



PROJECT SUMMARY

Ecosystem
Management

Forest Productivity

Public Involvement

Adaptive
Management

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.

Morice And Lakes Timber Supply Areas Predictive Ecosystem Mapping Accuracy Assessment



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 (PEM) mapping project of the Lakes and Morice Timber Supply Areas (TSAs). An accuracy assessment determined that the PEM thematic accuracy was below the minimum threshold of the 65% required for approval for use for ecosystem based timber supply analysis. Subsequently, Tweedsmuir Forest administered a follow-up project to improve mapping accuracy of the existing PEM. This project was completed by Timberline Resource Group in 2007.

Objective

A second PEM accuracy assessment was tendered by Tweedsmuir Forest in 2007. Bio-Geo Dynamics Ltd was chosen to undertake the second accuracy assessment. Two separate accuracy assessment reports were completed; one for each TSA. This summary

report deals specifically with the Bio-Geo Dynamics Ltd. 2007 audit results and recommendations for the Morice and Lakes TSAs PEM mapping projects.

The accuracy assessment results for each TSA have a strong bearing on the usefulness of the PEM as a tool for forest management interpretations. A high mapping accuracy is desirable for all resource uses. A minimum threshold score of 65% is required for ecosystem based timber supply analysis. Passing that threshold is a key benchmark for ecosystem mapping projects throughout the province.

Methods

Sample area

Three major biogeoclimatic (BGC) units are found within the Lakes and Morice TSAs. The SBSdk, SBSmc2 and ESSFmc together total approximately 78% of the landbase. 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 second PEM and our accuracy assessment of it, focussed on improvements to mapping the SBSdk, SBSmc2 and ESSFmc climatic units. Only commercially harvestable site series within the three climatic zones were scored for accuracy.

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 the 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 were chosen; 30 sample triangles in each TSA. 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.

Office Analysis

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 on our results. Two different protocols for data handling and analyses were used 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 is 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 with.

Assessment using Polygon based Line Intercept Transects of Polygons
Using our triangle transect data, we completed a polygon based line intercept accuracy assessment as well. This involved 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

Three analysis methods were utilized to assess accuracy of the mapped units on these two datasets. 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). The third method consists of showing graphically the proportions of each site series found in the sampled data compared with that predicted by the PEM mapping. This can point out possible error trends in the PEM mapping, which may be useful in making mapping rule adjustments

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. TSR analysis is based on area. In PEM accuracy assessment area is relevant as well, to give credit to larger than average polygons which may represent a significant proportion of the landscape. Area weighting of dominant correct and percent overlap scores is thus standard accuracy assessment procedure.

Results

The small area assessment technique generally displayed approximately 10% higher accuracy for dominant ecosystem correct for both the Morice and Lakes TSAs. The percent correct overlap score was also slightly higher (less than 5% higher) using the small area assessment technique rather than the polygon based line intercept method. The accuracy assessment scores using the small area assessment protocol, for both the Lakes and Morice TSAs, are shown in Tables 1 and 2 respectively.

Table 1. Lakes TSA, Small Area Method, Dominant Correct and Percent Overlap by Subzone (Variant).

Statistical Operation	N	BGC Unit	% Basic Score	% Alternate Ecosystem	%Area Weighted-Basic Score	% Area Weighted Alternate Ecosystem
Dominant Correct	5	ESSFmc	80	80	80	80
	11	SBSdk	72	72	72	72
	17	SBSmc2	89	89	89	89
	33*	TSA Total	82.4	82.4	82.4	82.4
Percent Overlap	5	ESSFmc	56	56	57	57
	11	SBSdk	70	70	71	71
	17	SBSmc2	70	70	71	71
	33*	TSA Total	67.7	67.7	68.	68.6

*Note that total transects equal 33 instead of 30 because of subzone lines splitting traverses

Table 2. Morice TSA, Small Area Method, Dominant Correct and Percent Overlap by Subzone (Variant).

Statistical Operation	N	BGC Unit	% Basic Score	% Alternate Ecosystem	%Area Weighted-Basic Score	% Area Weighted Alternate Ecosystem
Dominant Correct	6	ESSFmc	67	83	67	83
	8	SBSdk	38	38	38	38
	17	SBSmc2	71	71	71	71
	31*	TSA Total	61.3	64.5	61.3	64.5
Percent Overlap	6	ESSFmc	56.5	60.5	55.6	60.5
	8	SBSdk	54.7	55	54.7	55
	17	SBSmc2	61.28	61.4	61.28	61.4
	31*	TSA Total	59	60	60	60

*Note that total transects equal 31 instead of 30 because of subzone lines splitting traverses

Discussion

Lakes TSA

In the Lakes TSA the percent dominant correct and percent overlap accuracy scores are all well above 65% except for the percent overlap score for the ESSFmc. The area weighted alternate ecosystem score is the most relevant for timber supply purpose in that it surpasses the minimum accuracy score of 65% for both dominant correct and percent overlap statistics.

Morice TSA

In the Morice TSA the area weighted alternate ecosystem correct score for dominant correct falls just barely below 65% while the area weighted alternate ecosystem percent overlap presently

stands at 60%. These scores are below the minimum accuracy standard of 65% required for ecosystem based timber supply purposes. Even though the Morice TSA shares the same climatic units with the Lakes TSA, PEM mapping was less accurate and the audit results more variable in the Morice TSA.

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 local ecosystems expands, the PEM knowledge bases used for predicting ecosystem distribution across the landscape should be continuously improved.

Morice TSA

- 1) The Morice TSA has failed the minimum standards required for ecosystem based timber supply analysis. To raise mapping accuracy to the 65% minimum threshold standard the following are required.
 - a. Improve the existing PEM knowledge base in order to better predict ecosystems within the landscape. This should be based on error trends revealed by the 2007 accuracy assessment.
 - b. Because of the greater inherent ecosystem variability of the Morice TSA, 35 more audit traverses must be completed in order to attain a statistically reliable estimate of map accuracy.
 - c. If required to further improve PEM accuracy, consideration should be made of combining ecologically and productively similar ecosystems into single mapping entities for the purposes of timber supply analysis. This has been undertaken in other jurisdictions where mapping accuracy was close to the minimum required accuracy threshold.
- 2) As our knowledge of local ecosystems increases the PEM knowledge bases used for predicting ecosystem distribution across the landscape should be continuously improved.

References

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Morice & Lakes

IFPA

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