NOVA SCOTIA
Natural Resources

Woodbridge Wood Supply Scenarios

Clearcut Harvest Policy Analysis

An Overview of Procedures Used to Examine Potential Wood Supply Impacts Across Multiple Clearcut Harvesting Scenarios - In Support of a Larger Economic Assessment being Conducted by Woodbridge Associates

1   Introduction

The wood supply scenarios, as presented in this report, are used as part of the Economic Impact Assessment conducted by Woodbridge Associates in 2010/11. Multiple scenarios were designed to provide decision support regarding potential wood supply impacts associated with policy changes intended to reduce the extent of clearcut harvesting. The analysis examines potential wood supply impacts of reducing the annual proportion harvested by clearcut to 50% of the total area within 5 years. This involved estimating a base potential wood supply forecast before harvest policy change, followed by additional scenarios related to achieving the 50% clearcut target. Scenarios also address impacts of applying clearcut targets at various geographic scales as well as the mitigation potential of increasing silviculture investment.

The Nova Scotia Crown Lands Forest Modeling (CLFM) framework[a] was used as the basis for formulating the scenarios. The CLFM framework represented the best option for evaluating the above scenarios under the given time and resource constraints. The key objectives and assumptions for this analysis include:

- Maximizing a short-term even-flow supply of softwood volume with a focus on spruce and fir. The supply could potentially be increased in the medium/long-term yet this consideration is outside the scope of the current analysis.
- Maintaining an even-flow wood supply from each management unit (see Section 2.1).
- Utilizing a standard set of softwood silviculture options that included: plantation, early competition control, and precommercial thinning.
- Having an extended set of options for partial harvesting that included: selection harvest, commercial thinning and shelterwood harvest. The new harvest policy will be mimicked by requiring that the sum of the area of partial harvest treatments (i.e. selection harvest, commercial thinning and 2 stage shelterwood harvests) be at least 50% of the total harvest area by year-5 of the projection.
- Constraining base level silviculture funding rates to harvest (@ $3.00/m³ and $0.60/m³ for softwood and hardwood respectively).
- The framework does not provide any explicit indicator for wood cost and the scenario results represent potential supply without reference to impacts on wood costs.

The CLFM framework, in this circumstance, was applied for high-level strategic analysis where the focus is on the relative change in selected indicators among multiple management scenarios. The primary objective behind this application of the CLFM is to explore relative impacts to potential wood supply, not to design detailed annual allowable cut estimates or operational forest management plans.

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[a] NSDNR. 2010. Nova Scotia Crown Lands Forest Model – Modeling Framework. Forest Management Planning Section, Nova Scotia Department of Natural Resources, Truro Nova Scotia. Unpublished Report.

2   Overview of Model Formulation

The CLFM is an integrated forest information and projection system under development within DNR to assist forest planners in designing management strategies that address a wide range of forest-related values (i.e. fiber, ecosystem, wildlife, and multiple-use) at various geographic and temporal planning scales. Figure 1 below provides an overview of the key components of the system.
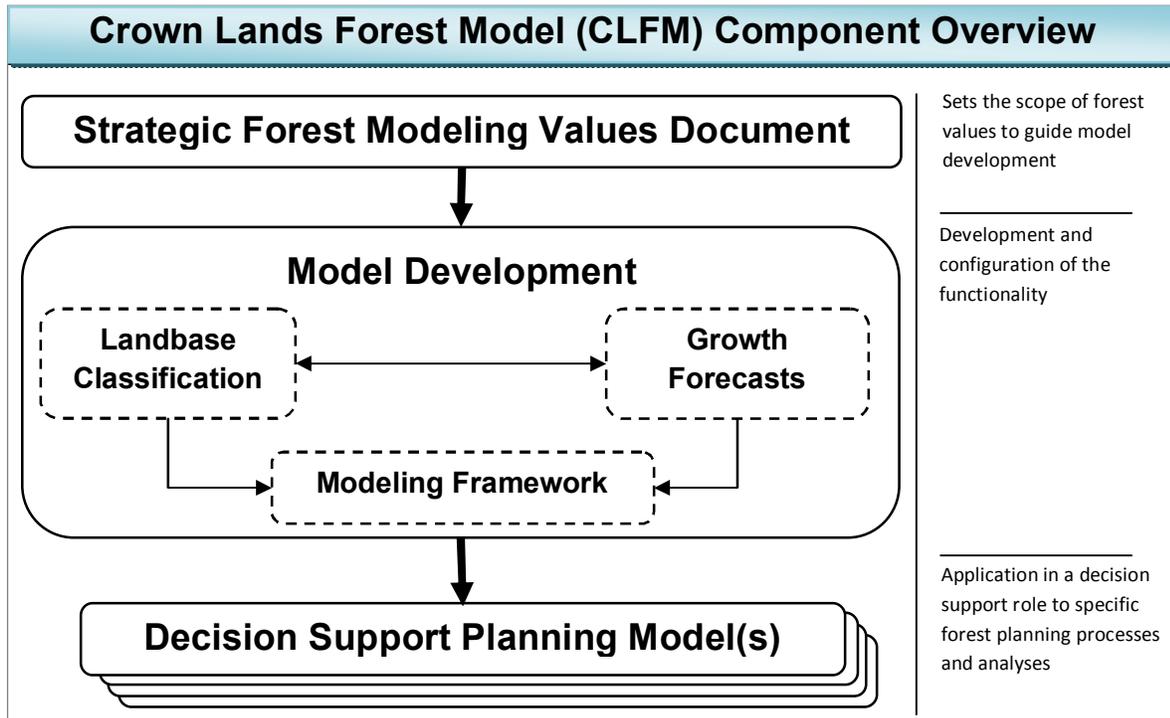

Figure 1. Crown Lands Forest Modeling system overview.

This analysis is a decision support application and uses the development state of the modeling system as of September 2010. The base information and assumptions within the model at that time formed the foundation for structuring the analysis. The following sections touch on some of the key CLFM information and assumptions.

2.1   Landbase Classification

The CLFM landbase classification (version 2010.4) provides the starting area-based inventory for the analysis. The CLFM landbase classification is a spatially explicit merged information database. Though developed primarily for analysis of Crown Land, it contains the entire inventory of forested land in the Province. Some of the main data sources include: NS Forest Inventory, NS Ecological Land Classification, NS Restricted and Limited Landuse Layer, NS Ownership Layer (updated to include the lands purchased by the Province in 2009/10), Crown Land Integrated Resource Management (IRM) Layer. Only a proportion of the total forested landbase was used for supply estimation and is referred to as the 'working landbase'. Working landbase is the forest area available for conventional forest management planning after policy and operational restrictions are applied (i.e. protected areas, water coarse buffers, steep slopes, Integrated Resource Management protected – C3, Oldgrowth, etc.). An additional restriction specific to

this analysis involved the removal of Crown Lands currently under consideration for protection under the 12% Protected Areas objective. A key geographic classification used throughout the analysis was Management Unit (MU). The MU theme breaks the province into eight units based on combinations of administrative region (eastern, central, western), ownership (crown, industrial private, non-industrial private) and crown tenure (NewPage license, Northern Pulp license, unlicensed).

2.2   Growth Forecasts

This analysis utilized the base CLFM natural and managed stand growth forecasts as of July 2010. For natural stands the system uses age-based empirical growth forecasts that are derived from the NS inventory Permanent Sample Plot (PSP) data[b]. Plantation forecasts come from the NS Growth and Yield (GnY) Model[c] which is based on separate research PSP data collected from forest management trials across NS. The GnY model is also used to forecast the natural stand growth response for the precommercial thinning, commercial thinning and selection harvest treatments.

2.3   Management Activities

The CLFM framework has formulations for various harvest and silvicultural management activities. Table 1 provides an overview of each of the activities used for this analysis.

Table 1. Overview of management activities.

Treatment	Description
Clearcut Harvest	The removal of an entire forest unit through a single treatment event. This assumes minimum regulatory retention levels.
Early Competition Control	Control of hardwood competition in naturally regenerating softwood stands by way of herbiciding.
Plantation	Artificial establishment of a new forest stand of native tree species. The scheduling of this activity assumes all competition control and density management is carried out for the targeted survival and free to grow conditions.
Precommercial Thinning	Density and species control on young over stocked naturally regenerating forests
Selection Harvest	The removal of mature trees, either as individuals or scattered groups, at relatively short time intervals repeated indefinitely that encourage the continuous establishment of desired species.
Commercial Thinning	Density and species control within well stocked natural or managed stands where some merchantable fiber is harvested in the process.
Shelterwood Harvest	Removal of an entire forest unit through a series of treatment events within a relative short time to encourage the establishment of regeneration

[b] NSDNR. 2004. Forest Inventory Permanent Sample Plot Field Measurement Methods and Specifications. Forest Inventory Section, NSDNR, Truro Nova Scotia. Forest Inventory Report Version 2004-1.2. 66 pp.
[c] NSDNR. 1993. Nova Scotia Softwood Growth and Yield Model – Version 1.0 User Manual. Forest Management Planning Section, NSDNR, Truro Nova Scotia. Forest Research Report Number 43. 12 pp.

2.4 Major Assumptions

The partial harvest management activities (selection harvesting, commercial thinning, shelterwood harvesting) are central to the analysis and were based on internal research and expert opinion. Knowledge of partial harvesting is less detailed than for clearcut harvest and regeneration. This underscores the caution that should come with interpreting these results.

- **Inventory**: From an inventory perspective the timing of this partial harvesting policy is very important in the sense that the mature commercial inventory (within actively managed units) is presently low and the regenerating inventory is still not eligible to contribute to partial harvesting objectives in the short-term.

- **Partial Harvesting – Eligibility**: The proportion of the current inventory classified as meeting recommended eligibility requirements for partial harvesting (DNR-Selection Management Guidelines[d][e]) was very small in relation to the requirement to achieve the 50% partial harvesting target. For this analysis the minimum eligibility requirements were lowered (for example the total merchantable volume minimum eligibility was lowered from 150m³/ha to 120m³/ha for the commercial thinning and selection harvest activities) to provide enough flexibility for the entire inventory to be managed under a 50% partial harvesting scenario. Sensitivity analysis showed the provincial softwood supply decreasing by as much as 60%, prior to adjusting the eligibility requirements.

- **Shelterwood**: For this analysis the shelterwood harvest method was considered to contribute to the partial harvesting objective. It was modeled on longer rotations that extended to a minimum of 85 years versus the minimum clearcut rotation of 55 years in natural stands and 40 years in plantations. Shelterwood harvest was modeled to be conducted in two stages, with a minimum retention time of two periods (10 years) before final overstory removal. To add some balance an upper limit of 15% was chosen to restrict shelterwood harvest contribution although sensitivity analysis showed that increasing this percentage would lessen supply impacts. Sensitivity analysis also showed the provincial softwood supply decreasing by as much as 25%, prior to allowing shelterwood to contribute to the partial harvesting objective.

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[d] NSDNR. 2010. Tolerant Softwood & Mixedwood Management Guide. Forest Management Planning Section, NSDNR, Truro Nova Scotia. Forest Research Report Number 2010-2. 22 pp.
[e] NSDNR. 2007. Tolerant Hardwood Management Guide. Forest Management Planning Section, NSDNR, Truro Nova Scotia. Forest Research Report Number 2007-8. 21 pp.

3   Overview of Scenarios

The mandated scope of the analysis was specific and involved examining the impacts of the proposed 50% partial harvesting policy on potential wood supply. The policy impacts were assessed at both the management unit level and provincial level. In addition to looking at the impacts the analysis was to have a preliminary look at the potential mitigation that could be achieved by increasing the silvicultural investment (by 50%). This resulted in the requirement to formulate five scenarios (S01, S02a, S03a, S04a and S05a):

1. **S01 [Base]**. This scenario was formulated to represent existing forest management planning that approximates the traditional approach to potential wood supply estimation in NS. In this scenario there is no target on the proportion of area required to be partially harvested.
2. **S02a [Impact – 50% Provincial Target]**. This scenario introduces an objective to have the proportion of area partially harvested at 50% by the end of the first 5-year period. In this scenario the 50% target is a province wide target and therefore the percentage in each of the management units will vary.
3. **S03a [Impact – 50% Target by Management Unit]**. This Scenario is the same as scenario 'S02a' with the only exception being the 50% partial harvest target is being applied to each management unit.
4. **S04a [Mitigation – 50% Provincial Target]**. This scenario introduced measures to mitigate supply impacts resulting from the introduction of partial harvesting target (S02a). This scenario is the same as scenario 'S02a', except that the silviculture budget is increased by 50% as a mitigation measure.
5. **S05a [Mitigation – 50% Target by Management Unit]**. This mitigation scenario is an extension of the impact scenario 'S03a', where the silviculture budget is increased by 50% as a mitigation measure.

4   Scenario Results Summary

Table 1 provides an overview of the estimated changes to the potential harvest levels across each of the five scenarios.

Table 2. Estimated potential harvest level impacts.

Mngt. Unit	Scenario	Estimated Short-Term Harvest (1000's m³/yr)(% change from Base)					
		Softwood		Spruce-Fir		Hardwood	
All	S01	5,117	n/a	4,479	n/a	2,169	n/a
	S02a	4,530	(11%)	3,868	(14%)	1,933	(11%)
	S03a	4,482	(12%)	3,828	(15%)	1,905	(12%)
	S04a	4,862	(5%)	4,193	(6%)	1,963	(9%)
	S05a	4,797	(6%)	4,123	(8%)	1,880	(13%)

[1]All reported potential harvest estimated are gross merchantable volume at min 9cm dbh (diameter at breast height), 7cm top diameter and 15cm stump height. No adjustments were made for 1)Operational Factors (adjacency, etc.) 2)Stand Retention   3)Cull and Wastage or 4)Insect, Fire and Disease Loss.

4.1   Partial Harvest Policy Impact Results:

- *Potential Harvest level*: Compared to the Base (S01) scenario, the forecasted effects on potential softwood supply (mainly spruce and fir) suggest a decrease of ~15% (S03a). All management units were impacted yet management units in the central and eastern regions tended to be impacted to a greater degree than the western region. On average about $^2/_3$ of the estimated harvest volume continues to come from clearcutting.

- *Forest Inventory Conditions* (on Working Landbase): The new policy results in a major shift in the structure of the future forest that management is moving towards. This was evident in differences in the future age class distributions and merchantable inventory. The Base scenario, manages the forest on a 50-60yr rotation with low operable inventory levels. The new policy results in a significant portion of the landbase (~30-40%) being managed on longer rotations or in an uneven-age state. The requirement that the retained portions of partially harvested stands must be held for various wait times, before re-entry, results in inventory levels 3-4 times higher relative to the Base.

- *Silviculture*: The analysis indicated large shifts in the estimated allocation of funding among the various silviculture options. The Base suggests clearcutting ~2% of the Working Landbase (WLB) per year, and planting about 15% of areas harvested with essentially no partial harvesting. The policy impact scenarios generally resulted in clearcutting ~1% and partial harvesting ~1% per year with essentially no planting. The decrease in planting is mainly due to the requirement to fund partial harvesting as a priority within silviculture budgeting constraints.

4.2   Potential Mitigation Results: Increasing Silviculture Investment

The mitigation scenarios examined the potential to reduce policy impacts by increasing the Base silviculture funding level by 50% (i.e. the $3.00/m³ of softwood and $0.60/m³of hardwood investment levels were increased to $4.50/m³ and $0.90/m³ respectively). The increased funding scenarios (S04a, S05a) offset about half of the original policy impact on harvest levels (reducing supply impact from ~15% to ~7.5%). The gain was mainly due to directing the additional funding towards regeneration activities like planting, early competition control and precommercial thinning on clearcut sites.