Yukon State of the Environment

A Report on Environmental Indicators - 2014

Yukon
Environment

Acknowledgments

Hiking in Tombstone Territorial Park.

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Cover Photo: Ice wedge polygons caused by freezing and thawing on the west arm of the Mackenzie Delta, Yukon North Slope.

Highlights

Lake Bennett from Montana Mountain. © Richard Legner 2013

This *State of the Environment Report* presents information on climate change, air, water, land, and fish and wildlife. It provides insight into whether Yukon is achieving the goal of maintaining and enhancing the quality of Yukon's natural environment for present and future generations.

The report is prepared in accordance with the *Environment Act*. It provides early warning and analysis of potential problems for the environment; allows the public to monitor progress toward the achievement of the objectives of the Act; and provides baseline information for environmental planning, assessment, and regulation. The best available and most recent information has been used in the report. The base year for comparing trend information is 2011.

Climate Change

In 2011, the most recent year for which data is available, 0.374 megatonnes of greenhouse gas (GHG) emissions were generated in Yukon, a 30 percent decrease from 1990 but a 10 percent increase from 2010 due to increased industrial activities during this period. Yukon emissions account for 0.05 percent of the Canadian total.

In 2013, Yukon had an average annual temperature 1.6ºC higher than the average annual temperature from 1948 to 2013 – making it the 10th warmest year here since 1948. The Yukon Research Centre provided digital access to weather data from the White Pass and Yukon Route log books from 1902-1957. This will enable analysis of climate during this period.

The transportation sector contributes the largest share of GHG emissions in Yukon. It is challenging to reduce GHG emissions in Yukon because of the high energy input required to live long distances from production centres and to heat buildings during cold winters.

Air

Whitehorse air quality is generally better than the national annual average. Particulate matter levels were unusually high in 2012 although still below the Canadian annual average. These higher levels were likely the result of: increased wood smoke in the downtown area from higher use of woodstoves; the extremely cold winter weather and consequent temperature inversions that occurred; the use of more sensitive sampling equipment; or the new location for the monitoring station.

Water

In 2011, water quality results from eight monitoring stations in Yukon ranged from "fair" to "excellent." In general, water quality varies through the year as a result of increased streamflow in the spring. The water quality index (WQI) for the Yukon River above the Takhini River remained at "good," while the WQI for the South McQuesten improved to "fair" from "marginal." For the first time, the WQI for Rose Creek, downstream from the Faro mine site, has been reported, indicating a "fair" rating.

Highlights

White cotton grass, Herschel Island-Qikiqtaruk Territorial Park.

The updated Yukon Water website, an online portal to water data, has been developed and maintained with new information related to water license triggers, flood forecasting and the draft Yukon Water Strategy.

Land

As of 2014, land use / resource management plans were in place for 43 areas, with a further 12 planning processes underway. The Yukon government's Regional Land Use Plan for Non-Settlement Land within the Peel Watershed identified 29 percent of the region (19,800 km^2) as protected area, with five rivers to be protected as "wild river parks." The Dawson Regional Planning Commission released a Resource Assessment Report in 2013 and plan alternatives in February 2014.

The Ecological and Landscape Classification Program developed a five-year strategic plan to focus on a uniform approach to ecosystem classification and mapping for land and resource assessments.

In 2013, 197 projects were assessed by the Yukon Environmental and Socio-economic Assessment Board, a drop from the previous two years (325 in 2011-12 and 257 in 2010-11). There were 47 placer mining and 32 land development applications assessed in 2012-13.

In the six years leading up to 2012, there was an increase in the number of registered nights at campgrounds. While non-resident camping peaked in 2010 (32,077), resident camping continued to climb, reaching 14,274 in 2012. Territorial campgrounds continue to be an important component of Yukon's tourism offering. The Yukon government announced plans in 2013 to develop the Atlin Lake campground and in 2014 to develop the Conrad Campground.

In 2013, the City of Whitehorse diverted 19 percent of its solid waste from landfills by recycling and composting. Households with curbside compost collection diverted 41 percent of their solid waste from the city's landfill. The city adopted a Solid Waste Action Plan with the goal of 50 percent less waste by 2015 and zero waste by 2040.

Fish and Wildlife

In 2013, the conservation goal for returning Chinook salmon in the Canadian portion of the Yukon River drainage was not met again – the fifth time in the last seven years. While the majority of lake trout fisheries were sustainable, rules are being proposed for four lakes to limit harvest pressure. Yukon's caribou populations continue to be strong, with 2 of the 26 caribou herds monitored by Environment Yukon showing some decline in population size.

Contaminants in fish and wildlife in Yukon have been monitored since 1991. The low levels of cadmium in moose and caribou organs are now believed to be the result of local natural sources rather than long-range transport.

In 2014, Yukon had the second-lowest number of species identified at risk in Canada. National recovery strategies are currently being developed for six species found in Yukon – Rusty Blackbird, Western Toad, Canada Warbler, Common Nighthawk, Olive-sided Flycatcher, and Wood Bison. Management plans have been completed for Baikal Sedge and Woodland Caribou (mountain and boreal populations). The Yukon government is monitoring the Little Brown Bat population here as part of a Canada-wide effort to understand the spread of the White-nose Syndrome that is affecting this endangered species.

The Yukon Invasive Species Council works through education, collaboration, and research to prevent the introduction and spread of invasive and alien species in Yukon. In 2013, it developed a Spotters Network to support early detection of and rapid response to invasive species, along with a "Top 10" list to focus efforts.

Table of Contents


Grizzly Bear near Haines Road.

Highlights **1**
- Climate Change 1
- Air 1
- Water 1
- Land 2
- Fish and Wildlife 2

Table of Contents **3**

List of Figures **5**

List of Tables **6**

Introduction **7**
- Changes in the 2014 State of the Environment Report 7

Climate Change **8**
- Global, national, and Yukon status 8
  - Indicators 8
  - What is happening 9
  - Significance 10
  - Taking action 12
  - Data quality 13

Air **14**
- Air quality 14
  - Indicators 15
  - What is happening 16
  - Significance 16
  - Taking action 19
  - Data quality 19

Water **20**
- Water quality and quantity 20
- Water quality 21
  - Indicators 21
  - What is happening 22
  - Significance 23
  - Taking action 23
  - Data quality 24
- Water quality 24
  - Indicators 24
  - What is happening 25

Table of Contents

Significance 25
Taking action 26
Data quality 26

Land 28
Land Use Planning 28
Indicators 29
What is happening 29
Significance 33
Land Use Activities 35
Indicators 35
What is happening 37
Significance 37
Solid Waste Management 37
Indicators 38
What is happening 39
Significance 40
Taking action 40
Data quality 41

Fish and Wildlife 42
Population trends and planning initiatives 42
Indicators 42
What is happening 45
Significance 46
Taking Action 46
Data quality 47
Contaminants 47
Indicators 48
What is happening 48
Significance 49
Taking action 49
Species at Risk 49
Indicators 50
What is happening 50
Significance 50
Taking action 51
Invasive Species 51
Indicators 51
What is happening 52
Significance 53
Taking action 53
Data quality 53

Conclusion 54

References 55

Profiles 55
Adaptation: Pan-Territorial Permafrost Workshop 11
Research: Fifth Assessment Report by the IPCC 13
Air Quality Management System 17
2013 Flooding 27
Yukon Water Website 27
Draft Yukon Water Strategy 27
New Water Sampling Stations in North Yukon 27
Ecological and Landscape Classification Program Five-Year Strategic Plan 40
Population Trends and Planning 47
Northern Bats and White-nose Syndrome 51

Hubbard Glacier, Disenchantment Bay.

List of Figures

Mt. Vancouver, St. Elias Mountains, Kluane National Park.

1. Climate Change

1.1 Yukon vs Canada GHG emissions by sector, 2011
1.2 Annual Canadian temperature departures and trend, 1948-2013

2. Air

2.1 Monthly averages of particulate matter ($PM_{2.5}$) in Whitehorse for 2012 compared to 10-year average, 2002-2011
2.2 Monthly averages of $PM_{2.5}$ in Whitehorse and Smithers, BC, 2012
2.3 Monthly comparisons of $PM_{2.5}$ in Whitehorse, 2010-2012

3. Water

3.1 Yukon River at Dawson ice break-up dates, 1896-2013
3.2 Schematic of past and current streamflow magnitude and timing
3.3 Changes in snow depth at Log Cabin throughout the past 50 years
3.4 North Yukon water hydrometric monitoring station locations

4. Land

4.1 Status of land use, forest resources, and official community planning processes in Yukon, 2014
4.2 Yukon planning regions
4.3 Parks and protected areas in Yukon, 2014
4.4 Project applications submitted to YESAB for assessment, 2005-2013
4.5 Applications submitted to YESAB by sector, 2012-13
4.6 Number of campsite-nights, 2007-2012
4.7 Visitors using Yukon government campgrounds 2007-2012
4.8 Waste landfilled at the City of Whitehorse Waste Management Facility, 2000-2012
4.9 Whitehorse waste diverted through local composting program or transported outside Yukon for recycling, 2000-2012
4.10 Curbside waste collected from single family homes in Whitehorse, 2000-2012
4.11 Bioclimate zones of the Dawson Planning Region

5. Fish and Wildlife

5.1 Number of Chinook salmon spawning in the Canadian portion of the Yukon River, excluding the Porcupine River drainage, 1985-2013
5.2 Sustainability of angler harvest on select Yukon lake trout populations based on angler harvest data up to 2011
5.3 Distribution of caribou herds in Yukon
5.4 Distribution of alien plant species along Yukon highways in 2007

List of Tables

Coyote © Richard Legner 2013 (14)

1. Climate Change

1.1 Trends in GHG emissions in Yukon, 1990-2011
1.2 Yukon GHG emissions by sector, 1990-2011

2. Air

2.1 Mean annual particulate matter ($PM_{2.5}$) and number of days $PM_{2.5}$ levels exceeded the Yukon standard, 2002-2012

3. Water

3.1 Water Quality Index ratings defined by Canadian Environmental Sustainability Indicators
3.2 Number of samples collected at Yukon monitoring stations, 2009-2011
3.3 WQI rolling average ratings for Yukon monitoring stations, 2003-2011

4. Land

4.1 Status of land use, forest resources, and official community planning processes in Yukon, 2014
4.2 Status of local area plans and zoning regulations, 2014
4.3 Rural Residential (RR) lot subdivision, 2005-2013
4.4 Status of parks and other protected areas in Yukon, 2014
4.5 Applications submitted to Designated Offices, 2012-13

5. Fish and Wildlife

5.1 Status of woodland caribou herd populations in Yukon, 2014
5.2 Status of fish and wildlife work plans and species plans, 2014
5.3 National status of species at risk that occur in Yukon, 2014
5.4 Top 10 invasive alien species selected for the Spotter's Network, 2013.

The *State of the Environment Report* provides insight into whether Yukon is achieving the goal of maintaining and enhancing the quality of Yukon's natural environment for present and future generations. It provides an opportunity to reflect on the status of the environment and to help guide future decision-making.

This full report presents information on climate change, air, water, land, and fish and wildlife. Yukon's *Environment Act* requires full state of the environment reports be prepared and tabled in the legislature every three years, along with interim reports in the intervening years. The report describes what is happening in the environment and why, and what actions have been taken to maintain or improve the quality of the environment.

Analysis is provided through key indicators, which are used to monitor, describe, and interpret changes in the condition of the environment. They help to evaluate and demonstrate whether environmental conditions are improving, remaining stable, or declining. Indicators are selected on the basis of data availability, data reliability, usefulness, and ease of understanding.

This report uses the best available information. Trend data use 2011 as the base year because it can take up to 24 months for the agencies involved to complete their data collection, compilation, analysis, and reporting to Environment Yukon.

The *State of the Environment Report* is a collective effort involving scientific experts and specialists from government agencies and non-governmental organizations who have provided information, data, and advice.

Changes in the 2014 State of the Environment Report

The 2013 report invited readers to comment on useful aspects and to offer suggestions for improvement.

Overall, the use of maps and graphs to convey information was preferred. A plain language report that provides condensed and useful information was suggested, along with updates and summaries on the various planning initiatives. There was interest in having access to the more detailed information summarized in the report. Information on broader land uses and a broader diversity of wildlife species was also suggested.

For the 2014 report, colour maps, tables, and graphs are used to convey the information. Also, information about land use activities has been included by using the Yukon Environmental and Socioeconomic Assessment Board as an indicator for industrial uses and territorial park campground information as an indicator for some outdoor recreation land uses.

The 2014 report has been designed to make the information more accessible and interesting for readers. New information to profile certain work or events, more photographs, and a professional design have been included. The electronic report has been enhanced to include hyperlinks to a wider array of related information on the topics. Bookmarks allow the reader to move easily to specific sections, figures, or tables.

Lastly, a plain language *Highlights Report* is available for a wider readership. Both the highlights and full reports are available on the Environment Yukon website, along with direct links to an array of environmental information, maps, and reports.

Environment Act

State of Environment Report

47. (1) The government of Yukon shall report publicly on the state of the environment pursuant to this Act.

(2) The purpose of this report under subsection (1) is:

a) To provide early warning and analysis of potential problems for the environment;

b) To allow the public to monitor the progress toward the achievement of the objectives of this Act; and

c) To provide baseline information for environmental planning, assessment and regulation.

48. (1) The Minister shall prepare and submit to the Legislative Assembly a Yukon State of the Environment Report within three years of the date this section comes into force and thereafter within three years of the date of the previous report.

(2) The Yukon State of the Environment Report shall

a) present baseline information on the environment;

b) incorporate the traditional knowledge of Yukon First Nation members as it relates to

c) the environment;

d) establish indicators of impairment of or improvement to the environment and identify and present analyses of trends or changes in the indicators; and

e) identify emerging problems for the environment, especially those involving long-term and cumulative effects.

50. (1) Commencing from the date of the first Yukon State of the Environment Report, for every period of twelve consecutive months in which a Yukon State of the Environment Report is not made, the Minister shall prepare an interim report and submit it to the Legislative Assembly.

(2) An interim report under subsection (1) shall comment on matters contained in the previous Yukon State of the Environment Report.

Climate Change

Hubbard Glacier Disenchantment Bay. Climate change is affecting northern regions at a pace greater than elsewhere on the planet.

Global, national, and Yukon status

The Intergovernmental Panel on Climate Change (IPCC 2013) considers global climate change to be the most significant threat our environment faces today. The IPCC says the evidence that climate change is taking place is unequivocal and that human influence on the climate is virtually certain. Impacts include atmosphere and ocean warming, reduced snow and ice extents, a higher sea level, and an increase in greenhouse gas (GHG) concentrations. It is also apparent that climate change is affecting the Arctic at a pace greater than elsewhere on the planet.

The Yukon government recognizes that climate change is occurring and is undertaking a range of activities, as set out in its *Climate Change Action Plan*, released in 2009, and the progress report released in 2012.

Indicators

GHG emission levels

- Trends in Yukon GHG levels (Table 1.1)
- Yukon vs Canada GHG emissions by sector (Figure 1.1)

Environmental changes

- Long-term trend in temperature variation (Figure 1.2)
- Changes in hydrology patterns (see water chapter)

GHG emissions include carbon dioxide, methane, and nitrous oxide. Carbon dioxide (CO_2) is recognized as the principal contributor to atmospheric levels of GHGs, which have increased steadily since the industrial revolution. CO_2 levels are now at their highest in over 400,000 years, trapping more of the energy radiated from the earth.

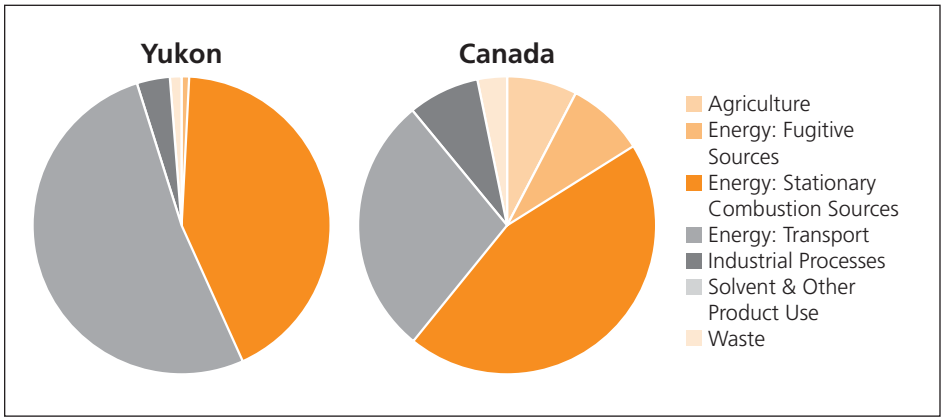
Table 1.1: Trends in GHG emissions in Yukon, 1990-2011

Trends	1990	2000	2005	2006	2007	2008	2009	2010	2011
Total GHG Emissions (Kt CO_2e)[1]	536	451	414	507	522	463	344	340	374
Annual Change (%)	NA	NA	NA	22.46	2.96	-11.3	-25.7	-1.16	10
Change since 1990 (%)	NA	-15.86	-22.76	-22.5	-23.2	-33	-41.3	-35.82	-30.22

Source: Environment Canada, National Inventory Report 1990-2011

Note: (1) $KtCO_2e$: Kilotonnes of CO_2 equivalent

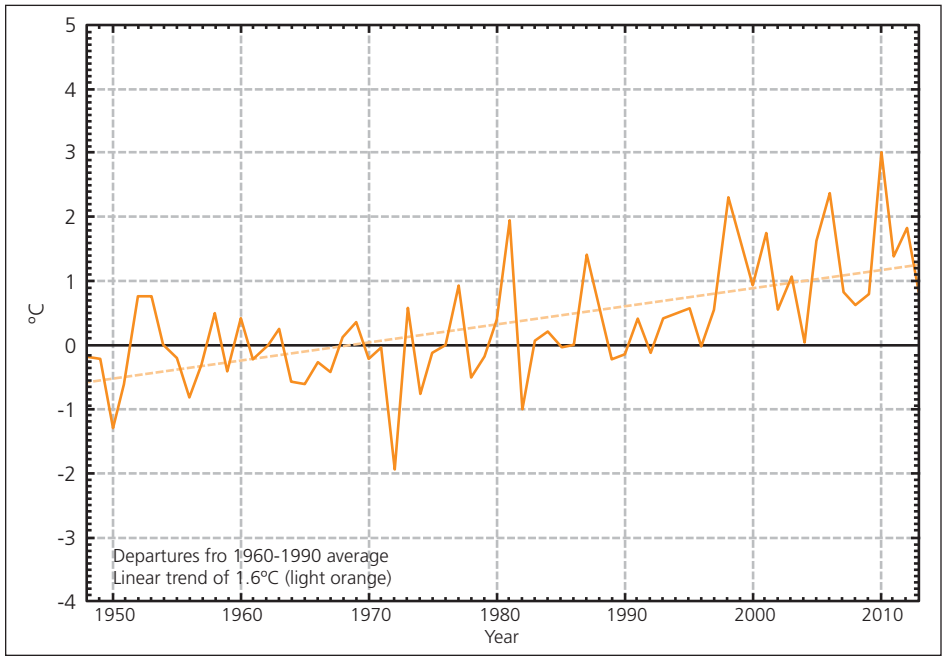
Figure 1.1: GHG emissions by sector, 2011



Source: Environment Canada, National Inventory Report 1990-2011

Environmental indicators for climate change include, but are not limited to, trends in air temperature, hydrological cycles, ocean levels, snow cover, or extreme weather events. Trend data show that climate change has occurred. Climate change modeling of indicator trend information predicts that changes will continue as a result of increasing global GHG emissions (IPCC 2013). Discussion on the hydrology indicator is found in the water section of this report.

Figure 1.2: Annual Canadian temperature departures and trend, 1948-2013



Source: Environment Canada, Climate Trends and Variations Bulletin, Annual 2013 Summary

Note: Lines show the temperature difference (positive or negative) from the long-term average annual temperatures. Positive temperatures are warmer than normal and negative temperatures are colder than normal.

What is happening

GHG emission levels

Canadian emissions for 2011 were 702 megatonnes (702,000 kilotonnes), about 19 percent above 1990 levels. Canada is ranked among the highest of all countries in the world in terms of per-capita GHG emissions.

Environment Canada reported Yukon's total GHG emissions for 2011 to be 0.374 megatonnes. This represents a 30.2 percent reduction since 1990 (see Table 1.1) but a 10 percent increase from 2010.

Yukon's total GHG emissions contributed only 0.05 percent towards the Canada-wide total of 702 megatonnes in 2011.

Climate Change

Table 1.2: Yukon GHG emissions by sector, 1990-2011

Greenhouse Gas Categories	1990	2000	2005	2007	2008	2009	2010	2011
TOTAL (kt CO_2equivalent)	**537**	**451**	**450**	**418**	**381**	**345**	**341**	**374**
1. ENERGY	**534**	**443**	**437**	**406**	**367**	**330**	**325**	**357**
a. Stationary Combustion Sources	221	192	195	213	203	134	136	159
Electricity and Heat Generation	93.6	17	22.9	17.9	18.1	17	18.7	27.6
Fossil Fuel Production and Refining	3.1	84	66	88	46	12	19	12
Mining and Oil and Gas Extraction	5.71	2.22	16.6	21.6	25	4.35	5.51	6.32
Manufacturing Industries	5.99	-	-	1.22	20.4	16.8	14.6	18.3
Construction	3.52	2.5	1.57	2.41	2.03	1.52	1.81	3.49
Commercial and Institutional	76.3	53	27.4	31.4	34.1	53.9	42.7	60.2
Residential	32	33	52	51	57	28	33	32
Agriculture and Forestry	1.08	0.95	8.19	-	-	-	-	-
b. Transport	312	247	238	190	161	193	186	194
Civil Aviation (Domestic Aviation)	34	32	34	39	34	33	38	37
Road Transportation	179	161	144	113	98.2	119	114	117
Light-Duty Gasoline Vehicles	79.4	48.5	28.7	19.1	15.2	19.8	19.4	17.9
Light-Duty Gasoline Trucks	30.4	38.3	30.9	20.6	16.5	21.4	20.9	19.4
Heavy-Duty Gasoline Vehicles	10	6.49	4.92	3.28	2.65	3.5	3.48	3.26
Motorcycles	0.5	0.33	0.27	0.18	0.15	0.19	0.19	0.18
Light-Duty Diesel Vehicles	0.77	0.47	0.31	0.21	0.17	0.23	0.24	0.23
Light-Duty Diesel Trucks	0.62	2.46	2.02	1.35	1.08	1.39	1.39	1.29
Heavy-Duty Diesel Vehicles	55.7	63.3	75.6	67	60.7	71.3	67.1	73
Propane and Natural Gas Vehicles	1.5	0.68	1.3	1.8	1.8	0.92	1.3	1.5
Other Transportation	100	55	60	38	29	41	35	40
Off-Road Gasoline	10	14	2.4	1.5	1.2	1.8	0.86	0.4
Off-Road Diesel	89	41	58	36	28	40	34	40
c. Fugitive Sources	-	4.02	3.88	3.02	3.1	2.77	2.9	2.86
Oil and Natural Gas	-	4.02	3.88	3.02	3.1	2.77	2.9	2.86
2. INDUSTRIAL PROCESSES	**1.5**	**5.45**	**9.42**	**9.6**	**9.97**	**11.6**	**13**	**14**
a. Mineral Products	0.13	-	-	-	-	-	-	-
b. Production and Consumption of Halocarbons and SF64	-	4.7	8.9	8.9	9.3	11	12	13
c. Other and Undifferentiated Production	1.4	0.71	0.56	0.71	0.71	0.71	0.99	1.1
3. SOLVENT AND OTHER PRODUCT USE	**0.18**	**0.45**	**0.37**	**0.32**	**0.34**	**0.26**	**0.25**	**0.25**
4. AGRICULTURE	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
5. WASTE	**1.8**	**2.4**	**2.7**	**2.8**	**2.9**	**3**	**3**	**3.1**
a. Solid Waste Disposal on Land	0.6	1.1	1.3	1.4	1.4	1.5	1.5	1.6
b. Wastewater Handling	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.5

Source: Environment Canada, National Inventory Report 1990–2011

Notes: (1) Dash (-) indicates no emissions. (2) kt C_2 equivalent means kilotonnes of carbon dioxide equivalent.
(3) Total is the sum of 1. energy, 2. industrial process, 3. solvent and other product use, 4. agriculture, and 5. waste.

2013 saw the most floods in Yukon in 30 years.

Environmental changes

Nationally, the annual average temperature has increased 1.6°C from 1948 to 2013 and the average winter temperature by 3.2°C (Environment Canada 2013).

In 2013, Yukon had an annual average temperature of 1.6°C higher than the annual average temperature from 1948 to 2013 (Environment Canada 2013). It was the 10th warmest year here since 1948.

The average winter temperature in Yukon has increased by 5.4°C since 1948 (Environment Canada 2013).

Recent global studies, such as the IPCC's *State of the Climate* in 2012, have shown the Arctic to be warming at a rate greater than elsewhere on the planet.

Increasing temperatures are resulting in permafrost degradation and glaciers are melting at a higher rate. Between 1958 and 2008, the total ice area in Yukon shrank by 22 percent *(yukonwater.ca)*.

Significance

GHG emission levels

Reductions in Yukon GHG emissions since 1990 are mainly due to changes in the nature and extent of industrial activity *(see Table 1.2)*. The cyclical nature of Yukon's resource economy is reflected in the territory's GHG emission levels, which were high in 1990 and lower in 2011.

Transportation accounts for the largest share of GHG emissions in Yukon *(see Table 1.2 and Figure 1.1)*. Heavy-duty diesel vehicles are the largest contributors in this sector, followed by off-road diesel use. Off-road diesel use includes the use of heavy mobile equipment in construction, agriculture, and mining, as well diesel that is used to generate electricity in remote industrial locations.

Commercial and institutional operations (stationary combustion sources) and electricity and heat generation are also large contributors of GHG emissions in Yukon *(see Table 1.2)*. When the demand for electricity exceeds Yukon's hydro generation capacity, diesel generators are used to make up the shortfall. Overall, transportation activities and electrical generation account for the increase in emissions from 2010 to 2011.

Yukon's population was 36,526 in June 2013 (Yukon Bureau of Statistics). It is growing, with 80 percent of the growth occurring in Whitehorse. As the population grew by 11.6 percent between 2006 and 2011, the number of dwellings grew by 11.9 percent.

There are challenges in reducing GHG emissions in Yukon because of the high energy input required to live long distances from production centres and to heat buildings during cold winters. Fluctuating resource-based activity and an isolated electricity grid that is not always able to meet demand contribute to variable emission levels.

While Yukon-generated GHG emissions are very low compared to the rest of the country, the rate and magnitude of temperature change in the region, observed and predicted, are among the largest. Although Yukon makes a minimal contribution to global GHG emissions, the Yukon government introduced measures to limit GHG emissions produced from its activities and is developing approaches to adapting to the changing climate in the short and long term.

The Yukon government collects GHG information at a territorial level to support estimating emissions trends at a national level. A recent analysis of Yukon transportation-sector emissions suggested that emission levels might be higher than what is now reported by Environment Canada at the national level. An accurate emission profile for Yukon is needed to support the monitoring and analysis required to move towards the sector-specific emission targets set out in the *Climate Change Action Plan Progress Report*.

Road damage from the thawing of permafrost.

PROFILE

Adaptation: Pan-Territorial Permafrost Workshop

A Pan-Territorial Permafrost Workshop was held in Yellowknife, NWT in fall 2013 to bring together decision-makers with permafrost researchers and experts.

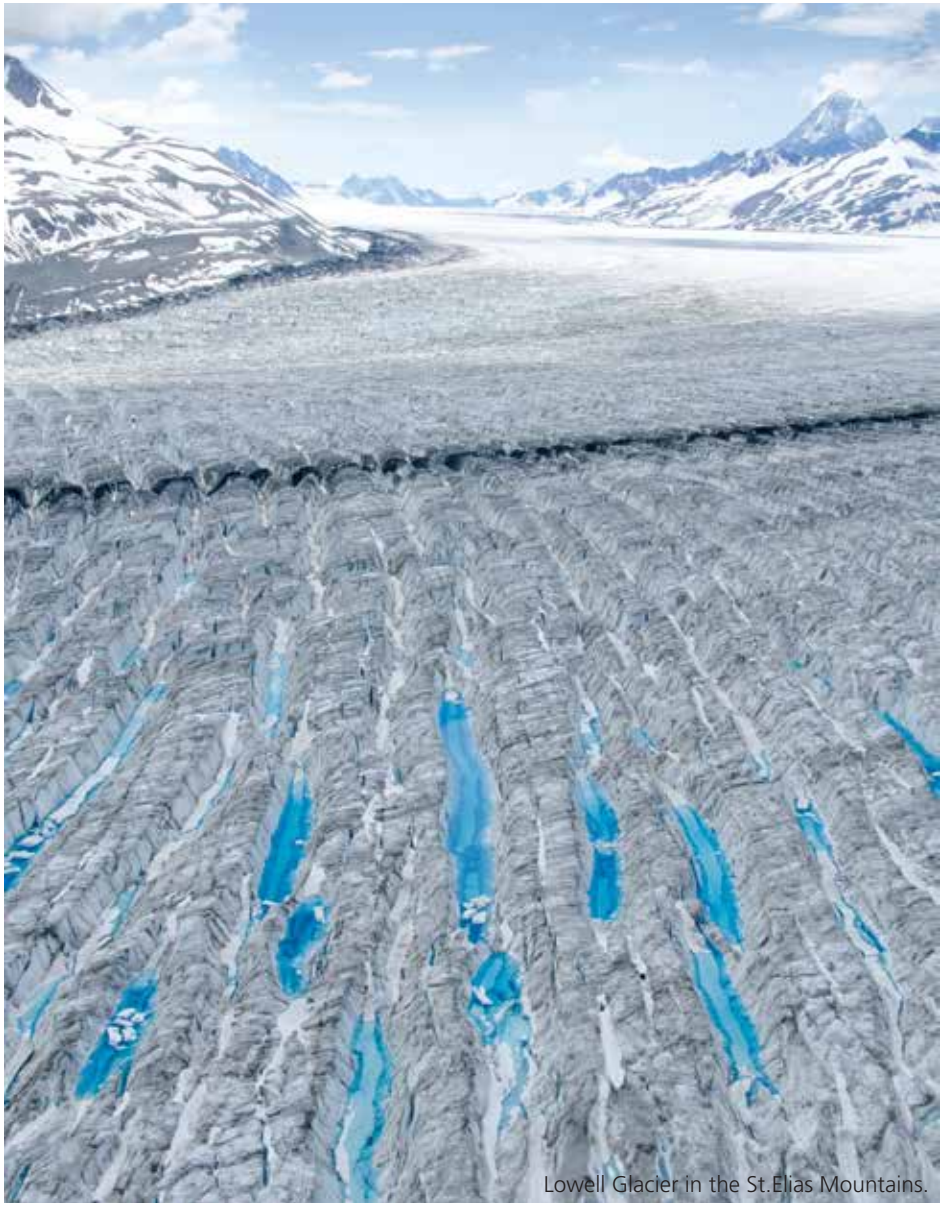
The workshop was organized by the Pan-Territorial Adaptation Partnership, a collaboration of the governments of Nunavut, Northwest Territories, and Yukon.

The workshop looked at how the thawing of permafrost will affect the North's landscapes, infrastructure, transportation, and resource development. It also included community perspectives on adapting to thawing permafrost and using the information presented at the workshops for community decision making.

The three governments formed the partnership in 2009 to share information on practical adaptation measures and support collaboration. In 2011, they released the *Pan-Territorial Adaptation Strategy: Moving Forward on Climate Change Adaptation in Canada's North* to set out an approach on sharing diverse and creative climate change adaptation knowledge.

Information on the workshop, the presentations, and the Pan-Territorial Adaptation Partnership is available at northernadaptation.ca/permafrost-workshop.

Climate Change



Lowell Glacier in the St.Elias Mountains.

Environmental changes

Climate change scientists have predicted and are observing a continued increase in warming, changes in precipitation amounts and seasonality, changes to water quality and quantity patterns, and a higher pace of changes occurring in the North. As a result, changes have started to, and are expected to continue to impact the distribution and abundance of vegetation, fish, and wildlife in Yukon.

Climate change is also expected to affect Yukon infrastructure, economy, and communities. A vulnerability assessment of water resources in Yukon, completed in 2011, recommended adaptation strategies and monitoring approaches for resource sectors, communities, and decision makers on water management and climate change.

Taking action

In 2013, the Yukon Research Centre provided digital access to weather data from the White Pass & Yukon Route log books from 1902-1957. The weather data was collected by stations along the railway and the Yukon River. Currently the data is raw, but future analysis could provide more information on Yukon's climate during this period. The logs also note the dates of river freeze-up, break-up, and water levels. They can be found at yukonresearch.yukoncollege.yk.ca/wpyr.

Adapting to climate change in the short and long term can be done through research, innovation, and action. The Yukon government is working to complete adaptation initiatives with federal departments, as well as with the governments of the Northwest Territories and Nunavut through the Pan-Territorial Adaptation Partnership. The government is also partnering with organizations like the Yukon Research Centre and the Northern Climate ExChange on research and projects.

Climate-change-related research involving Yukon has recently been collected to assist in providing a better understanding of the range of changes at a local and territorial level. The *Compendium of Yukon Climate Change Science 2003-2013* provides a useful overview.

The Yukon government released the *Climate Change Action Plan Progress Report* in 2012 to convey successes to date, note lessons learned, and identify current priorities. Nine sector-specific targets and new actions to help achieve these targets were identified. The report noted the following actions had been completed:

- a vulnerability risk assessment of Yukon water resources,
- a vulnerability risk assessment of Yukon forest tree species and forest health,
- community climate change adaptation projects,
- reporting on GHG emissions from Yukon government operations,
- setting emissions targets by sector, and
- establishing the Yukon Research Centre in partnership with the Council of Yukon First Nations and Yukon College.

The Yukon government's *Energy Strategy for Yukon* complements the *Climate Change Action Plan*. The Energy Strategy vision is for a sustainable and secure energy sector that is environmentally, economically, and socially responsible. It proposes principles to guide Yukon government decisions and identifies goals, strategies, and actions for efficiency and conservation, renewable energy, electricity, oil and gas, and energy choices. The most recent progress report was released in 2012.

Data quality

When Environment Canada compiles national, provincial, and territorial GHG data for the *National Inventory Report* (NIR), it notes that interpretation of the data must consider the possible presence of estimation, calculation, or input errors.

Because the transportation sector is the largest contributor of GHG emissions in Yukon, the Climate Change Secretariat conducted research in 2013 to obtain a more detailed understanding of its many contributing sources. The *Yukon Greenhouse Gas Emissions-Transportation Sector Final Report* found that there are discrepancies between the GHG levels reported in the NIR and its analysis. The main cause for the difference appears to be that the NIR analysis, while accurate at the national level, does not capture the fuel imported from Alaska to Yukon as well as the significant amount of fuel shipped in from Alberta, which is reported as Alberta data.

When the Yukon transportation sector's GHG emissions levels were recalculated for 2009 and 2010, they were 70 percent (2009) and 92 percent (2010) higher than the NIR figures. Subsequent research by the secretariat has found that the recalculated 2011 emissions were 718 kt CO_2e, compared with the NIR estimate of 374 kt CO_2e – a 92-percent difference.

Yukon GHG emissions levels are still low when compared at the national level and to other jurisdictions. Regardless of our comparatively low emissions, accurate measurement is needed to support measuring progress towards sector emissions targets and GHG reduction strategies. Environment Canada and the Yukon government are working together to develop an approach to providing emissions information to meet territorial, national, and international reporting commitments. In the meantime, the NIR data will continue to be reported.

PROFILE

Research: Fifth Assessment Report by the IPCC

In 2013, the Intergovernmental Panel on Climate Change (IPCC) released the Fifth Assessment Report (IPCC 2013) which found that climate change is unequivocal and the effects of humans on the climate are clear.

The IPCC 2013 was prepared by 259 experts from 39 countries who assessed past, present, and future trends of climate change as well as identifying the level of confidence associated with each trend. It reported with high confidence that many of the changes are unprecedented in recent history, including the rate the atmosphere and oceans have warmed, the reductions in the amounts of snow and ice, the rising sea level, and increasing concentrations of GHGs.

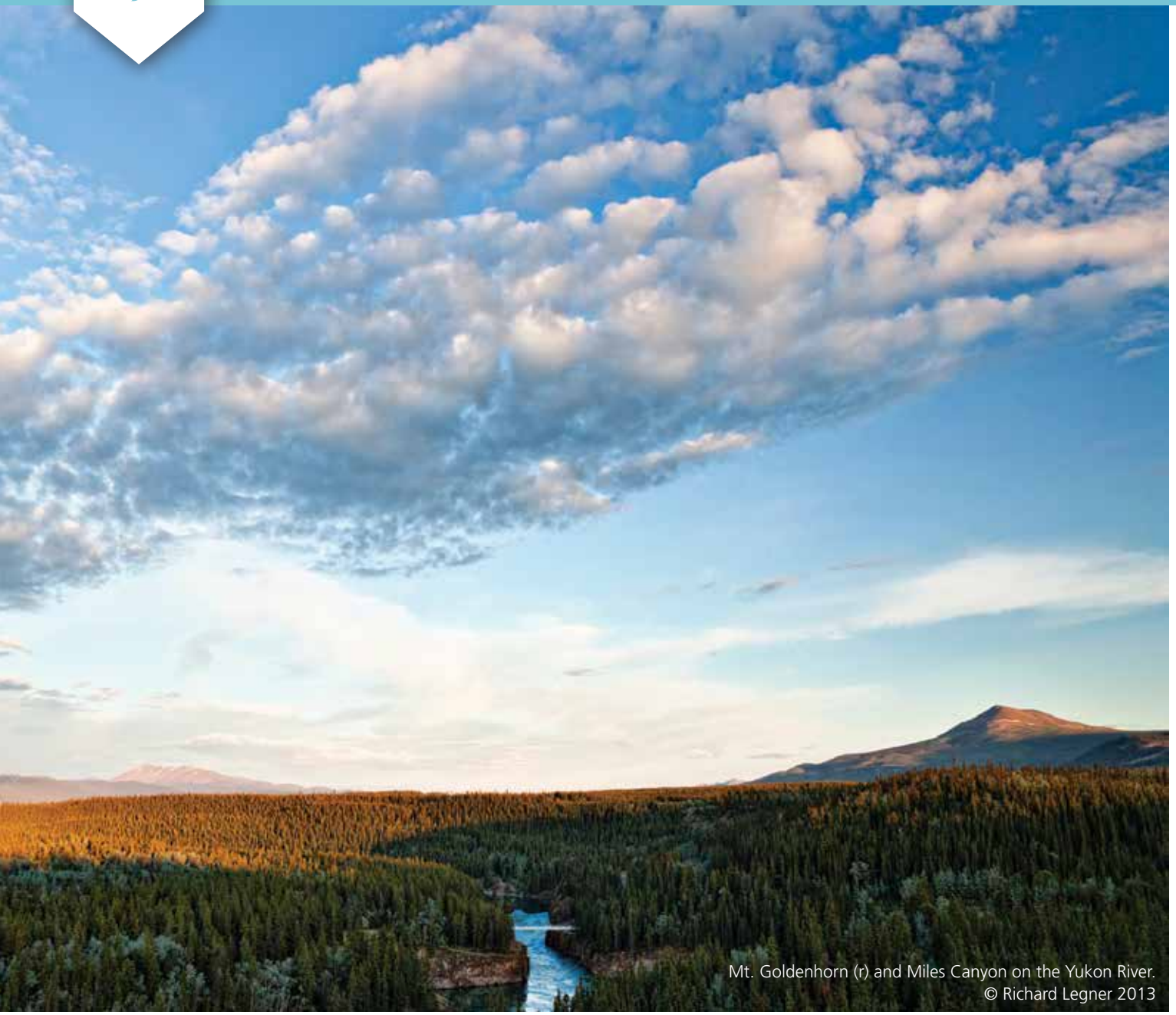
The drivers of climate change are the human-caused increases in GHGs, particularly CO_2, since 1750, resulting in "radiative forcing" that has altered the earth's energy budget. IPCC 2013 reported that human-caused drivers have increased more rapidly since 1970 than during prior decades.

The following Yukon-relevant climatic trends were reported with medium to high confidence by the IPCC:

- Arctic sea ice extent has decreased since 1979 for the summer sea ice minimum. During the summer period, arctic sea ice has rapidly decreased and the spatial extent of the sea ice has decreased in every decade since 1979.
- The northern hemisphere snow-cover period has decreased by approximately two percent per decade since the middle of the 20th century.
- Permafrost temperatures have increased in most northern regions since the early 1980s.
- The Arctic has been warming substantially more than other regions in the globe since the mid-20th century.
- 1983-2012 was probably the warmest 30-year period in the northern hemisphere during the last 1400 years, and precipitation has increased in the mid-latitudes of the northern hemisphere.

The IPCC reported that these trends will continue unless substantial and sustained reductions of GHG emissions occur across the globe.

Air



Mt. Goldenhorn (r) and Miles Canyon on the Yukon River.
© Richard Legner 2013

Air quality

Poor air quality can harm human and environmental health. Children, the elderly, and people with respiratory problems are particularly at risk. To understand ambient air quality in Whitehorse, scientists measure fine particulate matter, ground-level ozone, nitrogen oxides, and carbon monoxide.

The Yukon government regulates activities that have the potential to release emissions into the air. Standards for air quality exist to allow regulators to determine the acceptability of emissions from existing and proposed activities. Permits issued under the *Environment Act* follow these standards and require the permit holder to submit reports to government to confirm compliance.

The Yukon government is a partner in the federal National Air Pollution Surveillance (NAPS) Program and operates an ambient air pollution station in downtown Whitehorse to monitor air quality. NAPS provides accurate and long-term air quality data from across Canada. This information allows comparison of Whitehorse air quality trends to other locales in Canada.

Indicators

Level of airborne particulate matter

- Average ambient annual $PM_{2.5}$ levels in the City of Whitehorse (Table 2.1)
- Number of days per year that $PM_{2.5}$ levels exceed standard (Table 2.1)
- Average monthly $PM_{2.5}$ levels for 2012 compared with 2001-12 (Figure 2.1)
- City of Whitehorse average monthly $PM_{2.5}$ levels compared with similar community (Figure 2.2)

Particulate matter consists of tiny airborne solid or liquid particles with varying chemical and physical composition, and so it is not defined by its chemical composition. Under the *Canadian Environmental Protection Act*, particulate matter is classified as a toxic substance because of the damage that can be caused when breathing this substance into the lungs. $PM_{2.5}$ (the fraction of particulate matter that is less than 2.5 microns in diameter) is an effective indicator of ambient air quality and is being monitored in downtown Whitehorse.

Natural sources of particulate matter include forest fires, wind-blown dust, pollen, and volcanoes. The man-made (anthropogenic) sources include emissions from fossil fuel burning (oil, gas, and coal), wood burning, waste disposal (incineration or open burning), and stirred-up dust from vehicles or construction.

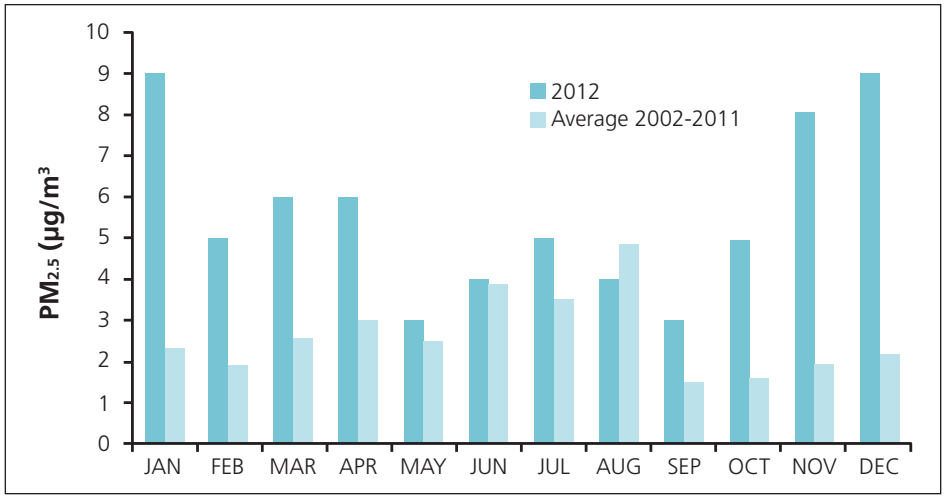
Table 2.1: Mean annual particulate matter ($PM_{2.5}$) and number of days $PM_{2.5}$ levels exceeded the Yukon standard, 2002-2012

Year	Mean Annual Level of $PM_{2.5}$ (ug/m^3)	Number of Days Yukon Standard Exceeded in Whitehorse
2002	2.4	0
2003	2.4	0
2004	4.8	12
2005	2.8	4
2006	Not Available	Not Available
2007	1.8	0
2008	1.9	0
2009	Not Available	15
2010	2.0	7
2011	3.1	7
2012	5.0	19

NOTE: The Yukon Ambient Air Quality Standard is 30 micrograms/m^3 over a 24 hour average (adopted from the *Canada Wide Standard for Particulate Matter*)

Yukon River. © Richard Legner 2013 (14)

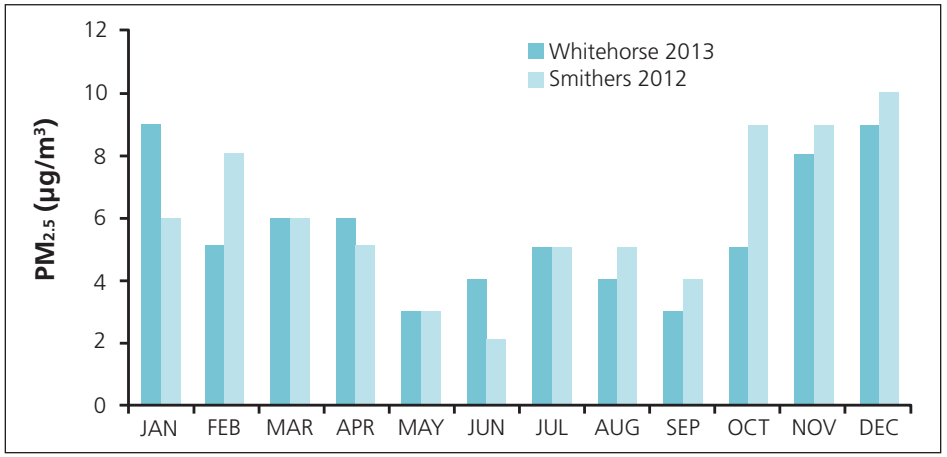
Figure 2.1: Monthly averages of particulate matter ($PM_{2.5}$) in Whitehorse for 2012 compared to 10-year average, 2002-2011



Mt. McIntyre. © Richard Legner 2013 (14)

Main Street, Whitehorse.

Figure 2.2: Monthly averages of particulate matter ($PM_{2.5}$) in Whitehorse and Smithers, British Columbia, 2012



Source for both figures and table: Whitehorse National Air Pollution Surveillance Station data, Standards and Approvals, Environmental Programs Branch, Environment Yukon

What is happening

The average ambient $PM_{2.5}$ concentration for Whitehorse in 2012 was 5.0 µg/m³ (Table 2.1) which is lower than the Canadian annual average of 8.6 µg/m³ (Table 2.1).

The $PM_{2.5}$ monthly averages for 2012 were higher than the 10-year average for every month except for August (and June was very close to average) (Figure 2.1).

In 2012, Whitehorse exceeded Yukon's Ambient Air Quality Standard for 19 days of the year (Table 2.1).

Monthly $PM_{2.5}$ levels for Whitehorse in 2012 were similar to Smithers B.C., a community comparable to Whitehorse (similar geography and woodsmoke issues). Smithers has been historically compared with Whitehorse (Figure 2.2).

Significance

Yukon's topography is complex, with numerous mountain ranges combined with deep river valleys and lakes. Strong inversions, when colder air is trapped below warmer air, prevent the dispersion of pollutants away from the valley bottoms where most Yukon communities are found. During the summer, inversions can trap not only anthropogenic (i.e., human-caused)

Fire smart program near Whitehorse.

pollutants but also smoke from forest fires. While most inversions are short-lived, some can persist for a week or more. These trapped pollutants, when accumulated over longer periods of time, have the potential to cause adverse effects on human health and the environment.

Natural sources of pollutants include forest fires, wind-blown dust, pollen, and volcanoes. Although the predominant flow is westerly (from Alaska), heavy smoke from fires in British Columbia, the Northwest Territories, and Alberta occasionally affects the territory. Anthropogenic sources include emissions from fossil fuel burning (transportation, electricity, oil, gas, and coal), wood burning (residential/commercial heating, land clearing, backyard burning), waste disposal (incineration or open burning), stirred-up dust from vehicles or construction, and even barbeques.

When inhaled, fine particulate matter has the ability to pose serious risks to human health, especially among the elderly, children, and people with chronic respiratory illnesses. Health impacts may include chronic bronchitis, asthma, or premature death. Reduced visibility as a result of high levels of fine particulate matter may also affect aviation, driving, and such daily activities as outdoor sports or recreational activities like fishing, hiking, or camping.

PROFILE

Air Quality Management System

The Canadian Council of Ministers of the Environment (CCME) is a 14-member council of the environment ministers from federal, provincial, and territorial governments. The CCME focuses on national issues that require the collective attention of all governments.

In 2012, the CCME established the Air Quality Management System (AQMS). It is a comprehensive approach for improving air quality throughout Canada. AQMS is the product of unprecedented collaboration by government and stakeholders.

Air Zones: AQMS requires the establishment of Air Zones within each jurisdiction. Air zones are geographical-based zones that will allow the provincial/territorial governments to manage local ambient air quality within their boundaries with the goal of continuous improvements in air quality. Work is underway to divide Yukon into Air Zones. Once these are established, the Yukon government will determine how ambient air quality will be assessed and reported for each air zone.

Canadian Ambient Air Quality Standards: The current Canada-wide standards are being revised for fine particulate matter and ground-level ozone. Work is also underway to assess the health and environmental impacts of nitrogen dioxide and sulphur dioxide.

Mobile Sources: An action plan is being developed to reduce emissions from mobile sources in the transportation sector. The plan would include addressing vehicle tampering and encouraging the conversion of fleets to electric vehicles. Priorities are to implement advanced transportation technologies and proper vehicle maintenance, to reduce emissions from diesel vehicles and engines, and to "green" vehicle fleets.

Base-level Industrial Emissions Requirements: Performance standards will be established for new and existing major industrial sectors and some equipment types.

Monitoring and Public Reporting: This area is critical for transparency, accountability, and the effective implementation of AQMS. Provinces and territories, with assistance from the federal government, will be responsible for managing each air zone within their jurisdictions and reporting to their residents on air quality and the measures taken to implement AQMS.

More information can be found on the CCME website at www.ccme.ca, in the "Our Work" area.

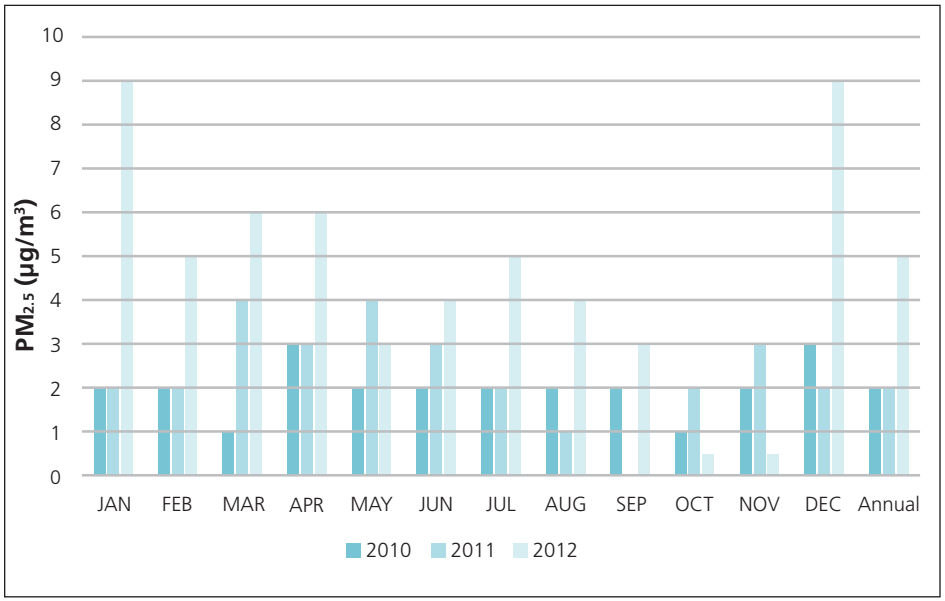

Kluane National Park. © Richard Legner 2013 (14)


Herschel Island-Qikiqtaruk Territorial Park

Whitehorse air quality is typically better than the national annual average. Particulate matter levels were unusually high in 2012 (the highest Mean Annual $PM_{2.5}$ since 2002), although still below the Canadian annual average. These higher levels were likely the result of: increased woodsmoke in the downtown area from higher use of woodstoves; the extremely cold winter weather and consequent temperature inversions; the use of more sensitive sampling equipment; or the new location for the monitoring station (Figure 2.3).

In 2012, January temperatures were a little colder than normal, while in November and December it was significantly colder than normal. The weather patterns during this period promoted strong temperature inversions with poor mixing of particulates out of the valley bottom. Moving the monitoring station from a relatively windy site near the Yukon River to downtown Whitehorse (corner of Steele Street & 5th Avenue) might also be a factor. In addition, the new, higher-precision monitoring instrument for $PM_{2.5}$ that was installed in 2011 generally provides higher readings than the previous instrument.

Figure 2.3: Monthly comparisons of particulate matter ($PM_{2.5}$) in Whitehorse, 2010 -2012



Source for both figures and table: Whitehorse National Air Pollution Surveillance Station data, Standards and Approvals, Environmental Programs Branch, Environment Yukon

Whitehorse. Temperature inversions occur when colder air is trapped below warmer air, preventing dispersion of wood smoke.

Dawson City.

Taking action

The National Air Pollution Surveillance (NAPS) station in Whitehorse continues to record ambient air quality data for particulate matter ($PM_{2.5}$), ground-level ozone, nitrogen oxides, and carbon monoxide.

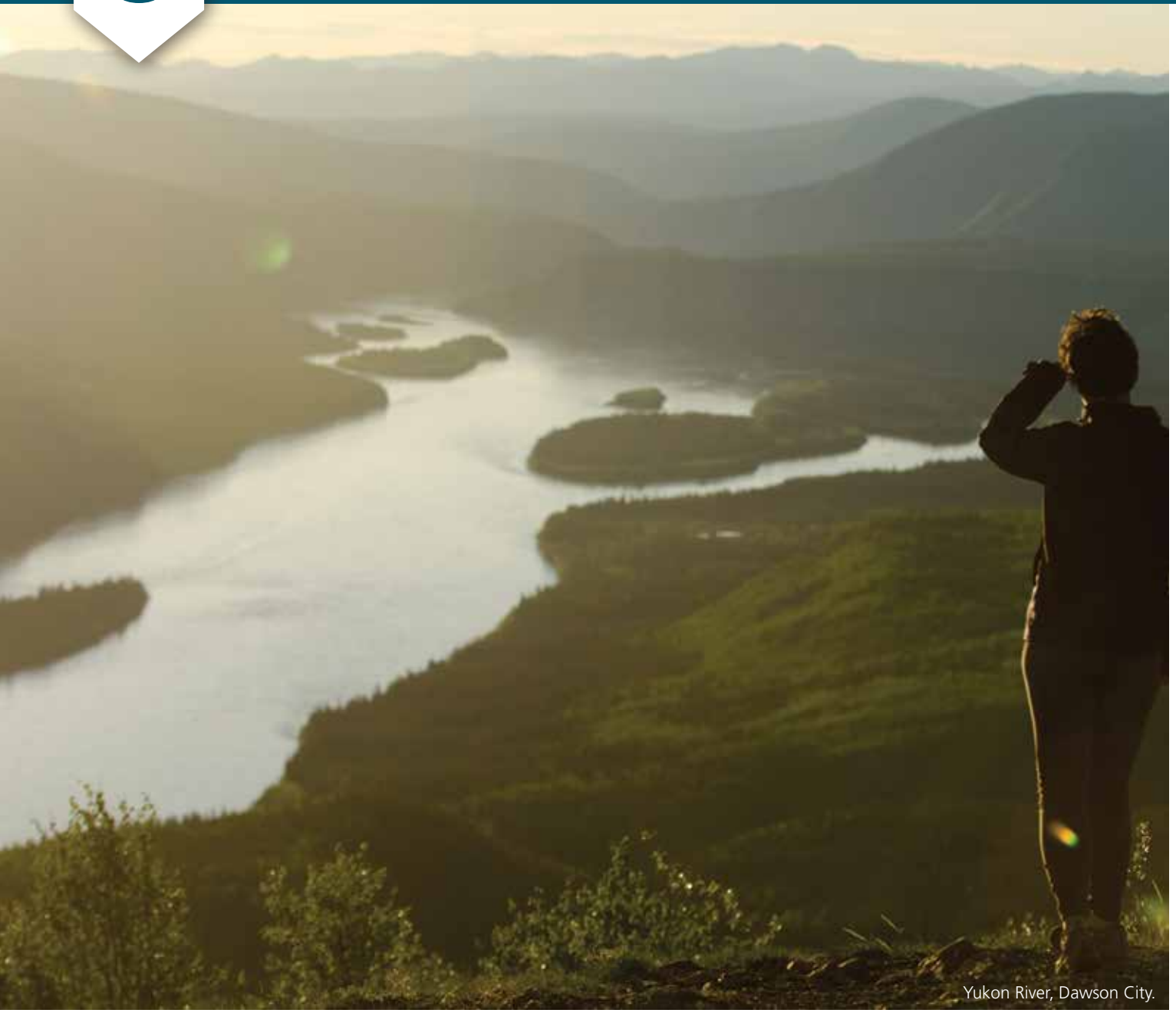
The Yukon government's Good Energy program offers rebates for EPA-approved woodstoves and CSA-approved pellet stoves. These stoves are the most efficient and emit the lowest amount of particulate matter.

Old Crow has installed a solid waste incinerator to dispose of their domestic garbage, in place of open burning. Incineration of solid waste at high temperatures reduces the generation of hazardous emissions, which reduces the impact on human health and the environment. See the Land – Solid Waste Management section for more information.

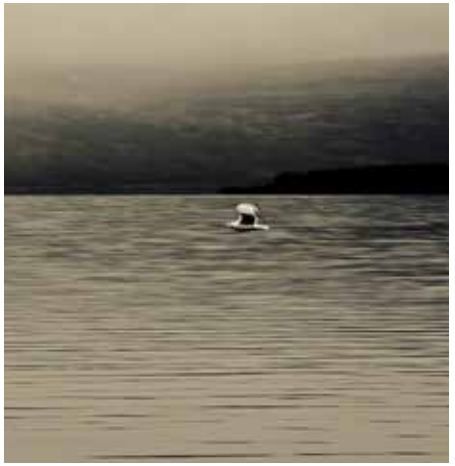
Data quality

The NAPS program is managed by a cooperative agreement between Environment Canada and Environment Yukon. NAPS data are quality-controlled, assured, and standardized by Environment Canada and Environment Yukon for inclusion in the Canada-wide air quality database. The air quality data for the Whitehorse area are not representative of air quality throughout Yukon. Intermittent gaps in the data set exist because of occasional technical problems.

Water



Yukon River, Dawson City.



Fish Lake. © Richard Legner 2013 (14)

Water quality and quantity

Freshwater of sufficient quality and quantity is essential for aquatic life and to support human uses for industry, recreation, agriculture, and drinking. Yukon's water bodies and watersheds are monitored to determine ambient water quality and quantity.

In order to ensure a sufficient quality and quantity of freshwater for the Yukon, it is important to monitor, report, and plan on the water quality and quantity within the territory and in relation to the rest of Canada.

Many factors can affect water quality and quantity, from industrial development to climate change. The short-term and long-term effects of climate change on water resources are an important consideration around the world and particularly in northern locations. For example, increased temperature and precipitation can affect the availability of water.

Changes in the amount of water will inevitably affect water quality by altering the concentration of nutrients, ions, metals, and hydrocarbons in the water. Lower water levels tend to increase concentrations of ions in water, whereas high-flow events tend to increase turbidity and flush contaminants (natural and anthropogenic) into the system. This chapter focuses on the two important aspects of water – quality and quantity.

Water quality

Indicators

- The Canadian Water Quality Index (Table 3.1)
- Samples collected at Yukon monitoring stations (Table 3.2)
- Water Quality Index rolling average ratings (Table 3.3)

The Water Quality Index (WQI) provides the public with information about the status of water quality in Canada and identifies emerging trends. It condenses data about the quality of a water body to a number scale that corresponds to a rating such as Poor, Good, or Excellent. The WQI also indicates the suitability of streams to support aquatic life (Table 3.1).

The WQI measures the frequency and extent to which selected parameters exceed water quality objectives at individual monitoring sites. When these objectives are exceeded, it is an indication of possible adverse effects on aquatic life.

Table 3.1: Water Quality Index ratings defined by Canadian Environmental Sustainability Indicators

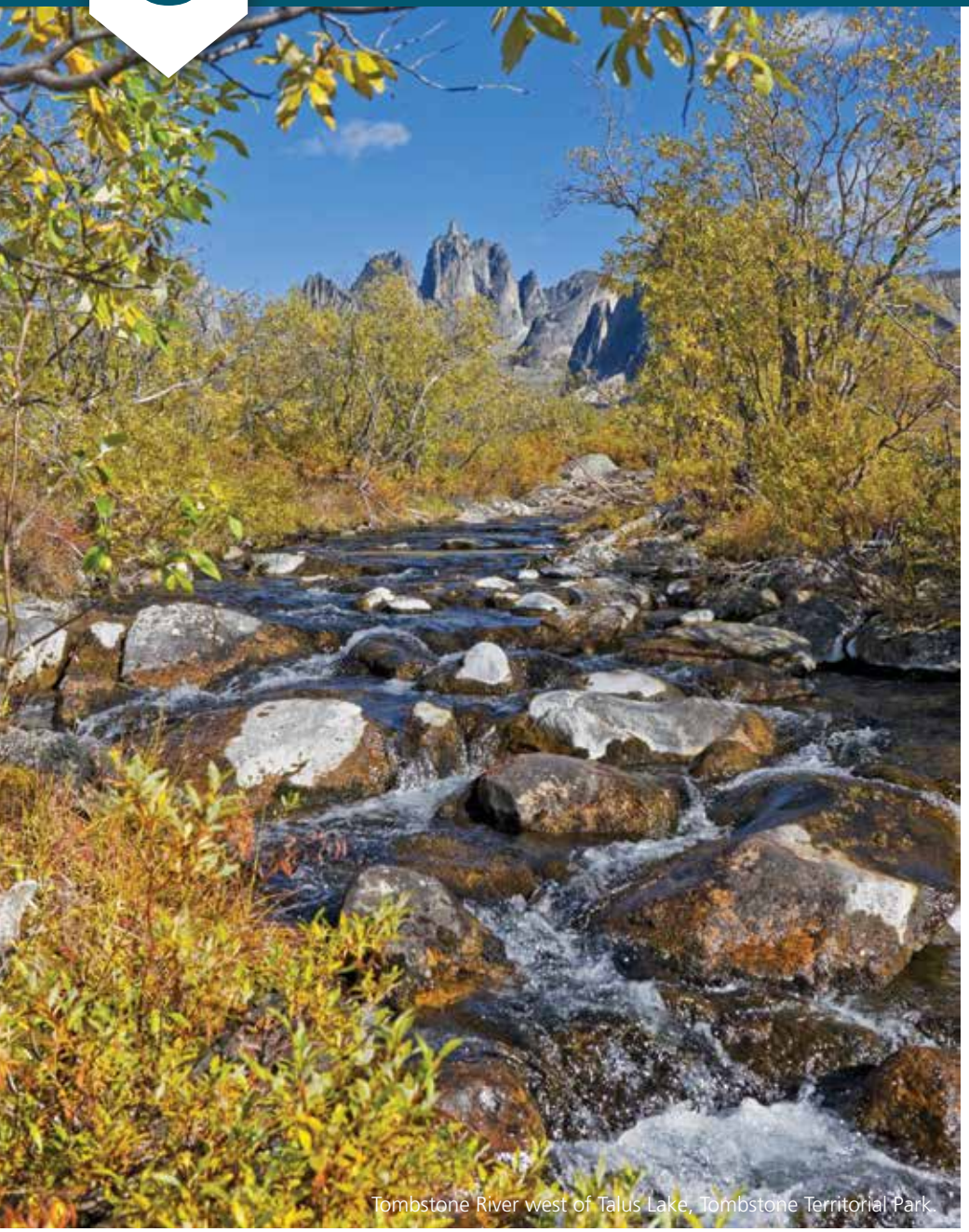
Excellent (95-100)	Aquatic life is not threatened or impaired. Measurements never or very rarely exceed water quality guidelines.
Good (80-94)	Aquatic life is protected with only a minor degree of threat or impairment. Measurements rarely exceed water quality guidelines and, usually, by a narrow margin
Fair (65-79)	Aquatic life is protected, but at times may be threatened or impaired. Measurements sometimes exceed water quality guidelines and, possibly, by a wide margin.
Marginal (45-64)	Aquatic life frequently may be threatened or impaired. Measurements often exceed water quality guidelines by a considerable margin.
Poor (0-44)	Aquatic life is threatened, impaired or even lost. Measurements usually exceed water quality guidelines by a considerable margin.

Sampling water quality.

Table 3.2: Number of samples collected at Yukon monitoring stations, 2009-2011

River	Station	Ecoregion	2009	2010	2011
Alsek River	Above Bates River	Yukon-Stikine Highlands	6	6	5
Dezadeash River	At Haines Junction	Ruby Range	23	24	22
Klondike River	Above Bonanza	Klondike Plateau	8	8	8
Liard River	At Upper Crossing	Liard Basin	17	19	15
Rose Creek	Above Anvil Creek	Yukon Plateau – Central	23	25	15
S. McQuesten River	Below Flat Creek	Yukon Plateau – North	11	9	9
Yukon River	Above Takhini River	Yukon Southern Lakes	10	10	10
Yukon River	At Marsh Lake Dam	Yukon Southern Lakes	10	10	11
Total samples			108	111	95

Water



Tombstone River west of Talus Lake, Tombstone Territorial Park

Table 3.3: Water Quality Index rolling average ratings for Yukon monitoring stations, 2003-2011[1]

Location	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	Current Rating
Dezadeash River at Haines Junction	84.2	84.2	89.5	N/A	89.5	N/A	89.5	Good
Klondike River above Bonanza Creek	N/A	N/A	66.8	66.6	67.4	74.2	74.2	Fair
Liard River at Upper Crossing	93.6	93.6	93.6	87.2	93.6	87.2	87.1	Good
South McQuesten River below Flat Creek	N/A	N/A	64.4	64.3	64.0	70	69.5	Fair
Rose Creek above Anvil Creek							65.3	Fair
Yukon River at Marsh Lake Dam	N/A	N/A	100	N/A	100	N/A	100	Excellent
Yukon River above Takhini River	N/A	N/A	100	100	100	93.6	93.6	Good

[1]The rolling average does not include the Alsek River as it is sampled too infrequently to have a reliable running average. N/A – Not available. Sources: Environment Canada and Environment Yukon.

What is happening

In 2011, the most recent year for which data have been evaluated, 95 samples were collected from eight Yukon monitoring stations operated by Environment Canada and Environment Yukon (Table 3.2).

The Water Quality Index ratings for the Liard, Klondike, South McQuesten, and Yukon River stations are stable and ranged from Fair to Excellent (Table 3.3). Three-year rolling average scoring provides additional confidence in the ratings.

Significance

Concentrations of metals that exceed Canadian Water Quality Guidelines may have negative (toxic) effects on aquatic organisms, and some metals can bioaccumulate in invertebrates and fish, eventually impacting human health. Excessive nutrients in water can cause aesthetic and nuisance issues in recreational waters.

In general, water quality varies throughout the year. Suspended solids and turbidity are higher in spring when increased streamflow from melting snow accelerates bank erosion. Metals can exceed the site-specific objectives during high flow. However, metals primarily associated with suspended solids are not available for uptake by fish and other aquatic organisms and are therefore not a concern. The three-year index period at each station may include natural variations or human-caused impacts on water quality that can result in changes to the index score.

Since 2010, the Water Quality Index rating for the Yukon River above the Takhini River has remained Good, down from Excellent in previous years. The change from Excellent to Good resulted from one guideline exceedence in that year for phosphorus. Although there were no guideline exceedences in 2011, the rating remains the same because of three-year averaging. This site is located below the City of Whitehorse and is influenced by storm water runoff from urbanization and an annual discharge of treated sewage from the Livingston Trail Lagoon.

The Yukon River at Marsh Lake Dam continues to maintain the highest (Excellent) water quality score of all stations monitored in the territory.

The rating for the Klondike River above Bonanza Creek has remained consistent since 2005. The Klondike River is influenced by historic gold mining, rural development, agriculture, placer mining, and recreation. Concentrations of metals and nutrients exceed aquatic life guidelines during May, which coincides with high flow and turbidity. Phosphorus exceeds guidelines later in the open-water season (August). This is likely a short-lived by-product of localized, intensive agriculture and is not a reason for concern at present. Instream biota rapidly utilize nitrogen and phosphorus inputs as long as the loadings are not excessive.

The Water Quality Index rating for the South McQuesten improved from Marginal to Fair in the 2008-2010 reporting period, and the site has maintained this improved rating for 2009-2011. The South McQuesten River is fed by melted snow in a naturally mineralized area and is influenced by past and present mining practices. Concentrations of metals exceeded guidelines in the May-to-October period. ERDC, a subsidiary of Alexco Resource Corporation, manages the care and maintenance of the historic liabilities at the Keno Hill mine with funding from the federal government. Its operations have made substantial improvements in reducing metal loads from the mine site to the South McQuesten River. Plans for further reduction of metal loads will be part of the historic liabilities closure plan. Mining and milling activities near Keno City resumed in 2010.

Yukon River. © Richard Legner 2013 (14)

The Liard River is stable and rated as Good, as one would expect in a natural system with little human impact. Increases in zinc concentrations are associated with spring melt and occur naturally.

The Dezadeash River is stable. Infrequent metal exceedences in May and October affect the overall rating of the river. The spring exceedence is attributed to turbidity resulting from freshet.

Enough data has now been collected to allow for the first evaluation of Rose Creek, downstream of the Faro mine site. The Rose Creek station is rated as Fair. The station is located downstream of the historic Faro Mine complex, which is currently undergoing reclamation and remediation for permanent closure. The rating was affected by exceedences of metal concentrations, mostly during freshet but also throughout the year. It is expected that sulphate and metals concentrations may increase in Rose Creek due to acid mine drainage associated with the mine property.

Taking action

Beginning in 2010, the Klondike River monitoring station has real-time sensor equipment that transmits several water quality measurements to a computer screen set up for public viewing as part of a display in the Dawson Visitor Reception Centre. In addition to water quality information, the display provides weather and hydrologic data (flow, water level), webcam views, and other visuals of the site, including surface images and underwater video. These activities and the accompanying poster serve to raise the profile of water and promote support for proper management. Visitor Reception Centre staff report that the display is popular with visitors.

Water

Emerald Lake, South Klondike Highway.

Data quality

Water quality samples were obtained by locally trained personnel using established protocols for sample collection and transport. Samples were analyzed in Environment Canada laboratories. The data was quality-controlled, assured, and standardized by Environment Canada and Environment Yukon, following the program for the Canadian Environmental Sustainability Indicators, Chronological Index reporting led by Statistics Canada.

Water quantity

Indicators

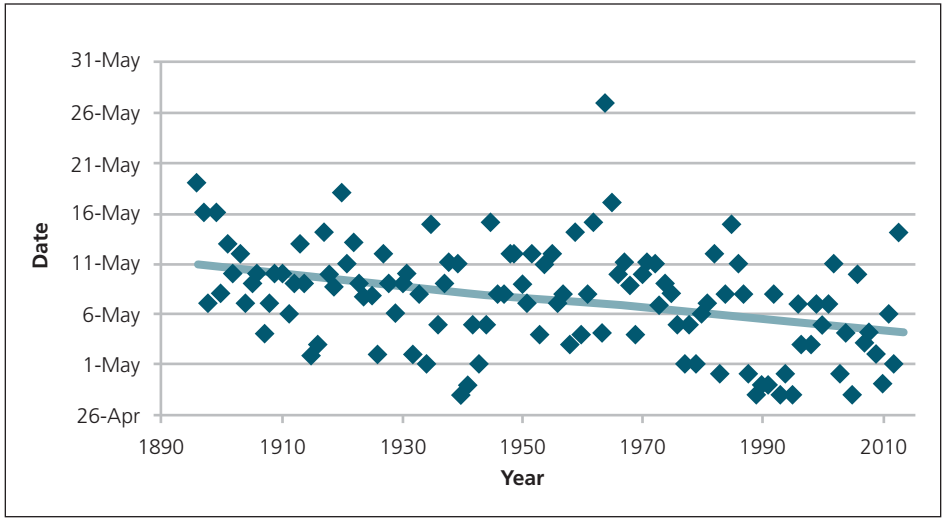
- Yukon River ice break-up dates (Figure 3.1)
- Magnitude and timing of peak flow (Figure 3.2)
- Changes in snow cover (Figure 3.3)

The Yukon government monitors water quantity to determine the distribution and circulation of water on and below the earth's surface. Environment Yukon operates hydrometric, snow survey, meteorological, and long-term groundwater monitoring networks. Data obtained from these stations is used to determine information about the hydrological cycle, including changes in river ice break-up dates (Figure 3.1), the magnitude and timing of peak flows (Figure 3.2), and snow cover (Figure 3.3). This information is used for a variety of purposes. For example, it supports flood forecasting, carrying out impact assessments and water licence reviews, designing culverts and dams, and monitoring the effects of climate change.

River ice break-up dates

Increasing spring air temperatures over the last several decades have resulted in a six-day advance in ice break-up on the Yukon River at Dawson (Figure 3.1).

Figure 3.1. Yukon River at Dawson ice break-up dates, 1896-2013

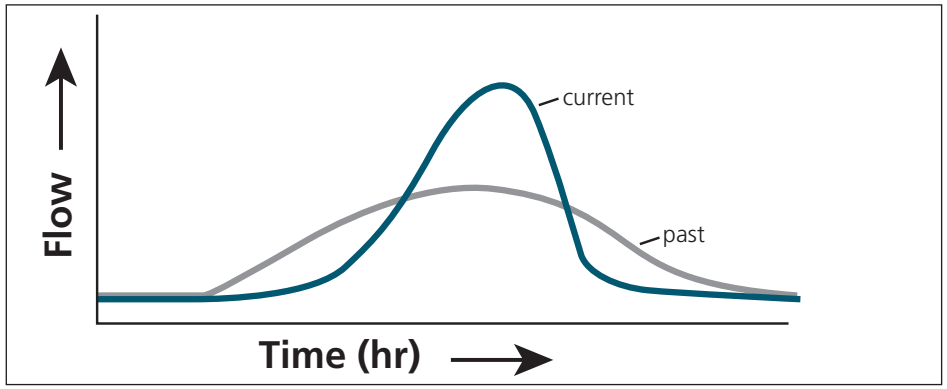


Source: Water Resources Branch, Environment Yukon

Peak flows

Increasing winter precipitation combined with higher spring temperatures have led to a snowmelt period that is shorter in duration. The result is a compressed runoff event with higher and more flashy streamflow discharge. The schematic below (Figure 3.2) illustrates how this change in the magnitude and timing of snowmelt has been affecting streamflow. The gray line represents normal streamflow timing and magnitude from several decades ago. The blue line represents the streamflow regime in recent years.

Figure 3.2. Schematic of past and current streamflow magnitude and timing

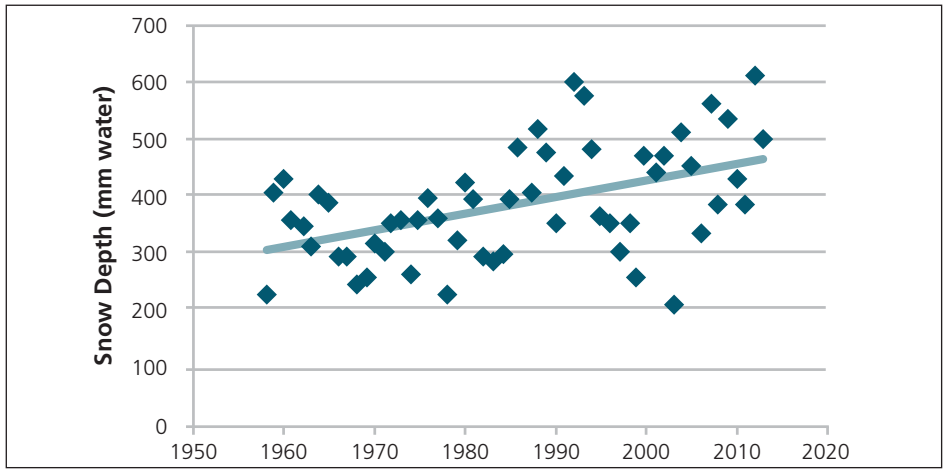


Source: UCAR 2010

Snow cover

There has been a significant increase in winter precipitation in the last several decades. This is reflected by the increase in snow depth at the Log Cabin snow survey station in the Upper Yukon River (Figure 3.3).

Figure 3.3. Changes in snow depth at Log Cabin over the past 50 years



Source: Water Resources Branch, Environment Yukon

What is happening

River ice break-up dates

Ice break-up now tends to occur earlier on the Yukon River and Porcupine River. Break-up at Dawson has occurred, on average, six days earlier between 1896 and 2013 (Figure 3.1). The water level during break-up has also been increasing during the last few decades.

Given the historic importance of the Yukon River to transportation, observations of freeze-up of the Yukon River at Whitehorse have been recorded (albeit not continuously) since the 1890s.

Swan Haven, Marsh Lake.

Peak flows

Streamflow characteristics are changing in Yukon, with increased winter low flows and earlier spring freshets in mountainous streams, reduced summer flows, reduced peak flows, and increased winter flows in the three permafrost zones, and increased annual and peak flows in glacierized basins in southwest Yukon.

Snow cover

Snowmelt has occurred earlier over the past several decades, and this trend is expected to continue. This will also result in earlier peak flows. Snow depths in northern Yukon have been decreasing, as in much of Canada from 1946-95. However increases were reported for northern British Columbia. Snow-cover in the Arctic is declining at a greater rate than elsewhere in the North.

Significance

The observed changes in the water quantity indicators are predominantly affected by increases in air temperature and precipitation associated with climate change. The warming is causing increased permafrost thawing and subsequent increase in winter low flows, changes in the magnitude and timing of glacier melt, earlier river ice break-up with higher water levels, earlier snowmelt, and a greater frequency of ice jams.

Earlier river ice break-up and increased severity of ice-jamming has detrimental impacts on communities and infrastructure. Higher flows can cause increased sedimentation and contaminants in river systems, affecting human health, drinking water, and ecosystems. Low flows can increase concentrations of ions, such as dissolved metals. Higher water temperatures

and low flows can affect aquatic ecosystems. Changes in flows can affect resource development, such as hydro power production, mining practices, or agriculture. Changes in flows and groundwater can affect availability of water for communities and local needs.

Fish Lake. © Richard Legner 2013 (14)

Taking action

In 2011, the Yukon government released the report, *Yukon Water: Assessment of Climate Change Vulnerabilities*, which assessed trends in the hydrologic cycle in the territory. The assessment included potential effects on environment, communities, and infrastructure. The report also provides recommendations to support adaptation, monitoring, and strategies to begin to address the vulnerabilities of Yukon's water resources by both users and decision makers.

The YukonWater website (http://yukonwater.ca/) was updated in 2013 to provide greater access to information on the quantity and quality of Yukon water resources.

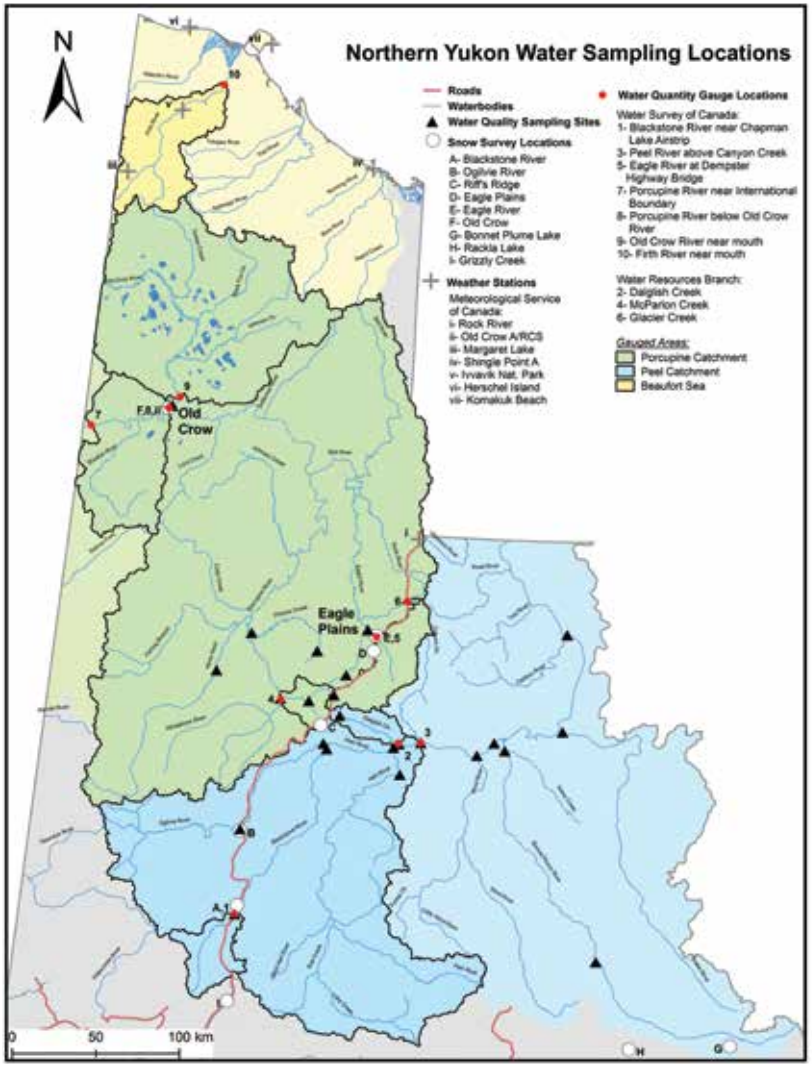
Yukon hydrologic response has changed over the last several decades, with a generally greater frequency of flooding associated with both ice jams and snowmelt. The Water Resources Branch established the Wolf Creek Research Watershed in 1992 to improve understanding of the linkages between climatic and hydrologic processes. Since that time, the Wolf Creek project has evolved to include the comprehensive study of climate and climate change. The findings of the Wolf Creek project have been successfully incorporated into hydrologic models and methodology used for flood forecasting and other flow estimation purposes, which are now applied to other Yukon regions.

The Water Resources Branch is currently involved in a project with Highways and Public Works to develop estimates of peak streamflow, based on various climate change scenarios, for bridge and culvert crossings of the Dempster Highway. A similar project is being carried out with the Emergency Measures Organization to develop floodplain maps for every Yukon community.

Data quality

The Water Resources Branch operates 55 snow survey stations, 8 groundwater monitoring stations, 15 hydrometric stations, as well as maintaining a cost-sharing agreement with Environment Canada to operate an additional 45 stations. The Water Resources Branch also operates several stations within the Wolf Creek Research Basin for the purpose of developing and calibrating hydrologic flow models.

Figure 3.4: North Yukon water hydrometric monitoring station locations



Source: Water Resources Branch, Environment Yukon. Note: A black triangle symbol can include multiple surface water sampling sites

Million Dollar Falls; Climate warming is causing earlier river ice break-up, higher water levels and more ice jams.

PROFILES

2013 Flooding

The year 2013 was the biggest flood year in 30 years. There were seven ice-jam and freshet floods in Yukon, with two communities experiencing both types of events separated by a 10-day period. Significant flooding, with new floods-of-record, also occurred in 2012, 2009, and 2007. There is some indication that the increase in flooding events is occurring as a result of greater precipitation amounts and a compressed runoff period, due to spring temperature increases associated with climate warming.

Yukon Water Website

In December 2013, the YukonWater website – YukonWater.ca – was re-designed following a review of the website completed in 2012. New features include improved navigation with drop-down and side menus, a news feed, a Twitter feed link, Facebook feed link, and a search bar.

YukonWater provides online information on water quality, water flow, snow and rainfall data, water management and monitoring, and legislation. The website is a platform to share water-related resources generated in the territory. As a result of user feedback, additional content was added in relation to:

- water valuation,
- water projects and current initiatives,
- FAQ: water licence triggers,
- best management practices,
- flood forecasting, and
- the Draft Yukon Water Strategy.

Draft Yukon Water Strategy

The Yukon government's Draft Yukon Water Strategy, released for public review in 2013, provides a framework of goals and priority actions, which helps establish the short-term and long-term actions in forms of policies, plans, and programs. By the end of 2013, the government had:

- developed a Draft Yukon Water Strategy with input from other water managers (federal, First Nation, and municipal governments),
- held a public review of the draft strategy,
- provided summaries of "What We Heard" during the public engagement period, and
- held a stakeholder workshop to address comments heard during the public review and to seek input on new ideas.

A Yukon Water Strategy and Action Plan is expected to be released in 2014.

New Water Sampling Stations in North Yukon

In response to increasing interest in oil and gas development in the Eagle Plains basin, the Yukon government began a water monitoring project in North Yukon. Data collected will assist in the assessment of current and future activities in the area.

Three new hydrometric monitoring stations were installed in August 2013: 1 near the mouth of Dalglish Creek and 2 upstream of Old Crow in the Porcupine River basin (Figure 3.4). Another station was installed in fall 2013 on the Eagle River at the Dempster Highway, in partnership with Environment Canada. Surface water quality monitoring samples were also collected at 18 sites to begin to establish baseline conditions in the oil and gas resource areas.

It is expected that a groundwater monitoring station will be installed on the Eagle River in 2014. More surface-water quality surveys are planned as well to capture seasonal variations in water quality over the next three years.

The information collected from these new sites will be available on the YukonWater website, the territory's one-stop source for water resources information.

Land

Ogilvie Mountains between Dawson City and Inuvik.

Backcountry in Tombstone Park.

This edition of the *State of the Environment Report* looks at three important aspects of land use in Yukon: planning, assessing activities on the land, and waste management.

Land use planning

The sustainability of resource use and development depends on effective planning for future human activities and environmental protection.

Planning provides for the designation of allowable activities and levels of activity on the land through processes and agreements that allow for collaboration by First Nations, the public, local governments, and the Yukon government. Planning outcomes can range from different types of land use designations through to specific management prescriptions for areas.

Indicators

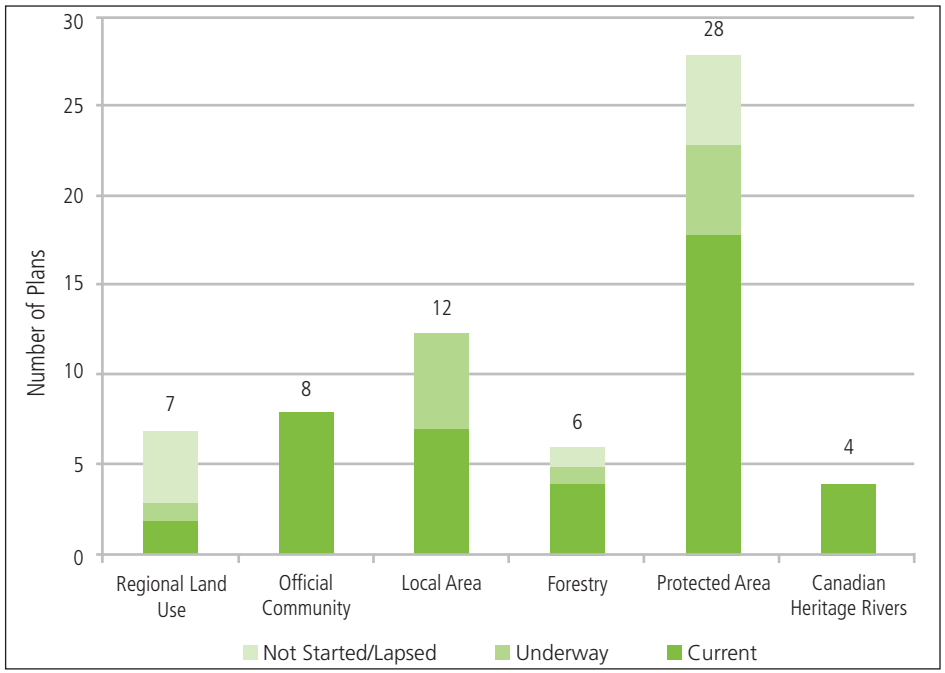
Management plans related to land use, resources and protected areas

- Status of land use, resource management and protected area plans in Yukon (Figure 4.1)

Management plans generally include an inventory of resources and interests, and strategies to meet a set of management objectives. For this report, management plans are divided into three status categories:

- Current – plan is finalized and is being implemented,
- Underway – plan is in development, or
- Not started/lapsed – plan does not yet exist, is out of date, or is awaiting a new planning process.

Figure 4.1: Status of land use, forest resources, and official community planning processes in Yukon, 2014



Source: Updates from resource planners.

What is happening

Types of plans include regional land use plans, official community plans, local area plans, forest resource management plans, protected area management plans, and other areas (including Canadian Heritage Rivers). See Tables 4.1, 4.2 and 4.4 for the status of all plans.

Table 4.1: Status of land use, forest resources, and official community planning processes in Yukon, 2014

Regional Land Use Plans	Status
Dawson Region	Underway
North Yukon Region	Current 2009
Peel Watershed Region	Current 2014
Teslin Region	Lapsed
Northern Tutchone Region	Not Started
Kluane Region	Not Started
Whitehorse Region	Not Started
Forest Resources Management Plans	**Status**
Champagne and Aishihik Traditional Territory Strategic Southwest Forest Management Plan	Current 2004*
Dawson Forest Resources Management Plan	Current 2013
Forest Management Plan for the Teslin Tlingit Traditional Territory	Current 2006
Integrated Landscape Plan For the Champagne and Aishihik Traditional Territory	Current 2011
Southern Lakes Forest Resources Management Plan	Underway
Kaska Traditional Territory Forest Resources Management Plan	Not Started**
Official Community Plans	**Status**
Carmacks	Current 2013
Dawson	Current 2012
Faro (Official Community Plan is being updated)	Current 2003
Haines Junction	Current 2013
Mayo	Current 2006
Teslin	Current 2010
Watson Lake	Current 2010
Whitehorse	Current 2010

Year indicates when the plan was approved

* In 2013 an Implementation Agreement valid for another three years was signed

** Discussions underway to resume the planning process

Mt. Vancouver St. Elias Mountains, Kluane National Park .

Regional land use plans

There are seven planning regions in Yukon (Figure 4.2), with plans completed for two regions and one underway.

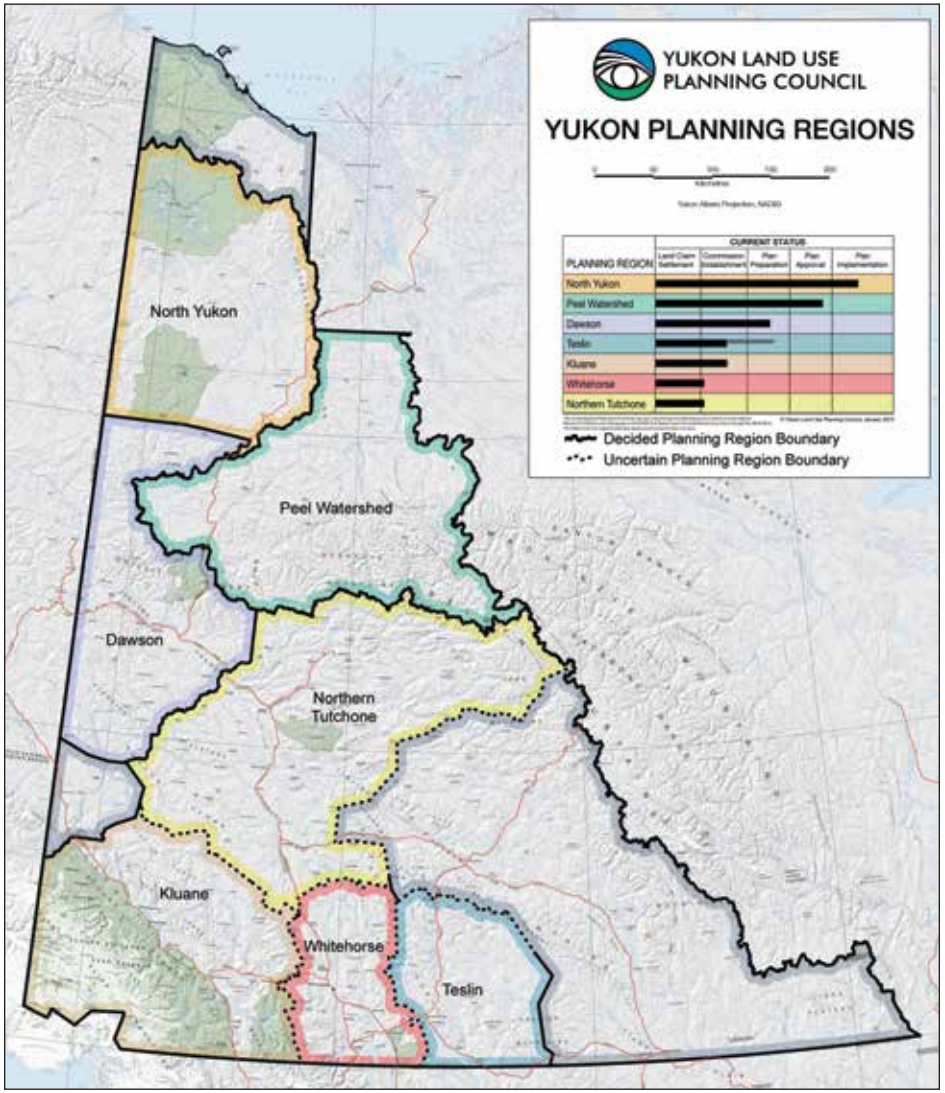
In 2009, the Vuntut Gwitchin First Nation and Yukon government approved the *North Yukon Regional Land Use Plan*. It provides a sustainable development framework for land management, while addressing the key issues of oil and gas development in Porcupine caribou herd habitat and development impacts in wetlands. The plan also recommends protected area status for the Whitefish Wetlands and the Summit Lake-Bell River area. It identifies important traditional use and wildlife areas that were mapped from local and traditional knowledge.

In January 2014, the Yukon government released the *Peel Watershed Regional Land Use Plan for Non-Settlement Lands*. The plan identified 29 percent of the region (19,800 km^2) as protected area, including the Wind, Bonnet Plume, Snake, Hart, and Peel rivers in a new Wild River Park designation. Forty-four percent of the region is identified as Restricted Use Wilderness Area, with a management focus on conservation and protection of the wilderness character of the region. The remaining land is identified as Integrated Management Area, where most land use activities may occur. In the latter two types of areas, mineral staking and proposed commercial activities will be subject to enhanced regulatory and permit processes. Only 0.2 percent of land can be disturbed in Restricted Use Wilderness Areas at any one time, however.

The Dawson Regional Planning Commission, formed in 2010, released a *Resource Assessment Report* in October 2013. The report provided information on the social and cultural values, resource potential, and ecological values in the planning region. The commission used it to assist with finalizing land use management alternatives for the area, which were released in February 2014.

The Yukon Land Use Planning Council recommended in 2011 that there be three planning regions in southern Yukon – Teslin, Whitehorse, and Kluane.

Figure 4.2: Yukon planning regions



Source: Yukon Land Use Planning Council

Fort Selkirk.

Forest resources management plans

The *Forest Resources Act* outlines the planning process, purpose, and scope of forest resources management plans in accordance with Chapter 17 of First Nations Final Agreements. Plans have been completed for the Tr'ondëk Hwëch'in, Teslin Tlingit, and Champagne and Aishihik traditional territories (Table 4.1).

In 2013, the Champagne and Aishihik First Nations and Yukon government signed a renewed three-year implementation agreement that enables the parties to continue working collaboratively under the Strategic Forest Management Plan in the Champagne and Aishihik Traditional Territory.

Work was underway at the end of 2013 to produce a forest management plan in the Whitehorse/Southern Lakes planning area. The process includes participation from the Carcross/Tagish First Nation, the Kwanlin Dün First Nation, and the Ta'an Kwäch'än Council. Discussions have also begun with the Liard First Nation and Ross River Dena Council on moving forward with finalizing a Forest Resource Management Plan in southeast Yukon.

Forest inventory projects enable the process of an annual allowable cut review and timber supply analysis, in support of forest resources management plan implementation. The inventory data and subsequent timber supply review is used to identify a sustainable rate of harvest for a forest planning area. Projects were underway at the end of 2013 in the Haines Junction, Whitehorse, and Southern Lakes regions, with one planned for the Dawson Region.

Official community plans

All eight Yukon municipalities have official community plans in place, as required under the *Municipal Act* (Table 4.1).

Local area plans

Local area plans cover settlements outside municipal boundaries (Table 4.2). They often address development pressures and are initiated by either residents or governments (territorial or First Nations). In 2014, seven local area plans were in place. Plans were currently underway for five areas, with the Marsh Lake plan in its final development stage.

Local area plans are implemented through zoning regulations under the *Area Development Act*, which divide an area into classes of land use, such as residential, industrial, recreational, or environmental protection. The regulations also set standards for the use of properties, including building setbacks and heights.

Table 4.2: Status of local area plans and zoning regulations, 2014

Development Area	Local Area Plan	Zoning Regulation
Bear Creek	Not Started	1983
Carcross	Current 2014	1976
Deep Creek	Current 2001	2011
Dempster Highway	Not Started	1979
Destruction Bay	Not Started	1980
Fox Lake	Underway	No
Golden Horn	Current 2004	2011
Grizzly Valley	Not Started	1996
Hamlet of Ibex Valley	Current 2001	2010
Hamlet of Mount Lorne	Current 1995	2006
Hot Springs Road	Current 2002	2005
Jackfish Bay	Not Started	2000
Klondike Valley	Not Started	1992
Little Teslin Lake Recreation	Not Started	2010
M'Clintock Place	Underway, Part of Marsh Lake Plan	1996
Marsh Lake	Underway	Restricted to M'Clintock Pl
Mayo Road	Not Started	2013
Mendenhall	Not Started	1990
Pine Lake	Not Started	1990
Ross River	Not Started	1978
Tagish	Underway	None
Watsíx Eetí	Underway, Part of Golden Horn Plan	2011
West Dawson/Sunnydale	Current 2013	1990
Whitehorse Periphery	Not Started	1978

Bolded areas indicate where joint planning is occurring (First Nations and Yukon government)
Local area plans are requested to be established by the community and are not required, so are not calculated into the 'not started' category.

Historic building at Herschel Island-Qikiqtaruk Territorial Park.

The Land Planning Branch of the Department of Energy, Mines and Resources considers requests by communities to lower parcel sizes from 6 ha to 3 ha or 2 ha sizes. Since 2004, the regulations have been amended to allow rural residential property owners to subdivide their lots in the Hotsprings Road, Ibex Valley, Golden Horn, and Mayo Road development areas (Table 4.3).

Table 4.3: Rural Residential lot subdivision, 2005-2013

Development Area	Initial RR lot parcel size	Regulation amended	minimum RR lot size	new RR lots potential	actual RR lots created since 2005	Notes
Hotsprings Road	6 ha	2005	3 ha	40	21	
Ibex Valley	6 ha	2010	2 ha	52	16	one time only subdivision
Golden Horn	6 ha	2011	2 ha	50	14	Incl. 3 commercial lots
Mayo Road	6 ha	2013	2 ha	75	9	commercial lot can be subdivided

In 2013, Cabinet delegated decision making for certain rezoning applications to the Minister of Energy, Mines and Resources. This arrangement will enable the Land Planning Branch to streamline the approval process and be more responsive to low-impact rezoning applications.

Protected area plans

As a percentage of its land base, Yukon has more of its lands protected than any other province or territory in Canada (Table 4.4). Most protected areas in Yukon were first recognized as special management areas in a First Nation final agreement, before being designated at a later date. Regional land use plans are also used to identify new protected areas. Different types of protected areas have different levels of legal protection. National parks and wildlife areas, territorial parks, and habitat protection areas are types of protected areas.

Management plans are current for the territory's three national parks (Ivvavik, Kluane, Vuntut) and one national wildlife area (Nisutlin River Delta).

Management plans are current for four territorial parks: Herschel Island-Qikiqtaruk Natural Environment, Ni'iinlii Njik (Fishing Branch) Ecological Reserve, Ni'iinlii Njik (Fishing Branch) Wilderness Preserve, and Tombstone Natural Environment. In 2013, a five-year review of the Tombstone Park Management Plan recommended no major changes to the plan. Interim management guidelines are in place for Coal River Springs Ecological Reserve.

Watson River valley. © Richard Legner 2013

Planning for Kusawa Park resumed in 2013. Planning has not yet started for Asi Keyi. The planning process for Agay Mene was suspended in September 2009. While the Summit Lake-Bell River area was identified as a future territorial park in 2009 through the North Yukon Land Use Plan, the park boundary has not yet been confirmed.

In 2013, management plans for seven habitat protection areas and one special management area were approved. Three more planning processes were underway, including Whitefish Wetlands.

Other areas

Designation as a Canadian Heritage River recognizes rivers or river segments for their natural or cultural heritage and recreational values, but the Heritage River designation itself does not provide legal protection. This protection comes through territorial and national laws when, for example, the areas are established as parks. Yukon has four Canadian Heritage rivers: Alsek – Kluane National Park, Bonnet Plume, Thirty Mile Section of the Yukon River, and Upper Tatshenshini. All have current management plans or strategies in place.

The Kluane Wildlife Sanctuary provides a refuge for wildlife from licensed hunters, with only two sheep permits issued nearly every year.

Significance

Developing long-term management plans through public processes helps governments recognize and balance competing views about how lands and natural resources should be used. Plans are tools that support effective management. Planning is an important obligation arising from land claims agreements. Regional planning is intended to reflect the traditional knowledge, experience, and recommendations of residents, as well as incorporate science and broad socio-economic and environmental interests.

Figure 4.3: Parks and protected areas in Yukon, 2014 (refer to Table 4.4 for names, status and colour codes)

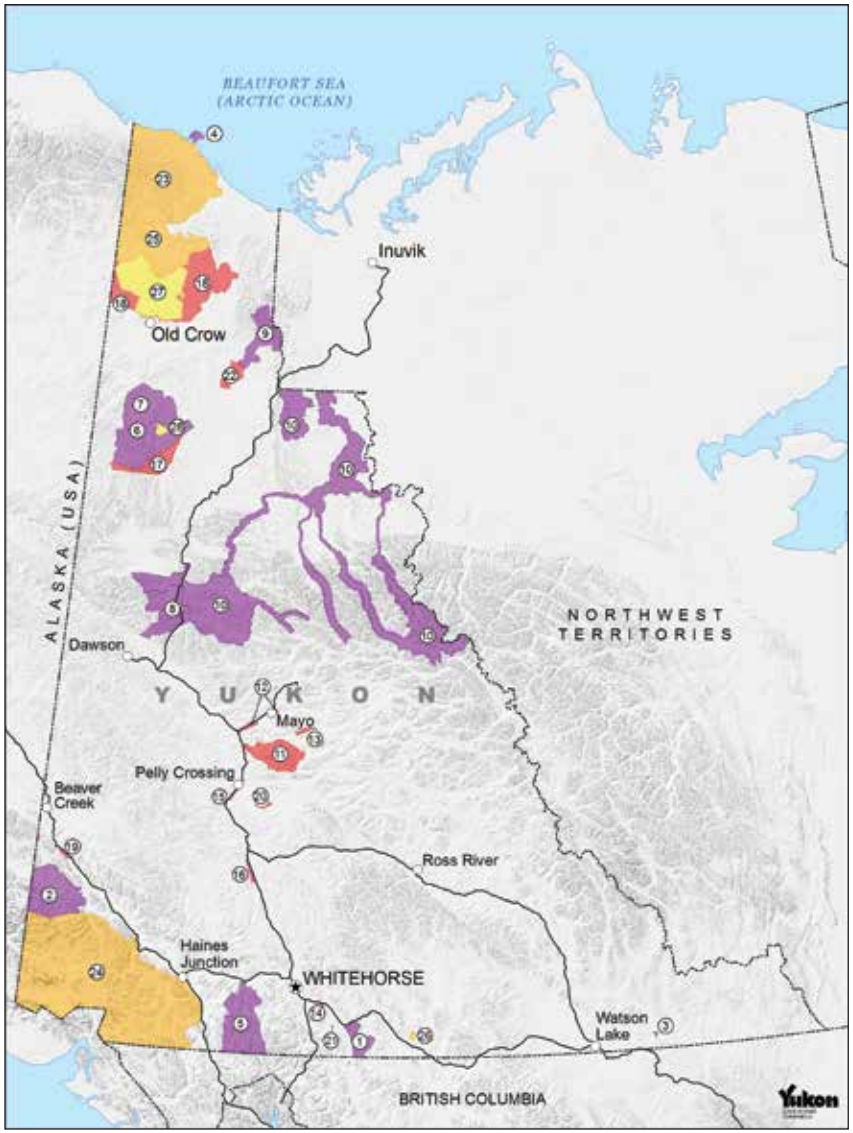


Table 4.4: Status of parks and other protected areas in Yukon, 2014[1]

Map #	Category / Name	Designated	Management Plan Status	Area (km²) and % of Yukon[2]		
				No Withdrawal	Interim Withdrawal	Permanent Withdrawal
Territorial Parks						
1	Agay Mene	No	Underway	725		
2	Asi Keyi	No	Not started			2,984
3	Coal River Springs	1991	2009			16
4	Herschel Island - Qikiqtaruk	1987	2006			113
5	Kusawa	No	Underway			3,082
6	Ni'iinlii Njik (Fishing Branch) Ecological Reserve	2003	2010			169
7	Ni'iinlii Njik (Fishing Branch) Wilderness Preserve	2003	2010			5,203
8	Tombstone	2004	2009			2,050
9	Summit Lake- Bell River	No	Not started		1,525	
10	Peel Watershed Protected Areas	No	Not started			19,800
Subtotal				**725 (0.1%)**	**1,525(0.3%)**	**33,417 (6.9%)**
Habitat Protection Areas						
11	Ddhaw Ghro	No	Underway		1,609	
12	Devil's Elbow & Big Island[3]	2011	2011			83
13	Horseshoe Slough	2011	2008		88	
14	Lewes Marsh	No	Not started			20
15	Łútsäw Wetland[3]	2006	2006		28	4
16	Nordenskiold (Tsâwnjik Chu) [3]	2010	2010			78
17	Ni'iinlii Njik (Fishing Branch)	2004	2010	978		
18	Old Crow Flats (Van Tat K'atr'anahtii)	2009	2006		3,238	534
19	Pickhandle Lakes	No	Underway	51		
20	Ta'Tla Mun Special Management Area	No	2005	33		
21	Tagish River	No	Not started			4
22	Whitefish Wetlands	No	Underway		358	110
Subtotal				**1,062 (0.2%)**	**5,321 (1.1%)**	**833 (0.2%)**
National Park and Wildlife Areas						
23	Ivvavik	1984	2007			9,704
24	Kluane	1972	2010			22,155
25	Vuntut	1995	2010			4,350
26	Nisutlin Wildlife Area		2004			55
Subtotal						36,264 (7.5%)
First Nation Settlement Lands						
27	Old Crow Flats[4]	2007	2006			3,947
28	Ni'iinlii Njik (Fishing Branch)[4]	2003	2010			141
Subtotal						**4,088 (0.8%)**
TOTAL AREA PROTECTED IN YUKON[5]				**1,787 (0.4%)**	**6,846 (1.4%)**	**74,602 (15.4%)**
						81,448 (16.8%)[5]

[1] Records are based upon Environment Yukon Environmentally Significant Area (ESA) and Canadian Conservation Area Tracking System (CARTS) databases 2013 and updates. [2] Areas are calculated from the best available digital polygons compiled by Environment Yukon. Yukon = 482,443 km². [3] A portion or all of this Habitat Protection Plan is comprised of Settlement Lands. [4] Recognized in approved management plans. [5] Total area protected includes lands with interim or permanent withdrawals.

Hoar frost.

Land use activities

It is important to assess and monitor activities on lands that have allowable uses and levels of activities. Resource-based activities, community uses, and areas that support recreation – such as territorial parks – can have effects on the environment.

Regulatory and governmental processes are designed to assess potential effects and support decision making. While the process depends on the type of activity being proposed, consideration is given to the possible effects and benefits of the project, as well as the distribution and concentration of the proposed activity in relation to other activities occurring in the area. If approved, the practices and monitoring to be undertaken and reported are identified for the appropriate regulatory body.

Approved plans or land use designations include management direction to establish the type and level of allowable activities, with monitoring requirements to assist in the implementation of the management direction.

Indicators

Environmental and socio-economic assessments

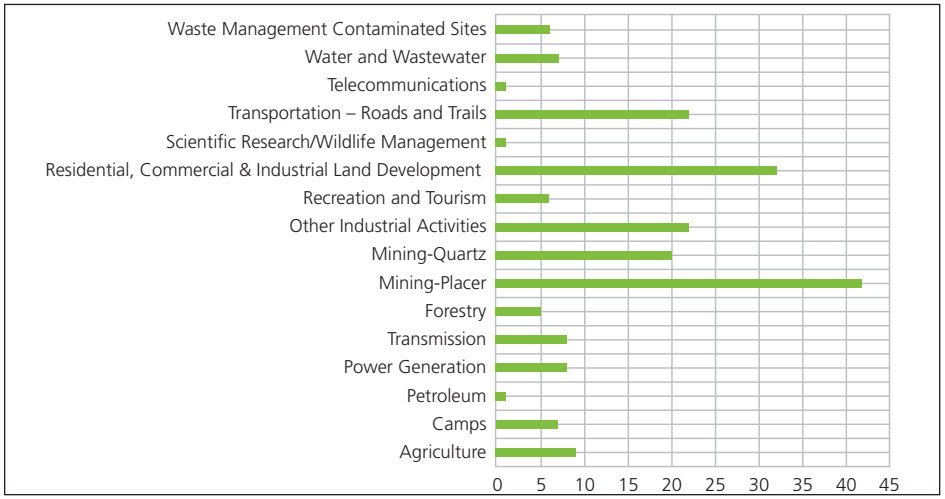
- Applications assessed by YESAB 2005-2013 (Figure 4.4)
- Applications assessed by YESAB by sector in 2012-13 (Figure 4.5)
- Applications assessed by Designated Office in 2012-13 (Table 4.5)

The Yukon Environment and Socio-economic Assessment Board (YESAB) is responsible for most assessments. YESAB reviews a proposed project and makes recommendations to government on measures to reduce, control, or eliminate the negative effects. YESAB may recommend that a project not proceed if it finds the potential effects are too great. The final decision is made by the appropriate government or regulatory body, which can accept, reject, or vary the recommendations.

Figure 4.4: Project applications submitted to YESAB for assessment, 2005-2013

Source: YESAB Annual Report 2013

Figure 4.5: Applications submitted to YESAB by sector, 2012-13



Source: YESAB Annual Report 2013

Table 4.5: Applications submitted to Designated Offices, 2012-13

Designated Office	Submitted	Cancelled or Withdrawn	Active or Assessed
Dawson City	57	6	51
Haines Junction	38	9	29
Mayo	28	2	26
Teslin	18	4	14
Watson Lake	25	2	23
Whitehorse	31	7	24
Total	197	30	167

Source: YESAB Annual Report 2013

Use of Yukon government campgrounds

- Nights by camp user 2007-12 (Figure 4.6)
- Visitors using Yukon government campgrounds 2007-12 (Figure 4.7)

The Yukon government operates and maintains a system of 41 roadside campgrounds. These provide outdoor recreation opportunities, such as fishing, hiking, and wildlife viewing. Boating opportunities are available within or close to many campgrounds.

The government monitors the level of use, the type of user, and intensity of use at its campgrounds through campground registrations compiled by the Parks Branch of the Department of Environment.

Figure 4.6: Number of campsite-nights, 2007-12

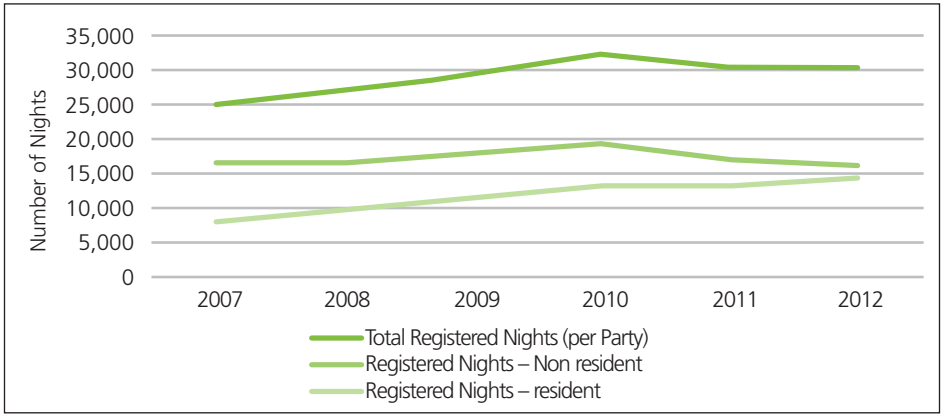
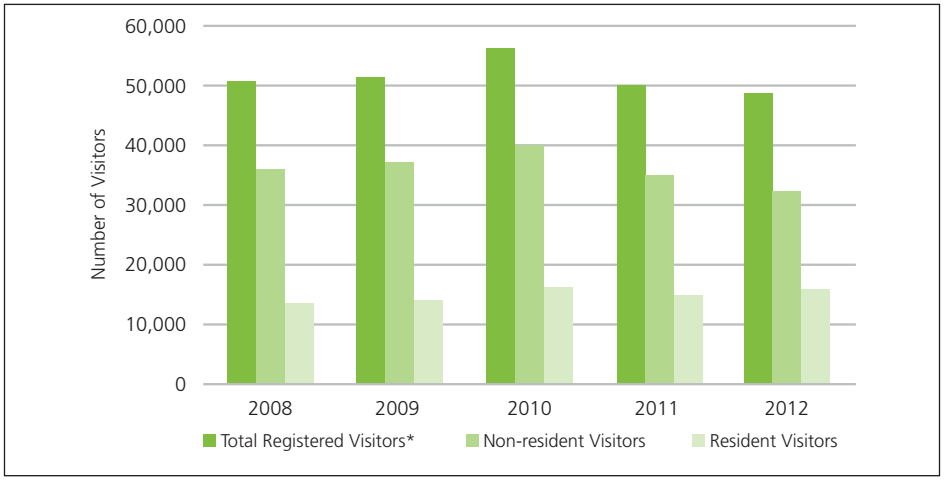


Figure 4.7: Visitors using Yukon government campgrounds, 2007-12



* Registered visitors are calculated as follows: No. of recorded visitors + (no. of unrecorded registered parties X average no. of visitors per party)

What is happening

Environmental and socio-economic assessments

Over the last eight years, an average of 260 projects per year were received for assessment by YESAB's Designated Offices and Executive Committee. The peak was in fiscal 2011-12, when 325 applications were submitted for assessment. In 2012-13, 197 applications were received, of which 167 were active or assessed. Most were for placer mining (42), followed by residential, commercial, and industrial land development (32). The Dawson City Designated Office handled the most applications (51) in fiscal 2012-13, followed by the Haines Junction Designated Office (29) (Table 4.5).

Use of Yukon government campgrounds

Over the last six years, there has been an increase in the number of "campsite-nights", the total number of campsites occupied overnight in all Yukon government campgrounds over the whole camping season. While non-resident campsite-nights peaked in 2010 at 32,077, resident campsite-nights have steadily increased, with 14,274 nights recorded in 2012 (Figure 4.6). As measured by the number of people using the campgrounds across the territory, non-resident use peaked in 2010 with resident use stable-to-increasing over the six years. (Figure 4.7).

Significance

Environmental and socio-economic assessments

YESAB's data for the number of project applications received per year shows the cyclical nature of the resource economy in Yukon. It is important to be aware of the number and type of projects reviewed by YESAB and the potential socio-economic and environmental impacts the projects may have. By making recommendations on management practices, monitoring, and reporting, YESAB assists government in determining what potential effects to the environment may occur from allowable land uses.

Use of Yukon government campgrounds

Campgrounds are an important component of outdoor recreation and tourism in Yukon. The data shows the increasing use of campgrounds by Yukon residents, while overall use is relatively consistent. This information is important in determining resources needed to maintain and operate the campgrounds, as well as monitoring the level of recreation use for the area. It is also an indicator of economic impact and the benefits of outdoor recreation to the Yukon economy.

Solid waste management

Solid waste disposal in landfills can pose environmental and health risks as well as land use planning challenges. Waste is costly to manage, whether it is sent to landfills, diverted through

Shore Camping, Kathleen Lake.

Marsh Lake.

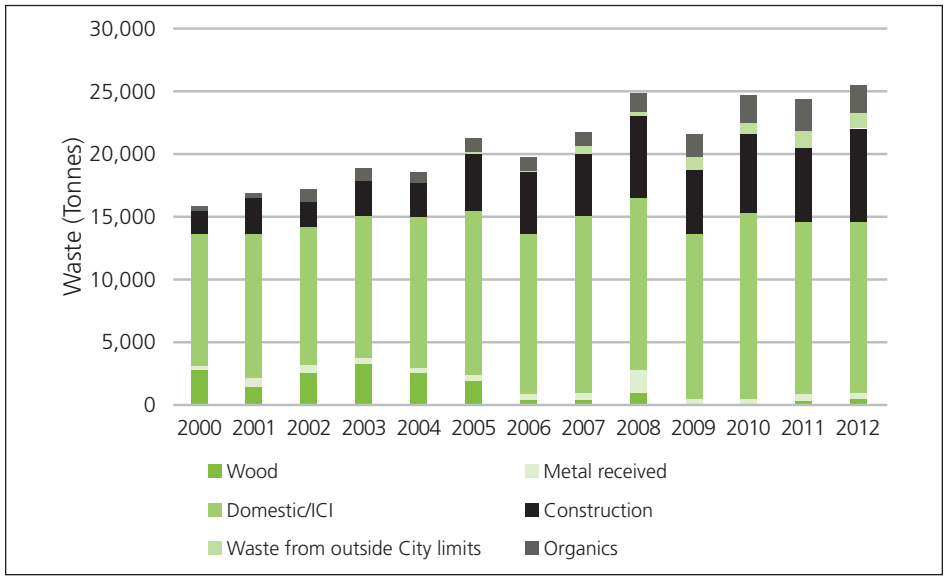
recycling and composting, or shipped outside the territory for treatment. We reduce our reliance on landfills by generating less waste and having more recycling and composting.

Indicators

Status of waste generated and waste diverted in Whitehorse

- Waste landfilled at the City of Whitehorse Waste Management Facility (Figure 4.8)
- Whitehorse waste diverted through recycling and composting (Figure 4.9)
- Curbside collection of garbage and organics (Figure 4.10)

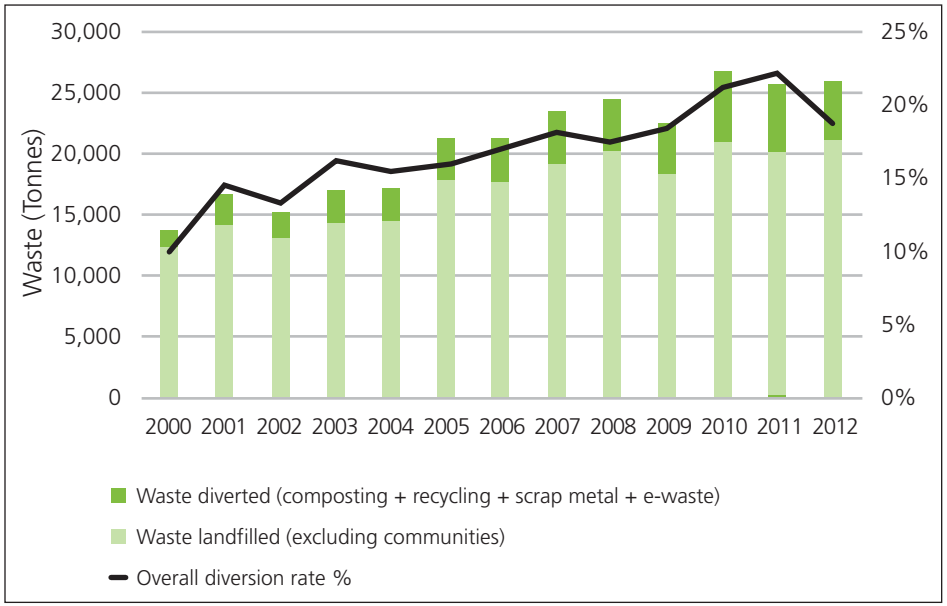
Figure 4.8: Waste landfilled at the City of Whitehorse Waste Management Facility, 2000-2012



Source: City of Whitehorse

Note: ICI = Industrial, commercial, and institutional waste

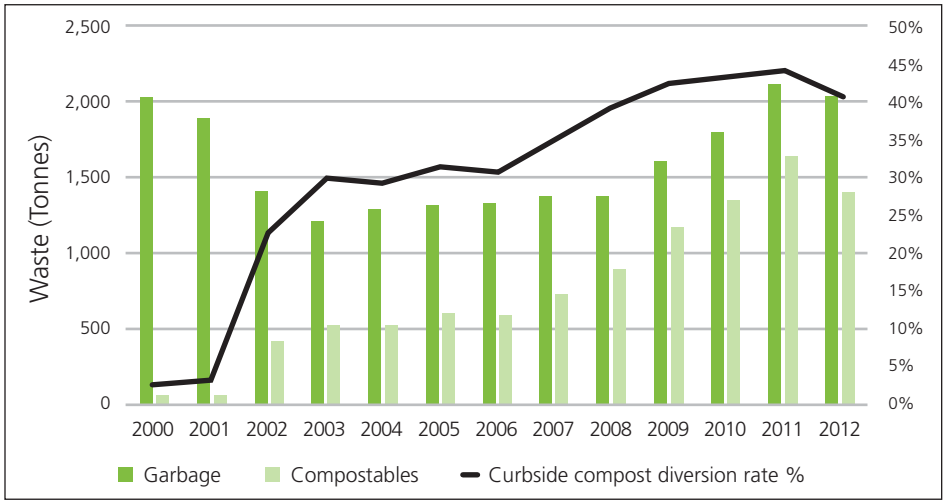
Figure 4.9: Whitehorse waste diverted through local composting program or transported outside Yukon for recycling, 2000-2012



Note: Diverted metals include white goods, car bodies, and other stockpiled metals that are shipped south for processing and recycling

Marsh Lake.

Figure 4.10: Curbside waste collected from single family homes in Whitehorse, 2000-2012



Note: Organics are processed at the central composting facility; garbage is landfilled at the City Waste Management Facility

What is happening

Since 2000 there has been an 88-percent increase in waste generated in Whitehorse (Figure 4.8). While the overall diversion rate in Whitehorse decreased from 22 percent in 2011 to 19 percent in 2012, it was still higher than the 10-percent diversion reported for 2000 (Figure 4.9).

Between 2000 and 2012, recycling rates have remained at 10-12 percent of diversion, while organics diversion has increased from 2 percent to 10 percent in that same time frame (Figure 4.9).

Households with curbside compost pick up diverted 41 percent of their household waste in 2012, comparable to the annual diversion rate for the last five years (Figure 4.10).

A Landfill Cost Assessment Report completed for the City of Whitehorse by Morrison Hershfield in January 2013 found that the capacity of the city's landfill has been reduced from 78 years to 41 years. This has a significant impact on landfill costs for the City of Whitehorse.

The City of Whitehorse accepts waste from outlying communities on a fee-for-service basis in order to lessen the landfill burden on those communities. About 6 percent of the waste landfilled in Whitehorse comes from communities outside Whitehorse.

Recycling.

The Yukon government increased funding for operations and infrastructure improvements for Yukon communities, consistent with the *Yukon Solid Waste Action Plan*. The action plan is focused on:

- improving composting, recycling and waste diversion,
- enhancing waste handling systems and site safety,
- installing groundwater monitoring stations, and
- improving household hazardous waste management at all facilities.

Ground water monitoring wells are installed in all community solid waste facilities except for Eagle Plains and Old Crow. All solid waste facilities have stopped the open burning of garbage except for Eagle Plains.

Significance

A growing population, increased construction and demolition projects, and accepting waste from communities affect the total waste being landfilled in Whitehorse. The waste generated on a per person basis has increased by 37 percent over 2000 levels. If diversion rates do not increase, the Whitehorse landfill will be full in 41 years. It will cost about $13.5 million to close the facility, with an additional $13.7 million needed to open a new landfill.

Waste disposal can negatively affect the quality of land, air and water. Individuals can mitigate these impacts by reducing, reusing, recycling and composting their waste as much as possible. Waste diversion through recycling and composting creates employment opportunities; recycling also prolongs resource supplies.

Taking action

The *Whitehorse Solid Waste Action Plan* released in 2013 set a goal of 50-percent waste diversion by 2015 as a first step in meeting the city's Strategic Sustainability Plan's goal of Zero Waste by 2040. Among the new services proposed are:

- organics collection from multi-residential housing and businesses,
- pilot waste/organic collection from rural residential, and
- increased funding to recycling processors to secure private-sector recycling of non-refundable items.

In 2013, the City of Whitehorse amended its Waste Management Bylaw to include cardboard as a controlled waste in order to increase the diversion of cardboard from the landfill. It will cost more to deposit cardboard in the landfill. Cardboard was estimated to comprise 7 percent of the waste sent to the landfill at the time the bylaw was amended.

Tombstone Territorial Park.

Other changes in 2013 to solid waste management included: enhanced infrastructure at the City of Whitehorse compost facility to increase capacity and quality, a private-sector fee-for-service recycling collection program offered in Riverdale and Porter Creek, and the ability to recycle clean styrofoam at the Raven Recycling Society's depot.

The practice of burning domestic garbage has ended in all unincorporated community solid waste facilities operated by the Yukon government, except for Eagle Plains. All non-Yukon government facilities have also stopped burning garbage. In addition, groundwater monitoring wells have been installed in all Yukon government and non-Yukon government facilities, with the exception of Eagle Plains and Old Crow. Old Crow is now burning its garbage in an approved solid waste incinerator. Incineration at high temperatures means less pollution is emitted, with less impact on human and environmental health.

Data quality

The City of Whitehorse weighs waste at its management facility to ensure high-quality data. Interpreting the data can be challenging, as commercial, construction, and domestic waste arrive co-mingled. Data regarding waste diversion are incomplete and difficult to correlate to an annual diversion rate, due to stockpiling and shipping irregularities (e.g. road closures, varying schedules, lack of container availability, etc.).

There is no data for what is happening in Yukon communities, other than the weight of material sent to Whitehorse for landfilling.

PROFILE

Ecological and Landscape Classification Program Five-Year Strategic Plan

In 2013, the Yukon government released a strategic plan for the Ecological and Landscape Classification Program (ELC). The ELC is establishing an ecosystem classification and mapping system to support a variety of programs and services, such as land use planning, environmental assessments, and forest management. The focus of the program for the period 2013-2018 includes:

ELC Framework: Provide a uniform approach to Yukon ecological landscape classification and mapping to facilitate the integration and exchange of ecosystem knowledge across multiple disciplines.

Standards: Ensure products are developed from a set of defined, consistent, and coordinated standards. These products provide foundational ecological information for sustainable resource planning and management.

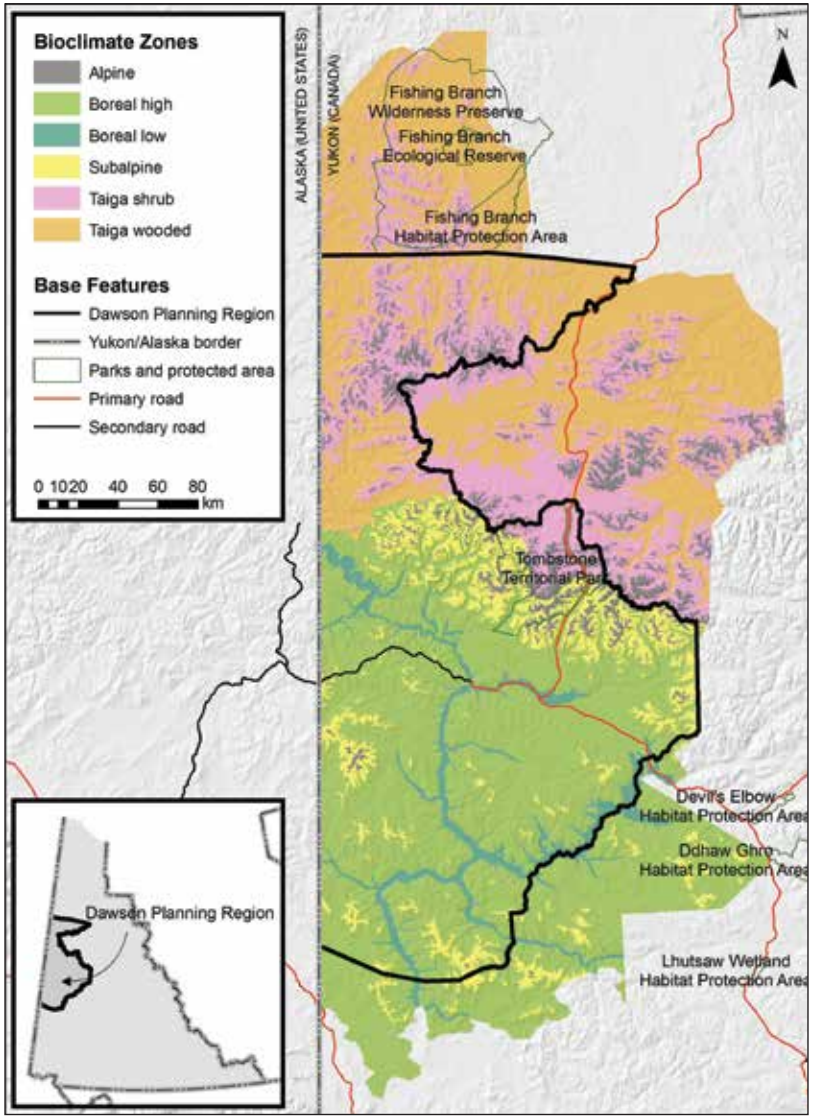
Program Services: Enhance understanding of Yukon's landscape by providing access to ecological knowledge, to support policy and decision making.

Implementation of the strategic plan includes a monitoring and evaluation approach to ensure the goals and objectives are being met over the next five years.

In 2012-13, an ecological map was produced for the Dawson Planning Region (West-Central Yukon) to describe the region's landscape and ecology (Figure 4.11). This information was used to support habitat assessments and to characterize terrain features and ecological relationships (such as fire and regeneration patterns) of the region.

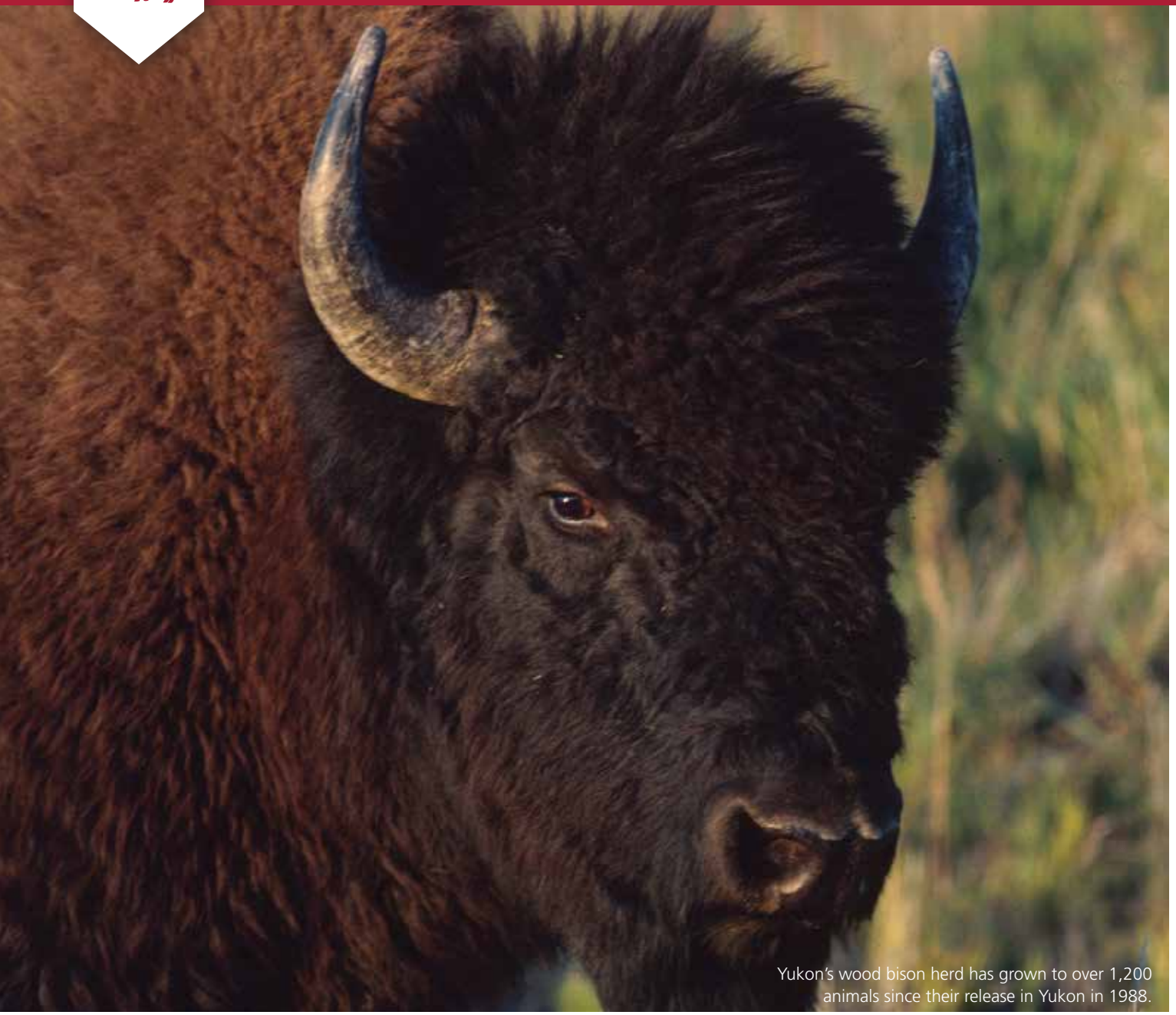
Supporting reports for this project are at *www.env.gov.yk.ca/elc* on the Projects and Initiatives page. Ecological maps can be downloaded from the Corporate Spatial Warehouse (www.geomaticsyukon.ca) Imagery and Data page, under Biophysical Datasets.

Figure 4.11: Bioclimate zones of the Dawson Planning Region



Source: Grods et al. 2012

Fish and Wildlife



Yukon's wood bison herd has grown to over 1,200 animals since their release in Yukon in 1988.

Caribou swimming in the Porcupine River near Old Crow. Yukon has 28 caribou herds.

The Government of Yukon monitors and manages many aspects of the territory's environment. This year's *State of the Environment Report* describes what is happening with several fish and wildlife species, contaminant monitoring, species at risk, and invasive species.

Population trends and planning initiatives

The health of fish and wildlife populations is important for healthy ecosystems and the well-being of the people who rely on them. Planning processes identify long-term and cooperative management solutions that ensure healthy fish and wildlife populations.

Indicators

Trends for select species and the development of plans to manage fish and wildlife populations

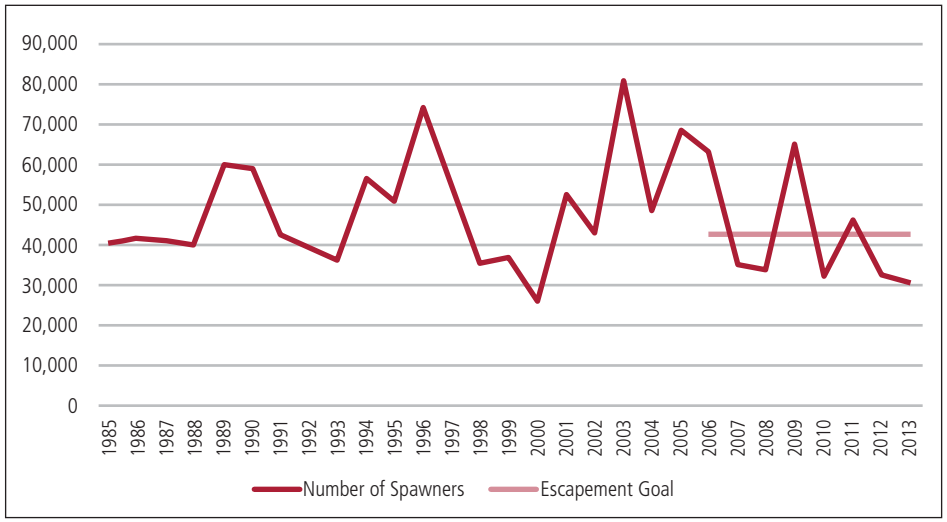
- Returns of spawning Chinook salmon (Figure 5.1)
- Sustainability of lake trout fisheries (Figure 5.2)
- Status of woodland caribou herd populations (Table 5.1)

- Distribution of Yukon caribou herds (Figure 5.3)
- Status of community-based wildlife plans and species plans (Table 5.2)

Harvest of fish is considered to be unsustainable when it exceeds the Optimal Sustainable Yield (OSY). Overharvested populations will decline and the fishing will become poor if no management actions are taken. In some cases, harvest may appear to be sustainable, when in fact a lake trout population has been depressed (e.g., Snafu Lake and Braeburn Lake as shown on Figure 5.2 with the *). Harvest data are available for the lakes where the most intensive fisheries take place (Figure 5.2). Fisheries on other lakes are expected to be, in most cases, within sustainable levels.

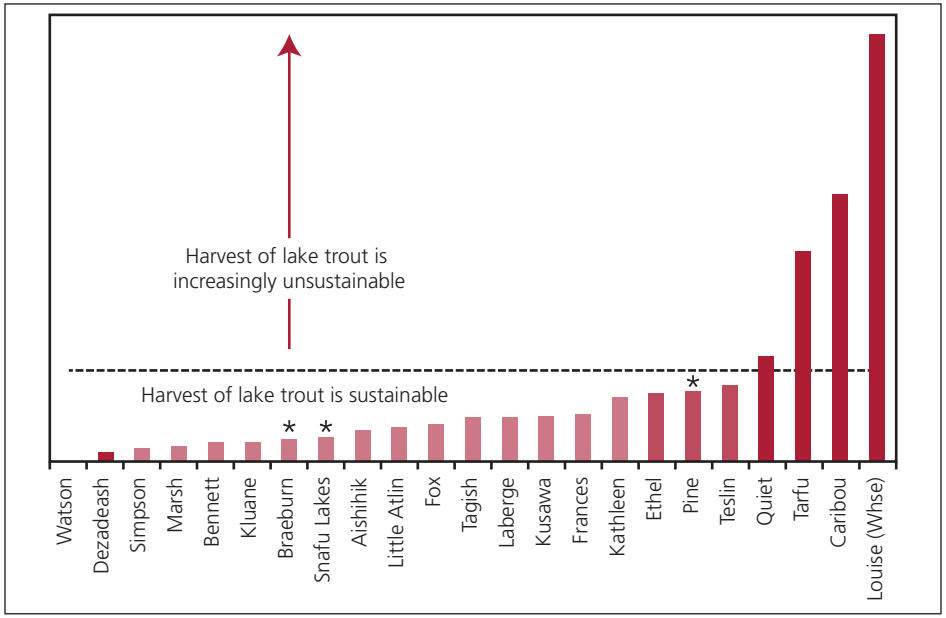
Regional fish and wildlife work plans are part of an ongoing cooperative approach to fish and wildlife management between the Yukon government, First Nations, and Renewable Resource Councils in non-overlapping traditional territories. The plans are developed to address local fish and wildlife management concerns in a coordinated manner within a traditional territory (Table 5.2).

Figure 5.1: Number of Chinook salmon spawning in the Canadian portion of the Yukon River, excluding the Porcupine River drainage, 1985-2013



Note: Escapement means the conservation target for the number of fish that reach the spawning grounds.
Sources: Yukon River Salmon 2012 Season Summary and 2013 Season Outlook. Fisheries and Oceans Canada Yukon River Salmon Update August 23 2013.

Figure 5.2: Sustainability of angler harvest on select Yukon lake trout populations based on angler harvest data up to 2011



Source: Environment Yukon

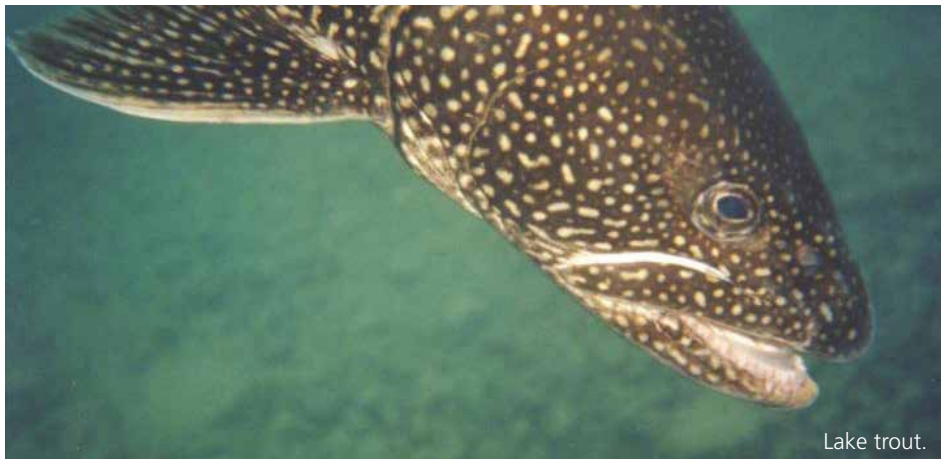

Lake trout.

Table 5.1: Status of woodland caribou herd populations in Yukon, 2014

Barren Ground Caribou				
Herd	Size	Method	Assessment Year	Current Trend
Fortymile	51,000	Estimate (4)	2010	Increasing
Porcupine	169,000	Estimate (4)	2010	Increasing

Woodland Caribou				
Herd	Size	Method	Assessment Year	Current Trend
Aishihik	2,050	Estimate (5)	2009	Increasing
Atlin	800	Estimate (2)	2007	Stable
Bonnet Plume	5,000	Guess	1982	Unknown
Carcross	800	Estimate (2)	2008	Stable
Chisana	680	Estimate (5)	2010	Stable
Clear Creek	900	Estimate (2)	2001	Unknown
Coal River	450	Estimate (1)	2008	Unknown
Ethel Lake	300	Estimate (2)	1993	Stable
Finlayson	3,100	Estimate (2)	2007	Declining
Hart River	2,200	Estimate (2)	2006	Unknown
Horseranch	600-1000	Estimate (2)	2000	Unknown
Ibex	850	Estimate (2)	2008	Increasing
Klaza	1180	Estimate (5)	2012	Increasing
Kluane	180	Estimate (5)	2009	Declining
Laberge	200	Estimate (2)	2003	Unknown
Labiche	450	Estimate (1)	1993	Unknown
Liard Plateau	150	Estimate (1)	2011	Stable
Little Rancheria	800 - 1000	Estimate (2)	1999	Unknown
Moose Lake	300	Estimate (2)	1991	Unknown
Pelly Herds	1,000	Estimate (3)	2002	Unknown
Redstone	10,000	Estimate (1)	2012	Stable
South Nahanni	2,100	Estimate (5)	2009	Stable
Swan Lake	600-800	Estimate (2)	2007	Unknown
Tatchun	500	Estimate (1)	2000	Unknown
Tay River	3,750	Estimate (2)	1991	Unknown
Wolf Lake	1,500	Estimate (2)	1998	Unknown

* (1) total count (2) stratified random quadrate (3) extrapolation (4) direct photocount (5) mark-resight

Figure 5.3: Distribution of caribou herds in Yukon (refer to Table 5.1 for status)

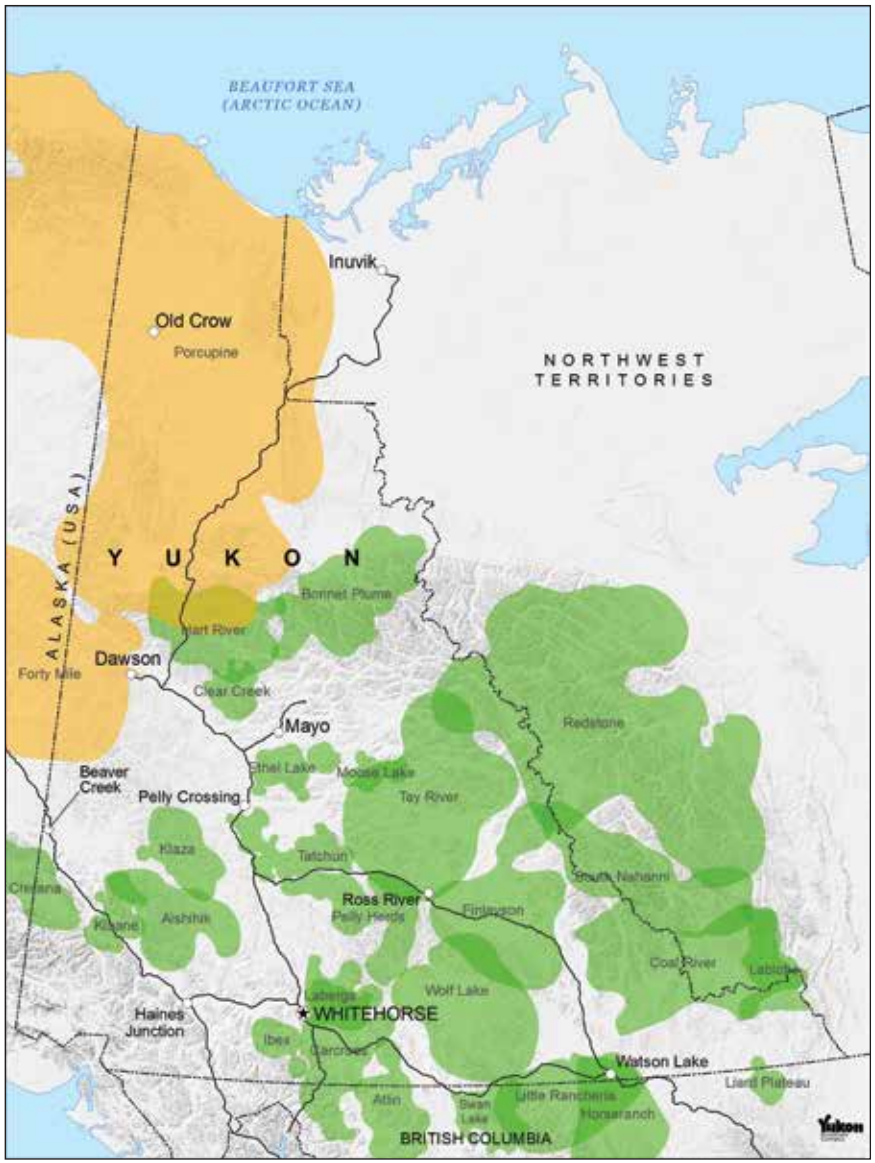


Table 5.2: Status of fish and wildlife work plans and species plans, 2014

Plan	Approved	Status
Community-based fish and wildlife work plans		
Champagne and Aishihik Traditional Territory	No	Being updated
Dezadeash Lake	No	Underway
Little Salmon/Carmacks Traditional Territory	2012	Current
Na-Cho Nyäk Dun Traditional Territory Community Based Fish and Wildlife Work Plan	2008	Being updated
Regional Assessment of Wildlife in the Yukon Southern Lakes Area	2012	Current
Teslin Tlingit Traditional Territory	No	Suspended
Vuntut Gwitchin Traditional Territory	2013	Current
Species Plans		
Baikal Sedge Recovery Strategy	2011	Current
Management Plan for Elk in Yukon	2008	Current
Management Plan for the Aishihik Wood Bison Herd in Southwestern Yukon	2012	Current
Management Plan for the Chisana Caribou Herd	2012	Current
Mandanna Lake	2013	Current
North Slope Muskox Management Plan	No	Underway
Northern Mountain Caribou Management Plan	2012	Current
Porcupine Caribou Harvest Management Plan	2010	Current
Wolf Conservation and Management Plan	2012	Current
Yukon Amphibian Management Plan	2013	Current

Source: Updates from Environment Yukon

What is happening

The spawning conservation target (escapement range) of 42,500 – 55,000 Canadian-origin Chinook was not met in 2013, with a preliminary return estimate of 30,725. This is the fifth time in the last seven years that the escapement goal was not met and is the lowest run estimated from 1985 to 2013 (Figure 5.1).

Harvest restrictions (both voluntary and enforced) in response to the recent low salmon runs have caused hardships for commercial and traditional harvesters in both Alaska and Yukon. Chinook salmon returns vary considerably due to a suite of factors, including: the strength of returning age classes, in-river harvest, offshore unintentional by-catch in the pollock fishery, predation, disease loads, water levels, and temperature. Environmental variables are also a factor: e.g., climatic events such as the Pacific decadal oscillation, El Niño, and La Niña.

Moose on Yukon River near Selwyn.

The majority of lake trout harvest in Yukon was sustainable, with most water bodies expected to maintain quality fisheries (Figure 5.2). Four lakes had a harvest that exceeded the sustainable limits: Quiet, Caribou, Tarfu, and Louise lakes. Teslin and Ethel lakes were nearing the point where harvest becomes unsustainable. While the lake trout harvest in Braeburn, Snafu, and Pine lakes is low, it might be unsustainable because these lake trout populations appear depleted. Generally, small lakes are more vulnerable to overharvesting because of their smaller lake trout populations and lower sustainable yields.

Of the 28 caribou herds present in Yukon (Table 5.1, Figure 5.3), 5 were increasing in size, 7 were considered relatively stable, 14 were unknown, and 2 were declining. The declines in herds in Yukon and across the circumpolar North may be due to environmental changes, natural population cycles, or human influences such as harvest and development.

Two community-based fish and wildlife work plans are current and three are under development. A regional wildlife assessment provides recommendations for the Southern Lakes area. Nine species plans are current and one planning process is underway (Table 5.2). These plans recognize that science, local, and traditional knowledge must all be considered when managing fish and wildlife.

Fish and Wildlife

Dall's Sheep, Kluane National Park. © Richard Legner 2013

Significance

Chinook salmon are an important part of ecosystems. They are a key food source for bears, eagles, and other predators, as well as bringing nutrients from the ocean to freshwater and terrestrial ecosystems. Salmon are important culturally, socially, and economically in Yukon. Despite having the Yukon River Salmon Agreement in place since 2001 to help rebuild and conserve stocks, Chinook salmon returns continue to fall short of the escapement target.

Lake trout are considered an indicator species due to their slow growth, position at the top of the aquatic food chain, reliance on healthy and clean habitats, and high value in Yukon fisheries. Healthy lake trout populations reflect the general health of an aquatic ecosystem. The status of lake trout fisheries informs management decisions affecting sustainable fisheries.

Caribou are important ecologically and culturally. Many people in Yukon also rely on caribou for subsistence and spiritual well-being. Caribou herds that cross jurisdictional boundaries require a coordinated approach to their management: e.g., Porcupine caribou herd.

Taking action

Regulation changes for Pine, Jackson (Louise), Snafu, and Tarfu lakes were put forward in 2013 by the Yukon Fish and Wildlife Management Board to address conservation concern in these water bodies. If ratified, these changes will result in restrictions on catch and possession limits for lake trout.

Harvest restrictions for Chinook salmon began in 2007. In order to maintain a healthy number of spawning salmon even in this time of low productivity, fisheries managers in Yukon and Alaska have undertaken a range of actions since 2008, including full or partial closures of commercial, domestic, and recreational fisheries, decreasing mesh sizes, and reducing fishing times in the subsistence fishery. As well, First Nations have put voluntary restrictions in place.

The Yukon River Panel, established by the Yukon River Salmon Agreement, recommends spawning goals and funds restoration and enhancement projects for Canadian-origin Chinook salmon ($1.2 million annually). In 2014, the United States and Canada Joint Technical Committee is to begin discussions on a new biologically based escapement goal for Canadian Chinook salmon. The use of the Eagle sonar and associated biological sampling program are providing higher accuracy and more reliable estimates than previous tools.

From 2009 to 2012, Environment Yukon surveyed key fisheries in 12 lakes and 2 rivers through angler harvest studies. Staff conducted fish population assessments on 14 lakes to better understand which fish populations are sustainable and which need management action. The department is developing new population assessment methods for Arctic grayling and burbot in order to better understand the state of the resource.

Environment Yukon continually monitors several caribou herds in order to assess overall status and trends. A recovery or management plan for the boreal and northern mountain caribou populations has been developed under the federal *Species at Risk Act.*

Data quality

Data are standardized by the agencies collecting the information. Estimates of returning spawning salmon are based on sonar estimates in Eagle, Alaska (2005-2013), radio tagging studies (2002-2004), and aerial survey counts (1985-2002). The methods used prior 2005 underestimated the number of returning salmon, so salmon returns were corrected in Figure 5.1 to remove the bias.

Caribou herd population status is usually determined through aerial surveys. The Yukon government has modified its approach over the past few years to use aerial surveys in combination with collared or marked animals. This approach has increased the precision of the estimates, as well as providing additional information on seasonal ranges and habitat use.

Contaminants

Heavy metals, persistent organic pollutants, and radionuclides can persist in the environment. Contaminants concentrated along the food chain may have serious health implications for wildlife as well as people – especially those who depend on traditional foods. Many contaminants found in the North were never used in the region or have been banned or restricted for many years. Transported here by wind and water, they tend to settle out in colder climates.

PROFILES

Population Trends and Planning

Estimating Herd Size Using "Marked" Animals
Biologists survey woodland caribou when the animals are most visible. This is usually in fall when the animals are primarily in the alpine and are in larger groups during the breeding period, or rut. This approach tends to miss caribou that are below treeline, however, because it is harder to see them from the air.

The Yukon government recently adopted a new technique to count caribou and estimate the herd's population. It relies on having a number of animals in the herd that are radio-collared (these are called marked animals). When the fall surveys take place, the number of radio-collars and total animals seen are compared to the number of radio-collared animals not seen. This information allows the biologists to estimate the herd's population.

This approach was used in 2010 to estimate the size of the Chisana caribou herd. Biologists conducted an aerial survey and counted the animals seen and the collars seen. Next, they compared the number of radio-collars detected but not seen and their location. All collared caribou were found on a later flight for the purpose of completing this analysis. The Klaza caribou herd was surveyed in 2012 using a similar approach, with 30 collared caribou used as the marked sample *(Inventory Studies Klaza Caribou Herd: 2012 Activities).*

This technique is known as a mark-resight method. It was also used to estimate the South Nahanni caribou herd population in 2009 (Hegel et al. 2010). A different approach was used to estimate the populations of the Aishihik and Kluane caribou herds in 2009. Instead of relying on collars already in the herd, a sample of caribou were temporarily marked with dye to generate the population estimate for the herds. This was a test to see if dye would work as a less intrusive method for marking animals (Hegel and Russell 2010). This approach demonstrated that a mark, whether it is a radio-collar or a dye mark, is useful for making reliable population estimates on specific caribou herds. There are considerations on how many marked animals must be present in the herd so that this can be effective. However, the mark-resight method using radio-collars is proving to be more efficient than previous population census techniques.

Monitoring Collared Pikas
Collared Pika, named for the partial pale grey collar around their neck, are monitored because they are sensitive to climate change effects. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed pikas as a species of Special Concern.

In July and August 2013, volunteers, community groups, and park rangers, determined the presence or absence of pika in Tombstone Territorial Park at 60 to 120 talus sites, using basic and non-invasive survey methods. Data from year-to-year will be compared to assess trends in how suitable habitat is occupied. As well, the 2013 data will be compared with data collected in 2009 at 59 talus sites to determine if there was a change in occupancy rates, which would signal a change in population status.

Monitoring the status of species at risk in Yukon, with a focus on documenting population change, will help with the development of national (or territorial) recovery strategies for pika, as required under the federal *Species at Risk Act.* For more information on this and other research projects, refer to the *2013-14 Fish and Wildlife Branch Project Summaries report*.

Management Plan for Yukon Amphibians
The Yukon government released in December 2013 a plan to guide the management of amphibians found in the territory: the Wood Frog, Western Toad, Boreal Chorus Frog, and Columbia Spotted Frog.

Globally, amphibians are in trouble, with 33 percent of species threatened and 7 percent near extinction (Stuart et al. 2004). Amphibians are considered a good indicator of local environmental health because they are sensitive to changes to ecosystems. Amphibians are culturally important to many First Nations and are of interest to the public.

The amphibian management plan provides a broad framework for action. It recognizes there is limited information on amphibian populations, so it supports further information being collected. The objectives of the management plan are to:

- improve knowledge of the distribution and abundance of amphibians,
- identify and maintain key habitats,
- assess and mitigate threats to amphibian populations, and
- increase public appreciation of amphibians and their habitats.

The Western Toad is listed as a species of Special Concern under federal legislation. The Yukon plan will be incorporated into the federal recovery management plan.

Fish and Wildlife

Bald Eagle at Wellesley Lake.

Indicators

Contaminant levels in key wildlife populations

- Mercury levels in caribou
- Cadmium levels in caribou and moose
- Airborne mercury levels
- Mercury levels in fish in Laberge and Kusawa Lakes

Mercury levels have been measured in the Porcupine caribou since 1994. The Northern Contaminants Program (NCP) has determined that, while mercury fluctuates over time in caribou organs, over the long term it has remained stable in the Porcupine caribou herd.

This is the last year cadmium levels in caribou and moose will be listed as an indicator in the State of the Environment report. Following long-term monitoring, the NCP has concluded that cadmium levels are not changing and appear to be the result of natural local sources rather than long-range transport. More specifically, the cadmium is coming from the underlying geology of areas within the Yukon. Some areas have small amounts of cadmium and others have more. Levels of cadmium vary between herds with local geology and the amount of willow available to eat, as willow hyper-accumulates cadmium.

An air monitoring station above Little Fox Lake has undertaken continuous atmospheric mercury sampling since 2007. Results to date indicate there is no evidence showing any changes of the mercury levels above the global background level.

The NCP has monitored fish since 1993 (Lake Laberge) and 1996 (Kusawa Lake) for mercury concentrations and fish consumption levels. Currently, there are no consumption advisories for lake trout.

What is happening

Caribou feed on lichen that can directly adsorb airborne contaminants, such as mercury. The annual changes in mercury in Porcupine caribou may reflect changes in atmospheric mercury levels or changes in the environment (e.g., temperature, precipitation, and wind) that affect how mercury moves from the air to caribou forage.

Caribou and moose meat remained a healthy food choice because cadmium levels were low. Over the last 15 years, cadmium levels did not appear to be changing.

The NCP was able to use archived caribou tissue samples to study potential effects of the Fukushima Daiichi nuclear accident (March 2012) on Porcupine caribou. A comparison of samples taken before and after the accident has indicated no increase in radioactivity in the caribou as a result of the accident.

The Northern Contaminants Program works towards reducing and, where possible, eliminating contaminants in traditional/country foods, while providing information that assists individuals and communities in making informed decisions about their food use.

Significance

The concentration of mercury in barren-ground caribou continues to be very low. Although mercury concentrations do not appear to be increasing over the long term, monitoring of the Porcupine caribou herd will continue, as well as of the Qamanirjuaq caribou herd in the eastern Arctic, so that the Yukon Contaminant Committee will be aware if that situation changes.

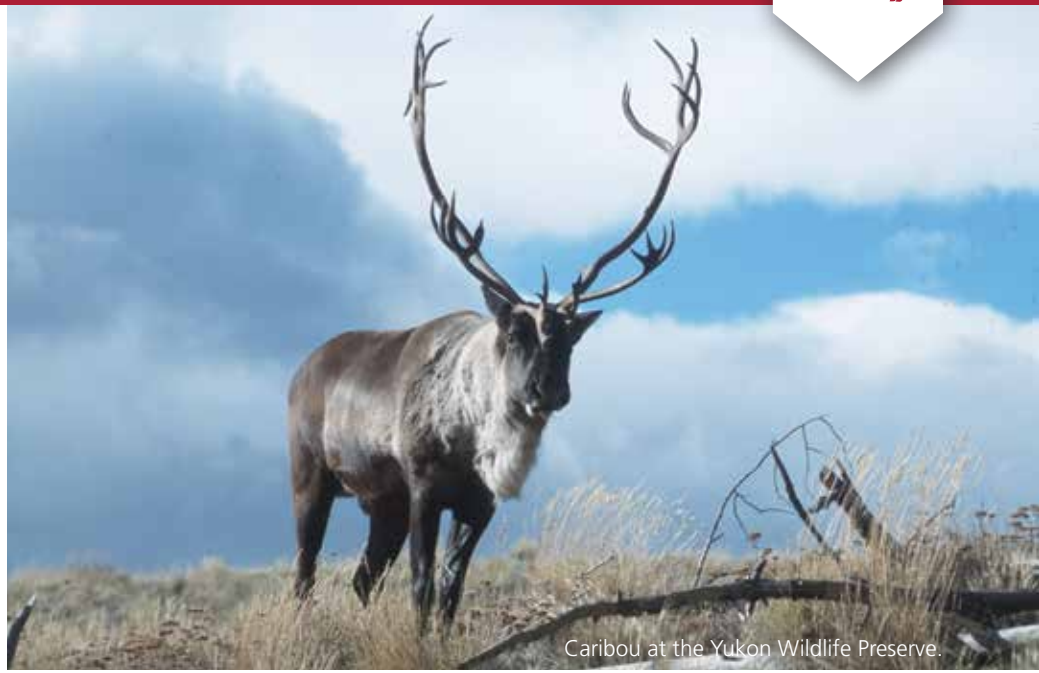
Taking action

The federal Northern Contaminants Program (NCP) has guided and funded contaminants research and monitoring in Yukon since 1991. The program has supported a wide range of contaminant studies in addition to monitoring contaminants in the Porcupine caribou herd, air quality at Little Fox Lake, and lake trout fish consumption. The NCP recently completed a Call for Proposals for 2014/15 fiscal year for the continued funding of research and monitoring on contaminants in the North.

Species at risk

The loss of biodiversity – the variety of life that exists on our planet – and the increasing rate at which that loss is happening are of international concern. The United Nations recognized this by declaring the Decade on Biodiversity (2011-2020) to promote an overall vision of living in harmony with nature.

The Yukon Conservation Data Centre tracks all species native to the territory, assigning a sub-national rank that indicates if they are of conservation concern. At the national level, the Committee on the Status of Endangered Species in Canada (COSEWIC) assesses wild species of conservation concern and ranks them as Extinct, Extirpated, Endangered, Threatened, of Special Concern, Not at Risk, or Data Deficient. Species at Risk found in Yukon require additional attention in their management, which may be a territorial (most terrestrial mammals, non-migratory birds) or federal (migratory birds, marine mammals, marine fish) responsibility.



Caribou at the Yukon Wildlife Preserve.

Columbia Spotted Frog.

Fish and Wildlife

Indicators

Species at risk found in Yukon

- Status of amphibians, birds, fish, mammals, plants, and insects (Table 5.3)

Table 5.3: National status of species at risk that occur in Yukon, 2014

Taxonomic Group	Common Name / Population	COSEWIC Status	Recovery Strategy or Management Plan
Amphibians	Western Toad	Special Concern	Underway
Birds	Barn Swallow	Threatened	No
	Bank Swallow	Threatened	No
	Canada Warbler	Threatened	Underway
	Common Nighthawk	Threatened	Underway
	Horned Grebe	Special Concern	No
	Peregrine Falcon	Special Concern	No
	Rusty Blackbird	Special Concern	Underway
	Short-eared Owl	Special Concern	No
	Olive-sided Flycatcher	Threatened	Underway
	Buff-breasted Sandpiper	Special Concern	No
Fish	Bering Cisco	Special Concern	No
	Dolly Varden (Western Arctic population)	Special Concern	No
	Squanga Whitefish	Special Concern	No
	Bull Trout (Western Arctic population)	Special Concern	No
Mammals	Bowhead Whale	Special Concern	Current
	Collared Pika	Special Concern	No
	Little Brown and Northern Long-eared Bats	Endangered	No
	Grey Whale	Special Concern	No
	Grizzly Bear (Northwestern population)	Special Concern	No
	Polar Bear	Special Concern	No
	Wolverine (Western population)	Special Concern	No
	Wood Bison	Special Concern	Underway
	Woodland Caribou (Boreal population)	Threatened	Current
	Woodland Caribou (Northern Mountain population)	Special Concern	Current
Plants	Baikal Sedge	Threatened	Current
	Yukon Draba	Endangered	No
Insects	Dune Tachinid Fly	Special Concern	No

Source: Committee on the Status of Endangered Wildlife in Canada.

What is happening

Short-eared owl.

In 2014, Yukon had the second-lowest number of species at risk, behind Prince Edward Island. Northwest Territories has almost twice as many species at risk as Yukon. However, COSEWIC had yet to assess every Yukon species that might be at risk.

In 2012, Little Brown Bats and Northern Long-eared Bats were assessed as endangered. In November 2013, Wood Bison was down-graded to Special Concern in Yukon. Spiked Saxifrage, a plant species previously assessed as Threatened, was requested to be withdrawn from listing under the federal *Species at Risk Act* (SARA) because several new populations of the plant were found. Reassessment will take place in future.

As of 2014, COSEWIC has identified 686 species at risk in Canada: 15 Extinct, 22 Extirpated, 302 Endangered, 166 Threatened, and 196 of Special Concern.

Through the Biodiversity Section of the Fish and Wildlife Branch, the Yukon government supports the management of species of risk through:

- participation in national species at risk forums,
- coordination of management planning for Yukon species by providing technical representation on national species at risk teams for key species,
- developing territorial general status ranks for vertebrate species (freshwater fish, resident birds, and raptors) in a workshop setting that includes resident Yukon experts for these species groups,
- providing technical input from Yukon into national species status assessments, and
- preparing reports on investigations of species at risk deemed as priority.

Significance

Competition from alien invasive species, habitat loss, and a changing climate are the major reasons why many species are at risk in Canada. Other factors include genetic and reproductive isolation, environmental contamination, overharvesting, and disease. Different tools are required at territorial, national, and international levels for the effective protection of species at risk.

Biodiversity is the term given to the variety of life on Earth and the natural patterns it forms. It is this combination of life forms and their interactions with each other and with the rest of the environment that has made Earth a uniquely habitable place for humans. There is great intrinsic value in having healthy ecosystems with all of their component parts, as well as benefits to individuals and society.

Taking action

National Recovery Strategies and Management Plans are currently being developed for six species found in Yukon: Rusty Blackbird, Western Toad, Canada Warbler, Common Nighthawk, Olive-sided Flycatcher, and Wood Bison. Management plans have been completed for Baikal Sedge and Woodland Caribou (mountain and boreal populations).

The Yukon government contributes to national species at risk recovery plans in partnership with other governments and groups in the territory. Yukon government technical experts sit on recovery planning teams convened by Environment Canada to share knowledge of the local situation.

The Yukon Conservation Data Centre serves as a central source for all rare species data for the territory. A coordinator and a biodiversity information specialist make up the data centre. Partners include Environment Canada, Parks Canada, and NatureServe Canada. The centre continues to incorporate new partners and increase the available data to support the management of species at risk in Yukon.

Environment Yukon holds workshops periodically to inform participants about current species at risk matters and new species of conservation concern, as well as to improve communications on species at risk management in Yukon.

Invasive species

Plants, animals, and microorganisms introduced outside their natural range by human action are considered alien species. Invasive species are those alien species whose introduction has an environmental, economic, or social cost.

Yukon's first alien plant species was collected in 1883. Today, an estimated 147 alien plant taxa have been identified in Yukon, with 86 now believed to be present, of which 20 are considered invasive (Yukon Conservation Data Centre 2013).

The 13 known alien animal species are not considered invasive.

Indicators

Presence of alien and invasive species

- Invasive species along Yukon highway corridors (Figure 5.4)
- Top 10 list of invasive and alien species (Table 5.4)

In 2007, a survey of highways, pullouts, and gravel pits was conducted that identified 28 alien plant species, with 17 categorized as invasive. Yukon data on alien plant species is available from the Alaska Exotic Plants Information Clearinghouse (Alaska Natural Heritage Program 2013).

Little Brown Bat.

PROFILE

Northern Bats and White-nose Syndrome

Bats are an important component of Yukon ecosystems and a good indicator of ecosystem health (Jung 2012).

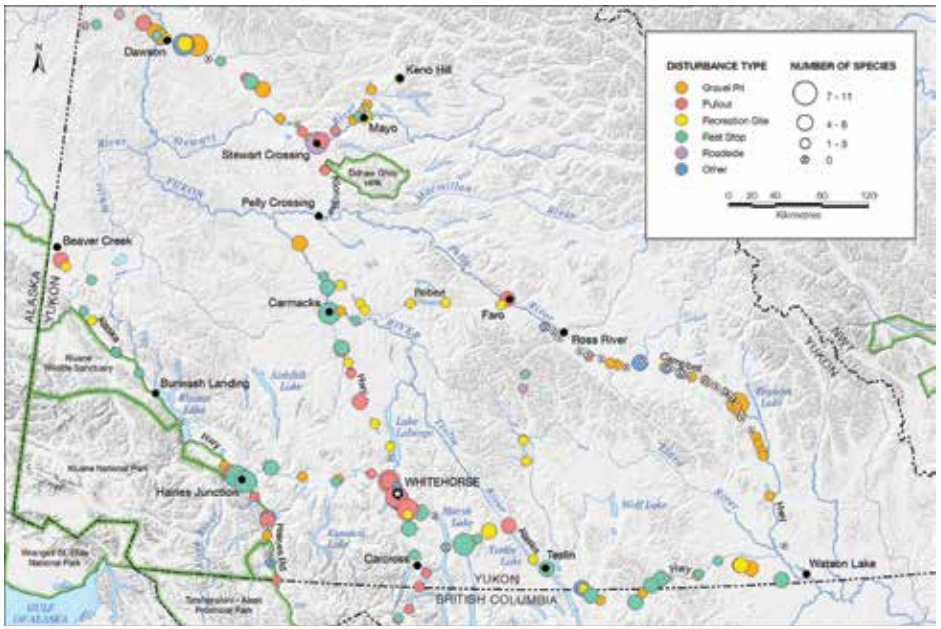
In 2012, COSEWIC assessed Little Brown and Northern Long-eared bats as endangered in response to mass die-offs of bat colonies due to White-nose Syndrome (WNS). WNS is a disease associated with a fungal infection that affects hibernating bats. First discovered in 2006 in New York State, it has caused local extinction of multiple bat species within 20 years of contact, the fastest mammal declines known to date. WNS is spreading westward and has been confirmed in Ontario. It is estimated that several million bats have died from this disease.

Yukon government biologists are monitoring the Little Brown Bat population here. The information collected, which will provide a baseline to assess impacts if WNS were to spread to Yukon bats, is being shared with COSEWIC. The monitoring project was designed to make the information comparable at a continental level. The information will also be used to assist in developing recovery strategies for the two endangered species.

For more information on the project refer to: Estimating Little Brown Bat (*Myotis Lucifugus) Colony Size in Southern Yukon: A Mark-Recapture Approach.*

In 2013, a Spotter's Network was launched, with 34 participants trained to identify and report on the most prolific invasive alien species in Yukon. To assist with data collection, a Top 10 list of the more invasive species was developed (Table 5.4). Anyone who is aware of one or more of these species' locations in the territory should consider reporting it.

Figure 5.4: Distribution of alien plant species along Yukon highways in 2007
Source: Environment Yukon (2008)



Creeping Thistle at Ft. Simpson.

Table 5.4: Top 10 invasive alien species selected for the Spotter's Network, 2013

Common name	Scientific name
Common Tansy	Tanacetum vulgare
Creeping Thistle	Cirsium arvense
Leafy Spurge	Euphorbia esula
Orange Hawkweed	Hieracium aurantiacum
Oxeye Daisy	Leucanthemum vulgare
Perennial Sow Thistle	Sonchus arvensis
Scentless Chamomile	Tripleurospermum inodorum
Spotted Knapweed	Centaurea stoebe
Tall Hawkweed	Hieracium piloselloides
Zebra and Quagga Mussel	Dreissena polymorph, D. bugensis

What is happening

Alien species are introduced through ballast water, recreational boating, aquarium trade, pet trade, horticultural trade, "hitchhikers" on commodities, stowaways in various modes of transportation, and disease in wildlife (Government of Canada 2004). Pathways of introduction

for invasive alien plants in Yukon are infrastructure, linear disturbances (roads/power lines, cut-lines), compacted soil, mine development, horticultural escapes, and agronomic seeds used in reclamation projects. A changing climate may help invasive species to persist but doesn't cause them to appear in new environments. Some events that helped introduce invasive plant species in Yukon include:

- agricultural activities during the Gold Rush (beginning 1898),
- pipeline and highway construction (1940s),
- seeding reclamation and maintenance (late 1980s), and
- escape of horticulture species from cultivation (1990s) (Bennett and Mulder 2008).

Alaska has noted an introduction rate of 2.5 alien species per year (Flagstad 2013). Similar information isn't tracked in Yukon, although many of the same concerns exist here.

Significance

The impacts of invasive species include loss of biodiversity, reduced property value, or reduced quality and abundance of resources to humans, including loss of plants traditionally used by First Nations.

Invasive plants in Canada cost the agricultural and forestry industry an estimated $7.5 billion annually (FAO 2013). Nearly 40 percent of known animal extinctions worldwide are believed to be caused by invasive alien species. Invasive alien species have the potential to threaten biodiversity in Yukon.

An increase in resource exploration and development, as well as increases in backcountry pursuits and a changing climate, will likely increase the range and number of invasive species (Bennett 2010). Ultimately, this will put pressure on native habitats and species in Yukon (Government of Canada 2013).

While there are only 13 known alien mammal, bird, and fish species in Yukon, their invasiveness and the full scale of their impact is unknown. Systematic assessment of invasive alien species has yet to be established in Yukon.

Taking action

The non-profit Yukon Invasive Species Council (YISC) was established in 2009 with participation drawn from municipal, territorial, federal, and First Nation governments, non-profit organizations, industry, and private citizens. It replaced an ad hoc group of concerned Yukoners with an interest in seeing a coordinated response to invasive species in Yukon.

The council works to raise awareness of invasive species issues and promote action to prevent the introduction of alien species and to reduce their spread within the territory, in collaboration with the public, professionals, governmental, and non-governmental organizations in Yukon and neighbouring jurisdictions. Based on An *Invasive Alien Species Strategy for Canada*, YISC has recommended management approaches for:

- prevention of new invasions,
- early detection of new invaders,
- rapid response to new invaders, and
- containment, eradication, and control of established and spreading invaders.

Leafy Spurge at Dawson City.

YISC developed the Spotters Network, with support from the Yukon government, to create awareness through "early detection, rapid response." In 2013, the Government of Yukon also created the Invasive Species Interdepartmental Working Group (ISIWG) to ensure that gaps and overlaps in the government's response to invasive species challenges are addressed. The group works closely with YISC and other organizations on invasive species issues.

In 2013, YISC and the Yukon Department of Energy, Mines and Resources collaborated on a project to remove invasive alien species found in the range of Yukon Draba *(Draba yukonensis)*, an endangered plant species.

While there is no stand-alone territorial legislation to address invasive alien species issues in Yukon, a variety of federal and territorial regulatory mechanisms exist. The Yukon Environmental and Socio-economic Assessment Board recognizes potential environmental and socio-economic impacts of invasive species. The board has developed standard terms and mitigation measures for invasive alien species to be included in their environmental evaluation reports where relevant projects occur.

Data quality

Through the Spotter's Network, there is a formal protocol for invasive alien species data collection within Yukon. The most up-to-date information is stored in the Alaska Exotic Plants Information Clearinghouse database (Alaska Natural Heritage Program 2013).

Conclusion

Grizzly Bear. © Richard Legner 2013

The *State of the Environment Report* fulfills an important requirement of the Environment Act. Environment Yukon is hopeful this report will help Yukoners better understand what is happening with the environment and engage in discussions about what actions are working well and where improvements may be needed.

Yukon has a rich and diverse natural environment. Good information about the current health of our environment allows governments and other organizations to plan for the future with a clear idea of where we are coming from. We have the benefit as well of being able to learn from the experiences of others. Ensuring we are headed in a sustainable direction underlies all our planning processes.

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Fish Lake, near Whitehorse. © Richard Legner 2013

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