

Predictive Maps of Seasonal Habitat for Boreal Caribou in Northeast British Columbia

Overview

This vignette accompanies the GIS maps of predicted seasonal habitats for boreal caribou in northeast British Columbia. Maps were developed for three seasons: Summer (15 July – 14 September), Rut / Fall (15 September – 30 November), and Winter (1 December – 15 April). A map of predicted calving areas, which was developed in 2015, is also available (see *Further Information* below). Each map is available in a raster data format.

Displaying the Maps

Maps are best displayed within ArcGIS using a colour gradient to represent the continuum of relative habitat suitability. This continuum is indexed by 10 categories of predicted values of habitat selection (1 = lowest suitability and 10 = highest suitability). If desired, the colour gradient can be changed from the default to provide an optimal visual representation of the continuum. This can be done by right-clicking on the raster data layer, going to Properties, selecting Symbology, then choosing a Color Scheme from the drop-down menu. A recommended starting point is to choose a scheme that grades from red (low suitability) to blue (high suitability). For each raster map, a “.lyr” file is available that includes these recommended settings.

Map Development

The maps represent visual models of relative habitat suitability for female boreal caribou during each season. The maps were developed using GPS location data from radio-collared female boreal caribou (summer: $n = 38$; fall / rut: $n = 85$; winter: $n = 120$) distributed among all five caribou ranges and monitored for various periods between 2011 – 2017. More detailed descriptions of the methods used to develop the maps are available in DeMars (2018)—see *Further Information* below.

Habitat suitability reflects the combined response of caribou to a suite of environmental attributes (or variables). The following environmental attributes were used to model caribou calving habitat:

1. Land cover (the dominant vegetation type at a given location)
2. Landscape context, defined as the proportion of various land-cover types in a 1-km radius
3. Slope
4. Normalized difference vegetation index (an index of plant greenness that is often used to model food quality and/or quantity—used only in summer and fall maps)
5. Distance to nearest river
6. Distance to nearest lake
7. Distance to nearest cut block or forest fire < 50 years old
8. Distance to nearest well site
9. Linear feature density in a 400-m radius (linear features are seismic lines, pipelines and roads)

To assess relative habitat suitability, the environmental attributes associated with caribou GPS locations were compared to the environmental attributes associated with random locations within a herd’s range. Note that “locations” equate to pixels (30 m x 30 m resolution) within the map. Areas with high

suitability reflect pixels with environmental attributes that were highly used by caribou relative to the availability of these attributes within the herd's range. For example, if 80% of all caribou locations were within treed bog (a type of land cover) yet the area of treed bogs comprised only 50% of a herd's range, caribou would be interpreted as "selecting" treed bogs (i.e. caribou use of treed bogs was greater than the availability of treed bogs). Conversely, if 10% of all caribou locations were within aspen forest and the area of aspen forest comprised 30% of the herd's range, then caribou would be avoiding aspen forests (e.g. caribou use is less than availability). In the final map, then, pixels of treed bog would be given a higher suitability rating than pixels of aspen forest, all else being equal. The statistical model used to develop each map simultaneously repeats this process for all environmental attributes. For each pixel in the final map, the habitat suitability value represents the summed weights for all environmental attributes associated with that location.

Primary Usage

As noted above, the maps depict a continuum of relative habitat suitability for a given season within caribou ranges in northeast BC. Higher predicted values of habitat selection represent higher suitability and the maps are therefore best used for comparing areas within caribou range in terms of their seasonal habitat suitability. Analyses during map development suggested caribou disproportionately use areas with predicted values ≥ 8 ; however, this value should not be viewed as an absolute threshold.

Caveats

1. To further emphasize, each predictive map represents a continuum of relative habitat suitability. It does not represent the absolute probability that a caribou will occur at a given location.
2. Even in areas with apparently high suitability, the actual probability of caribou occurrence will be relatively low because boreal caribou normally occur at low densities throughout their range (e.g. ~ 3 caribou / 100 km²).
3. Caribou can—and probably do—occur in areas with relatively low suitability, although the probability of caribou occurring in these areas is lower than for high suitability areas.
4. Female caribou can show individual variation in how they select seasonal habitats and this variation is difficult to depict visually on a map. Seasonal maps therefore represent the average response of the population.
5. Maps do not yield inferences on the spatial requirements of caribou during each season. Caribou need sufficient habitat to carry out life processes and reduce predation risk but the amount, configuration, and relative quality of habitat required is not fully understood.
6. Habitat suitability may not correlate with the probability of survival. In general, caribou should select habitats that maximize their probability of survival but this relationship may not hold in caribou ranges where populations are declining.

Further Information

For further information on map usage, interpretation and development, please contact Steve Wilson, research director for the Research Effectiveness and Monitoring Board (steve.wilson@ecologicresearch.ca) or the map developer, Craig DeMars (cdemars@ualberta.ca).

More detailed information on the modelling framework used to develop these maps can also be found in the following technical reports:

DeMars, C. 2018. Seasonal Habitat Selection by Boreal Caribou in Northeast British Columbia: Predictive Mapping Methodology and Results. 12p.

DeMars, C. and S. Boutin. 2015. Calving Area Selection by Boreal Caribou in Northeast British Columbia. December 2015 Update. 61p.

These reports can be downloaded from the BC Oil and Gas Research and Innovation Society website (www.bcogris.ca).