CHASE MODEL UPDATES FOR PINE-LICHEN LICHEN HABITAT TYPES (PRR AND PLWR) (SEPTEMBER 9, 2004)

To date, most maps associated with pine-lichen woodlands presented to the Northern Caribou Recovery Implementation Group for North-Central BC have been of low elevation pine-lichen winter range (PLWR) modelled using CHASE - PLWR v. 10b sub-model[1].

In addition to low elevation sites there is a subset of pine-lichen woodlands that are used through the late fall months that occurs at mid elevations. These areas have been referred to as post rut range (PRR) and were not modelled in version 10b of CHASE. A general observation is caribou use the post rut range in the late fall prior to snow accumulations/conditions becoming unfavourable for foraging. As the snow dictates, animals migrate to lower elevation areas where snow levels/conditions are less restrictive. At the end of July an initial run of a Post Rut Range model v11c was presented to the RIG.

The PLWR v. 10b sub-model was used as the bases for the development of the PRR model. During the modification/updating of the model, some inconsistencies were found and issues addressed to ensure subsequent models were founded on the intent of the original models. In turn 2 channels of activities were completed.

1. Identify inconsistencies and fix problems
2. Update the PLWR to provide the ability to identify PRR.

Addressing Inconsistencies

While developing the PRR model we noticed three issues with how the model was compiling information:

1. Ecological Mapping input data was not being read into the model properly;
2. The PLWR model lacked the appropriated cumulative probability tables for the use of forest cover input data; and,
3. Stand age had not been set to the optimal parameter to allow us to identify all the sites that had the highest capability of producing terrestrial lichen.

Ecological Mapping Input Data

Over the past years of model development, subtle changes have occurred in the reading and synthesising of input data. In the instance of ecological mapping, the methods applied to 'tag' the source information and the subsequent relationships of the data had been changed; thus, the relationships that we were trying to model had been broken. Though all scripts appeared to be functioning properly we found on a close inspection of

[1] McNay, R. S., K. L. Zimmerman, and R. Ellis. 2003. Caribou habitat assessment and supply estimator (CHASE): Using modeling and adaptive management to assist implementation of the Mackenzie LRMP in strategic and operational forestry planning. Wildlife Infometrics Report No. 55. Wildlife Infometrics Inc., Mackenzie, BC. 115pp.

the resultant data, that the model was not compiling information correctly. The problem has been corrected to ensure ecological mapping information is used where it is available.

Forest Cover Input Data

In areas where ecological mapping is not available, forest cover data is relied on as a key source of input data for identifying terrestrial lichen sites. In the v. 10b sub-model a query (outside of the Netica model run) of forest cover information (.fc1) was made to find low productivity sites based on the theory they would correlate directly with dry nutrient poor types. This value was then inserted as a surrogate into Netica for the ecological unit node. The problem, however, is the ECO: Ecological Unit node was weighted very high in the TLHC: Terrestrial Lichen Habitat Capability cumulative probability table. Thus, when using only forest cover information, a cell could be spruce leading and result in a >65% probability of providing favourable lichen conditions (a situation that doesn't occur). The filtering that was previously done with the BGC node, however, negated this error as the v. 10b sub-model didn't permit lichen types outside dry BGC variants or the mk2 variant. Likewise, with previous runs of the Wolverine herd area, the majority of the area within the dry and mk2 variants had ecological mapping as a base.

The change to the model that was made to address this problem was the addition of a forest cover input node (referencing Site Index state values), addition of a state value of "Not Classified" at the ECO node, and an updating of the CPT at the TLHC node to accommodate the additional input state values. The CPT at the TLHC node was updated such that all probabilities that were previously modeled in v10b were maintained (i.e. if ecological information is available then site index has no influence) and new probabilities incorporating site index were developed.

Stand Age

During the evaluation of the previous runs of the model we noticed that there were inconsistencies associated with the input parameters of stand age for selecting "capability". Some runs had stand age set for optimal parameters where as others used existing age. All current runs of "capability" now have stand age set to optimal parameters (i.e. 70 to 140 years).

Model Updates to Identify PRR

The v10b had many of the components necessary to identify PRR, with the exception of a means to fine tune where snow accumulations in the mid-elevation may be favourable for foraging during the fall and where they may not. To construct the PRR model the v. 10b PLWR model was updated, thus, the one model is run twice, once for each range type, to generate the resultant maps. The purpose for this approach was to avoid a redundant construction of a sub-model, however, two runs are required because PLWR and PRR are not necessarily mutually exclusive range types. A "Range" node was inserted as a switch to enable independent runs (the Range node is identified as a red node in the model diagram(s) below).

To develop the PRR range model a node called 'Sol_Load: Solar Loading' was added as a parent node to "PLWR_PREF: PLWR Habitat Preference'. The input values for the Sol_Load node rely on an algorithm that calculates the short-wave solar radiation that a site is exposed to given various geographic and terrain factors. The intent of using the solar loading algorithm was to identify cells (areas) that should have enough solar heating to result in a reduction/delay in snow accumulation through the fall months (October and November). The Sol_Load node is merged with the ELE: elevation and BGC: biogeoclimatic subzones nodes to predict the value of sites for providing PRR.

During the development of the PRR/PLWR sub-model (v. 12c) the BGC node was evaluated for the different state possibilities. In the PLWR v. 10b sub-model the state values for this node were "BWBSdk1 and SBSmk2" and "Other Variants." The intent with this classification of states was to capture areas that had lower snow levels through the winter. Upon evaluation of available climate data the breakdown of state values was inconsistent with the data. In particular the mk2 was classed as a low snow zone where as the mk1, which receives the same amount of snow was classed as a high snow zone (Table 1). In the v. 12c sub-model the BGC: Biogeoclimatic Variant node has been changed to contain 3 state values: dry, moist and wet, and the relationship of snow accumulation that were previously capture with the designation of the mk2 as a dry subzone in the v. 10b sub model has become a more explicit function of the BGC node and ELE: Elevation node in the v. 12c sub-model.

Table 1. Climate Data Summaries for the Biogeoclimatic zones that are within the Chase, Wolverine and Takla herd areas. Data is summarized from Version 4 of the provincial list Climatic Data Summaries (1997) prepared by Meidinger and Reynolds.

BCG	Varient	Mean Annual Precip	Mean Winter Precip	Mean Snow	Mean Annual temp	Temp Range
BWBS	dk1	417	221	177	-0.2	-1.9 to +2.0
SBS	dk	480.6	267	188.1	2.1	+0.8 to +3.5
SBS	dw3	494.4	270	204.2	2.6	+1.3 to +3.5
SBS	mc2	574	354	237	1.5	-0.7 to +3.6
SBS	mk2	748	434	337	1.2	+0.7 to +1.9
SBS	mk1	727	444	306	1.5	-0.2 to +3.3
SBS	wk2	862	598	786	1	-0.1 to +1.7
ESSF	mv3	750	400	500		
ESSF	mvp3	800	450	500		
AT	un	1460		1265	-0.8	-1.8 to +0.2

Notes:

2) Shaded cell background indicates subzones that were classified as "low snow" in the PLWR sub-model v. 10b.
3) Red/Light Text indicates zones values based on estimates extrapolated from other areas of the province.

General Trends modelled in PRR/PLWR v. 12c

Winter Range

Revisions of the model structure, especially the BGC node had an influence on the development of the cumulative probability table for the winter range run of PLWR_PREF node. The focus of all development for the v. 12c sub-model was to maintain the same relationships that were modelled in v. 10b. To do this the basic rules established in the v. 12c sub-model were:

- To be preferred PLWR the site must be either in a dry subzone or if it is in a moist subzone the site must be at an elevation less than 1000 m.
- Sites with moderate lichen abundance can provide at best equivocal conditions.
- Increasing elevations decreases the value potential of a site to provide PLWR
- Sites with scarce lichen abundance, sites higher than 1300 m elevation and sites in wet subzones are all summarized as “avoided.”
- Solar loading does not influence winter range because during the winter months there is not a significant influence from incoming short-wave radiation on the conditions of the snow pack.

The primary variation between the capability resultants of v. 10b and v. 12c is the inclusion of pine-lichen woodlands in moist biogeoclimatic variants situated below 1000 m as preferred sites. In the v. 10b model these sites were excluded as a function of the classification of state values for the BGC node.

Post Rut Range

The relationships to identify lichen-bearing ground in post rut range are the same as those for the winter range model. The models vary however when considering factors that influence caribou use (as a function of snow conditions). In turn, sites must be in mid elevations and have high solar loading values to provide preferred levels of PRR at the PLWR_PREF node.

Forest Floor Characteristics

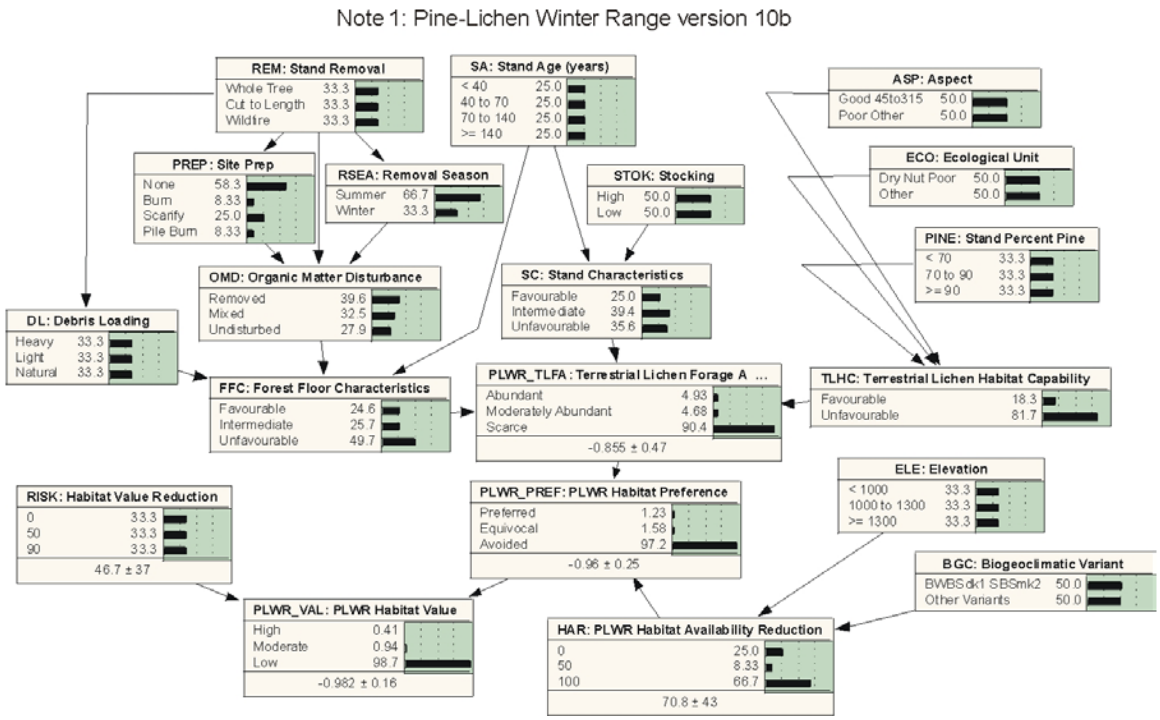
An additional change made between v10b and v12c is a simplification of the nodes that feed into the FFC:Forest Floor Characteristics node. In the v10b sub-model a summary node was used to indicate debris loading factors. This node was somewhat redundant, however, as it had a 1:1 ratio of input to output variables. As part of the pine-lichen woodland adaptive management silviculture trial[2], values for this portion of the model were updated in the spring of 2004. The new values were applied in v12c.

[2] Sulyma, R and Breck Alward. 2004. Adaptive management of forestry practices in pine-lichen woodlands in north-central British Columbia. Wildlife Infometrics Report No. 140. Wildlife Infometrics Inc., Mackenzie, BC. 22pp.

Figures included for comparisons:

PLWR	Wolverine
v. 10b	x
v. 12c	x
PRR	
v. 12c	x

PLWR V. 10B



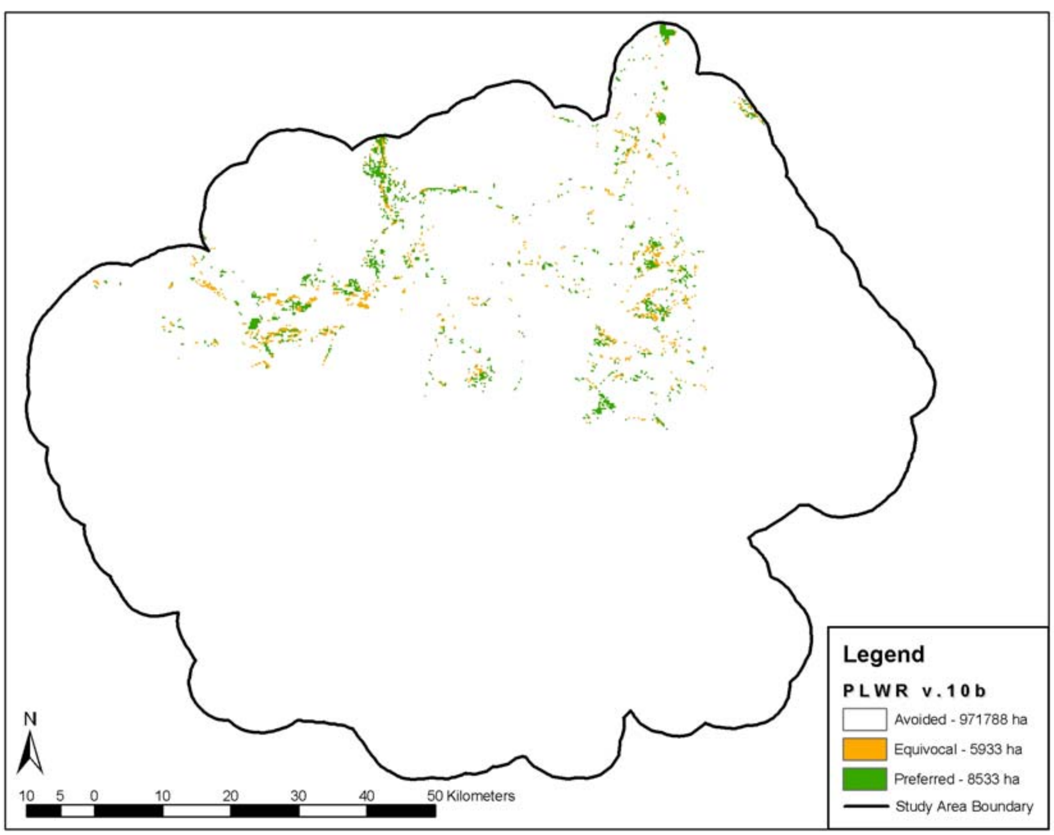
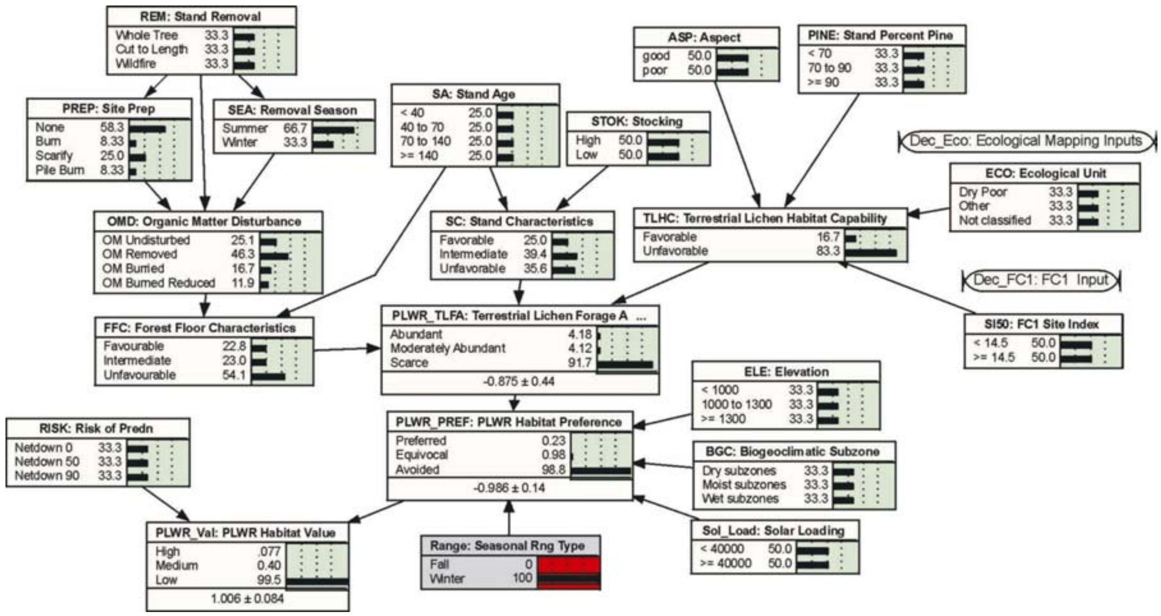


Figure 2. Wolverine Herd – PLWR v. 10b capability map.

PLWR V. 12C



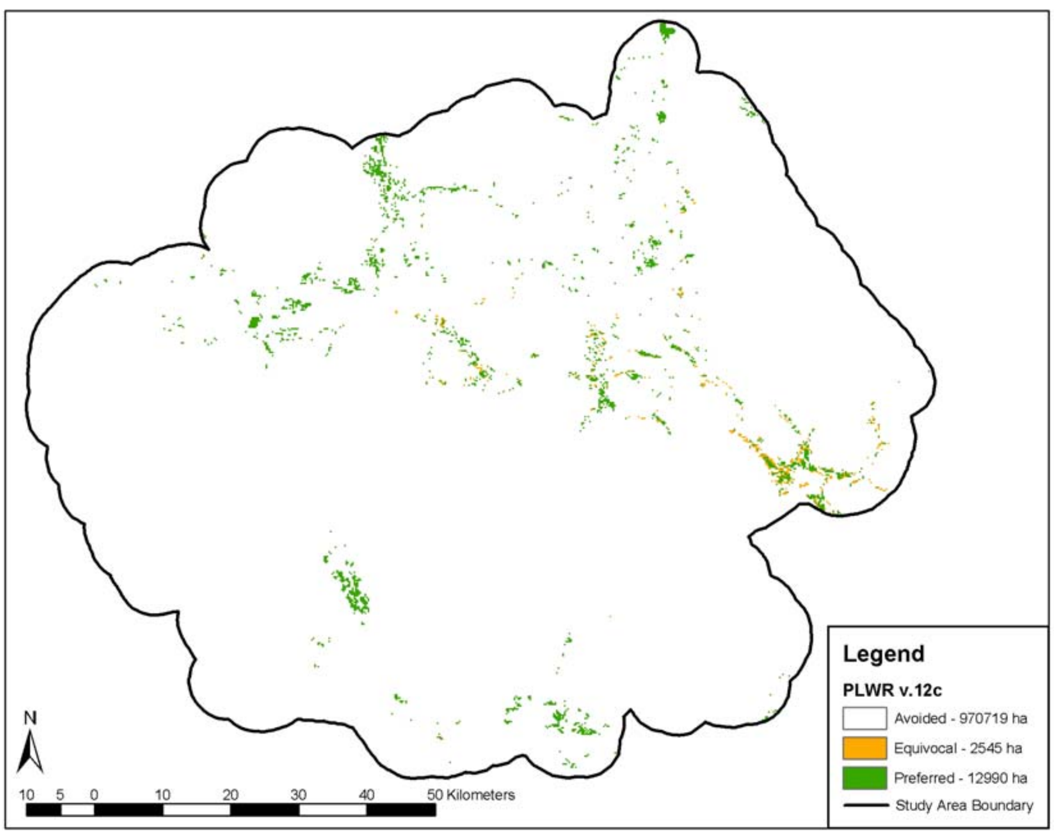
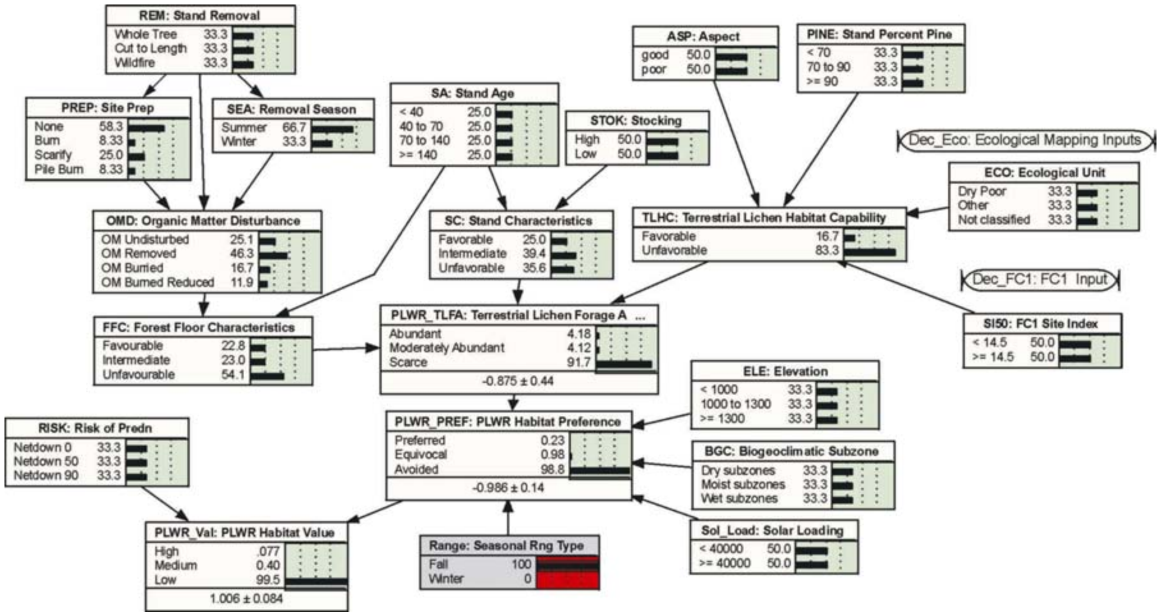


Figure 3. Wolverine Herd – PLWR v.12c capability map.

PRR V. 12C



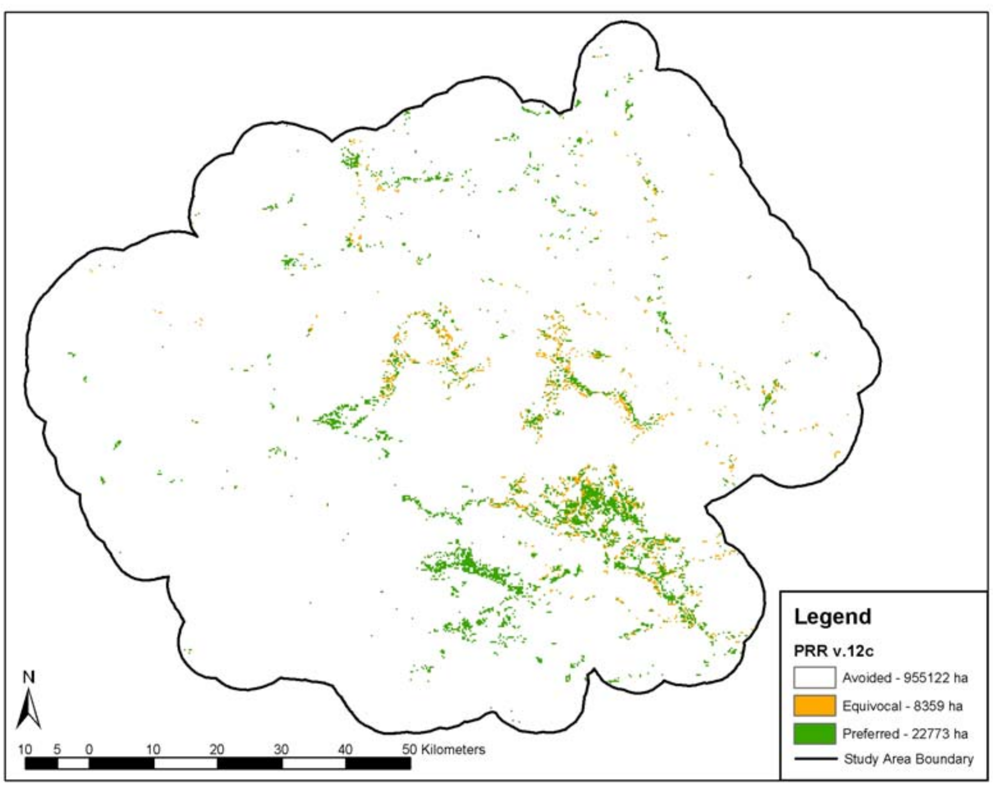


Figure 4. Wolverine Herd – PRR v. 12c capability map.