

COMMUNITY ADAPTATION PROJECT



DAWSON CLIMATE CHANGE ADAPTATION PLAN

PLAIN LANGUAGE SUMMARY

DECEMBER 2009



Northern Climate Exchange

independent information, shared understanding, action on climate change

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TAKING ACTION ON CLIMATE CHANGE



Prepared by the Dawson Adaptation Project Team:
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Ryan Hennessey,
Community Adaptation Project Manager
Sebastian Jones,
Dawson Local Adaptation Coordinator
Frank Duerden,
Dawson CAVIAR, Ryerson University
Stephen Swales,
Dawson CAVIAR, Ryerson University

With Support From:

John Lenart	<i>Yukon Agricultural Association</i>
Renée Mayes	<i>Tr'ondëk Hwëch'in</i>
Jim Taggart	<i>Conservation Klondike Society</i>
Mark Wickham	<i>Klondike Visitors Association</i>
Gerry Couture	<i>Retired (Natural Resources Specialist)</i>
Jim Regimbal	<i>City of Dawson</i>
Norm Carlson	<i>City of Dawson</i>
Antoni Lewkowicz	<i>University of Ottawa</i>
Aynsle Ogden	<i>Forest Management Branch, Yukon Government</i>
Rick Janowicz	<i>Hydrology Section, Yukon Government</i>
Robin Walsh	<i>Transportation Engineering, Yukon Government</i>
Val Walker	<i>Social Economy Research Network of Northern Canada</i>
Lacia Kinnear	<i>Northern Climate ExChange</i>
Arelia Werner	<i>Pacific Climate Impacts Consortium</i>
Ian Church	<i>Senior Science Advisor, Yukon Government</i>
John Streicker	<i>Northern Climate ExChange</i>
Trix Tanner	<i>Department of Fisheries and Oceans</i>
Robert Clark	<i>Tourism Product Development and Research, Yukon Government</i>
Greg Finnegan	<i>Yukon Bureau of Statistics, Yukon Government</i>

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Adaptation Plan Highlights

The Dawson Adaptation plan draws on the local knowledge of the community of Dawson to identify the risks and opportunities that climate change may hold for residents.

The plan evaluates the consequences of climate change based on three predetermined characteristics of resilience: the adaptive capacity of the community to respond to each climate change consequence, the level of event associated with the consequence and the likelihood of the event. Priority risks were identified if the climate change consequence had a high level of impact and likelihood of occurring and the community had a low ability to respond to it.

Dawson is anticipated to experience a relatively uniform increase in annual temperature of 2.5°C to 3.5°C over the next sixty years because of climate change. During the same period annual precipitation is projected to increase by 10% to 40%. Increases are projected to take place more so in winter than in summer. A 30% to 50% increase in winter precipitation is projected. An increase of only 10% to 30% is projected for the summer months.

In all, sixty three consequences were identified that may increase the level of risk for Dawson residents as a result of climate change. These risks are generated by changing conditions in the landscape and from within the community. Fourteen opportunities that may benefit residents were also identified as the result of climate change.

Forty-two adaptations were recommended for implementation by 2020. Immediate actions that will reduce risks for residents of Dawson include:

- Maintain or develop research and monitoring to observe change and evaluate possible climate change impacts and responses.
- Update the EMO (Emergency Measures Ordinance) to reflect possible climate change vulnerabilities.
- Investigate need to raise the existing level of the dyke. Determine who is responsible for the work.
- Investigate flood proofing of sewage facility.
- Continue highway vulnerability assessment and action planning (e.g. build on experiences in and around Beaver Creek, YT).
- Complete the hydro-geological testing of the Quigley Solid Waste Facility.
- Designate fiscal responsibility for remediation of abandoned waste disposal sites.
- Explore the feasibility of technologies that will conserve the permafrost.
- Communicate the need to respect fish and wildlife to present and future generations.
- Update/Implement OCP recommendations relating to Recreation, Parks and Open Space (Section A.5.5).
- Advertise local produce and explore food storage.

Adaptations that were proposed by the community can also influence the recommendations of other plans, such as Dawson's emergency response, official community, and land-use plans.

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Dawson City, Yukon Territory (photo: NCE)

About This Plan

The Dawson Adaptation Plan uses a process that brings the experience and knowledge of residents together with science. The plan is intended to be used by the community to prepare for climate change and to support other planning processes in the study area, the Tr'ondëk Hwëch'in Traditional Territory (Figure 1). The Dawson Adaptation project team is made up by members of the International Polar Year Dawson Community Adaptation and Vulnerability in Arctic Regions (CAVIAR)¹ team, and the Northern Climate ExChange (NCE).

We chose the Tr'ondëk Hwëch'in Traditional Territory as our study area because it is large enough to allow us to assess all the possible environmental changes that might affect the community. However, because this study focused mainly on how climate change may affect the community, we mostly focused on those problems that affect the community most; the infrastructure and townsite of Dawson.

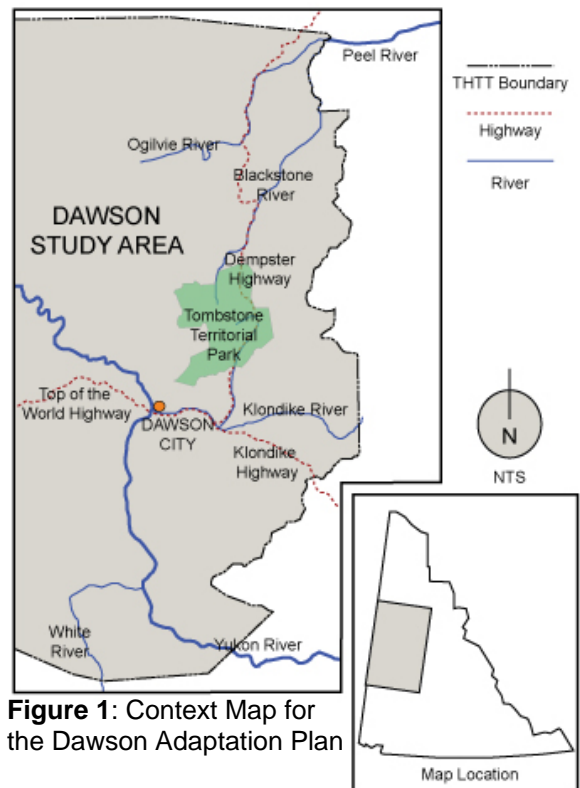


Figure 1: Context Map for the Dawson Adaptation Plan

Ensuring that the project team worked closely with Dawson residents was an important part of this project. Guidance in the development of this plan (Figure 2) was provided by the Dawson Local Advisory Committee, which included representatives from the Conservation Klondike Society, Government of the Tr'ondëk Hwëch'in and the City of Dawson. The membership of the Local Advisory Committee was determined by identifying stakeholders that may be at risk from climate change. The role of the Local Advisory Committee was to ensure that what was important to the community was reflected in the planning process. Yukon Government voluntarily chose not to participate because of the community nature of the planning process.

¹ Dawson CAVIAR is funded by the International Polar Year and examines establishing how local populations respond or adapt to stresses, identifying the way in which the environment of the region may change in the future, and assessing the capacity of the community to respond to these anticipated events.

The Dawson Adaptation Plan was developed in two parts. During the first part the project team worked with residents to find out how they may be affected by climate change. Residents told us how climate change might affect at a number of open houses, during individual interviews for the Dawson CAVIAR project, and through community input sessions. These community input sessions brought local experts together to discuss climate change and the community. Based on these discussions, a community vulnerability scenario was written for use in the adaptation plan. The community vulnerability scenario was then reviewed by a Technical Advisory Committee, made up of government and academic experts from outside the community, to reinforce local findings and bring together local and scientific knowledge.

In the second part of the planning process, the project team worked with the Local Advisory Committee to create a list of consequences that climate change may have for residents from the vulnerability scenario. Each consequence may harm the community. We then measured each consequence to sort out which ones would have the most harm for the community based on a risk assessment framework. The framework ranks the consequences of climate change based on three predetermined characteristics of resilience: the ability of the community to respond to each consequence, the severity of the consequence and the likelihood of the event. Resilience, in this context, is the ability of the community to stay the same while things change around them. Priorities were determined based on the relative ranking of each consequence.

To help with the planning process, the Dawson Local Advisory Committee developed a vision statement. This vision statement set the tone for the plan recommendations. The Dawson Local Advisory Committee vision of a successfully adapted community is:

Dawson City and its hinterlands will be a self sustaining society, a community that lives within the limits of the local ecosystem and serves as a haven for its residents in an uncertain world.

It will achieve this by:

- *Taking steps to increase its resilience,*
- *Actively promoting self sufficiency*
- *Increasing our knowledge of the environment around us.*
- *Developing ways to adapt to sudden changes in society and the climate*

The remainder of this summary describes how climate change may affect the community of Dawson. First we present the current conditions in the community. This baseline shows what the currently climate of Dawson is like, and if/how the community of Dawson

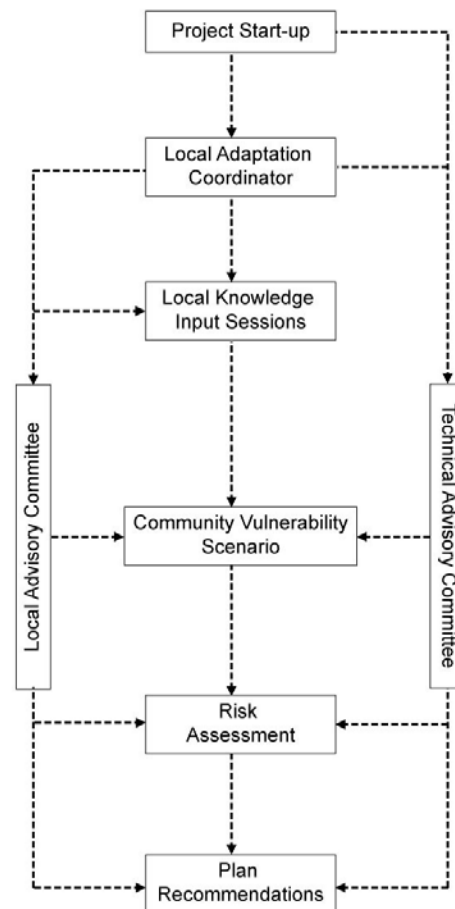


Figure 2: Dawson Adaptation Planning Process

is ready for climate change. We then describe how the climate of Dawson may be different in the future, from the years 2041 to 2070. Once these climate conditions have been established, we then discuss how the community may be vulnerable to or benefit from climate change. Conclusions and recommendations follow.

Current Conditions in the Community

Socio-economic Characteristics of Dawson

An understanding of existing conditions is an essential part of determining where a community will be sensitive to change and how resilient residents are to the consequences of that change. To determine how things may change, the Dawson Adaptation Plan pulled together information about the current state of the environment and socio-economic characteristics of Dawson.



Aboriginal Day in Dawson (photo: NCE)

We found that mining has always played a prominent part of the local economy, and that after a boom in the early part of the 20th century, placer mining in Dawson is now a seasonal industry. Tourism has developed over the past 40 years and people come from all over the world to view the many heritage buildings from the gold rush days. These buildings are now maintained by the Federal Government. Traditional dirt roads and boardwalks also remain. Other attractions include a nearby placer mining dredge (also maintained by the Federal Government), gold panning opportunities, long hours of summer

daylight, northern lights (*aurora borealis*), "traditional" dancing and gambling halls and bars, back country tours and ferry access to the "Top of the World Highway" en route to Alaska. Tourism is mostly confined to summer months and tourist sources include southern Canada, the USA and Europe. While most tourist facilities close in winter, there are a few winter attractions such as the Yukon Quest; a dog sled race between Fairbanks, Alaska and Whitehorse, Yukon. Many in the community move around by walking or cycling, but there is no opportunity for public transit use.

The Federal and Yukon Governments are important employers in the town which has a school, a branch of Yukon College, an RCMP detachment, Service Yukon facilities, Client Services for the mining industry, a Fish and Wildlife office, a YESAB office, EMS services, Yukon and NWT tourism centres, and, as noted, sizeable Federally maintained tourism attractions. The Tr'ondëk Hwëch'in also has a substantial presence in the community with offices and facilities located in the Dawson downtown core. There is a local airport to the south and seasonal ferry service across the Yukon River to the communities of West Dawson and Sunnydale via the Top of the World Highway. The Top of the World Highway also connects Dawson to the Alaska border. The high degree of government employment and investment, small population size, and a high dependence of residents on tourism and gold mining create a limited economy that is sensitive to change.

Dawson residents have learned to deal with many challenges stemming from living in a harsh and remote area. These challenges have evolved from a combination of natural and human activities. With respect to the human activities, the Klondike gold rush resulted in extensive de-forestation (with subsequent implications for eco-system health), water diversions (affecting fish habitat), and excessive wild-life harvesting to feed the early mining population of Dawson. Natural disruptions include spring flooding, forest fires, permafrost degradation, periodic shifts in the freeze-thaw cycle of the Yukon River, and shifts in the availability of fish and wild-life.

Because of the relative isolation of Dawson and the experience that the community has had with dealing with acts of nature, residents have a general sense that they live with ongoing environmental stress and have adopted an attitude that they can cope with future challenges. The population boasts a wide range of skills, from traditional land-based skills to engineering and geo-technology.

Landscape Characteristics of Dawson

Dawson City is located on a small flood plain at the confluence of the Klondike and Yukon Rivers, near the Arctic Circle at 64°04'North latitude and 139°26' West longitude. The microclimate of Dawson is influenced by the Tombstone Mountains, which frequently stops shallow outflows of cold arctic air, generating a relatively balmy microclimate.

Mount Monolith, Tombstone Mountain Range (photo: NCE)



This balmy microclimate has created a distinct landscape around Dawson region, which is unique because of its forest composition, discontinuous permafrost distribution, local flood regime, local land uses (farming, trapping, hunting and fishing), and its location

within the ancient landscape of Beringia. Beringia was an unglaciated land mass that provided a land bridge across the Bering Strait until between 12.8-11,300 years BP. Because it was unglaciated the soil is well weathered and more fertile than that found in the more populated region around Whitehorse. Landforms are characteristic of a long unglaciated plateau, with deeply incised valleys and rolling hills. Because of Beringia, there are also many examples of relic flora and fauna from pre glacial times that no longer exist elsewhere.

After we compiled this profile of the characteristics of Dawson, we asked participants to identify how climate change could affect the region. To support discussions of climate change in Dawson we asked the Pacific Climate Impacts Consortium (PCIC) to project regional climate changes around Dawson. We then presented PCIC's findings to Dawson residents at a Community Input Week in November 2008. At the same meeting, we collaboratively developed a Dawson Community Vulnerability Scenario.

Looking away from Dawson City at the Confluence of the 40-mile River (photo: NCE)



Climate Change and Dawson

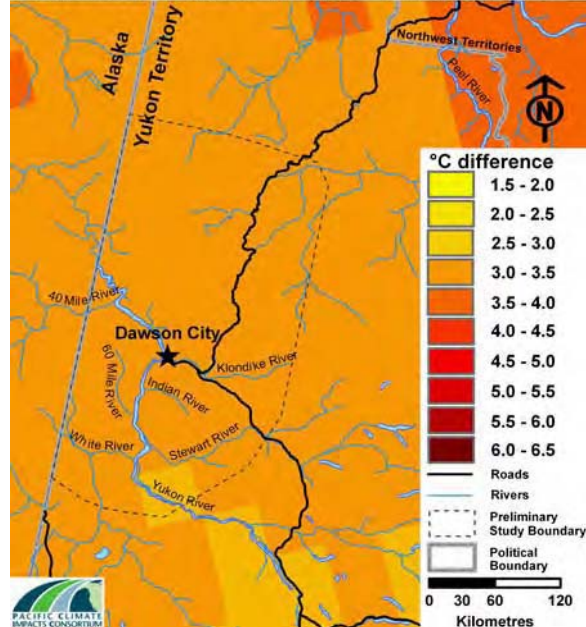
Climate change is expected to greatly alter the general characteristics of Dawson and increase the risk of damaging environmental impacts on residents. Historical trends for temperature, precipitation, and streamflow in the region were assessed by PCIC to give some indication of how climate conditions are being affected locally. PCIC's findings suggest that climate change has already taken place in the Dawson region.

To illustrate how climate change may affect Dawson, PCIC established a baseline for annual temperature and precipitation in Dawson from 1961-1990. Annual temperatures in Dawson were found to be of -7.2°C to -1.2°C . During the same period, annual average precipitation ranged from 200mm to 500mm.

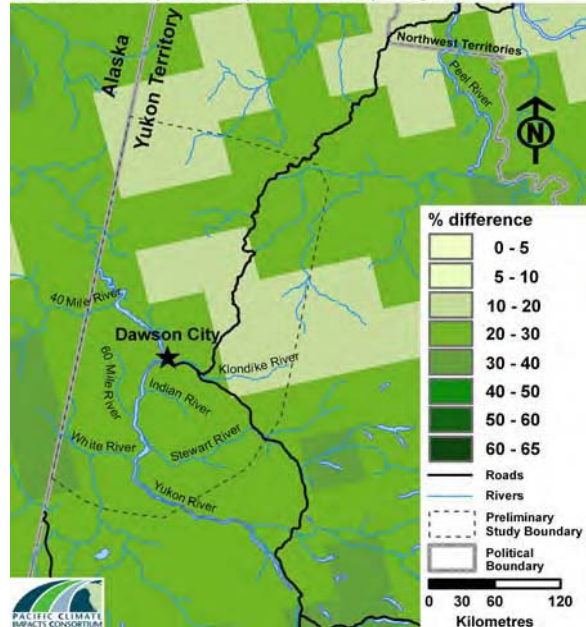
Projected changes to the climate of Dawson City were derived from the Canadian Regional Climate Model (CRCM) for the 2050's (2041-2070). The CRCM builds on the results of global climate models (GCMs) by incorporating elevation, topography, and other physical and dynamic processes at an increased resolution of 45km^2 . We also examined the results from 15 Global Climate Models for the 2020s (2011-2040), 2050s and 2080s (2071-2100) to support the CRCM findings. All climate change projections were based on the A2 scenario developed by the International Panel on Climate Change. This scenario assumes that we will continue to rely on fossil fuels and that the global population will continue to grow. For this reason, the A2 scenario is called the "business as usual" scenario. Results are presented as a difference from the 1961-1990 baseline for the 2050's (2041-2070).

A relatively uniform increase in the annual temperature of Dawson (2.5°C to 3.5°C) is projected for 30 year period of the 2050's. Winters are expected to warm more (3.0°C to 6.0°C) than summers, which may only warm from 1.0°C to 3.0°C . Annual precipitation in the Dawson region is projected to increase by 10% to 40%. More precipitation is expected during winter months than in the summer. A 30% to 50% increase in winter precipitation is projected, while summer months may experience an increase of only 10% to 30%.

Annual Mean Temperature (2041 - 2070) Projection



Annual Precipitation (2041 - 2070) Projection



It should be noted that large scale events such as the El Niño Southern Oscillation have effects on the short and medium term climate; winters are considerably warmer during El Niño periods in the Dawson region. Other phenomena include the Arctic Oscillation and the Pacific Decadal Oscillation. These events last varying periods of time, with the ENSO typically lasting months while the others can last for decades. These events reinforce or cancel each other in respect to their effects on the climate in Dawson, and will mask or enhance the underlying warming of the climate.



Ice Bridge to West Dawson (photo: NCE)

Based on the projections established by PCIC, residents identified five landscape level climate change events that will affect Dawson. Residents expect an increase in the local forest fire regime, flooding, and local weather variability. They also anticipate negative shifts to the wildlife and forests around Dawson and a decline in permafrost across the region. These events are expected to affect the region in many ways, and could result in a significant overall change to the landscape around Dawson. As the landscape changes, so too will life in Dawson - and sixty three consequences of climate change that may negatively affect the community were identified by the community. Community members also identified fourteen opportunities that may benefit residents. These benefits and consequences are summarized in next section.

Climate Change Consequences and Recommended Adaptations for Dawson

The consequences of the climate change that we identified in collaboration with the community are described below. Community vulnerabilities have been prioritized based on the elements of risk established by the project team. These risk elements are: the anticipated level of the impact, the likelihood of the impact, and the adaptive capacity of the community. Priority risks are characterized by a high level of impact, high likelihood that the impact will occur and a low capacity observed in the community to respond. For the purposes of this assessment, the adaptive capacity of Dawson was evaluated based on four components: the familiarity of the impact, the resources available within the community with which to respond to the impact, the motivation of residents to respond to the impact, and the level of education/skills required to effectively respond to the impact.

Eleven regional/non-community based vulnerabilities were identified by residents. These larger landscape level effects of climate change are of concern because they will change the region around Dawson. These vulnerabilities differ from community based consequences of climate change because the community cannot effectively respond to them.

Fifty-two consequences of climate change for the community were also identified by residents. Each consequence stems from climate induced changes in regional flooding, forest fires, and weather. These changes may affect access, health, land use and the local economy. We also identified fourteen opportunities that may evolve from changing climate conditions. These opportunities stem from climate induced changes to the regional forest fire regime, seasonal weather changes, tourism and recreation, permafrost decline and a local economy that will likely favour residents.

Priority risks were characterized by a high level of impact and likelihood of the identified consequence and low observed ability of the community to respond. A high priority was also assigned if one or more of the risk assessment criteria were unknown. This is because a need exists to increase the level of knowledge associated with the consequence. Priority opportunities were identified based on the existing adaptive capacity of residents to respond to favourable conditions and the likelihood that the opportunity would emerge.

It is anticipated that, over time, improved climate change projections and additional scientific research will allow for greater certainty in decision making. For the immediate future, it is suggested that the recommendations of this plan be implemented in keeping with upcoming global timetables. Specifically, the global community is anticipating that emission controls are necessary and that specific carbon cuts will be required by 2020. At that time, based on the success of nations to curb their carbon emissions, communities will have greater certainty of the severity of the climate changes that they must face. The project team therefore suggests that the following actions be taken in the Dawson region, led by the community and supported by various institutions, by 2020. We also recommend that this plan be updated by the year 2020 to reflect the success or failure of the global community to curb their carbon emissions.

Adaptations Recommended for Immediate Implementation

- Maintain or develop research and monitoring to observe change and evaluate possible climate change impacts and responses.
- Integrate climate change assessment into rural planning processes.
- Update the Emergency Measures Ordinance (EMO) to reflect possible climate change vulnerabilities.
- Investigate need to raise the existing level of the dyke. Determine who is responsible for the work.
- Investigate flood proofing of sewage facility.
- A detailed permafrost assessment is required which could build on/update the assessment completed by EBA in the 1970's.
- Continue highway vulnerability assessment and action planning (e.g. build on experiences in and around Beaver Creek, YT).
- Complete the hydro-geological testing of the Quigley Solid Waste Facility.
- Designate fiscal responsibility for remediation of abandoned waste disposal sites.
- Explore the feasibility of technologies that will conserve the permafrost.
- Continue weed pull programs.
- Communicate to present and future generations the need to respect for fish and wildlife.
- Diversify economy by supporting emerging markets.
- Use local materials when implementing projects.
- Update/Implement OCP recommendations relating to Recreation, Parks and Open Space (Section A.5.5).
- Advertise local produce.
- Explore food storage.



Dawson Community Gardens (photo: NCE)

Adaptations Recommended for Implementation by 2020



Placing a Fish Wheel (photo: NCE)

- Implement preparedness education to respond to potential climate change related emergencies.
- Ensure resources necessary to repair damage within plan boundary are available.
- Develop education programs to assist residents in making sound decisions when coping with or preparing for climate induced changes in the community.

- Re-establish experimental farms (e.g. Swede Creek) and investigate local agricultural options/alternatives.
- Develop and/or release information about possible flooding.
- Investigate the potential of drought and its impacts on the Dawson region.
- Create emergency storm shelter systems within the community.
- Construct helicopter pad for emergencies as needed.
- Change road materials - use stronger materials.
- Monitoring in the area for changes in water quality.
- Complete a risk assessment that also inventories abandoned dump sites in the Dawson area.
- Incorporate flexible regulations and policies into rural land use planning.
- Explore feasibility of fish hatchery.
- Ensure that climate change is incorporated into forestry management plans.
- Study how small animals toward the bottom of the food chain react to climate change.
- Ensure building codes are congruent with the expectations of a changing climate.
- Re-brand community marketing strategy to offset long distance aspect of travel (e.g. create slogans such as “You’ve come so far to get here; stay a little longer”).
- Emphasize grassroots culture/unique events (e.g. music festival)
- Use local materials when implementing projects.
- Explore/expand existing trail network.
- Coordinate ski-hill expansion with EMO implementation.
- Revisit local features (convert firebreaks to trails).
- Investigate possible markets for surplus (if necessary).



Dowdell's Farm (photo: NCE)

Next Steps and Conclusions

Some selected adaptations will be implemented as a component of the Dawson Adaptation Project with funding from the Northern Strategy Trust. These projects will be selected by the Dawson Local Advisory Committee. To ensure the selection of relevant and successful implementation projects, the Local Advisory Committee prepared the following terms of reference:

- Have broad appeal.
- Have high visibility.
- Have high relevance/utility.
- Produce readily measurable results.
- Reduce the carbon footprint of the community or have a minimal footprint.
- Leverage other funding.
- Attract partners.
- Be built upon later.
- Provide local employment.
- Tie into and or build upon existing plans.
- Increase local resilience.
- Use local resources and materials.
- Be characterized by financial sustainability that continues past the implementation deadline (July 2010).

Projects will be implemented from 2009 to 2010 by the Dawson Adaptation Coordinator. A full implementation report will be provided at the conclusion of the implementation period in summer 2010.

Mainstreaming Climate Change in the Community

Mainstreaming climate change is the integration of climate change into other community activities. For example, many of the adaptations identified in this plan can be integrated into other plans or community development projects. In the Dawson Adaptation Plan, we have identified how climate change may influence a future update of the Dawson official community plan, land-use planning in the region, emergency response planning, fire management planning and infrastructure planning.

Addressing Uncertainty and Climate Change in the Dawson Region

While this report has made every attempt to assess uncertainty associated with the identified climate change consequences there is still a lot that we don't know. We therefore recommend that every effort should be made to increase our knowledge of how climate change may affect us. The project team suggests that integrating climate change mitigation and adaptation efforts will likely result in a better action strategy by providing a solid rationale for decisions, in addition to providing the balanced and effective response to climate change suggested by the IPCC. We have also found that increased monitoring and research is desperately needed in Yukon and in Dawson.