Guide to the Forest System Model Control Panel

Land Management

General – Non-Industrial Private

Annual development rate
The effective size of the "general" forestlands may be shrinking over time due to expansion of urban areas (particularly in the Southern part of the states) that consumes some forestlands and leaves other lands functionally inaccessible due to fragmentation of parcels. This variable is the annual percent of the whole forest lost to development/fragmentation, and all loss comes from the "general" lands. Varies between none (0% loss per year), low (.25% loss per year), and high (.5% loss per year).

Annual % landowners who harvest
In any given year, only a certain percent of "general" landowners are open to harvesting or part of the annual sawlog market. This number can be increased or decreased.

Fewer owners harvest
In the future, it is possible that the non-industrial private forestlands may become dominated by second homes and wealthier, conservation-oriented, urban people who are not interested in harvesting off their lands. This test leads to a 1.5% per year decrease in the annual percentage of landowners who are willing to harvest. This is not the same as sending land to permanent reserve – the sawtimber will become available eventually as land changes hands etc.

Effect of price on % who harvest
Higher sawlog prices lead more landowners to be willing to harvest. In economic terms, this value is the landowner elasticity. There could no effect, a weak effect (low), or a strong effect (high). Given a 50% increase in sawlog price, the following scenarios would lead to the associated increases in the annual percent of landowners who harvest (for example, in the low scenario, a boost in price from $135 per mbf to $200 mbf, a 50% increase, would lead to the fraction who harvest to rise from 45% up to 58%, an increase of 28%).

None – 0%	Low – 28%	High – 67%

Planning horizon (yrs)
The planning horizon sets the rate at which the "general" landowners who are open to harvesting would be willing to sell their sawtimber size class stock at current prices. It is the number of years over which a landowner plans to sell their sawtimber inventory. Averaged across all the general land holders, a time horizon of 10 would mean that the annual available market volume from the general lands would be $1/10^{th}$ of the inventory on the lands of those willing to harvest. This value can be increased or decreased down to three or up to 15.

Willingness to sell more if price is high
Buyers of sawlogs must offer higher prices when the overall demand exceeds what landowners are willing to sell. This parameter measures how willing the landowners are to sell more at the price increases – the elasticity of supply. "Low" would mean that price will rise strongly as demand exceeds offered supply – "high" would mean the opposite. The following is a measure of how much sawlog buyers have to increase

their price in order to secure a supply that is 20% above the amount that landowners would like to sell at the base price.

Low – 51%	Mid – 18%	High – 6%

Mill Integrated Land

Fraction of acres in plantation

Mill-owned land can be put in plantations, where it grows approximately 40% faster than elsewhere. The model does not track any of the ecological or other side effects of plantations or their financial costs.

Investor Managed Land

Rotation goal (years)

This is the goal for the number of years after which investors harvest their sawlogs. If they fail to meet their return on investment goals, they will decrease the rotation down to the minimum.

Decrease if supply short?

When this is checked, investors will lower their rotation time in order to provide supplies to the mills when sawlogs are scarce. When not checked, investors will adhere strictly to their rotation goal.

Minimum rotation

The investors will never go below this rotation length in their efforts to meet their ROI goals or when trying to meet the supply needs of the mills.

Thinning

When pulpwood prices are high enough, investment landowners will harvest fiber and pulpwood in proportion to their inventory. For example, with an inventory of 30% sawlogs, they will try to harvest 30% sawlogs and 70% fiber. If you choose "less", they will harvest 25% less fiber than normal (less thinning) and if you choose "more" they will harvest 25% more fiber harvest than normal (more thinning).

Fraction acres in easement

Environmental groups can choose to purchase conservation easements from the investors. The goal is to prevent development and to decrease the debt load of land management, which should decrease the revenue level at which they meet their ROI goals (and sustain a longer rotation). The cost of the easements are shown in "Resulting Cost ($M)"

Conservation Managed Land

Rotation goal (years)

This is the goal for the number of years after which conservation owners harvest.

Land Use Scenarios

There are many possible future scenarios for land ownership. Several of them are available for testing with pre-set conditions. You can also change the mix directly by changing the percentages next to each of the ownership categories. Just make sure the total of fractions does not exceed one. Any land use scenarios will phase in between 2000 and 2020.

	Initial values (1970)	1997 (base case)	Reserve (dominated)	Investor (dominated)	Triad
General	65%	52%	47%	42%	**40%**
Mill	20%	13%	3%	3%	**20% (plnt)**
Investor	2%	20%	15%	**40%**	10%
Conservation	4%	5%	**10%**	5%	10%
Reserve	9%	10%	**25%**	10%	**20%**

The Triad scenario also includes 50% of the mill land in plantation.

Total Land Fraction

This box shows the sum of the fractions of land allocated to the various landowner classes. After making changes to the percentages, the value must show "100" and the color must be green.

Future forest growth scenarios (acid rain, etc.)

The future rate of growth in the forest is uncertain. This allows the base growth rate to vary up or down 20%. "Slow" might represent a worst case scenario regarding the effects of acid rain and other effects on Calcium levels. "Fast" might represent an unforeseen boost.

Mill Management

Sawmill Capacity

Ban sawlog export test

In 1997, approximately 25% of the sawlogs in the Northern Forest states were exported to Canada. We therefore assume that the Canadian mill capacity that depends on Northern Forest timber supplies are part of the "region's" mill capacity and are included in the overall sawmill capacity in the model. However, such exports could end at some point. This test policy enacts a one-time reduction in regional mill capacity, equal to the approximate capacity of Canadian mills.

Base Annual Investment

As long as they remain profitable, a region's sawmills will expand capacity to meet demand, either with new mills or added capacity to existing mills. Unless influenced by other factors (particularly the average mill profitability in the region, as primarily driven by sawlog price) the model's regional capacity increases by a fixed fraction every year, assumed in the base case to be 3% and changeable up or down. This does not include increases in capacity as a side effect of new technologies.

Effect of profitability on investment

When the region's mills are, on average, more profitable, the mills attract more capital investment (and therefore expansion) by the individuals or companies that own them. Likewise, less profitable mills are less attractive to investment. This assumption strengthens or weakens this relationship.

Base Capacity Lifetime

Despite continued upgrades and maintenance, eventually a sawmill's infrastructure ages and the mill closes, often making way for a new mill to be built to use the timber supply. The base value is 50 years, but this can be changed.

Effect of profitability on lifetime

Average regional mill profitability affects how long a mill stays open. More profits may lead a mill to receive sustained maintenance and upgrades to keep it operating. More significantly, low profits will lead to a significant reduction of average mill lifetime (i.e., mill closure). This effect of profitability on lifetime can be strengthened or weakened. Given an average 50 year lifetime, if the average ROI were to fall to zero, the following are the average lifetimes under the three scenarios:

Low – 43	Mid – 37	High – 28

Sawmill Operations

Effect of ROI on technology investment

When profitability falls, mills respond by increasing their investment in new cost-saving technologies. Strengthen this effect (high) to assume that technology investments are quite sensitive to profitability. Weaken it (low) to assume that technological improvement is more steady and less driven by changes in profits. Either way, technology has diminishing returns over time.

(Effect of new mill technologies on)
Labor & other cost reduction

One of the ways that new mill technologies reduces costs is by employing fewer people. Computer controlled operations, inventory control, quality control, order fulfillment, and other functions all reduce headcount, as do mechanical sorting and scanning. Further, technologies reduce other fixed costs. Average per-decade reductions for each scenario are:

Low – 3.1%	Mid – 5.2%	High – 8.3%

As reference, one Forest Products Laboratory researcher stated that it was conceivable to cut labor costs 50% from about 1990 to 2020, a reduction of 16.7% per decade. We assumed lower rates over a longer period.

Lumber recovery factor

Different sawmills use different conventions to measure how much of the sawlogs they purchase ends up as lumber and how much as scrap and residues. This measure is the lumber recovery factor, and new technologies increase it through thinner sawblades, computer-aided scanners, curved sawing technologies, and other advancements. Average per-decade reductions for each scenario are:

Low – 1.8%	Mid – 3.9%	High – 6.1%

As reference, a study by the Forest Products Laboratory forecasted a 15% improvement in lumber recovery factor for softwood lumber between 1985 and 2040, an improvement of 2.7% per decade.

Minimum sawlog size

Over the years, sawmills have adapted to saw smaller and smaller diameter sawlogs. Whereas the average diameter once was around 14-15 inches, now many mills are reportedly sawing logs as small as 4-5. This effect changes the amount of the forest that can be used as sawlogs and can be strengthened, weakened, or turned off.

Capacity creep

To install new mill technologies such as sorters, scanners, blades, and saw lines, mills typically replace older equipment with new equipment. The new equipment usually has a higher overall throughput and faster cycle time than the old, leading to a net increase in mill capacity. The result across the region is an increase in overall mill capacity with investments in new technology. This effect can be strengthened, weakened, or turned off.

Lumber Demand

Dynamic lumber price

With this on, lumber price will increase if there is more demand than regional capacity – at least for the short time until competitors from other regions fill the gap! With it off, lumber price will not change.

Effect on lumber demand growth

In the base run of the model, the market for lumber grows at 3.5% per year in 1970, gradually falling to 2.0% in 2010, staying at that level unless there is insufficient lumber supplies to fill the demand. The rate of growth can be doubled or halved.

% local sawlog price increase passed on to lumber price

For niche product such as some hardwoods, it is possible to pass increases in raw material prices to the customer through higher lumber prices. This is the overall percent of sawlog price increases that can be passed on.

Fiber Industry Assumptions

Future of pulp mill industry

The future of pulp mills in the region will be dictated more by global effects than by the regional influences of pulpwood prices, technological advances, and other effects. Therefore, we have assumed three possible futures for the industry in the region.

- *Pulp Mills Persist* – Pulp price continues to decline at 1% per year but mills do not accelerate their closure due to low-to-negative profits. As long as revenue exceeds fixed costs (i.e., mills are cash-flow positive), mills stay open.
- *Pulp Mills Close* – Same pulp price scenario as above, but closure is driven by profitability, not just an assessment of staying cash-flow positive.
- *Crash* – Profitability drives closure and pulp price declines at a faster rate – 2.5% per year.

OSB mill growth test

As pulp mill growth slows, the potential for other fiber-processing capacity such as OSB mills increases. This test introduces 30 mcf/yr of mill capacity to the region, which then grows at 15% per year up to a maximum of 400 mcf/yr, which is roughly one half of the late 1990s regional pulp capacity.

Public Policy Limits

Harvest limit test

Under this policy, public pressure drives the industry to reduce sawlog harvesting if the *reported* sawlog inventory begins to fall. Naturally, this is a long process so there is both a delay in getting the report and the report leading to a negotiated solution.

Supply side or Demand side

Is the harvest limited on the supply side or the demand side? “Supply side” would mean that landowners can sell a limited amount of sawlogs every year. “Demand side” would mean that sawmills could purchase a limited amount of sawlogs every year.

Years between inventories

This is the average number of years between forest inventory measurements, which sets the overall delay time between an inventory drop and a negotiated solution.

Negotiated limit

This negotiated harvest limit is the percent of the current harvest that the industry agrees to set as the maximum for future harvests (as least until inventory starts to rise). For example, 90% would mean that if the reporting inventory is shown to be falling, the industry will agree to a limit of 90% of the previous year’s harvest.