ESSF High Elevation Subzone Mapping in the Bulkley Timber Supply Area

Progress Report 2003

Prepared for:

J. Baker
FIA Administrator for
Pacific Inland Resources
Smithers, British Columbia

Prepared by:

Boreal Research and Development Ltd.
Smithers, British Columbia

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BACKGROUND

Pacific Inland Resources (PIR, A Division of West Fraser Mills Ltd.) initiated a pilot project in 1999 to address where an upper elevation operability line should be placed for forest planning and modeling in the Bulkley Timber Supply Area (TSA). During the 1999 pilot project, an ecotone was recognized between mid-elevation Engelmann Spruce – Subalpine Fir Zone (ESSF) forests of relatively average productivity, to a zone that was characterized as low productivity (Trowbridge 2000).

In continuation of the pilot project in 2000 and 2001 (Trowbridge 2001, Trowbridge 2002), we proposed to:

1. define a new biogeoclimatic unit and site classification that would identify this ecotone (and ecosystems) of low forest productivity, and;
2. have this biogeoclimatic unit be considered as an option for establishing a biological/elevational limit to industrial forestry operations¹.

At that time, this ecotone was termed “ESSF Upper Forest phase” (ESSFu), and primarily reflected productivity restraints due to harsh climate and sensitive environments through plant species composition and structure. All reporting and mapping in this study applied that terminology up to April, 2002. Provincial biogeoclimatic correlation recommended treating all similar high elevation ESSF transition zones in the Province as “woodland” subzones (ESSFw) (Trowbridge et al. 2002). The terminology in this current report is consistent with that latest recommendation.

BIOGEOCLIMATIC AND ESSF HIGH ELEVATION SUBZONE MAPPING

Except for the (former) Kamloops Forest Region², most current, and all older, biogeoclimatic ecosystem classification (BEC) mapping in the Province of British Columbia was prepared and approved at a scale of 1:250 000 (current BEC mapping is cited as “BIGBEC”, older versions are termed “Legacy BEC” by the Ministry of Forests). BEC is, in essence, a map of regional climates that have been characterized by climax vegetation.

¹ An upper elevation boundary is one factor that defines “operability” in the forest land base. Many other factors are also considered in netting-out areas not suitable for industrial forestry operations.
² Kamloops Forest Region re-visited all BEC units and site series over the past five years, and updated Regional BEC mapping to 1:50 000 scale.

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PIR’s BEC mapping of the ESSFw subzones (mcw, mkw, and wvw) in the Bulkley TSA has been prepared and presented at 1:50 000 scale. This boundary, in general, is found directly below the ESSF parkland (ESSFp), and above the middle elevation ESSF forested subzones. Less frequently, the ESSFw subzones may occur as the upper most BEC unit in high elevation ESSF topography that does not have either ESSFp or Alpine Tundra above it, typically as “islands” of exposed mountain tops and ridges, generally above approximately 1400 m in elevation.

Mapping in the Telkwa and Babine River Landscape Units (LU’s) was prepared by first applying a digital elevation model (DEM), using elevation and aspect rules to approximate the lower boundary for the new ESSFw subzones, themed onto satellite images. We then corrected the DEM manually to better represent data based on our plot samples, field transect notes, and helicopter reconnaissance. These two mapped LU’s provided the base data and photo signatures for what we have termed “1st approximation” mapping. In the remaining TSA LU’s, ongoing mapping has been completed in stages as resources allowed, without DEM’s, helicopter reconnaissance, or field sampling. The 1st approximation ESSFw lines have been drawn at 1:50 000 scale on satellite images, relying entirely on interpretation of aerial photos, contours, and our previous experience.

The first approximation ESSFw mapping of the remaining LU’s will require ground truthing to assess a level of reliability, and corrections to all maps will undoubtedly need to be made over time. Relative reliability of the maps are indicated on all ESSFw LU map legends (i.e. moderate to good for sampled areas, and 1st Approximation for un-sampled areas). None the less, we feel that the ESSFw mapping at 1:50 000 can be expected to be as reliable as current 1:250 000 BEC maps. Our mapping of the ESSFw subzones in the Bulkley TSA has lead to a number of recommended corrections to adjoining BEC-mapped parkland in the TSA.

CURRENT PROJECT

This year we completed 1st approximation mapping in seven more LU’s of the Bulkley TSA. Table 1 lists all the Bulkley LU’s, their respective ESSFw reliability estimates, and year the mapping was completed. The Nilkitkwa LU remains unmapped
because the landscape is atypical in the TSA, and will require field sampling in order to assure correct photo signatures and key elevation data points. Because only relatively small areas within the Bulkley LU included ESSFw subzones, we combined mapping of those ESSF high elevation woodlands with adjacent LU’s (Corya_Bulkley and Trout_Bulkley). A small section of the northernmost Telkwa LU (Miller Creek to western-most ski hill area) is included in the Trout_Bulkley, because it had not been identified as part of the Telkwa watershed when the original ESSFw mapping was completed in 2000.

Table 1. List of ESSFw landscape unit maps, their estimated reliability, and year completed.

<table>
<thead>
<tr>
<th>Landscape Unit(s) maps</th>
<th>Estimated reliability</th>
<th>Year completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Babine River</td>
<td>Moderate to good</td>
<td>2001</td>
</tr>
<tr>
<td>Blunt</td>
<td>1st Approximation</td>
<td>2002</td>
</tr>
<tr>
<td>Chapman</td>
<td>1st Approximation</td>
<td>2003</td>
</tr>
<tr>
<td>Copper</td>
<td>1st Approximation</td>
<td>2003</td>
</tr>
<tr>
<td>Corya_Bulkley</td>
<td>1st Approximation</td>
<td>2003</td>
</tr>
<tr>
<td>Deep Creek</td>
<td>1st Approximation</td>
<td>2003</td>
</tr>
<tr>
<td>Harold Price</td>
<td>1st Approximation</td>
<td>2002</td>
</tr>
<tr>
<td>Kitsequecla</td>
<td>1st Approximation</td>
<td>2002</td>
</tr>
<tr>
<td>Nilkitkwa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reiseter</td>
<td>1st Approximation</td>
<td>2003</td>
</tr>
<tr>
<td>Telkwa</td>
<td>Moderate to good</td>
<td>2000</td>
</tr>
<tr>
<td>Torkelson</td>
<td>1st Approximation</td>
<td>2002</td>
</tr>
<tr>
<td>Trout_Bulkley (Telkwa)</td>
<td>1st Approximation</td>
<td>2003</td>
</tr>
</tbody>
</table>

3 The Nilkitkwa LU is the northern-most LU in the Bulkley TSA. It consists mainly of higher elevation forests and extensive alpine tundra. A large extent of the ESSF mc subzone in the Nilkitkwa LU is comprised of a mosaic of interspersed wetlands with relatively open, low productivity woodlands. The productive landscape for industrial forestry appears to be only in areas that are well drained, both in terms of cold air and soil moisture. These more productive forests are restricted to better drained soils on moderate to steep slopes, primarily in the southern portion of the LU, and along the west slopes of the northern Bait Range. The climate appears to be very snowy and cold throughout much of the year, snow cover is persistent well into late spring and early summer, resulting in a very limited growing season before late summer is beset with the beginnings of winter. It did not prove helpful to apply the same attributes and aerial photo signatures used from other LU’s to the south, in order to delineate the ESSF mcw from the ESSF mc in the Nilkitkwa LU. Field sampling and further study will be required to complete the ESSFw mapping in this LU.
1ST APPROXIMATION MAPPING METHODS

The LU’s were prioritized by PIR, and all cartography this year was completed by the GIS department at Silvicon Services Ltd. in Smithers. We received satellite images and air photo coverage (in as much as possible) for each LU from the Ministry of Sustainable Resource Management (MSRM), the Bulkley/Cassiar Forest District, and PIR. Using all satellite images, photos, and TRIM contours, we interpreted environmental attributes and photo signatures to draw the 1st approximation ESSFw BEC lines onto mylar overlays, and which were subsequently digitized. Draft maps were produced for review and editing, and then final maps and digital files were prepared. Isolated “islands” less than 50 ha in size, photo-typed as potential ESSFw on mountaintops and ridges, were presumed to be expressing edaphic attributes, and were not delineated as ESSFw subzone polygons in this sequence of 1st approximation mapping.

DISCUSSION AND RECOMMENDATIONS

Digital Elevation Models and ESSFw mapping

The initial use of DEM’s did not prove to be satisfactory 1) in narrow, steep valleys terminating in glacial landscapes or high elevation passes, 2) as our mapping moved out of the Telkwa watershed and into other LU’s where the ESSFw was found at higher or lower elevations, and 3) at our scale of 1:50 000 compared to BEC mapping at 1:250 000. DEM’s are likely sufficient in small scale mapping (e.g. 1:250 000) where general concepts are required, and errors of accuracy are overshadowed by the scale of mapping.

In a very general manner, the ESSFw in the Bulkley TSA was found at higher elevations in the interior, on warmer aspects, and where topography encouraged rapid cold air drainage. The ESSFw was found at lower elevations as it approached the ICH and coastal mountains, on cold aspects, and where topography restricted cold air drainage. Further calibration, attribute improvement, and smaller landscape units (large polygons) of ESSFw DEM’s will be required before they can be widely used to model high elevation ESSF woodlands.

In lieu of having acceptable DEM’s at present, we recommend that mapping of the ESSFw and MHw (Mountain Hemlock woodlands) in the Province employ 1st
approximation mapping as described in this report, followed by sampling and ground-truthing, and finally editing and correcting the initial maps to a determined reliability and accuracy. We also recommend that all future BIGBEC mapping bring into play the scale of 1:50 000.

**Estimating the ESSFw spatially with adjoining BEC units**

If the spatial extent of the ESSFw subzones is to be estimated, the result would be affected by the reliability and accuracy of adjacent BEC unit lines. For example, because the ESSFp forms the upper boundary of the ESSFw subzones in most all cases, accuracy of the ESSFp line would become important in the error associated with estimating the extent of ESSFw subzones below it. Likewise, if the lower boundary of the ESSF (upper boundary of the SBS mc2 and ICH mc1) is not accurate, then the proportion of the ESSF occupied by the ESSFw would be dependent on the accuracy of the mapped SBS mc2 or ICH mc1 subzones. Errors associated with estimating the spatial area of the ESSFw can be attributed as well to the difference in scale of BEC mapping (1:250 000), and the scale of ESSFw mapping (1:50 000). Not often well understood, BEC can be, and often is, presented at any chosen scale when overlaying this theme onto other resource inventories and maps (e.g., onto 1:20 000 forest cover maps).

While the ESSFw subzone is estimated to be an elevational band of approximately 75-150 m (Trowbridge and Banner 2002), there are a number of areas where this appears larger or smaller than that, when the ESSFw theme is combined with BEC lines on our satellite images. The ESSFp BEC lines have been found to be inaccurate in some areas of each landscape unit studied in this project. A number of those areas were identified, and sent on for review to the Ministry of Forests in 2001 (e.g. areas associated with the Netalzul wetlands and the northeast slopes of the Blunt Range). If the upper boundary of the ESSFw subzones become an important theme in strategic planning, ESSF parkland lines will have to be corrected in order to accurately display and estimate the area of ESSFw spatially, given the current BEC inventory.

The SBS mc2 and ICH mc1 have also been broadly mapped at 1:250 000 scale, assisted by DEM models. In some cases, we feel that the SBS mc2 and ICH mc1 boundaries are mapped at higher elevations than what is actually found on the ground, and therefore can present an inaccurate representation to the extent of the mid-elevation
ESSF forests, in comparison with the ESSFw theme in these areas. Because it was not part of the terms of reference for this project, or part of our contract schedules, we could not justify spending more time than we did identifying and correlating BEC lines other than the new ESSFw in the Bulkley TSA.

Current status of the Bulkley TSA ESSFw mapping and site classification

1st approximation ESSFw BEC mapping at 1:50 000 scale for the Bulkley TSA is complete, with the exception of the Nilkitkwa LU. The Telkwa and Babine LU maps do not require further field sampling when used for strategic planning. However, because these two LU’s employed a DEM in un-sampled areas, some inaccuracies will undoubtedly be found as site prescriptions and field operations approach the mapped boundaries. The Telkwa and Babine River ESSFw maps identify locations of the sample transects and plots for reference to ground-truthing.

The 1st approximation mapping of the ESSFw in the remaining LU’s will require field sampling to assess a level of reliability. However, as stated earlier in this report, we feel that the initial Bulkley TSA ESSFw mapping at 1:50 000 is likely to be as reliable and accurate as current 1:250 000 BEC mapping.

A preliminary author’s draft of ecological site classification for all ESSFw site units in the Bulkley TSA was prepared as a Supplement to the Prince Rupert Regional Field Guide in 2002 (Trowbridge and Banner 2002), and circulated to local industry and government forest workers and ecologists. Operational activities and site prescriptions should always rely on field visits to verify ESSFw boundaries and site classification, using the ESSFw site classification supplement. As well, interpretive prudence should be used when applying the ESSFw mapping theme as an overlay with other resource inventories and planning maps of scales other than 1:50 000.
ACKNOWLEDGEMENTS

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- Bulkley/Cassiar Forest District: Bob Shiach
- Boreal Research and Development: Aaron Trowbridge

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