







STRATEGIC PLAN 2009-2013

Pacific Climate Impacts Consortium April 2009



ACRONYMS				
BCH	=	BC Hydro		
CCCma	=	Canadian Centre for Climate Modelling and		
		Analysis		
EC	=	Environment Canada		
ENSO	=	El Niño-Southern Oscillation		
FSP	=	Forest Science Program, BC Ministry of Forests		
		and Range		
GCM	=	Global Climate Model		
MoE	=	BC Ministry of Environment		
MoFR	=	BC Ministry of Forests and Range		
PAC	=	Program Advisory Committee		
PCIC	=	Pacific Climate Impacts Consortium		
PDO	=	Pacific Decadal Oscillation		
PICS	=	Pacific Institute for Climate Solutions		
RCM	=	Regional Climate Model		
SFU	=	Simon Fraser University		
UBC	=	University of British Columbia		
UNBC	=	University of Northern British Columbia		
UVic	=	University of Victoria		
VIC	=	Variable Infiltration Capacity macroscale hydro-		
		logic model		
W-CIRC	=	The Water & Climate Impacts Research Centre,		
		University of Victoria		

Cover Photos: top and middle right: PCIC library: middle left: CADBORO BAY, VICTORIA, 2006, Ben Kangasniemi; bottom: Markus Schnorbus.



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EXECUTIVE SUMMARY

The Pacific Climate Impacts Consortium (PCIC) is composed of research and stakeholder organizations that are concerned about the consequences of climate change. The founders of PCIC recognized that *adaptation* to changes in climate by socio-economic sectors and governments requires quantitative information on historical trends and future projections of the physical climate system in Pacific North America. PCIC is a consortium that addresses these issues through targeted research and by strengthening collaboration among research and stakeholder organizations.

Since its inception in 2005, PCIC has witnessed an extraordinary growth in public and political recognition of the threat of climate change. Notwithstanding the need to mitigate the growth of greenhouse gases, there has been an increased realization of the necessity to prepare to adapt to the consequences of climate change. If so, precisely what climatic conditions in Pacific North America are to be expected? What current evidence is already apparent that is consistent with these future expectations? How should communities, governments, industry and commerce adapt to these future environmental conditions?

The current context of these questions makes the choice of PCIC's Vision several years ago seem prescient. The *Themes* for PCIC were subsequently developed and articulated in the 2007 *Strategy and Plan*¹ and are now the pillars of the organization. Most recently (April 2008) the Province of British Columbia granted an endowment to the University of Victoria and designated a portion of the endowment for base funding of PCIC.² The University responded by restructuring PCIC into a not-for-profit corporation and implementing a governance structure of corporate members and stakeholder directors.

Over the next five years, PCIC will address the expectations of its *Vision* to become a premier climate centre in British Columbia within a network of centres in Pacific North America and Canada. We will focus on strengthening the work already being done on the Themes of Regional Climate Impacts, and Hydrologic Impacts. We will develop plans and build resident expertise for the Themes of Ocean Influences and Climate Analysis. We will take steps to increase collaboration within the Consortium, with the University of Victoria and the extramural experts and Affiliates of the Consortium, and to build capacity in British Columbia to support adaptation to climate change.

¹ PCIC (2007) – Strategy and Plan. Swain, H., T. Murdock, and D. Rodenhuis (http://PacificClimate. org/docs/aboutus/PCIC.StrategyAndPlan.pdf).

² The endowment created the Pacific Institute for Climate Solutions (PICS), a collaboration of UVic, UBC, SFU and UNBC. Authorizing letter from the BC Ministry of Environment to the University of Victoria, (reference, http://PacificClimate.org/docs/news/BCPICS-NewsRelease.pdf).

It is our intention to maintain agreements with our principal stakeholders, to develop extramural resources to achieve a desired balance of support, and to double the annual resources of PCIC within 5 years to approximately \$3 M per year. We will enhance the PCIC web site as a primary resource for users of climate information and increase the scope of climate information, including reports, publications, and presentations that evaluate changes in climate and assist the assessment of climate impacts.

A record of PCIC products and services, including online tools for the study of climate impacts, are documented on the Consortium's web site:

http://www.PacificClimate.org/

Who developed this Strategic Plan?

We did.

The vision for a PCIC Consortium was developed at an organizational workshop in June 2005 that was attended by researchers and stakeholders from provincial ministries of British Columbia, academics from the University of Victoria and the University of Washington, and several representatives from federal laboratories. Subsequently, at a staff retreat in 2007, the structural Themes for PCIC were accepted and confirmed by extramural participants and documented in *Strategy and Plan* (Swain et al, 2007).

The current version of the *Strategic Plan* was drafted after input from PCIC staff following a second retreat (November 2008). After editing and further input from the Chair of the Program Advisory Committee (PAC), a draft version was reviewed by the members of the PAC as representatives of the Consortium. Subsequent corrections and additions were incorporated into a penultimate draft for consideration and approval by the Board of Directors of the PCIC Corporation.

We are grateful to many colleagues who contributed seminal ideas, constructive criticism, and most importantly, encouragement and inspiration. Only a few names can be mentioned, but it would be inconsiderate not to acknowledge:

Dr. Daniel Caya, Director of Simulations, Consortium Ouranos, Montreal Professor Andrew Weaver, PhD, School of Earth and Ocean Sciences, University of Victoria Rick Lee, Climatologist, Victoria Ben Kangasniemi, Chair of the Program Advisory Committee (2006-present) Dr. Howard Brunt, Chair of the Board of Directors, PCIC Corporation (2008-present) Dr. Gordon Smith, former Chair of the PCIC Board of Directors (2006-2008) Dr. Harry Swain, former President of PCIC (2006-2007)

> David R. Rodenhuis, President and CEO Heather S. Travers, Writer/editor Cassbreea Dewis, Administrative Officer



INTRODUCTION

The importance of climate variability and the prospect of substantial climate change are increasingly apparent. Knowledge of future climate impacts on the environment is needed for community planning,



development of government policy, and commercial decisions, including reconsideration of options for energy production. Management of natural resources must address climate impacts on the ecosystem and limits of water resources, threats to sustainable forests, and reduction in coastal habitat for native fish.

The Pacific Climate Impacts Consortium (PCIC) was created in 2005 to bridge the gap between climate research and practical applications; between information sources on climatic hazards, commercial decision-making, and government planning; and among the technical disciplines that are able to assess climate impacts. The Consortium is composed of research and stakeholder representatives from academic and government research labs and industry, including stakeholders from British Columbia and Washington State.

However, PCIC is neither an academic research institute nor a business; it is a needs-driven, practical consortium for targeted applied research. It operates through collaboration among researchers and produces practical climate information for decisionmaking, development of policy,

Geographical scope of British Columbia and Pacific North America, defined by water resources that originate in British Columbia. and education. Historical observations and traditional empirical design rules are no longer a source for design standards. PCIC is a source for estimates of future environmental design conditions for the 21st century that will guide actions by governments, commercial organizations and communities that must prepare to adapt to climate change. This information is used to reduce society's vulnerability to climate variability, climate change, and extreme weather events.

VISION³

The Vision of the Pacific Climate Impacts Consortium is to stimulate collaboration among government, academe and industry to reduce vulnerability to extreme weather events, climate variability and the threat of global change. The consortium for climate impacts will bridge the gap between climate research and climate applications and will make practical information available to government, industry, and the public.

MISSION

The Mission of the Pacific Climate Impacts Consortium is to quantify the impacts of climate change and variability on the physical environment of Pacific North America.

SCOPE

The Scope of the Pacific Climate Impacts Consortium is the physical sciences that describe climate, its variability and change, including extreme events, in Pacific North America.

FOCUS

The Focus of the Pacific Climate Impacts Consortium is on climate stakeholders in industry, government, commerce and communities that require climate information for adaptation to future climate conditions.

PRODUCTS

The Products of the Pacific Climate Impacts Consortium are analyses of historical trends and climate conditions as well as estimates of future environmental design conditions for the 21st century.

³ PCIC (2005) – Report of the Organizational Workshop. (http://PacificClimate.org/docs/aboutus/ PCIC.Meeting.Summary.pdf).



GOALS AND OBJECTIVES⁴

- To foster collaborative and interdisciplinary approaches to applied research on meteorology, hydro-climatology, atmospheric science, climate variability and climate change;
- To provide climate information for policy development and decision making in the social sciences and economics;
- To channel and strengthen the capacity to inform and engage stakeholders in understanding regional climate change and variability, including extreme weather events;
- To perform targeted research on the needs of public and private sectors in order to provide the physical basis and the analytical tools necessary for adaptation to climate change.

OPERATING CONCEPT



4 PCIC (2007) – Strategy and Plan, Op. cit.

THEMES

The implications of geophysical climate change are only understood fully in terms of their economic and environmental impacts. Industry and government can now take steps to assess the risks and opportunities of climate change and take the appropriate adaptation actions.



Radial integration of climate impacts

The importance of socio-economic impacts was recognized at the inception of PCIC and described in its Vision and Objectives. However, PCIC recognized the need to first address the underlying geophysical attributes of climate variability and change as the basis for meeting the needs of users and stakeholders in the socio-economic sectors, ecosystems, and natural resources.

Subsequently, four distinct, but overlapping PCIC Themes were selected (no priority):⁵

- Regional Climate Impacts
- Hydrologic Impacts
- Ocean Influences
- Climate Analysis

These Themes are the structural components for implementing the vision of translating climate research into practical applications. They are the foundation for bridging the gap to each sector and supporting their needs for assessment and adaptation.

The formation of the Pacific Institute for Climate Solutions (PICS) at four research universities in British Columbia brings new urgency to evaluating the geophysical impacts of climate change to support adaptation efforts in all socio-economic sectors, ecosystems, and natural resources.

⁵ PCIC (2007) – Strategy and Plan, Op. cit.



Regional Climate Impacts

The first Theme addresses the demand to explain and interpret potential impacts of global climate change on a regional scale. This includes knowledge of current trends and estimates of uncertainty within the context of climate variability, as well as output from climate models,



statistical descriptions, and climate model diagnostics. A significant portion of this work is referred to as "downscaling" global scale model results to regional and local climatic conditions by the application of corrections for topography and local conditions. From these results the consequences of climate change in different regions can be estimated, including climate impacts on the most critical sectors of socioeconomic activity and community infrastructure. Output products include maps and graphics of

historical climate and future climate projections from global climate models (GCM) or regional climate models (RCM), and analysis of historical trends and variability. In addition, PCIC collaborates with university research groups outside the physical sciences (city planning, architecture, forestry) to refine the questions and detailed needs of these stakeholders. This work draws on the results of other PCIC Themes.

- Develop and apply downscaling methodologies, including estimates of uncertainty.
- Provide climate information (beyond traditional temperature and precipitation) that is more useful to each socio-economic sector.
- Improve methods for providing climate change information at the local community scale.
- Provide local and regional scale climate impact projections to communities in British Columbia.

Hydrologic Impacts

The objective of this Theme is to estimate the impacts of climate change on water resources throughout British Columbia by using hydrologic models and Regional Climate Model (RCM) outputs to estimate climate change scenarios for river flow. This project was



initiated by BC Hydro and the Ministry of Environment in 2006. The work will inform numerous water resource decisions, including those related to power generation, flood protection and drought preparedness. The four major components of ongoing work on this theme include: Climate Overview (completed); Hydrologic Model Diagnostics; Climate Model (RCM) Diagnostics; and Synthesis. The output of this work is also a source for related studies on other Themes: Regional Climate Impacts, and Climate Analysis.

- Apply and test the Variable Infiltration Capacity (VIC) hydrologic model to the Fraser, Columbia, Peace, and Campbell river watersheds.
- Use regional and global climate models of climate change scenarios to generate projections of future hydrologic conditions.
- Engage Environment Canada's Water & Climate Impacts Research Centre (W-CIRC) at the University of Victoria and hydrologists at other BC universities to advance this work.
- Employ a high resolution hydrologic model for the study of climate impacts on smaller watersheds.
- Synthesize results to identify climate change impacts on flooding, low flows, and timing of seasonal flow.
- Communicate results to BC Hydro and to stakeholders in BC watersheds in support of their decisions on water and power management.



Ocean Influences

British Columbia lies directly in the path of wintertime Pacific storms. The objective of this Theme is to recognize this unique position and analyze climatic changes and impacts at the Pacific coast. In particular,



Pacific storms are responsible for a major fraction of water resources; they are the source of storm surges in the estuaries of the coast for extreme weather events and explosive wind forces. Its proximity to the Pacific Basin exposes BC to major climate fluctuations from El-Niño (ENSO) and the Pacific Decadal Oscillation (PDO). This Theme includes historical analysis as well as future projections on sea-level rise, storm surge, and damaging wind events that are critical for coastal communities.

- Develop a research plan for evaluation of the climatic influence of climate impacts due to Pacific storms and marine influences.
- Develop resident expertise on storm surge, ENSO influences, seasonal prediction, and storm tracks, and analyze the influence of climate change.
- Collaborate with other centres, such as the Pacific Geoscience Centre and the Institute of Ocean Sciences, as well as the BC Ministry of Environment, to analyze climatic changes and impacts on the Pacific coast.

Climate Analysis

The foundation of climate analysis is the collection of hydrometeorological data, construction of climate information in relation to the historical record, and monitoring of fluctuations and changes to the



climate system. This is the objective for this Theme—to monitor the regional climate in near-realtime—and is the heartbeat of an operational climate centre. A Provincial Climatologist at PCIC would be the resident resource for information on BC climate trends, variability and projections, including source data and quality control. Routine analyses of current, regional climate would be produced, including impact variables and summaries explaining current climate anomalies within the context of potential climate change.

- Develop a plan for analysis and interpretation of near-real-time climate variability and change, including extreme weather events (climate monitoring).
- Develop resident expertise; i.e., a Provincial Climatologist at PCIC. Collaboration is essential with provincial and national authorities, such as BC Ministry of the Environment, and Environment Canada.
- In collaboration with other centres in Pacific North America, prepare an improved high-resolution climate data base for direct application to natural resources management.
- Improve the collection and quality control of hydro-meteorological data and establish a climate archive.
- Develop a comprehensive data management system to facilitate quality control, data access, and integration of independent data networks.
- Collaborate with other centres in Pacific North America to analyze and monitor all components of Pacific climate.

PACIFIC CLIMATE



PRODUCTS & SERVICES

Information

Information of common interest to numerous users can be developed as Web Tools. They are a natural product of climate data analysis and climate model output diagnostics that are associated with most projects undertaken by PCIC.

PCIC's online access to climate scenarios, data, maps, and tools has been developed for users in local and regional governments and for users in all socio-economic sectors, including ecosystems and natural resources. In addition to online tools, interpretation and targeted research are available through consultation.

PCIC has special responsibility for outreach to Consortium stakeholders, including communities, governments, commercial enterprises, and non-government organizations. Reports, technical publications and presentations are an important means of communication.⁶ This output is built on the foundation of resident expertise, as well as affiliated experts who produce well-defined and useful products.

Objectives

- Enhance the PCIC web site as a primary source of self-serve climate information for a broad range of user applications and interests.
- Increase the number and enhance the quality of climate products delivered to stakeholders and clients. These include reports, publications and presentations that investigate changes in climate and assist in the assessment of climate impacts and adaptation to those impacts.

Training

PCIC is located at the University of Victoria and is associated with several academic programs aligned with climate science. PCIC supports graduate students and attracts visiting scientists. This goal is achieved through hosting visitors, secondments, and encouraging graduate student research at PCIC in collaboration with academic departments.

- Utilize expertise at PCIC to attract visiting scientists and guide students engaged in university programs.
- Encourage secondments, trainees and targeted research by graduate students.

⁶ A list of current PCIC presentations and publications can be found at http://PacificClimate.org/ resources/publications/.

RELATIONSHIPS

Collaborative research with academic consortium members and affiliates is of fundamental importance to PCIC's objectives. Stakeholders are direct beneficiaries of these relationships. Thus PCIC will continue to seek collaborative relationships with research and stakeholder organizations.

With academic programs, researchers and institutes at the University of Victoria

The quality of PCIC climate products and services depends on the resident expertise and close collaboration with academic researchers at universities, chiefly in Pacific North America, and especially on the University of Victoria campus.



PCIC is hosted by the University of Victoria and works within an academic research environment. Among the traditional responsibilities of the University teaching, research and service—the PCIC professional staff contribute heavily to the service objective. However, the comprehensive nature of climate and its impacts requires that PCIC senior staff have the qualifications of (at least) adjunct faculty.

In particular, the Canadian Centre for Climate Modelling and Analysis (CCCma) and the Water & Climate Impacts Research Centre (W-CIRC) of Environment Canada are members of the Consortium and offer a unique opportunity

INIVERSITY OF VICTORIA CAMPUS, Photo: University of Victoria

for collaboration—to apply their research results to problems of climate stakeholders.

The Pacific Institute for Climate Solutions (PICS), hosted by the University of Victoria, is a partnership of four research universities, established to contribute toward the identification and implementation of solutions to the challenges presented by climate change. PICS researchers require an effective linkage to the climate data and applied climate knowledge available through PCIC. Hence the PICS - PCIC collaboration forms an important foundation for PICS activities.

Members of the Consortium also have an opportunity to contribute to advanced education and applied research. Likewise, there is an opportunity for graduate students and faculty to contribute reciprocally to the objectives of PCIC and the needs of climate stakeholders through targeted research projects.



With academic research centres

The Consortium thrives on extramural collaboration that will support research applications and bring specialized expertise to Pacific North America. Other BC universities are a primary resource, but also academic centres in Alberta and the Yukon, and in the States of the US Pacific Northwest and Alaska.

With other climate centres

The geographical scope of PCIC work is Pacific North America. Within this domain there are several other climate centres that are making important contributions, both in Canada and the US. The intention of PCIC is to collaborate with these centres and exchange expertise and to deny any competitive intentions.

Within Canada there are regional climate centres and consortia, and several research networks that address technical issues of water, glaciers, climate modelling, model intercomparison, or data acquisition. The intention of PCIC is: (i) to support the objectives of research networks, solicit their input and encourage the transfer of research knowledge for stakeholders; and (ii) to collaborate with other centres and consortia on problems of common interest.

With stakeholders in local, provincial and national governments, NGOs and First Nations communities.

Since PCIC works in the gap between research and application, the users, decision-makers, and managers of resources and infrastructure at all levels



EMBERTON, October 2003, Photo: Courtesy of The Vancouver Sur

of government are important stakeholders for using climate information. The impacts of climate variability and change have the potential to comprehensively change the social and economic structure of the world, the Nation, and the Province. Therefore, stakeholders in government have a special claim on the work of PCIC. This has already been recognized in the funding and governance structure that is the base for PCIC operations.

Since the impacts of global climate change are experienced at a regional and local level, PCIC has a responsibility to respond to the needs of Provincial and local governments. Often this is achieved through bilateral contracts, or through Provincial (regional) support to meet the social, economic, and infrastructure needs of the Province. Agreements, grants and contracts with stakeholders define the relationships undertaken by

PCIC. These relationships have already demonstrated their power to build capacity at PCIC as a resource for climate information and analysis.

With stakeholders in commerce and industry and their professional organizations

PCIC is committed to meeting the climate needs of stakeholders, including those in commerce and industry. Many commercial organizations depend on decisions that now require climate information, along with an evaluation of uncertainty.

Furthermore, the gap between academic climate research and commercial utility is not easily bridged. For these reasons an extra effort is required to present climate information in useful terms, and to attract industry support for the development of new climate information at PCIC that will lead to adaptation measures.

CRITICAL SUCCESS FACTORS

The PCIC Themes and their Products and Services are the structural elements for attaining success. From a strategic viewpoint, there are several critical factors that represent the most important attributes of our work:

- Build resident expertise and increase collaboration with members of the Consortium, University of Victoria experts and extramural researchers.
- Increase engagement with user-groups that recognize the important influence of climate change and variability on their operations and decisions.
- Deliver a suite of climate products and services.
- Maintain a professional connection to climate researchers through technical, peer-reviewed publications, and collaborative projects.
- Increase active membership in PCIC of stakeholders who come from academic research, governments, the private sector, and nongovernment organizations.
- Seek a substantial increase in resources through collaborative proposals and agreements with researches and stakeholders.

CORE VALUES		
Quality	We ensure that our methods are current and relevant, and that the implications and limitations of our results are clear. We take the initiative to solve problems and eliminate errors in order to produce robust results.	
Collaboration	We work with researchers to provide new solutions for practical problems, and with stakeholders to target our applied research. This collaboration is an integral part of PCIC and benefits all parties involved.	
Respect	We listen to the needs of others and value their opinions.	
Sustainability	We know that human activity has had a major impact on the environment, so we strive to set an example of wise use of resources.	
Balance	We are dedicated to PCIC's mission, and PCIC supports our professional development. We excel in our roles by balancing our professional and personal lives.	
	PCIC staff	



FINANCIAL RESOURCES

The PCIC program is built upon base funding provided through an endowment from the BC Ministry of Environment. Additional resources come from other Provincial and Federal agreements, and contracts for directed, applied research.

Over the next five years, existing resources will be used to supplement base funding and attract additional matching support. The strategy is to incrementally grow the PCIC program towards a goal of doubling the resources, including leveraged funding through matching resources from additional stakeholders.

- Double the annual resources of PCIC within 5 years to approximately \$3M per year.
- Develop extramural resources to achieve a desired balance of support from the endowment (1/3); extramural funding (1/3); directed research, contracts, and secondments (1/3).



- Invest approximately 25% of PCIC resources in extramural collaborative projects outside of PCIC.
- Maintain funding agreements with PCIC's current principal stakeholders: Ministries of the Provincial government, and BC Hydro.

RESIDENT EXPERTISE

The resident expertise at PCIC is grouped around each of the Themes, with a Lead position or Team supported by analysts and computer programmers. The resident expertise is intended to collaborate with researchers in the Consortium who collectively contribute to the objectives of PCIC.



Photo: Paul Nienaber

Over the next five years, PCIC intends to attract the most qualified staff to support its focused Vision, Objectives, and Themes. Recruitment will depend on available resources and project demands, but PCIC will retain a core staff of scientific leaders in each of the four themes. These leaders will be responsible for developing their programs, communicating between researchers and stakeholders and advancing the role of PCIC in the climate community.

An important element of the PCIC program is to collaborate through professional secondments. Seconded personnel will bring expertise from their home organization to the PCIC program, and return with a greater knowledge of stakeholder needs.

An outline for a target organizational structure is outlined below:

PCIC Organizational Structure: Target Program President & CEO/Director Administrative Support Senior Scientist Regional and Community Climate Impacts Team Hydrologic Impacts Team Ocean Influences Team Climate Analysis Team



GOVERNANCE

The governance of PCIC is accomplished at three levels:

Strategic Review and Consultation—the Directors of the Board of the PCIC Corporation who are elected by the Members of the Corporation. The Board selects and contracts the President & CEO to carry out the duties of the Corporation.⁷

Programmatic Review and Advice—the Program Advisory Committee (PAC), members of which are invited to join the PAC by joint agreement between the Chair of the PAC and the Director of PCIC.⁸

Direction and Operation of the Consortium—The President & CEO of the Corporation who is also the Director of the Consortium. The Director is advised by regular meetings of the PAC and reports to the Board of Directors of the PCIC Corporation.⁹



7 CICS(PCIC) (1994) – Corporate Bylaws

- 8 PCIC(2008) Program Advisory Committee Terms of Reference
- 9 PCIC (2008) Responsibilities of the PCIC Board





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