Morice & Lakes IFPA

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Morice & Lakes Innovative Forest Practices Agreement

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.

Predictive Ecosystem Mapping Accuracy Assessment (2009)

Introduction

Ecosystem mapping is a potentially useful management tool for forest harvesting silviculture planning, forest yield prediction, wildlife habitat assessment, and measuring and reporting out on ecological indicators. However, for ecosystem mapping to be useful, the relative accuracy or reliability of the final map product must be known.

In 2004 Tweedsmuir Forest administered a Forest Investment Account (FIA) funded, predictive ecosystem mapping (PEM) project for the Morice and Lakes Timber Supply Areas (TSAs). An accuracy assessment determined that the PEM thematic accuracy was below the minimum threshold of the 65% required for approval with ecosystem based timber supply analysis (TSR). Subsequently, Tweedsmuir Forest administered a follow-up project to improve mapping accuracy of the existing PEM. The project was completed by Timberline Natural Resource Group Ltd (Timberline) in 2007. In 2007 - 2008 Bio-Geo Dynamics Ltd (Bio-Geo) completed an accuracy assessment (AA) on the Timberline PEM. The Lakes PEM acheived a map accuracy score of over 65%. The Morice TSA PEM did not. Because of variation in PEM success between audit samples it was calculated that larger sample sets from both TSAs would have to be acquired to ensure reliability of the audit statistics. Therefore additional audit samples were completed in both TSAs in the summer and fall of 2008 and the results analysed. Separate final PEM AA reports were completed in 2009 for both the Morice and Lakes TSAs.

Objective

This summary report briefly reviews the final 2009 Bio-Geo Lakes and Morice PEM AA reports. Methodology and results are given in context of the earlier 2008 Bio-Geo reports.

Methods

Sample area

The sample area included the Morice and Lakes TSAs. Three major biogeoclimatic (BGC) units totalling approximately 78% of the landbase are found within the Morice and Lakes TSAs: the SBSdk, SBSmc2 and ESSFmc. The remaining 22% of the area is comprised of 16 other climatic units, almost half being in elevations above and outside the commercial forest area. The Timberline PEMs and our two accuracy assessments of each, focussed on improvements to mapping the SBSdk, SBSmc2 and ESSFmc climatic units. Only commercially harvestable site series within the three climatic units were scored for accuracy.

Babine Forest Products

BCTS BC Timber Sales Babine

D.L.F.P.

Houston Forest Products

L & M Lumber Ltd.

Fraser Lake Sawmills

CANFOR

Brief Overview of Ecosystem Field Sampling and Identification

In the summer of 2007, Ken Simonar and Saphida Migabo, senior terrestrial ecologists at Bio-Geo Dynamics Ltd., completed field data collection for both TSAs. In the winter of 2007-2008 this data was compiled and analyzed by Ken Simonar. Digitec Consulting assisted with GIS data manipulation.

A level 4 accuracy assessment was conducted according to methods outlined in the following documents:

- A Protocol for Assessing Thematic Map Accuracy Using Small-Area Sampling. Moon et al. (2005)
- Protocol for Accuracy Assessment of Ecosystem Maps. Meidinger (2003).

The primary field assessment technique we employed was the small area sampling protocol employed by Moon et al (2005). The sampling protocol involves establishment of randomly placed equilateral triangle traverses, 1500m long and 500m per side. This is similar to the polygon based line intersect method employed in Meidinger et al (2003) except that the small area method is independent of PEM polygon boundaries while line intercept traverses are entirely within individual polygon boundaries. For more detail on the field methodology for both techniques, please refer to Moon et al (2005) and Meidinger et al (2003)

Sixty sample triangle traverses—30 in each TSA —were chosen in 2007. The ground traverse of each polygon was completed with the aid of GPS units as well as compass and hip chain. Ecosystem boundary changes were recorded on GPS units as well as in field note cards. Ecosystem descriptions for each ecosystem were recorded on ground inspection (GIF) forms. This information was used to assign a site series to the traverse segments.

Statistical analyses on the 2007 field sampling indicated that the both TSAs required more samples to ensure that the results met minimum statistical standards for such audits. It was determined that the Lakes TSA could require up to 3 more samples and the Morice TSA over 30 more additional samples. Subsequently in the 2008 field season 3 more samples were taken in the Lakes TSA and a total of 22 in the Morice TSA.

Office Analysis

Office analyses were completed in two stages. The first stage was setting up the field and PEM mapping data into data comparison tables to enable the second stage, statistical analyses. Both are described below. Notwithstanding the 2007 sampling deficiencies, other AA analyses, described in the following office analysis section, indicated that the Morice TSA failed to pass minimum AA standards while the Lakes TSA passed minimum AA standards.

Data Table Creation

Data table creation is the first step in data analysis. Field data from these transect notes were summarized and analysed according to methods outlined in Meidinger (2003). Data from the field assessment (observed) was juxtaposed with map entities (expected) based on PEM polygon designation. The information was further grouped according to biogeoclimatic (BGC) unit to determine accuracy within a BGC unit and for illuminating error trends. Comparison tables were produced in EXCEL spreadsheets which enabled us to carry out statistical analyses of our results. Two different protocols for data handling and analyses were used in the 2007 assessments and are described below. Each of them has a different comparison table from which standard (Meidinger 2003) statistics are derived.

Small Area Protocol

For creation of comparison tables using the small area protocol the basic unit used is the triangle transect. The sum of lengths of ecosystem sites series field transects intersecting any particular polygon are compared with the ecosystem site series attribute label of each polygon. The sums of the lengths of all the ecosystem sections of ecosystems along the entire field traverse are then compared with the sum of all the ecosystem values of all the polygons that the transect overlaps.

Assessment using Polygon-based Line Intercept Transects of Polygons

Using our triangle transect data, we completed a polygon based line intercept accuracy assessment in 2007. This involves a comparison of overlap values of each section of traverse within each individual polygon to arrive at an individual polygon score between the PEM polygon label and the actual ecosystem composition found within that polygon. Individual polygon scores were then tabulated and analyzed instead of individual triangle scores.

Statistical Analyses

Overview of Statistical Analysis Methods

The two most important analysis methods utilized to assess accuracy of the mapped units on these two datasets are described below. The first of these methods consisted of a comparison of dominant ecosystem unit between observed and expected. Dominant unit was scored as being either right (1) (if the expected dominant unit was the same as the observed) or wrong (0). The right scores were then summed and divided by the total number of assessed polygons to establish a percent of total correct. The second method consisted of assessing the direct percent overlap of expected versus observed polygon or line transect proportions. More detail on these scoring mechanisms and their significance can be found in Meidinger (2003). A third method graphically comparing proportions of actual versus predicted ecosystem for each site series is also useful. It was completed in the 2007 report but not the final report since the error trends would have been similar.

Using Alternate Calls and Area Weighting

If there are ecosystem transitions in the field or if it is impossible to distinguish between two ecosystems on the ground, then the ecosystem proportions score for the traverse can be amended to reflect this uncertainty. If the resultant alternate ecosystem calls give a higher overlap score for dominant correct and percent overlap, then that score is allowed to stand. If PEM databases are to be used for TSR purposes, area weighting of dominant correct and percent overlap scores is very important. (TSR analysis is based on area.)

Results and Discussion

Tables 1 (Lakes TSA) and 2 (Morice TSA) show small area method, statistical summaries 2007 and 2008. It was determined during the 2007 analyses that that the small area PEM AA method was the most statistically rigorous. For this reason only the polygon based line intercept method analyses was replicated in 2008-2009. In the Lakes TSA, both the 2007 and 2008 sample sets resulted in the dominant correct and percent overlap statistics passing the minimum accuracy threshold of 65% required for ecosystem based TSR. The increased Lakes 2008 sample set met the 95% confidence limits for sample size.

In the Morice TSA the 2007 dataset marginally met the minimum 65% threshold for area weighted, alternate ecosystem, dominant correct, if rounded up to 65%. The additional Morice TSA sampling in 2008 resulted in a pass for all dominant correct statistics. The 2007 Morice TSA dataset percent overlap statistics were all well below the 65% minimum threshold. The 2008 dataset resulted in a very marginal fail of 64.2% for area weighted alternate ecosystem percent overlap score. Reappraisal of sample size indicated that it exceeded the 95% confidence level.

Analysis completed in our first report indicated that the two subhygric ecosystems, SBSmc2 05 and 06, were virtually impossible for PEM mappers to differentiate. In addition these ecosystems have virtually identical tree species site indices, and forest management interpretations. If these ecosystem site series are combined in the 2008 dataset then all predictions of percent overlap pass the minimum threshold score of 65%. These are shown on the bottom of Table 2.

Table 1 Lakes TSA, Small Area Method, Dominant Correct and Percent Overlap Scores 2007 and 2008.

Statistical Operation and Year	No.	% Basic Score	% Alternate Ecosystem Score	% Area Weighted Basic Score	% Area Weighted Alternate Ecosystem Score
Dominant Correct					
2007	33	82.4	82.4	82.4	82.4
2008	36	75.7	75.7	75.7	75.7
Percent Overlap					
2007	33	67.7	67.7	68.6	68.6
2008	36	68.1	69.1	68.1	69.1

Table 2 Morice TSA, Small Area Method, Dominant Correct and Percent Overlap Scores 2007 and 2008.

Statistical Operation and Year	No.	% Basic Score	% Alternate Ecosystem Score	% Area Weighted Basic Score	% Area Weighted Alternate Ecosystem Score
Dominant Correct					
2007	31	61.3	64.5	61.3	64.5
2008	53	67.9	71.7	67.9	71.7
2008 merged*	53	66.0	69.8	66.0	69.8
Percent Overlap					
2007	31	59.0	60.0	60.0	60.0
2008	53	62.5	64.2	62.5	64.2
2008 merged*	53	66.2	67.5	66.2	67.5

**SBSmc2 05 and 06 combined into one PEM map unit.*

Recommendations

Lakes TSA

1) The Lakes TSA has passed the minimum standards required for ecosystem based timber supply analysis. Ecosystem based timber supply analysis is considered to be a more accurate reflection of true forest stand productivity and therefore should be used in forest productivity analyses for the Lakes TSA as well as for other forest management applications

2) As our knowledge of ecosystems expands, the Lakes TSA PEM knowledge base used for predicting ecosystem distribution across the landscape should be continuously improved.

Morice TSA

1) The Morice TSA marginally failed the minimum standards required for ecosystem based timber supply analysis for area weighted alternate ecosystem percent overlap. However it is extremely close to a pass and should be considered as a pass for TSR purposes. If merging of two almost identical ecosystems (the SBSmc2 05 and 06) are allowed in the Morice TSA, the PEM mapping for this TSA passes minimum AA standards for ecosystem based TSR.

2) As our knowledge of ecosystems increases, the Morice PEM knowledge base used for predicting ecosystem distribution across the landscape should be continuously improved.

References

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Contact

Ken Simonar, Senior Ecologist,
Bio-Geo Dynamics Ltd.
Prince George, B.C.
Tel: (250) 964-6004
Email: mail@biogeo.bc.ca

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For more information on the Morice & Lakes IFPA, please contact:

Jim Burbee, RPF, IFPA Manager
c/o Tweedsmuir Forest Ltd.
3003 Riverview Road
Prince George, B.C. V2K 4Y5
Tel: 250-564-1518
e-mail: venturefc@telus.net

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www.moricelakes-ifpa.com