**4 cords per acre pulpwood  $\times \$35.72 = \$142.88$**

$$\text{Present Value} = \frac{142.88}{(1.07)^{28}} = \$21.49$$

4) Year 28: 4 mbf sawtimber per acre X \$598.54 = \$2394.16.

$$\text{Present Value} = \frac{2394.16}{(1.07)^{28}} = \$360.09$$

**3 cords chip-n-saw per acre X \$114.20 = \$342.60**

$$\text{Present Value} = \frac{342.60}{(1.07)^{28}} = \$51.53$$

Present Value of all revenues = \$281.25 + \$21.49 + \$360.09 + \$51.53 = \$714.36.

Therefore, the Net Present Value = \$473.67 per acre (\$714.36 - \$240.69).

Therefore, in this example the best rotation alternative is the 24-year chip-n-saw rotation, because it provides the highest net present value per acre. Keep in mind that this is only an example. Results vary widely according to local markets, local growing conditions and the interest rate you choose. You can make the same calculations to assist you in deciding which rotation is best for you, however. The optimal rotation could easily change if markets changed. For example, if markets for chip-n-saw diminish significantly, prices may decline substantially for that product. In that case, the sawtimber rotation would be the clear choice. If a global shortage of wood pulp occurred, or if more pulp and paper mills were built in your area or region, however, pulpwood prices might increase substantially, making the pulpwood rotation the most attractive option.

A forest investor must account for all types of potential impacts to product prices that might occur. The most important tool in making sound decisions is access to good information. The wise forest investor should:

- 1) Realize that, all things being equal, the longer you hold a forest investment, the riskier it becomes. Also realize that, generally, forest investments increase in value the longer they are held, up to a point of maximum marginal value given a certain interest rate. You must make a personal calculation regarding how much revenue you wish to make and how much risk you can tolerate.
- 2) Calculate a reasonable rate of return that you feel is necessary to invest in forest management. You should make sure this rate is comparable to other investments. A good general rule is to make your investment calculations using the bank Prime interest rate. Or, if you invest in stocks and are indifferent between investing in stocks or in forests, choose a rate comparable to *long-term historical* (not just recent past) rates of return for the stock market. A good general rule for historical stock market rates of return is 8% - 10%.
- 3) Account for the effects of interest rates, inflation and relative stumpage prices for different forest products. Make sure you or your forester or your financial planner accounts for inflation and includes best estimates regarding future stumpage prices for pulpwood, chip-n-saw and sawtimber.

- 4) Keep up with economic events and news. Stay abreast of local political trends that might affect your investment strategy. Attend meetings, stay in touch with the forestry community and solicit information from academic institutions, state and federal government agencies, private forestry consultants and industry foresters associated with landowner assistance programs. Studies have shown private forestry consultants more than pay for themselves with the additional revenue they generate for landowners.
- 5) Be a good land steward. Stewardship and profit are not mutually exclusive. It is possible to manage your land actively and, at the same time, leave it in better environmental condition. The best forest investors practice good forest stewardship.

Investment in forestry can be beneficial not only to you and your family, but also to the ecology and welfare of our state. Stay informed and educated, make careful decisions based on good economics and forest stewardship ethics, and enjoy your forest!

Michael A. Dunn, Forest Economist

Visit our website:  
[lsuagcenter.com](http://lsuagcenter.com)

LDAF website:  
[ldaf.state.la.us](http://ldaf.state.la.us)

**Louisiana Department of Agriculture and Forestry**, Bob Odom, Commissioner  
**Louisiana State University Agricultural Center**, William B. Richardson, Chancellor  
**Louisiana Cooperative Extension Service**, Jack L. Bagent, Vice Chancellor and Director

Pub. 2804

(3M)

6/00

Issued in furtherance of Cooperative Extension work, Acts of Congress of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. The Louisiana Cooperative Extension Service provides equal opportunities in programs and employment.