



PROJECT SUMMARY

Morice & Lakes IFPA projects are exploring ways to enhance forest productivity through a better understanding of factors affecting productivity, through intensive silviculture treatments, by increasing the area of productive forest land, and by improving site productivity estimates.

Ecosystem
Management

Forest Productivity

Public Involvement

Adaptive
Management

Operational Adjustment Factor (I) Analysis for the Bulkley, Morice and Lakes Timber Supply Areas



Fraser Lake Sawmills



Introduction

Under Section 7 of the Forest Act, when the Chief Forester of British Columbia determines the Annual Allowable Cut (AAC), consideration of the growth rates and yield for regenerated stands is one of the factors considered. Growth and yield models assist the Chief Forester in assessing yield in managed stands. TASS, the tree and stand simulation model is an individual tree, distance-dependent, crown-based model used by the Ministry of Forests to approximate yield in managed stands. TASS 'grows' trees in specific spatial stocking patterns. Information used to calibrate the model was derived from research plots measuring tree growth under ideal conditions with even spacing and without gaps. Because of perceived differences between this 'ideal' stand and actual stand conditions, provision for an operational adjustment factor was incorporated in TASS and its associated interpolation program, TIPSYS (Tree Interpolation Program for Stand Yields).

There are two types of operational adjustment factors (OAFs) in TASS: OAF1, which addresses un-mappable stocking gaps and OAF 2, which is meant to address decay, waste and breakage and forest health concerns that are not static over the life of the stand. A type one OAF reduces volume to account for small stock-

ing gaps, espacement patterns, and other factors that may cause parts of the stand to be unproductive relative to what TASS simulates. The current concept promoted in timber supply analysis (by timber supply branch), is that a type one OAF is comprised of four general types of net downs (Pers Comm., Nussbaum, 2001):

- OAF 1a: Non-productive areas e.g. rock outcrops and swamps
- OAF 1b: Management effects e.g. espacement and non-commercial cover
- OAF 1c: Losses due to forest health factors
- OAF 1d: Losses due to random risk factors

The actual reduction necessary to approximate the yield of the average managed stand is not known and current defaults are conservative in order to account for unknowns that are difficult to quantify. On the recommendation of the BC Ministry of Forests (MoF) Research Branch, the default value for OAF1 is 15% for timber supply review purposes, where no local information exists to refine this figure. It is generally recognized, however, that site-specific OAF1 values leading to more realistic default values are required to reflect actual stand characteristics with respect to stocking and tree distribution.

This summary addresses OAFI stocking gaps due to natural areas such as swamps or rocky outcrops, non-commercial cover, slash piles, forest health losses, and windthrow that are not already accounted for in TASS.

Objectives

As a means of increasing the accuracy of predicted sustainable harvest levels from the productive land base, a main objective of this project was to collect sufficient data to obtain localized OAFI estimates. This project is a continuation of a Morice & Lakes IFPA OAFI initiative from 2001 in which substantial data were collected in the Bulkley, Morice, and Lakes Timber Supply Areas (TSAs) for site series that were not previously sufficiently sampled. The primary goal of this project was to augment data already obtained including the testing of the sensitivity of the ground based survey method to critical distance, and determine areas where there is potential for current OAFI defaults to be changed. It is anticipated that any recommendation resulting from this data must satisfy the Chief Forester that a change from the provincially accepted default value of 15% is appropriate.

The development of stocking gap information across the three TSAs for derivation of accurate ground based OAF I values is important in modeling timber supply and it is expected that it will be used in future TASS analyses. The intention is to develop OAFI values by site series as it is expected that site series will be closely correlated with stocking distribution. Based on results from both years, it is expected that OAFI values significantly lower than the default value of 15% will be obtained.

Table 1. OAF I values by site series in the Bulkley, Morice and Lakes TSAs

Analysis Unit	# Of Plots	Pep%	Critical Distance	Total Trees/ha	Planted/Natural	Site Index ¹	Leading Species	Oaf I Value Topsy Ver. 1.3
SBSdk 01	126	2.4	2.7	2895	P	20.0	PI	0
SBSdk 05	52	3.8	2.7	2873	P	20.0	PI	0.2
SBSdk 06	55	5.8	2.7	2815	P	20.0	PI	1.8
SBSdk 07	55	16.4	2.7	1920	P	20.3	PI/Sx	11.0
SSmc2 01B	316	0.9	2.7	2772	P	20.7	PI/Sx	0
SBSmc2 01c	40	2.5	2.7	2700	P	20.0	PI	0
SBSmc2 05/06	176	1.2	2.7	2259	P	20.8	PI/Sx	0
SBSmc2 09	50	10.0	2.7	1826	P	21.6	Sx (PI)	5.2
SBSmc2 10	50	4.0	2.7	1408	P	15.2	Sx	0.4
ESSFmc 01	50	2.0	2.7	3136	P	11.5	PI (Sx)	0
ESSFmc 04	50	0	2.7	2946	P	11.0	PI (BI)	0
ESSFmc 05/06	50	4.0	2.7	2160	P	13.4	Sx (PI/BI)	0.4
ESSFmc 09/10	56	16.1	2.7	1481	P	10.6	Sx (BI)	10.0
ESSFwv 01	50	4.0	2.7	2224	P	12.4	Sx (PI)	0.4
ICHmc1 01	57	0	2.7	2526	P	18.8	PI (Sx/Hw)	0
ICHmc1 03	50	4.0	2.7	1976	P	20.7	Sx/PI	0.4

¹Site index was determined using the growth intercept method where suitable stands existed and through site series correlation where they did not.

Methods

Laing & McCulloch Forest Management Services Ltd conducted the OAFI field sampling in the Lakes, Morice, and Bulkley forest districts during the 2002 field season. The objective was to collect a maximum of fifty OAFI samples per biogeoclimatic site series representing at least 2% of the THLB in any given district, based on the hypothesis that OAFI may be related to site series. Data was collected at each OAF I sample point and was consistent with the *Ground Based Survey Methodology Report 2* (Martin, 1998). However, since the objective was not to determine OAF value for each block surveyed, but rather to determine OAF value by site series, sample intensity differed from that suggested by Martin.

Results

The 2002 field sampling results were summarised and combined with last year's results for analysis by Laing & McCulloch. The summary includes OAFI values for all data combined and by biogeoclimatic zone (BEC). Additional breakdowns were planned (e.g. by District by species,) however, as a result of the repeated achievement of 0% for OAFI values further analysis was not deemed to be useful. A total of 1264 point samples were obtained across the three TSAs between 2001 and 2002 (586 in 2001 and 678 in 2002). Preliminary analysis suggests that a default value of 15% is not appropriate for many sites in the Bulkley, Lakes and Morice TSAs. Field-confirmed OAFI values are much lower (0% in most cases). The summary for each site series is outlined in the table below. (Calculations done using the OAF1 calculator found at <http://www.for.gov.bc.ca/pScripts/hfp/oaf1/Calc.asp>.)

A standard deviation for the random binomial variable *percent empty plots* (PEP) was calculated for each of the site series described above using the formula $SD = \sqrt{\frac{(\# \text{ empty plots} / \text{ total plots} \times \text{ total plots}) \times [1 - (\# \text{ empty plots} / \text{ total plots})]}{n}}$ ¹. Standard deviation for the PEP values was used to determine corresponding OAF values using the MoF calculator (http://www.for.gov.bc.ca/hfp/OAF1/intro_calc.htm). Results of this analysis are shown in Table 2.

Table 2. Standard deviation for OAF values by site series.

Site Series	PEP	OAFI
SBSdk/01	0.7 – 4.1	0.0 – 0.5
SBSdk/05	2.4 – 5.2	0.0 – 1.4
SBSdk 06	4.7 – 6.9	1.0 – 2.7
SBSdk 07	13.7 – 19.1	8.6 – 13.4
SBSmc2/01	0.0 – 2.6	0.0 – 0.0
SBSmc2 01c	1.5 – 3.5	0.0 – 0.0
SBSmc2 05/06	0.2 – 2.2	0.0 – 0.0
SBSmc2 09	7.9 – 12.1	3.5 – 6.8
SBSmc2 10	2.6 – 5.4	0.0 – 1.5
ESSFmc 01	1.0 - 3.0	0.0 – 0.0
ESSFmc 04	0.0	0.0 – 0.0
ESSFmc 05/06	2.6 - 5.4	0.0 – 1.5
ESSFmc 09/10	13.3 – 18.9	7.6 – 11.6
ESSFwv 01	2.6 – 5.4	0.0 – 1.5
ICHmc1 01	0.0	0.0 – 0.0
ICHmc1 03	2.6 – 5.4	0.0 – 1.5

OAFI values for these site series averaged less than 2% on a weighted average basis. Overall, 51 of the 1264 plots (4.0%) had spacing gaps greater than 2.7m critical distance. Only 18 of the 1264 plots (1.4%) had spacing gaps between 3.6m and 4.0m critical distance. Further analysis demonstrates that OAFI estimates are sensitive to critical distance. Table 2 summarizes the standard deviation for OAFI values of selected site series (SBSmc2/01, SBSdk/05,07, and ESSFmc 09/10) by critical distance. When critical distances were decreased from 2.7 to 2.3m, OAFI values increased by 1.0% to 9% and when critical distances were increased from 2.7m to 3.0m, OAFI values decreased by up to 2.4%.

Discussion

In summary, conclusions that can be drawn from the 2001 - 2002 OAFI analysis are:

- The SBSdk/01/05/06, SBSmc2/01/01c/05/06/09/10, ESSFmc01/04/05/06, ESSFwv01, and ICHmc1 01/03 site series have been sufficiently sampled to form a conclusion for an appropriate OAFI value.
- Definitive conclusions can be reached for these areas as the site series in which sufficient data were collected represents a significant portion of the Bulkley, Morice, and Lakes TSAs and the geographic distribution of plots across these areas was reasonably wide.
- It is clear from the results obtained from the 2001 and 2002 OAFI sampling projects that OAFI values in planted stands are very unlikely to be as high as 15% currently used as default.
- Licensees in the Bulkley, Lakes, and Morice TSAs should consider the value of OAFI surveys in identifying opportunities for enhancing stocking to achieve optimum levels. This is particularly true for the ESSFmc 09/10 and SBSdk 07.

Recommendations

It is recommended that an OAFI value of 5% be considered for the following site series:

- SBSdk 01/05/06,
- SBSmc2 01/01c/05/06/09/10,
- ESSFmc 01/04/05/06,
- ESSFwv 01

Based on the 2001 and 2002 field sampling programs and direction from timber supply branch, a value of 5% is recommended for the sites listed above. OAF values for site series representing less than 2% of the land base should be defaulted to the value used for the site series adjacent to it on the edatopic grid, to the extent that they fall into the same broad category of ecological condition (dry poor, mesic mesotrophic, and wet rich).

This figure (5%) is based on the combined results from the 2001-2002 OAFI data in which an OAFI value of 0–1.5% was repeatedly achieved on the aforementioned sites. It also incorporates direction from Albert Nussbaum that future risk must be considered.

For the SBSdk 07 and ESSFmc 09/10 site series, an OAFI value of 10-15% is considered appropriate. It is noteworthy that the OAFI values of 10-11% obtained for these sites were a result of issues with tree quality than with actual stocking gaps even though these sites are often at the extreme ends of the ecological spectrum, where stocking and tree distribution are more likely to be erratic. It is anticipated that the recommended OAF values for the Bulkley, Lakes, and Morice TSAs will satisfy the Chief Forester's requirements for utilizing OAF values that deviate from the provincial defaults for future Bulkley TSA timber supply reviews.

¹ Jay Devore and P. Roxy, *Introductory Statistics, 2nd Ed*, West Publishing Co., 1994

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