



Kluane Lake Research Station NEWSLETTER

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SUMMER 2007

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In 1974, as the decade-long Icefield Ranges Research Project drew to a close, Melvin Marcus wrote: "The integration of all of the processes and elements of the mountain environment into a meaningful whole is extremely difficult. The very complexities of the landscape militate against such an effort, yet in the long run such an integration is one of our most important needs. The environment, after all, is not made up of isolated actions and events, but rather of interdependent elements responding to a variety of interacting processes."

Some thirty years later research teams at KLRS continue to work towards this goal of integrating our understanding of the Kluane

The Kluane Lake Research Station (KLRS) is managed and operated by the Arctic Institute of North America (AINA). Established at the south end of Kluane Lake, Yukon, in 1961, it supports the activities of scientists in disciplines such as glaciology, geomorphology, geology, biology, botany, zoology, hydrology, limnology, climatology, high-altitude physiology, anthropology and archaeology. This diversity, as well as the high calibre of work accomplished, has created a legacy unique in Canada. AINA provides support and access to the facility, but it does not design or supervise the research. KLRS attracts researchers and field schools from across Canada and around the world. Funding from the Natural Sciences and Engineering Research Council of Canada (NSERC) and five partner universities supports operation of KLRS.



environment. Ecologists, glaciologists, botanists, geomorphologists and many others are coordinating their efforts during the International Polar Year (2007-2008) with the objective of developing a comprehensive understanding of this region. In collaboration with local communities and organizations like Parks Canada, we hope that the long history of research at KLRS can serve as a model of how to observe environmental change and contribute to a better understanding of northern mountain ecosystems.

Dynamics of Kluane's Valley Glaciers and Alpine Ecosystems

Gwenn Flowers, Department of Earth Sciences, Simon Fraser University

Between the boreal forest surrounding Kluane Lake and the contiguous icefields of the St. Elias Mountains, lies a transitional region dominated by individual valley glaciers in the Donjek Range. Glaciologists from SFU, led by Gwenn Flowers, initiated a project in 2006 to examine the variability of glacier response to climate in this transitional area. A crew of four spent four weeks in summer 2006 on an unnamed tributary to the Kaskawulsh Glacier setting up meteorological stations, establishing a stake network for mass balance and velocity measurements, gauging the glacier outlet stream, mapping the glacier surface with GPS and glacier bed with ice-penetrating radar, and precisely monitoring glacier surface motion with GPS receivers drilled into the ice. Two additional meteorological stations were erected along a transect between the site and the headwaters of the Duke River to monitor the weather throughout the year. The group returned for two weeks in May 2007 to maintain these stations, to set up two additional stations on a second glacier on the northwestern side of the Donjek Range, and to conduct an accumulation survey. Meteorological data are being used in an energy balance analysis to identify spatial and temporal variations in the energy available for melt, while temperature and humidity lapse rates are being used to relate glacier surface conditions to larger scale synoptic weather patterns.



Field site overlooking the Kaskawulsh Glacier (Photo by Laurent Mingo, May 2007).

Characterization of the 2006 glacier geometry and dynamics suggests that active ice in the accumulation area (flow rates of 30 m per year) abuts thin and nearly stagnant ice in the lower reaches of the glacier. Nearly all of the upstream motion appears to be accomplished by the ice moving over its bed (rather than by internal ice deformation), causing pronounced undulations in the glacier surface. These undulations may prove to have significant feedbacks on mass balance because of the sensitivity of the surface energy flux to glacier surface slope and orientation. Similar data to be collected at the northern glacier test site will enable a detailed comparison between two glaciers in close proximity but on opposite sides of the range.

An IPY Effort

This work is an important contribution to a new interdisciplinary research project being called "The St. Elias Project", or StEP for short (<http://step.biology.ualberta.ca>). StEP has been established as part of the International Polar Year (IPY) and involves researchers from the University of Alberta, University of British Columbia and Simon Fraser University with expertise in ecology and the environmental earth sciences. Its primary goal is to examine the state and fate of alpine tundra landscapes and ecosystems in the Kluane Lake region. More specifically, the project is combining new and ongoing field

SFU graduate student Brett Wheeler setting up a new micrometeorological station in the accumulation area of northern glacier (Photo by Laurent Mingo, May 2007).

studies with the development of computer simulation of climate change induced land-ecosystem interactions to address the following questions:

- Are there significant spatial gradients, in addition to those associated with elevation change, in controlling physical (climatic and landscape) variables in this region and are those spatial gradients sensitive to regional changes in climate?
- What is the nature of the relationship between regional climatology and local meteorology and how does this relationship manifest itself in quantities like glacier cover and the partitioning of the water budget?
- Can alpine ecosystems adjust to a warming climate by upward migration, (i.e. by exploiting the elevational gradient in temperature)?
- How will elevational shifts of montane and subalpine plant species affect alpine plant communities?
- How will increased temperature and nitrogen availability influence alpine plant biomass and species diversity?
- How will loss and fragmentation of alpine habitats affect demographic and genetic connectivity of alpine animal populations?
- How will life history differences of animals (e.g. migrant vs. resident, habitat specialists vs. generalists) influence their ability to respond and adapt to climate change?



As part of the StEP IPY project, forecasts of land cover and vegetation change will incorporate process-based information derived from field observations and experimental investigations related to the elements identified in this photo. A major component of this will be an analysis of changes in the dynamics of wildlife populations, like the hoary marmot pictured above.



*Evening at the headwaters of Canada Creek
(Photo by Laurent Mingo, May 2007).*



Snow density sample (Photo by Laurent Mingo, May 2007).





Pair of summer and winter photos from the Kluane Lake Research Station (Ryan Danby).

Canadian IPY Publications Database

The Canadian International Polar Year Publications Database (CIPYPD) is now available at <http://www.aina.ucalgary.ca/ipy>

The CIPYPD makes the Canadian portion of the international IPY Publications Database available from its own bilingual website. The CIPYPD describes publications from IPY 2007-2008 and from the three previous IPYs. It includes publications by and about Canadian IPY projects, as well as publications by and about foreign IPY projects that studied northern Canada (including the adjacent marine areas).

The CIPYPD creates records describing Canadian IPY publications and submits those records to the international IPY Publications Database. The success of the CIPYPD depends on the willingness of Canadian IPY researchers, educators and communicators to report their publications, as required by the Canadian IPY 2007-2008 Data Policy.

If you are working on a Canadian IPY project, please see the Report Your Publications page of the CIPYPD website for reporting guidelines. Note that the CIPYPD includes magazine and newsletter articles about Canadian IPY projects, as long as those articles are at least one page long and have authors. Note also that if an existing research project has been incorporated into an IPY 2007-2008 project, it is up to the project to decide which of its recent publications are to be considered IPY publications. Please report publica-

tions by or about your project as soon as possible, so that the project can be added to the "IPYs, Projects and Expeditions" menu of the CIPYPD search page.

At present, the CIPYPD describes 140 publications. This number is expected to grow to approximately 4000 publications ten years from now. The CIPYPD has been created by the Arctic Institute of North America's Arctic Science and Technology Information System (ASTIS), with startup funding from EnCana Corporation.

INTERNATIONAL POLAR YEAR BANQUE DE DONNÉES CANADIENNE DES PUBLICATIONS DE L'API
 CANADIAN IPY PUBLICATIONS DATABASE

The Canadian International Polar Year (IPY) Publications Database describes publications from IPY 2007-2008 and the three previous IPYs. The database includes publications from Canadian IPY projects, as well as publications from foreign IPY projects that studied northern Canada. For a detailed description of the scope of the database, please see the "Report Your Publications" page.

The database currently describes 138 publications. Publications containing the research results of IPY 2007-2008 will not be available in large numbers until 2009. Coverage of the publications of the three previous IPYs will be developed during 2007 and 2008.

Funding for the Canadian IPY Publications Database has been provided by [EnCana Corporation](#).

La Banque de données canadienne des publications de l'API fournit la description de publications concernant l'Année polaire internationale (API) de 2007-2008 et les trois API précédentes. Cette banque de données comprend les publications ayant trait aux projets de la section canadienne de l'API de même qu'aux projets étrangers de l'API portant sur le Nord canadien. Si vous désirez avoir un aperçu de l'étendue de la banque de données, consultez la page « Pour signaler vos publications ».

En ce moment, la banque de données comporte les descriptions de 138 publications. Les publications contenant les résultats de recherche de l'API de 2007-2008 ne seront pas très nombreux avant 2009. Les descriptions des publications des trois API antérieures seront élaborées en 2007 et en 2008.

Le financement de la Banque de données canadienne des publications de l'API a été fourni par [EnCana Corporation](#).

☒ English ☐ Français

Kluane Lake Research Station Bibliography

Ross Goodwin, Arctic Institute of North America, University of Calgary

The Kluane Lake Research Station (KLRS) Bibliography now describes 565 publications, an increase of more than 60 publications since the last issue of the *KLRS Newsletter*. The bibliography is a searchable database available from the KLRS web page (see address on page 10).

The Kluane Red Squirrel Project has recently been added to the bibliography's Project list. There are now 70 records in the bibliography that have URL links to full text PDF files, and a further 155 records that have DOI links which give you access to PDF files if your organization has the appropriate electronic journal subscriptions.

AINA's ASTIS project depends on KLRS researchers to inform us about publications that are missing from the KLRS Bibliography. Because we are funded by contract work and are only able to devote a small amount of staff time to free projects it is going to take several more years to make the bibliography complete. KLRS researchers are encouraged to do an Author search for their surnames and inform us about missing publications. Please send us DOIs, URLs, PDFs, photocopies or citations.
(www.arctic.ucalgary.ca/ (rgoodwin@ucalgary.ca))



Your search will find records that satisfy **all** the conditions you specify.

Words in **Title** or **Abstract**

Subject Code

Author

Year

Project

Publication Type

The Kluane Lake Research Station Bibliography, a subset of the [ASTIS database](#), describes 565 of the more than 1000 publications that have resulted from research conducted from the Arctic Institute of North America's [Kluane Lake Research Station \(KLRS\)](#). Work to improve the coverage of the bibliography is currently focusing on publications produced since 1990, including those from the [Kluane Boreal Forest Ecosystem Project](#), the [Kluane Red Squirrel Project](#) and the Kluane Alpine Ecosystem Project. It will take several years to make the bibliography complete.

KLRS researchers are encouraged to do an Author search for their surnames and [inform us](#) about missing publications. Research conducted from KLRS includes research done at field camps if any of the KLRS facilities were used, and any research that used the KLRS airstrip. Publications by researchers who have never been to KLRS are included in the bibliography if the research used data collected by others at KLRS.

In search results, records that were most recently added to the database are displayed first. Records containing the note "Not seen by ASTIS" may be incomplete, and will eventually be updated. While viewing a record you can click on authors, subject codes, subject terms and geographic terms to search for all records that have that author, code or term. The best way to search for specific subjects or places is to search for words in the title or abstract, and then to supplement that search by clicking on appropriate subject or geographic terms in the records.

Websites of Interest



Arctic Institute of North America
<http://www.arctic.ucalgary.ca>

Our own website. Find information about AINA, listings of news, media, and events, profiles of research and education programs, and links to publications and collections, including the ASTIS database, the journal *Arctic*, an art collection, and photographic archives.



Geomatics Yukon
<http://www.geomaticsyukon.ca>

The Yukon Territory's own geospatial data clearinghouse is available at this website. Users can download vector and raster data including basemaps, digital elevation models and thematic layers, as well as select satellite images covering different parts of the territory. An interactive area allows users to view, query and print maps they create on-line.



Taiga Net
<http://www.taiga.net/index.html>

A cooperative environmental and community web network on all things Yukon-related. Many Yukon organizations and groups can be accessed here, including the Northern Climate Exchange, Yukon Science Institute, and Canadian Tundra and Taiga Experiment.



INTERNATIONAL
POLAR YEAR
2007-2008
ANNÉE POLAIRE INTERNATIONALE
2007-2008

International Polar Year (IPY)

<http://www.ipy.org>
<http://www.ipy.gc.ca>

<http://www.ipycanada.ca> IPY is a two year program of science, research and education focused on the Arctic and Antarctic regions. See what Canada and the rest of the world is doing for this landmark event.

Recent Treeline Dynamics in the Kluane Region

Ryan Danby, Department of Biological Sciences, University of Alberta

The boundary between forest and tundra ecosystems, commonly known as 'treeline', is expected to advance as climate continues to warm. Treeline advance is expected to have significant effects on the global climate system through feedback processes, and more locally, on wildlife habitat and human land use. But exactly how rapidly treeline will advance and how widespread this advance will be remains unclear. To answer these questions, I examined the last 300 years of treeline change in the northwestern portion of the Kluane Ranges using dendroecology and supplemented this long-term record with recent aerial photography.

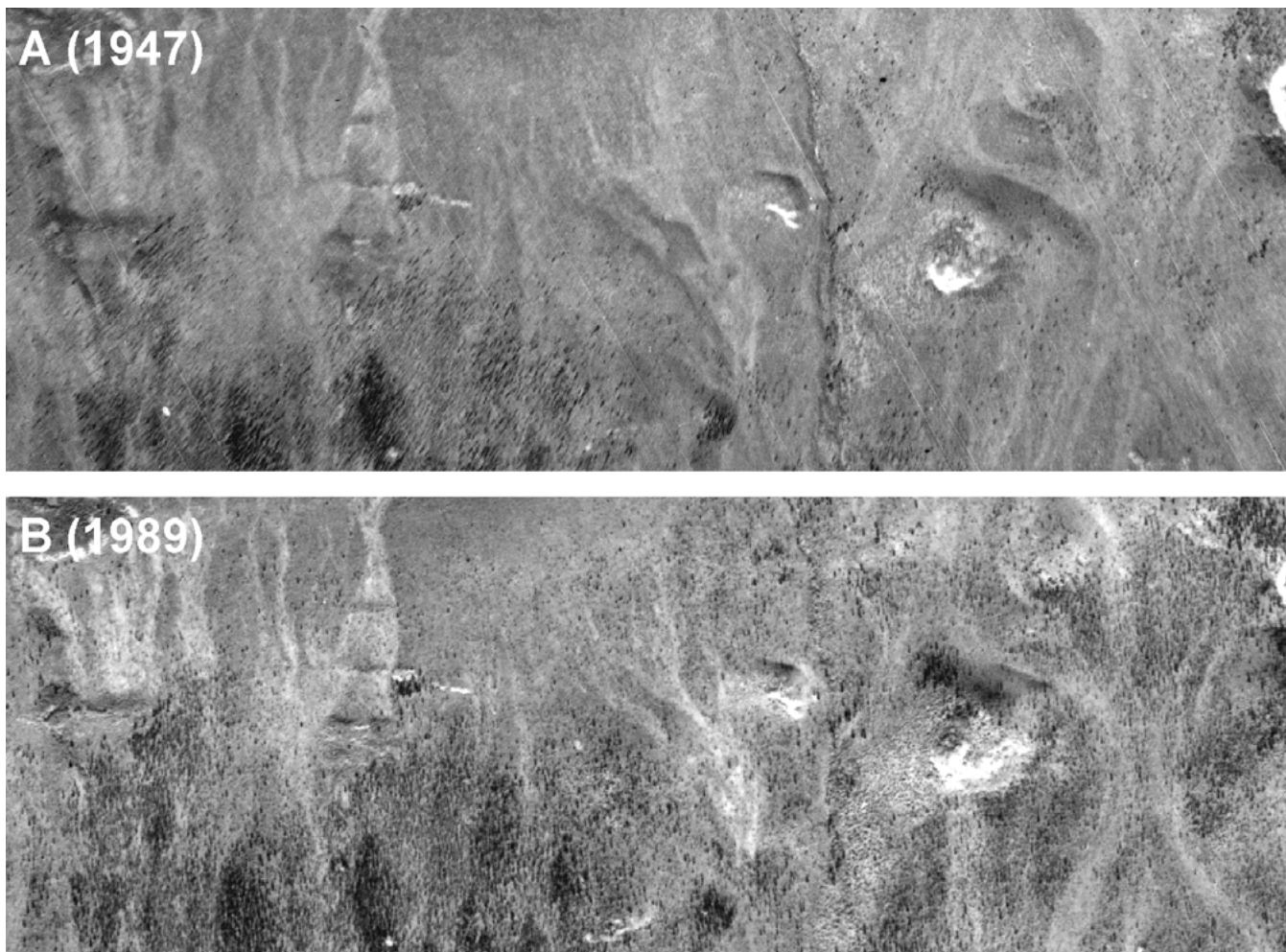
Six locations were selected for reconstructing treeline stand dynamics. These were located on north and south-facing slopes in the Duke River, Burwash Creek, and Quill Creek drainages. Using tree ring analysis I was able to precisely date establishment and death of spruce trees and reconstruct vegetation change at each location. The results provide evidence of a rapid change in response to climate warming during the early-mid 20th century. Treeline ad-

vanced considerably (65-85 m in elevation) on warm, south-facing slopes and tree density increased significantly (40-65%) on cooler, north-facing slopes (see figure). The mechanism of change appears to be occasional years of extraordinarily high seed production (mast events, which are induced by hot, dry summers) followed by successive years of conditions favourable for seedling growth and survival. My experimental work east of Kluane Lake indicates that in addition to temperature, snow-related variables – including depth and timing of melt – are among the most important of these conditions.

These results are supported by repeat aerial photography. By standardizing image geometries and scale, I was able to rigorously compare photographs taken in 1947 with images taken in 1989. Significant changes were observed over the 42-years, but the degree of change varied throughout the study area. The most common change was an increase in canopy size of individual trees, and an increase in stand density resulting from the establishment of new individuals. Several



Above: Spruce trees on the Burwash Uplands. Like the cross-section pictured in the inset photo, the vast majority of these trees date to a 25 year period starting in 1925 and ending in 1950 (photos by Ryan Danby).



Above: A comparison of aerial photographs from 1947 (top) and 1989 (bottom) supports the data from tree ring analysis, indicating that treeline spruce populations have expanded over the last 50 years. Individual spruce trees are visible as dark spots against the lighter tundra background. Photos measure 2500 metres across.

instances of treeline advance were also observed. As with the dendroecological data, an absence of major natural disturbances or widespread land use change indicates that these changes are attributable to climate.

Collectively, these results challenge the conventional notion that treelines will respond gradually to future climate warming and provide evidence that the pattern of advance could be highly variable in the Kluane region, depending not only on air temperature, but also on variables such as snowfall, slope, aspect, soil temperature, and existing vegetation types.

My research on treeline in the Kluane region is continuing as a contribution to PPS-Arctic, an International Polar Year network comprised of several researchers working across the circumpolar north. One of the main goals of PPS-Arctic is to compare and contrast recent treeline dynamics from different environments around the globe and to identify any generalities that emerge. Work in the

Kluane area will now focus on quantifying spatial pattern of treeline as well as characterizing the biological and environmental conditions that are responsible for these patterns. For instance, characterizing the differences in the forest-tundra transition between north and south-facing slopes in terms of vegetation “patchiness” and relating these differences to environmental parameters such as soil temperature and biological processes such as plant competition.

Kluane-based field-work for PPS Arctic will involve meteorological instrumentation, but much of the research will be “virtual” using high resolution satellite imagery and geographic information systems (GIS) to develop and test hypotheses about how the subalpine landscape behaves. (rdanby@ualberta.ca)

Recent Publications from the KLRs Community

A section of each newsletter issue is devoted to highlighting recent publications produced as a result of research based out of the KLRs. You can submit citations and very brief summaries to rdanby@ualberta.ca for inclusion in subsequent issues.

Bonnaventure, PP. 2006. Validation of the Basal Temperature of Snow (BTS) Method to Map Permafrost in Complex Mountainous Terrain, Ruby Range YT & Haines Summit BC. MSc thesis, Department of Geography, University of Ottawa, Ottawa.

Boonstra R, Krebs CJ. 2006. Population limitation of the northern red-backed vole in the boreal forests of northern Canada. *Journal of Animal Ecology* 75 (6): 1269-1284.

Clague JJ, Luckman BH, Van Dorp RD, Gilbert R, Froese D, Jensen BJL, Reyes AV. 2006. Rapid changes in the level of Kluane Lake in Yukon Territory over the last millennium. *Quaternary Research* 66 (2): 342-355.

Clark DC & Slocumbe DS. 2005. Re-negotiating science in protected areas: grizzly bear conservation in the southwest Yukon, Canada. In: G Humphrys & M Williams (eds) *Presenting and Representing Environments: Cross-Cultural and Cross-Disciplinary Perspectives*, pp. 33-53. Springer, New York.

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Morrison, S. F. 2007. Foraging Behaviour and Population Dynamics of Collared Pikas (*Ochotona collaris*). PhD thesis, Department of Biological Sciences, University of Alberta, Edmonton.

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Slocumbe DS & Danby RK. 2005. The Alaska-Yukon-British Columbia borderlands: the world's largest transboundary protected area complex. In: RA Mittermeier et al. (eds) *Transboundary Conservation: A New Vision for Protected Areas*, pp. 118-126. CEMEX/Conservation International, Mexico City.

Wilson S, Martin K, Hannon SJ. 2007. Nest survival patterns in willow ptarmigan: influence of time, nesting stage and female characteristics. *Condor* 109: 377-388.

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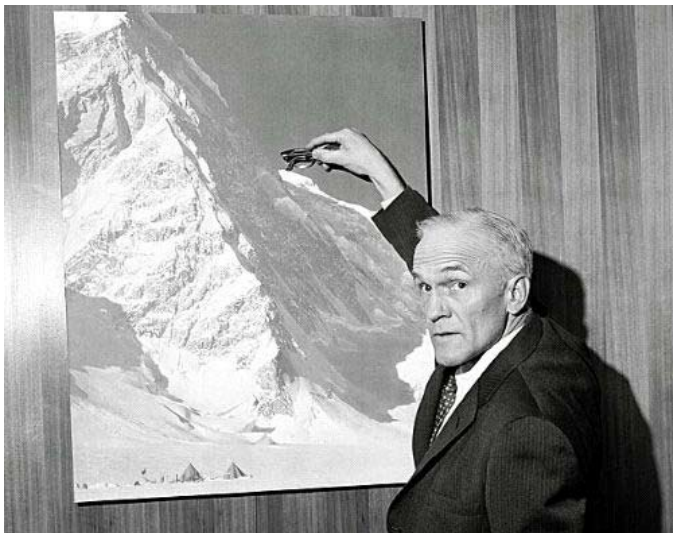


The Donjek Valley (John Clague, Simon Fraser University)

News

For he's a jolly good fellow! Andy Williams, KLRS Manager since 1973, was recently elected a Fellow of the Arctic Institute of North America. Congratulations Andy!

Bradford Washburn passed away January 10 of this year at the age of 96. Brad was a photographer, mountaineer and cartographer of world renown. He led several early expeditions into the Kluane region, including the first aerial reconnaissance of the Icefield Ranges in 1935 and the first ascent of Mt. Lucania in 1937.



Photos: **BELOW LEFT:** Bradford Washburn points to a photo of Mt. Kennedy in this 1965 photo (Bill Chaplis/Associated Press Files). **BELOW RIGHT:** KLRS Manager Andy Williams in his element (Garry Clarke, University of British Columbia).



Financial Contributions



Donjek Glacier (John Clague)



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KLRS NEWSLETTER

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