Selected Milestones

Calendar Year 2008

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Selected Milestones

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Acknowledgements

The Pacific Climate Impacts Consortium (PCIC) gratefully acknowledges the support of the Province of British Columbia through the BC Ministry of Environment. BC Hydro, BC Ministry of Forests and Range, and BC Forest Science Program have provided additional support. Several contracts have supported directed research and applications for communities and stakeholders: BC Ministry of Agriculture and Lands: Integrated Land Management Bureau, City of Prince George, Raincoast, City of Whitehorse, the Northern Climate Exchange and Columbia Basin Trust.

PCIC would also like to acknowledge collaboration with the Canadian Centre for Climate Modelling and Analysis, Consortium Ouranos, and the River Forecast Centre (MoE).

In several instances exceptional individuals have worked closely with PCIC to provide advice and expertise; we have acknowledged these contributions within the project summaries.

Executive Summary

The Pacific Climate Impacts Consortium (PCIC) has been supported by a combination of grants and contracts from the BC Ministry of Environment, the Ministry of Forest and Range, BC Hydro, Forest Science Program (FSP) and a number of small contracts with BC communities and non-government organizations. Recently, funding from the BC Ministry of Environment was replaced by an extraordinary endowment from the BC government that is now the foundation of the Consortium and contributes about 70% to the budget.

With this support, the PCIC consortium is charged to take a major step forward to improve collaboration, increase its products and services, and attract accomplished scientific staff who are committed to its mission: *…. to bridge the gap between climate research and climate applications, and make practical information available…..* The support from the Province is the foundation for attracting additional resources to bring climate information to stakeholders and decision makers in government and industry.

The five Themes of PCIC are

- **Regional and Community Climate Impacts**
- **Hydrologic Impacts**
- Ocean Influences
- Climate Monitoring and Analysis
- Socio-economic Impacts.

From a *technical viewpoint*, our current focus is on the first two themes of PCIC, with some first steps being taken in the third. Some highlights identified in Sections 1-3 are:

- **Fraser River and Columbia River** – Early results on the impacts of climate on streamflow and modeling future water resources have been achieved with the VIC hydrological model.
- **Forest Climate and Insect Epidemics** – the influence of climate change on both the insect population and on the species of Spruce and Douglas Fir are estimated.
- **Community Climate Impacts** – Future Climate Change has been investigated for seven BC communities.
- **Products and Services** – Several climate datasets have been assembled: high resolution display of BC climate; future projections of climate change in Pacific North America from Global Climate Models (GCMs) and Regional Climate Models (RCMs); and an analysis of BC climate trends and projections. A Regional Analysis Tool is available at the PCIC website.
- **Critique of Seasonal Forecasts** – The potential skill of a regional climate forecast for the Province has been identified and strengths/weaknesses are being examined.

The output of the PCIC Consortium goes beyond technical accomplishments and is identified as **Products and Services** (Section 4) that are specifically useful to climate stakeholders in British Columbia.

From a *programmatic viewpoint*, the **PCIC Corporation** and a **Program Advisory Committee** (PAC) have been formed to monitor and advise the development of PCIC. A **Strategic Plan** for PCIC has been initiated. An active recruitment of technical leaders and climate scientists has **attracted new qualified staff** members. The energizing of the Consortium is evidenced in the number of presentations by visitors and the establishment of the **PCIC Seminar Series**. These topics are covered in Section 5 of this report.

This report on Selected Milestones will be followed by a more complete accounting in an Annual Report of PCIC early in 2009.

1. Hydrologic Impacts

1.1. Fraser River—Impacts of Mountain Pine Beetle

Project Name: Fraser River Mountain Pine Beetle VIC modelling project—Macro-scale impacts of the Mountain Pine Beetle on Fraser River Basin hydrology.

Project Objective: The objective of this project is to develop a comprehensive knowledge of Mountain Pine Beetle effects on the hydrology of the Fraser River watershed and its major sub-basins.

Description: The Mountain Pine Beetle (MPB) outbreak is the largest recorded in BC history; more than 8.7 million hectares of the province's pine forests are currently infested with MPB. The Variable Infiltration Capacity (VIC) hydrologic model has been developed to evaluate MPB (i.e. forest cover change) effects within the entire Fraser River watershed upstream of Hope (270,000 km^2 drainage area) at a $1/16^{th}$-degree model resolution. The VIC model was selected to examine the widespread change to land cover because VIC has specific capacity to simulate forest cover changes for scenario development and subsequent analysis of changes to streamflow. Scenarios are designed to evaluate different MPB infestation and harvest levels at several locations coinciding with gauged stream locations within and at the outlet of the Fraser Basin.

Development of the VIC hydrologic model includes preparation of several prerequisite fields, including forcings, vegetation, soils, and river routing. Model *forcing data* (maximum and minimum temperature, precipitation and wind speed) are produced by interpolation of Environment Canada daily weather data to a $1/16^{th}$-degree grid for all of British Columbia spanning the period 1915 to 2006. *Vegetation classification* was produced for the Fraser River using data from the Ministry of Forests and Range's Vegetation Resources Inventory. *Soil classification* and the estimation of associated hydrologic and hydraulic parameters were completed for the entire province based on physical soil data from the ISRIC-WISE global soil profiles datasets. The *streamflow channel network* or *routing model* was developed by hydrologically conditioning the SRTM 15-arc seconds digital elevation model using the 1:20,000 BC Corporate Watershed Base and producing gridded flow direction and flow accumulation surfaces. Calibration of the VIC model is now underway.

Results and Accomplishments:

Principal results of the hydrologic simulation include accumulated snowpack estimates (snow water equivalent, SWE), illustrated for the calibration period (1985-1995) for each grid cell in the Fraser Basin (Figure 1). VIC streamflow estimates are a key model result, shown compared to the observed river flow for the Fraser River at Hope (Figure 2). The VIC model and its associated routing model have been set-up to run on the University of Victoria Research Computing Facility's powerful Mercury Linux cluster.

Reports and Publications:

Quantifying the water resource impacts of mountain pine beetle and associated salvage operations across a range of watershed scales. Cheong, T. 2008. Progress Report 2007/2008 to NRCAN. BC River Forecast Centre. Victoria, BC.

Status Update Report, VIC Hydrologic Modelling Project, January 2008 – June 2008. Bennett, K.E. 2008. Report to BC Hydro. Pacific Climate Impacts Consortium. Victoria, BC.

Work plan for Hydrologic Modelling. Development of the VIC Hydrologic Model for BC Watersheds. Bennett, K.E., Werner, A.T., Schnorbus, M., and Rodenhuis, D.R. 2008. Pacific Climate Impacts Consortium. Victoria, BC.

Acknowledgements: Support from BC Hydro and NRCan are acknowledged.

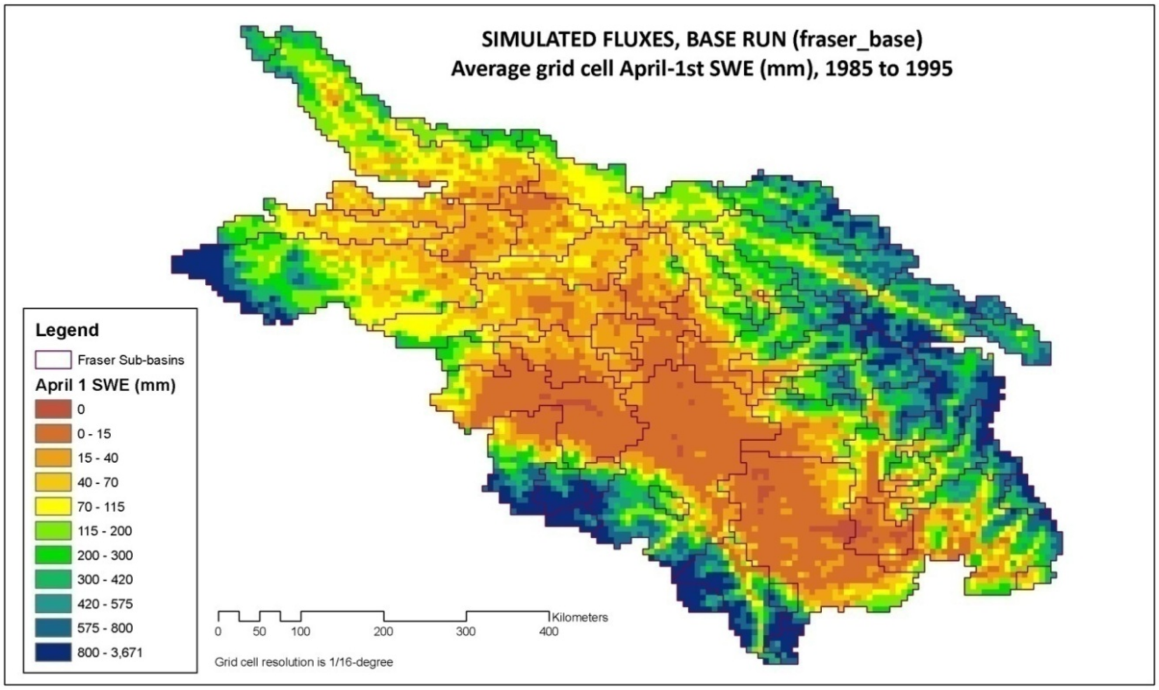

Figure 1: Average April 1st snow water equivalent by grid cell for the Fraser base run (i.e. uncalibrated).

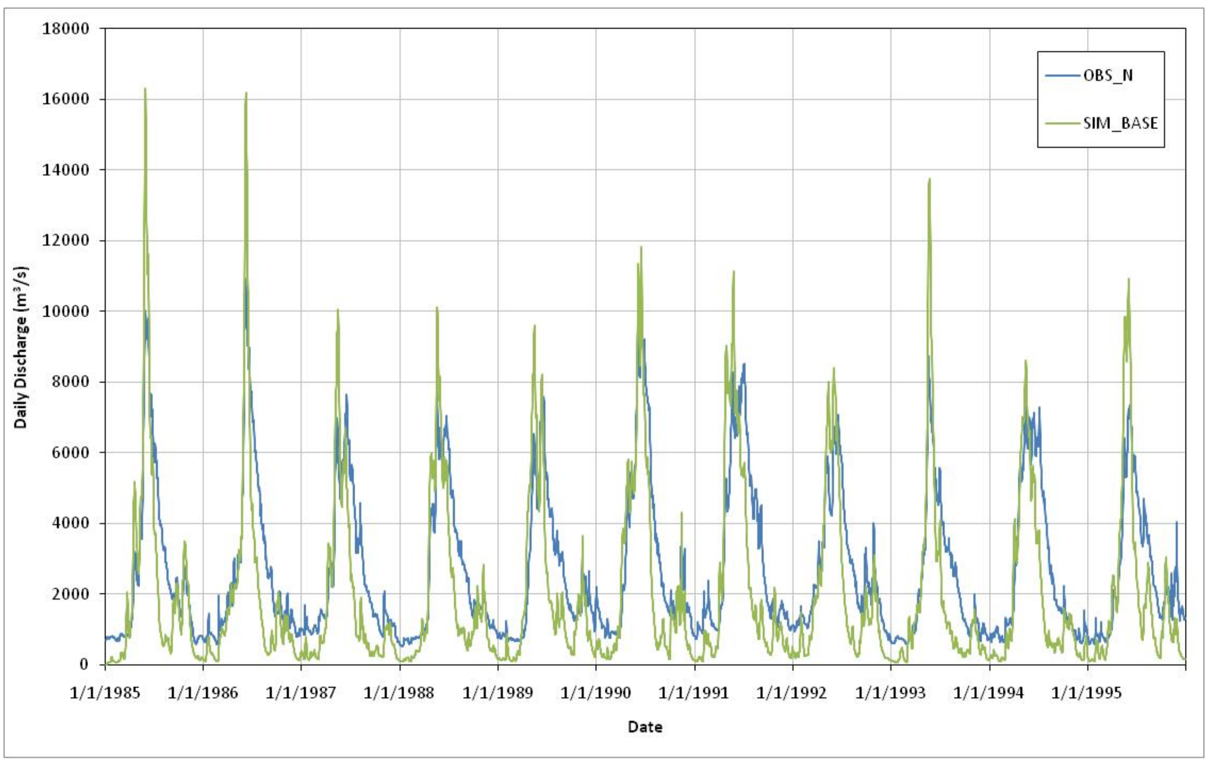

Figure 2: Simulated (base run) and observed hydrographs for the Fraser River at Hope for the period 1/1/1985 to 12/31/1995 (uncalibrated results).

1.2. **Columbia River—Water resources**

Project Name: Macro-scale climate change impacts on streamflow in the Columbia River Basin.

Objective of Project: The objective of this project is to analyse results from the Columbia River hydrologic model produced by the University of Washington's Climate Impact Group and to build a comprehensive knowledge of climate change impacts at streamflow locations across the Columbia River Basin.

Description: In the Columbia River Basin (CRB), hydro-electric operations, forestry, agriculture and fisheries are all sectors that may be impacted by climate change. This project was initiated in collaboration with the Climate Impacts Group at the University of Washington (UW-CIG) to generate output hydrographs at approximately 50 watersheds through the Canadian portion of the CRB. The information (i.e. streamflow projections) generated by UW-CIG and analysed by the Pacific Climate Impacts Consortium is invaluable data for the province and the public to evaluate the range of climate change impacts projected for the CRB.

The streamflow projections are produced using the UW-CIG's 1/16th-degree resolution Variable Infiltration Capacity (VIC) model and downscaled Global Climate Model data. Raw model input data will be collected, the model will be re-run at the University of Victoria and results will be analysed to compare and evaluate the simulations against observed historical streamflow. Raw information includes: forcings, vegetation, soils, and stream network for the entire CRB using similar methods as described for the Fraser River Basin project. The VIC model gridded fluxes (runoff, evapotranspiration, baseflow, snowpack, etc.) will be produced for all grid cells in the CRB. Future projections (2020's, 2050's, 2080's and the 2100's) are developed based on the historical forcings from 1950 onward, and projections are produced by downscaling GCM information.

Results and Accomplishments:

As of 2008, raw model data has been gathered by PCIC, including forcings (historical), soils, vegetation, and stream network for a sub watershed of the Columba River Basin (Mica). Daily, monthly and annual hydrographs for the historical period (1915-2006) at Mica were produced (1975-1985 streamflow shown in Figure 1). A report by UW-CIG will describe methods and analysis for the entire Columbia Basin, while PCIC will provide analysis and interpretation for select BC watersheds.

Complete model results for the CRB will be available in April 2009.

Reports and Publications:

Status Update Report, VIC Hydrologic Modelling Project, July to December 2008. Bennett, K.E. 2008. Report to BC Hydro. Pacific Climate Impacts Consortium. Victoria, BC.

Acknowledgements: Support from BC Hydro and MOE is acknowledged. Collaboration with the University of Washington Climate Impacts Group is acknowledged.

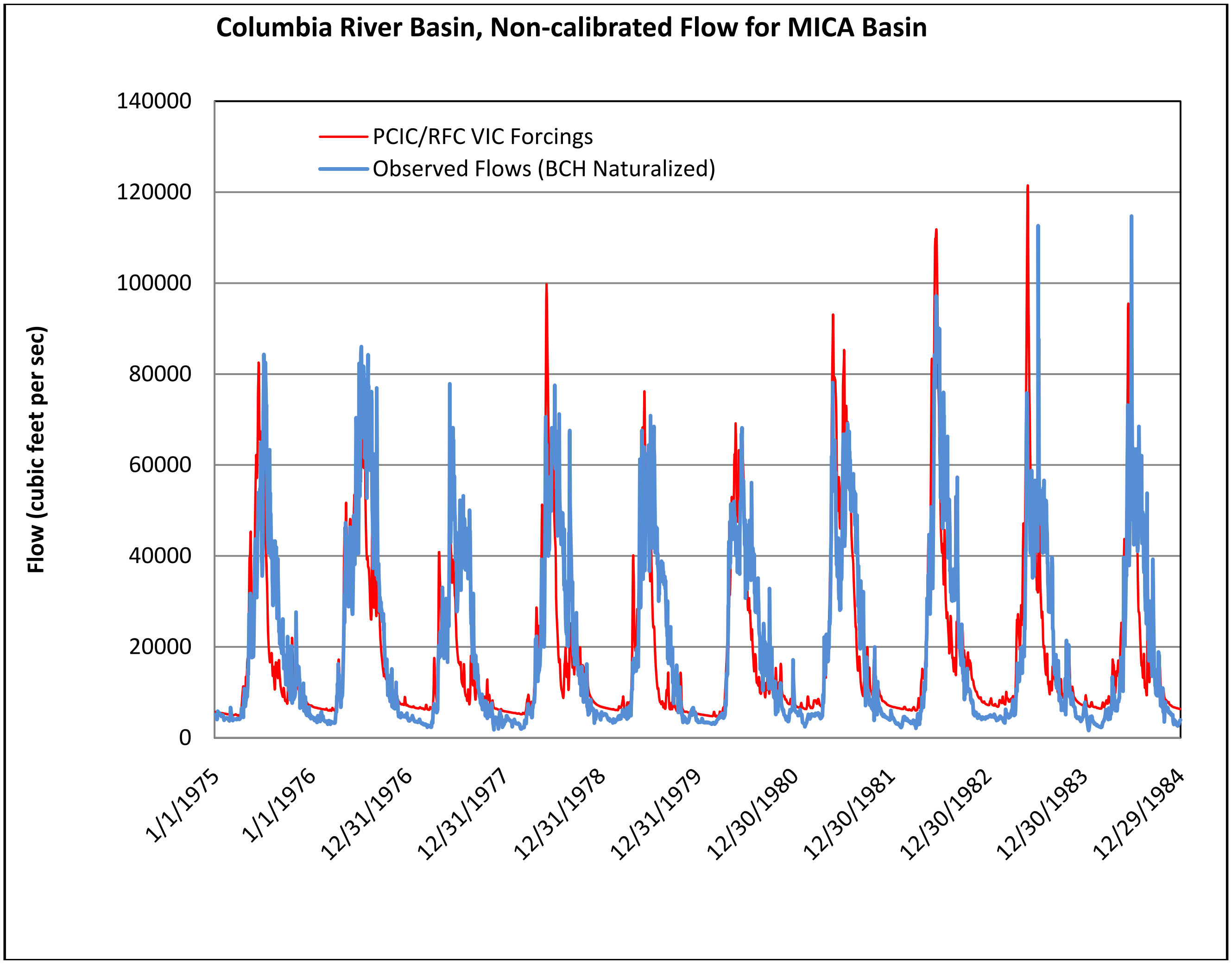

Figure 1: Example of model calculations of streamflow at the Mica Basin and comparison with naturalized observed flow.

2. Regional and Community Climate Impacts

2.1. Impacts of climate change on outbreaks of western spruce budworm and spruce bark beetles

Project Name: Projected impacts of climate change on outbreaks of western spruce budworm and spruce bark beetles.

Project Objective: The objective of this project is to define the climatic envelope in which pest outbreaks occur, so that the likelihood of pest outbreaks under future climatic conditions can be assessed.

Project Description: The devastation caused by the current mountain pine beetle epidemic is widely known, but mountain pine beetle is not the only pest species currently threatening British Columbia's forests. Western spruce budworm, which feeds on Douglas Fir trees, and spruce bark beetle, which attacks spruce trees, are two species that could have widespread and very serious negative impacts on forests in British Columbia. In this project, the climatic envelopes within which pest outbreaks occur were defined through comparison of the climatology of areas where outbreaks have occurred to the climatology of all areas where the host tree species is found. Mismatches between the two can be considered an indication of climatic influences on the occurrence of outbreaks.

Results and Accomplishments: Climatic envelopes were successfully defined for both species of forest pests. There is a clear mismatch between the range of climatic conditions in which the pest outbreaks occur and the range of climatic conditions in which the host tree species grow. *The results indicate that warming temperatures will lead to an increased risk of pest outbreaks in many of the areas where the host tree species currently grows.*

This analysis revealed a strong relationship between temperature and occurrence of spruce bark beetle outbreaks (Figure 1). The percentage of outbreaks occurring at a given mean annual temperature closely follows the percentage of spruce trees occurring at that temperature in the upper limits of the temperature distribution. However, there is a clear mismatch between the percentage of spruce trees occurring in areas of lower mean annual temperature and the percentage of outbreaks occurring at the same temperature. *This indicates that the distribution of spruce bark beetle outbreaks is restricted to the warmer areas of their host's distribution*. Hosts now living at the colder limits of the distribution of spruce trees will therefore likely become more susceptible to spruce bark beetle outbreaks as climate warms. This analysis also indicates that spruce bark beetle outbreaks are less common in the drier areas of their host's distribution (Figure 2).

Furthermore, this analysis showed western spruce budworm outbreaks to be less common among hosts living in the extremes of Douglas fir's temperature distribution (Figure 3). There are currently Douglas fir populations occupying areas with mean annual temperatures that are too cold or too warm for outbreaks to occur. *Douglas fir trees currently living at the colder limits of this species' distribution will be at a much higher risk of western spruce budworm outbreaks as temperatures increase.* Western spruce budworm outbreaks are also considerably more common in areas with low summer and spring precipitation (Figure 4).

Reports and Publications:

Symposium addresses science of researching forest pests, climate change, submitted to and accepted by the Forrex journal Link. Flower, A., Murdock, T.Q. 2008. Pacific Climate Impacts Consortium. Victoria, BC

Acknowledgements: Funding provided by BC Ministry of Forests and Range Forest Science Program (FSP). Consultation with David Spittlehouse, BC Ministry of Forests and Range; Steve Taylor, Canadian Forest Service; Richard Hebda, Royal British Columbia Museum; and Tongli Wang, University of British Columbia are also acknowledged.

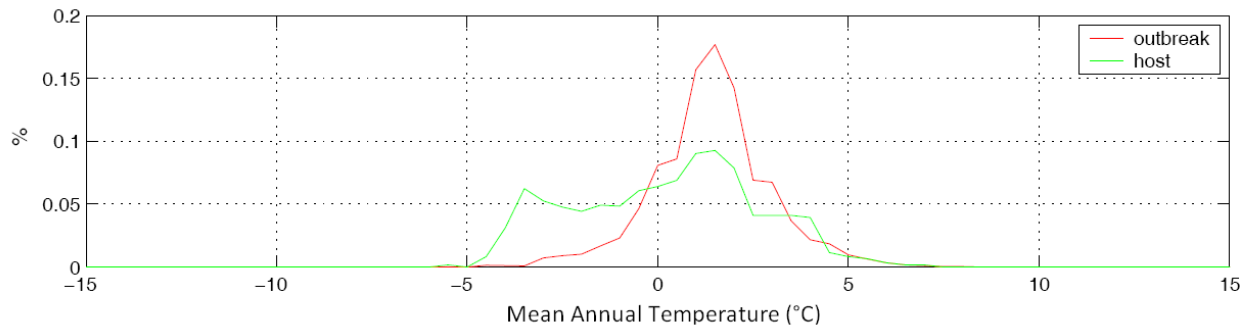

Figure 1: Occurrence of host (spruce trees) and spruce bark beetle outbreaks compared to mean annual temperature.

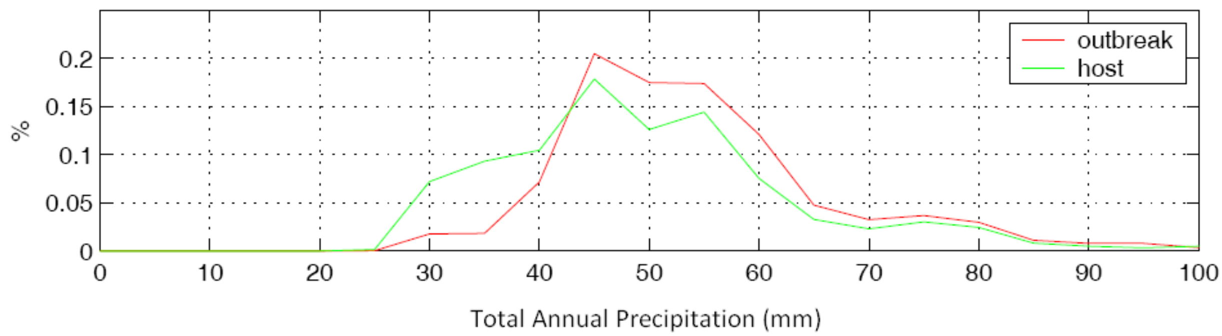

Figure 2: Occurrence of host (spruce trees) and spruce bark beetle outbreaks compared to total annual precipitation.

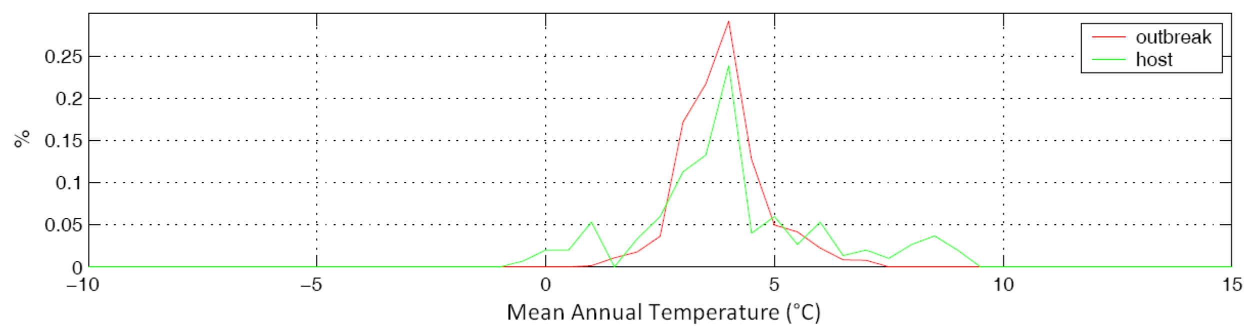

Figure 3: Occurrence of host (Douglas fir trees) and western spruce budworm outbreaks compared to mean annual temperature.

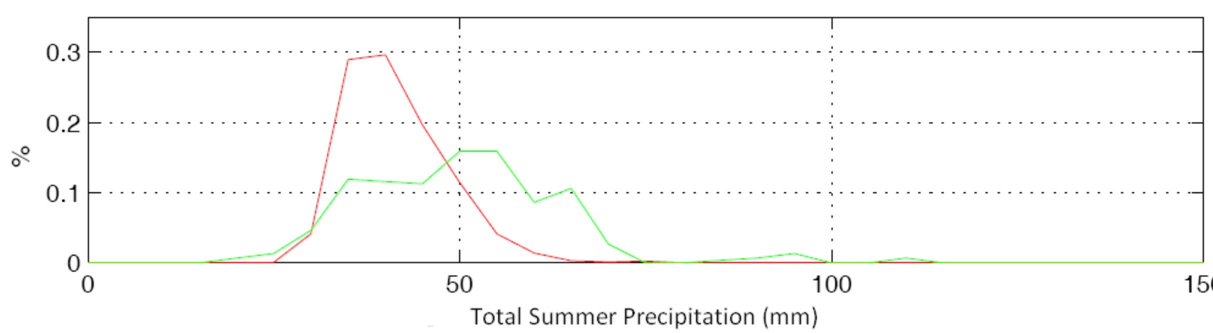

Figure 4: Occurrence of host (Douglas fir trees) and western spruce budworm outbreaks compared to total summer precipitation.

2.2. **Impacts of Climate Change on Spruce and Douglas Fir Forests**

Project Name: Projected impacts of climate change on spruce and Douglas fir forests in British Columbia

Project Objective: The objective of this project is to explore the impact of projected climate change on existing spruce and Douglas fir forests in British Columbia.

Project Description: Bioclimatic envelope models were employed to define the current distribution and predict the future distribution of areas with climatic conditions suitable for spruce and Douglas fir forests. Bioclimatic envelope models use historical climate data to model a species' spatial distribution. Projected future changes in climatic conditions can then be fed into the model to predict future climatic suitability for each species. Model results were mapped using GIS software at a resolution of 600 x 600 metres throughout British Columbia.

Results and Accomplishments: Bioclimatic envelope models were developed for spruce and Douglas fir forests. The models successfully predict the current distribution of spruce and Douglas fir trees in British Columbia based on a suite of eight climate variables. Five different climate projections were used to analyze a broad range of projected future changes in climatic suitability for these species. Changes in climatic suitability were modeled for the next century.

The bioclimatic envelope model results indicate that areas of *suitable climatic conditions for spruce forests will shift to higher latitudes and elevations over the next century* (Figure 1). Large areas of decreasing suitability are evident in southeastern British Columbia.

Climatic suitability for Douglas fir shows a large expansion in suitability at higher latitudes and elevations; whereas suitability decreases on lower valley slopes and along the eastern edge of Vancouver Island (Figure 2). Although there is a large expansion in the area of climatic suitability for Douglas fir, *climatic suitability will decrease over the next century for the majority of the current stands of Douglas fir.*

Uncertainty due to differences between the five climate projections was assessed. Although the projections used in this analysis represent a wide range of potential future climatic conditions, there is considerable agreement between them regarding broad areas of future climatic suitability for these two species.

Reports and Publications:

Symposium addresses science of researching forest pests, climate change, submitted to and accepted by the Forrex journal Link. Flower, A., Murdock, T.Q. 2008. Pacific Climate Impacts Consortium. Victoria, BC

Acknowledgements: Funding provided by BC Ministry of Forests and Range Forest Science Program (FSP). Consultation with David Spittlehouse, BC Ministry of Forests and Range; Steve Taylor, Canadian Forest Service; Richard Hebda, Royal British Columbia Museum; and Tongli Wang, University of British Columbia are also acknowledged.

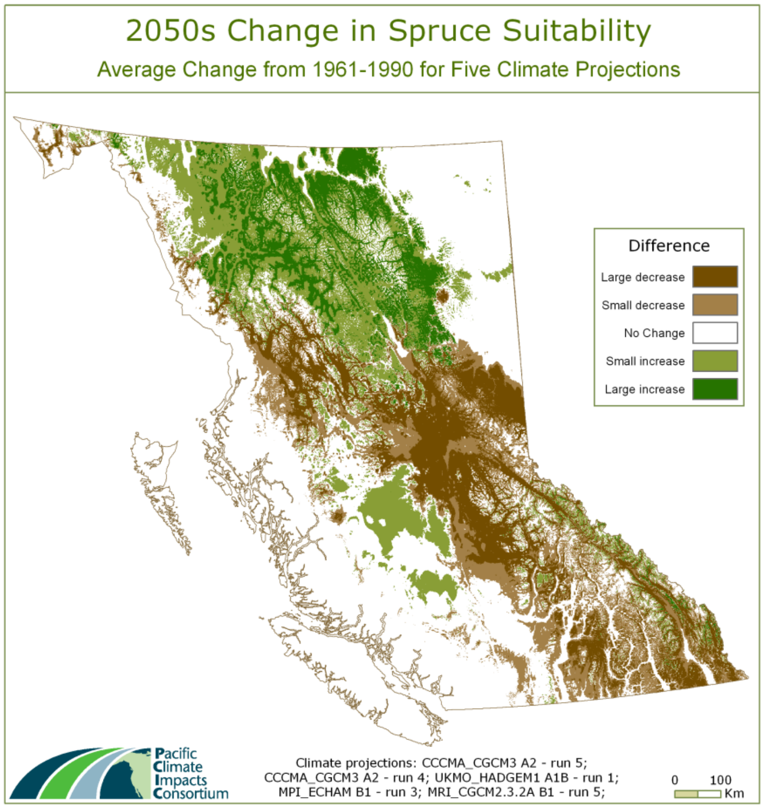

Figure 1: Change in climatic suitability for spruce trees relative to the 20th century. Results are based on the average of five climate projections for 2050.

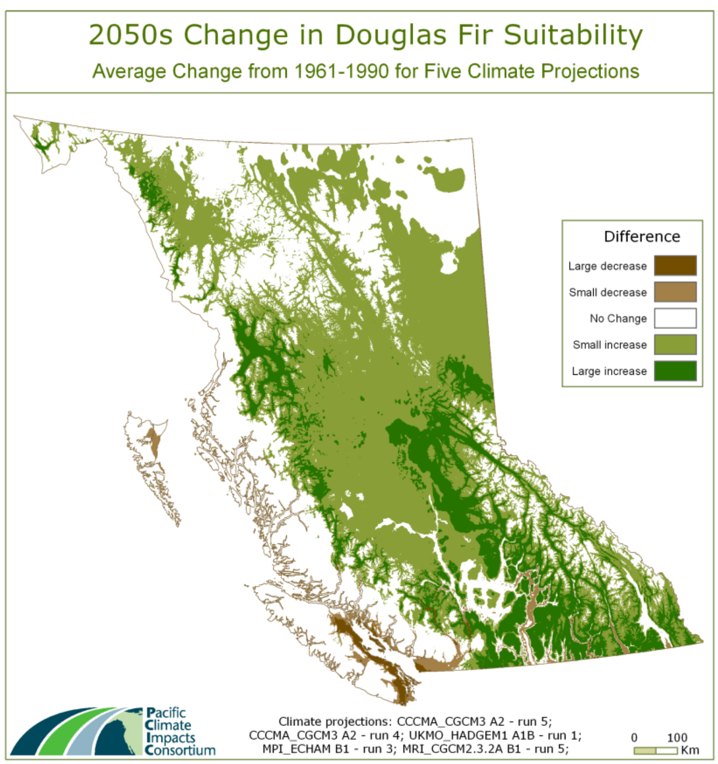

Figure 2: Change in climatic suitability for Douglas fir trees relative to the 20th century. Results are based on the average of five climate projections for 2050.

2.3. **Climate Change for Prototype Communities**

Project Name: Community Climate Analyses in BC and the Yukon

Project Objective: The objective of this project is to provide region-specific information on past trends and future projections of climate that will enable communities to adapt.

Project Description: The "Hydro-climatology and Future Climate Impacts in British Columbia" report (PCIC, 2007) documented broad-scale impacts at the provincial level. Many community managers and planners see the need to integrate region-specific climate change information into their community and resource management plans. A few communities in BC and the Yukon have joined forces with PCIC, and have established *Advocates* to lead the transfer of relevant information. To maximize the capacity of these *Advocates* in their communities, PCIC has provided quantitative scientific results and worked with them to develop reports and workshops that are tailored to each community.

Results and Accomplishments: BC's proximity to the Pacific Ocean and complex geography imposes climatic diversity across the entire province. This requires an in-depth examination of trends and climate variability in order to estimate climate impacts at the community or regional level. ***Seven** Community Climate Reports* (referenced below), document region-specific assessments of past trends and climatic variability and future projected changes in climate.

In each report, climate was assessed via a suite of tools and presented in graphical and map forms to provide visual representations that could be grasped by the layperson. Observational and interpolated datasets (Figure 1) were queried and compared to understand spatial variability in temperature and precipitation and the limitations of our observational data. The range of future climate projections was presented with boxplots of temperature and precipitation using 15 GCMs each driven by the A2 and B1 emissions scenarios (Figure 2). Spatial variability of projected changes was discussed via mapped projections from the Canadian Regional Climate Model. Techniques for analysis were devised based on those in the most recent literature. All tests included confidence bounds and tests for significance where possible (Figures 3 and 4). Each report was sent for peer-review prior to final publication.

PCIC representatives also engaged the *Advocates* from the community to transfer knowledge of the science of climate change to the community. These *Advocates* can now act as nodes in an information network, starting a cascade of information out to other members in the form of workshops, steering groups and planning initiatives. The *Advocates* have also given PCIC feedback from the community. This has helped PCIC to shape its work-plan to accommodate studies that will deliver results that are relevant for adaptation planning.

In addition to these outcomes, an automated system has been developed to produce GIS maps (Swartz and Bennett, 2008), assess trends and produce graphics efficiently (Paterson and Werner, 2008). Many datasets have also been gathered and are now in-house and accessible for future work. Thus, an efficient system for producing climate analyses has been built that allows more time for interpretation and communication of results.

As a result of work in this area, PCIC has been asked to host the Regional Adaptation Collaborative (RAC) for western Canada. This project will be funded by Natural Resources Canada (NRCAN).

Reports and Publications:

Community Assessment Project Manual, Patterson, B. and A.T. Werner, November 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

GIS Automation Project for Community Assessments: A PCIC Co-op Workterm Report, Schwartz, J. and K.E. Bennett, November 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

Community Climate Reports:

1. **Prince George, BC. -** *Summary Report: Changes in Past Hydro-climatology and Projected Future Change – for the City of Prince George,* Picketts, I., A.T. Werner and T.Q. Murdock, November 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.
2. **Kimberley and Elkford, BC. -** *Climate Analysis for the Canadian Columbia River Basin – 2008 Update – Focus on Kimberley and Elkford, BC,* Werner, A.T., T.Q. Murdock, B.M. Paterson and H.K. Jaswal, October 8th 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.
3. **Dawson City, YK. -** *Preliminary Climate Analysis for the Dawson City Region,* A.T. Werner, B.M. Paterson and H.K. Jaswal, October 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.
4. **The Great Bear Rainforest, BC.-** *Preliminary Climate Analysis for the Great Bear Rainforest Region,* A.T. Werner, B.M. Paterson and H.K. Jaswal, September 19th 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.
5. **The Cariboo-Chilcotin, BC. -** *Preliminary Analysis of Climate Change in the Cariboo-Chilcotin Area of British Columbia,* Dawson, R.J., A.T. Werner and T.Q. Murdock, September 8th 2008, Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.
6. **City of Vancouver, BC. -** *City of Vancouver Administrative Report on Climate Change Adaptation*. Page 5, Table 1 - Vancouver Climate Change Projections Table and page 11, Appendix 1 – Overview Climate Change Projections Table created by A.T. Werner and T.Q. Murdock. Beck, B. and B. Crowe, May 27th 2008.
7. **Whitehorse, YT. -** *Summary Report: Changes in Past Hydro-Climatology and Projected Future Changes – for the City of Whitehorse*, Werner, A.T. and T.Q. Murdock, January 11th 2008. YT, Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

Acknowledgements: Support is acknowledged from the BC Ministry of the Environment, BC Hydro, BC Ministry of Agriculture and Lands: Integrated Land Management Bureau, City of Prince George, Raincoast, City of Whitehorse, Northern Climate Exchange, Columbia Basin Trust and City of Vancouver. Reviews by Stephen Tyler, Tim Kittel and Sean Fleming are also acknowledged.

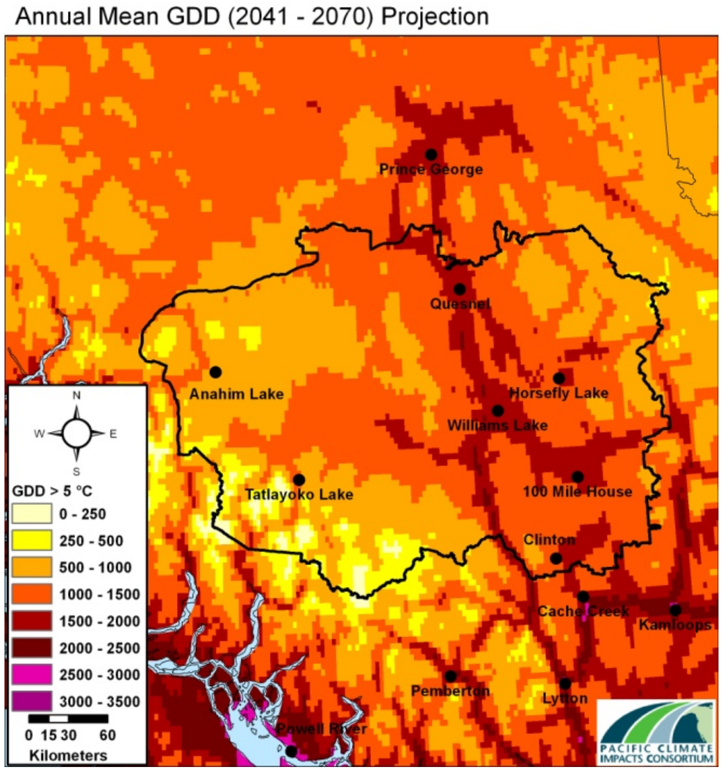

Figure 1: High-resolution climate projections of Growing Degree Days (GDD) using PRISM climatology delta-method using CGCM3 A2 emissions scenario for the Cariboo-Chilcotin. Source: Lawrence Livermore National Laboratory (LLNL) data, ClimateBC.

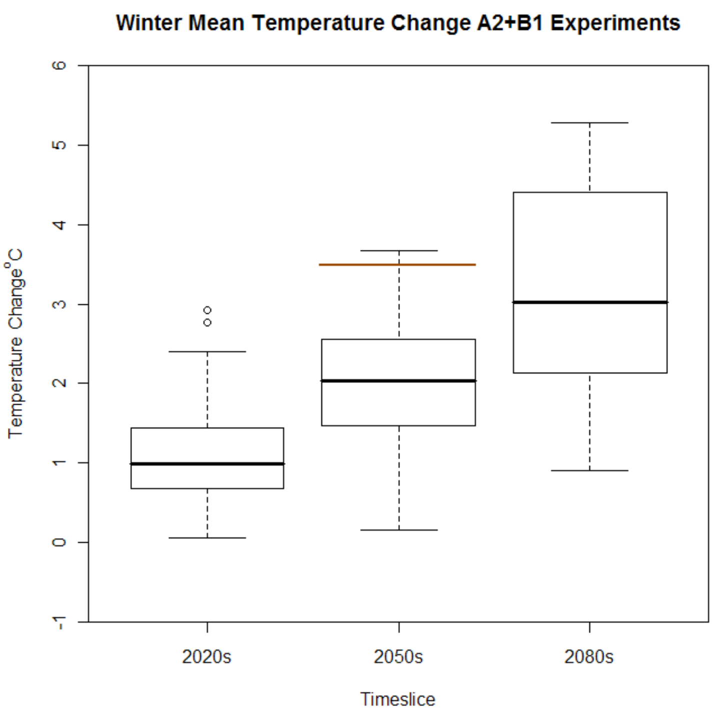

Figure 2: Projected change in winter mean temperature in the Prince George region as compared to the 1961-1900 baseline for 15 GCMs following each of B1 and A2. The brown line indicated the CGCM3 A2 emissions scenario, run 4 result. Source: Lawrence Livermore National Laboratory (LLNL) data, ClimateBC.

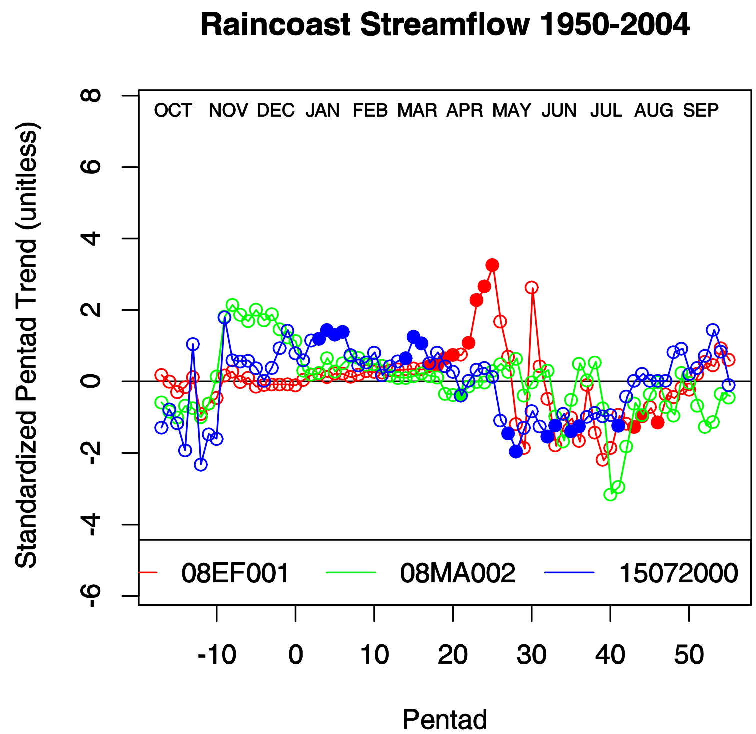

Figure 3 - Standardized trends in streamflow for the Great Bear Rainforest region including Skeena River (08EF001), Chilko River (08MA002), and Fish Creek near Ketchikan, Alaska (15072090). Closed circles indicated significance at the 95% confidence level.

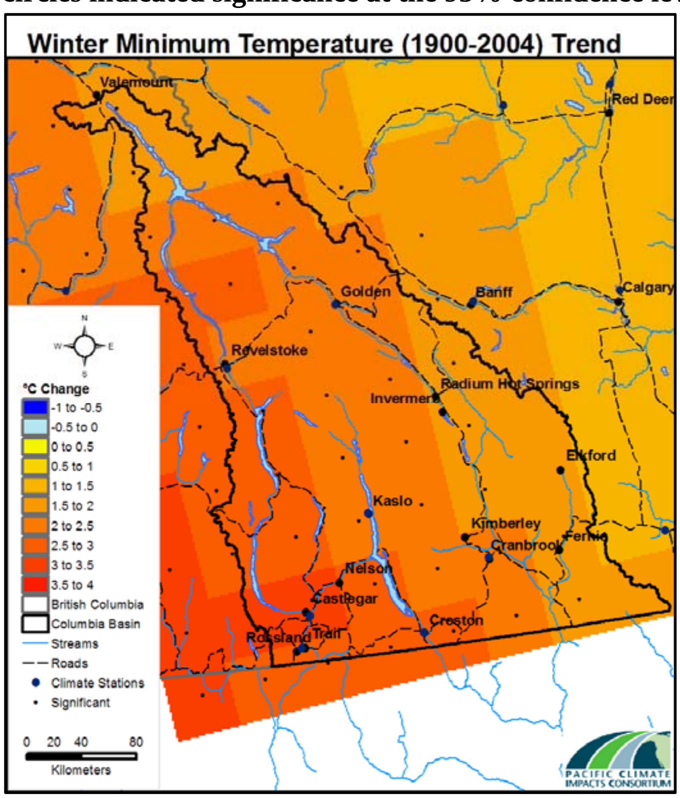

Figure 4 - Trends in winter minimum temperature for the Columbia Basin. Results are based on 1900 to 2004 data and calculated as degree Celsius change per century. Black solid circles indicate statistically significant results (95% confidence level).

2.4. **Trends in Snow Water Equivalent**

Project Name: Snow Water Equivalent (SWE) trends and climate analysis for Northwest Pacific North America.

Project Objective: The objective of this project is to extend the analysis of snowpack (as snow water equivalent, SWE), undertaken for the Climate Overview report, throughout Pacific North America.

Project Description: Declines in snowpack have been observed in southern BC; however, the extent and spatial variability of past trends and relationships to climate of snowpack changes are not understood for the entire region of Pacific North America. This information is key to interpreting future projected changes that may occur within this important reservoir of water.

This study examines the spatial variability in cold season (January-June) snowpack trends for selected periods (1951-2007, 1971-2007) at stations from Alaska to New Mexico. Notably, the work focuses on changes occurring in the Northwest. Observational databases of snow water equivalent (SWE) have been collected from Alaska, western US states and the Canadian provinces of British Columbia, Alberta, Saskatchewan, and territories of NWT, and the Yukon. These databases were validated to remove inconsistencies and errors in the station records, dates, or the geographic co-ordinates of the station. The relationships of changes in SWE trends compared to climate (precipitation and temperature) and other factors such as elevation, slope, aspect, distance to coast and wind speed was an important component of this work.

Results and Accomplishments:

Analysis of SWE shows spatial variability in the count of records in different months and over time. Initial trend results show spatial consistency (in both magnitude and direction of trend) across the southern regions of the study area for both periods (Figure 1), while spatial variability was present across the north. Climate correlations and principal components indicate different drivers of change in SWE across the western US, Canada and north to Alaska. These results will be used to validate future predictions of SWE available in the Canadian Regional Climate Model (CRCM) and the Variable Infiltration Capacity (VIC) hydrologic model for Western Northern America and British Columbia.

Reports and Publications:

Analysis of Snow Water Equivalent (SWE) Trends and Climate relationships across Pacific North America. K.E. Bennett, T.D. Prowse. Forthcoming. Peer-reviewed publication, in preparation for Journal of Hydrometeorology.

Presentation: **Observed SWE Estimates and Climate Analysis for Northwest Pacific North America: Analysis and Validation for future projection of SWE using the CRCM and VIC**. K.E. Bennett, Bronaugh, D., and Rodenhuis, D.R. Accepted poster presentation for AGU 2008. San Francisco, CA.

Presentation: **Snow Water Equivalent (SWE) Trends in Pacific North America. Canadian Geophysical Union Conference**. K.E. Bennett, Werner, A.T., and Bronaugh, D. 2008. Banff, AB.

Acknowledgements: Support from BC Hydro is acknowledged.

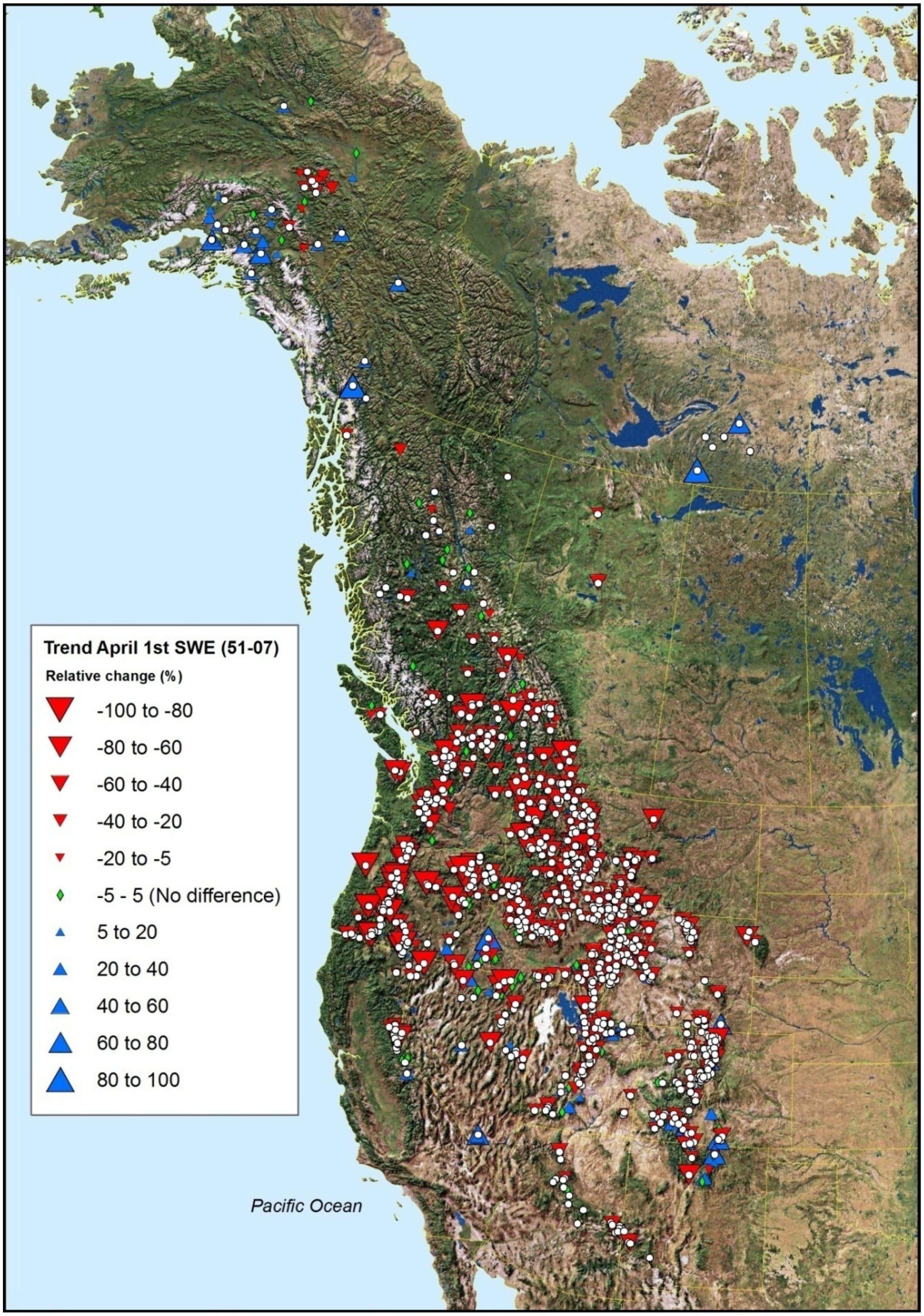

Figure 1: Analysis of SWE trends across the study region, 1951 – 2007. Red triangles indicate negative trend, blue triangle are positive trend, green triangles indicate no change (less than 5% change). White dots indicate significance at the 95% confidence level. White dots indicate abnormally large trend increases or decreases, but not significant.

3. Ocean Influences

3.1. Critique of skill—monthly/seasonal forecasts for BC

Project Name: Seasonal Predictions Assessment

Project Objective: The objective of this project is to assess and improve the skill score of seasonal predictions of near surface air temperature and precipitation using a multimodel ensemble for Western North America and British Columbia.

Project Description: The performance of monthly and seasonal hindcasts produced with four global atmospheric models in the second phase of the Canadian Historical Forecasting Project (HFP2, Kharin et al. 2008) is being evaluated. Using several methods of combining multimodel output, deterministic and probabilistic forecasts of near surface air temperature for 0-month and 1-month leads are being considered. The emphasis is made on assessing skill of seasonal predictions in Western North America, and in British Columbia in particular.

Results and Accomplishments: The four models being used in the multimodel ensemble are the second and the third generation General Circulation Models (GCM2 and GCM3) of the Canadian Centre for Climate Modelling and Analysis (CCCma), the Spectral Element Finite model (SEF) and the Global Environmental Multiscale model (GEM) developed at Recherche en Prévision Numérique (RPN). The total ensemble size is 40. The hindcast period covers 33 years from 1969 to 2002. The hindcasts are being verified against ERA40 reanalysis and homogenized gridded records prepared by the Climate Monitoring and Data Interpretation Section of the Climate Research Division of Environment Canada. The HFP2 results form the basis for the operational seasonal predictions produced by the Canadian Meteorological Centre.

Figure 1 shows the maps of the correlation skill score of monthly predictions of near surface air temperature at 0-month lead in British Columbia in winter and early spring when the skill is among the highest. The correlations are above 0.6 in many parts of BC implying that more than a third of interannual variability can be explained by the model hindcasts. Unfortunately, skill of the corresponding precipitation predictions is much lower (not shown). The work is currently under way to develop statistical methods to improve model forecasts of precipitation over BC.

We also plan to evaluate model predictions of cooling and heating degree days. These quantitative indices are designed to reflect the demand for energy needed to heat or cool a home or business.

Reports and Publications:

Skill assessment of seasonal hindcasts from the Canadian Historical Forecast Project: (to be submitted to *Atmosphere--Ocean*) Kharin, V. V., F. W. Zwiers, Q. Teng, G. J. Boer, J. Derome, and J. S. Fontecilla, 2008.

Acknowledgements: Funding provided by BC Hydro. Consultation by Vlatcheslav Kharin, Canadian Centre for Climate Modelling and Analysis is acknowledged.

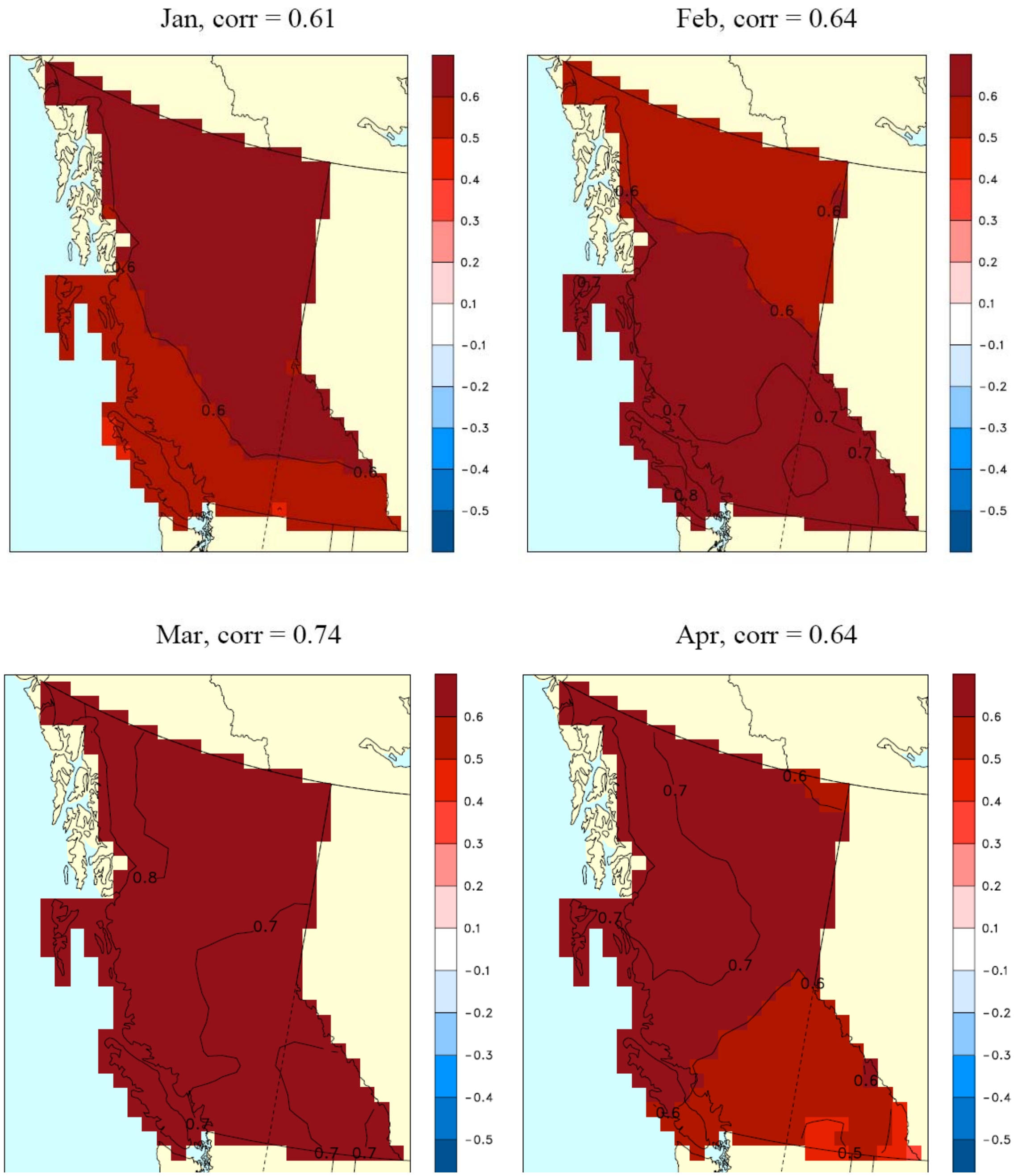

Figure 1: Spatial distribution of the correlation skill score for prediction of monthly means of 2m temperature in British Columbia at zero month lead in winter and early spring months. Spatial-mean skill scores are indicated in the titles.

Products and Services

3.2. **Online Interface**

Project Name: Online interface—Regional Analysis Tool (RAT)

Project Objective: The objective of this project is to provide climate projections on the PCIC website for extramural data analysis.

Project Description: PCIC's Regional Analysis Tool is a web-based tool designed to analyze and display climate model results (GCM[i], RCM[ii]) and historical climate data acquired and developed by PCIC. The presentation is designed for knowledgeable stakeholders and scientists. The tool compares model results over predefined or user defined regions and displays results to users on maps.

Results and Accomplishments: PCIC has recently added all 145 models from the IPCC[iii] AR4[iv] ensemble of GCM runs. These are the most recently created IPCC vetted GCM results available, and extend the existing ensemble of the IPCC TAR[v] ensemble. Figure 1 shows a scatter plot of mean temperature change averaged over BC from the 1961-1990 baseline for the 2020s, 2050s, and 2080s timeslices. It illustrates the agreement on climate change among different models, as well as the uncertainty inherent in anticipating future emissions and in GCM simulations. This is essential to proper application and interpretation of GCM results.

PCIC has also added to the RAT a historical data set covering all of British Columbia at 400m resolution. This data set is on a monthly time scale and extends from 1901 to 2002. This data set is a hitherto unprecedented accomplishment – not only is the resolution high, but the spatial extent is large and the historical record is long. Figure 2 illustrates the 1961-1990 mean annual temperature average over BC. The level of detail available with this product will improve the precision of climate results over individual river basins, topographic features and municipalities.

References:

http://www.pacificclimate.org/tools/regionalanalysis/

Acknowledgements: The support of BC Ministry of Environment is acknowledged. The IPCC AR4 ensemble of output was acquired from the Earth Systems Group at Lawrence Livermore National Laboratory.

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i GCM, Global Climate Model
ii RCM, Regional Climate Model
iii IPCC, Intergovernmental Panel on Climate Change
iv AR4, Assessment Report 4: Climate Change 2007
v TAR, Third Assessment Report: Climate Change 2001

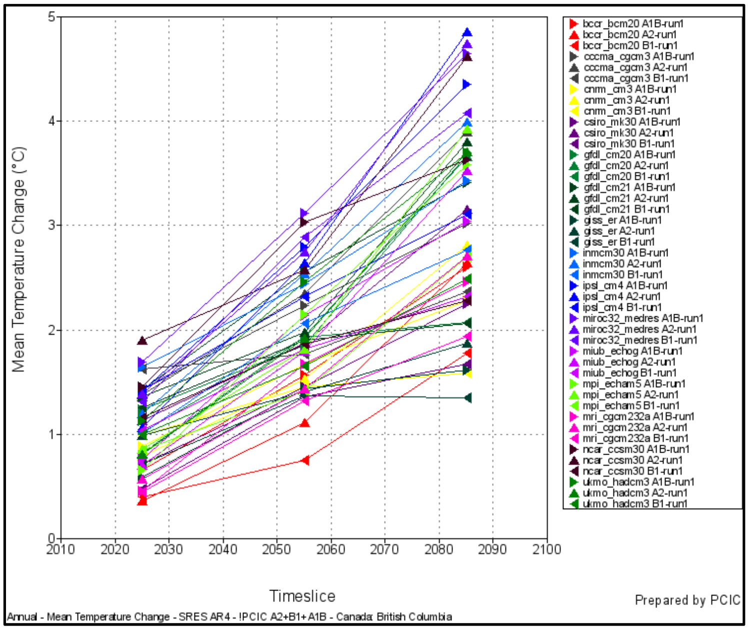

Figure 1: Scatter plot by timeseries of predicted change in mean annual temperature for the 2020s, 2050s, and 2080s from the 1961-1990 baseline averaged over British Columbia. The ensemble used is the PCIC A2+B1+A1B ensemble, which includes 45 selected GCM runs from the IPCC AR4 ensemble.

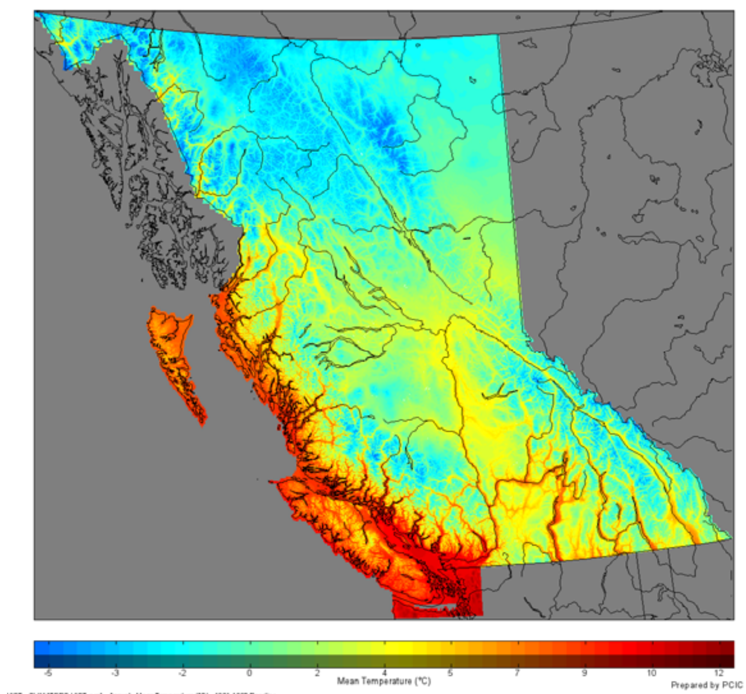

Figure 2: Map of 1961-1990 mean annual temperature over BC. This high resolution downscaled map uses the 400m data set created by PCIC.

3.3. **Climate BC—Hi-resolution mapping**

Project Name: ClimateBC—High resolution historical data

Project Objective: The objective of this project is to create and display a historical timeseries covering BC at 400m resolution.

Project Description: PCIC acquired a climate data set for BC at 400m resolution on a monthly timescale covering the period 1901 to 2002. ClimateBC software was chosen because it utilizes data from BC only to adjust data with linear regressions. Furthermore, the historical data were corrected and downscaled with PRISM technology.

Results and Accomplishments: PCIC created a historical timeseries over BC at 400m spatial resolution using a custom version of the ClimateBC software. The timeseries is available for download upon request, and available on PCIC's Regional Analysis Tool (RAT) for analysis and visualization. These data have been used for the spruce budworm / spruce bark beetle forestry project to correlate pest outbreaks with climate. In this application, high spatial resolution was essential to precisely pinpoint climate drivers in BC's complex terrain.

The high resolution of this data set is necessary for use in BC, where narrow valleys and fjords make the standard timeseries data sets available irrelevant or misleading. Figures 1 and 2 show December 1996 mean daily precipitation for 1996 and 1997 respectively. The level of detail on the map is high enough to resolve yearly differences. For example, although precipitation along the coast of BC was higher overall in 1997, precipitation in the Victoria area was higher in 1996, coinciding with the blizzard of 1996.

Reports and Publications:

http://www.pacificclimate.org/tools/data/#climatebc

http://www.pacificclimate.org/tools/regionalanalysis/

Acknowledgments: The support of the Ministry of Forests and Range and the Forest Sciences Program (FSP) is acknowledged.

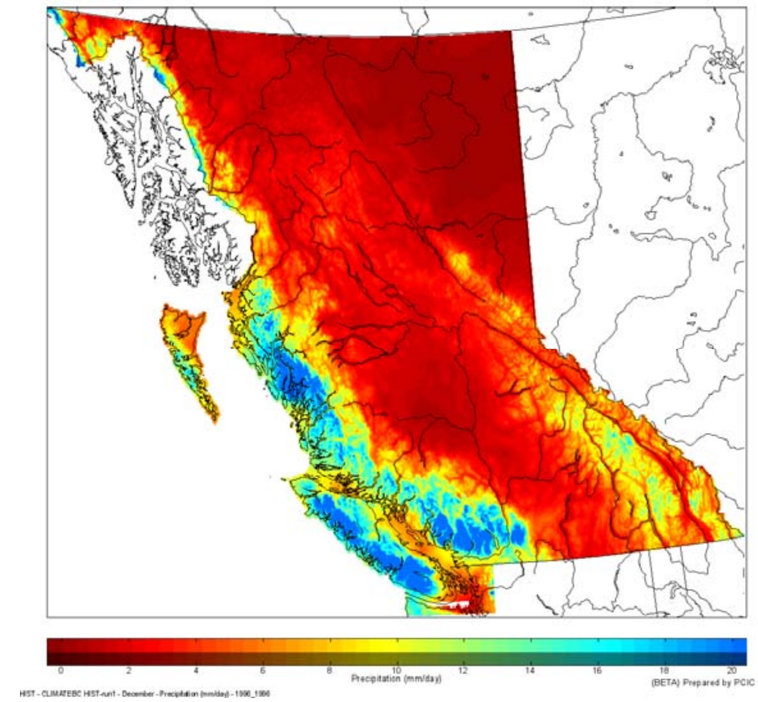

Figure 1: December 1996 mean daily precipitation, in mm/day.

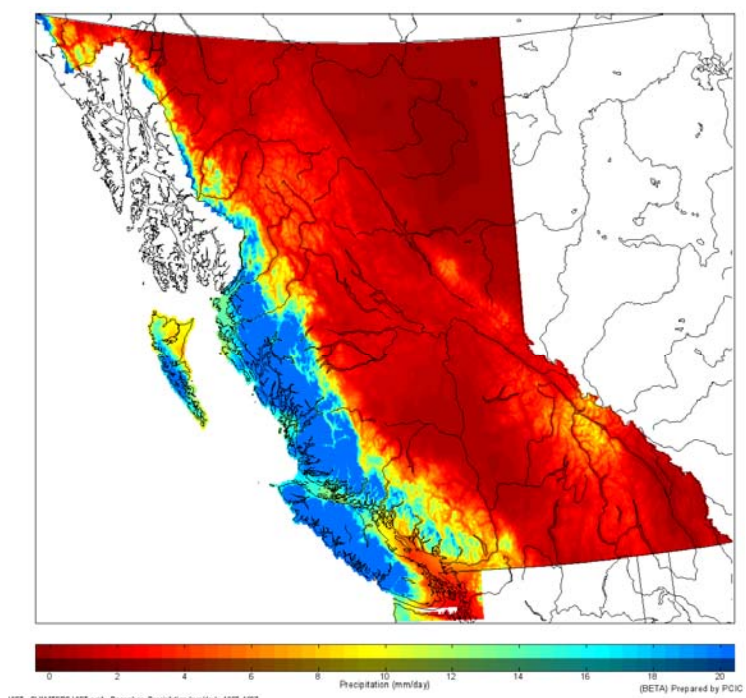

Figure 2: December 1997 mean daily precipitation, in mm/day.

3.4. **Regional Climate Model—presentation**

Project Name: RCM analysis - North American Regional Climate Change Assessment Program

Project Objective: The objective of this project is to display and analyze future climate projections from Regional Climate Models (RCMs) over BC and Pacific North America.

Project Description: RCM results were accessed from several different models that originate from climate centres across Canada, the US, and Europe. These results have been analyzed, displayed, and will be made available on the PCIC online interface. Variables obtained include temperature, precipitation, snowpack, as well as additional parameters, including extremes.

Results and Accomplishments: RCM climate projections have been obtained at high resolution from Ouranos Consortium and the North American Regional Climate Change Assessment Program (NARCCAP). Results have been sought at the highest resolution available (space: 10 to 45 km, time: twice daily to monthly) for surface parameters as well as selected atmospheric outputs. Several models have been included in order to ensure that model uncertainty can be described.

1. Obtained RCM results for the Canadian RCM (4 runs), ARPEGE (2 runs), and from 7 different models from Ouranos and through NARCCAP.
2. Analyzed RCM results for BC Climate Overview and community climate impacts assessments.
3. Used RCM results to project future tree species suitability.
4. Provided RCM results to next version of ClimateBC (UBC Forestry).

Additional detail is provided by an RCM when compared to GCM results. For example, temperature projections (Figure 1) illustrate a larger projected temperature increase over the mountains of the northern Columbia Basin than indicated by the low resolution GCM. Similarly, the RCM shows the rainshadow effect on future precipitation projections resulting from BC’s mountain chains (Figure 2). This appears as smaller percentage increases on the coast and Columbia Basin where the baseline precipitation is larger than in the interior plateau.

Reports and Publications:

http://www.pacificclimate.org/resources/climateimpacts/overview/

http://www.pacificclimate.org/tools/regionalanalysis/

Acknowledgements: Data from Ouranos Consortium and NARCCAP. Support by BC Ministry of Environment is acknowledged.

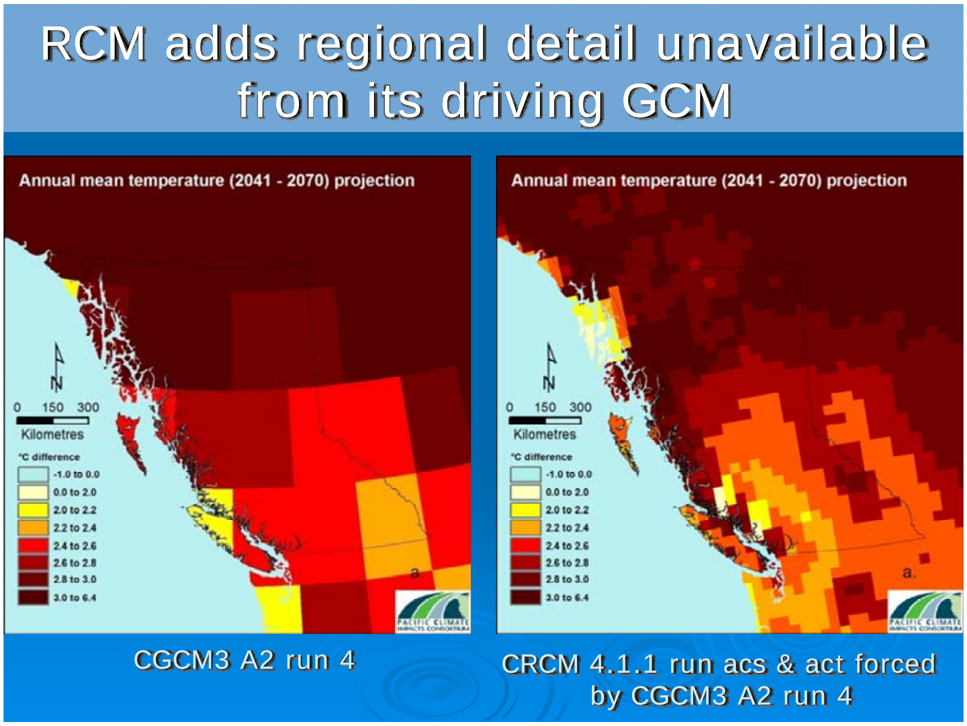

Figure 1: Comparison of Global and Regional Climate Models for BC - Annual mean temperature

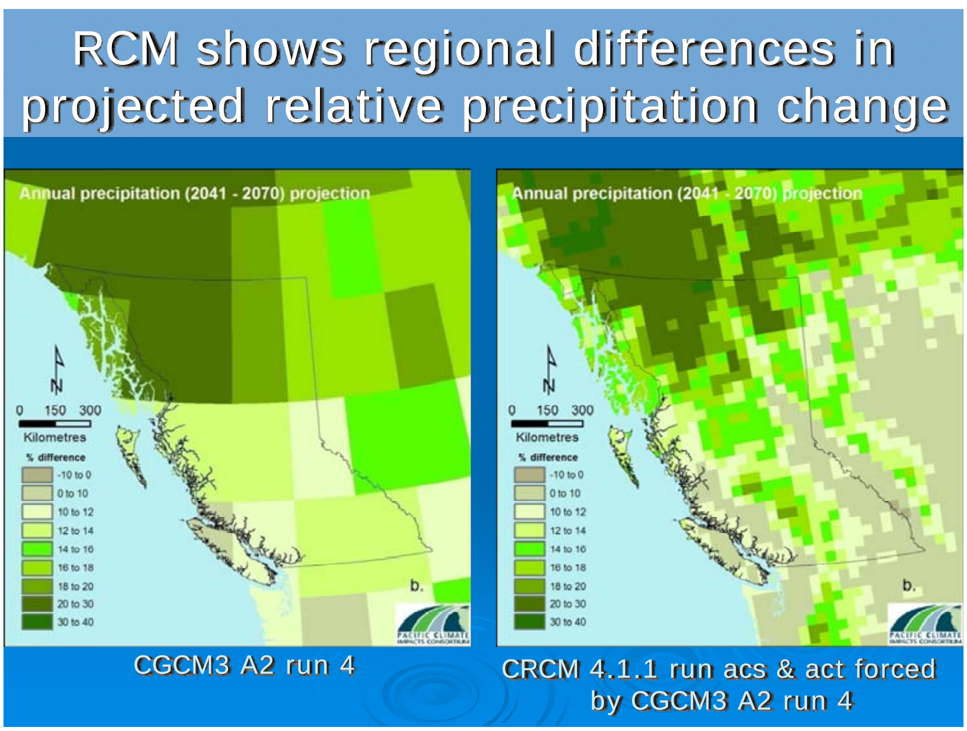

Figure 2: Comparison of Global and Regional Climate Models for BC - Annual mean temperature

3.5. **BC Trends and Projections**

Project Name: State of the Environment review

Project Objective: The objective of this project is to supply historical trends, future projections, and interpretation for the Provincial government and other organizations in British Columbia.

Project Description: PCIC acquired historical climate data and future climate model projections. These data and projections were presented as maps and provided to extramural publications. Finally, interpretation and review of these publications were provided.

Results and Accomplishments: Historical trends and future projections were computed and selected maps were then made publicly available with interpretation online.

Historical trends were computed from a gridded historical (1990-2004) dataset. Examples of historical trends are shown in Figure 1: annual mean temperature trends. This figure shows that the *annual average temperatures have increased throughout all of BC*. Statistical significance (indicated by small black dots) is apparent throughout the entire Province, *indicating that the warming trends did not arise from statistical chance* based on the length of the records.

Future projections were obtained from Global Climate Models, Regional Climate Models, and empirical downscaling. Examples of future projections are shown in Figure 2: annual mean temperature projection. The projected temperature change by the middle of the century is shown for the Canadian Regional Climate Model. These results indicate that *annual mean temperature increases of a few degrees by the 2050s are not spread equally across the Province,* but with larger increases in the North, the Columbia Basin, and parts of the Coast.

Finally, selected images were provided for ***six*** publications (Figure 3), as well as technical reviews.

Reports and Publications:

Online dissemination of maps and interpretation http://www.pacificclimate.org/resources/climateimpacts/

1. **State of the Environment Report: Environmental Trends in British Columbia**, 2007, BC Ministry of Environment.
2. **Taking Nature's Pulse, The Status of Biodiversity in British Columbia,** BiodiversityBC, 2008.
3. **Climate change, impacts, and adaptation scenarios: climate change and forest and range management in British Columbia**, 2008: BC Ministry of Forests and Range, Spittlehouse.
4. **BC Budget Backgrounder**, BC Government, 2008.
5. **Mitigating and adapting to climate change through the conservation of nature, Land Trust Alliance of BC**, 2008, Wilson and Hebda.
6. **BC Climate Action Plan**, BC Government, 2008.

Acknowledgements: Support from BC Ministry of Environment and BC Hydro is acknowledged. Climate data from Environment Canada and model output from Consortium Ouranos are acknowledged.

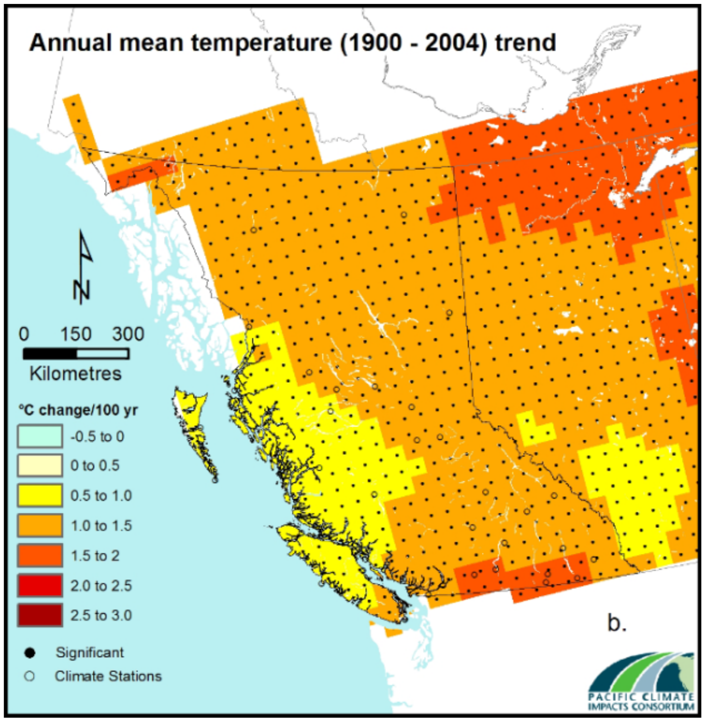

Figure 1: Annual mean temperature trend (1900-2004)

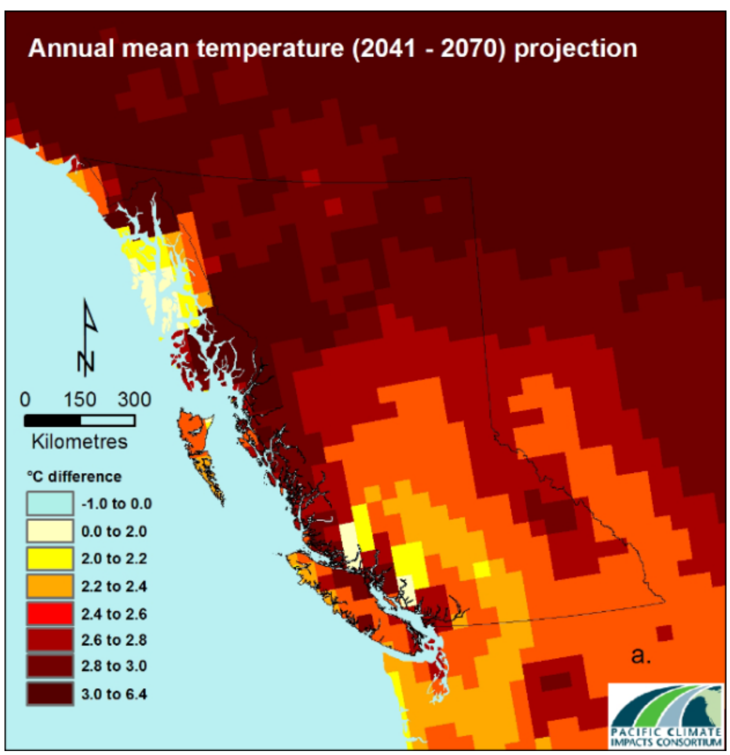

Figure 2: Annual mean temperature projection (2041-2070) - Canadian Regional Climate Model

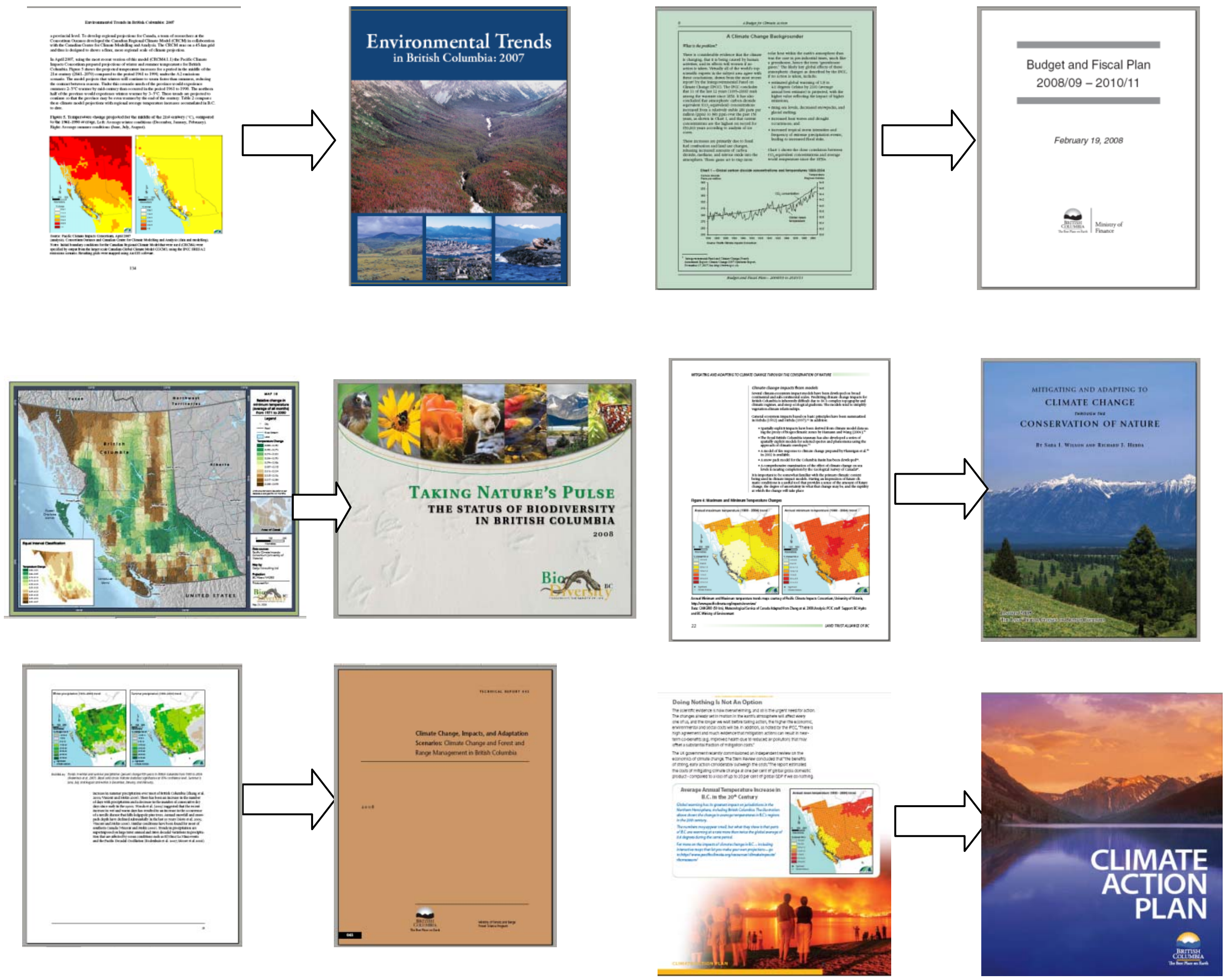

Figure 3: Trends and projections provided for six reports: (a) BC Ministry of Environment, 2007: State of the Environment Report: Environmental Trends in British Columbia; (b) Biodiversity BC, 2008: Taking Nature's Pulse, The Status of Biodiversity in British Columbia; (c) BC Ministry of Forests and Range, Spittlehouse, 2008: Climate change, impacts, and adaptation scenarios: climate change and forest and range management in British Columbia; (d) BC Government, 2008: BC Budget Backgrounder; (e) Land Trust Alliance of BC, 2008, Wilson and Hebda, Mitigating and adapting to climate change through the conservation of nature; (f) BC Government, 2008: BC Climate Action Plan

4. Establish a PCIC Consortium at the University of Victoria

4.1. Host visitors and seminars

Visit Date	Visitor	Affiliation	Presentation Title
03 Dec 2008	Francis Zwiers	Canadian Centre for Climate Modelling and Analysis	An Introduction to the analysis of extremes
19 Nov 2008	Alex Cannon	Meteorological Service of Canada, Environment Canada	Nonlinear, probabilistic statistical models for multi-site/ multivariate climate downscaling
18 Nov 2008	Jörg Schulla	Zurich	Water Balance Simulation Model
06 Nov 2008	Daniel Bewley	Department of Forest Resource Management, UBC	Baker Creek Project: Hydroclimate measurements over larger basins to advance modelling technology.
06 Nov 2008	Younes Alila	Department of Forest Resource Management, UBC	Forests and Floods: Will a new paradigm shed light on forest hydrology age-old controversies?
30 Oct 2008	David Atkinson	International Arctic Research Center, University of Alaska Fairbanks	Empirical temperature downscaling: Method and potential applications
17 Sept 2008	Dilumi Abeysirigunawardena	Department of Geography, University of Victoria	Storm Surge Climatology for Coastal British Columbia
19 Aug 2008	James Byrne	Water and Environmental Science Group, University of Lethbridge	Downscaling Weather and Climate Data for modeling past, recent and future Environmental Change in BC
22 May 2008	Eric Salathé	Center for Science in the Earth System, University of Washington	Regional Climate Modeling and Impacts Assessment in the US Pacific Northwest
23 April 2008	Sven Kotlarski	Max Planck Institute for Meteorology	Representing Glaciers in a Regional Climate Model
26 March 2008	Norm Henderson	Prairie Adaptation Research Collaborative	Climate impacts adaptation options and issues in forests of the Prairie Provinces: From zero intervention to landscape-scale exotic species introductions
27 March 2008	Elaine Barrow	Private Consultant	Initial Explorations into Drought Variability in Alberta and Saskatchewan
23 Jan 2008	Dimitri Parishkura	University of Quebec at Montreal/ Environment Canada	Evaluation and application of dynamical and statistical downscaling tools for reconstruction of the variability and extremes of current climate regime and future scenario projections

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4.2. **Host for PICS standup**

For a period of approximately five months (April-August), the offices of PCIC and PICS were merged into a Joint Pacific Climate Office (JPCO). The staff and leadership resources of PCIC were also utilized to stand up the PICS organization. During this period, the first outline of the PICS structure was identified and consensus established on the core of PICS: *integrated assessment*.

More specific PICS accomplishments have also been documented:

- Space and facilities procured in the Sedgewick Building, University of Victoria campus
- New PICS staffing identified: 1 visiting scientist, 2 contract staff, and 1 joint appointment.
- Spending Plan for FY08/09 developed and negotiated.
- Solicited list of major issues from the Provincial government.
- Newsletter initiated
- Concluded the appointment of PICS Fellows and negotiated with (four) university sites.
- Conducted meeting of the PICS Program Committee and established four working Subcommittees.
- Defined and initiated PICS Campus Coordinators.
- Wrote proposals for an Organizational Workshop, and annual PICS Colloquia.

At the present time PICS is proceeding to develop independently and is an important client of PCIC. The challenge of integrated assessment by PICS requires PCIC to be a source of reliable geophysical (environmental) information for environmental design standards in Pacific North America.

4.3. **Building resident expertise**

**new 2008 positions shaded in green

Personnel	
President & CEO	David Rodenhuis
Office Administrator	Cassbreea Dewis
Administrative Assistant	Melissa Nottingham
Writer/Editor	Heather Travers
Regional & Community Climate Impacts	
Lead, CCI	Trevor Murdock
Lead, RCI	TBD—offer made to candidate
Analyst-Empirical Downscaling	TBD—posting closed and under review
Analyst-Climate Mod Diagnostics	TBD—posting closed and under review
Data-Manager	TBD—posting closed and under review
Programmer/Analyst	David Bronaugh
Forest Impacts Researcher	Aquila Flower
Research Assistant	Harpreet Jaswal
Hydrologic Impacts	
Lead	Vacant
Hydrologist (1)	Katrina Bennett
Hydrologist (2)	Arelia Werner
Hydrologist (Seconded, MoE)	Markus Schnorbus
Analyst-Climate Mod Diagnostics	TBD—posting closed and under review
Programmer/Analyst	Paul Nienebar
Research Assistant	Vacant
Ocean Influences	
Lead	Vacant
Analyst	Vacant
Climate Modelling	
Lead	Vacant
Analyst	Vacant

4.4. **Collaborative Agreements**

Memoranda of Understanding	
River Forecast Centre, BC MoE	2008-2009
Consortium Ouranos	2008-2013
BC Hydro	2006-2010; renewed in 2008
University of Washington	In progress
Agreements	
UQAM—Assessment of climate-change impacts on Canadian water resources using Regional Climate Model projections (L.Sushama)	2008-2010
Canadian Centre for Climate Modelling and Analysis (D.Flato)	2009-2009
Faculty MOU	TBD

4.5. **Reports, Publications, Presentations, and Website**

Change and Watershed Hydrology: Part 1 – Recent and Projected Changes in British Columbia. Pike, R.G., D.L. Spittlehouse, K.E. Bennett, V.N. Egginton, P.J. Tschaplinski, T.Q. Murdock and A.T. Werner, 2008. Climate. Streamline Watershed Management Bulletin. Vol 11. No 2.

Climate Change and Watershed Hydrology: Part 2: Hydrologic Implications for British Columbia. Pike, R.G., D.L. Spittlehouse, K.E. Bennett, V.N. Egginton, P.J. Tschaplinski, T.Q. Murdock and A.T. Werner, 2008. Streamline Watershed Management Bulletin. Vol. 11. No 2.

B.C. Ministry of Forests Extension note: A summary of climate change effects on watershed hydrology. Pike, R.G., D.L. Spittlehouse, K.E. Bennett, V.N. Egginton, P.J. Tschaplinski, T.Q. Murdock and A.T. Werner, 2008. Ministry of Forest and Range, Forest Science Program.

Analysis of Snow Water Equivalent (SWE) Trends and Climate relationships across Pacific North America. K.E. Bennett, T.D. Prowse. In preparation for Journal of Hydrometeorology.

Prince George, BC. - *Summary Report: Changes in Past Hydro-climatology and Projected Future Change – for the City of Prince George,* Picketts, I., A.T. Werner and T.Q. Murdock, November 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

Kimberley and Elkford, BC. - *Climate Analysis for the Canadian Columbia River Basin – 2008 Update – Focus on Kimberley and Elkford, BC,* Werner, A.T., T.Q. Murdock, B.M. Paterson and H.K. Jaswal, October 8th 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

Dawson City, YK. - *Preliminary Climate Analysis for the Dawson City Region,* A.T. Werner, B.M. Paterson and H.K. Jaswal, October 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

The Great Bear Rainforest, BC.- *Preliminary Climate Analysis for the Great Bear Rainforest Region,* A.T. Werner, B.M. Paterson and H.K. Jaswal, September 19th 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

The Cariboo-Chilcotin, BC.- *Preliminary Analysis of Climate Change in the Cariboo-Chilcotin Area of British Columbia,* Dawson, R.J., A.T. Werner and T.Q. Murdock, September 8th 2008, Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

City of Vancouver, BC. - *City of Vancouver Administrative Report on Climate Change Adaptation*. Page 5, Table 1 - Vancouver Climate Change Projections Table and page 11, Appendix 1 – Overview Climate Change Projections Table created by A.T. Werner and T.Q. Murdock. Beck, B. and B. Crowe, May 27th 2008.

Whitehorse, YT. - *Summary Report: Changes in Past Hydro-Climatology and Projected Future Changes – for the City of Whitehorse,* A.T. Werner and T.Q. Murdock, January 11th 2008. YT, Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

Internal Reports

Report on Training. Initial Development of the VIC Hydrologic Model for the Fraser River Basin. January 2008 – June 2008. Bennett, K.E. 2008. Report to BC Hydro. Pacific Climate Impacts Consortium. Victoria, BC.

Status Update Report, VIC Hydrologic Modelling Project, January 2008 – June 2008. Bennett, K.E. 2008. Report to BC Hydro. Pacific Climate Impacts Consortium. Victoria, BC.

Workplan for Hydrologic Modelling. Development of the VIC Hydrologic Model for BC Watersheds. Bennett, K.E., Werner, A.T., Schnorbus, M., Rodenhuis, D.R. 2008. Pacific Climate Impacts Consortium. Victoria, BC.

Status Update Report, VIC Hydrologic Modelling Project, July to December 2008, K.E. Bennett, Report to BC Hydro. University of Washington. Forthcoming in March 2009. Technical Report to the Department of Ecology, Pacific Climate Impacts Consortium. Victoria, BC.

GIS Automation Project for Community Assessments: A PCIC Co-op Workterm Report, Schwartz, J. and K.E. Bennett, November 2008. Pacific Climate Impacts Consortium, University of Victoria, BC, Canada.

Newsletters

Volume 2, No. 1, September 2008

Volume 2, No. 2, December 2008 (in preparation)

Presentations

December 2008: Observed SWE Estimates and Climate Analysis for Northwest Pacific North America: Analysis and Validation for future projection of SWE using the CRCM and VIC, K.E. Bennett, Bronaugh, D., and Rodenhuis, D.R. Accepted Poster Presentation for AGU 2008. San Francisco, CA.

30 October 2008: Historical climate trends and future scenarios for BC, Trevor Murdock, BC MOE - Science Committee

28 October 2008: Historical climate and a sprinkling of future scenarios for Kimberley, Trevor Murdock, Kimberley Adaptation Project: Public Presentation

28 October 2008: Historical climate trends and future scenarios for Kimberley, Trevor Murdock, Kimberley Adaptation Project: City of Kimberley

27 October 2008: Historical climate and future scenarios - Columbia Basin, Trevor Murdock, Canadian Columbia River Forum

17 October 2008: Historical climate trends and future scenarios for BC, Trevor Murdock, Climate Action Secretariat / BC MOE Environmental Stewardship Division

13 Aug 2008: Regional Climate Projections for British Columbia: Tools and Uncertainty, Trevor Murdock, American Meteorological Society 2008 Congress, Whistler, BC

10 July 2008: Historical climate trends and future scenarios for BC, Trevor Murdock, Climate Action Secretariat

12 June 2008: Historical climate trends and future scenarios, Trevor Murdock, Planner's Institute of BC, Prince George, BC

11 June 2008: Available Data for Assessing Vulnerability to Climate Change, Arelia Werner & Trevor Murdock, Planner's Institute of BC, Prince George, BC

2 June 2008: Changing Precipitation Patterns in BC, Katrina Bennett, Arelia Werner & Trevor Murdock with Brian Beck, ACT Conference, Vancouver, BC

5 June 2008: Projections and Community Level Assessments of Climate Change and Variability, Arelia Werner, Climate Impacts Group Seminar Series, Seattle, Washington

29 May 2008: Responses of streamflow in BC to climate trends and variability, Arelia Werner & David Rodenhuis, Canadian Meteorological and Oceanography Society Congress 2008, Kelowna, BC

27 May 2008: Community Level Assessments of Climate Change and Variability, Arelia Werner & Trevor Murdock, Canadian Meteorological and Oceanography Society Congress 2008, Kelowna, BC

14 May 2008: Developing a high resolution long term gridded climate surface for British Columbia, Katrina Bennett, J. Deems & Allan Hamlet, CGU Conference, Banff, AB

12 May 2008: Snow Water Equivalent (SWE) Trend in Pacific North America, Katrina Bennett, Arelia Werner & David Bronaugh, CGU Conference, Banff, AB

9 May 2008: Pacific Climate Impacts Consortium, Aquila Flower, Climate Change Impacts on Ecology and the Environment Workshop

30 April 2008: Changing Precipitation Patterns in British Columbia, Katrina Bennett, Arelia Werner & Trevor Murdock, BCWWMA Conference, Whistler, BC

22 April 2008: Historical climate trends and future scenarios for BC From Impacts to Adaptation: Canada in a Changing Climate 2007, Trevor Murdock, NRCAN

17 April 2008: Hydrologic Impacts of Climate Change in BC, Katrina Bennett, Climate Impacts Group Weekly Seminar, Seattle, Washington

11 April 2008: Adapting to Climate Change on Vancouver Island, Trevor Murdock, Association of Vancouver Island and Coastal Communities 59th Annual Meeting

31 March 2008: Climate trends for biodiversity adapting to range shifts of plants and animals, Trevor Murdock, Adaptation to Climate Change Conference

25 February 2008: Introduction to Climate Change Projections, Arelia Werner and High-resolution Climate Change Projections, Arelia Werner. (Water Supply Assessment - Climate Change Workshop; Edmonton, Alberta)

23 January 2008: Evaluation and application of dynamical and statistical downscaling tools for reconstruction of the variability and extremes of current climate regime and future scenario projections, Dimitri Parishkura, University of Quebec at Montreal/Environment Canada (Joint PCIC/CCCma TAO seminar)

Website

http://pacificclimate.org/