Profits and Investment Analyses

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Abstract

This paper addresses economic analyses for an advance in reforestation (i.e. analysis for maximum return) and for a challenge (i.e. analysis for minimizing loss).

Introduction

Reforestation practices are driven, in large part, by economics. While it is important to meet reforestation laws and to observe environmental conditions, foresters must also consider optimum practices which will minimize cost while maximizing return.

Advances

To provide a simple illustration of a maximum return for investment, let's examine the economics of recent advances in use by The Timber Company. We have been using "Big Ass Plugs" (BAP's, styro-15 and styro-20). When compared to styro-8 seedlings, unfertilized BAP's have greater height and stem diameter at the time of outplanting and are able to maintain this size advantage in the field (Figure 1). In addition to using BAP's, we are also incorporating controlled-release fertilizer into the growing medium. This has resulted in increased field growth over unfertilized stock for all stock sizes. In fact, in a study with the Nursery Technology Cooperative (Oregon State University), fertilized styro-8 seedlings grew as much as unfertilized styro-20 seedlings after two field seasons (Figure 1). Furthermore, fertilized BAP's outperformed plug+1 seedlings despite the significant initial size difference (Figure 1). In 1997, The Timber Company, Oregon planting program was 70% styro-2 (for transplant) and 30% styro-8 for field planting. In 2000, we are now planting 50% styro-2+1 transplants and 50% BAP's.

In order to determine the best stock to use, we must first calculate the per acre investment for each. This includes the total cost of planting stock in the ground (450 seedlings/acre). For container stock, this includes the price of the stock itself, the

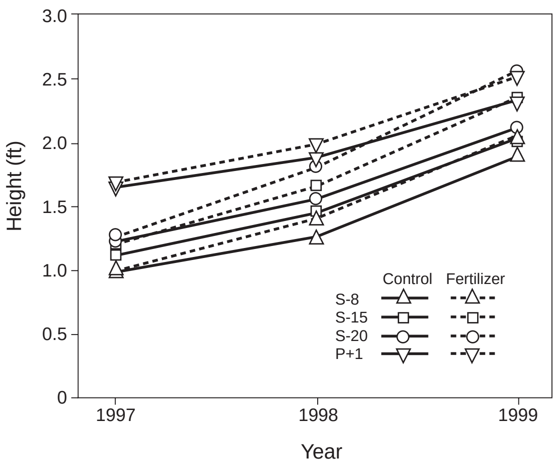

Figure 1. Field performance of Douglas-fir container stock grown with fertilizer- amended media (Nursery Technology Cooperative 98-1), The Timber Company, Coos Bay, OR.

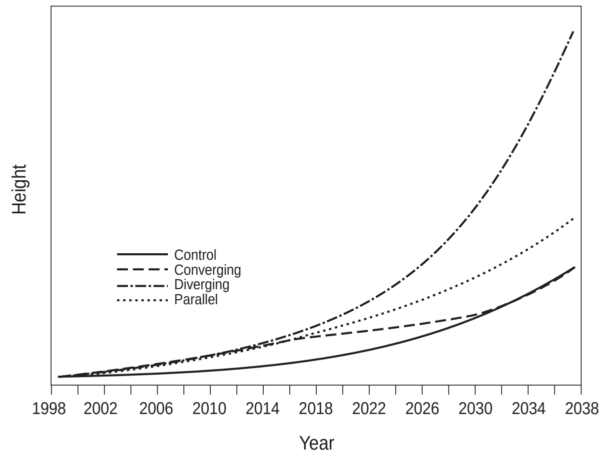

Figure 2. Possible models for prediction of future gain.

cost of the fertilizer if used, and the planting cost. For plug+1 stock, this includes the styro-2 price*1.2 (fall down in transplant nursery), the transplant price, and the planting stock (Table 1).

For container stock, the investment period will be a 40-year rotation, with all capital costs in year one. For plug+1 stock, the investment period will be a 41-year rotation, with styro-2 stock cost in year one and transplant nursery plus planting costs in year two. Predicting future volume gain could be based on a converging, diverging, or parallel growth pattern over time (Figure 2). For these purposes, we will assume that height growth is divergent to age two and then parallel based on measurements taken at age two in the field (very young). We will also assume that percent additional harvest volume equals one half the percent height gain (e.g. 10% height gain = 5% volume gain).

Bare Land Value (BLV) assumptions include:

- 32 mbf/acre at 40 years for baseline
- Douglas-fir stumpage: $500/mbf
- Investment of $186-338 acre
- 6% real discount rate
- No taxes and administration.

By taking the above data and assumptions into account, a quick and dirty analysis shows that adding controlled-release fertilizers to container stock is a good investment (Table 2). Additionally, we can examine which stocktype provides the best return on investment. Table 3 shows that there is no clear winner or loser when comparing stocktypes. Decisions could depend on

Table 1. Investment ($/acre) for each stocktype.

	Control	Fertilized
S-8	186	195
S-15	252	269
S-20	315	338
P+1	236	291

Table 2. Percent price increase and gain for container stock as a result of fertilization.

	S-8		S-15		S-20	
	unfertilized	fertilized	unfertilized	fertilized	unfertilized	fertilized
% height gain	0	9	0	16	0	21
% price increase	0	5	0	7	0	7
% BLV gain	0	4	0	6	0	8

Table 3. Comparisons of percent price increase and gain for fertilized container stock and plug+1 stock.

	S-8	S-15	S-20	P+1	P+1(+fert)
% height gain	0	14	25	13	22
% price increase	0	38	73	21	49
% BLV gain	0	1	0	-4	-2

other considerations such as harvest scheduling (adjacent timber), scheduling seedling orders (one year versus two year turn around), access to seedlings during wet weather, and anticipated animal damage (e.g. elk are know to pull out plugs).

Challenges

Unlike the above example, reforestation challenges require a different economic approach in which we try to minimize losses. To provide a simple illustration of this, let's examine the impacts of Swiss needle cast (SNC) and mixed species plantings. The increasing incidence of SNC infection in coastal Douglas-fir threatens established plantations as well as future reforestation efforts. Damage caused by SNC infection includes needle chlorosis and premature needle loss. Since the late 1980's SNC has become increasingly severe in plantations and naturally established stands, especially along the PNW coast. To combat the huge losses associated with SNC, many companies are planting mixed species. The Timber Company, Oregon property impacted by Swiss needle cast is currently planting 60% SNC "resistant" Douglas-fir, 30% western hemlock, 5% noble fir, and 5% western redcedar.

For this example, we will do a financial analysis of Douglas-fir and western hemlock plantings based on volume growth losses associated with years of needle retention (Figure 3). We will make assumptions of 32 mbf/acre at 40 years for 100% healthy Douglas-fir, or 50% healthy Douglas-fir and 50% western hemlock, or 100% western hemlock. Stumpage prices are assumed to be $500/mbf for Douglas-fir and $425/mbf for western hemlock. Establishment costs will be set at $400/acre with a 6% real discount rate and no taxes and administration.

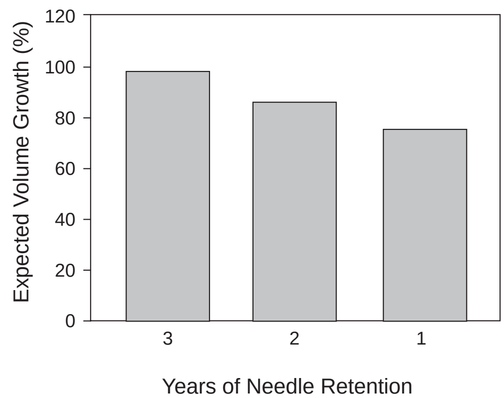

Figure 3. Douglas-fir percent volume growth loss from SNC infection (Maguire, D., et.al. 1998).

Table 4. Impacts of SNC growth loss and western hemlock on BLV (expressed as a percent of expected BLV for 100% healthy Douglas-fir).

Needle retention	100% D-fir	50:50 D-fir:hemlock	100% hemlock
3 years (98% D-fir volume)	100	90	80
2 years (87% D-fir volume)	83	82	80
1 year (75% D-fir volume)	67	74	80

In Table 4, the expected BLV values show that mild or moderate SNC infection (2-3 years of needle retention) may not necessitate a mixed planting based on the assumptions presented above. However, a 100% hemlock planting may minimize losses under conditions of severe SNC infection (only one year of needle retention).

Conclusion

Frequently, reforestation decisions are based on the lowest cost silviculture, but an economic analysis can reveal that a marginal increase in cost that provides an increase in productivity can provide a good return on investment. This analysis of two year growth results showed that the increased cost of BAP's was a break even investment compared to S-8's and provided a better return on investment than plug+1's. Longer term growth responses are needed to see if this trend holds over time.

The intensification of Swiss needle cast (SNC) in coastal Oregon and Washington Douglas-fir has introduced a new element of risk in making silvicultural investments. A sensitivity analysis around the expected BLV's from infected Douglas-fir or planting an alternative species, such as western hemlock, can help reduce risk. This analysis showed that in moderately infected areas a 50/50 mix of Douglas-fir and western hemlock will help reduce risk. In heavily infected areas, a 50/50 mix or 100% western hemlock will help reduce risk.