SUMMARIES OF PRESENTATIONS

CMI Annual Researchers' Meeting 2000
April 27, 2000 Revelstoke BC

The following pages are summaries of talks presented at the CMI's Annual Researchers' Meeting, held every spring in conjunction with the society's Annual General Meeting. Not all talks were suitable for a print summary, for example in some cases the presenter narrated a slide show.

For more information on any of these projects please contact the presenter directly at the contact numbers provided. For more information about the Columbia Mountains Institute of Applied Ecology, please contact:

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Many thanks to Chris Steeger of Pandion Ecological Research Ltd. for coordinating this meeting. Chris can be reached at 250-354-0150 or csteeger@netidea.com

List of Summaries:

by Karen Bray, Columbia Basin Fish & Wildlife Compensation Program, Revelstoke

- **Effect of Pushover Harvesting on Soil Properties and Subsequent Tree Growth at Mount Seven, Golden**
  by Harry Quesnel, Ecotessera Consultants, Nelson

- **Geobotanical Investigations at the Illecillewaet Glacier**
  by Dan McCarthy, Brock University, St. Catharines, ON

- **Preliminary Analyses of Midge Fossils from Eagle Lake, Mount Revelstoke National Park**
  by Sandra Rosenberg, **I.R. Walker**, & **R.W. Mathewes**, SFU, Burnaby

Development of a Northern Goshawk Breeding Habitat Suitability Index for the Nelson Forest Region

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The Northern Goshawk (Accipiter gentilis) is a large forest raptor associated with mature and old seral forests throughout its range. It is considered sensitive to timber harvest and requires special management consideration as outlined in the Identified Wildlife Management Strategy. To evaluate the effects of forest management strategies on goshawk breeding habitat availability in southeastern BC, a goshawk habitat suitability index (HSI) was developed. In this study, we address empirical gaps relating to goshawk breeding habitat use in local forests. This information is being used to further develop the HSI for modeling application in the Nelson Forest Region, using the Invermere Enhanced Forest Management Pilot Project (EFMPP) area as a test case.

We conducted call playback surveys and intensive searches in the pilot area during July of 1998 and 1999 and solicited goshawk nest and sighting information from agencies, licensees, forest workers, naturalists and the general public. Playback survey response rates were relatively low (1.01 and 1.12 responses/100 stations in 1998 and 1999, respectively) and only two active nest areas were detected using this technique. An additional seven active nest areas were found by following up tips and seven historical nest areas were re-visited, for a total of 16 sampled in the East Kootenay over the two-year period. Using analogous methods, six goshawk nest areas were sampled in the West Kootenay from 1997-1999.

Productivity ranged from 1-2 (mean ± SE = 1.8 ± 0.20) fledglings at five successful nests in 1998 and 1-3 (2.1 ± 0.34) fledglings at seven successful nests in 1999. Rates of goshawk nest area re-use (29 and 10% for 1998 and 1999, respectively) for this population are very low and 13 of the16 nests area have (or are scheduled for) harvesting or road-building £200 m from nest trees.

Goshawk nest tree, site, and area characteristics were described based on assessment of selected habitat indicators in 16 nest areas. Nests were located in lower tree crowns (mean ± SE = 14 ± 0.7 m height) and supported by large horizontal limbs. Nest trees were live Douglas-fir (n = 14), western larch (n = 11), trembling aspen (n = 1) and Engelmann spruce (n = 1) of large diameter (53 ± 2.7 cm dbh) and height (29 ± 0.7 m), relative to trees available in the stands sampled. Of the western larch nest trees, 82% showed symptoms of larch dwarf mistletoe, Arceuthobium laricis.

Nest sites were found at elevations ranging from 849-1,702 m in the IDFdm2, MSdk and ESSFdk biogeoclimatic units. These sites were located primarily at middle (53.6%), lower (28.6%) and level (14.3%) slope positions on gradual to moderate slopes (22 ± 2.1%). A range of aspects were represented in the sample (W - 32%; SW - 17.9%; no aspect - 14.3%; NE - 10.7%; N -

7.1; NW - 10.7%; S - 3.6%; E - 3.6%). Based on forest cover age class, nest sites were found mainly in older forest stands (class 8 - 35.7%; class 7 - 17.9%; class 6 - 28.6%). Tree cores in the single age class 5 nest site suggest that it was a minimum of age class 6. The remaining two nest areas found in uneven-aged age class 4 stands were in the IDFdm2 and had a significant layer two veteran component.

Nest areas were generally characterized by moderate to high crown closure (mean ± SE = 49 ± 2.4%), with multi-layered canopies and relatively open understoreys (B1 layer: 20 ± 3.2%; B2 layer: 23 ± 3.6%). Nest area densities of very large trees (>50 cm dbh), large trees (>40 cm dbh) and snags (>30 cm dbh) averaged 19 ± 4.1, 71 ± 10.4 and 15 ± 3.5 stems per hectare, respectively. Mean coarse woody debris volume was 56.7 ± 9.3 m3/ha in nest areas. Nest area patch sizes ranged from 18-341 ha, based on air photo interpretation using pre-harvest information. Nest sites were located 25-2,000 m from permanent water and 45-1,500 m from roads (irrespective of type or level of activity). There was considerable variation in these attributes among BEC subzones and a greater sample of goshawk nest areas will permit us to stratify the index by BEC subzones found in the NFR.

The effects of forest harvesting strategies on goshawk breeding habitat quality and quantity in the pilot area are currently being evaluated using the Simulation Forest (SIMFOR) model. The process involves (i) selecting a set of critical habitat attributes to define goshawk habitat suitability, (ii) defining precise relationships between goshawks and these attributes, and (iii) incorporating information on the effects of disturbance regimes and harvest schedules on the supply of these attributes over time. SIMFOR generates spatial (GIS) habitat suitability output that can be validated through field-testing. Model output will serve as valuable decision support for personnel involved in evaluating impacts of forest development plans and Identified Wildlife Management Strategy implementation in the Nelson Forest Region. Field-testing of preliminary goshawk nesting suitability output for the pilot is planned for summer of 2000.

Acknowledgements:

Jakob Dulisse, Carl Savignac, and Marc-Andre Beaucher conducted the fieldwork.

Funding was provided mainly through the Invermere Enhanced Forest Management Pilot Project (EFMPP), with supplementary funds for the West Kootenay from the Arrow Forest District Small Business Forest Enterprise Program and the Inter-Agency Management Committee (Land Use Coordination Office).

Photos were taken by Jakob Dulisse.

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West Slopes Bear Research Project

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In May 1994, the West Slopes Bear Research Project (WSBRP) commenced fieldwork investigating several major questions concerning the status of grizzly bears (Ursus arctos) and black bears (Ursus americanus) in the Yoho-Golden-Glacier area of British Columbia. The 5,000 km2 project area included trail-less wilderness, multiple-use lands, a major transcontinental transportation corridor, small rural settlements, and an urban area (Golden). About half of the WSBRP study site was within national parks and the majority of the remainder on forested provincial lands. We choose this study area to reflect the range of land uses found in bear habitat in this region of British Columbia.

Principal research questions included:

- How can the bear population size and trend be estimated?
- What is the mortality rate of grizzly bears?
- Are there barriers to bear movement between the Rocky Mountains and Columbia Mountains?
- How do bears use habitat within the study area?
- What impacts are human activities having on bears in this area?
- What happens to "problem" bears when they are moved to new areas?

With the main fieldwork for the project completed, WSBRP is focusing on data analysis and presentation in the scientific literature. WSBRP reported on the use of DNA from bear hair to fingerprint and monitor individual bears (Woods et al. 1999). Data from WSBRP also was used in a paper by McLellan et al. (1999) illustrating a relatively high mortality rate for female grizzly bears in areas dominated by the mountain parks although few bears were killed within park boundaries. This result underscored the need for park managers to work cooperatively with adjacent land managers to reduce total bear mortality. Using data from WSBRP, Munro (1999) reported on species and sex differences in use of habitats adjacent to major transportation corridors. Black bears used these areas more and female grizzly bears used them less than expected. This information will be useful in transportation corridor planning and vegetation management.

We anticipate that the majority of data analysis will be completed by the end of 2001. A final report based on scientific papers will be available in 2002. In the interim, a detailed project update including complete literature citations and acknowledgements is available on this website.

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Grizzly Bear Use of Avalanche Chutes in the Columbia Mountains

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Integrating Caribou Research into Management Practices

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Making a Difference: The Path from Research to Reality

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To ensure that research relating to wildlife habitat is used, researchers should understand the decision making process and develop the research in collaboration with decision makers. Researchers should ensure that their research is available to the planning tables and used in the development and implementation of management policies.

The planning processes that determine the location and abundance of protected habitat regionally and sub-regionally, and the policies that govern the establishment of protected areas in Landscape Units and at the stand level, influence provision of habitat. The location of protected habitat at the regional and sub-regional scale is determined in part by the decisions made by the regional CORE tables and through Land and Resource Management Planning tables. The policy statements in the Managing Identified Wildlife Strategy directs the establishment of protected Wildlife Habitat Areas (WHAs). At the landscape level the location of protected old forest habitat (e.g. Old Growth Management Areas) will be determined by the procedures outlined in the Landscape Unit Planning Guide. The Riparian Management Guidelines direct the establishment of protected areas along streams. The Wildlife Tree Retention policy directs the establishment of patches of protected habitat within cutblocks.

Researchers should bear the following in mind when working with decision makers:

- It is important to maintain objectivity. Decision makers rely on people who they feel provide them with unbiased advice.
- Provide the best available information. Scientists are sometimes reluctant to provide decision makers with their "best guess" in situations where research results are limited.
- Synthesize available information. Documents that synthesize the state of knowledge are valuable for decision makers, who often lack the time to read or evaluate source documents.
- Develop a consensus amongst scientists about the results of research. To the extent that scientists can develop some consensus amongst themselves about the conclusions that can be drawn from research, they can greatly assist decision makers.
- Make research findings understandable. Decision makers prefer brief, clearly explained summaries of research results.
- Make research information widely available. There are a wide variety of people involved in decision making processes - from participants in Local Resource Management Plans to government staff who change job responsibilities frequently. It is important to extend the results of research widely.
- Keep up with trends in management decision making i.e. who is making what decisions. In order to effectively extend research to decision makers and to determine who to work with to design research, scientists need to be aware of trends in decision making processes.

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Nelson Region MoF Forest Sciences Activities and Expected Influence on Forest Resource

Management and Policy Evolution

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Tracing the Development of Old-Growth Structures in Interior Cedar-Hemlock Forests

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Conservation of old-growth forests in managed landscapes is regulated by the Forest Practices Code Landscape Unit Planning Guide and the Biodiversity Guidebook. These documents outline set percentages of a landscape unit that are to be targeted as Old Growth Management Areas, or OGMAs. Target percentages are based on Natural Disturbance Types and Biogeoclimatic subzones. In Landscape Units with a "low" biodiversity emphasis, it is only necessary to meet one third of the OGMA target. In all Landscape Units, OGMAs must be located in areas outside of the Timber Harvesting Landbase in order to minimize the impact of old growth conservation on timber. Old growth, in the guidebooks, is defined on the basis of age.

My Master's thesis focuses on characterizing the development of old-growth stand structural attributes from young through mature, old and ancient stands in the Columbia-Shuswap moist warm Interior Cedar Hemlock BEC variant (ICHmw2). I am interested in assessing changes in stand development as they relate to seral stage and stand age. I am using Temporary Sample Plot (TSP) data from the Ministry of Forests Resources Inventory Branch and intend to collect additional field data this summer. TSPs were collected during the 1950s, '60s and 70's for inventory and Growth and Yield purposes. They are an imperfect, but large, data set and can provide interesting stand-level information such as diameter and species distributions. My field sampling will focus on assessing structural attributes (e.g. diameters, height, snags, course woody debris), stand age-structures (lots of coring trees!), and the correlations between stand structure and age.

The results of this study will have three key management applications:
aiding in the selection of old growth management areas (OGMAs) through expanding definitions and characterizations of old growth; assessing age based definitions of old growth; and developing guidelines for the retention of attributes following timber harvest.

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Integrated Remote Sensing and GIS Habitat Classification and Fragmentation Analysis of Old Growth Cedar/Hemlock Forests

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The Habitat Fragmentation Analysis Project was initiated between Parks Canada (Mount Revelstoke and Glacier National Parks) and the Department of Geography, University of Calgary in November 1997. The project forms an important component of an ecological integrity monitoring program proposed by Parks Canada for the detection of fragmentation of old growth forests in the Columbia Forest District. Changes to old growth forest habitat may be occurring as a result of timber harvesting and wildfires. The development of an appropriate methodology is required to assess the spatial effects of such disturbances and facilitate landscape-scale monitoring of old growth habitat connectivity and fragmentation over time.

This presentation summarizes the methodology and results of work toward two main research objectives:

- The development of an integrated GIS/remote sensing classification procedure to map and classify important habitat units in the study area.
- The documentation and analysis of changes in old growth forest distribution and structure over time.

A habitat unit map was generated for the 1997 time period using Landsat TM imagery and BCMOF forest inventory data. A Hybrid Decision Tree Classifier was applied which combined maximum likelihood decision rules and a spatial/contextual rule base. The accuracy of the resulting map was 91.8% overall. This digital map product will form a "baseline" database against which future annual updates of disturbance features could be maintained in order to monitor fragmentation of old growth forests over time.

To illustrate the applicability of the developed methodology to an ecological monitoring program, a second satellite image was acquired to represent the landscape in a previous condition (1975). A habitat unit map was also produced for 1975 and a comparative analysis between the 1975 and 1997 classifications illustrates how a similar methodology may be applied to track future changes. Specifically, a select set of landscape pattern and configuration metrics was calculated and analyzed to measure the amount of change and fragmentation within the matrix of old growth forests. Based on the methodology and results presented, a number of recommendations for the long-term monitoring of forest fragmentation in the study area will be outlined.

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Structural Definitions of 'Old' and 'Mature' for Ecosystems with Frequent Stand Maintaining Fires (NDT4)

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'Old' and 'mature' are forest seral stages defined in the Biodiversity Guidebook and Landscape Unit Planning Guide (LUPG) solely by age. The definitions differ by Natural Disturbance Type (NDT) and biogeoclimatic zone, to reflect the different ways and rates that old-growth stand structure develops in different parts of the province. But in the Biodiversity Guidebook: "Seral stages can be [also] defined … by stand-level attributes: Older mature or partially cut stands can be considered old if they provide the important attributes of an old-aged stand … Stand-level attributes and partial cutting descriptions to meet mature and old seral objectives should be developed for each biogeoclimatic subzone or variant, based on natural stand characteristics …"

Why do we want to look at structural characteristics of old-growth forests, and how they develop with stand age? A few reasons:

because it's basic information about the ecosystems;
to develop targets for silviculturists, to speed development of old-growth characteristics in second-growth stands (reward: they can call them 'old' for purposes of retention in the Landscape Unit Planning Guide);

to examine the ages selected for 'old' forests in the Biodiversity Guidebook and LUPG;
perhaps, in areas where there doesn't seem to be enough age-defined 'old' forest in our LUs, use structure-defined 'old' forest;
to gain a better appreciation of what's 'rare'.

The question of using structurally-based definitions of old and mature is particularly important in NDT4. NDT4 is Natural Disturbance Type 4, characterized as being "Fire Maintained Ecosystems": the Bunchgrass and Ponderosa Pine biogeoclimatic zones, drier portions of the IDF, and very driest variant of the ICH.

According to LUPG, you're supposed to leave a certain % of 'old' forest in each Landscape Unit. Well, it's not there in most NDT4 LUs. It turns out that according to forest cover inventories, there's very little area typed as age class 9 (>250 years) in any of the NDT4 Landscape Units, even undeveloped ones. This suggests that either:

- 250 years was a poor age to select for NDT4;
- the forest cover inventory doesn't really reflect stand age in NDT4; or
- how the heck do you determine stand age anyway in multi-layered, multi-aged ecosystems?

As we're supposed to be applying LUPG and/or KBLUP across the province (including NDT4) ASAP, we needed to determine how to make LUPG work in NDT4. And so we had a "Structural Attributes of Fire Maintained Ecosystems" workshop in Kamloops February 22-23. One of the things agreed to at the meeting was that it would be useful to have structural definitions of 'mature' and 'old' for NDT4 ecosystems.

This raised the question, what (classification) level do we develop definitions for? Some have suggested one definition for NDT4, or definitions for biogeoclimatic zones within NDT4, or perhaps subzones or variants, or site series. We're working on reaching a common agreement about the Site Groups we're going to define, and we're close on this. Then we'll have to fit available data into this framework.

How will it be applied in Landscape Unit planning? We don't have most of this structural data in forest cover databases, so we'll have to start with the forest cover maps, and use structural data for field evaluation and comparison of potential Old Growth Management Areas. Structural definitions will also provide targets for managers currently out there doing ecosystem restoration - primarily with thinning and fire - in NDT4. And eventually, understanding how stand structure develops over time should direct us towards inventories and management systems better suited towards meeting habitat supply goals.

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Bull Trout Spawning and Migratory Movements in the Arrow Reservoir

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Bull trout (Salvelinus confluentus) is a char endemic to western North America. Populations in British Columbia are considered threatened (blue-listed) and while regulations allow for a limited sport fishing harvest, threats to the viability of bull trout populations are a significant concern, including forestry operations in tributary drainages, hydroelectric development, and climate change. The Canadian Columbia River drainage has been severely impacted by the construction of several large hydroelectric dams that have inundated the mainstem river, valley bottoms and lower reaches of tributaries, blocked migratory routes, and created nutrient depletion problems in their associated reservoirs. Efforts to understand and help sustain bull trout populations in the Columbia River Basin are ongoing through the Columbia Basin Fish and Wildlife Compensation Program (a partnership of the provincial Ministry of Environment, Lands and Parks and BC Hydro) with several projects focusing on the Arrow Reservoir. Originally two large lakes separated by a riverine section, the Arrow Reservoir sits between two large mainstem dams, inundates >100km2 of original littoral and riverine habitat at full pool, and fluctuates as much as 15m annually. Along with investigations into the genetic structure and early life history of bull trout populations, a radio telemetry project is now underway in the Arrow Reservoir to determine critical habitats, migration timing, and spawning characteristics of bull trout. In 1998/99, 38 bull trout were surgically implanted with radio transmitters and are tracked from July to November to determine their spawning movements and locations. Tracking also occurs in late winter when the reservoir is at low pool and fish are close to the surface. Length of tagged fish ranges from 454 - 801mm and the sex ratio is 18 females to 20 males. Tracking has shown use of several tributaries and large migratory movements of some bull trout throughout the entire reservoir system (eg. >300kms) and will continue for another two years to follow annual variations.

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Post-Harvest Soil Disturbance And Compaction After Shelterwood Harvesting Near Golden

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Soil disturbance and compaction are described for an integrated project testing the use of shelterwood harvesting and root removal treatments. The site at Golden was winter harvested and assessed the following summer using criteria from the Forest Practices Code (FPC) of British Columbia. Pushover harvesting caused a significantly greater level of counted soil disturbance than hand felling combined with ground skidding. As the level of basal area removed from the stand increased, the disturbance levels increased on the treatment units with pushover harvesting. The greatest area of disturbance was on the clearcut pushover treatment, where levels averaged 36%. Pushover harvesting also yielded over 25% of the sample points with exposed calcareous subsoils or surface deposits derived from these subsoils. In contrast, less than 5% of the surface area of hand felled treatment units were calcareous after harvesting. Pushover harvesting yielded clear-felled areas with 33% of a treatment unit occupied by stump holes. Aeration porosity is a measure of the ability of a soil to support gas exchange for plant roots. This property is very sensitive to soil compaction. At the Golden site, compacted microsites had significantly less aeration porosity than undisturbed soils. Aeration porosities for some compacted samples were at or below "critical" values of 15%. Based on soil properties, tree growth on pushover harvested areas at Golden is expected to be reduced because compaction has reduced aeration porosity and pushover harvesting exposed greater levels of free lime. However, five years after treatment the growth of planted seedlings and residual trees reflects the level of basal area retained rather than the application of the root removal treatment.

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Geobotanical Investigations at the Illecillewaet Glacier

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A long-term research project funded by the Natural Sciences and Engineering Research Council of Canada is investigating environmental change and the ecology and growth of crustose lichens in the forefield of the Illecillewaet Glacier. This work has so far examined documentary, photographic and tree-ring evidence for climate and glacial change at the site, taken annual measurements of the radial growth of Rhizocarpon lichens and used digital image analysis to analyze epilithic lichen communities.

This research addresses the need for scientific/interpretive data about one of the most visited glacier forefields in North America and seeks to provide insights that will lead to improvements in the resolution and accuracy of lichenometric dating. Lichenometry is a technique that uses lichen size to estimate a minimum age for a landform surface. It is based on questionable assumptions about lichen growth and ecology yet is increasingly being used worldwide to estimate the recurrence intervals of prehistoric earthquakes and other geological hazards.

A map showing Little Ice Age to modern icefront positions and the various moraines of the Illecillewaet Glacier is nearing completion. However, no dating controls are available for the avalanche modified terminal moraines downvalley from the 1887 ice front.

Lichen studies have so far produced a field key for the identification of Rhizocarpon section Rhizocarpon and established fixed points to enable repeat measurement of lichen growth. Analysis of the 1996 to 1998 data found that many of the 1038 lobes do not grow in every year and that mean growth in each 5 mm diameter size class was close to the 0.42 mm yr-1 growth that was indirectly estimated on identical lithologies in Jasper and Mount Robson parks. The data verify that growth trends in Rhizocarpon growth "curves" are not an artifact of the lichenometric method, but suggest that radial growth may stop after a few centuries. If so, the lifespan of individuals may be centuries, not millennia and modern growth rates may be similar to historical rates and might be used to calibrate growth "curves" that accurately represent growth ca. 300-500 yrs BP.

Low-cost image analysis software is being used to measure lichen communities. Replicate analyses show the technique produces reproducible results that allow a user to distinguish very small differences in lichen. The technique is suitable for use with other forms of alpine vegetation and is a practical and accurate way to analyze repeat photographs of permanent plots.

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Preliminary Analyses of Midge Fossils from Eagle Lake, Mount Revelstoke National Park, BC, Canada

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Fossil midge head capsules are of particular importance in reconstructing past climates. To investigate postglacial environmental changes in the Columbia Mountains region, we examined fossils of these insects contained in a core from a shallow subalpine pond (Eagle Lake) in Mount Revelstoke National Park. Two visible tephras provide dating control for the

110 cm long sediment core. The first tephra is Mazama ash, derived from a catastrophic eruption at Crater Lake, Oregon (7470-7620 cal year BP). The second is derived from Mount St. Helens (~3400 cal year BP). A preliminary midge stratigraphy and postglacial climate reconstruction for Eagle Lake will be presented, and discussed in terms of British Columbia's climatic history and in terms of vegetation development since the last glaciation.

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