Chapter 1 Appendices

1.1 Letter of Support from Lax Kw 'alaams

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1.3 Historical Climate Data Prince Rupert

1.4 Historical Climate Data Terrace

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Lax Kw'alaams Band Council

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May 28, 2009

Future Forest Ecosystem Science Council
Victoria, BC

Dear Madam and Sir:

I write to support Coast Tsimshian Resource's (CTR) proposed Future Forest Ecosystem work to develop a climate adaptation plan with the communities in this region.

CTR is a Limited Liability Partnership, with its limited liability units held by every man, woman and child in the Lax Kw'alaams community. The community is increasingly dependent on the license and looking forward strongly to further developments in the region arising from CTR's strategic initiatives. In addition, the First Nations communities of Kitsumkalum and Kitselas also have Non Renewable Forest Licenses in the study area. The civic communities of Terrace and Prince Rupert where many of our people live, and where the people employed by CTR and the other licenses also live, are also highly dependent on the forest ecosystem and its industrial sectors.

Not far to the east of CTR's licenses, due to fifteen years of unprecedented warm winters, the MPB has grown to catastrophic proportions and devastated the forests. Without warning some 100 neighboring First Nation's communities now face the threat of having lost a large proportion of the mature trees in their region.

Commencing in 2006, Professor Mathews from the sociology department in UBC began to work with the people and elders in our communities, who shared with him their view of the impending impacts of climate change. This work studies how our community, and its neighboring communities understood the impacts and possible opportunities of climate change. It did not work with us to develop adaptation plans which have to be developed by the community, for the community. But for that we need to understand better the range of trends and the effect on the resources we value, that climate change may bring. The Lax Kw'alaams community embodies generations of experience with change taking place in our traditional resources, from which we can draw in developing appropriate adaptive action plans.

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So we look forward over the next two years to working with CTR, UBC, University of Victoria, Ministry of Environment, Cortex, ESSA and WWF to better understand and to collectively develop an adaptive respond to these changes in the best possible way.

Yours Truly
Lax Kw'alaams Band

John Helin
Chief Councillor

Appendix 1.2 Research Team, Project Design, and Integration Challenges

1.2.1 Research Team, Tasks and Objectives

The broad goal of empowering adaptation planning and adaptive management required participation from a range of actors, representing expertise in a number of fields. The research team includes advisors and researchers: Coast Tsimshian Resources, Brinkman Forest Ltd, UBC Department of Sociology, UBC Department of Forestry, École Polytechnique Fédérale de Lausanne (EPFL),BC Ministry of Environment (MOE), BC Ministry of Forests, Lands and Natural Resource Operations (MoFLNRO); Environment Canada, ESSA Technologies Ltd, Cortex Consultants, and World Wildlife Fund Canada. A brief outline of the role and tasks of team members is included below Table A1.1 .

Table A 1.2.1: Research partners and advisors are listed with their respective teams and tasks. In total, there were 4 separate areas of focus coordinated by an umbrella integration team that participated in all elements of the study.

Project Component & Research Team	Description of tasks / role
Project Coordination and Integration **Dirk Brinkman, Brinkman Forest Ltd (on behalf of Coast Tsimshian Resources) ; Katie McPherson & Richard Chavez (Brinkman Forest);**	Liaise between CTR board, staff and project members; coordinate completion of FFESC project tasks; administrative support for all teams; organization of team meetings and communications; collaborate with other team members to manage risks and revise project plan as needed; facilitate integration of project components, as well as between CCAP and SRWCP; adaptively manage methodological changes; organize community workshops; responsible for integrating findings into future management plans post-project; summarize literature and pursue next steps.
Project Support **Dr. Stewart Cohen, Environment Canada;**	Provide advice regarding integration process and contribute extensive knowledge from former and ongoing participation in interdisciplinary adaptation work.
David Marmorek, President ESSA Technologies Ltd	Assist with integration during the project design phase, based on experience with interdisciplinary ecosystem modelling; contribute to structure of community workshops; support FSW and vegetation modelling elements.
James Casey, WWF	Integrate relevant aspects of the CCAP project into the SRWCP with specific focus on community values and incorporating selected indicators from the FSW work into the cumulative effects analysis framework; engage local FSW experts and promote communication between this group and CTR.

Social Science Research and Community Engagement **Dr. Ralph Matthews, UBC; Jordan Tesluk, Georgia Piggot, Dr. Robin Sydneysmith**	Synthesize previous research as starting point for the group to become familiar with regional issues and values; engage communities in project through interviews and follow up; assess perceived condition of community and environmental resources; advise and inform biophysical modelling; advise and support community workshop development and knowledge sharing between science teams and community members; contribute to adaptation tool-kit and final reports.
Climate and Vegetation Modelling for Study Area **Dr. Joe Melton and Dr. Jed Kaplan, *École Polytechnique Fédérale de Lausanne (EPFL)*; Don Robinson, ESSA Technologies**	Synthesize historical climate data for the study region; conduct assessment of different vegetation models and define approach for modelling vegetation and carbon for Skeena under IPCC scenarios; parameterize 19 tree species and grass for the study region and project changes based on 3 climate models / emissions scenarios; work with social science team and Brinkman staff to identify land-use scenarios and indicators for outputs; prepare report of findings and recommendations for future work.
Fisheries Sensitive Watershed Monitoring Protocol **Lars Reese-Hansen, Ministry of Forests, Lands and Natural Resource Operations; Richard Thompson, Ministry of Environment; David Marmorek, President, ESSA Technologies Ltd; Marc Porter, ESSA; Darcy Pickard, ESSA; Katherine Wieckowski, ESSA.**	Build on ongoing work for the development of FSW monitoring protocol including tier 1 (remote sensing) and tier 2 (field work and data collection) analysis of indicators; contribute to community engagement process and train local resource managers and volunteers in monitoring protocol; pilot monitoring protocol in Lakelse watershed; assist with integration of overall project and link to SRWCP project; provide adaptation recommendations to resource managers
Skeena River Water Conservation Project **James Casey, World Wildlife Fund Canada; Doug Williams, President, Cortex Consultants Inc; Jason Smith, Cortex; Mike Buell, Cortex**	Information sharing and integration of CCAP and SRWCP work, especially social science and FSW indicators; specific engagement with CTR board and staff members; design of cumulative effects analysis tool for strategic planning use; run scenarios demonstrating capacity of tool for integrated land management; provide recommendations to CTR around potential for integrated resource management and future adoption of cumulative effects tool in strategic and operational planning; receive and share input from community advisors around watershed priorities; engage local experts in selection of indicators and discussion of local watershed characteristics and planning needs.

In the original proposal, we identified 4 separate objectives of the FFESC that our work would address. We feel that despite unanticipated challenges of integration, we were successful in restructuring our plan and process to achieve these objectives, which are described in Table A 1.2. In addition to these objectives, and the overall project goal, each team had a number of aims and deliverables specific to their respective research areas which linked to other projects.

Table A 1.2.2: FFESC Objectives and CCAP Project Approach and Results

FFESC Objective	Project approach and results
1: Increase understanding of how forest and range ecosystems may change due to the influence of climate change	• Used LPJ-GUESS to model vegetation of the region and better understand impacts on tree species, carbon, runoff, and fire risk. • Engaged experts through FSW and SRWCP to determine cumulative impacts of climate and forestry operations on water quality and fish habitat. • Synthesised historical climate data to identify trends. • Organized community workshops to share and discuss results with community leaders, resource managers, and local experts to raise awareness and discuss adaptation options.
2. Develop projections of changes to forest and range ecosystems.	• Modelled and mapped projected impact of climate change on 19 tree species and grass. • Published and presented results in this report, online, and in a number of academic presentations. • Developed regional model that can be improved and refined over time as data availability and knowledge increase.
3. Develop methods to adapt forest management in response to climate change to reduce impacts on forest and range ecosystems and productivity.	• Pilot monitoring protocol for fisheries sensitive watersheds in the Lakelse Watershed and train a number of local volunteers and resource managers in the process. • Developed monitoring protocol that can be used to assess the impacts of forestry operations on FSWs, and identify opportunities for forest management to contribute to climate change mitigation • Used post-project results from all phases to inform the development of future management plans for TFL 1. • Compiled policy-relevant research and recommendations from local communities about methods for land and tenure management to improve adaptive capacity. • Through the SRWCP, developed cumulative effects analysis tool to facilitate integrated management in the future.
4. Research the economic and social consequences to BC of the potential change in forest and range ecosystems, and the effects of the proposed adaptation options.	• Using the New Institutional Analysis (NIA) approach, sociologists explored adaptive capacity of communities and organizations. • Identified and prioritized valued community and environmental resources, for use directing local policy and informing decision making around resource management. • Held community-based workshops that identified adaptation options along with barriers and enablers.

For all teams, the initial phases of the project included collating existing data relevant to their respective areas of expertise, and preparing information reports and presentations for the rest of the group that were used to inform the actions and direction of the overall research project. Given the interdisciplinary nature of the group, these presentations and reports were also an educational opportunity for those of us unfamiliar with the range of methodologies being applied. The project was first introduced to communities and prospective participants during a trip to each community in July

2010. An introductory brochure was distributed in Terrace, Prince Rupert, and Lax Kw ‘alaams that outlined some of the projected impacts of climate change in the Skeena and invited participation in the project (See Appendix 1.2). At the end of Year 1, the entire team met in Terrace during the Climate Action Secretariat meeting, to review research progress and determine a revised agenda and work schedule for Year 2. Moving into Year 2, more team meetings were held and a project website was created to bring the various elements of the study closer together in preparation for final community workshops which were held in December 2011 in Lax Kw alaams, Terrace and Prince Rupert. In January 2011, a public website was developed to provide communities with further information and post interim results (http://brinkmanforest.com/ffesc). Due to resource constraints and extenuating circumstances at the end of Year 1, coordination responsibilities were transferred from Richard Chavez at the CTR office in Terrace to Katie McPherson at the Brinkman office in New Westminster.

Over Year 2 integration proceeded on several fronts, with some planned and some unanticipated results. Weather and funding limitations resulted in the FSW pilot being delayed until May 2011, which subsequently allowed for more input from the wider group. Given the social and cultural significance of the Lakelse Lake watershed, this region was selected to pilot the Fisheries Sensitive Watershed Monitoring Protocol, ensuring an opportunity for community members to be involved in the data collection process and resulting in a strong response from participants in community workshops in support of watershed monitoring. As a monitoring framework with defined indicators, the FSW work was also incorporated into the development of the cumulative effects analysis tool and led to further integration between the CCAP and SRWC projects.

As research progressed through Year 2, the modelling team provided the wider group with a number of sample outputs. These were collectively reviewed and it was decided that useful outputs for the community and clients would include information about: runoff (key for understanding the impact of climate and forestry on water quality, flooding, and road construction); carbon flux and storage (critical for determining the capacity of regional forests to contribute to carbon sequestration and inform potential investment and adaptive management); tree species composition (to inform adaptive practices and identify risks and opportunities for ecosystems and forest industry); fire risk (to inform adaptive management). Later in Year 2 Brinkman identified 3 hypothetical harvest scenarios to be modelled by LPJ-Guess to represent potential future impacts of land-use and climate change.

A1.2.2 Integration challenges and deviations from the project plan

As noted above, this study involved a number of very different components, the specific methodologies of which are described in the appendices. Though experienced researchers in their respective fields, very few team members had engaged in collaborative research to this extent, presenting a learning opportunity with regard to the research process itself. Described below are 4 key challenges to integration the team confronted that required restructuring of the timeline and approach to ensure maximum use of resources.

Challenge 1: Restructuring project timelines and process after delay in ethics approval for sociological research.

The project began with general goals and the intention that sociological research would play a central role in informing and refining scientific modelling, based on the response from community members. Unfortunately, the ethics approval process for community interviews took longer than anticipated, and the science teams were forced to begin inputting data into the models before the interviews were complete, in order to meet their deadlines. However, thanks to previous research done in the region by Dr. Matthews and his team, input from CTR and Brinkman Forest staff, and informal observations from community members serving on the advisory group for the Skeena River Water Conservation Project (SRWCP), input for the climate and vegetation modelling team was nonetheless provided. In order to account for the delayed start, the social science team conducted interviews with 50 participants in each community, which provided better representation than the originally scheduled 20 per community. In addition, the interviews were lengthened substantially to address a wider range of issues within a single set of interviews, as it was determined that there was insufficient time remaining to conduct 2 sets of interviews with each participant in addition to community workshops. It should be noted also that while the original project proposal called for interviews to be conducted in 4 communities (including 2 First Nations communities), the social science team was only able to obtain support from Lax Kw ‘alaams within the timeframe. This lack of representation from other First Nations is recognized as a limitation in the end-results of the project. In the future the team aims to secure further funding and support from additional communities in order to build on this study.

Challenge 2: Change in requirement for CTR to prepare Management Plan 11 for 2012.

Originally the results of this project and those of the SRWCP were intended to inform Management Plan 11 for CTR. However, soon after the project commenced, the government extended the current management plan through until December 2018. This means that while the outcomes and tools will likely still be used for MP 11, the project did not result in the immediate development of a plan. Regardless, the project provided a valuable opportunity for CTR and Brinkman Forest staff to engage with community stakeholders during various project workshops, an important step in sustainable forest management and in ensuring that future plans align with the values and vision of the wider community. CTR and Brinkman Forest are also working to support a number of recommendations that come out of this report, along with instigating research to fill knowledge and data gaps. To support integration, CTR staff participated in the community workshop in Terrace, and also in the WWF-led workshop to identify indicators for stream health to be used as part of the cumulative effects analysis tool developed by Cortex. The CTR Board of Directors invited WWF and Brinkman representatives to give a presentation on the SRWCP and to discuss the potential for using cumulative effects analysis tools in the future. Brinkman staff in the CTR office have been helpful in advising on the unique characteristics of tenure for Tree Farm License 1, and identifying barriers and enablers to moving toward integrated land management; one of Brinkman Forest’s long-term goals as a resource manager and advisor for First Nations companies.

Challenge 3: Shift of coordination from CTR office in Terrace to Brinkman office in New Westminster.

In November 2010, the coordination role for the project was transferred from Richard Chavez at the CTR office in Terrace, to Katie McPherson at the Brinkman office in New Westminster. This change was partially a result of increased operations in the Terrace office that coincided with the deadline extension for Management Plan 11. This unanticipated situation meant that there was less capacity in the Terrace office to coordinate the many elements of the CCAP. Moving coordination to New Westminster facilitated stronger communication between the sociological research team and Brinkman, while contact with staff and planners in Terrace was maintained. While it would have been preferable to coordinate the project locally, given the circumstances, it was determined that transferring coordination to New Westminster would ensure sufficient resources were available to coordinate and administer the project.

Challenge 4: Reporting on and integrating community values and priorities not associated with climate change or forestry.

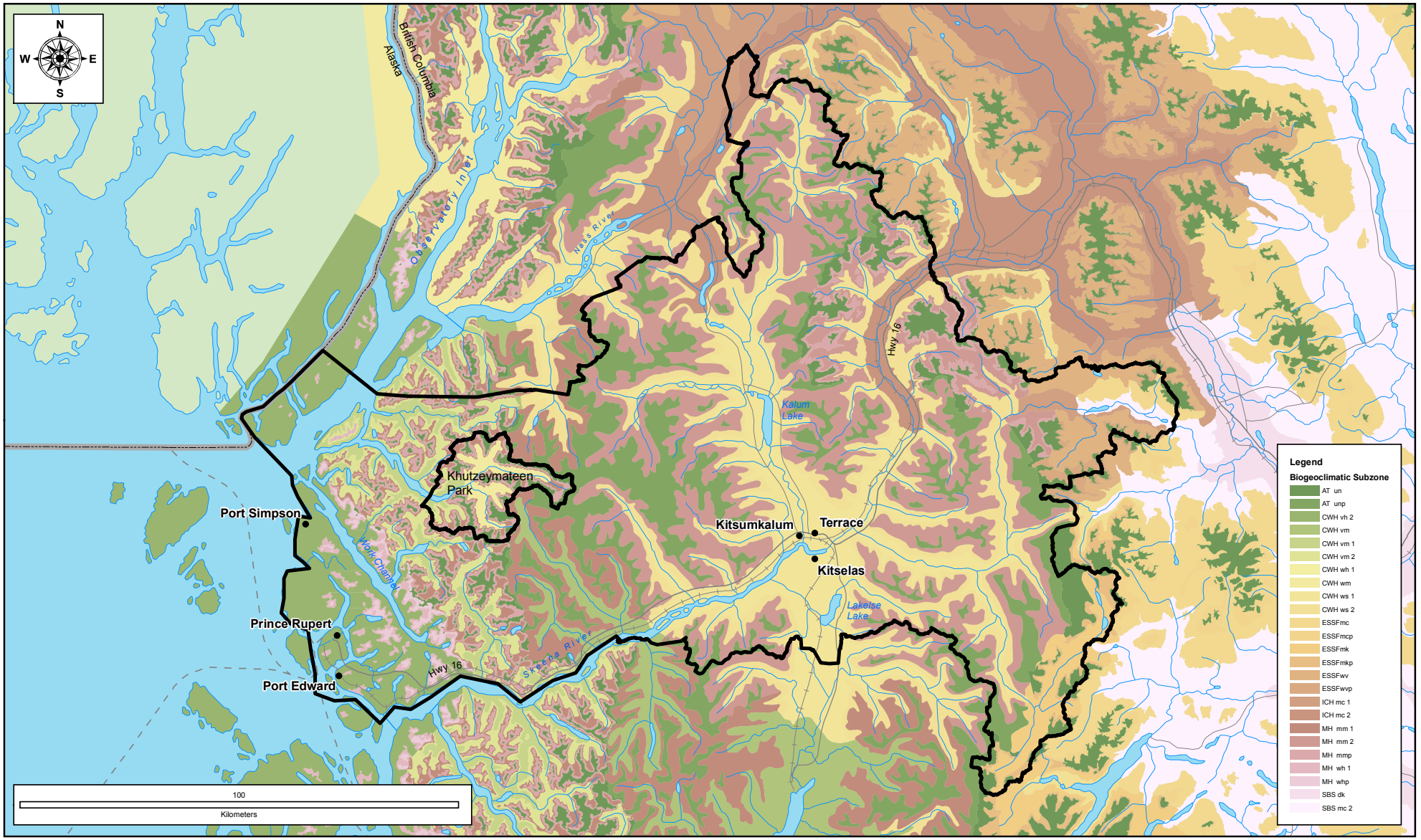
One of the challenges that the group faced was integrating the sociological research findings, community values in particular, with the biophysical research and modelling that was planned largely around forestry and forest ecosystems. Wide-ranging input from community leaders and stakeholders has, as evidenced by the Valued Resources Report, resulted in the identification of issues and values that are beyond the scope of the scientific research and modelling capacity of the project. Given that a goal of the project was to enhance regional and local adaptive capacity, in addition to contributing information necessary for adaptation within the forest sector, incorporating community discussions at a broader level than forestry, while still placing forest management within the context of greater community values and visions, was essential. This is consistent with the principle of sustainable forest management, which includes public participation, and social and economic benefits alongside other ecological criteria and indicators, in the assessment process. For this study, although it was not entirely possible to speak to all of the issues brought forward, and despite the fact that some do not have direct relevance to forest management policy, it was important to provide participants with a forum to discuss a range of adaptation options in the context of their community., whether or not they were linked to forestry. To address this challenge, the community workshops were structured so that participants were first shown a summary of results and findings from each component of the research, and then were asked to keep this new information in mind as they identified adaptation options, barriers and enablers to the recommendations.

A 1.2.3 Project Deliverables and Additional Research Outputs

In addition to the deliverables contained in the original proposal, several other products have come out of this study. Further, plans are already in place for further analysis of the sociological data for future papers and reports.

Deliverables achieved include:

1) Project Summary Report for the FFESC.
2) *Climate Change Adaptation Planning for Northwest Skeena Communities: Report for Communities* – a publically available compilation of findings and reports from all components of the study available.
3) Climate Adaptation Tool-kit – an interactive CD based adaptation tool-kit for community stakeholders.
4) Individual community reports for Prince Rupert, Terrace and Lax Kw 'alaams, based on preliminary analysis of research interviews and Sustainability Matrix.
5) Development and piloting of the 'Sustainability Matrix' as a new method of vulnerability assessment for communities and natural resources.
6) Piloting of Fisheries Sensitive Watershed Monitoring Protocol in Lakelse Lake Watershed, including public technical reports, and draft FSW Report Card (FSW pilot work is being reviewed and refined by experts and a full report will be available in summer of 2012).
7) Regional application of cutting edge LPJ-GUESS dynamic global vegetation model (DGVM) to assess potential vulnerability to climate change of 19 major tree species in the Skeena region, and subsequent modelling of the potential cumulative impacts of different harvesting scenarios and climate change on runoff, carbon, fire incidence, and landscape on a regional scale.
8) Community workshops in each of three communities to share results and empower future adaptive planning among local leaders and stakeholders.
9) Development of a cumulative effects analysis framework capable of projecting multiple future climate and land-use scenarios, to facilitate optimal planning and protection of ecosystem resources.
10) Summary report from expert community workshop to identify hydrological indicators for the Skeena region as part of the Skeena River Water Conservation Project (SRWCP).
11) Results from SRWCP scenario runs to support strategic planning and analysis of potential site-level impacts of different harvesting regimes and climate futures on freshwater resources and fish habitat. This tool is now ready to be operationalized for use in forest and other resource planning should CTR and other resource managers choose to invest further. The full SRWCP report will be available in summer 2012
12) Multiple posters and presentations at conferences, as well as journal articles to be released in the future.
13) A number of recommendations for next steps and climate change adaptation strategies for policy-makers, local communities, and resource managers in the Skeena.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Appendix 1.4: Terrace Historical Seasonal Precipitation and Temperature Trends (Environment Canada, 2011)

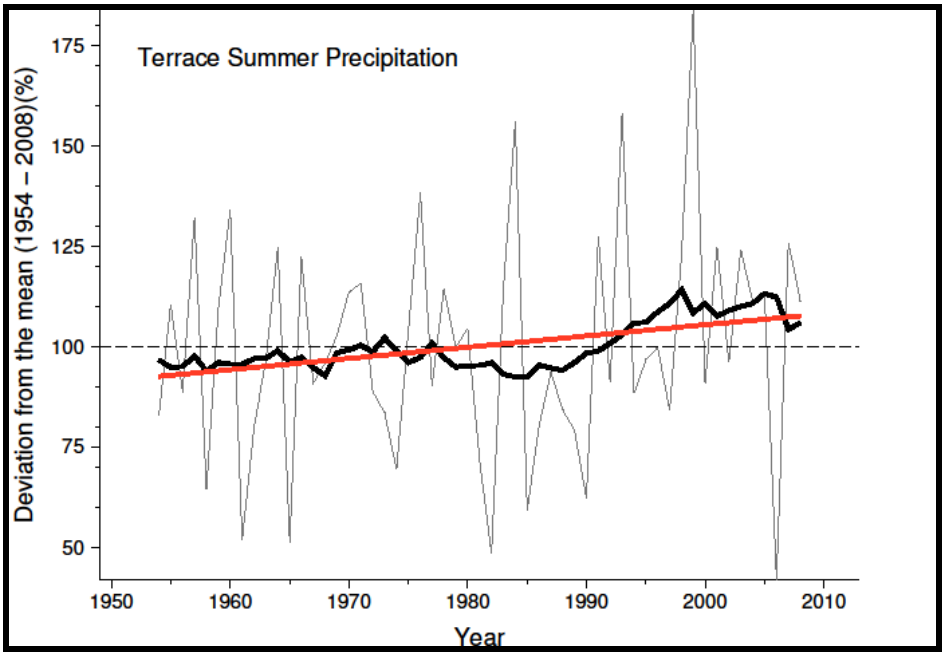

Figure (A)1.4.1
Trend in summer precipitation levels in Terrace from 1954-2008.

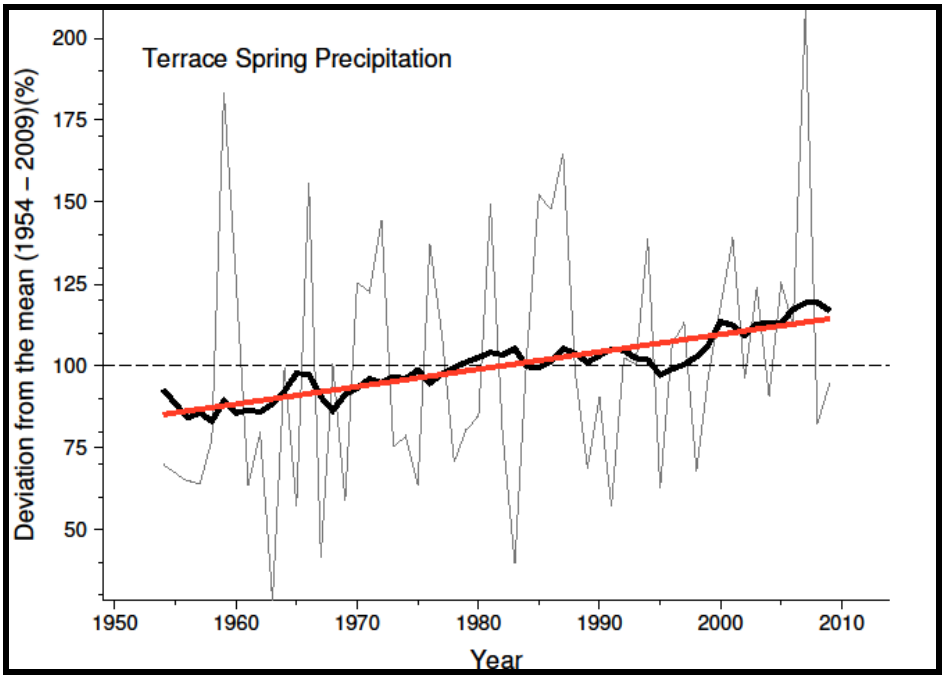

Figure (A)1.4.2
Trend in spring precipitation levels in Terrace from 1954-2009.

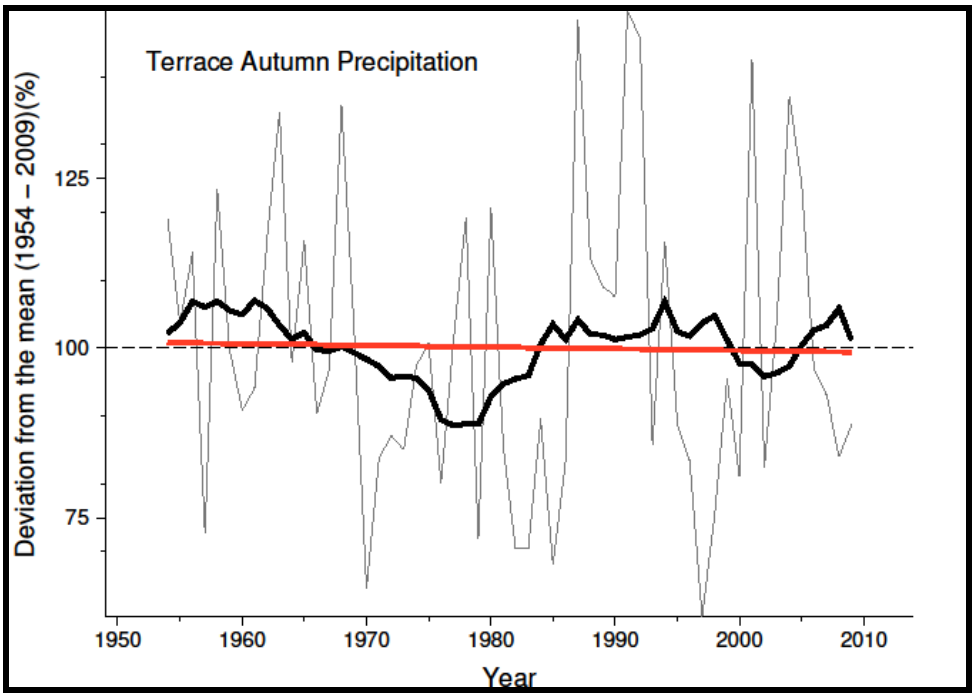

Figure (A)1.4.3
Trend in autumn precipitation in Terrace from 1954-2009.

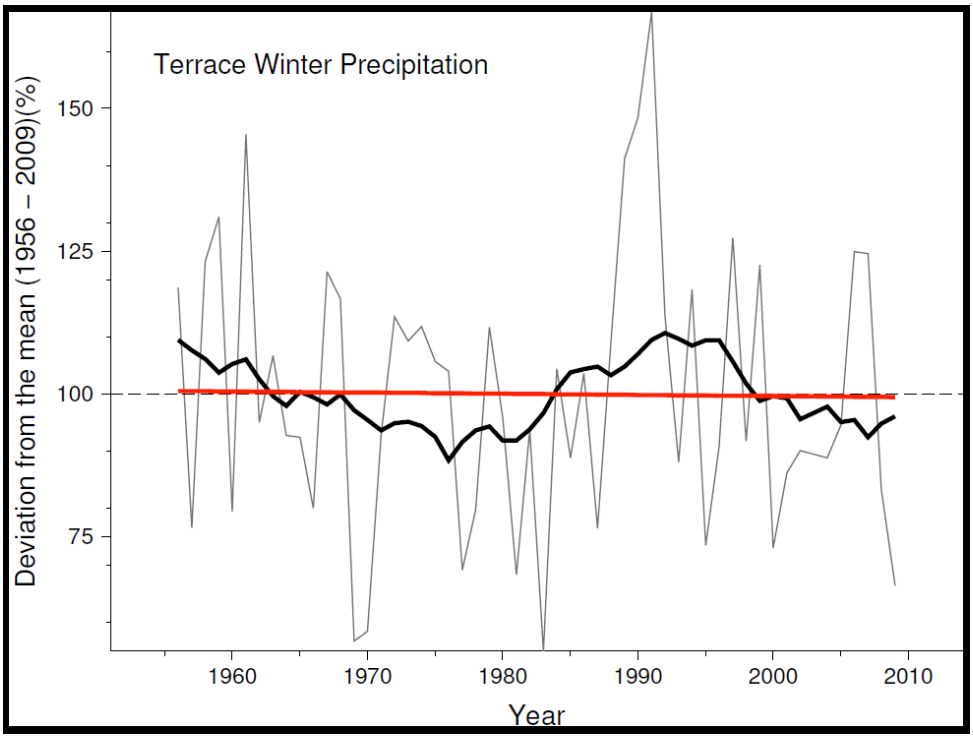

Figure (A)1.4.4

Trend in winter precipitation in Terrace from 1956-2009.

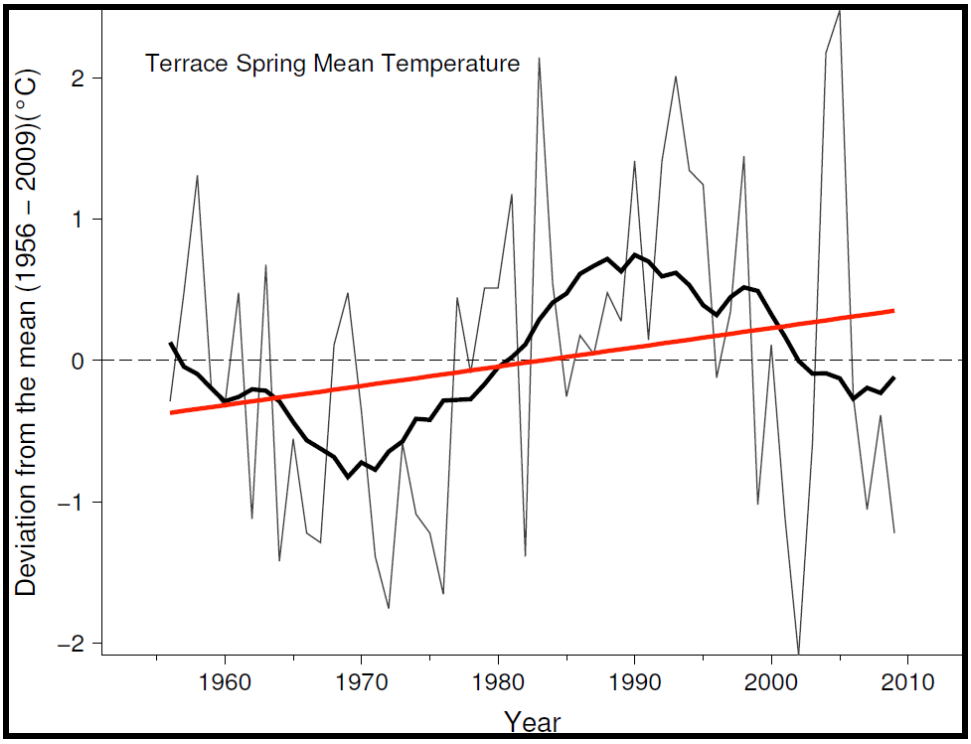

Figure (A)1.4.5
Trend in spring mean temperature in Terrace from 1956-2009.

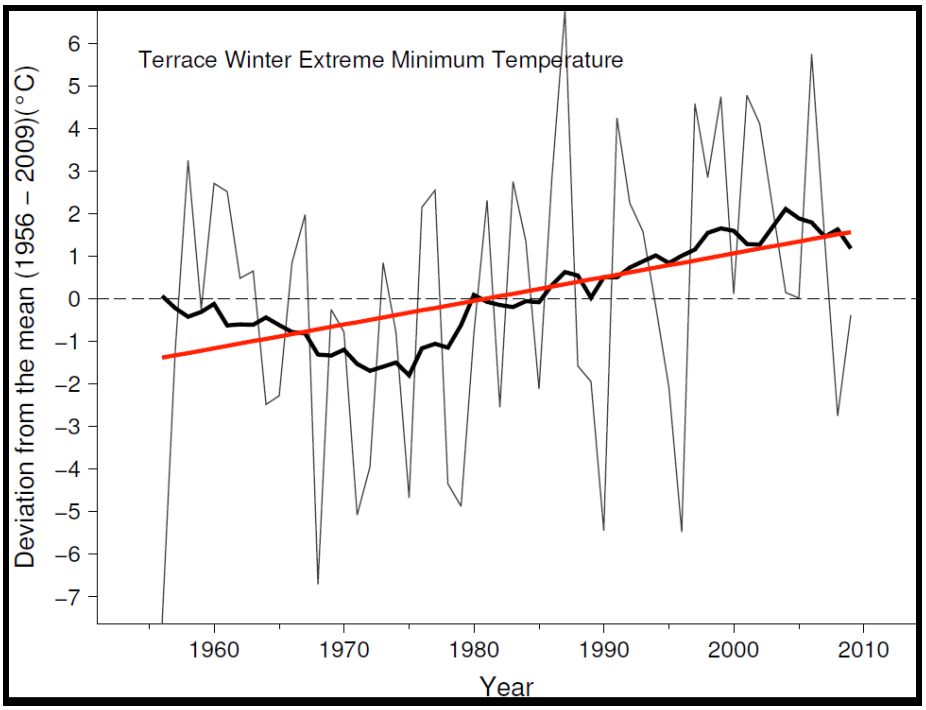

Figure (A)1.4.6

Trend in winter extreme minimum temperature in Terrace from 1956-2009.

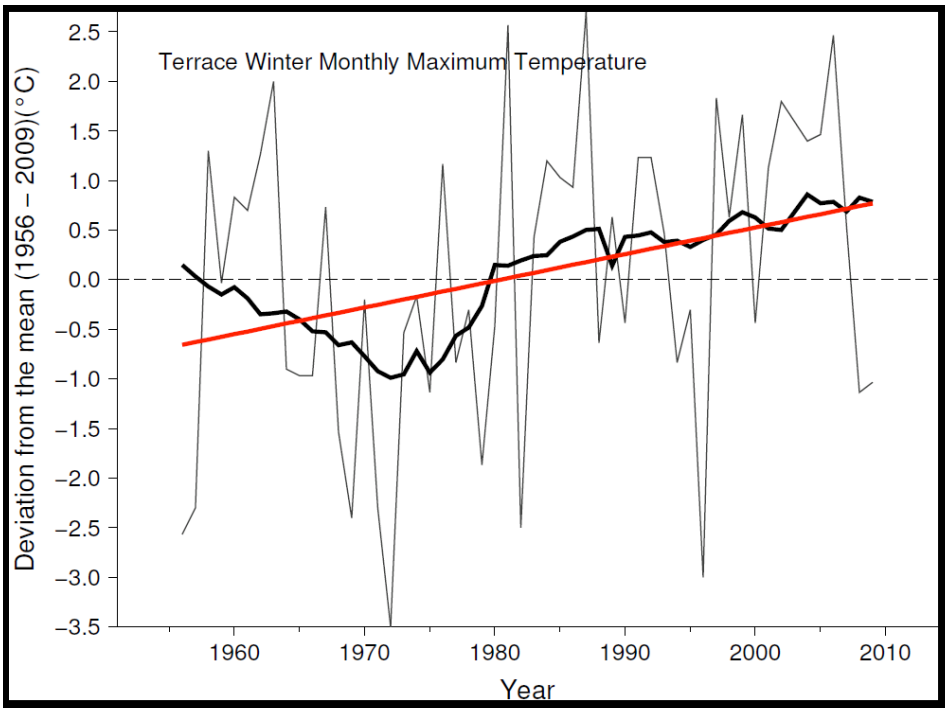

Figure (A)1.4.6

Trend in winter monthly maximum temperature in Terrace from 1956-2009.

Appendix 1.5 Prince Rupert Historical Precipitation Trends (Environment Canada, 2011)

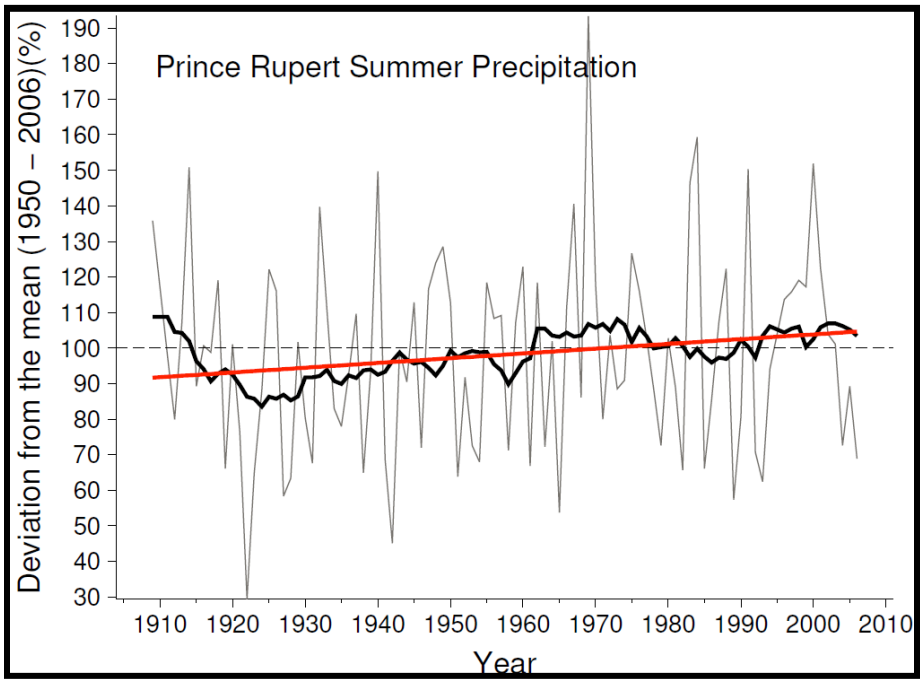

Figure (A)1.5.1
Trend in summer precipitation in Prince Rupert from 1950-2006.

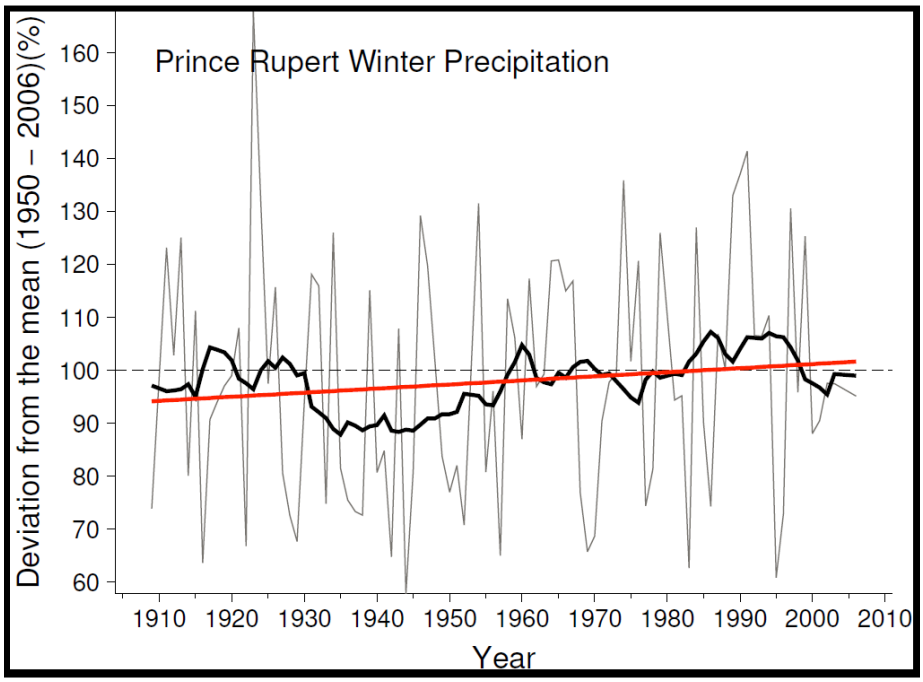

Figure (A)1.5.2
Trend in winter precipitation in Prince Rupert from 1950-2006.

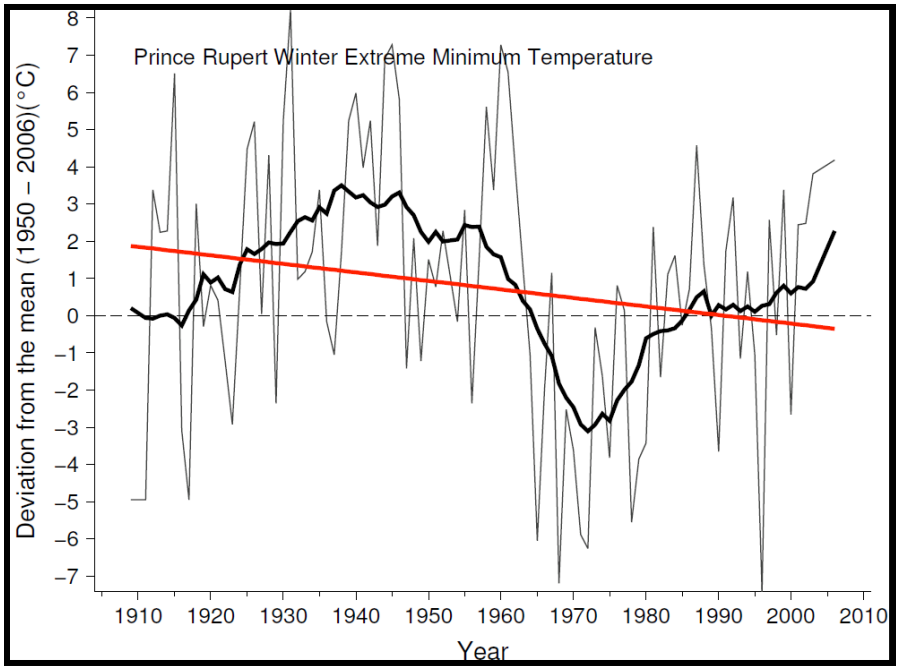

Figure (A)1.5.3
Trend in winter extreme minimum temperatures in Prince Rupert from 1950-2006.

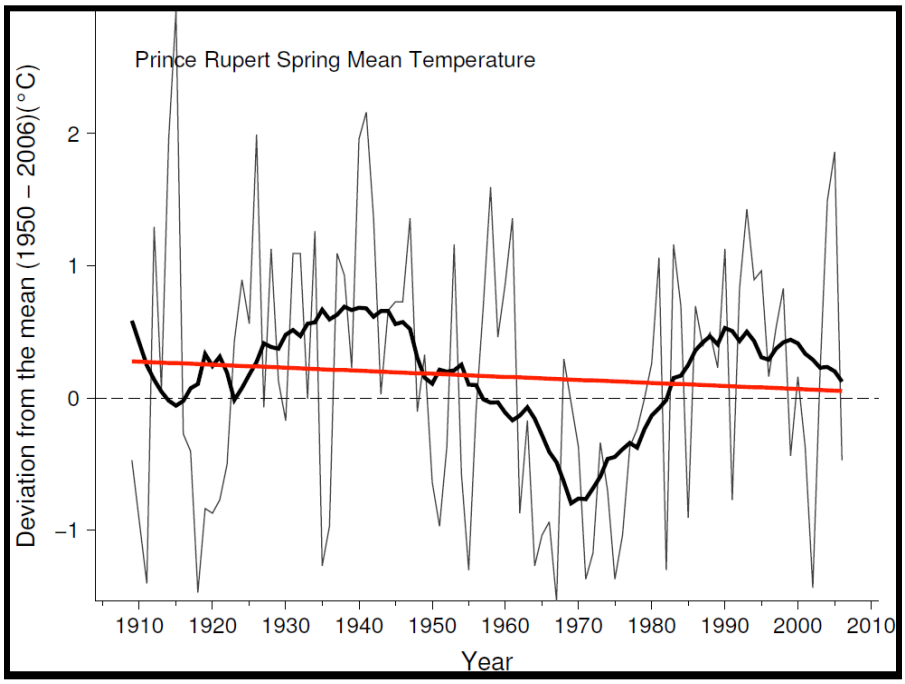

Figure (A)1.5.4
Trend in spring mean temperature in Prince Rupert from 1950-2006.

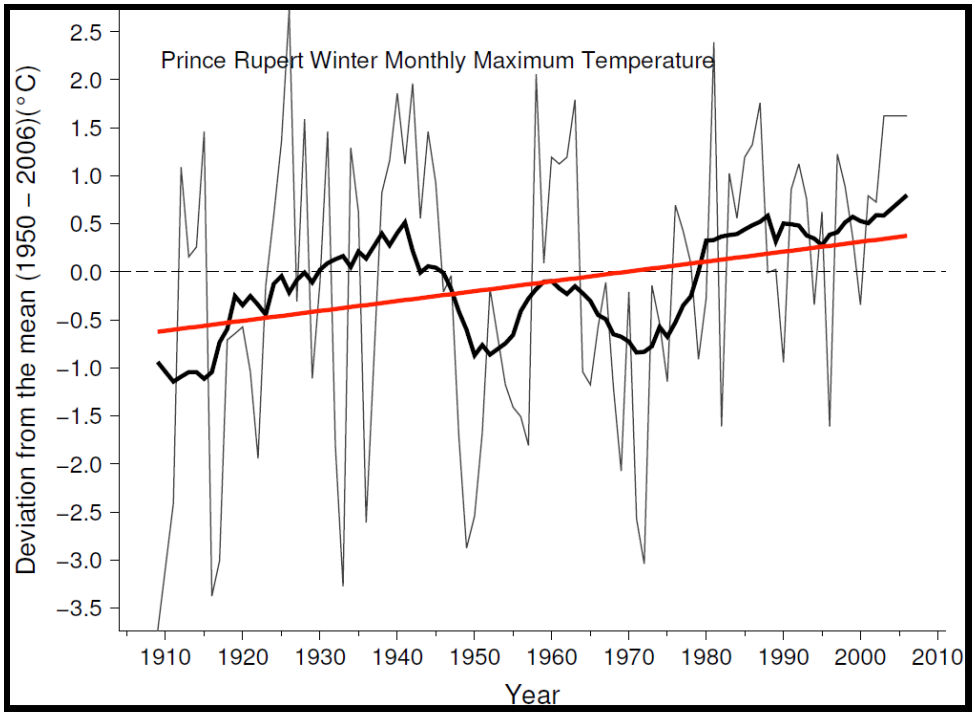

Figure (A)1.5.5

Trend in winter monthly maximum temperature in Prince Rupert from 1950-2006.