Yukon state of the environment interim report 2019

A report on environmental indicators

Yukon

Keno.

Acknowledgements

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On the cover: The Hart River in winter

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Trends in greenhouse gas levels

2016 emissions were up 2.6 per cent since 2009. However, from a peak in 2011, emissions were lower in 2016 by 13 per cent. Transportation accounted for 62 per cent of Yukon's greenhouse gas (GHG) emissions in 2016. Yukon's total GHG emissions were 0.08 per cent of the national total in 2016.

Arctic sea ice extent and volume

Approximately 300 km³ of sea ice is lost every year. Remaining sea ice is becoming younger and thinner.

Long-term temperature variation

Over the past 50 years, winters have warmed by an average of 4°C. Yukon's annual average temperature has increased by 2°C, twice the global rate.

Air

Levels of particulate matter

In 2016, Whitehorse had the lowest concentrations of fine particulate matter in urban areas across Canada.

Organic pollutants in air

Air concentrations of two pesticides, hexachlorocyclohexane and endosulfan, are decreasing at Little Fox Lake.

Ten new flame retardants that are not regulated in Canada were detected in air at Little Fox Lake. Air samples from 2015 to 2018 are currently undergoing chemical analysis.

Water

Snow accumulation

The amount of water in snowpacks has increased an average of three per cent per decade at 14 long-term snow survey stations. 2016 and 2017 experienced below-average snow throughout Yukon.

Extreme high and low water in lakes and rivers

Most river stations measured significant increased water flows in the winter months, when water is usually lower.

Yukon River ice break-up at Dawson City

Ice break-up on the Yukon River at Dawson City now occurs more than seven days earlier on average than in 1896. Eight of the 10 earliest recorded break-up events at Dawson City have occurred in the past 30 years.

Land

Population of Yukon

In 2016, there were 0.1 people per square kilometer in Yukon. From June 2017 to June 2018, the total Yukon population increased by 816 people, or 2.1 per cent.

Community and local area planning

All eight Yukon municipalities have official community plans. In 2018, eight local area plans were in place. Local area planning processes are currently underway for Marsh Lake, Fox Lake, Tagish, Alaska Highway West, and Fish Lake.

Recreational land use

Between 2015 and 2016, 82 new Government of Yukon campsites were added across the territory. These include additional campsites at the Marsh Lake, Wolf Creek, Twin Lakes and Tombstone Mountain campgrounds, and Conrad Campground on Tagish Lake. This has resulted in a 20 per cent increase in the number of campsites within 200 km of Whitehorse.

Waste handled at the Whitehorse Waste Management Facility

In 2017, Whitehorse residents sent an average of 710 kg of waste to the landfill. This is an increase from 610 kg in 2016. The increase mainly came from construction and demolition waste like the demolition of FH Collins. Twenty-seven per cent of waste was diverted from the Whitehorse landfill through recycling and composting in 2017.

Fish and wildlife

Species management plans

The Government of Yukon and the Yukon Fish and Wildlife Management Board have developed a draft conservation plan for grizzly bears in the territory. The draft plan presents a 25-year vision for grizzly bears in Yukon, and provides guidance to achieve this vision.

Density of snowshoe hares

2006 and 2017 were the last peaks in the snowshoe hare cycle. Currently, the hare population cycle is in a decline phase. The peak population of the snowshoe hare cycle has been declining in the Kluane area since 1973.

Number of spawning Chinook salmon

In 2017, the spawning conservation target for Yukon River Chinook was met for the sixth time in the last 10 years.

Monitoring wild sheep and goat health

M. ovipneumoniae (*m. ovi*) testing has been completed for 244 thinhorn sheep and one mountain goat between 2015 and 2018. The *m. ovi* bacterium was not detected in any of these tested animals.

Mount Decoeli.

Introduction

The Yukon state of the environment report reflects on the status of the environment and helps guide future decision-making. This interim report presents information on climate change, air, water, land, and fish and wildlife.

This report includes information available at the end of the 2018 calendar year. The base year for comparing trend data in this report is 2016, because several agencies require up to 24 months to complete data collection, compilation, analysis and reporting to the Government of Yukon.

This report tracks environmental indicators, which are key measurements used to monitor, describe and interpret change. Indicators cannot provide all of the information on a particular topic, but they give indications of how aspects of the environment are doing. The indicators featured in this report are based on criteria including data availability, data reliability, usefulness and ease of understanding. Indicators are used to evaluate and demonstrate whether environmental conditions are improving, remaining stable or declining.

This report represents a collective effort from scientific experts, government agencies, and non-governmental organizations that have provided information, data and advice.

***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.

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.

Yukon River Valley, Whitehorse. Photo: R. Cherepak.

Trends in Yukon greenhouse gas levels

Significance

Greenhouse gases (GHGs) trap heat in the atmosphere, keeping the Earth's surface warmer than it would be in their absence. This process is essential for sustaining life on the planet, but burning fossil fuels has increased the amount of GHGs in the atmosphere, which enhances the warming effect. Global GHG levels are now at their highest in the last 800,000 years (IPCC 2014) because of human activity, resulting in climate change.

GHG emissions include carbon dioxide, methane, and nitrous oxide among others. Carbon dioxide is the principal contributor to human-caused increased atmospheric levels of GHGs; therefore, it is used as a basis to compare all greenhouse gases.

Carbon dioxide equivalent (CO_2e) is the measure most often used to compare emissions from various GHGs based on their potential to contribute to global warming. Tracking GHG emissions (in units of kilotonnes of CO_2e) allows tracking of Yukon's emissions across time, identifying the major sources of emissions and opportunities for reductions, as well as tracking Yukon's contributions to national and global emission levels.

The observed and predicted rate and magnitude of temperature change in Yukon are among the largest in Canada. The Government of Yukon is taking action to limit GHG emissions produced from its operations and those from key sectors. The Government of Yukon is also working on climate change adaptation in the short and long term. These measures take the unique challenges in Yukon into consideration, including long distances from production centres, high demand for heat during cold winters and an isolated electricity grid.

What is happening?

Yukon's emissions

The Government of Yukon is working with local and federal partners to achieve an accurate and consistent emissions profile for Yukon. This profile is necessary to support the effective policy development for minimizing growth in Yukon's overall GHG emissions. To date, two data sets are available to support an understanding of Yukon's overall GHG emissions:

- Emissions estimates by Environment and Climate Change Canada for Yukon found in the *National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada*. See: canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html.
- The Yukon GHG Inventory 2009-2016, developed in partnership between the Yukon Bureau of Statistics and the Department of Environment, with support from the Department of Energy, Mines and Resources. This data is based on reliable fuel tax data collected under the *Fuel Oil Tax Act* and held by the Government of Yukon's Department of Finance. See: Yukon.ca/greenhouse-gas-emissions-yukon.

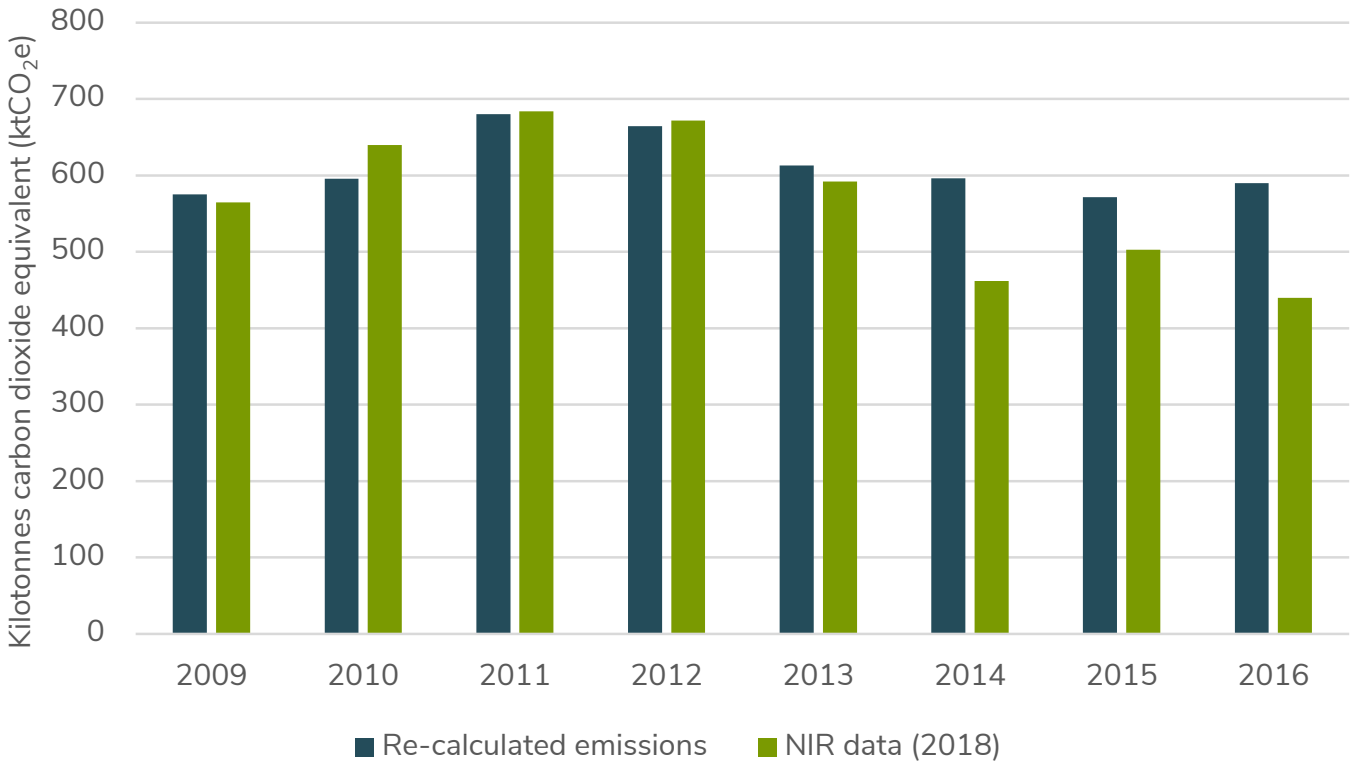

Figure 1: Yukon greenhouse gas emissions reported by Environment and Climate Change Canada and by the Yukon Bureau of Statistics.

The Government of Yukon is continuing its work with the federal departments of Environment and Climate Change Canada as well as Statistics Canada to improve accuracy in federal data collection and reporting. Until federal data better reflects Yukon's overall GHG emissions, the Government of Yukon considers fuel tax data from the Yukon Bureau of Statistics and Department of Finance as the most accurate.

Summary points from the Yukon GHG Inventory 2009-2016 data include:

- Emissions were up by 2.6 per cent since 2009. However, from a peak of 680 kilotonnes of CO_2e in 2011, emissions were lower in 2016 by 13 per cent.
- Yukon's total GHG emissions for 2016 were 590 kilotonnes of CO_2e.
- Transportation accounts for the largest share of greenhouse gas emissions in Yukon: 62 per cent of the total in 2016.
    - This means that passenger vehicles are a significant source of emissions in the territory.
- After transportation, space heating from fuel oil and propane is the next highest source of GHG emissions in Yukon at 18 per cent. Electricity generation accounts for three per cent of Yukon's emissions.

National comparison

- Canada is ranked among the highest of all countries in the world in terms of per capita GHG emissions. Canadians produced 704 megatonnes (704,000 kilotonnes) of CO_2e in 2016, about 17 per cent above 1990 levels (Environment and Climate Change Canada 2018).
- Per capita emissions in Yukon in 2016 were 16.4 tonnes per person. Compared to the per capita emissions of the 12 other provinces and territories as reported in the *National Inventory Report* (NIR), Yukon's per capita emissions rank eight out of 13.
- Yukon's total GHG emissions contributed 0.08 per cent towards the national total in 2016.

Climate Change

Klondike Highway South.

Taking action

The Government of Yukon partnered with the Northern Climate ExChange at Yukon College on developing a *Yukon Climate Change Indicators and Key Findings* report. This cross-sector, structured, evidence-based assessment of Yukon climate change knowledge synthesizes our current understanding, providing researchers, decision-makers and the general public with an objective overview of the climate system and any potential changes.

The Government of Yukon released its first climate change action plan in 2009. We have balanced monitoring and progress reporting of existing commitments, with development of new actions to ensure work is relevant and up-to-date. Progress reports in 2012 and 2015 included new climate change action commitments, and a 2018 update gave a snapshot of progress on previous commitments and summarized work underway.

The Government of Yukon is developing a new strategy that combines climate change, energy and green economy to enhance Yukon's capacity to thrive in a rapidly changing climate. It is anticipated for release in late 2019.

Climate change, energy and economy are interconnected. By addressing all three together, Yukon can plan for its future more effectively. We are working in close collaboration with Yukon and transboundary First Nations, the Inuvialuit, and Yukon municipalities to ensure the new strategy reflects the needs and priorities of all Yukoners.

Data quality

Previously, the GHG emissions indicator was based on data provided by the federal department of Environment and Climate Change Canada via the *National Inventory Report* (NIR), which presents GHG information annually for Yukon in kilotonnes of CO_2e by sector (Energy, Industrial Processes and Product Use, Agriculture and Waste). All national inventory reports are accessible online at: canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html.

The Government of Yukon considers the Yukon GHG Inventory 2009-2016, based on tax and finance data provided by Yukon Bureau of Statistics and Department of Finance, as the most accurate data for Yukon-wide emissions. The Government of Yukon will continue to work with the federal departments of Environment and Climate Change Canada as well as Statistics Canada to improve data accuracy, and in the meantime, will access and report Yukon data from local sources to inform our understanding of Yukon GHG emissions.

References

Environment and Climate Change Canada. 2018 National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada. Pt. 3, p.40. Environment Canada, Gatineau, Quebec, Canada.

Government of Yukon. 2018. Greenhouse gas emissions in Yukon. Available from: Yukon.ca/en/greenhouse-gas-emissions-yukon.

Intergovernmental Panel on Climate Change (IPCC). 2014. Climate Change 2014 Synthesis Report. IPCC, Geneva, Switzerland. Available from: ar5-syr.ipcc.ch.

Arctic sea ice extent and volume

Significance

Sea ice melt is one of the most visually striking global indicators of climate change, and is especially relevant for the circumpolar North. As ice melts over the Arctic Ocean, there is a significant shift in the energy balance between ocean, ice, and the atmosphere. A dark-coloured ocean surface absorbs more energy and allows it to be redistributed throughout Arctic systems, whereas light-coloured ice reflects energy back into space.

Arctic sea ice is melting as indicated by changes in the extent and volume of ice across Arctic and northern oceans. Less and less ice is remaining from one year to the next, and the ice that lasts more than one season is thinning significantly.

The net result, if this trend continues, is that summer sea ice will be nearly nonexistent across the Arctic by the end of the century. This has wide-ranging implications for the Arctic and the globe, including increased coastal erosion, changes to atmospheric circulation in distant locations, damage to human infrastructure and negative impacts on species that depend on sea ice.

What is happening?

- Arctic sea ice is melting, reducing both the minimum annual sea ice area and its overall volume.
- Sea ice melt appears to be accelerating, with most of the melt occurring in the past decade.
- Figure 1 shows the annual extent (area) in September (in millions of square kilometres) of Arctic sea ice with at least 15 per cent ice concentration.
- Figure 2 shows the annual Arctic September sea ice volume (in thousands of cubic kilometres).
- September sea ice loss averages 90,000 km² per year, although there is significant variability from one year to the next and more recent losses have exceeded earlier losses.
- Approximately 300 km³ of sea ice volume is lost per year. Remaining sea ice is becoming younger and thinner.

Beaufort Sea, ice along Herschel Island shoreline.

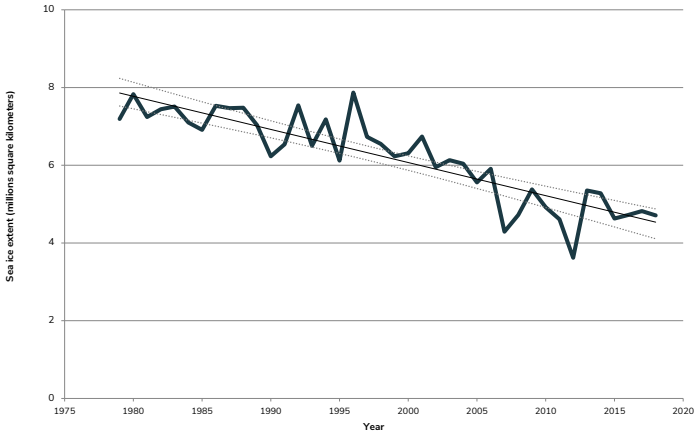

Figure 1: Arctic September sea ice extent.
Source: National Snow and Ice Data Centre.

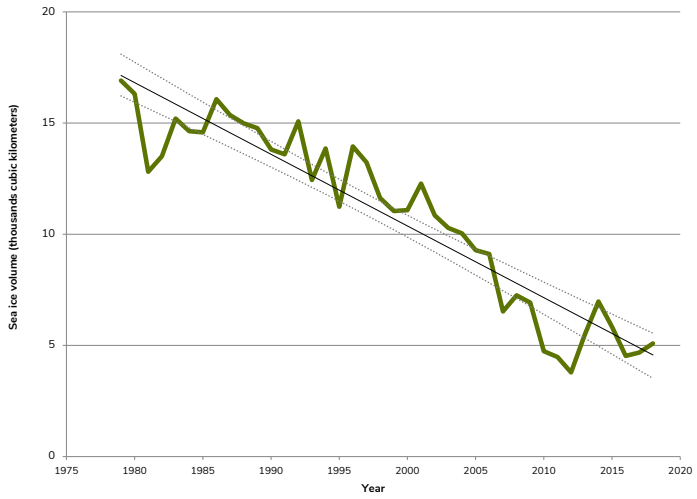

Figure 2: Arctic September sea ice volume.
Source: Polar Science Centre.

Beaufort Sea, ice along Herschel Island shoreline

Taking action

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Reducing GHG emissions in Yukon will help to reduce the long-term negative impacts of the trends presented in this indicator.

Data quality

- The National Snow and Ice Data Centre gather satellite data to make calculations for sea ice extent. You can find this data at: nsidc.org/data/g02135.
- For sea ice volume, the University of Washington Pan-Arctic Ice-Ocean Modeling and Assimilation System (PIOMAS) makes data available at: psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/data.

References

National Snow and Ice Data Center. 2015. Sea Ice Index, Version 1. University of Colorado, Boulder, Colorado, USA. Available from: nsidc.org/data/g02135.html.

Osborne E., J. Richter-Menge and M. Jeffries, eds. 2018. Arctic Report Card 2018. Available from: arctic.noaa.gov/report-card/report-card.

Polar Science Center, Applied Physics Laboratory. 1979-2019. PIOMAS Daily Ice Volume Data, 1979-present [cited 2019 Jan 4]. University of Washington, Seattle, Washington, USA. Available from: psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/data.

Streicker J. 2016. *Yukon Climate Change Indicators and Key Findings* 2015. Northern Climate ExChange, Yukon Research Centre, Yukon College, Whitehorse, Yukon, Canada. Available from: yukoncollege.yk.ca/sites/default/files/inline-files/Indicator_Report_Final_web.pdf.

Long-term precipitation variation

Significance

Temperature and precipitation are the two most commonly used variables to demonstrate changes in climate.

Monitoring the difference in annual precipitation from the average of the past 30 years helps us to understand the rate and extent of changes occurring in Yukon. Beyond the historic and projected trends for increasing precipitation, the variability of our climate is also expected to increase. This will mean an increase in extreme weather events (like storms) and greater fluctuations in precipitation (rain and snow).

Changes have started 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, with water levels and extreme events playing a large part in this.

What is happening?

Annual precipitation

- Precipitation variability is measured by the departure from a baseline – the 30-year average from 1961 to 1990. Precipitation departures are given as a percentage change from this average (Figure 1).
- Precipitation has increased by about six per cent over the past 50 years.
- The largest increase in precipitation occurred in summers.
- There is variability in terms of where precipitation occurs in the territory, and what time of year it occurs.

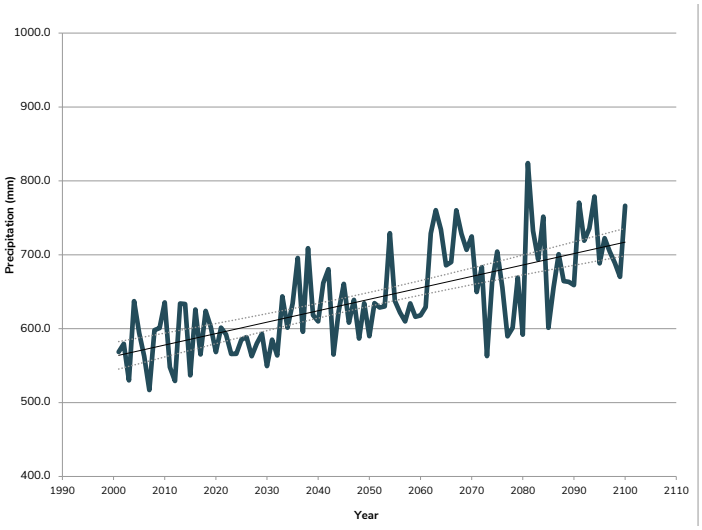

Figure 1: Yukon annual precipitation variability, 1950-2016.
Source: Environment and Climate Change Canada, Climate Research Branch (2016) Climate Trends and Variations Bulletins.

Projected precipitation

- Global studies, including the 2014 Intergovernmental Panel on Climate Change Fifth Assessment Report, show that climate scenarios project a significant increase in precipitation over the next 50 years (Figure 2).
- The three different lines in Figure 2 represent three potential precipitation futures based on emissions scenarios developed by the Intergovernmental Panel on Climate Change.
- All scenarios show an increase in precipitation and its variability.

Fog at Samuel Glacier. Photo: Cathie Archbould.

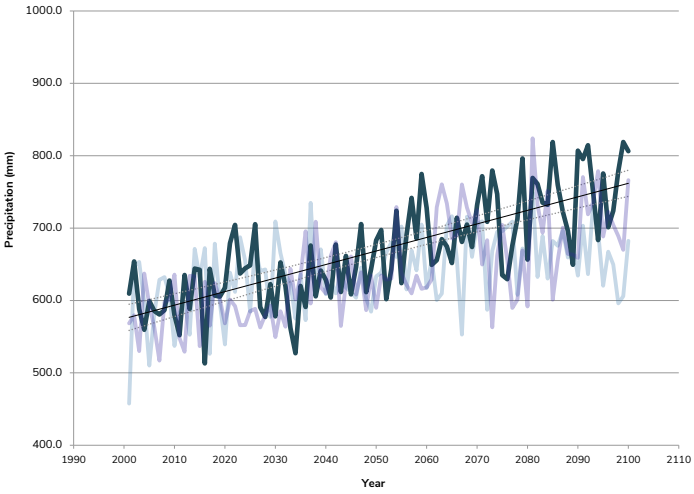

Figure 2: Yukon projected annual precipitation anomalies (A2, A1B, B1)*.
Source: Environment and Climate Change Canada, Climate Research Branch (2016) Climate Trends and Variations Bulletins.

* A2, A1B and B1 are different future emission scenarios that have been developed by the Intergovernmental Panel on Climate Change. Further detail on those scenarios can be found at: ipcc.ch/site/assets/uploads/2018/02/ar4-wg1-chapter8-supp-material-1.pdf.

Taking action

The Government of Yukon partnered with the Northern Climate ExChange at Yukon College on developing a *Yukon Climate Change Indicators and Key Findings* report. This cross-sector, structured, evidence-based assessment of Yukon climate change knowledge synthesizes our current understanding, providing researchers, decision-makers and the general public with an objective overview of the climate system and any potential changes. Precipitation change and projections are two indicators presented in this report.

Reducing GHG emissions will help to reduce the long-term negative impacts of the precipitation trends presented.

Data quality

- The data are exclusively from Environment and Climate Change Canada's Climate Trends and Variations Bulletins.
- Northern BC is included in Environment and Climate Change Canada's regional separation of the data, meaning the results could be skewed towards southern Yukon.
- There is uncertainty in the identified trends for precipitation because data are collected over a large area with uneven coverage (particularly for winter precipitation), and because of differences in instrument methodology over time.
- Data is currently only available to 2016 because of changes to precipitation monitoring within Environment and Climate Change Canada. The update and reporting of historical adjusted precipitation trends and variations is currently on hiatus pending extensive data reconciliation.
- However, these data findings are supported by local Yukon and Northern-specific research and data that can found in the *Yukon Climate Change Indicators and Key Findings* report.
- The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of global climate change. The IPCC Fifth Assessment Report is a reputable synthesis of current climate change knowledge captured from 9,200 peer-reviewed scientific publications.

References

Environment and Climate Change Canada, Climate Research Branch. 2014-2015. Climate Trends and Variations Bulletins [modified 2018 Dec 10; cited 2016 Jan 9]. Available from canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/trends-variations.html.

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Long-term temperature variation

Significance

Temperature and precipitation are the two most commonly used variables to demonstrate changes in climate.

Global studies, including the 2014 Intergovernmental Panel on Climate Change Fifth Assessment Report, show that the Arctic is warming more quickly than other regions.

Climatic changes have started to impact the distribution and abundance of vegetation, fish and wildlife in Yukon. Climate change is also affecting Yukon infrastructure, economy and communities.

What is happening?

Annual temperature

Monitoring the temperature departures from the average over the past 30 years helps us to understand the rate and extent of changes occurring in Yukon.

- Temperature variability is measured by the departure from a baseline – the 30-year average from 1961–1990. Temperature departures are given as a change in °C from this average (Figure 1).

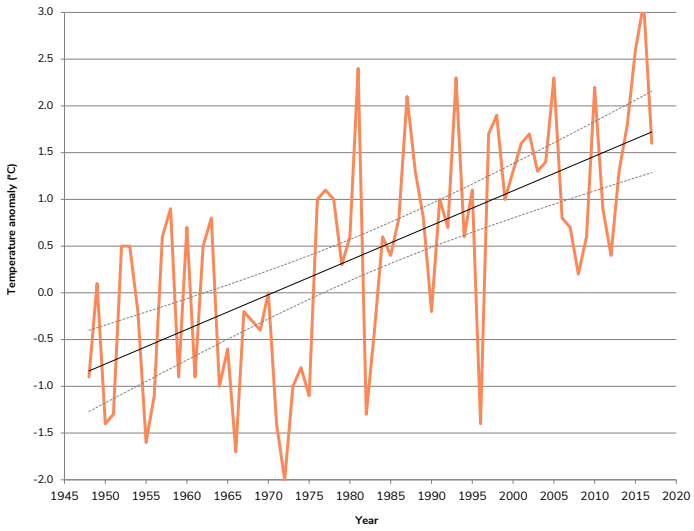

Figure 1: Yukon annual temperature variation, 1950-2016.
Source: Environment and Climate Change Canada, Climate Research Branch (2017) Climate Trends and Variations Bulletins.

Over the past 50 years:

- Yukon annual average temperature has increased by 2°C, twice the global rate.
- Winters are warming more than other seasons, with an average increase of 4°C.

Projected temperature

- Global studies, including the 2014 Intergovernmental Panel on Climate Change Fifth Assessment Report, show that climate scenarios project a significant increase of more than 2°C in temperature over the next 50 years (Figure 2).

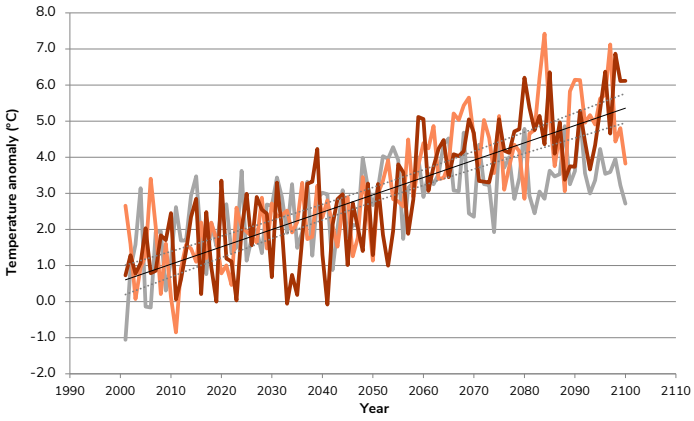

Figure 2: Yukon projected annual temperature anomalies (A2, A1B, B1)*.
Source: Environment and Climate Change Canada, Climate Research Branch (2016) Climate Trends and Variations Bulletins.

- The three different lines in Figure 2 represent three potential temperature futures based on emissions scenarios developed by the Intergovernmental Panel on Climate Change.
- All scenarios show an increase in temperature and its variability.

Yukon River Valley, Whitehorse. Photo: R. Cherepak.

* A2, A1B and B1 are different future emission scenarios that have been developed by the Intergovernmental Panel on Climate Change. Further detail on those scenarios can be found at: ipcc.ch/site/assets/uploads/2018/02/ar4-wg1-chapter8-supp-material-1.pdf.

Climate Change

Taking action

The Government of Yukon partnered with the Northern Climate ExChange at Yukon College on developing a *Yukon Climate Change Indicators and Key Findings* report. This cross-sector, structured, evidence-based assessment of climate change knowledge about Yukon synthesizes our current understanding from numerous sources both local and national, providing researchers, decision-makers and the general public with an objective overview of the climate system and the changes we are seeing. Temperature change and precipitation are two indicators presented in this report.

Reducing GHG emissions will help to reduce the long-term negative impacts of the temperature trends presented here.

Data quality

- The data found in Figure 1 and 2 are exclusively from Environment and Climate Change Canada's Climate Trends and Variations Bulletins.
- The data spans from 1948 to present and are complete. Northern BC is included in Environment and Climate Change data.
- Canada regionally separates the data, meaning results could be skewed towards southern Yukon.
- However, these data findings are supported by local Yukon and Northern-specific research and data that can found in the *Yukon Climate Change Indicators and Key Findings* report.
- The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of global climate change. The IPCC Fifth Assessment Report is a reputable synthesis of current climate change knowledge captured from 9,200 peer-reviewed scientific publications.

References

Environment and Climate Change Canada, Climate Research Branch. 2017. Climate Trends and Variations Bulletins [modified 2017 Aug 9; cited 2018 Sep 4]. Available from: canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/trends-variations.html.

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Whitehorse winter day.

Levels of particulate matter

Significance

Yukoners have come to expect a healthy natural environment. It is the responsibility of the Government of Yukon to protect public health and the environment, as identified in Yukon's *Environment Act* and *Public Health and Safety Act*.

Levels of particulate matter in our air are a significant indicator with respect to human health, as these fine microscopic airborne particles can enter the bloodstream through the lungs, and may contribute to short- or long-term health problems.

Particulate matter are microscopic airborne particles that come in either solid or liquid form. Small particles of concern include:

- fine particulate matter, such as those found in wood smoke, that are smaller than 2.5 micrometers in diameter ($PM_{2.5}$); and
- coarse particulate matter, such as those found near roadways and industrial activities (e.g., quarries), that are larger than $PM_{2.5}$, but smaller than 10 micrometers in diameter (PM_{10}).

Health effects

The size of particles is directly linked to their potential for causing health problems. Smaller particles pose large health problems, as these particles can more readily get deep into the lungs and potentially into the bloodstream (Haikerwal et al. 2015). Fine particulate matter also stays airborne for longer periods than coarse particulate matter (as coarse PM settles to the ground faster), and are therefore associated with longer exposure periods.

Residential wood burning for heating is estimated to be the largest source of harmful fine particulates in the Whitehorse area during cold winter months.

Exposure to particulate matter has been linked to a variety of health issues. Inhalation can irritate lungs and airways, make it harder to breathe, and worsen chronic conditions such as heart disease, chronic bronchitis, emphysema and asthma.

The elderly, children, and people with chronic respiratory illnesses are most at risk, but even healthy people can experience temporary symptoms.

Exposure to particulate matter has been scientifically proven to be detrimental to both public health and the environment. Sources of fine particulate matter in Yukon include:

Natural sources	Human sources
Forest fires: Although the predominant air flow is westerly (from Alaska), smoke from fires in BC and the NWT occasionally affect Yukon's air quality.	Emissions from fossil fuel burning, such as transportation, electricity generation, oil and gas.
Wind-blown dust from gravel roads, especially in spring.	Wood burning for residential / commercial heating, land clearing, or recreational burning.
Pollen.	Incineration or open burning of waste.
Volcanic activity, sometimes from as far away as Asia.	Fugitive dust from vehicles, quarrying or construction.

Yukon Ambient Air Quality Standards have been developed under the *Environment Act* to protect human health and the environment. The Government of Yukon monitors levels of $PM_{2.5}$ in Whitehorse. Continuous, 24/7-monitoring of $PM_{2.5}$ provides an indication of the state of, and trends in, local air quality. It is in addition to providing a point of comparison of Yukon air quality to national results.

Other environmental effects

Particulate matter may also affect the environment through:

- High pollution levels impairing visibility, which may affect driving, aviation, and outdoor sports or recreational activities like fishing, hiking, or camping.
- Changing nutrient and/or acidity balance in soil or water when particulate matter carried by the wind settles on the ground.
- Black carbon, a component of $PM_{2.5}$, is considered a short- lived climate pollutant (SLCP). These pollutants have a relatively short lifetime in the atmosphere – a few days to a few decades – and are generally more potent than carbon dioxide in terms of their climate warming potential.

Temperature inversions, when air higher in the atmosphere is warmer than air closer to the earth, can increase the impacts of particulate matter pollution.

Inversions act like a cap on the atmosphere, preventing the dispersion of pollutants away from valley bottoms. In Yukon, the two most populated communities, Whitehorse and Dawson City, are located in valleys.

What is happening?

The *Canadian Environmental Sustainability Indicators Air Quality Report*, for which National Air Pollution Surveillance data is based on, shows the following highlights about the average concentrations of fine particulate matter in Canada:

- Since 2002, average $PM_{2.5}$ concentrations have consistently remained below the 2020 standard across all regions of Canada, except for the first two years in southern Quebec.
- An increasing trend was detected for the average $PM_{2.5}$ concentrations in Atlantic Canada and the Prairies and northern Ontario region. A decreasing trend was found for southern Quebec.
- The key results in urban areas from 2016 show that Whitehorse recorded the lowest concentrations of fine particulate matter from across Canada.

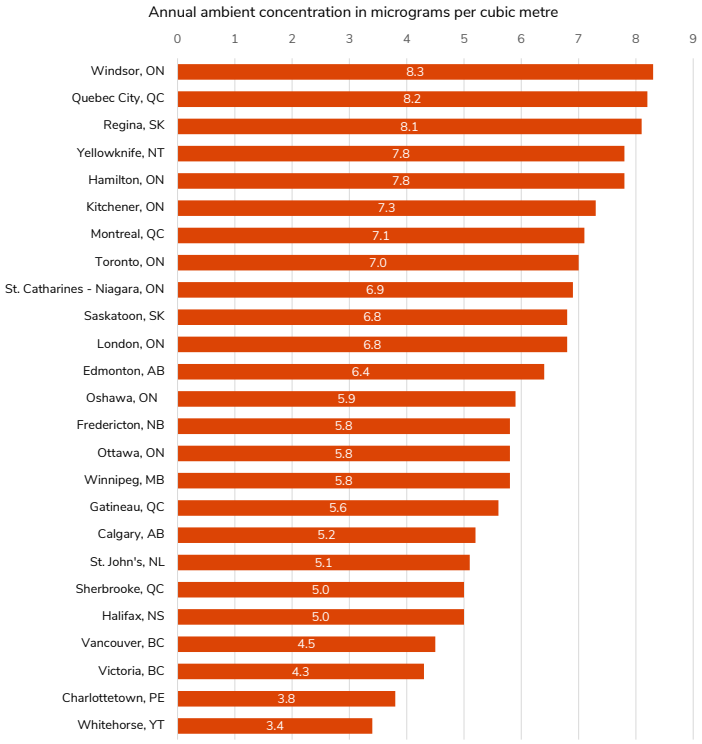
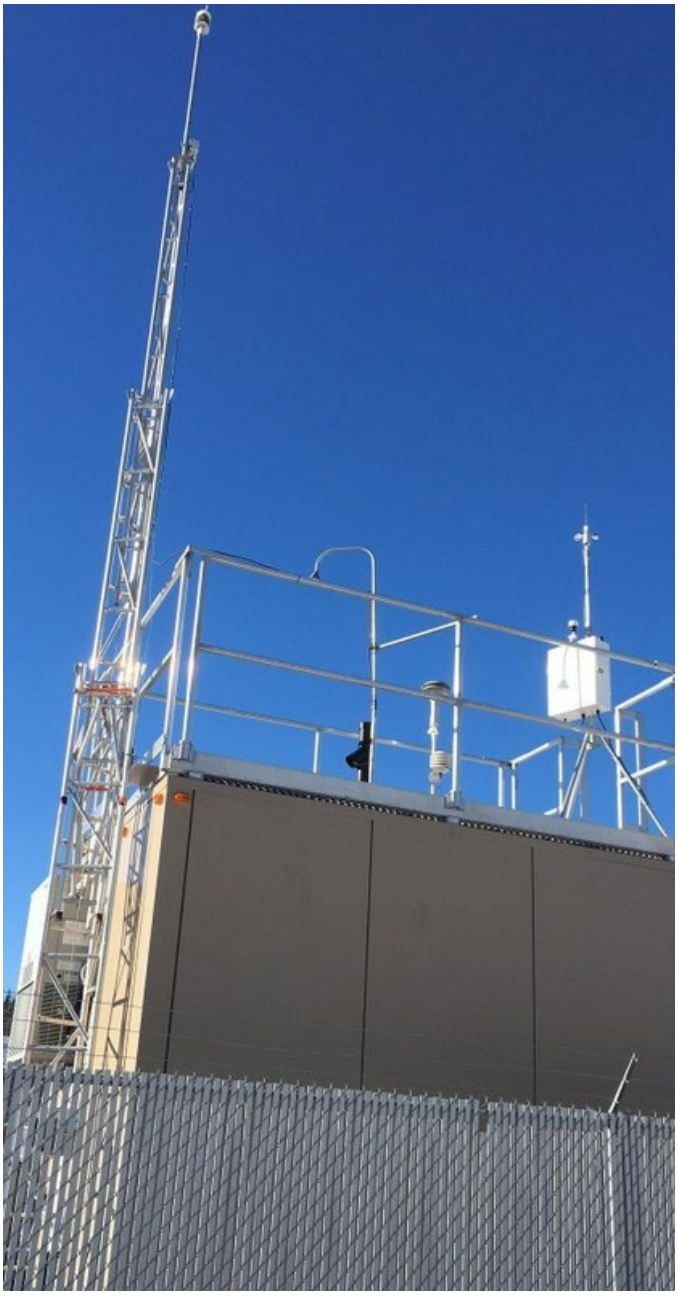


Figure 2: Average fine particulate matter concentrations, selected Canadian urban areas, 2016.
Source: Environment and Climate Change Canada (2018) Canadian Environmental Sustainability Indicators: Air Quality.

Taking action

- The Government of Yukon is continuing to monitor fine particulate matter in Whitehorse and Dawson City. This study is continuing to collect data from eight monitoring stations in Whitehorse and one in Dawson City. Data will be used to determine the levels and spatial variability of $PM_{2.5}$ pollution in the various neighbourhoods, and subsequently enable partners to make decisions on actions that need to be taken in high-pollutant neighbourhoods. The results are anticipated to be available at the termination of the study in 2020.
- Monitoring Yukon's air quality occurs as part of the National Air Pollution Surveillance (NAPS) program, which monitors the quality of ambient air in urban areas and provides long-term air quality data of uniform standard across the country. A Memorandum of Understanding establishes the collaborative effort of the program between the federal, provincial, territorial and some municipal governments. Jurisdictions use the air quality data compiled by NAPS to assess and report on the state of the air and to develop programs to address priority air quality issues in air zones. Data provided by NAPS also support public information tools, such as the Air Quality Health Index and the Canadian Environmental Sustainability Indicators. NAPS data can be accessed from the Canada-wide air quality database, available at: maps-cartes.ec.gc.ca/rnspa-naps/data.aspx.
- In the spring of 2016, the Air Quality Health Index (AQHI) was launched for Whitehorse. The AQHI is a public information tool that helps Canadians protect their health on a daily basis from the adverse effects of air pollution. The AQHI is calculated based on the relative risks of a combination of common air pollutants, including ozone, particulate matter and nitrogen dioxide; the data is collected from the Whitehorse NAPS station.
- Data provided by NAPS also support public information tools, such as the Air Quality Health Index and the Canadian Environmental Sustainability Indicators.
- The Government of Yukon is nearing completion participating in a national Health Canada study: Outdoor Air Pollution Exposure and Risk Assessment. The study examined the oxidative potential of $PM_{2.5}$ and the relationship with human health concerns, including lung cancer and heart attacks. Sampling at the downtown Whitehorse NAPS station began in the spring of 2016 and ended in December 2018. Results and a report will be prepared by Health Canada in 2019.



NAPS station in Whitehorse.

Data quality

- NAPS data are quality-controlled, assured, and standardized by Environment and Climate Change Canada and the Government of Yukon's Department of Environment for inclusion in the Canada-wide air quality database.
- The Whitehorse NAPS station, located in downtown Whitehorse, continuously monitors particulate matter, nitrogen dioxide and ground-level ozone.
- Air quality data collected at the NAPS station are not representative of air quality throughout Whitehorse or Yukon because of differences in geographical layout, population density and pollution sources.
- Canadian Environmental Sustainability Indicators (CESI) measure the progress of the Federal Sustainable Development Strategy, report to Canadians on the state of the environment, and describe Canada's progress on key environmental sustainability issues. The indicators, built on rigorous methodology, are added and updated as new, high quality data become available.

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Organic pollutants in air

Significance

Organic pollutants, such as flame retardants and pesticides, are human-made chemicals that may contaminate ecosystems. Wind and water can carry these chemicals away from their sources to reach places like the Arctic, where they have never been used before. They tend to settle in colder climates and once deposited, can enter Arctic ecosystems. Many of these contaminants are toxic and can accumulate in the food chain, affecting the health of wildlife and humans.

Measuring how much organic pollutants are present in Arctic air over time will provide us with information on:

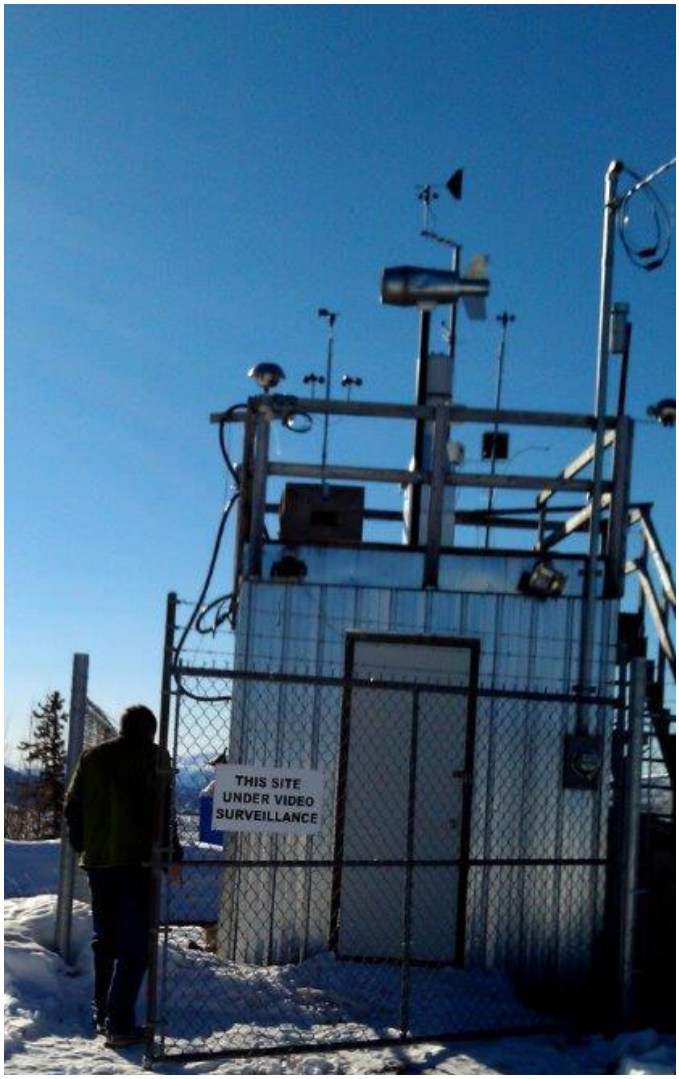
- whether their concentrations are decreasing, increasing or not changing over time;
- where these chemicals have come from;
- how much of each chemical comes from which region; and
- what climate conditions influence their movement to the Arctic.

This information can inform policies that limit emissions and may reduce what comes into the Arctic. Results about how organic pollutant concentrations change in air can be used to negotiate and evaluate the effectiveness of domestic and international control agreements and to assess the risks of new contaminants. The results are also used to test atmospheric models that explain contaminant movement from sources in the South to the Arctic.

What is happening?

- Air samples have been continuously collected at the Little Fox Lake Station in Yukon since August 2011.
- The detection of these chemicals in the remote subarctic site of Little Fox Lake demonstrates their long-range transport through air and suggests that they could contribute to the chemical contamination of remote areas such as the Arctic.
- The air concentrations of two pesticides, hexachlorocyclohexane and endosulfan, are decreasing at Little Fox Lake.

- Measurement results show that globally regulated flame retardants (e.g., some of the polybrominated diphenyl ethers) have declined from 2012 to 2014. Canada regulated these flame retardants in 2008 and they have been regulated globally since 2009.
- Conversely, 10 new flame retardants that are not currently regulated were detected in air at Little Fox Lake (Figure 1).
- Organophosphate esters flame retardants and plasticizers were monitored and detected in samples taken in 2015.
- Air samples taken at Little Fox Lake in 2015 to 2018 are currently undergoing chemical analysis to investigate if the concentrations of new flame retardants are changing with time.
- In warm seasons, organic pollutants tend to stem from potential sources in Northern Canada, the Pacific and East Asia. In cold seasons, they mainly came from the Pacific Rim. One example of this is a new flame retardant called 2-ethylhexyl 2,3,4,5-tetrabromobenzoate (Figure 2).



Air monitoring station at Little Fox Lake. Photo: Pat Roach.

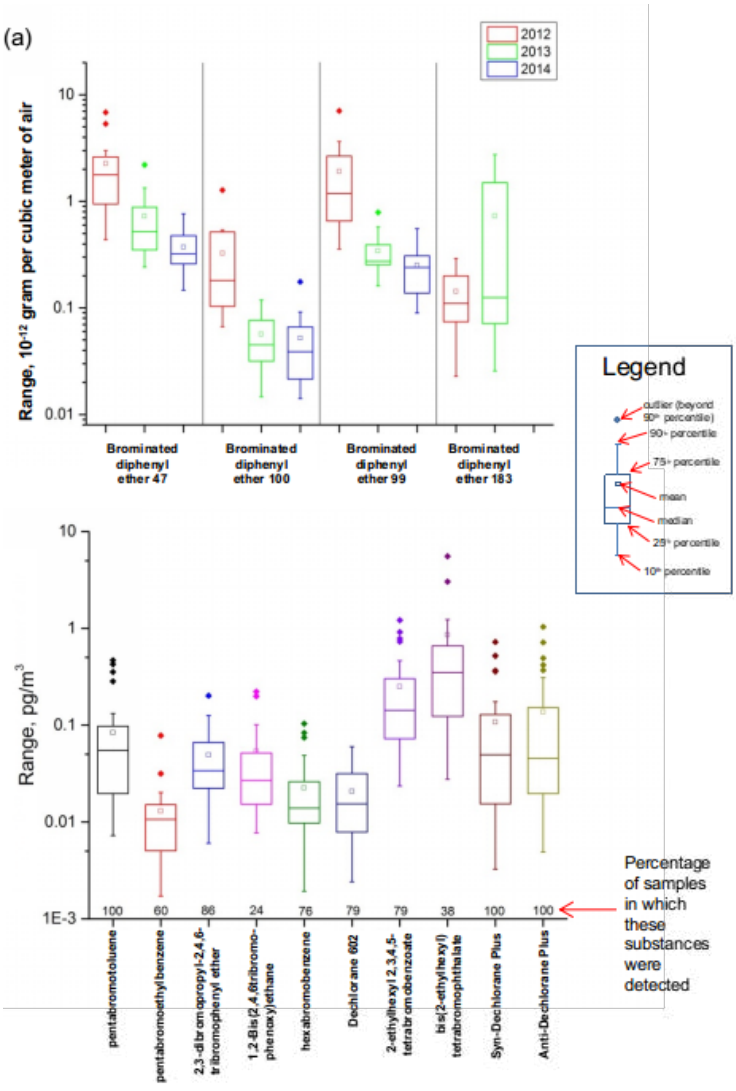


Figure 1: Regulated flame retardants at Little Fox Lake showed declining tendency from 2012 to 2014. Flame retardants found in air in Little Fox Lake that are currently not regulated (Yu et al. 2015).

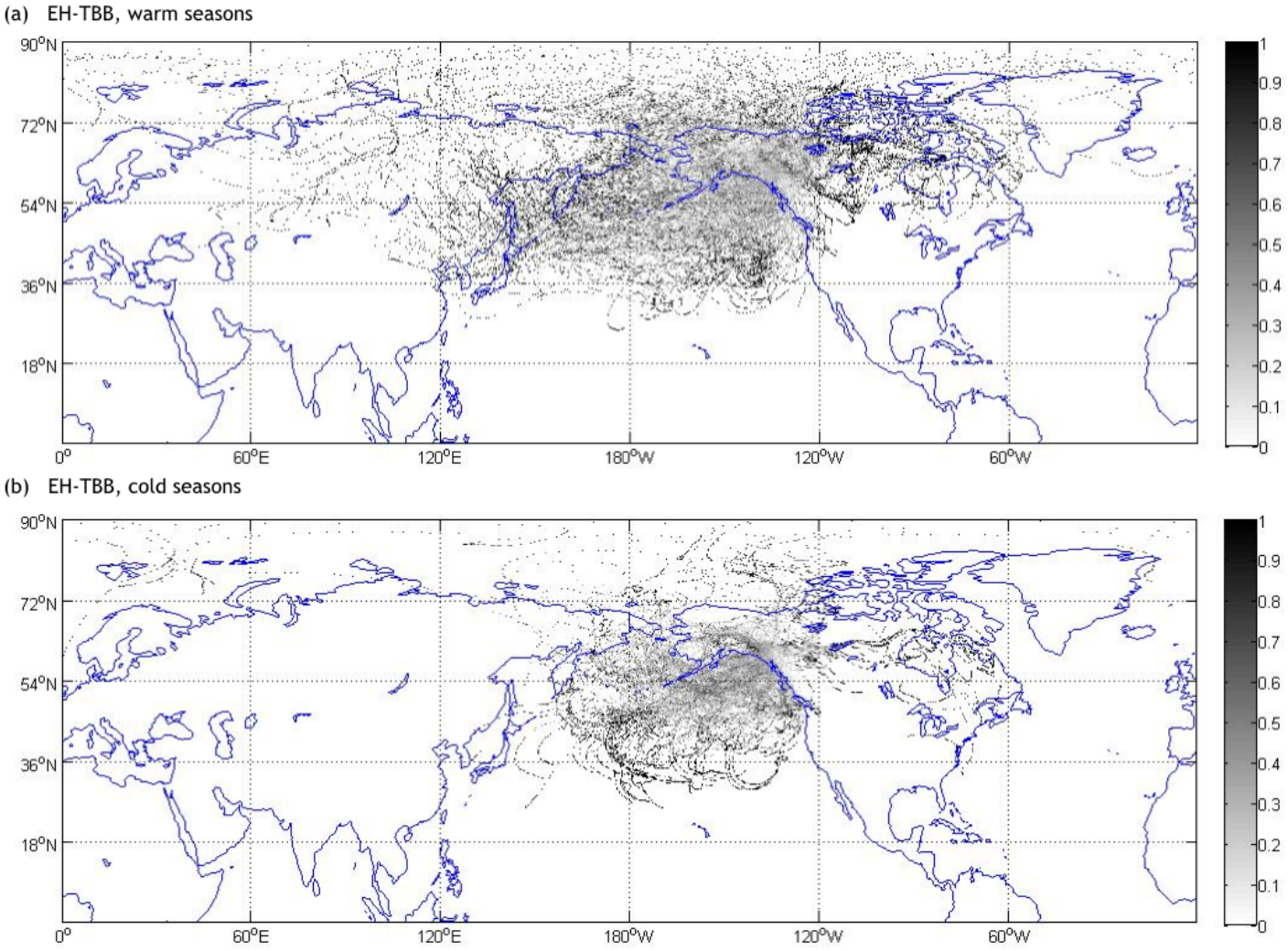


Figure 2: Maps showing potential source regions for one of the new flame retardants detected at Little Fox Lake, 2-ethylhexyl 2,3,4,5-tetrabromobenzoate. The maps indicate that (a) in the warm seasons most of this chemical observed at Little Fox Lake stemmed from sources in Canada, the Pacific and East Asia; (b) in cold seasons they mainly came from the Pacific Rim. Black dots on map show potential paths of movement of wind carrying this chemical reaching Little Fox Lake.

Air monitoring station at Little Fox Lake. Photo: Pat Roach.

Taking action

The federal Northern Contaminants Program has measured organic pollutants in air in Yukon since 1992 during three short term studies at Tagish (December 1992 to March 1995) and Little Fox Lake (July 2002 to July 2003 and August 2007 to October 2009).

Continuous measurements are now conducted at Little Fox Lake since August 2011 to determine:

- if the air concentrations are declining for chemicals that are under domestic and international regulations, showing these regulations are effective;
- where these chemicals have come from, and how much from which region; and
- if new chemicals that are currently not under control can enter Yukon by wind.

The Little Fox Lake data are provided to support the Stockholm Convention on Persistent Organic Pollutants – a global treaty to protect human health and the environment from the adverse effects of these pollutants. Signatories to the convention work towards controlling how much and what kind of persistent organic pollutants humans release into the environment.

These data also support the Arctic Council's Arctic Monitoring and Assessment Programme that provides information on the status and threats to the Arctic environment, and provide scientific advice on actions to be taken to support Arctic governments in their efforts to take remedial and preventive actions relating to contaminants.

Data quality

- Data are available for air samples taken once a month using a flow-through air sampler, which does not require electrical power to operate, at the Little Fox Lake station.
- Air concentrations of different chemicals may vary with seasons.
- The target chemical list includes pesticides, flame retardants and plasticizers. New chemicals are added to this list from time to time to assess chemicals that may be of concern to the Arctic environment.

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Five Mile Lake.

Caribou River, Peel Watershed.

Snow accumulation

Significance

The amount of snow on the ground across Yukon is determined through measuring the snow water equivalent (SWE) at survey stations. There are 52 snow survey stations across Yukon and a number of complementary instruments that measure snow on the ground on a continuous basis. This is a measurement of the liquid water volume held within a snowpack that can become available when melted. The SWE throughout and at the end of winter has an influence on a number of hydrological and related processes:

- It is a major component of spring freshet and therefore influences flood forecasting. Larger-than-average SWE contribute to an increased likelihood of higher spring flows .
- The SWE can also influence the timing and severity of river ice break-up.
- A higher SWE (deeper snow) acts to further insulate the ground surface from cold winter air temperatures and can promote permafrost thaw during the following summer.
- Low SWE can increase the likelihood of wildfire risk at the beginning of summer.
- In the long term, SWE can generate shifts in vegetation.
- Finally, the duration of the snow season significantly affects transportation.

Overall, climate change projections generally indicate an increase in winter precipitation over a shorter snowfall period (a trend in earlier snowmelt has been identified and this is expected to continue), and a higher proportion of precipitation occurring as rainfall. These contradicting climate processes may induce a complex response that may vary significantly by region and over time.

Dog mushing in Ibex Valley. Photo: F. Mueller.

Water

Wolf Creek snow survey.

What is happening?

There has been a significant increase in the snow water equivalent, measured at three of the 14 long-term snow survey stations analyzed. None of the sites measured showed significant decreasing trends. Including all 14 locations, the average increase in snow water equivalent per decade is three per cent. It is important to note that there are no stations with long-term records available in the far north of the territory (basins draining directly into the Arctic Ocean).

Recent years (2016 and 2017) have experienced below average snow throughout most of the territory. This has resulted in three locations that previously indicated significant increasing trends (Watson Lake, Frances River, and King Solomon Dome) to fall slightly below what is considered statistically significant (p-values <0.1). The influence of recent years does not change the overall interpretation of the data, which in general, suggest an increasing maximum snowpack over time, resulting from an increase in winter precipitation.

- The stations at both Log Cabin and Meadow Creek showed significant increasing trends in snow accumulation; these were +6 per cent and +4 per cent per decade, respectively.
- Recently low snow years have resulted in no significant trends within the Liard drainage.
- There were no significant trends noted at any of the Central Yukon stations.
- Mayo Airport shows a significant increasing trend in snow accumulation of five per cent per decade.

Taking action

The Government of Yukon's Water Resources Branch staff continue to collect data, as do their partners in Yukon's remote areas including private contractors and staff from the Department of Energy, Mines and Resources. Water Resources compiles and quality controls all snow accumulation data.

Data quality

- Access archived snow survey bulletins: Yukon.ca/snow-surveys-and-water-supply-forecasts.
- Current snow survey data from across Alaska and Yukon can be viewed on an interactive map made available through a United States Department of Agriculture webpage at nrcs.usda.gov.
- There are currently 52 snow survey stations located across Yukon, with an additional four in adjacent areas of Alaska and British Columbia that are used by Water Resources. Most areas of Yukon have good spatial coverage with the exception of the far north, where stations are sparse.

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Snowmobiling at Fish Lake. Photo: Marten Berkman

Extreme high and low water in lakes and rivers

Significance

A range of short and long-term processes affects water levels in Yukon lakes and rivers, including:

- the timing and magnitude of snowmelt;
- the phase and intensity of precipitation;
- permafrost thaw and groundwater flux variations;
- shifts in vegetation;
- morphological adjustments; and
- melting glaciers.

The response in water levels and flows to these processes may vary in different regions of the territory.

High flows and more intense river ice break-up conditions in river systems can cause:

- Increased sediment and contaminant mobilization and transport, affecting human health, drinking water and ecosystems.
- Increased flooding potential in populated areas, which can result in direct impact on the health and security of people, infrastructure loss, transport interruption, and other economic costs.
- In turn, low flows in lakes and rivers can cause:
- Increased concentrations of dissolved contaminants, such as metals, which can negatively affect aquatic ecosystems and human health.
- Low hydroelectric production and therefore higher greenhouse gas emissions.
- Negative impacts on water consumption (agriculture, municipal, industrial) and aquatic life.

Increased flows in winter, which is normally a low-flow time of year, are one of many climate change driven hydrological trend. It results from warming air temperatures, a shorter cold season, degrading permafrost, and in some locations, increased precipitation. Such a trend is expected to continue with future warming.

Takhini River flowing into Kusawa Lake

What is happening?

Annual river flow

Thirty stations across Yukon are used for trends in annual minimum and maximum river flows:

- Yukon River: 17 stations
- Alsek River: 3 stations
- Liard River: 3 stations
- Peel River: 2 stations
- Porcupine River: 1 station

Twenty-four of 26 long-term river stations measured significant increases over time in the amount of water flowing when the river was at its annual minimum while no station indicated the opposite (Figure 1). Moreover, stations showing an increasing low flow trend over time had a median increase rate of +9 per cent per decade.

In turn, Figure 2 shows that most (25 of 26) long-term river stations did not show a significant trend for annual maximum river flow.

The majority of stations examined are monitoring hydrological conditions on large rivers (22 of 26 have drainage areas greater than 1,000 km²).

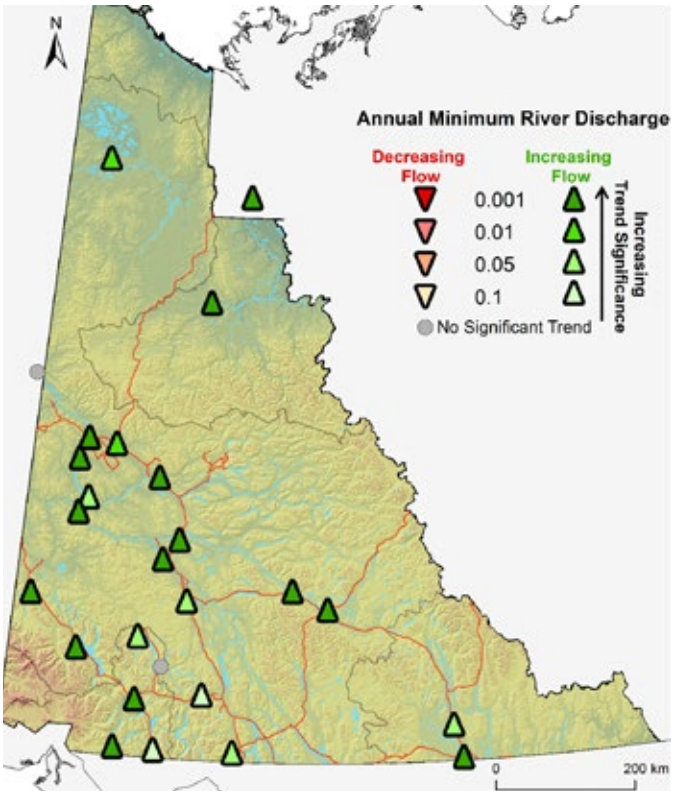


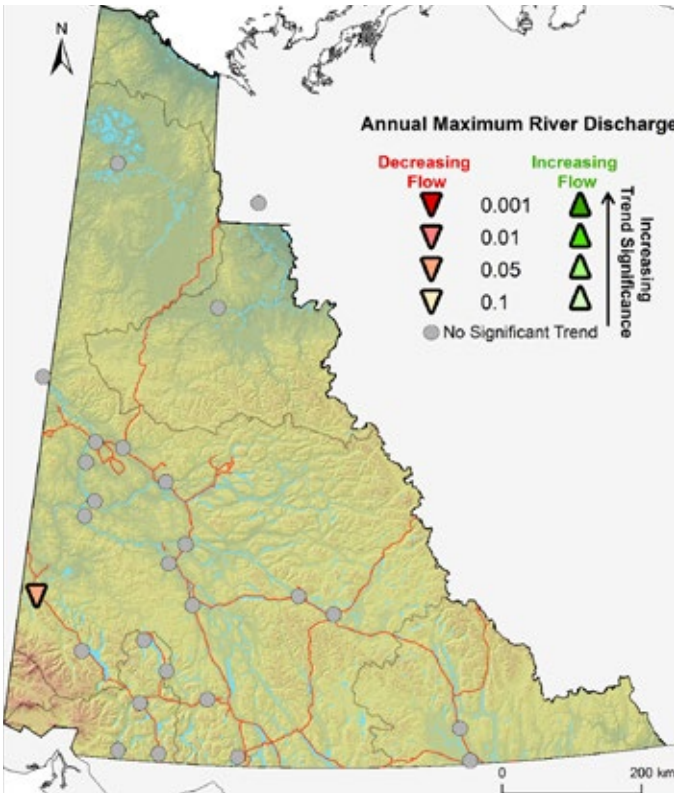
Figure 1: Trends in annual minimum river flow. Trend significance is represented by p-values. Period of record varies by station and includes information until 2016.

Annual lake levels

Annual minimum and maximum water levels are monitored at three Yukon lakes:

- Bennett Lake (as part of the Bennett – Tagish – Marsh Lake system)
- Kluane Lake
- Teslin Lake

Two lakes (Bennett and Kluane) showed significant declines in minimum water levels over time, while Teslin Lake showed significant increases in minimum water levels. None of the sites have significant changes in annual maximum water levels over time; however, Kluane Lake water levels have dramatically decreased in



Figures 2: Trends in annual maximum river flow. Trend significance is represented by p-values. Period of record varies by station and includes information until 2016.

recent years from the movement of headwater glaciers that has diverted water away from the Slims River.

Taking action

The water level drop in Lhù'àän Mân (Kluane Lake) has unknown implications on the keystone chum salmon species, who migrate from the Bering Sea to spawn in Kluane River and Kluane Lake.

The Kluane Watershed Salmon Climate Change Adaption Project used thermal imaging of Kluane Lake and Kluane River to create maps of groundwater discharge areas. Since Chum salmon only spawn in groundwater discharge areas, this project will be essential in determining how well chum salmon are adapting to changes in their spawning environment.

Data quality

- The Water Survey of Canada conducts long-term measurements of large rivers and lakes. They provide summaries of annual peak high and low flows based on daily mean flows and water levels.
- The Water Survey of Canada provides public access to hydrometric data.
- All stations included in the analysis are active sites that have at least 30 years of peak flow data. The oldest station on record began collecting data in 1943.
- Data from the Water Survey of Canada is typically re-analyzed and released two years after data collection; currently data is approved to 2016.
- The majority of stations have a minimal number (less than five per cent) of missing years in the record.

Further information

- Water levels in Yukon lakes and rivers: Yukon.ca/water-levels.

Measuring water levels on 180 Mile Creek.

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Yukon River ice break-up at Dawson City

Significance

The timing of river ice break-up is one factor influencing break-up severity and associated negative impacts. In general, an early rise in river discharge results in the mobilization of a very resistant ice cover whereas a delayed snowmelt period may generate a compressed runoff period and a sudden mobilization of the ice cover over long stretches of river. Both conditions increase the potential for severe ice jams that lead to floods.

River ice conditions also affect transportation routes, both for winter roads and wildlife corridors. Early river ice breakup and increased ice-jamming severity can have detrimental impacts on communities and infrastructure. Over the past centuries, breakup has been occurring earlier in the spring, which represents a strong indicator of a changing climate. Even if warmer winter temperatures contribute to reduce the ice cover thickness, ice jam intensity and frequency may increase in the future along several rivers of Yukon.

What is happening?

Ice break-up on the Yukon River at Dawson City now occurs more than seven days earlier on average than in 1896, when data collection began (Figure 1). Eight of the ten earliest recorded break-up events at Dawson City have occurred in the past 30 years.

Taking action

Over the past four years, the Water Resources Branch has expanded its ice break-up monitoring program on the Yukon River near Dawson through real time satellite imagery. In partnership with Public Safety Canada and the Canadian Space Agency, high-quality maps of current river ice conditions are produced daily prior to and during the break-up period. The imagery differentiates between intact ice, open water, and consolidated ice (potential ice jam) locations. This allows for improved identification of ice jam hazards upstream of the community. A break-up timing forecast tool used in the past is also being updated to include potential break-up intensity.

May 2014 break-up of the Yukon River at Dawson City. Photo: Tyler Williams.

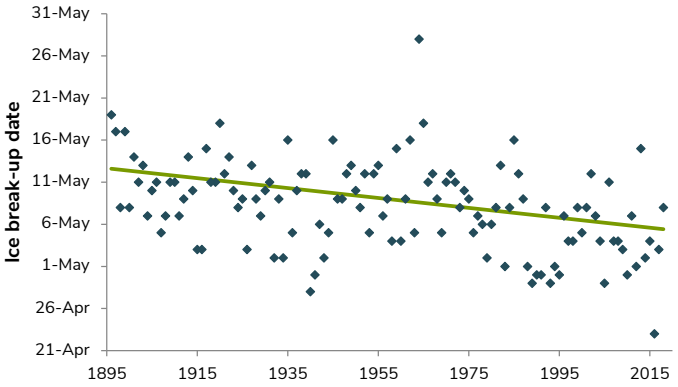


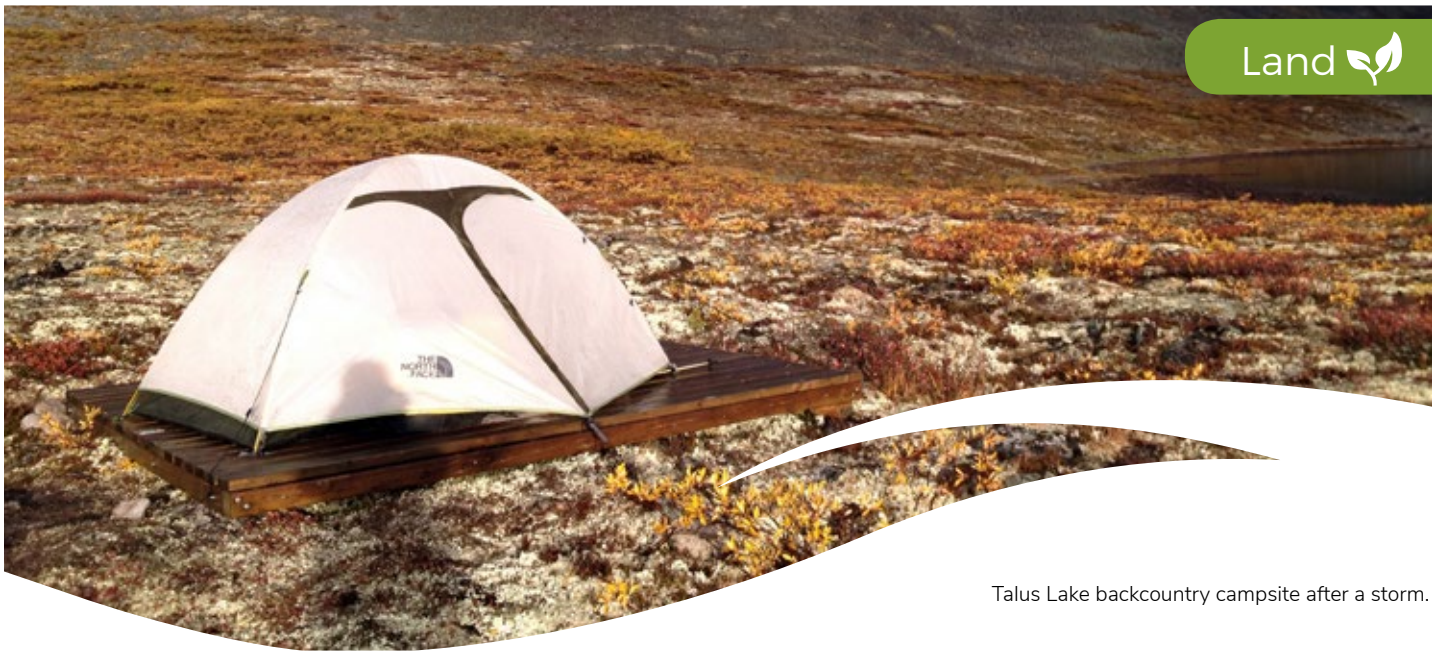
Figure 1: Date of ice break-up on the Yukon River at Dawson City, 1896-2018.

Data quality

At first a betting tradition, the exact time and date of break-up has been recorded at Dawson since 1896. A tripod has been set up on the ice and connected by cable to the Danoja Zho Cultural Centre. When the ice starts moving, it takes the tripod with it and stops the clock, thereby recording the official breakup time. Statistics and a photo documentary about Yukon River ice breakup at Dawson City are available at: yukonriverbreakup.com/statistics.

Further information

See the Dawson City Ice Bridge report produced by the National Research Council of Canada (NRC): Yukon.ca/en/national-research-council-dawson-city-ice-bridge-report-2018.



Talus Lake backcountry campsite after a storm.

Population of Yukon

People enjoying the Dawson City Music Festival.

Significance

Human population can have an impact on the state of the environment based on:

- how many people there are (population growth);
- where those people live (population distribution); and
- how close in proximity they live (population density).

Keeping track of these three population indicators can help in analyzing and predicting the impact that human activities can have on the environment.

The distribution and density of Yukon's population may have an impact on where land use activities take place; however, land use is also determined by opportunities for development. For information on Yukon's economy, visit the Yukon Bureau of Statistics website: eco.gov.yk.ca/stats/ybs.html. Land use activities in Yukon are managed through environmental assessments, permitting and land use planning.

What is happening?

Overall, Yukon's population density is very low. On the 2016 census, there were 0.1 people for every square kilometer in Yukon.

Yukon's population is not distributed evenly across the territory. There are many more people residing in southern Yukon, with approximately 78 per cent living in the Whitehorse/Marsh Lake area.

	2018 population	Population growth from 2017 (per cent change)	2016 Population density (people per square kilometre)
Beaver Creek	111	1.8%	3.4
Burwash Landing	107	-0.9%	2.4
Carcross	506	1.4%	18.7
Carmacks	564	2.2%	13.3
Dawson City	2,323	2.5%	42.4
Destruction Bay	56	1.8%	4.1
Faro	413	4.0%	1.7
Haines Junction	960	4.2%	17.8
Mayo	514	2.8%	188.7
Old Crow	265	3.1%	15.6
Pelly Crossing	387	-2.0%	10.9
Ross River	405	1.0%	14.2
Tagish	275	4.6%	5.5
Teslin	521	1.2%	64.6
Watson Lake	1,497	-0.3%	129.4
Whitehorse / Marsh Lake	31,527	2.1%	3.3
Yukon total	40,483	2.1%	0.1

Table 1: 2018 Population, growth and density of Yukon communities.

The population density of this area, however, is still low at 3.3 people per square kilometre because the population total incorporates Whitehorse and all surrounding areas (e.g., Ibex Valley, McPherson/Grizzly Valley, Marsh Lake and Mount Lorne).

Over the past 10 years (June 2008 to June 2018), the population increased by 7,189 people, or 21.6 per cent.

Over the past year (June 2017 to June 2018), the total Yukon population increased by 816 people, or 2.1 per cent. The increase in population is mostly due to growth in the Whitehorse/Marsh Lake area. Population density is only 0.1 people per square kilometre.

Yukon's community populations have been fairly stable since 1990. One exception is Faro, as the population was tied to the operation of the Faro mine that closed in April 1993, reopened in August 1995 and then closed permanently in January 1998.

For more information on Yukon community socio-economics, visit the Government of Yukon Socio-Economic Web Portal: sewp.gov.yk.ca/home.

Data quality

Population density is calculated during the Statistics Canada census; therefore, the most current data is from 2016. For the census, Statistics Canada divides data into 37 geographic census subdivisions that are different from the community divisions that the Yukon Bureau of Statistics uses for population estimates. For this reason, use population density information with care.

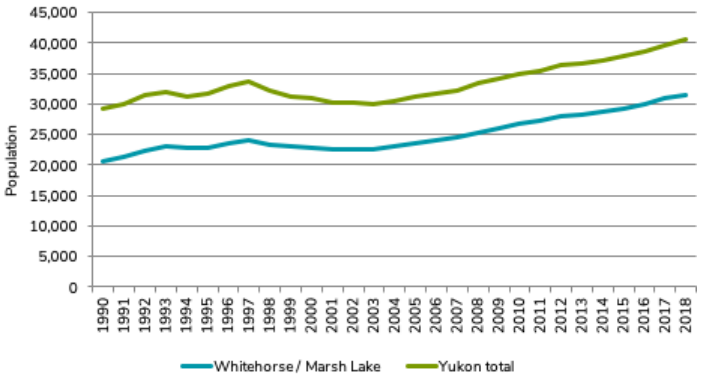


Figure 1: Population of Whitehorse compared to total population in Yukon. Due to a change in methodology in 2018, revised figures for the period from April 2011 onward are not strictly comparable to figures prior to that period.

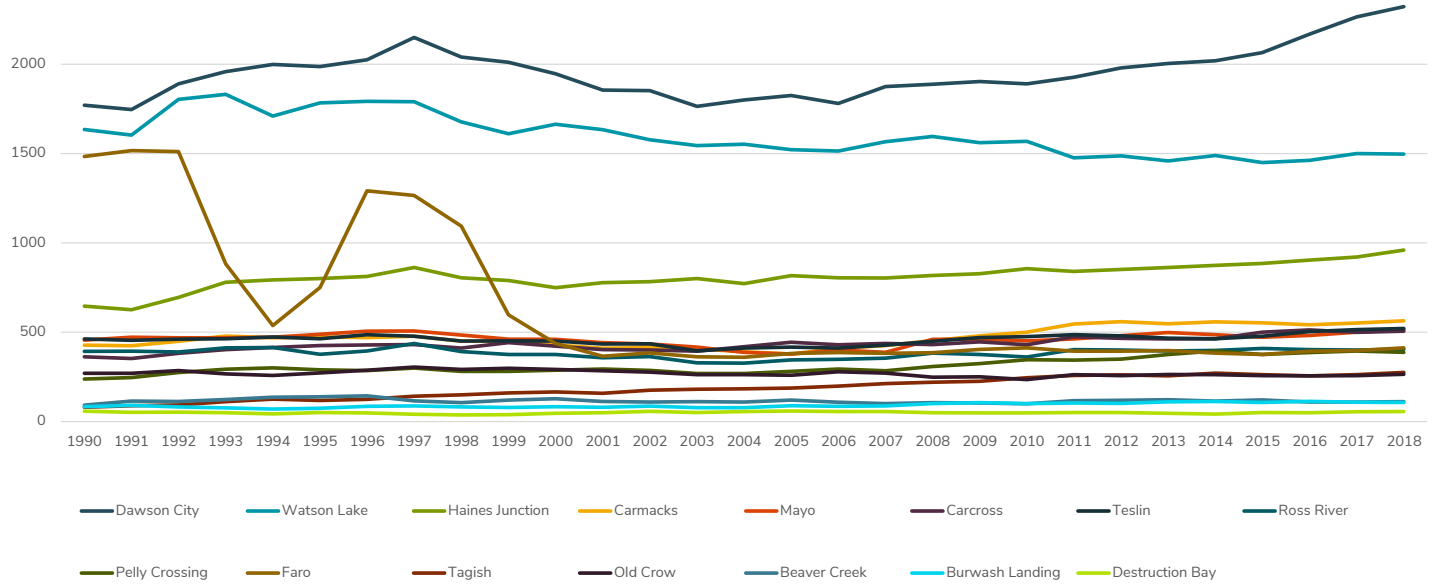


Figure 2: Yukon community populations, 1990-2018. Due to a change in methodology in 2018, revised figures for the period from April 2011 onward are not strictly comparable to figures prior to that period.

Regional land use plans

Significance

Developing long-term land use plans through public processes helps governments recognize and balance competing views about how lands and natural resources should be used.

Plans support effective land and resource management and are important obligations arising from Yukon First Nation Final Agreements. Chapter 11 of the Yukon First Nation Final Agreements established the regional land use planning process and represents a commitment by the governments to conduct regional land use planning in Yukon. Through land use planning, a regional commission, appointed by Yukon and First Nation governments, prepares a regional land use plan in consultation with First Nations, stakeholders and residents. The plans are approved by Yukon and First Nation governments and guide the future use and sustainable development of land in the planning region.

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.

What is happening?

The Yukon Land Use Planning Council has proposed seven planning regions in Yukon. See the map and table below.

- One regional plan, the North Yukon Regional Land Use Plan, was completed in 2009 and is being implemented.
- The Peel Watershed planning process has been relaunched following the Supreme Court hearing on the plan. The Final Recommended Plan is anticipated to be approved in 2019.
- The Dawson planning process has been relaunched. Work is being done to finalize the Planning Commission and update pre-planning documents.

Figure 1: Areas of regional land use plans.

Regional land use plan	Status	
Dawson	Current	The Dawson Planning Process has been relaunched. Work is being done to update the Resource Assessment Report and Plan Alternatives. The Vuntut Gwitchin First Nation, and Tr'ondek Hwech'in have approved an overlap agreement for a new boundary for the planning region, which excludes Vuntut Gwitchin.
North Yukon	Current 2009	In 2009, the Vuntut Gwitchin First Nation and the Government of Yukon 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.
Peel Watershed	Current	Land use planning began for the Peel watershed in 2004 and the planning commission produced a recommended land use plan in 2011. The process was on hold while awaiting the outcome of a supreme court hearing on the plan. A staking moratorium across the Peel Watershed Regional Land Use Planning Region has been in place since the planning process, which expires on January 1, 2020. Following the Supreme Court decision, the planning process was relaunched. In late 2018, final consultation occurred with affected communities, public, and stakeholders on the Final Recommended Plan. An approved plan is anticipated in 2019.
Teslin	On Hold	A previous planning process for the Teslin region was suspended in 2004 before a draft plan was produced. In September 2011, the Yukon Land Use Planning Council recommended the Teslin Region as a priority planning region.
Northern Tutchone	Not Started	Planning in this region has not been initiated.
Kluane	On Hold	In September 2011, the Yukon Land Use Planning Council recommended the Kluane Region as a priority planning region.
Whitehorse	Not Started	Planning in this region has not been initiated.
White River	N/A	Regional planning as envisioned under the Umbrella Final Agreement does not apply to White River as White River First Nation does not have a Final Agreement.
North Slope	N/A	The Yukon North Slope is part of the Inuvialuit Settlement Region. As such, the provisions set out in the *Inuvialuit Final Agreement* speak to how land use planning processes are to be undertaken. The Final Agreement provides for the Inuvialuit to be effectively involved in all bodies, functions, and decisions pertaining to land and wildlife management in the Inuvialuit Settlement Region.
Kaska	N/A	Regional planning as envisioned under the Umbrella Final Agreement does not apply to asserted Kaska traditional territory, as Kaska does not have a Final Agreement.

Carcross.

Community and local area planning

Significance

Long-term planning helps to define a community's vision for the future and how it can move forward in that direction. Plans provide guidelines and policies to balance competing views for land use, and make sure that future development and growth occur in an orderly manner.

Planning provides property owners and local residents with the opportunity to influence the decisions about the use of land in their community while ensuring that broader public interests are taken into consideration, such as those identified through Yukon and First Nation government legislation and policies.

Yukon has eight municipalities that are required by the *Municipal Act* to develop official community plans. These documents guide land use and development within their boundaries. A local area plan is a similar document that is prepared for areas outside of municipalities. While there is no legislative requirement for developing these, the governments of Yukon and First Nations have been working on developing local area plans to ensure the orderly development of unincorporated communities in Yukon.

What is happening?

Official community plans

- All eight Yukon municipalities have official community plans.

Official community plans	Year approved
Dawson	2016 (Amendment to original plan) New OCP under review
Watson Lake	2016 (Amendment to original plan)
Whitehorse	2016 (Amendment to original plan)
Mayo	2016 (Amendment to original plan)
Faro	2014
Carmacks	2013
Haines Junction	2013
Teslin	2010

Table 1: Status of planning for municipalities in 2018.

Local area plans

Local area planning is done for unincorporated communities and typically includes private lands, Yukon public lands, and Settlement Lands. As official community plans, local area plans include policies and maps that designate (or "zone") areas for different uses, such as Residential, Recreational or Industrial.

With the exception of the Carcross/Tagish First Nation Self-Government Agreement, local area plans are not required by law. However, once a plan has been developed, plan provisions can be enforced through legislation and policies, such as the *Subdivision Act* and the *Area Development Act*.

The *Subdivision Act* requires any subdivision to conform to a local area plan. The *Area Development*

Act stipulates the development of development area (zoning) regulations that are based on the policies of an applicable local area plan. Besides dividing areas into specific classes of land use such as Downtown Residential, Public Use or Light Industrial, zoning regulations also state how a parcel can be developed, such as the number of dwellings, their height, use and setback from property lines. Zoning regulations are enforced through development permits.

In the past, zoning regulations have been developed without first developing a local area plan. Today, governments strive to develop local area plans before developing zoning regulations in order to ensure that local residents' and First Nations' perspectives are integrated into the planning process and resulting plan.

- In 2018, eight local area plans were in place.
- Local area planning processes are currently underway for five areas: Marsh Lake, Fox Lake, Tagish, Alaska Highway West and Fish Lake (Table 2).
- For up-to-date information about local area plans and to access completed plans, visit the Department of Energy, Mines and Resources website: emr.gov.yk.ca/landplanning/local-area-plans.html.

Fox Lake Local Area Plan, public meeting.

Development Area	Local Area Plan (date of approval)	Zoning Regulation (date of approval or last comprehensive update)
Carcross	2014	1976 New regulations underway
West Dawson/ Sunnydale	2013	1990 New regulations underway
Golden Horn	2004	2011
Watsíx Eetí	Part of Golden Horn Local Area Plan	2011
Hotsprings Road	2002	2005
Deep Creek	2001	2011
Hamlet of Ibex Valley	2001	2010
Hamlet of Mount Lorne	1995	2006
Klondike Valley	1988	1992
Marsh Lake	Underway	None
M'Clintock Place	Part of future Marsh Lake Local Area Plan	1996
Fox Lake	Underway	None
Tagish	Underway	None
Alaska Highway West	Underway	None
Fish Lake	Underway	None
Shallow Bay		Underway
Silver Trail		Underway
Dutch Harbour Remote Recreational Lots		2016
Remote Recreational Lots (Lake Bennett and Tagish Lake)		2014
Mayo Road		2013
Little Teslin Lake Recreation		2010
Jackfish Bay		2000
Grizzly Valley		1996
Mendenhall		1990
Pine Lake		1990
Bear Creek		1983
Destruction Bay		1980
Dempster Highway		1979
Ross River		1978
Whitehorse Periphery		1978

Table 2: Status of local area plans and development area (zoning) regulations for unincorporated communities in 2018.
Note: Bolded areas indicate where area plans have been or are being developed between the governments of Yukon and First Nations.

References

Yukon Department of Energy, Mines and Resources. 1988-2016. Local area plans [modified 2015 Dec 29; cited 2019 Jan 2]. Available from: emr.gov.yk.ca/landplanning/local-area-plans.html.

Status of parks and protected areas

Significance

Protecting parts of the land base provides a foundation for protecting biodiversity, and ecological and cultural heritage. In 1992, Canada and 167 other countries signed the *Convention on Biological Diversity*. Part of this agreement includes establishing networks of protected areas to conserve biodiversity.

The International Union for the Conservation of Nature defines a protected area as "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley 2008). Canada has indicated its support for this definition.

A protected area is land that has been withdrawn from resource and industrial development – mining, oil and gas, logging, dams and land dispositions – and where conservation is the primary objective within the area.

Many protected areas in Yukon were first recognized as special management areas in First Nations Final Agreements. More recently, protected areas are being identified through the regional land use planning process. Yukon has several types of protected areas: national parks and reserves, national wildlife areas, territorial parks, habitat protection areas and special management areas.

What is happening?

Currently, Yukon has 63,275 km² of land identified for conservation purposes – just over 13 per cent of Yukon's total area. Of that, 61,486 km² are protected lands, which include territorial parks, habitat protection areas, national parks, national wildlife areas, and special management areas.

Lewes Marsh Habitat Protection Area.

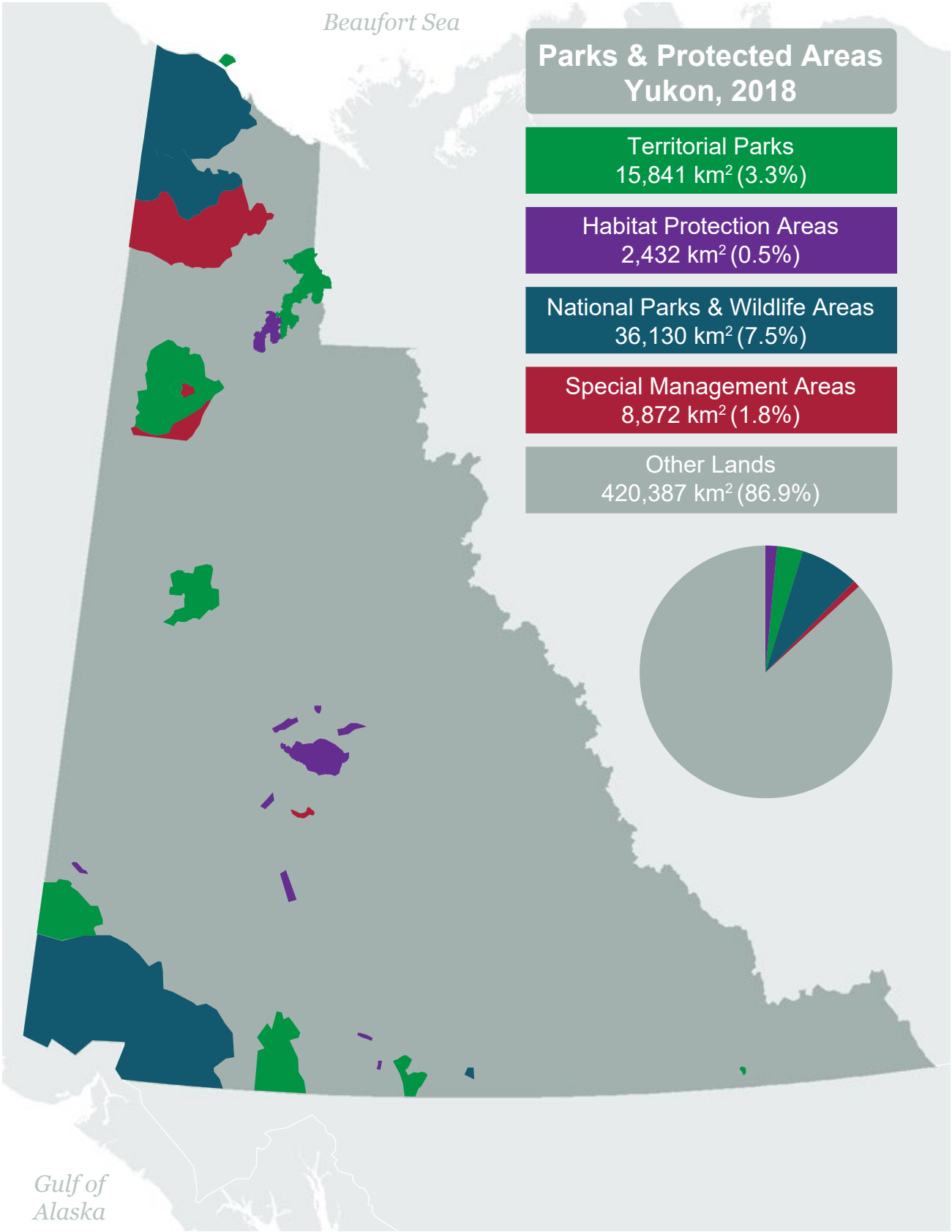


Figure 1: Parks and other conservation areas in Yukon.

Territorial parks

- All territorial parks under the classifications of natural environment parks, with the exception of Agay Mene, wilderness preserves and ecological reserves have interim or permanent withdrawals from mining, oil and gas and surface dispositions. For Agay Mene, the Carcross/Tagish First Nation Final Agreement indicates that land use decisions will be determined through park management planning.
- Management planning for Asi Keyi and Dàadzàii Vàn (Summit Lake-Bell River) territorial parks will be ongoing through 2019.

Habitat protection areas and special management areas

- Habitat protection areas and special management areas are created to maintain important features of Yukon's natural or cultural environment for the benefit of residents and visitors, while respecting the rights of First Nations.
- Habitat protection areas may be established through First Nation final agreements, regional land use planning, or the submission of a proposal to the Minister subject to criteria identified in the *Wildlife Act*.
- Yukon has twelve habitat protection areas, identified or established.

Established	Horseshoe Slough, Nordenskiold (Tsâwnjik Chu), Nordenskiold (Tsâwnjik Chu), Devil's Elbow and Big Island, Fishing Branch (Ni'iinlii Njik), Van Tat K'atr'ananhtii (Old Crow Flats), Lhutsaw Wetland, Ta'tla Mun, Mandanna Lake
Underway	Pickhandle Lakes, Tagish River, Ddhaw Ghro, Ch'ihilii Chik (Whitefish Wetlands)
Anticipated	Lewes Marsh

- Ch'ihilii Chik is the first habitat protection area identified through the regional land use planning process.

National parks and reserves and national wildlife areas

- There are three national parks and one national wildlife area in Yukon.
- Ivvavik National Park was established through the *Inuvialuit Final Agreement* and was the first national park in Canada to be created as a result of an Indigenous land claim agreement. Parks Canada and the Inuvialuit cooperatively manage Ivvavik National Park.
- Kluane National Park and Reserve was declared a World Heritage Site in 1979. Together with Alaska's Wrangell-St. Elias National Park and Preserve, Glacier Bay National Park and Preserve, and British Columbia's Tatshenshini-Alsek Provincial Park, it forms part of the largest international UNESCO World Heritage Site. Parks Canada, the Champagne and Aishihik First Nations, and the Kluane First Nation manage Kluane National Park and Reserve in partnership.

Canadian heritage rivers

- Designation as a Canadian heritage river recognizes rivers or river segments for their natural or cultural heritage and recreational values. This does not provide legal protection for the area. Management of Yukon Canadian heritage rivers is described in each respective approved management plan.
- Yukon has four designated Canadian heritage rivers:
  - Alsek (within Kluane National Park and Reserve);
  - Bonnet Plume;
  - Thirty Mile Section of the Yukon River; and
  - Tatshenshini.

Peel Watershed

In December 2017, the Supreme Court of Canada ruled that the Parties to the Peel Watershed Regional Land Use Planning process return to the final consultation and approval stage in the process. The final public consultation concluded in November 2018. The Parties

are now working collaboratively to complete, approve and implement a Regional Land Use Plan for the Peel Watershed region. The implementation phase of the plan will include the formal creation and designation of permanently protected areas outlined in the land use plan.

Bonnet Plume Canadian Heritage River.

Data quality

The total area of Yukon is 483,662 km² including all land and freshwater based on the best available geospatial representation of the Yukon border and offshore islands. The management plans for each area provide the specific details of land ownership and withdrawal from resource development or equivalent status.

The areas reported as protected are confirmed by the following methods:

- If the area is subject to an interim or permanent withdrawal under the *Lands Act* or a prohibition order under the *Quartz Mining Act* and *Placer Mining Act*, or if it is designated as a protected area under the *Parks and Land Certainty Act* or the *Wildlife Act*:
  - the area stated as protected in the relevant legislation is reported; or
  - if no area is stated, the area from the administrative plan map referenced by the relevant legislation is reported as protected.
- If there is no area or administrative plan referenced in legislation as protected, or there is no legislation in place, the management plan area or area recorded in a Final Agreement is reported.

References

Dudley N., editor. 2008. Guidelines for Applying Protected Area Management Categories. Best Practice Protected Area Guidelines Series No. 21, Gland, Switzerland: IUCN. Available from: cmsdata.iucn.org/downloads/iucn_assignment_1.pdf.

Number, type and location of environmental and socio-economic assessments

Significance

Environmental and socio-economic assessment is a process that identifies the potential environmental and socio-economic effects of proposed activities before they are carried out. The Yukon Environmental and Socio-economic Assessment Board (YESAB) carries out assessments in Yukon.

When a potential effect is identified, an assessor recommends mitigations to reduce, control or eliminate the effect. If the significant adverse effects of a project cannot be mitigated, the assessor must recommend that the project not proceed. YESAB directs its recommendations to decision bodies, which are federal, territorial or First Nation governments or agencies, who make the final decisions.

The number, type, complexity and location of projects assessed by YESAB can indicate development pressures on environmental and socio-economic values, such as:

- impacts on wildlife and their habitat;
- impacts on air and water quality;
- impacts on fish and fish habitat; and
- permanent land conversion.

What is happening?

In 2017, 209 project proposals were submitted to YESAB for assessment, including the Kudz-Ze-Kayah Mine and Coffee Gold Mine proposals submitted for screening by the Executive Committee.

Four common sectors that submit project proposals for assessment are placer mining, land development, quartz mining, and transportation (Figure 1).

In 2017, the majority of project proposals were received in the Mayo and Dawson City areas (Figure 3). Whitehorse, given its population density, generates a large number of project submissions for residential

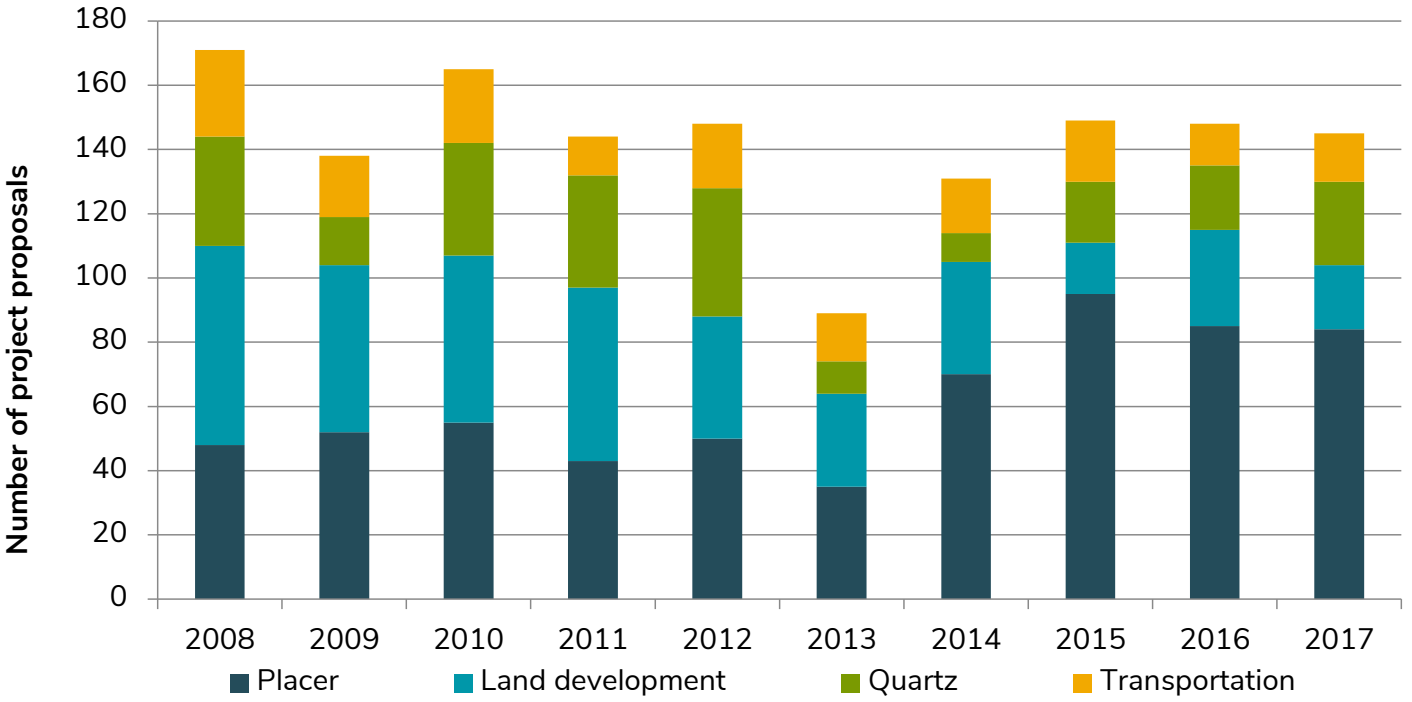


Figure 1: Number of project proposals for the four common sectors, 2006-2017.
Source: YESAB

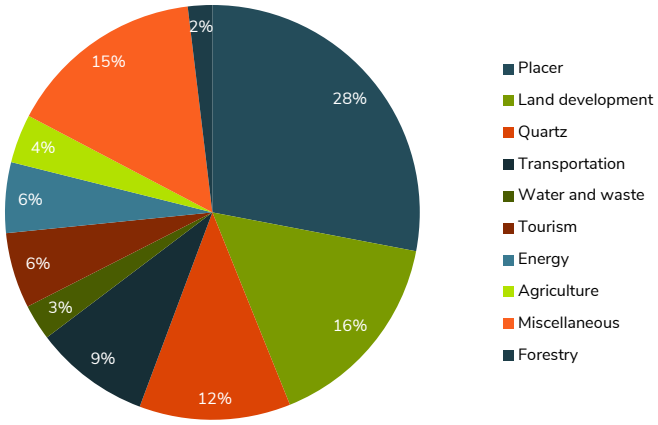


Figure 2: YESAB percentage of projects assessed by sector, 2005-2017.
Source: YESAB

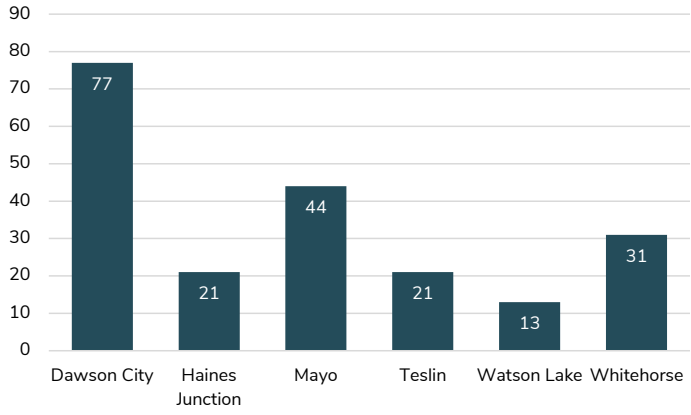


Figure 3: YESAB, project proposal submissions by designated office, 2017.
Source: YESAB

and commercial activities, such as access roads, subdivisions, road upgrades and lot enlargements. Dawson City is a well-known mining district with a long history of placer mining. A significant number of assessable project activities related to placer mining take place within the district, although Mayo also received 25 placer proposals in 2017. Overall, placer mining projects made up 40 percent of the total project proposals submitted to YESAB in 2017. This is in contrast to an average of 28 percent for the period 2005 to 2017.

Additional YESAB assessment statistics are available on YESAB's website at yesab.ca/about-yesab/assessment-statistics. Information regarding individual projects can be found on YESAB's Online Registry (yesabregistry.ca).

Recreational land use

Significance

The Government of Yukon operates and maintains 42 roadside government campgrounds. These provide access to outdoor recreation opportunities such as fishing, hiking, boating and wildlife viewing. Recreational land use may have a negative impact on the environment "when the level of visitor use is greater

than the local environment's ability to cope with this use within the acceptable limits of change" (United Nations Environmental Programme (UNEP) n.d.).

For statistical purposes, the Government of Yukon tracks the number of people using its campsites.

What is happening?

- In 2016, the Government of Yukon's territorial parks included:
  - 42 campgrounds; and
  - 11 day-use recreation sites.
- There are roughly twice as many non-resident campers as resident (Yukon) campers camping in the territorial campgrounds (Figure 1).
- Since 2012, there has been an increasing use of campgrounds by both resident and non-residents.
- In 2017, there were approximately 83,000 visitors to Yukon territorial campgrounds.

Taking action

The Government of Yukon has worked to increase the number of campsites available to visitors and residents. Between 2015 and 2016, 82 new campsites were added across the territory, including additional campsites at the Marsh Lake, Wolf Creek, Twin Lakes and Tombstone Mountain campgrounds, along with the new Conrad Campground on Tagish Lake. This has resulted in a 20 per cent increase in the number of campsites within 200 km of Whitehorse (and four per cent across the territory).

Data quality

- The Department of Environment's Parks Branch track the level of use through campground registrations.
- Registered visitors are calculated by number of recorded visitors + (number of unrecorded registered parties × average number of visitors per party). This number includes repeat users.
- There are other campsites operated throughout the territory including Kathleen Lake Campground in Kluane National Park and Reserve and several private RV campgrounds. Data from these sites are not included.

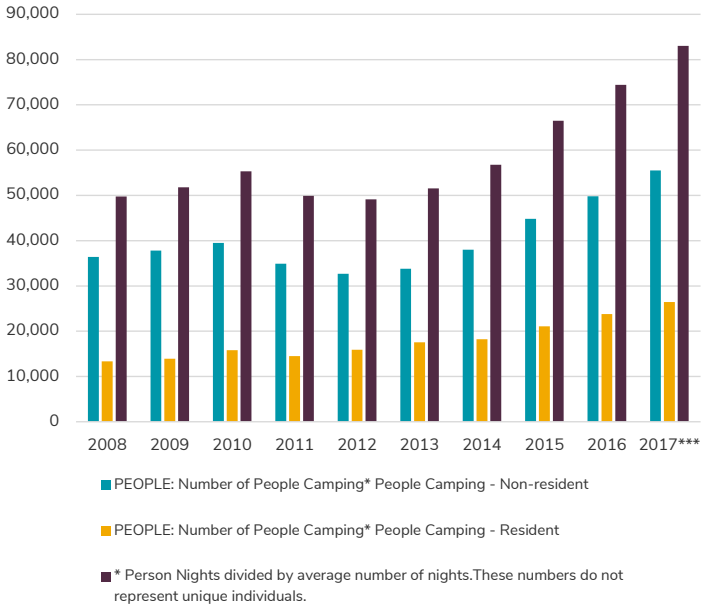


Figure 1: Number of people camping, 2008-2017.

References

United Nations Environmental Programme (UNEP). n.d. Tourism's Three Main Impact Areas [cited 2019 Jan 2]. Available from: gdrc.org/uem/eco-tour/envi/one.html.

Waste handled at the Whitehorse Waste Management Facility

Significance

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 recycling and composting, or shipped outside the territory for treatment.

Landfill closure liability is a standard Public Sector Accounting Board principle that requires owners of landfills to account for the full costs of the closure and post-closure of a landfill. In Yukon, this has put financial pressure on municipalities to incorporate the liability, but has also provided an incentive for waste diversion as a means of lengthening the life of a landfill.

What is happening?

The City of Whitehorse monitors the amount of waste handled by the waste management facility. This includes waste that enters the landfill and waste that is diverted away from the landfill through composting or recycling (Figure 1).

Waste that enters the landfill come from three major sources:

- domestic or household waste and the industrial, commercial, and institutional (ICI) sector;
- construction and demolition; and
- waste from outside city limits. Since 2006, the City of Whitehorse has accepted waste from outlying communities on a fee-for-service basis in order to lessen the landfill burden on those communities.

710 kg – the total average, annual amount of waste per person landfilled in Whitehorse in 2017. The increase from 2016 (610 kg per person) is primarily the result of increases in construction and demolition waste (e.g., FH Collins demolition, etc.).

27 per cent – the percentage of waste diverted from the Whitehorse landfill through recycling and composting efforts.

The most recent information for Canada-wide waste per person is from 2012, when the amount of waste landfilled was 0.72 tonnes (Statistics Canada, 2015b). Comparatively, Whitehorse waste per person in 2012 was 0.77 tonnes and is now 0.71 tonnes.

Increases in the diversion rate can be attributed to the City's 2013 *Solid Waste Action Plan*, which focused on the diversion of cardboard and organics from the commercial sector in 2014/15.

Decrease in the overall diversion rate in 2017 can be attributed to increase waste landfilled (in particular construction waste).

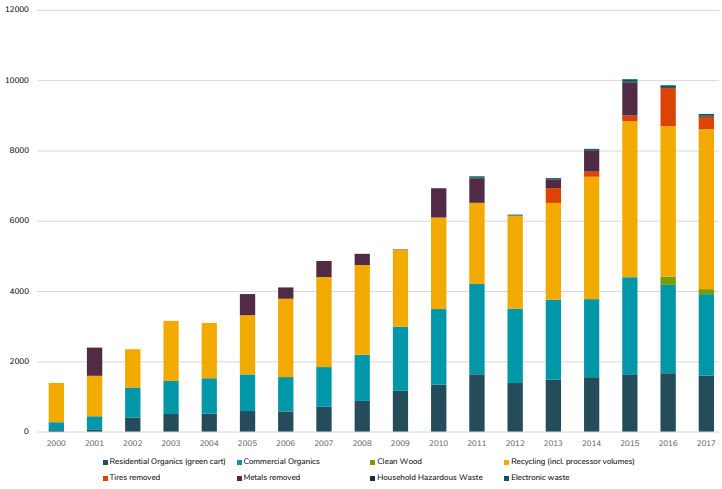


Figure 1: Type and amount of diverted at the City of Whitehorse Waste Management Facility, in tonnes.

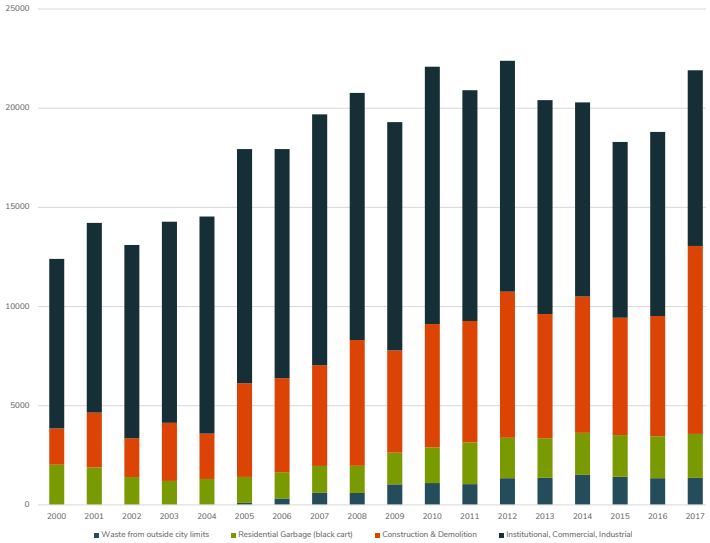


Figure 2: Type and amount of waste landfilled at the City of Whitehorse Waste Management Facility, in tonnes.

Taking action

- In 2018, the City of Whitehorse changed its *Waste Management Bylaw* to ensure that the food service sector, followed by the Multi-Family sector, must participate in an organics collection service. Roll out will begin in 2019.
- Other initiatives include offering one-on-one assistance to businesses to identify waste diversion options and the creation of a waste-sorting app called "What Goes Where?"
- Organics from food service providers, cardboard and clean wood have become controlled

waste under the City of Whitehorse's *Waste Management Bylaw*, which means that they are no longer welcome in the landfill and must be sorted.

- The composting facility at the City of Whitehorse Waste Management Facility was upgraded between 2012 and 2015 with the help of the Build Canada Fund and Gas Tax. Future expansion of the site will include hard surfacing the compost pad to increase operational efficiency. The City of Whitehorse has now qualified its compost as an OMRI (Organics Management Review Institute) listed product. This means the quality of the compost is very high and can be used in organic gardens.

Data quality

- The Whitehorse population estimates are based on total Whitehorse area (excluding Marsh Lake but including people residing outside city limits) and were obtained from the Yukon Bureau of Statistics.
- The 2012 population for calculating the Canada-wide waste per person is an average of the four quarter estimates from Statistics Canada (2015a). The quarterly estimates are based on the 2011 census.

References

Statistics Canada. 2015a. Table 051-0005 - Estimates of population, Canada, provinces and territories, quarterly (persons). CANSIM [modified 2019 Jan 4; cited 2019 Jan 4]. Available from: www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000901.

Whitehorse landfill.

Statistics Canada. 2015b. Table 153-0041 - Disposal of waste, by source, Canada, provinces and territories, every 2 years (tonnes), CANSIM [modified 2019 Jan 4; cited 2019 Jan 4]. Available from: www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810003201.

Forest health

Significance

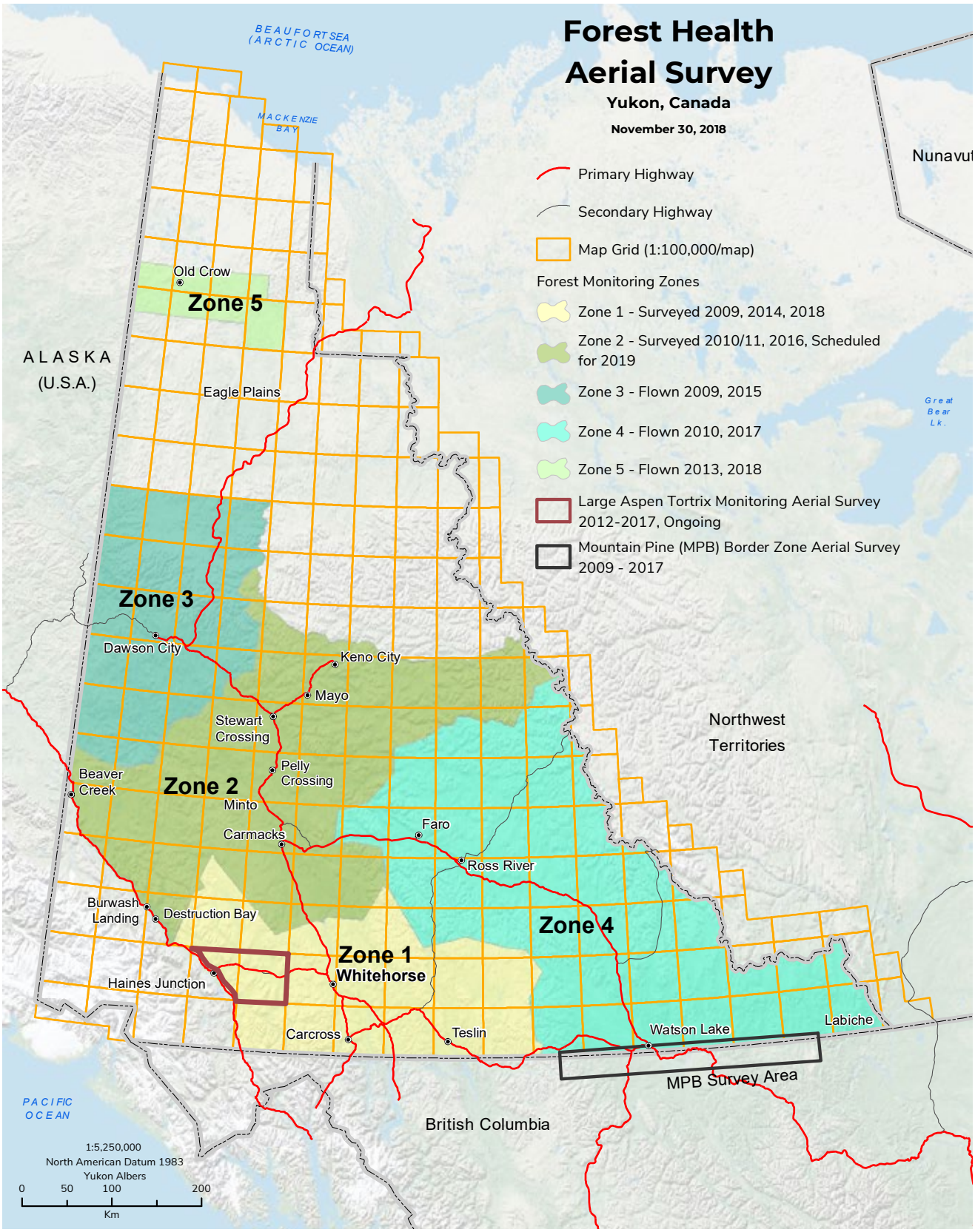
Native forest insects and diseases are generally of little concern when they exist at non-damaging population levels. It is when populations of these native species increase beyond an acceptable threshold, or when alien or native species behave invasively that concerns arise. If ecological or economic damage results in measurable impacts – such as a decline in ecosystem health or large reduction in the available wood fibre – then the insect or disease outbreak is seen as being a disturbance and active management intervention may be considered (Natural Resources Canada n.d.).

In 2009, the Government of Yukon's Forest Management Branch implemented a risk-based approach to forest health monitoring that is consistent with the Canadian Council of Forest Ministers *National Forest Pest Strategy*. The objectives of the approach are to:

- provide a Yukon-wide overview of forest health issues;
- focus monitoring activities on high-risk forest health agents in high value forest regions; and
- contribute to the *National Forest Pest Strategy* goals, one of which is developing early detection and reporting capacity of forest health pests.

Additionally, the Forest Management Branch produces an annual forest health report, which presents the biotic and abiotic disturbances detected by the annual forest health survey. The survey is performed in a different area (Forest Health Zone) each year.

For a full assessment of Yukon forest health issues, see the Yukon Forest Health Reports, available at: emr.gov.yk.ca/forestry/forest_health_reports.html.



Map 1. Forest Health Zones. Shows areas flown from 2009-2018 and planned surveys for 2019.

What is happening?

As a part of the risk-based forest health monitoring program, the Forest Management Branch conducted the following activities in 2018:

- aerial overview surveys;
- monitoring of the Yukon/ British Columbia border zone for mountain pine beetle, mountain pine beetle pheromone bait deployment; and
- spruce beetle pheromone trapping.

Aerial overview surveys were conducted over Forest Health Zones 1 and 5 (refer to Map 1). Portions of Forest Health Zone 1 have been specifically targeted annually since 2012 to map the large aspen tortrix outbreak. In 2018, the branch also responded to a variety of public reports, including an aerial assessment of discolored conifer stands near Little Salmon Lake in Forest Health Zone 2.

Forest health disturbances

The branch maps both biotic and abiotic disturbances. Biotic refers to living, such as native and invasive insects and diseases, whereas abiotic are non-living disturbances caused by weather or wildfires. Declines and pest complexes are generally a combination of both biotic and abiotic factors.

Unless otherwise stated the following summarizes disturbances mapped in Forest Health Zone 1. Aerial surveys conducted in the Old Crow area, Forest Health Zone 5, found no disturbances in 2018.

Biotic disturbances

Spruce beetle

- In 2018, spruce beetle was recorded over 1,196 hectares, the majority of which was found near the south end of Kusawa Lake. It is estimated that the infestation has been ongoing for 3 to 4 years.
- The origin of the infestation is uncertain, but suspected to be associated with the last outbreak as spruce beetle was mapped in the vicinity in 2012, the last year the area was flown.
- Beetles at the end of the last outbreak likely found an endemic niche with populations persisting in stressed trees and expanding into homogeneous spruce forests at the south end of Kusawa Lake, and to the east Takhini River and Primrose Lake.
- Trees that have been attacked by spruce beetles are identified as faders (live trees with yellowing needles and developing broods), reds (dead trees before the needles drop and no brood), and greys (long dead trees with all needles dropped and no brood).
- The Forest Management Branch will continue to monitor this area as part of their proactive approach to forest health management.

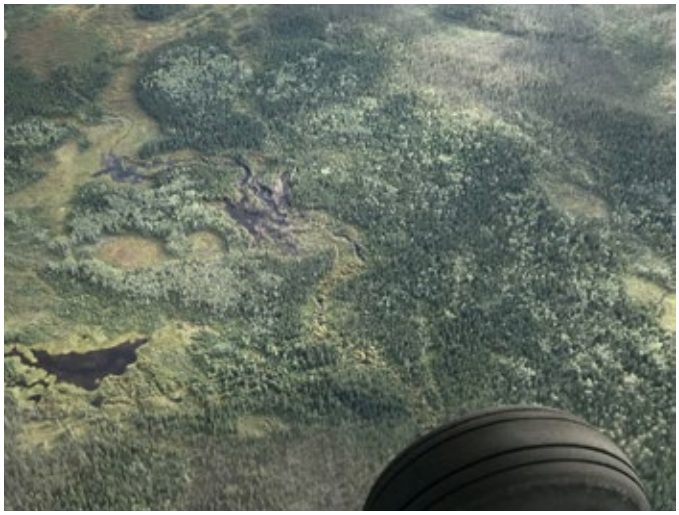
Western balsam bark beetle

- A new bark beetle to Yukon sub-alpine fir forests with northern spread and expansion occurring over the last 20 years.
- Areas infested in 2018 decreased to 1,816 hectares from 2,760 hectares in 2014, with the most notable decrease in stands near the Nisutlin River and Wolf Lake.
- Endemic populations can cause single tree mortality; however, outbreak populations can cause extensive group tree or stand-level mortality over successive years of attack.
- Infested trees retain red foliage for up to five years, making it difficult to determine trends.

Scattered fader, red and grey attack at the very south end of Kusawa Lake.

Aspen serpentine leafminer

- This leafminer has been present in trembling aspen stands every year for the last two decades with variation in annual levels, severity and extent.
- In 2018, area infested increased to 3,257 hectares up from 400 hectares in 2014, but down significantly from 111,720 hectares recorded in 2009.
- This increase in area from 2014 may be partially attributable to the collapse of the large aspen tortrix outbreak in the Haines Junction/Whitehorse corridor and corresponding availability of host material.
- The majority of the defoliation occurred in trembling aspen stands in the Teslin River drainage, including Teslin Lake. It was also recorded on the east side of Lake Laberge, and along Nisutlin.



Light to moderate aspen serpentine leafminer near the Nisutlin River, northeast of Teslin.

Large aspen tortrix

- The outbreak in the Whitehorse/Haines Junction corridor that began in 2012 was thought to be collapsing in 2017; however, populations increased to 1,060 hectares from 452. Defoliation occurred in stands not previously defoliated, representing an expansion of the infestation rather than intensification in previously infested stands.
- Elsewhere in Forest Health Zone 1, defoliation was also noted in areas with no history of defoliation; south of Whitehorse to the British Columbia border and east to Morley Lake and north to Fox Lake. Historical Canadian Forest Service Forest Insect and Disease Survey records for this area, however, indicate large numbers of larvae (722) near Johnsons Crossing in 1993 and Fox Lake in 1989 (200).
- Stand-level decline symptoms, associated with defoliation events, decreased in Forest Health Zone 1 as trembling aspen stands recovered following successive years of defoliation.

Light to moderate large aspen tortrix defoliation near Four Mile Lake southwest of Teslin close to British Columbia border. Note aspen serpentine leafminer also present.

Willow leafblotch miner

- This common leaf miner was first recorded in Yukon in 2007 adjacent to the Stewart River at Stewart Crossing. In 2018, this defoliator caused severe defoliation to 246 hectares of willow along the Dezadeash River, near Champagne.

Foliar diseases

- Foliar diseases, including rusts, occur on virtually every tree and shrub species in Yukon, with higher incidence generally associated with increases in precipitation.
- Many foliar diseases require alternate hosts to complete their life cycles.

- Pine needle cast, *Lophodermella concolor*, led to discolouration/defoliation of 780 hectares of immature lodgepole pine along the Takhini and Ibex rivers, near Snafu and Teenah Lakes, and near Spirit Lake north of Carcross.
- Spruce needle rust, *Chrysomyxa ledicola*, caused discolouration to this year's growth over 45 hectares in three locations; near Haines Junction, Champagne, and near Boswell River east of Whitehorse.
- In Forest Health Zone 2, there were public reports of red trees in the Little Salmon Lake area. Aerial surveys over the area mapped 17 hectares of pine needle cast and 90 hectares of spruce needle rust. Both of these foliar diseases were more widespread than that captured for Forest Health Zone 2 based on aerial observations made while ferrying from Whitehorse to Old Crow.

Moderate discolouration of young lodgepole pine by pine needle cast, just west of Whitehorse.

Abiotic disturbances

Flooding

- Flooding affects trees by reducing the supply of oxygen to the soils and roots, sediment accumulation which can lead to poor soil aeriation, exposure to toxic compounds that accumulate in waterlogged soils, and in some cases physical damage to the roots or sudden exposure to the elements (Anon 2008).

Dead and dying mature lodgepole pine stands adjacent to Flat Creek, northwest of Whitehorse.

- In 2018, flooding was widespread, recorded in over 50 locations totaling 346 hectares. The majority occurred in spruce stands but lodgepole pine was also affected in a few areas.

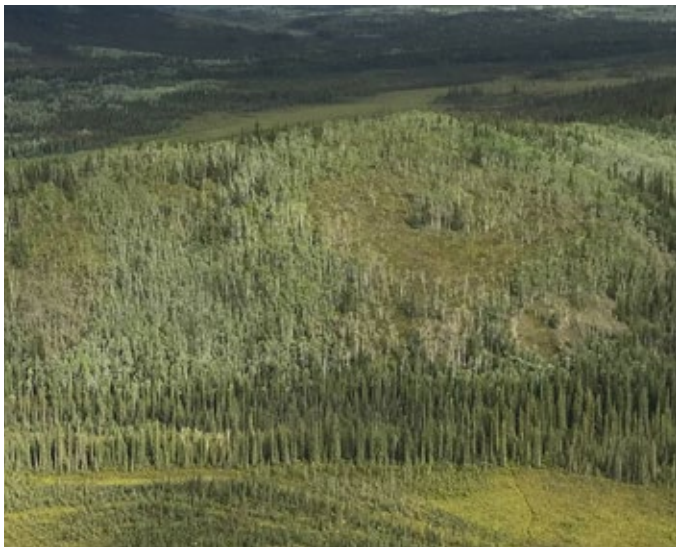
Windthrow

- Shallow-rooted tree species, such as spruce, are more prone to wind throw.
- In 2018, 38 hectares of spruce windthrow was mapped in three separate locations; Natyon Creek east of Haines Junction, near the Takhini River southwest of Champagne, and near Munntiger Lake north of Champagne.

Pest Complexes

Aspen decline

- Aspen decline or dieback refers to mortality or damage to forests due to unknown causes, including a possible combination of biotic and abiotic factors.
- Spatial analysis and ground checks have found a relationship between aspen decline symptoms and frequency and severity of defoliator outbreaks.
- In Forest Health Zone 1 the area with symptoms of aspen decline decreased to 2,102 hectares, down from 4,618 hectares. This decrease in affected area marks the recovery of stands previously infested with large aspen tortrix.



Symptoms of aspen decline: thin crowns, top dieback, stem mortality, and stem breakage.

Stand-level signature of porcupine/bark beetle pest complex.

Porcupines and bark beetles

- Porcupines feed on the nutrient-rich inner bark of all species of coniferous and deciduous trees, but they prefer pine. Some of the trees are girdled by the feeding and subsequently die, or are predisposed such that secondary bark beetles, such as lodgepole pine beetle (*Dendroctonus murrayanae*) or pine engraver beetle (*Ips pini*) attack and further weaken or kill the trees
- Porcupine/bark beetle damage on lodgepole pine was mapped over 1,466 hectares in Forest Health Zone 1, up from 815 hectares in 2014. While the majority were spots of 1-10 trees, there were many polygons mapped as having trace, light, or moderate infestations. These accounted for most of the affected area.
- The most concentrated and largest area was between Whitehorse and Lake Laberge where 591 hectares of trace damage was recorded, including an area 356 hectares in size.
- Damage was observed throughout most of Forest Health Zone 1, with the exception of southwest Yukon, west of Champagne, and north of Lake Laberge.
- The geographic extent of the damage was also larger than that mapped in 2014.

Flooding complex

- Tree mortality caused solely from flooding is dependent upon the tree species affected, and the longevity and severity of the flooding event. If trees survive they may be predisposed to secondary biotic factors, such as bark beetles and wood borers, which could in turn lead to tree mortality. These include spruce beetle, engraver beetles (*Ips pini* and *Ips pertubatus*) and wood borers (*Monochamus spp.*).
- Ground checks at a 55 hectare flooded area near Little Atlin Lake revealed a number of pests, including spruce beetle, northern spruce engraver beetle, wood borers, and ambrosia beetle.
- As the majority of trees were likely dying prior to attack, it is felt that this site will act more as a sink than a source for bark beetles.
- Given the amount of host material in the area, the Forest Management Branch will conduct aerial surveys in this area next year in conjunction with proactive aerial survey efforts in the Kusawa Lake area.

Dead and dying white spruce in stand flooded in spring/early summer of 2018, near Little Atlin Lake

Disturbance Type	2009	2014	2018
Biotic			
Aspen serpentine leaf miner	111,720	400	3,257
Large aspen tortrix	-	6, 120	2,292
Large aspen tortrix/ aspen decline	-	-	140
Spruce beetle	3,130	2	1,196
Western balsam bark beetle	1,465	2,760	1,816
Willow Leaf miner	65	-	246
Pine needle cast	-	-	780
Spruce needle rust	-	-	45
Abiotic			
Flooding and high water	640	608	346
Windthrow	40	10	38
Pest Complexes			
Aspen Decline	-	-	2,102
Porcupine/lodgepole pine beetle/Ips	180	815	1,466
Flooding Complex	-	-	55

Table 1: Summary of forest health disturbances recorded in Forest Health Zone 1 in 2009, 2014 and 2018 (in hectares).

Taking action

In addition to the annual aerial survey monitoring of the Forest Health Zones:

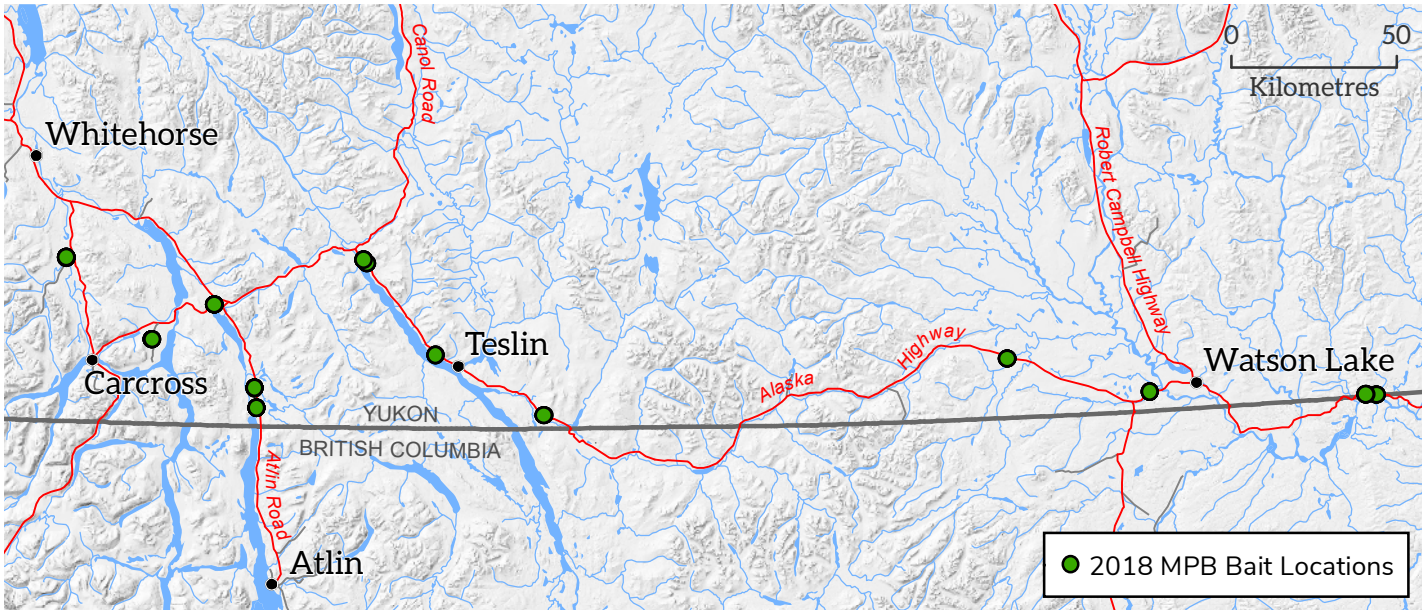
Proactive management of mountain pine beetle

This marks the ninth eighth consecutive year that the Forest Management Branch has conducted aerial surveys in northern British Columbia.

In 2010, when aerial surveys began, mountain pine beetles populations and subsequent pine mortality within the Rocky Mountain Trench of British Columbia were very high (within 150 kilometers of Yukon border). Since that time, severe winter cold has killed beetle broods within the trees. That, combined with no large feeder population in northern British Columbia, has slowed significant northward movement of the populations. The Forest Management Branch continues to monitor the border zone as per the mountain pine beetle monitoring strategy (See Map 1).

Since 2009, the branch has set up and monitored 15 pheromone bait tree stations in southern Yukon to detect the presence of mountain pine beetle (Map 2). These pheromone baits do not attract the beetles over long distances, but will draw them to the baits if they are already in the area. They also do not attract other species of bark beetles. No presence of mountain pine beetle was found in 2018.

Main body of mountain pine beetle infestation 150 km south of Yukon border. This was observed at its peak of infestation in Rocky Mountain Trench British Columbia in 2011.



Map 2. Location of pheromone baiting sites in southern Yukon.

Pheromone trapping in the historical outbreak area

In 2018, a spruce beetle monitoring program was established in the Haines Junction area. The objective of the program is threefold:

- to track the presence or absence of spruce beetle in the Haines Junction timber harvest planning areas;
- to better understand the timing of the spruce beetle flight period in the Haines Junction area; and
- to determine if spruce beetle populations are higher ins some areas than others.

Trap (Lindgren funnel traps) catches in 2018 were very low with only 147 spruce beetles and 43 northern spruce engraver beetles caught in 80 traps spanning 10 locations (8 traps/location).

Data Quality

From 1950 to 1995, the Canadian Forest Services conducted the Forest Insect and Disease Survey. From 1995, both the Canadian Forest Service and the Forest Management Branch conducted aerial surveys monitoring spruce bark beetle near Haines Junction. In 2009, with *National Forest Pest Strategy* funding, the branch adopted the aerial overview survey program and have been conducting annual aerial surveys since then.

Lindgren funnel trap at Pine Canyon, 2018.

The Forest Management Branch has conducted forest health aerial surveys at a landscape level since 2009 to identify both biotic and abiotic disturbances.

Aerial overview surveys and ground field checks are a relatively simple and low-cost method for effectively monitoring forest health over large areas (Ciesla 2000). Aerial overview surveys are also adequate for regional and provincial summaries and to meet national requirements for the Forest Health Network (BC Ministry of Forests and Canadian Forest Service 2000).

As a result, aerial overview surveys are the primary tool for monitoring forest health in Yukon. The forest health aerial overview survey standards used by the British Columbia Ministry of Forests, Lands and Natural Resource Operations are also used in Yukon, which ensures continuity across shared boundaries. Field checks are important for validating the data collected from the aerial surveys. Researchers check a portion of surveyed areas to confirm the identity and severity of the pest or disease disturbance.

As of 2013, all five Forest Health Zones in Yukon were monitored by aerial overview survey. Baseline data has been collected from each Forest Health Zone. Hence, from 2014 on mapping resolution moved from eight kilometre gridlines to 12 kilometre gridlines. During the monitoring of the Forest Health Zones, researchers may select disturbances for further monitoring in the same year. If necessary, these disturbances are identified as ongoing monitoring areas to be included along with the Forest Health Zones scheduled for aerial surveys during the current year.

The Forest Management Branch's Forest Health Program contains ground survey protocols to predict insect population trends, as well as to evaluate the potential risk from various insect pests.

Further information

Forest Management Branch Website: forestry.gov.yk.ca.

Forest Health brochures featuring main pests and pathogens of Yukon: emr.gov.yk.ca/forestry/insects_disease.html.

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Wetlands

Significance

Wetlands can be essential for maintaining water flows, flood protection, purifying water, recharging/discharging groundwater, and providing habitat for fish and wildlife. Some wetlands support traditional subsistence and cultural activities and provide for recreation. Wetlands also provide a number of additional valuable functions including:

- slowing the flow of water, thereby reducing erosion;
- providing habitat for plants that help stabilize stream banks and shorelines;
- creating and fertilizing floodplains;
- supporting the food chain;
- enhancing aesthetics; and
- serving as a rich arena for education.

The Government of Yukon uses the Canadian Wetlands Classification System (1997) that includes five classes of wetlands: bogs, fens, swamps, marshes and shallow open water. These classes are determined by soil, vegetation, water and other ecological characteristics. The classification system provides a practical and consistent framework for the characterization and description of wetlands throughout Yukon and Canada that can be used by specialists and non-specialists alike. Wetland classification can be used by proponents to communicate with assessors and by land managers to identify habitat that may warrant special consideration in planning.

The Canadian Wetland Classification System is a scientific classification and does not address environmental, social or economic importance of a wetland. It is used for naming and describing various kinds of wetlands for use during environmental assessments, regulatory applications, conservation area planning and planning of infrastructure projects.

The largest concentrations of wetlands in Yukon are located in areas underlain by continuous permafrost from central to northern Yukon. Smaller wetlands and wetland complexes are scattered throughout the territory. Wetland mapping has not been carried out in Yukon and the full extent of wetlands is not known,

in particular the extent of peatlands. Wetlands are important for a disproportionally high number of species compared to many other habitats, which is reflected in the number of protected areas in Yukon that include wetlands.

What is happening?

The Government of Yukon has committed to developing a wetlands policy for Yukon. We have invited other governments and external organizations with an interest in wetlands to be partners in developing the policy. Roundtable meetings occurred throughout 2018 and will continue in 2019. Find more about the process on engageyukon.ca.

The Land Planning Branch of Energy, Mines and Resources is responsible for undertaking local area planning in unincorporated communities and supporting the development of regional and sub-regional land use plans. Land use plans are intended to reduce land use conflicts and promote the orderly development of land for the economic, social and environmental well-being of Yukoners. This includes consideration and protection of ecological values, including those of wetlands.

As needed, wetland inventory is conducted to support various governments and non-government projects and planning processes.

- There are a number of important wetlands identified as "significant" in the Government of Yukon's key wildlife area database held within the online Lands Viewer map tool available from: mapservices.gov.yk.ca/arcgis/rest/services/GeoYukon/GY_Biological/MapServer.
- Many of our existing and proposed protected areas include important wetland habitat.
- There are bird monitoring programs in place in a number of wetland complexes recognised for their value to migratory birds which can provide an indication of wetland ecological health (i.e., waterfowl monitoring).

Taking action

The Government of Yukon's Wetland Policy

One of the recommendations in the *Yukon Water Strategy and Action Plan* (2014) is to develop a wetland policy for Yukon. A number of wetland initiatives carried out by the Government of Yukon over the last 15 years include: wetland classification, best practices, environmental assessment, inventory, management planning for specific wetlands, and monitoring of environmental change.

The Government of Yukon, led by the Department of Environment and an interdepartmental working group, is developing a wetland policy. A consistent approach to, and understanding of, wetlands will enable governments to better manage wetlands and consider their functions and values in planning and decision-making.

Aishihik Lake

Mining and Wetlands

The Government of Yukon, led by the Department of Energy, Mines and Resources, has undertaken several activities related to placer mining and wetlands in the Indian River watershed including working with Tr'ondëk Hwëch'in and the Klondike Placer Miners' Association to develop guidelines and policy for the protection and reclamation of wetlands in the Indian River valley. The guidance is intended to provide assistance to placer miners who are required to develop a wetland

reclamation plan in accordance with an approval and/or licence, as well as assist assessors and regulators to provide consistent advice and direction during assessment and licensing of placer mining operations in wetland areas.

Additionally, research projects are underway to gather information and data to develop a better understanding of the wetland complex in the Indian River watershed. Most recently, a two-year wetland mapping and inventory study, involving field and desktop mapping exercises, was completed. The Government of Yukon is exploring ways to make the data available for assessments, licensing and evaluation of proposed wetland reclamation plans. Other studies completed include a wetlands research study led by the Klondike Placer Miners' Association and Ducks Unlimited Canada. This focused on developing a better understanding of waterfowl use of reclaimed wetlands.

Presence of alien and introduced species

Significance

Plants, animals and microorganisms introduced outside their normal range by humans are considered introduced alien species. Not all alien species are harmful to an ecosystem, and some are introduced on purpose (e.g., for conservation, in gardens, to increase hunting or fishing opportunities).

Invasive species are alien species whose introduction has an environmental, economic or social cost. (CBD Secretariat n.d.). 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.

Increases in resource exploration and development and increases in backcountry pursuits will likely increase the range and number of invasive species. A changing climate is also a factor in the increase and spread of alien and invasive species (Streicker 2016).

What is happening?

Plants

- As of September 2018, an estimated 170 alien plant species have been identified in Yukon. Of these, 96 are currently believed to be present, 33 are believed to be absent, and the presence of 41 additional species is unknown (Figure 1).
- Thirty-three of these plant species have a high to medium invasiveness rating in Yukon (Yukon Conservation Data Centre n.d.)
- Several vascular plant species once thought to be introduced are now considered to be expanding their range and are therefore considered native. Changing species range is natural and the rate of expansion appears to be increasing. This phenomenon has been more clearly documented with vertebrate animals sure as mule deer, cougar, and moose which have expanded their range northwards.
- Several species are newly reported and have been added to the list of exotic species. These include Norwegian Angelica (*Angelica archangelica*), Common Dog Mustard (*Erucastrum gallicum*), White Campion (*Silene latifolia*), Loesel's Tumble Mustard (*Sisymbrium loeselii*), Common Mullein (*Verbascum thapsus*), and Tatarian Honeysuckle (*Lonicera tatarica*).
- Since the late 1800s, botanists have searched communities collecting and identifying plants. With few exceptions, introduced plant species are associated with human disturbance. By looking at the results of surveys in the communities (particularly Dawson City and Whitehorse), along major highways (particularly the Alaska and Klondike highways), and along major rivers (such as the Yukon and Teslin rivers), a trend in the number of introduced species naturalized is shown (Figure 1).

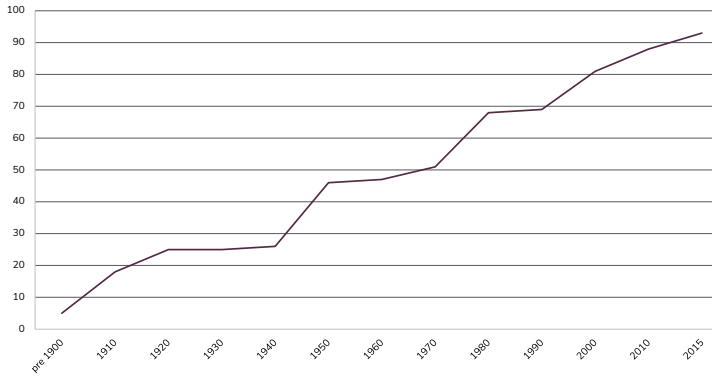

Figure 1: Introduced plant species persisting in Yukon.

Common Mullein (*Verbascum thapsus*) was discovered for the first time in Yukon in the Dawson area. Photo: B.A. Bennett.

Seven spotted lady beetle. Photo: Kelcy Tousignant.

Mammals

- There are 72 regularly occurring mammal species in Yukon; of these, three are introduced beyond their native range.
- No mammals are considered invasive in Yukon.
- The house mouse is an alien species from Europe that was introduced accidentally or has spread from southern populations.
- Feral horses are known to be present in Yukon at the time of this report.
- Elk, though native to southeast Yukon, were introduced to south-central Yukon in the late 1940s, to reduce hunting pressure on moose and caribou.

Elk. Photo: J. Bergold.

Birds

- There are four introduced bird species out of the 243 bird species that regularly occur in Yukon: Rock Pigeon, House Sparrow, Eurasian Collared Dove, and European Starling.
- These species were introduced accidentally or have spread from southern populations.
- These four species occur in low numbers and are not expected to have a large impact on native species (Yukon Invasive Species Council n.d.).
- Rock Pigeons, once common in Whitehorse are now believed to be extirpated with only a single individual seen recently.

House Sparrow. Photo: Cameron Eckert.

Freshwater fishes

- Most Yukon lakes and waterways appear to be free of invasive or introduced species.
- Out of the 38 regularly occurring species of freshwater fish, two are introduced:

- Goldfish is an alien species that occurs in Yukon and was either introduced accidentally or spread from southern populations.
- Threespine stickleback is native in BC and Alaska but was accidentally introduced into two pothole lakes with fish stocking programs in the 1970s.

- Several fish species, though native in some rivers or lakes in Yukon, were intentionally released in other areas to enhance fishing opportunities (Table 1).

Species:	Native to:	Introduced in:
Arctic char	Two lakes in Ivvavik, northern Yukon	Southern Yukon
Bull trout / Dolly Varden	Yukon and Liard drainages	Pothole Lakes
Kokanee	Alsek drainage	Scout Lake
Rainbow trout	Alsek drainage	Yukon River

Table 1: Native Yukon fish species introduced to other places in Yukon.

Threespine Stickleback. Photo: NOAA Fisheries, Auke Bay Laboratories.

Invertebrates

- Less is known about alien invertebrates in Yukon.
- The Conservation Data Centre currently has about 3,500 invertebrate species recorded in their database; 36 are known to be introduced and believed to be present. It is likely that more introduced species are present but not detected.
- There are several alien earthworms that are believed to live year round in Yukon (i.e., the night crawler or dew worm). The red wiggler is commonly used for composting, but is not known to overwinter in Yukon outside cultivation.
- The seven-spotted lady beetle is commonly used to control aphids in greenhouses and has been found in remote places such as Keno Hill. It is now believed to be persisting in the wild.

Taking action

The Yukon Invasive Species Council works to address the threats posed by invasive species through prevention, early detection and rapid response, control and management, research, and education. Council members come from different governments, industry and the public.

The Fisheries Unit at the Department of Environment asks Yukoners to report aquatic invasive species. They actively promote information at boat launches throughout the Yukon.

Data quality

- Through the Spotter's Network, there is a formal protocol for invasive alien species data collection within Yukon.
- The Yukon Conservation Data Centre makes data publicly available to anyone wishing to access information on species or ecosystems of conservation concern. This includes lists of species, range maps and identification guides.
- The Government of Yukon provides additional information about Yukon's aquatic invasive species at Yukon.ca/aquatic-invasive-species and invasive plants at env.gov.yk.ca/animals-habitat/invasiveplants.

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Yukon Invasive Species Council. n.d. Yukon Invasive Species [cited 2019 Jan 4]. Available from: yukoninvasives.com/index.php.

Wolves play an important role in Yukon's ecosystems.

Species management plans

Significance

Species management plans address conservation and population management concerns for fish or wildlife populations. They are used to help to develop or revise approaches to managing a population and regulating human interaction with these species.

Management plans are developed in response to local or territorial population management needs or as required through the federal species at risk legislation. Tracking the implementation of management plans helps to demonstrate commitment to continued action on managing species.

Cow moose with two calves.

Aishihik wood bison.

Fish and wildlife

What is happening?

The Government of Yukon has the following species management plans in place or in progress:

Plan	Approved	Status	Summary
Management Plan for Elk in Yukon	2016	Current	This plan provides an adaptive framework to guide the management of the Takhini and Braeburn elk herds.
Management Plan for Yukon Amphibians	2013	Current	This plan provides a broad framework guiding the management of amphibians in Yukon. The Western Toad is listed as a Species of Special Concern under the federal *Species at Risk Act*.
Management Plan for the Aishihik Wood Bison Herd in Southwestern Yukon	2012	Current	This plan provides a broad framework guiding the management of the herd in a manner consistent with recovery of a species at risk, while addressing local concerns and interests.
Yukon Wolf Conservation and Management Plan	2012	Current	This plan guides wolf conservation and management throughout Yukon, ensuring that the roles of wolves and their prey species are respected.
A Conservation Plan for Grizzly Bears in Yukon	No	Underway	The Government of Yukon and the Yukon Fish and Wildlife Management Board worked in partnership to develop this plan to address local management issues and to meet federal and international obligations. It is anticipated that the plan will be approved in 2019. The grizzly bear is listed under the federal SARA as a Species of Special Concern.
Management Plan for the Chisana Caribou Herd	2011	Current	This plan guides the management and conservation of the Chisana caribou herd, a small international herd shared with Alaska. The herd experienced population declines and a successful recovery effort in the past. The management plan provides guidance to maintain a healthy herd.

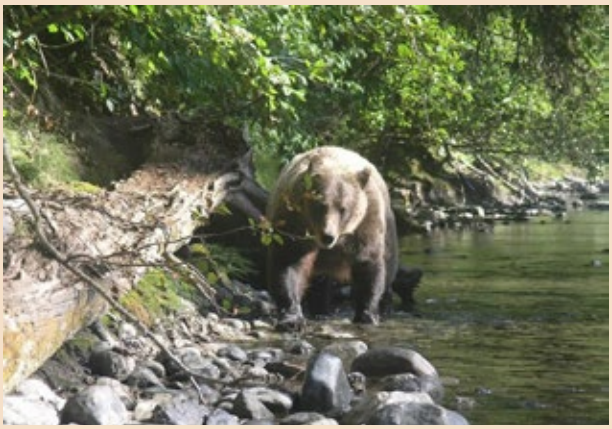
The federal government has the following recovery strategies and management plans in place or in progress:

Recovery Strategy (in place) Baikal sedge Eskimo curlew Northern Mountain caribou Wood bison Little brown myotis and northern myotis	**Management Plan (in place)** Short eared owl Rusty blackbird Peregrine falcon
Recovery Strategy (in progress) Common nighthawk Olive sided flycatcher Red knot – roselaari type	**Management Plan (in progress)** Polar bear

The *Management Plan for Yukon Amphibians*, *Management Plan for the Aishihik Wood Bison Herd in Southwestern Yukon*, and A Conservation Plan for Grizzly Bears in Yukon were developed in part to address the national requirements under the federal *Species at Risk Act*.

Taking action

View the species management plans: Yukon.ca/wildlife-habitat-planning.



Female grizzly. Photo: Angela Milani.

A Conservation Plan for Grizzly Bear in Yukon

It is important to have a plan to conserve grizzly bears because they can be very slow to recover from population declines – grizzly bears are sensitive to human disturbance, and changes to their habitat. Across Canada, the health of grizzly populations varies, with some considered stable (as is the case in most of Yukon) and others declining or gone. In areas where conflicts between humans and bears are common, grizzly bear populations are more likely to decline.

Grizzly bears are nationally assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a Species of Special Concern. Once listed in the federal *Species at Risk Act*, the Conservation Plan for Grizzly Bear in Yukon will provide important Yukon-specific context and guidance to support the development of a national plan for grizzly bears.

The conservation plan considers many aspects of grizzly bear conservation with particular focus on habitat and land use issues, hunting, reducing conflicts between grizzly bears and humans, wildlife viewing and tourism values, and improving our understanding of grizzly bear populations and ecology.

The conservation plan provides overarching direction for addressing the range of values and issues related to grizzly bear conservation across Yukon. Although local or regulatory issues are not specifically addressed in the plan, it contains related recommendations.

The working group engaged with First Nations, Inuvialuit, boards and councils, non-governmental organizations, interest groups, and the public to gather Yukon's collective knowledge and wisdom about grizzly bears. The plan integrates local, traditional and scientific knowledge.

The draft conservation plan went out for public engagement from October to December 2018.

Community-based fish and wildlife work plans

Significance

Strategic work planning helps to identify long-term and cooperative management solutions to help support healthy fish and wildlife populations.

Community-based fish and wildlife work plans are one way that the Government of Yukon, First Nations governments, and Renewable Resources Councils work together to decide the priority of fish and wildlife management issues for an area and propose cooperative approaches for addressing these issues. Tracking the implementation of these work plans is one measure of effective fish and wildlife management.

What is happening?

- There are four community-based fish and wildlife work plans currently in place.
- Science, traditional and local knowledge is considered in the development and implementation of these plans.
- The *Southern Lakes Regional Wildlife Assessment and Recommendations* was developed by governments (First Nations, Yukon, Canada, and British Columbia) to recover and conserve wildlife populations and their habitat in the Southern Lakes area.

Taking action

- Many fish and wildlife surveys and habitat mapping initiatives have been completed in traditional territories due to issues identified through community-based planning.
- Opportunities for working with different agencies to address fish and wildlife management concerns in communities are often identified through these work plans.
- Art work done by youth in the communities have been featured in the completed plans.

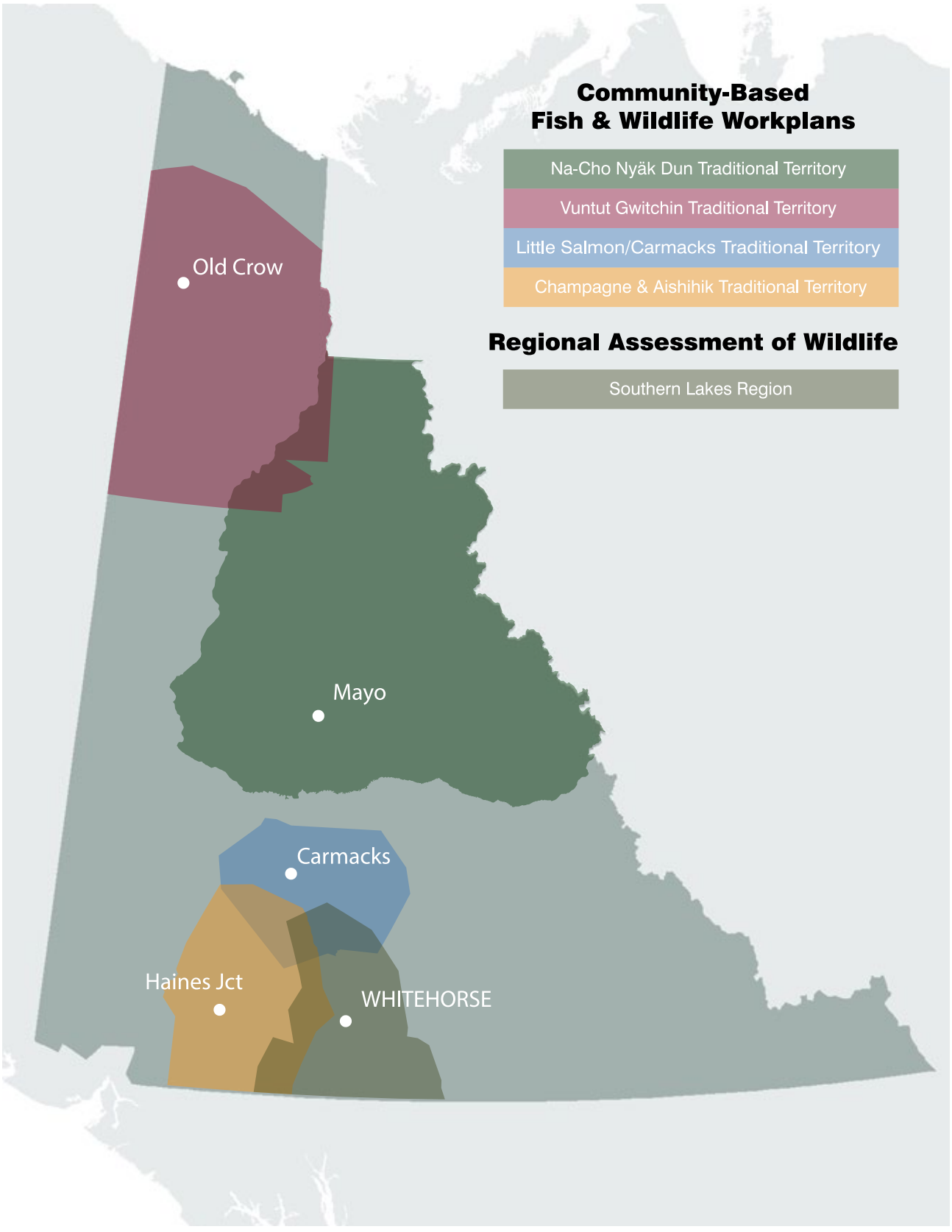


Figure 1: Map of areas covered by community-based fish and wildlife work plans and regional assessments of wildlife.

Little Salmon Carmacks Community-based Fish and Wildlife Work Plan

The *Little Salmon Carmacks Community-Based Fish and Wildlife Work Plan* has been updated with new priorities for 2019-2023. The plan is a tool to come together and coordinate priorities for fish, wildlife, and habitat issues within the Traditional Territory of the Little Salmon/Carmacks First Nation. The plan allows for stronger communication and information sharing between parties and the community.

2012 to 2017 work plan successes

Klaza Caribou

- There was an extensive amount of work completed to better understand the Klaza caribou herd.
- A five-year study of the Klaza caribou herd was completed and involved monitoring radio collared caribou, habitat mapping, lichen mapping, ground disturbance mapping and fire risk mapping.
- A full herd population count was completed in 2012.
- A range assessment evaluating cumulative effects on the herd was written.

Freshwater fish

- Lake trout population assessments and angler surveys were completed on Frenchman Lake and Twin Lakes and a lake trout survey was conducted on Mandanna Lake.
- Results from the Twin and Frenchman Lakes surveys led to regulation changes to limit angler harvest.

Moose

- Workshops to map local knowledge of important moose habitat and discuss moose management in the Carmacks area were held in 2012, 2013, and 2015.
- Aerial surveys to map late winter moose habitat were carried out in 2012 and 2013.
- The Tatchun moose population was surveyed in 2013.
- The Carmacks Community Moose Monitoring Project continues to be active and all moose harvest is monitored by Little Salmon/Carmacks First Nation and the Government of Yukon and is discussed annually at May Gathering.

Sheep

- The Magundy-Little Salmon Lake and Glenlyons Range sheep populations were surveyed in 2014, 2015, 2016, and 2017.
- A survey was conducted in the Division Mountain area in 2017 to evaluate important sheep habitats.

Wildlife conflict

- Electric fences were put up at the Carmacks waste management facility which has reduced the number of problem foxes and wolves in town.
- There are ongoing efforts to get information out to the community on human-wildlife conflicts and how to avoid these situations. Further community input is needed to continue to address these concerns.

The planning team identified new priorities based on community input. The most important priorities to address in the Traditional Territory over the next five years include:

- **Cumulative effects on fish and wildlife:** Further our understanding of the impacts of development, particularly mining and exploration, on fish and wildlife and their habitat within the Traditional Territory. This will include an evaluation of the effects of increased access to remote areas and reclamation of past development.
- **Climate change:** Further our understanding of the potential impacts of climate change on fish and wildlife and their habitat within the Traditional Territory to better prepare for future scenario planning and adaptation needs.
- **Moose:** Complete a Traditional Territory-wide moose range assessment to better prepare for future land development, and to effectively manage moose and their habitat. This will involve identifying culturally and ecologically important areas for moose.

Caribou population and distribution

Significance

Caribou are important ecologically and culturally. Many people in Yukon rely on caribou for subsistence and spiritual well-being. Conserving and protecting key caribou habitat – rutting areas, migration corridors and winter range – is important for herd health and abundance.

Caribou herds that cross jurisdictional boundaries require a coordinated approach to their management. For example, the Porcupine caribou herd has a range that covers Yukon, Alaska, and the Northwest Territories.

Woodland caribou. Photo: Cameron Eckert.

What is happening?

There are two subspecies of caribou in Yukon, *Rangifer tarandus granti*, which are the large migratory herds (e.g., Porcupine, Fortymile and Nelchina) and *Rangifer tarandus caribou*, which are more sedentary woodland herds (e.g., Northern Mountain and boreal).

Woodland caribou herds

- In 2014, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) re-assessed all Northern Mountain woodland caribou in Canada as a Species of Special Concern. These caribou are designated as such under Canada's *Species at Risk Act*.
- Across Canada, boreal woodland caribou are designated as a Threatened Species under Canada's *Species at Risk Act*.
- Of the 26 Northern Mountain woodland caribou herds present in Yukon, four are increasing in size, seven are considered relatively stable and three are declining.
- The declines in Yukon herds and across the circumpolar north may be due to environmental changes, natural population cycles, or human influences such as harvest and development.
- Population trends are unknown for 12 of the woodland caribou herds.
- The Ibex caribou herd is expanding its range to the north, south and west. Information collected by the Government of Yukon and by members of the public indicates that this herd is now being seen in areas where it has not been observed for many decades, particularly west of Kusawa Lake.
- Based on the area of mapped disturbances (human-caused and fire-related), Yukon's boreal caribou are considered "self-sustaining" (i.e., stable), under Environment and Climate Change Canada's boreal caribou recovery guidelines. Yukon's boreal caribou are small in number and represent a small fraction of the overall boreal caribou population in Canada and are contiguous with boreal caribou in the Northwest Territories.

Large migratory caribou herds

- In 2016, COSEWIC assessed all "barren-ground" caribou in Canada as a Threatened Species. Yukon's Porcupine caribou herd is included in this assessment.
- The Fortymile and Nelchina herds are not considered "barren-ground" caribou under COSEWIC's barren-ground caribou assessment and their status has not been assessed.
- In Yukon, all of the large migratory caribou herds, Fortymile, Nelchina, and Porcupine, are increasing in size.
- Starting in the winter of 2013-14, the Fortymile caribou herd dramatically increased its presence in Yukon, expanding its recent range to the east

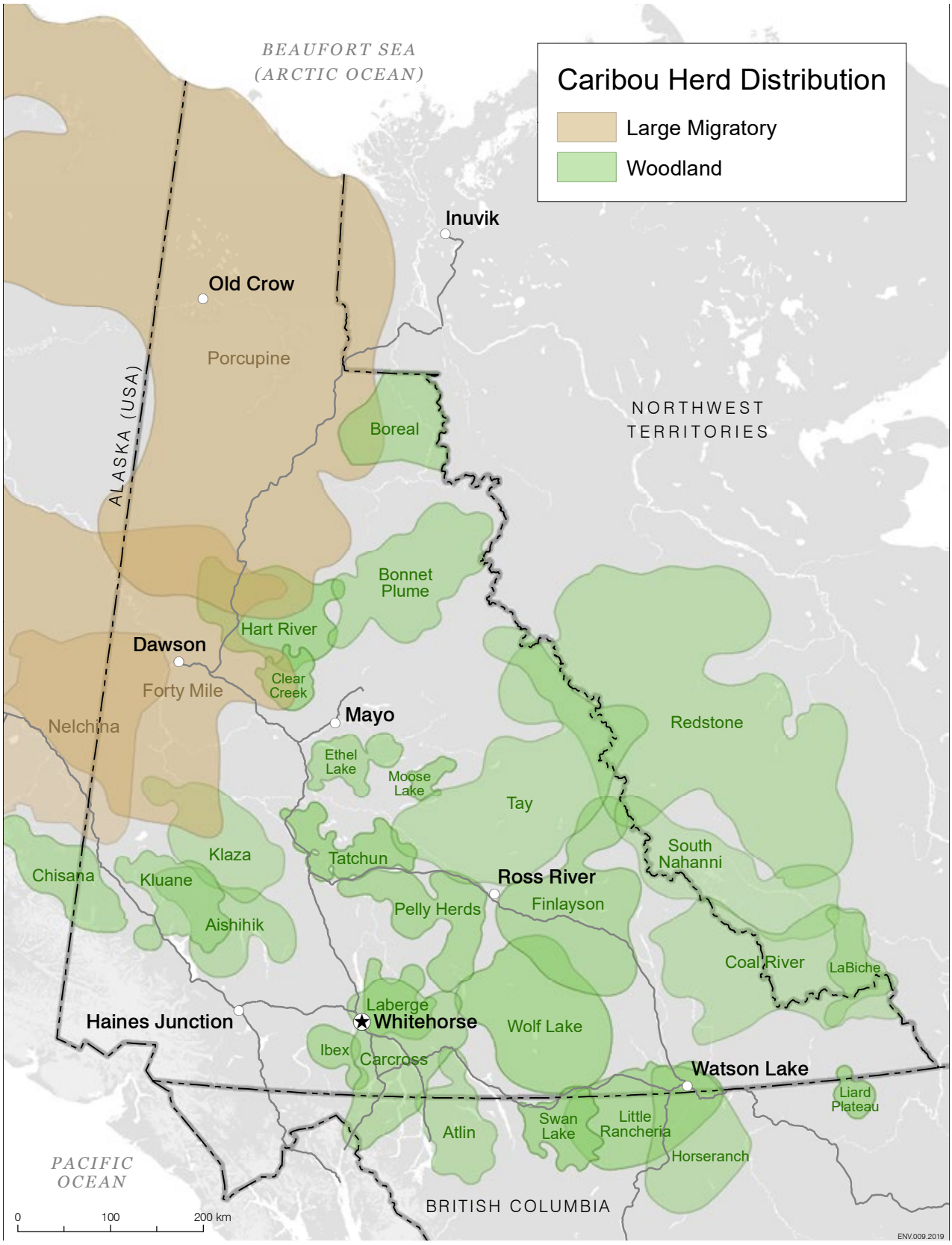


Figure 1: Distribution of caribou herds in Yukon, 2017.

and southeast, back to historic ranges last used in the 1960s. This movement of Fortymile caribou into Yukon was aided by conservation actions in Yukon and Alaska initiated in 1995. At roughly the same time, the Nelchina herd also began moving into Yukon during the winter months. Its range in Yukon overlaps substantively with the Fortymile herd.

Taking action

- The Government of Yukon monitors several caribou herds each year to assess overall status and trends.
- Recovery plans for woodland caribou populations have been developed under the federal *Species at Risk Act*.
- Harvest management plans have been developed for the Fortymile and Porcupine caribou herds in collaboration with co-management partners.
- An international, multi-jurisdictional management plan for the Chisana herd has been developed.

Data quality

- Caribou herd population status (size and trend) is typically determined through aerial surveys, which estimate both herd size and the number of calves produced each year.
- The Government of Yukon has modified its approach over the past few years to use aerial surveys in combination with radio-collared animals to monitor Northern Mountain woodland caribou herds.
- This approach has increased the precision of population estimates as well as provided additional information on seasonal ranges and habitat use.
- The sizes of large migratory herds are estimated using aerial photo-census techniques. The Government of Yukon partners with the Government of Alaska, which leads these surveys.

Collared caribou are key for monitoring the Fortymile caribou herd. Photo: Scott Cameron.

Caribou mercury levels

Significance

Contaminants such as heavy metals can persist in the environment and can have serious health implications for wildlife and for people, especially people who depend on traditional foods. In Canada, mercury is a risk to Canadian ecosystems and human health (Environment and Climate Change Canada 2016).

Many contaminants found in the North were never used in the region but have been transported here by wind and water, as they tend to settle in areas with colder climates. Many contaminant sources have been banned or restricted for many years, but still persist in northern ecosystems.

Caribou feed on lichen that can directly absorb 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.

What is happening?

In 2016, samples were collected from 23 Porcupine caribou.

Mercury concentrations in liver are generally lower than in kidneys, averaging 1.8 µg/g dry weight. While mercury levels fluctuate over time in caribou organs, over the long term it has remained stable in the Porcupine caribou herd.

Yukon health advisories

- Meat (muscle) from Yukon caribou is a healthy food choice, as heavy metals are present in very low concentrations.
- Intake of kidney and liver from Yukon caribou should be restricted depending on the herd (e.g., a maximum of 25 kidneys or 12 livers from the Porcupine herd per year).

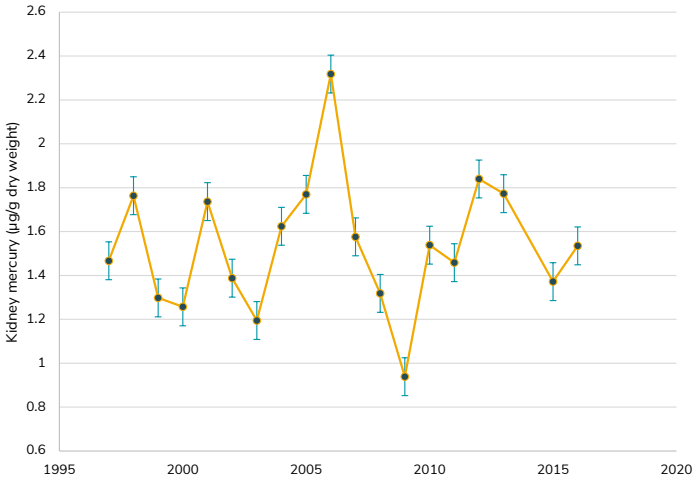


Figure 1: Average mercury concentrations found in the kidneys of Porcupine caribou bulls.

Taking action

- The federal Northern Contaminants Program has measured mercury levels in the Porcupine caribou herd since 1994 to determine if these populations remain healthy (in terms of contaminant loads) and whether they remain a safe and healthy food choice for northerners.
- The Porcupine caribou data were part of a dataset submitted by the Northern Contaminant Program to the United Nations Environmental Programme. The data was provided to support the Minamata Convention, a global treaty to protect human health and the environment from the adverse effects of mercury. Signatories to the Convention work towards controlling how much mercury is released into the environment. The 50-ratification milestone was reached on May 18, 2017, and the Convention came into force on August 16, 2017.
- The Arctic Monitoring and Assessment Program (AMAP) Assessment 2015: Human Health in the Arctic is an assessment of Arctic human health impacts of contaminants and other stressors. The assessment was conducted between 2012 and 2014 by an international group of over 60 experts. Recommendations from the report were delivered to Arctic Council Ministers at their meeting in Iqaluit in April 2015.

Data quality

- Data are available for kidneys and livers only. This does not reflect the amount of mercury in the muscle (meat) of the animal.
- The gender of the animal as well as season of collection can affect Mercury concentrations.
- Generally, this program collects samples in the fall.
- Annual variation in mercury concentrations is common.

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Density of snowshoe hares

Significance

Snowshoe hare is a key component of the boreal ecosystem. In Yukon, hares make up almost 50 per cent of available food for predators (Figure 1). Their abundance regulates the predator populations that rely on them for food. They also have a significant impact on the plant communities they eat from, and other small mammals that predators eat when snowshoe hare numbers are low.

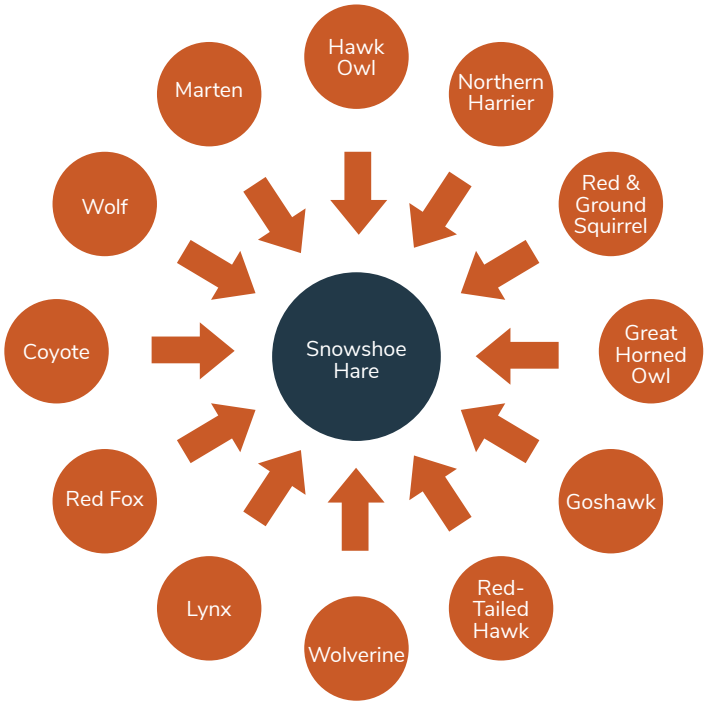

Figure 1: Predators of snowshoe hare.

Snowshoe hare populations fluctuate in nine to 10 year cycles throughout the boreal ecosystem. The dominant driver of this process is predation. The cycles appear to be in sync across Yukon.

Because snowshoe hare are one of the most important components of boreal food webs, monitoring their numbers is valuable. Long-term data on their abundance can provide information on the population fluctuations of their key predators, such as lynx, which is a valued furbearing animal to trappers.

The timing and size of the snowshoe hare population peaks help biologists see where trends are headed when assessing potential changes in the boreal ecosystem, such as predator abundance, alternative prey abundance (e.g., arctic ground squirrels or grouse) or browse intensity (impact on shrubs). This information is valuable to research programs, park and forest management, and as baseline information for environmental assessments.

Monitoring of snowshoe hare numbers provides a continuous record of the response of this key ecosystem component to changes over time. The consequences of climate change on boreal ecosystem dynamics are difficult to predict, and biologists rely on long-term monitoring programs to detect and understand these responses.

Young snowshoe hare.

What is happening?

The Keystone Boreal Species Trend (KBST) project monitors snowshoe hare density at undisturbed forested sites in different regions of Yukon.

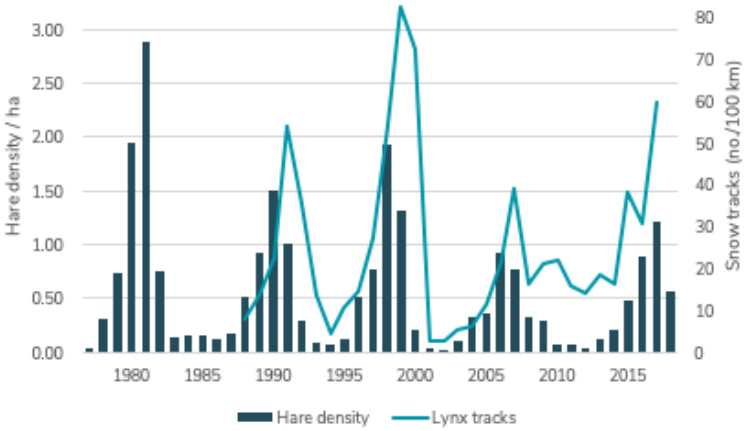

Figure 2: Population density estimate for snowshoe hare in Kluane region, 1977–2018. Recapture data for hares are given as histogram bars, and estimates of lynx abundance are given as points (95 per cent confidence limits). Hare densities in other regions of Yukon are estimated through fecal pellet counts. The fecal pellet count data was unavailable at the time of publication.

2006 and 2017 were the last peaks in the snowshoe hare cycle. Currently the hare population cycle is in its decline phase.

The amplitude of the snowshoe hare cycle has been diminishing over the last 30 years in Yukon, demonstrated by research in the Kluane area going back to 1973 (Krebs et al. 2014).

The reason for this change is currently unknown. Because the snowshoe hare cycle is mostly driven by predation pressure, the answer may be related to changes in predation success. Snow conditions are likely to change with climate change and this may affect the hunting success of both avian and terrestrial predators of snowshoe hare.

The KBST project also monitors lynx abundance through winter track counts. Their abundance fluctuates with snowshoe hare abundance. Lynx numbers increased in all areas as the hare numbers increased in recent years. However, lynx abundance was higher than expected for the last low of the hare cycle in Kluane, indicating potential predation pressure on alternative prey populations. Currently lynx numbers are expected to decline as the hare population declines.

Taking action

- The KBST has five stations for ongoing monitoring in Yukon's boreal forests. There are stations near Faro, Kluane, Mayo, Watson Lake and Whitehorse.
- An annual report on these trends is produced (e.g., Krebs et al. 2017), and various researchers utilize these data to assist in understanding the dynamic food web of the boreal forest ecosystem. The Government of Yukon's Biodiversity Programs provides access to this information.

Snowshoe hare in winter.

Data quality

- KBST estimates the number of snowshoe hares by live trapping, marking and releasing individuals at the Kluane monitoring station. They also count fecal pellets yearly at all monitoring stations to come up with an estimate of how many hares are in each area.
- Hare density is calculated by dividing the number of hares by the number of hectares in the monitoring area.
- Data from most KBST areas are available from 2005 onwards. Monitoring has occurred in the Kluane area since 1973, but the protocols and additional areas were developed in 2004, so comparisons can only occur from 2005 onwards.

References

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Winter tick surveillance

Significance

Winter ticks (Dermacentor albipictus) are one-host external parasites that can be found on cervids such as elk, mule deer, and moose in Yukon. These parasites can negatively affect host health when present in large numbers. Moose are especially vulnerable because they do not groom off larval stages of ticks. In some regions of Canada, winter ticks can be responsible for severe disease and mortality in moose.

To date, data suggests that winter ticks are not a major disease concern for Yukon cervids. By studying the distribution and occurrence of winter ticks in Yukon, we are monitoring how these parasites may affect Yukon's wild cervid populations and how their geographical distribution may change over time. This is especially important for species such as moose, which are a key harvest species in Yukon.

Winter ticks do not carry diseases of concern to humans or wildlife, nor do they negatively affect the meat of harvested animals. Winter ticks do not feed on people and are rarely found on domestic animals.

Climate may be an important factor in the tick-cervid relationship. Warmer temperatures in the summer and winter may support larger populations of cervids that carry ticks, and allow larval ticks to survive longer in the environment. A changing climate could influence vegetation patterns and winter temperatures thereby influencing the distribution and presence of wildlife parasites like winter ticks.

What is happening?

Winter ticks affect different species in different ways.

- In early autumn, elk and deer groom off larval ticks, which reduces tick numbers and minimizes negative health impacts.
- Moose only begin to groom off ticks once adult ticks are present (late winter), which can lead to high numbers of ticks on individual moose.
- Moose can experience severe disease associated with blood and hair loss from heavy tick burdens.
- Since 2012, the Government of Yukon's Animal Health Unit has examined cervid hides to monitor winter tick geographical presence over time (Figure 1).

Species	Number of hides sampled	% hides found with winter ticks (actual number)
Mule deer	57	58% (33)
Moose	7	14% (1)
Elk	53	74% (39)
Caribou	12	9% (1)

Table 1: Hides examined for winter ticks between 2011 and 2018.

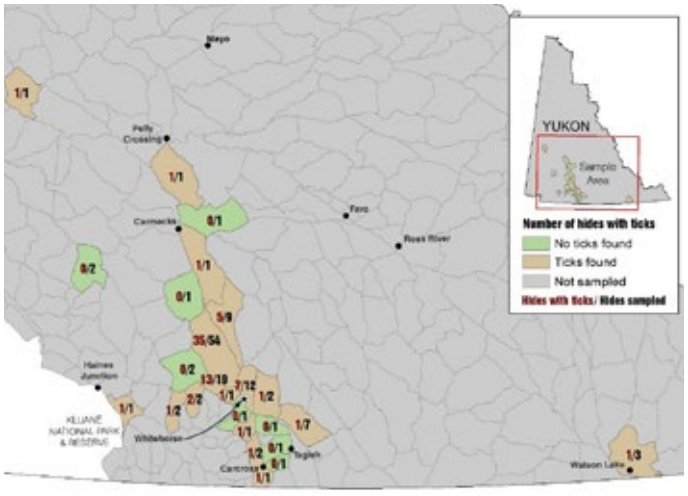

Figure 1: The known distribution of winter ticks based on hides examined to date (collected between 2011-2018).

- Winter ticks are established on elk in Yukon. Winter ticks likely originated in Yukon from translocation of elk from central Alberta, and/or by range expansion from northern British Columbia and Alberta (Leo et al. 2014).
- Winter ticks have been found on cervids in 15 out of the 21 Game Management Zones where hides have been examined.
- The Animal Health Unit uses an index from 0 to 10 to describe the severity of winter tick burdens on the hides that are sampled. While the majority of hides have light burdens (indexed from 1 to 2) some have heavier burdens (indexed from 3 to 8), with one moose hide having 543 ticks, which corresponds to a burden ranging from 4,000 to 8,000 ticks (index of 8).

Taking action

The Animal Health Unit continues to monitor for winter ticks through assessment of cervid hides. Elk hides are a mandatory harvest submission, while deer, caribou and moose hides are submitted voluntarily.

So far, all of the hides examined have been from Southern Yukon (see Figure 1) which has provided good baseline data on winter ticks in this region. In order to understand what is happening in other parts of Yukon, more hides from other areas are needed for this surveillance. Hunters from all over Yukon are encouraged to contact the Department of Environment to submit cervid hides for examination.

Since 2017, the Animal Health Unit and the University of Toronto are collaborating on a project that will help us better understand the geographical distribution of winter ticks in Yukon and the impacts of climate change on ticks and their hosts. The goals of this project are to:

- predict changes in winter tick distribution in Yukon;
- better understand the survival of winter ticks in cold and wet weather; and
- predict changes in the exposure of host populations to winter ticks in Yukon.

Data quality

The Animal Health Unit uses a standardized hair transect method to evaluate the level or severity of tick burden. The method can be used on hides, unskinned animals or live animals, which increases the number of animals that can be examined. The Animal Health Unit has used the standardized hair transect method on hides collected since 2011.

References

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Sustainability of lake trout fisheries

Significance

The health of lake trout populations reflect the general health of an aquatic ecosystem due to the species':

- slow growth;
- position at the top of the aquatic food chain; and
- reliance on healthy and clean habitats.

As an indicator species, monitoring the sustainability of lake trout populations can provide valuable information about the ecosystem. This species is also highly valued in Yukon fisheries. Monitoring the harvest data and calculating the optimal sustainable yield for each lake informs management decisions such as changes to catch and possession limits.

Lake trout.

What is happening?

Recreational harvest data are available for the lakes in Yukon where the most intensive fishing activity takes place. Fisheries on other lakes are expected to be within sustainable levels, due to low fishing activity. Generally, small lakes are more vulnerable to overharvesting because of their smaller lake trout populations and lower sustainable yields.

Harvest of fish is considered to be unsustainable when it exceeds the "optimal sustainable yield." Overharvested populations will decline and fishing will become poor if no management action is taken.

In 2017:

- The majority of the recreational lake trout harvest in Yukon was sustainable, with most water bodies maintaining quality fisheries.
- Lake trout harvest in Fox, Caribou, and Fish lakes exceeded sustainable limits according to most recent angler harvest data.
- In some cases, harvest may appear to be sustainable when, in fact, a lake trout population has been depleted. For example, while the lake trout harvest in Braeburn, Laberge, Little Atlin, Frenchman, Pine, Teslin, Ethel, and Louise lakes is below the sustainable threshold, it may prove unsustainable because these lake trout populations appear to be depleted.
- Snafu and Tarfu lakes have been removed from Figure 1. In 2015, a regulation change was implemented for both lakes resulting in a zero retention limit for lake trout. Angler harvest surveys were completed on Snafu and Tarfu lakes in 2017, but there is no lake trout harvest to report.

Taking action

- In 2017, the Yukon Fish and Wildlife Management Board recommended regulation changes for Fish, Laberge, Ladue, Little Salmon, Mayo, Twin,

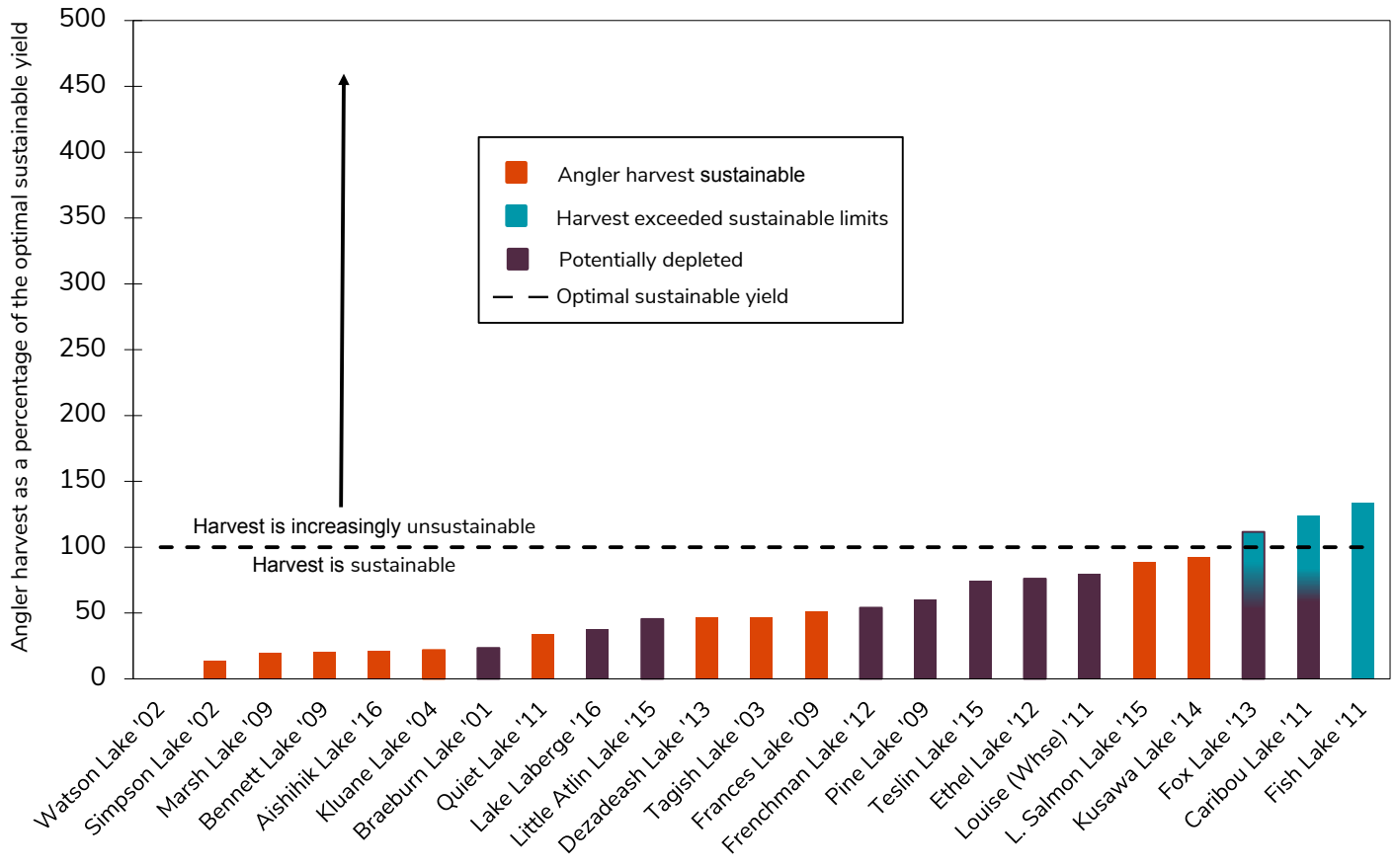

Figure 1: Sustainability of angler harvest on select Yukon lake trout populations based on most recent angler harvest data up to 2017.

Nares lakes, and Nares River to reduce catch and possession limits for lake trout in order to maintain a sustainable fishery. These changes came into effect on April 1, 2018. An evaluation of these changes is planned for future years.

- In 2018, the Government of Yukon's Fish and Wildlife Branch performed lake trout and lake whitefish population assessments at three lakes; burbot population assessments at one lake; and performed angler harvest surveys at five lakes. Data from these surveys are currently being analyzed.

Data quality

- The optimal sustainable yield is derived from a model based on physical and chemical parameters of the lake, such as temperature and nutrient content.

Number of spawning Chinook salmon

Significance

Chinook salmon are a key food source for bears, eagles and other predators and they bring nutrients from the ocean to freshwater and terrestrial ecosystems. Salmon are important culturally, socially and economically in Yukon.

Chinook salmon returns vary considerably due to a number of factors, including:

- the strength of returning age classes;
- in-river harvest;
- offshore unintentional by-catch in the pollock fishery;
- predation;
- disease;
- water levels;
- temperature; and
- environmental variables, e.g., climatic events such as the Pacific Decadal Oscillation, El Niño, and La Niña.

The international Yukon River Salmon Agreement has formally been in place since 2002 to help rebuild and conserve Canadian-origin salmon stocks and to define harvest allocations to Canadian and US fisheries. The Yukon River Panel established a spawning conservation target for the number of Chinook salmon returning to spawn in the Canadian portion of the Yukon River.

Capturing lake trout in gill nets to estimate their density and abundance.

Salmon in the Takhini River.

Fish and wildlife

The goal is for an escapement (number of fish reaching spawning grounds) of 42,500 to 55,000 fish. This is tracked by the federal government through Fisheries and Oceans Canada.

What is happening?

- In 2017, the spawning conservation target for Yukon River Chinook was met, with a preliminary estimate of approximately 70,000 fish reaching their spawning grounds in the Yukon (Figure 1).
- This was the sixth time in the last ten years that the spawning escapement target was met, and one of the highest escapements on record.
- The 2017 drainage-wide run size (i.e., the number of Chinook salmon that entered the river) was not particularly strong relative to historical levels. As such, the high spawning escapement was only made possible through closures to the commercial, domestic and recreational fisheries, and significant harvest restrictions in subsistence and First Nation fisheries in Alaska and Yukon.

Taking action

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, including:

- full or partial closures of commercial, domestic and recreational fisheries;
- closing key staging or salmon spawning areas to angling;
- decreasing mesh sizes;
- selective release of female salmon; and
- reducing fishing times.

In addition, Yukon First Nations have placed voluntary restrictions or avoided subsistence harvesting activities in years of low returns.

The Yukon River Panel, established by the Yukon River Salmon Agreement, recommends spawning goals, reviews management strategies and conservation objectives, and funds restoration and enhancement projects focusing on Canadian-origin salmon stocks.

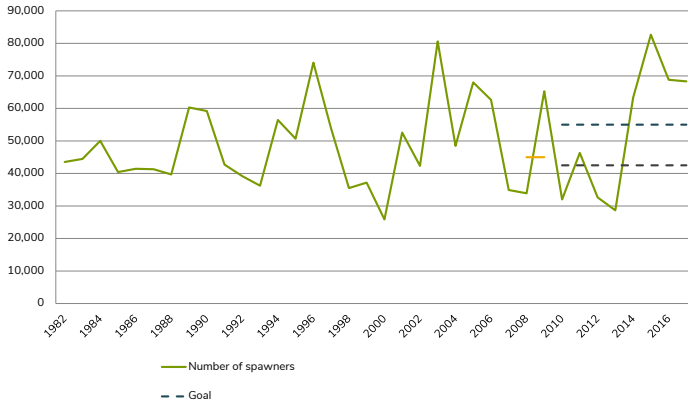

Figure 1: Number of Chinook salmon spawning in the Canadian portion of the Yukon River, excluding the Porcupine River drainage. **Source:** Yukon River Salmon Season Summary and Season Outlook.

Children releasing salmon into Wolf Creek.

Data quality

Estimates of the total number of salmon that return to their spawning grounds in Yukon are based on sonar passage estimates in Eagle, Alaska and harvest estimates from fisheries upstream of the sonar in both Alaska and Yukon.

In addition, a number of counting projects in the upper Yukon River watershed are used to monitor the number of adult salmon that reach specific spawning tributaries. These projects also evaluate the proportion of adult female to male salmon, and the size and age of fish returning to spawn.

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Trumpeter swan population monitoring

Significance

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Trumpeter Swans as a species of Special Concern in 1978. Their status was re-examined and they were found to no longer be at risk in 1996, largely based on surveys of Trumpeter Swan breeding grounds in northern Canada and Alaska (COSEWIC 2011).

What is happening?

- Yukon has two swan populations – the Rocky Mountain Population and the Pacific Coast Population, surveyed since 1985 in Yukon and northern BC.
- The Pacific Coast Population breeds mainly in Alaska, but also in Yukon and northwestern BC.
- The Rocky Mountain Population breeds mainly in Alberta, western Saskatchewan, southern Yukon, and the Northwest Territories.

Trumpeter Swan in flight. Photo: Cameron Eckert.

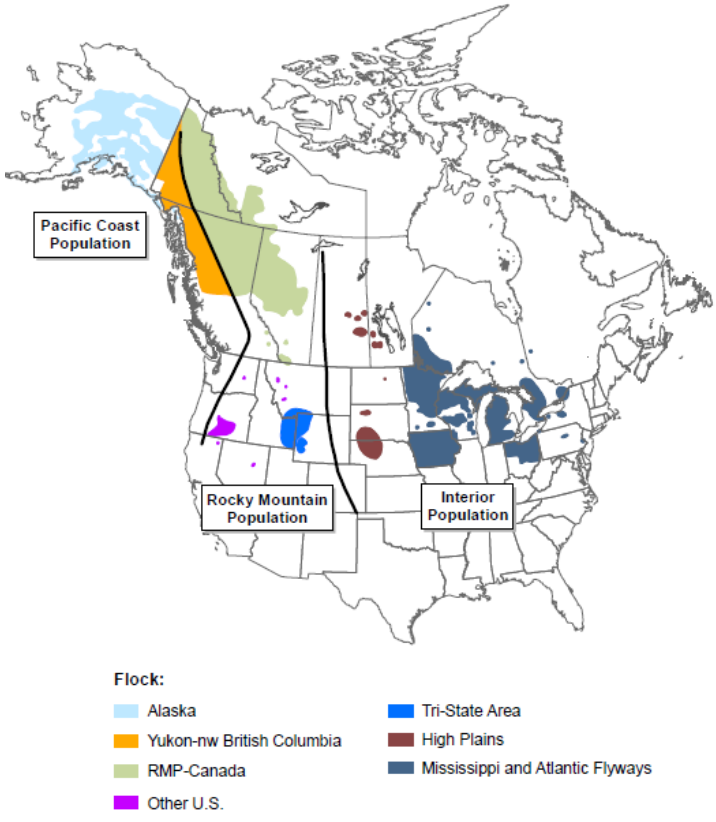

Figure 1: Breeding distribution of Trumpeter Swan populations in North America sampled in the Yukon as part of the 2015 North American Trumpeter Swan Survey.
Source: Groves 2017.

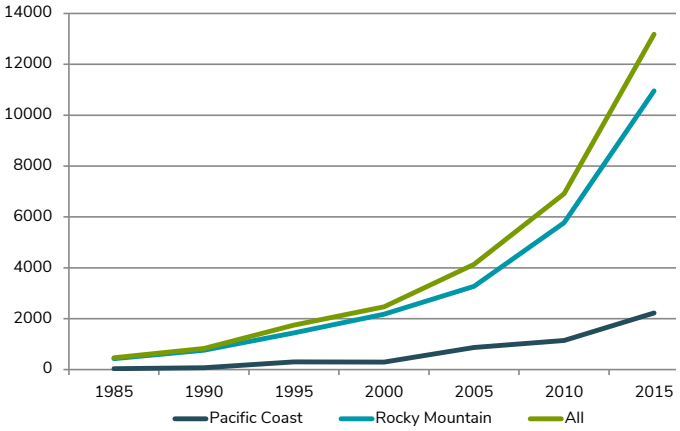

Figure 2: Population estimates for Canadian Trumpeter Swans.

- The 2015 estimate for the Canadian portion of the Rocky Mountain Population was 10,957 (SE = 227) compared to the 5,773 (SE = 295) estimate for 2010. The Canadian flock increased 11.5 per cent annually from 1968 to 2015.
- The 2015 estimate for the Canadian portion of the Pacific Coast Population was 2,225 (SE = 436) compared to the 1,141 (SE = 294) estimate for 2010. The Yukon – northwestern British Columbia flock increased 14.5 per cent annually from 1985 to 2015.
- All Canadian areas of the Rocky Mountain and Pacific Coast Populations exhibited growth since the 2010 survey.

Taking action

Surveys coordinated by Environment and Climate Change Canada in Yukon contribute to national and international trend and population estimates for Trumpeter Swans.

The Government of Yukon operates the Swan Haven Interpretive Centre, where visitors can view and learn about M'Clintock Bay on Marsh Lake, an important staging area for migrating swans, waterfowl, gulls and shorebirds.

Data quality

- Continued monitoring of this species occurs through the North American Trumpeter Swan Survey, available through trumpeterswansociety.org. Yukon contributes survey information of its swan populations to the continent-wide monitoring.
- The survey is conducted across Trumpeter Swan breeding grounds every five years. Surveys have been conducted since 1968.
- The survey was originally designed as a complete census, i.e., counting all the birds across the entire range. By 1995, increases in the Trumpeter Swan population made a complete census unfeasible and a stratified random sampling approach was adopted, i.e., randomly selecting map grids to survey which are likely to have breeding swans.

Trumpeter Swans. Photo: Environment and Climate Change Canada, Jim Hawkings.

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Monitoring breeding waterfowl

Significance

Yukon is the summer breeding home for more than 30 species of waterfowl and provides critical staging areas for birds migrating in the spring and fall seasons.

Specific threats to Yukon waterfowl include:

- Removal of standing dead wood (i.e., snags, standing dead trees) from areas along lake and river margins by commercial or small-scale timber harvest removes potential nesting cavities and sheltering areas for waterfowl.
- Changes in water regimes due to climate change or human activities (e.g., hydroelectric projects) may change the timing of ice formation and/or spring break-up. This has the potential to alter migration stopover sites for waterfowl either by preventing access (e.g., no open water in spring time) or by changing the accessibility of food (e.g., if water is too deep, waterfowl may not be able to reach submerged vegetation).
- Disturbance of waterfowl due to increased human recreational activity (e.g., loose dogs, boating, etc.) has detrimental effects on foraging efficiency and body fat acquisition. It is especially important during spring migration when there is often less time and less space (due to ice cover) for birds to acquire the resources they need to ensure successful reproduction.

Waterfowl and gulls in flight.

This indicator provides information about waterfowl through an example of a diving duck (Lesser/Greater Scaup) and a dabbling duck (Mallard) in two survey areas in Yukon.

Monitoring waterfowl presence and abundance gives a good indication of the ecological health of an area, as waterfowl depend on wetland areas for food, nesting areas, and cover from predators.

What is happening?

There are two long-term survey areas for Yukon waterfowl:

- Old Crow Flats is Yukon's largest wetland for waterfowl and is considered globally significant. This 12,122 km² area is almost completely free of development. It is used by the Vuntut Gwitchin First Nation for hunting, trapping and cultural activities.
- The Yukon Southern Lakes region features highly productive inlets and outlets of numerous large lakes that provide important waterfowl staging areas.

Overall, waterfowl populations in Old Crow Flats and the Southern Lakes region are stable, though there is annual variation in populations among species.

Lesser Scaup. Photo: Cameron Eckert.

Diving ducks – Lesser and Greater Scaup

Diving ducks are named by their habit of diving for food. As well, they generally nest close to the water's edges. The presence and abundance of diving ducks are indicators of water health.

Lesser and Greater Scaup are two diving duck species that are grouped for the purpose of this monitoring

analysis since they are almost impossible to distinguish during aerial surveys. Scaup are in decline across North America with estimated populations approximately 43 per cent below the *North American Waterfowl Management Plan* (2012) conservation goal of 6.3 million.

- At Old Crow Flats, the 2018 combined Lesser and Greater Scaup total adult population estimate was 45902 (SE = 19848.37), 32 per cent below the estimate from 2017. This is also 54 per cent below the long-term average (1955 to 2018) of Scaup in this area (Figure 1).

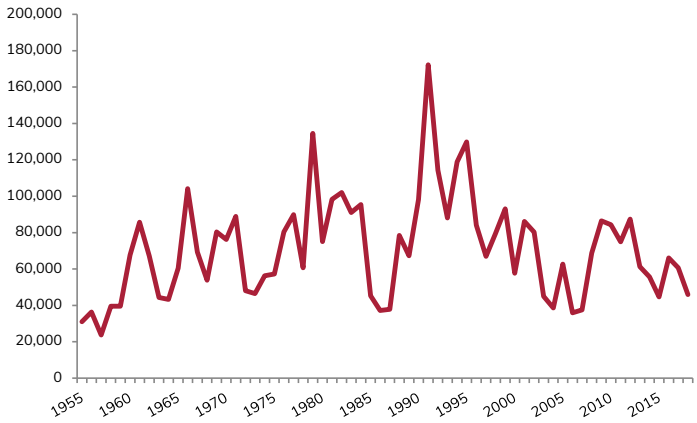


Figure 1: Adult population estimate for Lesser and Greater Scaup at Old Crow Flats.

- The Southern Lakes ground surveys also show that Lesser and Greater Scaup are in decline. Although from 2012 to 2013 there was a 28 per cent increase in the breeding pairs of Scaup counted, since the start of the survey in 1991, there has been a decreasing trend.

Mallard hen on Hidden Lakes. Photo: Jamie Kenyon

Dabbling ducks - Mallard

Dabbling ducks walk well on land and can nest far from the water's edge. They feed on grass and seeds on land, as well as algae, plants and insects in the water. The presence and abundance of dabbling ducks are indicators of the health of a wetland area.

Mallard is a common dabbling duck that is also extensively hunted in Canada; therefore, their populations are monitored. Across North America, Mallard populations are 26 per cent above the *North American Waterfowl Management Plan* target.

- At Old Crow Flats, the 2018 Mallard total adult population estimate was 11,595 (SE = 47779.49) - 42 per cent below the 2017 estimate. There is an overall increasing trend for Mallards; the 2018 estimate is 18 per cent above the long-term average (1955 to 2018) at Old Crow Flats (Figure 2).

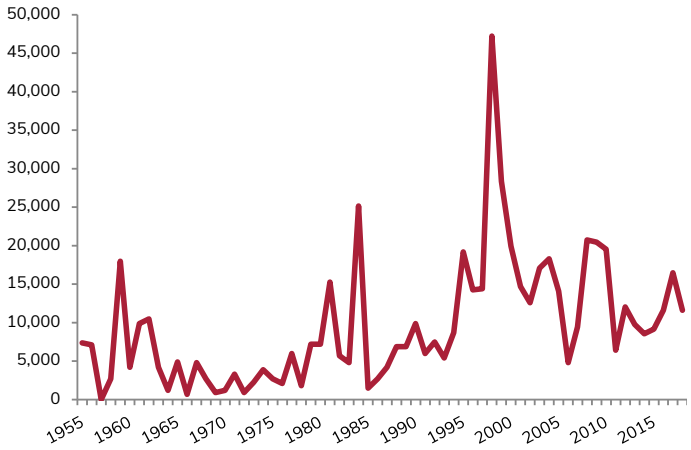
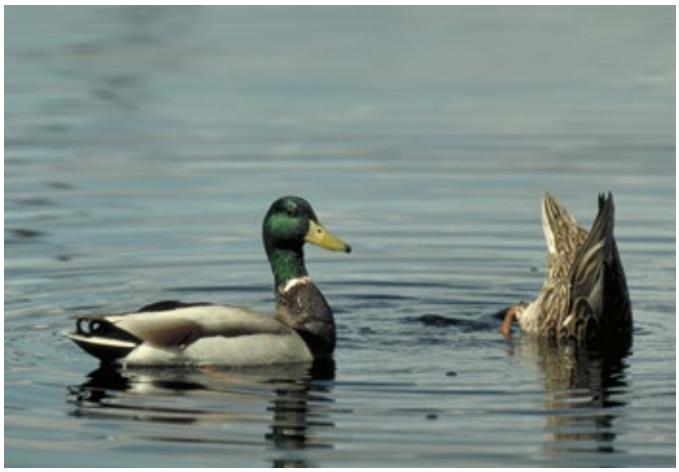


Figure 2: Adult population estimate for Mallard at Old Crow Flats.

- The Southern Lakes ground survey shows that there is a modest long-term increasing population trend (over 15 years) for Mallards. Additionally, from 2012 to 2013 the breeding pair population of Mallards observed increased by 20 per cent.



Mallard pair. Photo: Jamie Kenyon.

Taking action

The *North American Waterfowl Management Plan* sets conservation goals for waterfowl across the continent; Yukon surveys contribute to information for continent-wide population monitoring. See the plan at: nawmp.wetlandnetwork.ca.

Data quality

Surveys are conducted annually in the Old Crow Flats wetland. In the Southern Lakes region, wetlands are surveyed along roadsides.

Old Crow Flats

- US Fish and Wildlife Waterfowl Population Status: fws.gov/birds/surveys-and-data/reports-and-publications/population-status.php.
- The annual aerial surveys are carried out on one day; count results may be influenced by weather conditions.

Southern Lakes ground survey

- Cooperative Yukon Roadside Waterfowl Breeding Population Survey: canada.ca/en/environment-climate-change/services/migratory-game-bird-hunting/consultation-process-regulations/report-series/population-status-2017.html.
- The survey consisted of counts in a sample of wetlands, conducted four or five times from early May to mid-June between 1991 and 2016. The survey was discontinued after the 2016 field season. Survey wetlands were adjacent to the road and wetland selection was determined to be non-random and not representative of the available off-road habitat.
- This ground survey tracks trends only, not population estimates.
- Ground surveys provide better accuracy for identification at the species level, but are limited by the requirement for road/foot access and are not suited to population estimates. Aerial surveys cover larger areas and are better suited for population estimates.

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Canadian Wildlife Service Waterfowl Committee. 2017. Population Status of Migratory Game Birds in Canada: November 2017. CWS Migratory Birds Regulatory Report Number 49. Available from: canada.ca/en/environment-climate-change/services/migratory-game-bird-hunting/consultation-process-regulations/report-series/population-status-2017.html.

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Monitoring wild sheep and goat health

Significance

Mycoplasma ovipneumoniae is a bacterium that has been identified as an important component in pneumonia outbreaks in bighorn sheep in the western USA and British Columbia. *M. ovipneumoniae* can be carried by apparently healthy domestic sheep and goats, but can cause severe respiratory disease in wild ungulates.

Pneumonia outbreaks in bighorn sheep have resulted in high rates of illness and death, and are associated with contact between wild sheep and domestic sheep or goats. *M. ovipneumoniae* has potential to cause severe respiratory disease in wild thinhorn sheep and mountain

goats across their range, including Yukon, although no pneumonia outbreaks have been detected in Yukon to date.

Concern for the health of wild sheep and goats in Yukon has resulted in increased surveillance for *M. ovipneumoniae* in Yukon wildlife. The Government of Yukon's Animal Health Unit (AHU) has been testing nasal swabs collected from harvested and found-dead thinhorn sheep and mountain goats in Yukon since 2015. Nasal swabs may be collected by hunters in the field, or AHU staff collect samples from sheep heads that are brought into government offices for mandatory verification of age.

Thinhorn sheep. Photo: Tony Grabowski.

What is happening?

- *M. ovipneumoniae* testing has been completed for 244 thinhorn sheep and one mountain goat between 2015 and 2018, and the bacterium has not been detected in any of these animals.
- The AHU continues to work with hunters to collect nasal swabs from harvested sheep and is further expanding the geographic area where these are collected.
- To help protect wild sheep and goats from respiratory disease, the Government of Yukon has issued a Control Order that specifies strict conditions for keeping domestic sheep and goats in Yukon. This Control Order comes into full effect on January 1, 2020.

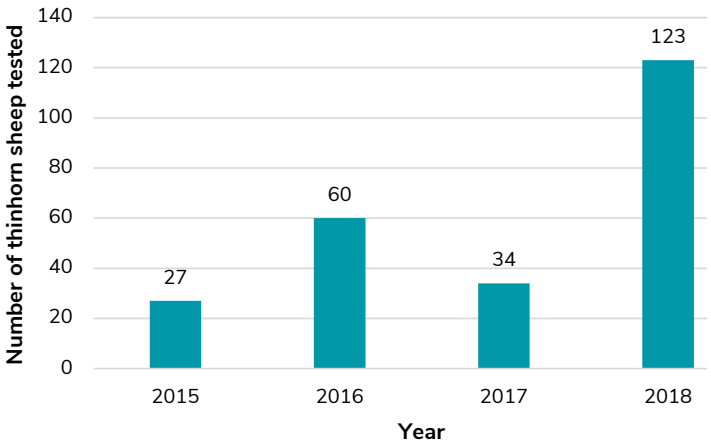


Figure 1: Number of thinhorn sheep tested for *M. ovipneumopniae* between 2015 and 2018.

Taking action

- The Animal Health Unit is responsible for health monitoring and diagnosis of disease in both wild and domestic animals.
- By monitoring for the presence of respiratory pathogens in wild sheep and goats, the AHU will be better informed on the health status of these species across their range in Yukon, and will be better positioned to mitigate occurrences of declining health.
- The Control Order, which comes into effect in January 2020, will help to protect wild sheep and goats from pathogens carried by domestic livestock.

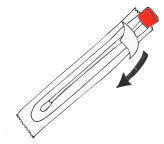
Thinhorn sheep. Photo: Tony Grabowski.

Collecting a sheep nasal swab

Yukon

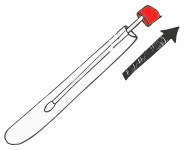
1 If the nose is dirty, wipe it clean before you begin.

2 Open the swab wrapper.



3 Remove swab from the tube.

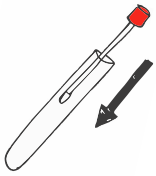
4 Do not touch the swab to any surface, including the outside of the nose.



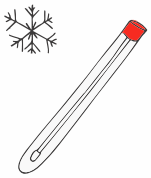
5 Insert the swab deep into one nostril, rotate so the swab rubs tissue inside of the nose.

6 Repeat in the other nostril. If one nostril contains a lot of blood, only swab the cleaner nostril.

7 Put swab back in tube.



8 Keep swab cool or frozen. Return to an Environment office as soon as possible.



To get deep into the nostril, point the swab towards the back of the throat. The entire swab (up to the red cap) should be in the nose. If you can't push the swab the whole way, try a lower angle.

Information for hunters collecting nasal swabs from harvested sheep.

Nasal swab collection and analysis

- Nasal swabs are collected by sheep hunters in the field or by Government of Yukon staff from sheep heads that are submitted for aging. Government of Yukon staff also swab sheep that are found dead or that are captured for placement of radio collars.
- Currently, most nasal swabs are collected from thinhorn sheep in southern Yukon and from areas surrounding Dawson City.
- Nasal swabs are submitted to a diagnostic laboratory to determine if *M. ovipneumoniae* genetic material (DNA) is present. As of 2018, the AHU has been collecting nasal swab samples in duplicate using two different preservation techniques to better ensure that *M. ovipnuemoniae* DNA can be detected. Thus far, both techniques have yielded identical results.

Mountain goats. Photo: Carrie McClelland