GLORIA's multi-summit approach: Reinforcing British Columbia's alpine biogeoclimatic ecosystem classification

Osorio F.G.[1,2] , Mackenzie W. H. [3]

[1] Dep. Forest Sciences, Faculty of Forestry, The University of British Columbia, 3041-2424 Main Mall, V6T 1Z4, Vancouver, B.C. [2]Contact: fgom@interchange.ubc.ca
[3] B.C. Ministry of Forests and Range Research Branch Bag 6000 3333 Tatlow Rd Smithers BC V0J2N0 CANADA

Introduction

High elevation ecosystems (alpine and subalpine) form nearly 20% of British Columbia's terrestrial land base. The Global Observation and Research Initiative in Alpine Environments' (GLORIA) Multi-Summit Approach yields sufficient information to help delineate and understand the composition, distribution, and character of alpine plant communities. Integrating this sampling design with the current BEC approach can reinforce the classification effort with quantitative data that captures the broad climatic and botanical differences of each ecological zone. Between 2008 and 2010 both the traditional BEC sampling method and the GLORIA multi-summit sampling approach be applied to 12 summits (3 target areas) in order to explore the feasibility of establishing a province wide GLORIA-BEC sampling design.

Biogeoclimatic Ecosystem Classification (BEC)

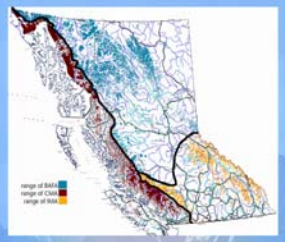
- Land managers and scientists in British Columbia use the classification for purposes ranging from site reclamation to conservation.
- Initially developed for forested ecosystems.
- Ongoing development includes all land based ecosystems.
- It combines phytosociology with site characteristics and gradient analyses to describe the distribution and composition of plant communities throughout the province.
- **Ecological zones** (areas of similar climate) are divided into subzones which capture local variations in climate.
  - **Subzones** are described by associating vegetation patterns with site types (topographic position, Figure 1) and site conditions (e.g.. soil moisture, soil nutrients, geology, Figure 2) that capture the major vegetation – site associations.

Figure 1. Examples of site types that could be subjectively described by combining traditional 'relevé' plots (BEC system) with the plots from the GLORIA multi-summit design.

Figure 2. Diagram showing ecotopic coverage of broad alpine types for very wet (purple) and very dry (yellow) alpine zones. Dark box depicts zonal ecosystem.

Alpine Biogeoclimatic Zones of B.C.

Ecosystems found above treeline were previously classified as a single ecological zone, the Alpine Tundra. Currently, the alpine zones are three of 16 biogeoclimatic or ecological zones within British Columbia.



The **Coastal Mountain-heather Alpine** (CMA) zone has deep snowpacks and the summers are moderated by maritime influences. The treeline is lowered by heavy and prolonged snow cover and can be as much as 900 m lower than in the alpine of comparable latitudes in the dry interior. The vegetation is primarily extensive beds of white and pink mountain-heathers.

In the **Interior Mountain-heather Alpine** (IMA) zone there is much precipitation variation within the zone but summers are warm relative to the other alpine zones. The vegetation is variable, with mountain-heathers typical in snowier climates and mountain-avens typical in the driest climates.

The **Boreal Altai Fescue Alpine** (BAFA) zone is the most extensive of the alpine zones, its winters are very cold and long, and summers are brief and cool but with very long day length. This zone typically has a windblown snowpack and the vegetation is primarily dwarf willows, grasses, sedges, and lichens.

GLORIA's Multi-summit approach

1. It's a worldwide research programme to monitor the impacts of climate change on high-elevation plant ecosystems.
2. Four-summits are chosen (within areas of similar climate and geology) to capture the gradient from treeline to nival ecosystems.

3. For each summit, four frequency count grids (1x1m^2) per cardinal direction, yield precise information on the abundance of vegetation and the variability in its distribution across site types (Figure 1).
4. Soil temperature data loggers are placed in each cardinal direction for every summit. Snowmelt dates can be accurately determined and compared between target areas across the province.

5. Four PRS-probes were placed in each cardinal direction, to analyze soil nutrient availability across site types and altitude gradients.

Integrating the Multi-summit approach with the BEC

- The BEC system is primarily based on qualitative field-based data. Including the quantitative vegetation and site data from the multi-summit approach can help validate or reject the inferred vegetation-site relations.
- The soil temperature information is an excellent and cost efficient way to compare date of snowmelt across the province. Snowmelt dates are critical for comparing length of growing seasons across elevation and latitude gradients and to delineate vegetation-site associations (Figure 2).
- The BEC system analyzes all vegetated ecosystems, thereby providing important baseline information that can be used to compare species richness, abundance, and distribution between summit areas and other high-elevation sites otherwise overlooked under the multi-summit approach.
- The design of the multi-summit approach allows for meaningful comparisons of species richness across target areas in B.C. This information will significantly aid the delineation and description of province wide alpine BEC site associations.
- There are currently two GLORIA target areas (8 summits) within the Costal Mountain Heather Alpine zone, and field work is underway for five target areas (20 summits) within the Interior Mountain Heather Alpine zone.

Further Information

- The Global Observation and Research Initiative in Alpine Environments <http://www.gloria.ac.at/>
- The Biogeoclimatic Ecosystem Classification Program <http://www.for.gov.bc.ca/hre/becweb/>