Yukon state of the environment report 2020

A report on environmental indicators

Yukon

Acknowledgements

Reviewers and contributors

Government of Yukon

Energy, Mines and Resources: Krysti Horton, Larissa Lychenko

Department of Environment: Nicole Goldring, Ellen Ward, Benoit Turcotte, Ryan Davis, Elizabeth Barker, Jane Harms, Meghan Larivee, Brian Johnston, Jessica Elliot, Bruce Bennett, Piia Kukka, Thomas Jung, Cameron Sinclair, Ryan van der Marel, Shailyn Drukis, Tyler Kuhn, Caitlin Willier, Mitch Heynen, Megan Foreman, Michal Wojcik, Diana Dryburgh-Moraal

Executive Council Office: Gary Brown

Others

City of Whitehorse: Geoff Quinsey

Environment and Climate Change Canada: Margaret Campbell

Yukon Land Use Planning Council: Nick Grzybowski

Gamberg Consulting: Mary Gamberg

Fisheries and Oceans Canada: Steve Smith

Photos

Published 2020

ISBN: 978-1-55362-858-3

Table of contents

Highlights

Climate change

Trends in greenhouse gas levels

Emissions increased by 11.8 per cent between 2009 and 2017. However, from a peak of 769 kilotonnes of carbon dioxide equivalent ($ktCO_2e$) in 2011, emissions declined by 9.2 per cent by 2017. Yukon's total greenhouse gas (GHG) emissions for 2017 were 0.693 megatonnes (693 kilotonnes) of CO_2e. Transportation accounts for the largest share of greenhouse gas emissions in Yukon: 61 per cent of the total in 2017. This means that road and air transportation is a significant source of emissions in the territory.

Arctic sea ice extent and volume

Arctic sea ice is melting, reducing both the minimum annual sea ice area and its overall volume. Based on trends, sea ice melt is accelerating, with most of the melt occurring in the past decade.

Long-term temperature variation

Over the past 50 years, winters are warming more than other seasons, with an average increase of 4°C in Yukon. Yukon's annual average temperature has increased by 2°C, which is twice the global rate.

Air

Levels of particulate matter

Data collected from 2012 to 2017 at the National Air Pollution Surveillance station located in downtown Whitehorse shows that overall, the amount of atmospheric particulate matter below 2.5 micrometres in diameter appears to be decreasing in Whitehorse.

Organic pollutants in air

The air concentrations of two pesticides, hexachlorocyclohexane and endosulfan, are decreasing at the monitoring station at Little Fox Lake. Ten new flame retardants that are not regulated in Canada were detected in the air at Little Fox Lake. Air samples from 2015 to 2018 are currently undergoing chemical analysis.

Water

Snow accumulation

Recent years (2016 to 2019) have experienced below average snow throughout much of the territory. However, the influence of recent years does not change the overall interpretation of the data, which generally suggest an increasing maximum snowpack over time, resulting from an increase in winter precipitation despite winters becoming shorter.

Extreme high and lower water in lakes and rivers

In 2017, two lakes (Bennett and Kluane) show significant declines in minimum water levels over time, while Teslin Lake shows significant increases in minimum water levels. This has implications for

the keystone Chum Salmon species, who migrate from the Bering Sea to spawn in Kluane River and Kluane Lake.

Water quality

In 2019, Yukon signed the Water Quality and Aquatic Ecosystem Monitoring Agreement with the Government of Canada. This agreement will make it easier to collect and share water quality data within Canada and supports community water monitoring arrangements with First Nations governments.

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, when it was first recorded. Nine of the 11 earliest recorded break-up events at Dawson City have occurred in the past 30 years.

Land

Population of Yukon

Comparing September 30, 2019 to September 30, 2009, Yukon's population increased by 7,216, or 21.1 per cent. Between June 2018 and June 2019, the total Yukon population increased by 709 people, or 1.7 per cent.

Regional land use plans

Two regional plans, the ***North Yukon Regional Land Use Pla***n and the ***Peel Watershed Regional Land Use Plan***, were completed and are being implemented. The Dawson planning process was restarted in 2019.

Community and local area planning

All eight Yukon municipalities have official community plans. Eight local area plans are also in place for smaller communities. Local area planning processes are currently underway for five additional areas: Marsh Lake, Fox Lake, Tagish, Alaska Highway West and Fish Lake.

Recreational land use

From 2017 to 2019, the Government of Yukon added 51 new campsites across the territory. This includes 22 new campsites at Congdon Creek, seven campsites at Little Salmon Lake, 15 campsites at Tombstone Mountain, six campsites at Five Mile Lake and one campsite at Lapie Canyon.

Waste handled at the Whitehorse Waste Management Facility

In 2018, Whitehorse residents sent an average of 600 kg of waste to the landfill. This is a decrease from 710 kg in 2017. Thirty per cent of waste was diverted from the Whitehorse landfill through recycling and composting in 2018.

Fish and wildlife

Species management plans

In 2019, the Government of Yukon and the Yukon Fish and Wildlife Management Board developed ***A Conservation Plan for Grizzly Bears in Yukon***. The plan presents a 25-year vision for Grizzly Bears in Yukon and outlines the conservation actions recommended to achieve this vision.

Number of spawning Chinook Salmon

For 2019, it is unlikely the spawning escapement goal for Yukon River Chinook Salmon was met, with a preliminary estimate of approximately 42,000 fish reaching their spawning grounds in Yukon. This would be the first time the spawning escapement goal was not achieved since 2013. The goal is to allow 42,500 to 55,000 Chinook to return to the Canadian portion of the Yukon River.

Monitoring wild sheep and goat health

M. ovipneumoniae was not detected in the 341 thinhorn sheep and two mountain goats tested between 2015 and 2019. The ***m. ovipneumoniae*** bacterium was also not detected in the 83 Mountain Caribou, 50 Barren-ground Caribou, five Moose, eight Elk, eight Muskox and three Mule Deer tested in 2018 and 2019.

Pelly Crossing in autumn.

Introduction

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

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 information that shows 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 includes information available at the end of the 2019 calendar year. The base year for comparing trend data in this report is 2016 because several agencies require up to 36 months to complete the data collection, compilation, analysis and reporting to the Government of Yukon.

This report represents information, data and advice from scientific experts, government agencies and non-governmental organizations.

Climate change

Trends in Yukon greenhouse gas levels

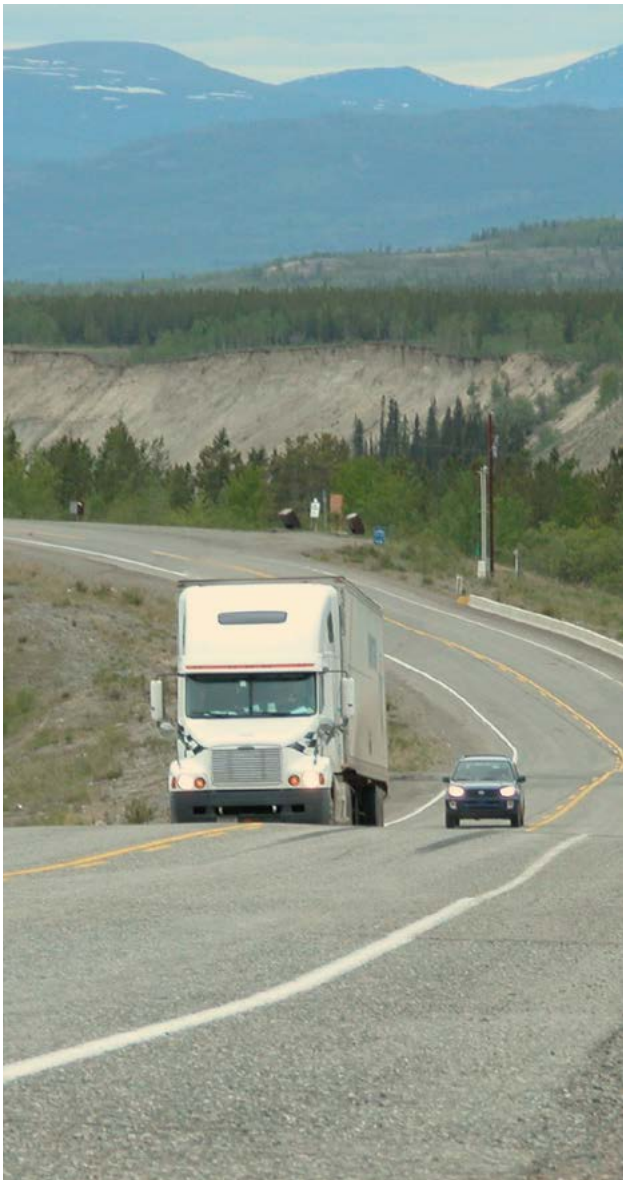
Significance

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 and results in climate change.

GHG emissions include carbon dioxide, methane and nitrous oxide among others. Carbon dioxide is the principal contributor to human-caused increases to 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 highest 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 Yukon's unique challenges into consideration, including long distances from production centres, high demand for heat during cold winters and an isolated electricity grid.



Vehicles on a Yukon highway.

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 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 (Canada's Greenhouse Gas Inventory), found in the ***National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada.***
- Emissions estimates by the Government of Yukon (Yukon GHG Inventory 2009-2017) found in ***Greenhouse gas emissions in Yukon***.

The Government of Yukon is continuing its work with 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 2009-2017 report include:

- Emissions have increased by 11.8 per cent between 2009 and 2017. From a peak of 763.8 $ktCO_2e$ in 2011, emissions declined by 9.2 per cent by 2017.
- Including mining activity, Yukon's total GHG emissions for 2017 were 0.693 megatonnes (693 kilotonnes) of CO_2e.

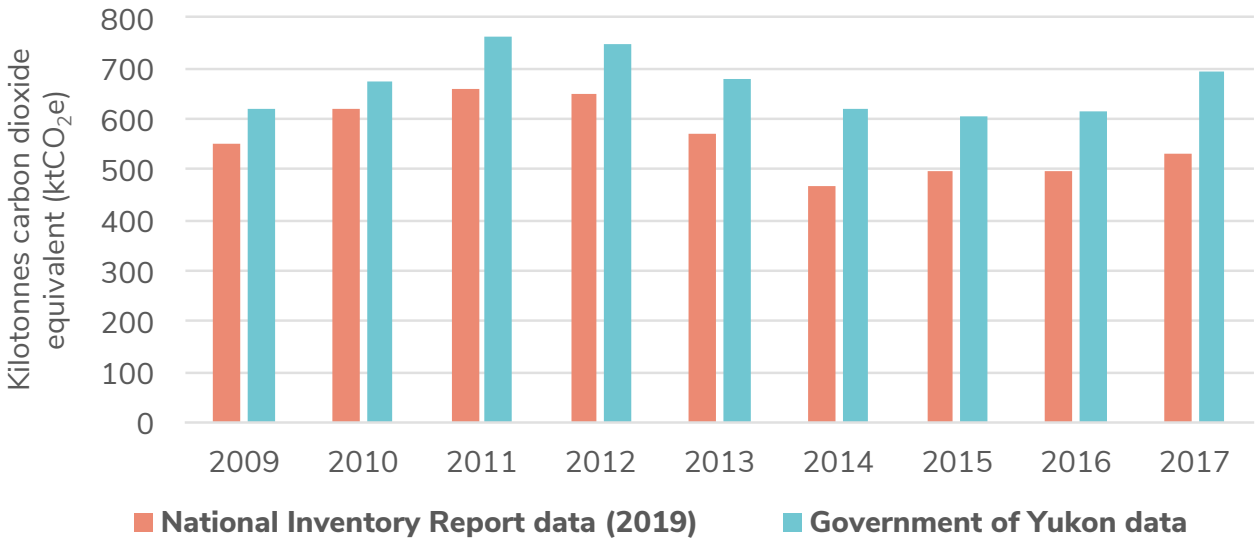


Figure 1: Yukon greenhouse gas emissions reported by Environment and Climate Change Canada and the hybrid approach taken by the Government of Yukon.

61%

of greenhouse gas emissions came from transportation in 2017

- Transportation accounts for the largest share of greenhouse gas emissions in Yukon: 61 per cent of the total in 2017.
    - 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 21 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 716 megatonnes (716,000 kilotonnes) of CO_2e in 2017, about 19 per cent above 1990 levels (Environment and Climate Change Canada 2019).
- Per capita emissions in Yukon in 2017 were 18 tonnes per person. Compared to the per capita emissions of the 12 other provinces and territories as reported in the ***National Inventory Report***, Yukon's per capita emissions rank sixth out of 13.
- Yukon's total GHG emissions contributed 0.1 per cent towards the national total in 2017.

Taking action

The Government of Yukon partnered with the Northern Climate ExChange at Yukon College to publish a ***Yukon Climate Change Indicators and Key Findings 2015*** report in 2016. 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.

Our Clean Future, a new draft strategy has 142 actions and commits the Government of Yukon to a 30 per cent reduction in GHGs below 2010 levels by 2030. This strategy is expected to be finalized in 2020. Reporting on greenhouse gas emissions and actions in the strategy will be coordinated with the reporting in this annual state of the environment report.

Climate change, energy and a green economy are interconnected. By addressing all three together, Yukon can plan for its future more effectively. The Government of Yukon is 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 sector (energy, industrial processes and product use, agriculture and waste). All national inventory reports are accessible online.

The Yukon GHG Inventory 2009-2017, based on tax and finance data provided by Yukon Bureau of Statistics and Department of Finance, is considered by the Government of Yukon as being the most accurate data for Yukon-wide emissions (Government of Yukon 2020). The Government of Yukon will continue to work with 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's GHG emissions.

References

Environment and Climate Change Canada. 2019. National Inventory Report 1990-2017: Greenhouse Gas Sources and Sinks in Canada. Environment Canada, Gatineau, Quebec, Canada.

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

Government of Yukon. 2020. Greenhouse gas emissions in Yukon. Government of Yukon, Whitehorse, Yukon, Canada.
Available from: Yukon.ca/en/greenhouse-gas-emissions-yukon.

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, damage to human infrastructure and negative impacts on species that depend on sea ice.

Ice on the Beaufort Sea.

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).**

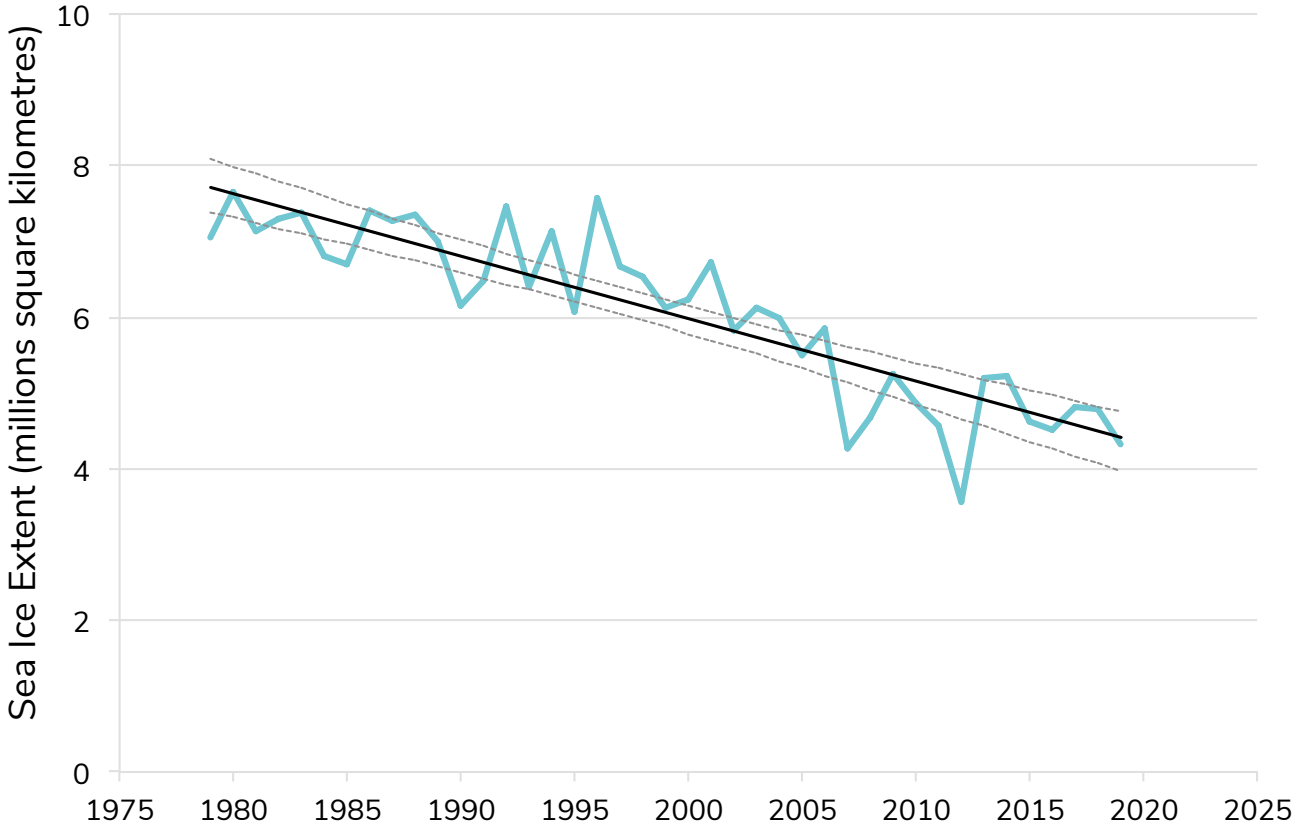


Figure 1: Arctic September sea ice extent.

Source: National Snow and Ice Data Centre.

- September sea ice loss averages 90,000 km^2 per year, although there is significant variability from one year to the next and more recent losses have exceeded earlier losses.
- Approximately 300 km^3 of sea ice volume is lost per year. Remaining sea ice is becoming younger and thinner.

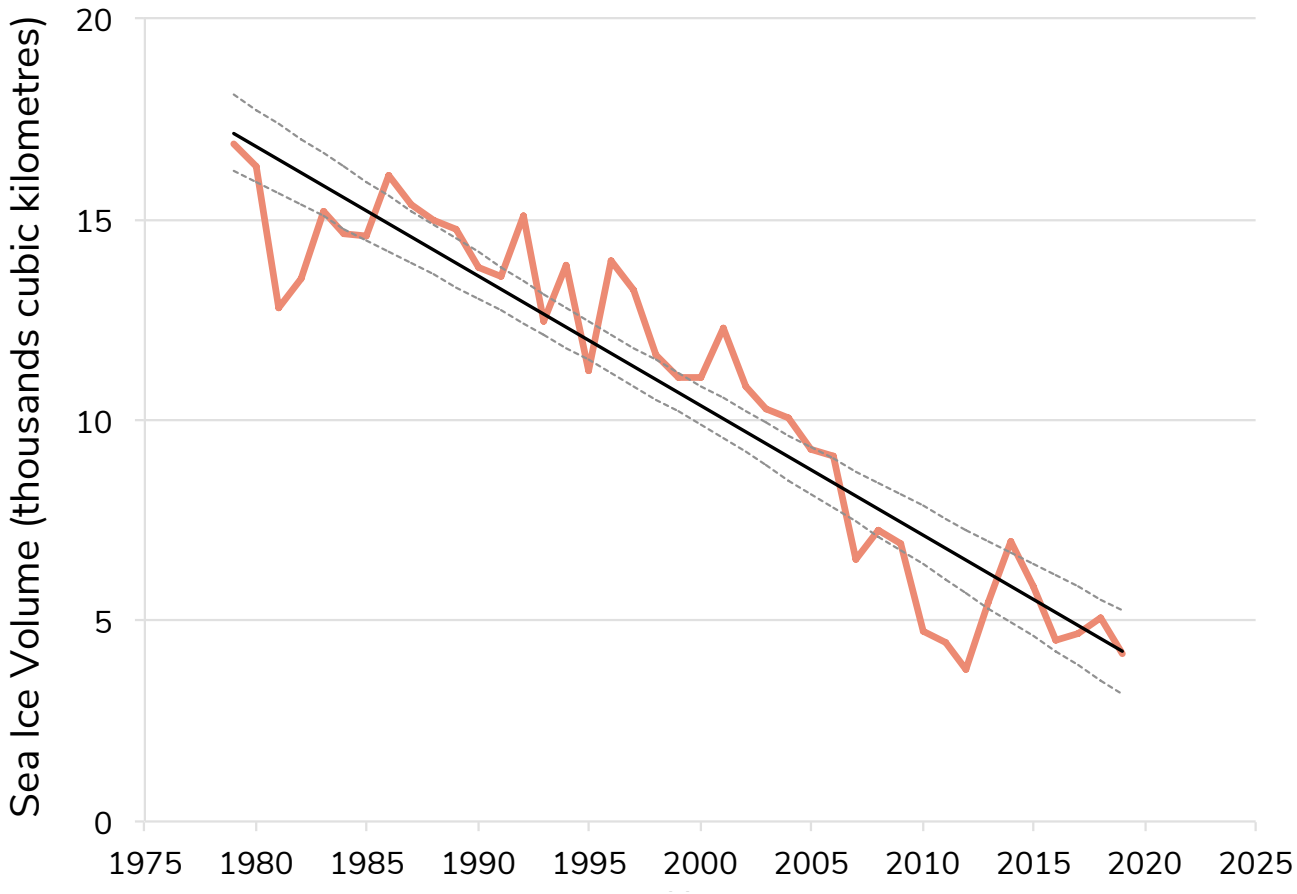


Figure 2: Arctic September sea ice volume.

Source: Polar Data Centre.

Taking action

Reducing GHG emissions will help to reduce the long-term negative impacts of the trends presented in this indicator. Yukon will be part of this national and global shift by taking action on reducing our GHG emissions at home. This is includes the upcoming release of Our Clean Future, a strategy for climate change, energy and green economy in Yukon. In addition, the Yukon Energy Corporation is preparing a 10-year renewable electricity plan to increase the availability of clean, renewable energy while supporting the Government of Yukon's emission reduction targets. We will continue to work collaboratively

Beaufort Sea, ice along Herschel Island shoreline.

with First Nations and transboundary Indigenous groups, municipalities, businesses and individuals to take collective action to lower our emissions and develop innovative solutions that will meet the growing energy needs of Yukoners today and in the years to come.

Data quality

- The National Snow and Ice Data Centre gathers satellite data to make calculations for sea ice extent. You can find this data online.
- For sea ice volume, data is made available by the University of Washington Pan-Arctic Ice-Ocean Modeling and Assimilation System (PIOMAS) online.

References

National Snow and Ice Data Center. 2019. Sea Ice Index, Version 3. University of Colorado, Boulder, Colorado, USA. Available from: nsidc.org/data/g02135.html.

Perovich D., W. Meier, M. Tschudi, S. Farrell, S. Hendricks, S. Gerland, C. Haas, T. Krumpen, C. Polashenski, R. Ricker, M. Webster. 2018. Arctic Report Card: Update for 2018. Available from: https://arctic.noaa.gov/Report-Card/Report-Card-2018/ArtMID/7878/ArticleID/776/About-Arctic-Report-Card-2018.

Polar Science Center, Applied Physics Laboratory. 1979-Present. PIOMAS Daily Ice Volume Data, 1979-present [cited 2019 Nov 20]. 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: www.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 using averages from 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 also affects 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).

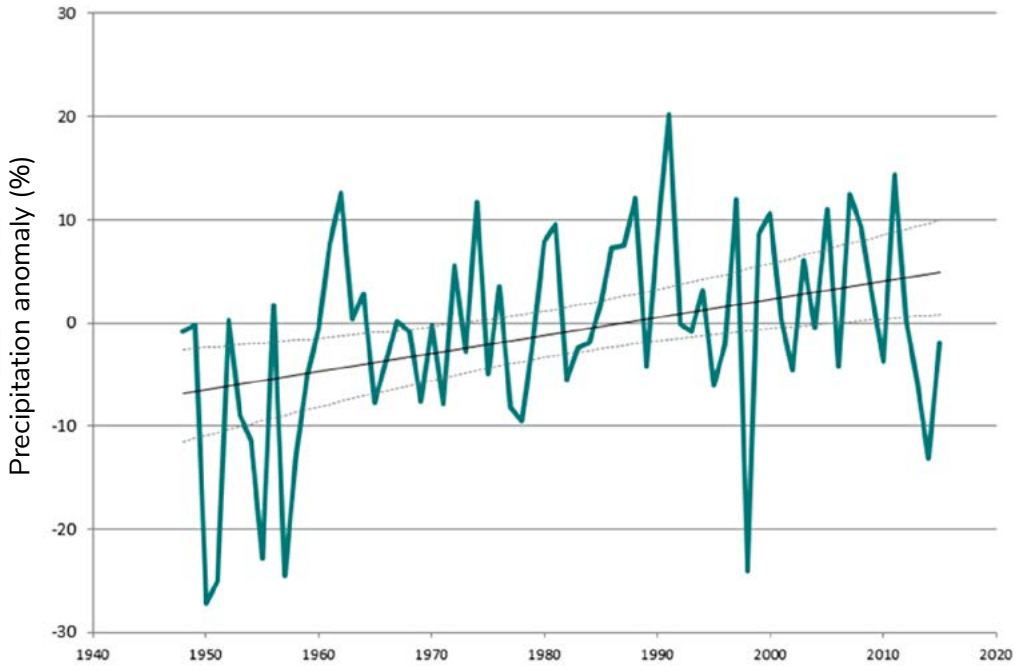


Figure 1: Yukon annual precipitation variability, 1950-2016.

Source: Environment and Climate Change Canada, Climate Research Branch (2016) Climate Trends and Variations Bulletins.

- Precipitation has increased by approximately six per cent over the past 50 years.
- The largest increase in precipitation occurred during the summer months.

There is variability in terms of where precipitation occurs in the territory and what time of year it occurs.

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.

Taking action

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

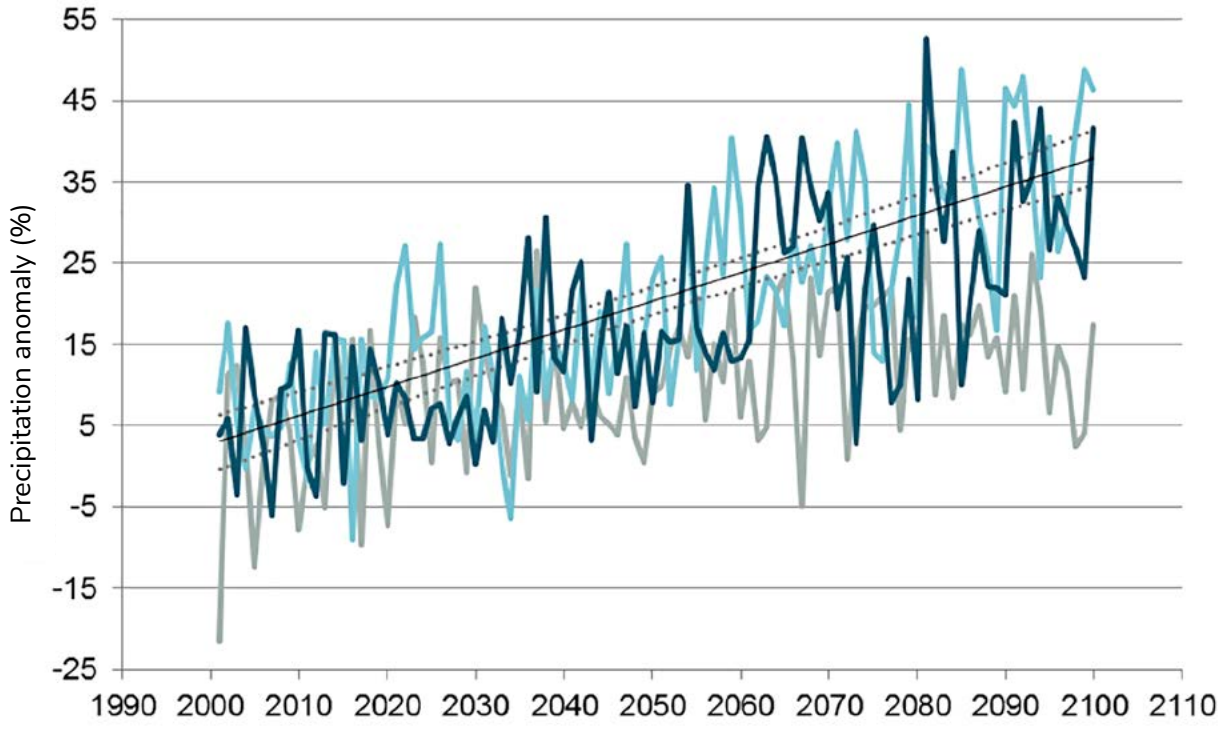


Figure 2: Yukon projected annual precipitation anomalies (A2, A1B, B1)*.

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 here.

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 is 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 as a result 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 which 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 Intergovernmental Panel on Climate Change Fifth Assessment Report is a reputable synthesis of current climate change knowledge captured from 9,200 peer-reviewed scientific publications.

Storm clouds over St. Elias Mountains.

Photo: Derek Crowe.

References

Environment and Climate Change Canada, Climate Research Branch. 2014-2015. Climate Trends and Variations Bulletins [modified 2020 Feb 2; cited 2020 Feb 13]. Available from: canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/trends-variations.html.

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

Scenarios Network for Alaska Planning (SNAP). 2011. Climate Projections for Yukon. Unpublished Data produced for the Northern Climate ExChange, Yukon College, Whitehorse, Yukon, Canada.

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

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.

Climate change has 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 to 1990. Temperature departures are given as a change in °C from this average (Figure 1).

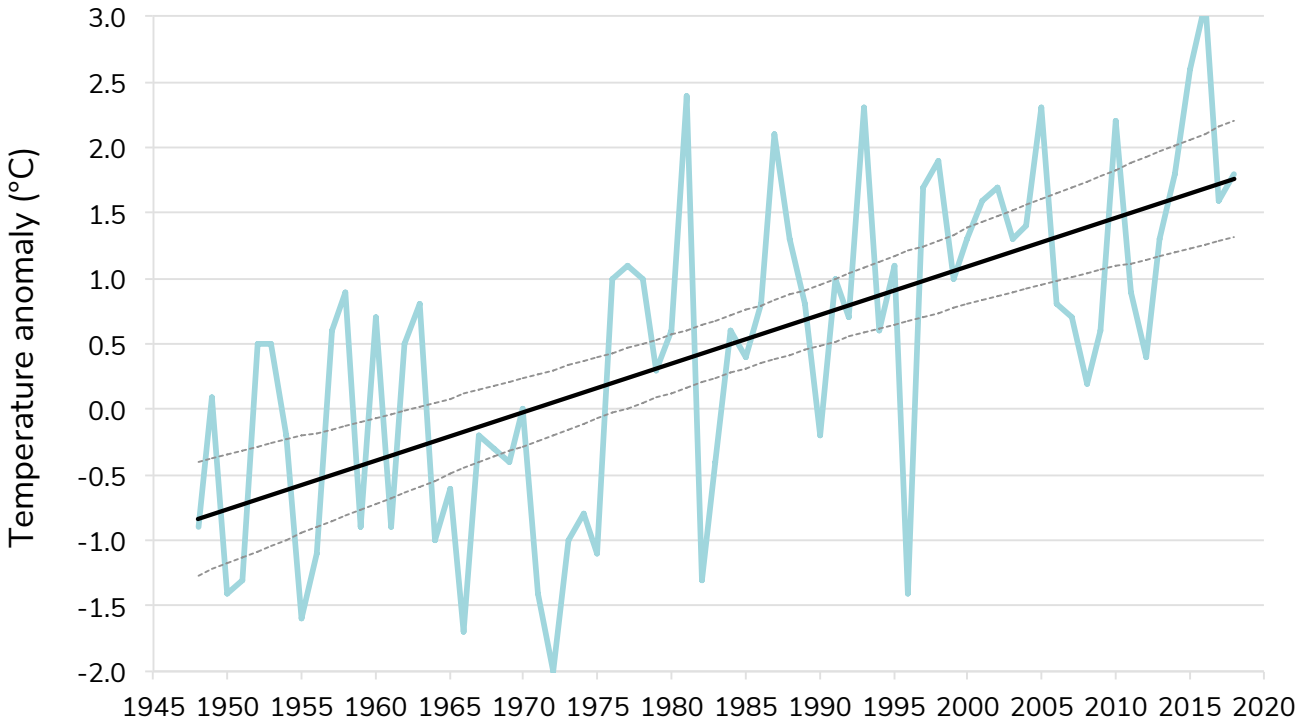


Figure 1: Yukon annual temperature variation, 1948 to 2018.

Source: Environment and Climate Change Canada, Climate Research Branch (2017) Climate Trends and Variations Bulletins.

Over the past 50 years:

- Yukon's 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).
- The three different lines (A2, A1B, B1) 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.

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 2015*** 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.

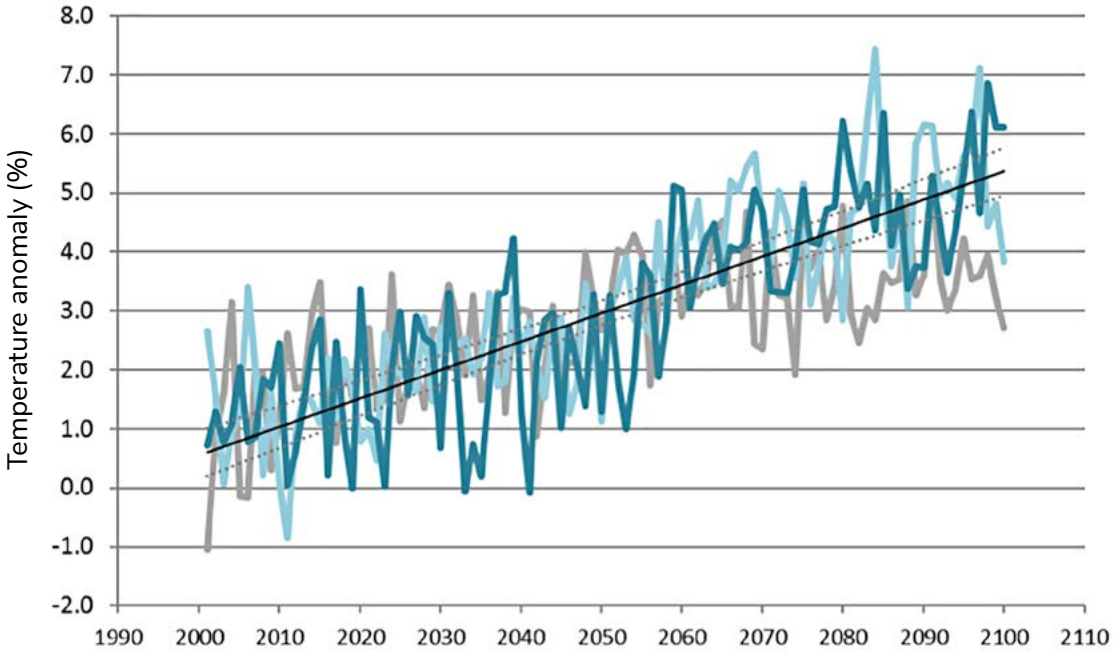


Figure 2: Yukon projected annual temperature anomalies (A2, A1B, B1).

Source: Environment and Climate Change Canada, Climate Research Branch (2017) Climate Trends and Variations Bulletins.

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 Canada data.
- Environment and Climate Change 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 which can be found in the ***Yukon Climate Change Indicators and Key Findings 2015*** 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.

Canoeing in the mist.

Photo: Sara Nielsen.

References

Environment and Climate Change Canada, Climate Research Branch. 2019. Climate Trends and Variations Bulletins [modified 2020 Feb 2, cited 2020 Feb 13]. Available from: canada.ca/en/environment-climate-change/services/climate-change/science-research-data/climate-trends-variability/trends-variations.html.

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

Scenarios Network for Alaska Planning (SNAP), 2011. Climate Projections for Yukon. Unpublished Data produced for the Northern Climate ExChange, Yukon College, Whitehorse, Yukon, Canada.

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

Air

Levels of particulate matter

Significance

Yukoners have come to expect a healthy natural environment, including the air we breathe. 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 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 is microscopic airborne particles that come in either solid form, liquid form or a mix of both. Particulates of concern include:

- fine particulate matter, such as those found in wood smoke, that are smaller than 2.5 micrometres 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 micrometres in diameter (PM_{10}).

Fine particulates pose large health problems.

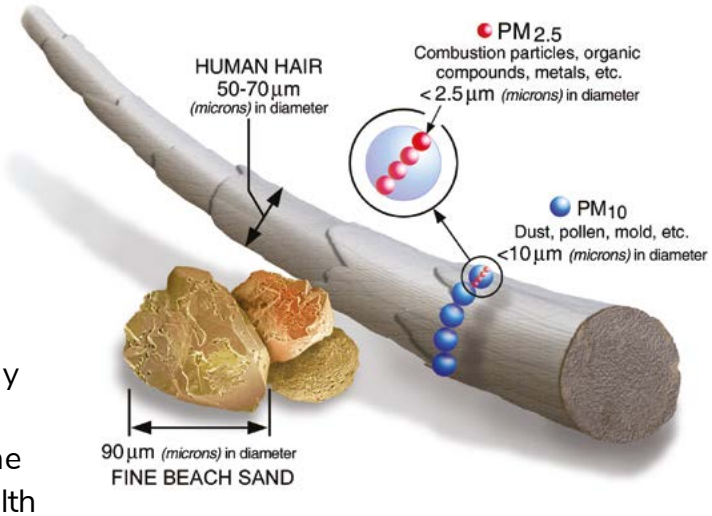


Figure 1: Sizes of particulate matter.

Source: United States Environment Protection Agency (2016).

Health effects

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

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

Exposure to fine 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 fine 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

- Forest fires: Although the predominant air flow is westerly (from Alaska), smoke from fires in British Columbia, Alberta and the Northwest Territories occasionally affects Yukon's air quality.
- Wind-blown dust from gravel roads.
- Pollen.
- Volcanic activity, sometimes from as far away as Asia.

Human sources

- Emissions from fossil fuel burning, such as transportation, electricity generation, oil and gas.
- Wood burning for residential/ commercial heating, land clearing or recreational burning.
- Incineration or open burning of waste.
- Fugitive dust from vehicles, quarrying or construction.

Forest fire along Tutshi Lake.

Photo: Elizabeth Barker.

The Yukon Ambient Air Quality Standards have been developed under the ***Environment Act*** to protect human health and the environment. In 2019, the Yukon's 24-hour average standard for $PM_{2.5}$ changed from 28 to 27 µg/m^3 and the annual average standard was changed from 10 to 8.8 µg/m^3. These changes were made to align Yukon standards with the national Canadian Ambient Air Quality Standards. 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. Additionally, continuous monitoring provides 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:

- Over the last 10 years, national $PM_{2.5}$ concentrations have consistently remained below the 2020 standard of 8.8 µg/m^3.
- Average $PM_{2.5}$ concentrations in Whitehorse have remained lower than national concentrations.
- The key results in urban areas from 2016 show that Whitehorse recorded the lowest concentrations of fine particulate matter from across Canada.
- From 2012 to 2017, data collected from the National Air Pollution Surveillance station located in downtown Whitehorse shows that overall, monthly $PM_{2.5}$ averages in Whitehorse appear to be decreasing over time.

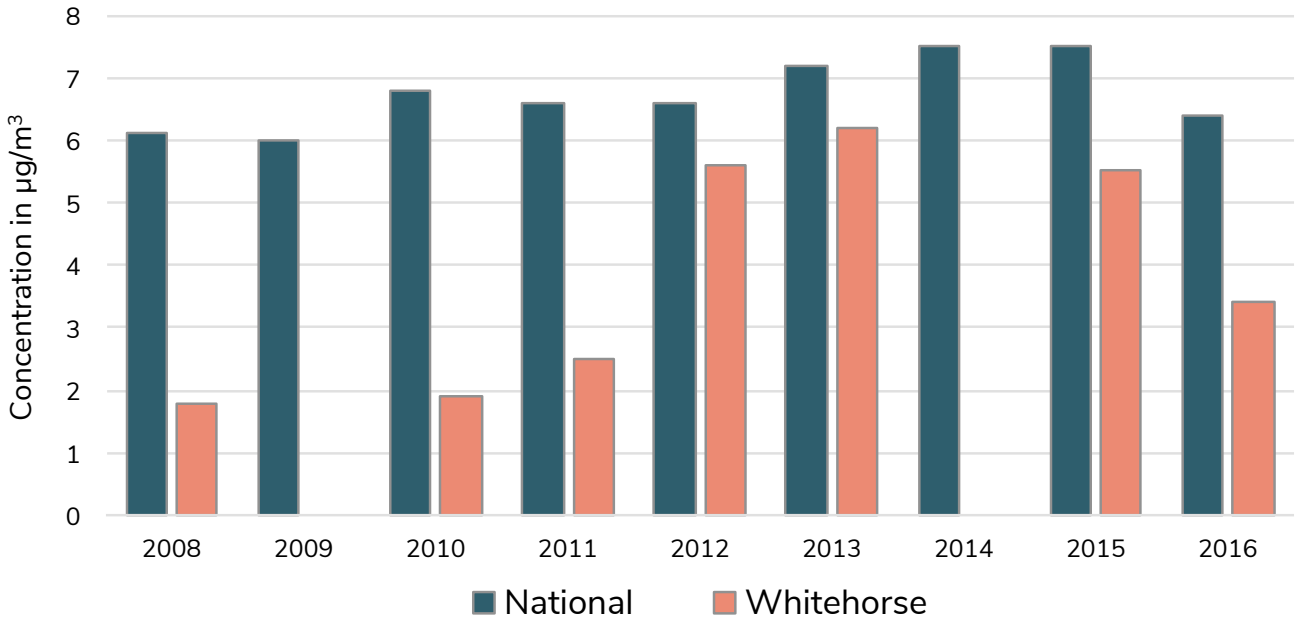


Figure 2: National and Whitehorse average annual $PM_{2.5}$ concentrations.

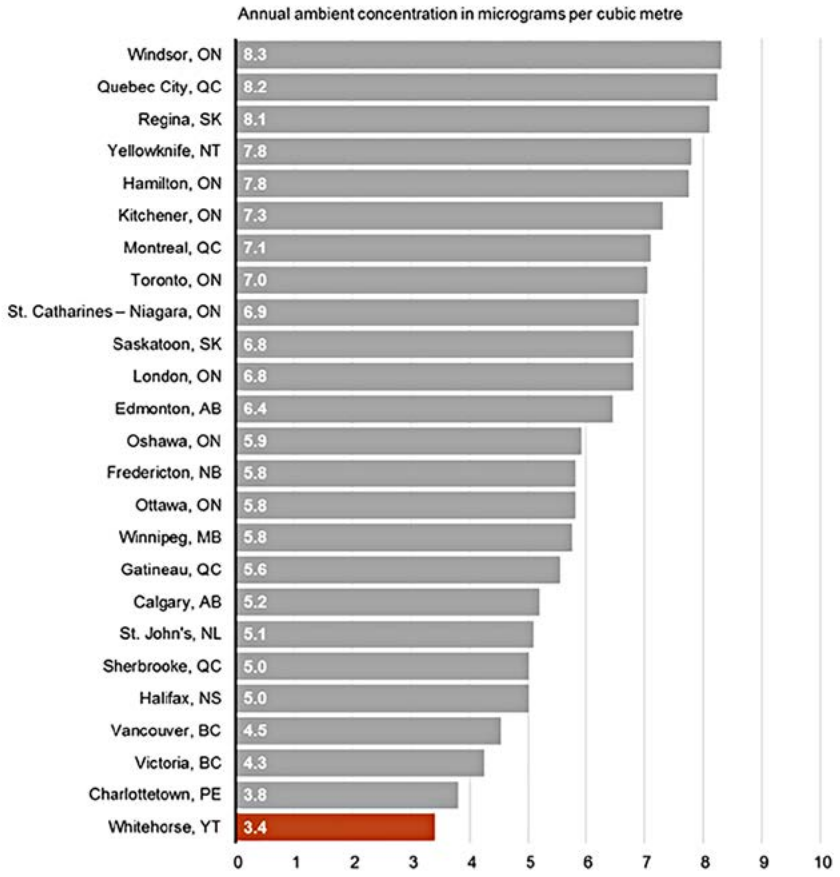


Figure 3: A comparison of fine particulate matter concentrations in select Canadian urban areas.

Source: Environment and Climate Change Canada (2019) Canadian Environment Sustainability Indicators: Air Quality.

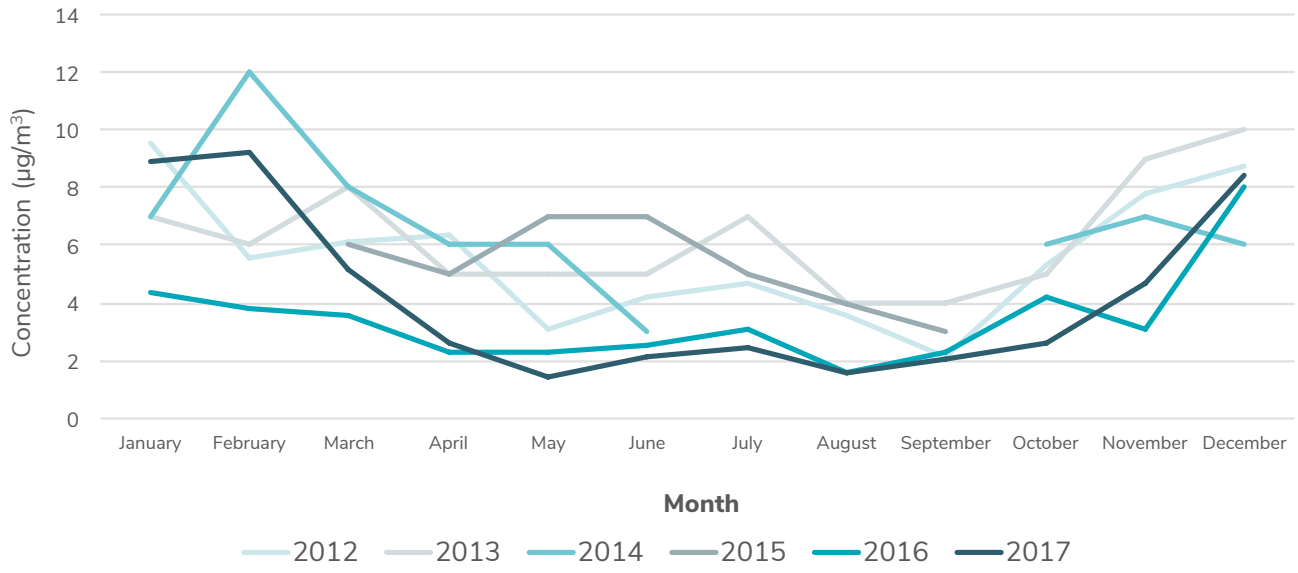


Figure 4: Average Monthly Concentrations of $PM_{2.5}$ in Whitehorse from 2013 to 2017.

Taking action

- Continuous air quality monitoring in Yukon occurs as part of the National Air Pollution Surveillance (NAPS) Program. This program 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. Data provided by NAPS also supports 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.
- 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.

NAPS station in downtown Whitehorse.

Photo: Elizabeth Barker.

- The Government of Yukon, in partnership with Health Canada, is continuing to monitor fine particulate matter in Whitehorse and Dawson City. This ongoing study is collecting 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.

- A joint study between the Government of Yukon and Environment and Climate Change Canada was launched in the fall of 2019. The aim of this new study is to test the use of low cost air sensors to measure fine particulate matter throughout Yukon. To date, three sensors have been installed in Whitehorse, one has been installed in Dawson and nine more sensors will be installed in various communities across the territory in 2020.

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 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.

References

Environment and Climate Change Canada. 2019. Canadian Environmental Sustainability Indicators: Air quality [cited 2019 Dec 2]. Available from: canada.ca/en/environment-climate-change/services/environmental-indicators/air-quality.html.

Government of Yukon. 2018. Whitehorse Air Quality Monitoring Study November 2015 – April 2017. Available from: Yukon.ca/en/whitehorse-air-quality-monitoring-study-november-2015-april-2017.

Haikerwal A., M. Akram, A. Del Monaco, et al. Impact of Fine Particulate Matter ($PM_{2.5}$) Exposure During Wildfires on Cardiovascular Health Outcomes. Journal of the American Heart Association: Cardiovascular and Cerebrovascular Disease. 2015;4(7):e001653. doi:10.1161/JAHA.114.001653.

United States Environmental Protection Agency. n.d. Particulate Matter (PM) Pollution [cited 2019 Jan 2]. Available from: epa.gov/pm-pollution.

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 once deposited and 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 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 numerical forecasting programs that explain contaminant movement from sources in the south to the Arctic.

Air monitoring station at Little Fox Lake (inset: flow-through air sampler).

Photo: Alexandra Steffen.

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 though 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 the air at Little Fox Lake.

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 come from the Pacific Rim. One example of this is a new flame retardant called 2-ethylhexyl 2, 3, 4, 5-tetrabromobenzoate (Figure 1).

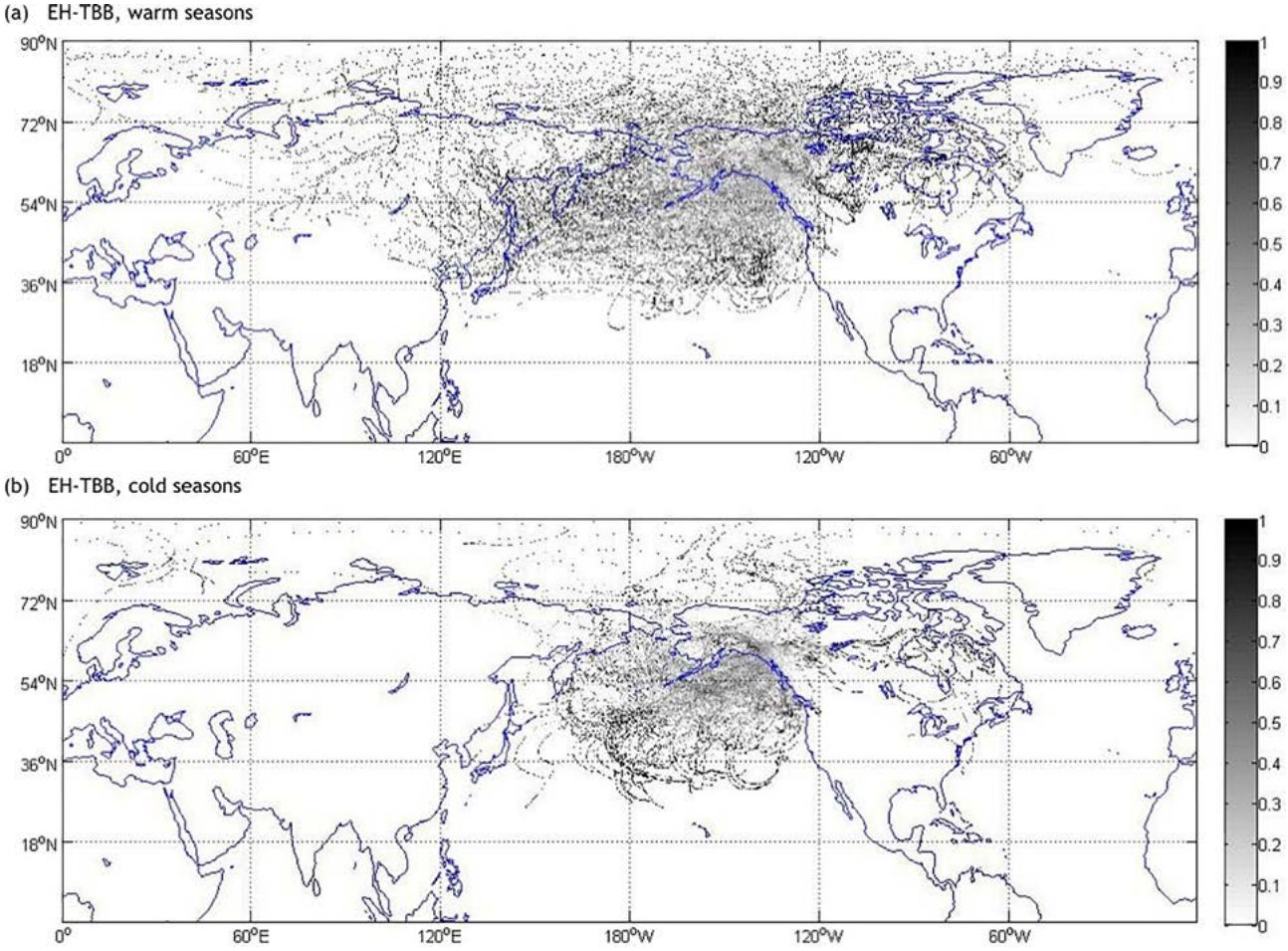


Figure 1: Maps showing potential source regions for one of the new flame retardants detected at Little Fox Lake, 2-ethylhexyl 2,3,4,5-tetrabromobenzoate. The maps indicate that (a) in the warm seasons most of this chemical is observed at Little Fox Lake stemmed from sources in Canada, the Pacific and East Asia; (b) in cold seasons they mainly came from the Pacific Rim. Black dots on the map show potential paths of the wind that carried this chemical to Little Fox Lake.

Source: Yu et al. 2015.

Taking action

The federal Northern Contaminants Program has measured organic pollutants in the 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.

This data also supports the Arctic Council's Arctic Monitoring and Assessment Programme that provides information on the status and threats to the Arctic environment and scientific advice on actions to support Arctic governments in their efforts to take remedial and preventative 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.

Air monitoring station at Little Fox Lake.

References

Arctic Council. n.d. Arctic Monitoring and Assessment Programme (AMAP) [cited 2020 Jan 2]. Available from: amap.no.

Government of Canada. n.d. Northern Contaminants Program [cited 2020 Jan 2]. Available from: science.gc.ca/eic/site/063.nsf/eng/h_7A463DBA.html.

Hung H., Y. Yu, M. Shoeib, T. Harner, A. Steffen, D. Muir, C. Teixeira, L. Jantunen, P. Fellin, P. Roach, F. Wania. 2015. Northern Contaminants Air Monitoring: Organic Pollutant Measurement. Pages 161-171 in Aboriginal Affairs and Northern Development Canada. Synopsis of Research Conducted under the 2014-2015 Northern Contaminants Program. Aboriginal Affairs and Northern Development Canada, Gatineau, Quebec, Canada. Available from: pubs.aina.ucalgary.ca/ncp/Synopsis20142015.pdf.

United Nations Environmental Programme (UNEP). 2015-2016. Stockholm Convention on POPs [cited 2016 Mar 3]. Available from: chm.pops.int/default.aspx.

Yu Y., H. Hung, N. Alexandrou, P. Roach, K. Nordin. 2015. Multiyear measurements of flame retardants and organochlorine pesticides in air in Canada's western sub-arctic. Environmental Science & Technology 49 (14): 8623 – 8630.

Water

Snow accumulation

Significance

There are 53 snow survey sites across Yukon and a number of complementary instruments that measure snow on the ground on a continuous basis. The amount of snow on the ground across Yukon is determined through measuring the snow water equivalent (SWE) at those survey sites. The SWE 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. A larger-than-average SWE increases the likelihood of high spring flows.
- The SWE can influence the timing and severity of river ice break-up.
- A high SWE acts to further insulate the ground surface from cold winter air temperatures and promotes permafrost thaw during the following summer.
- Low SWE can increase the likelihood of wildfires at the beginning of summer.
- In the long term, changing SWE can generate shifts in vegetation.
- Finally, the duration of the snow season has a significant impact on transportation.

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

What is happening?

There has been a significant increase in the snow water equivalent (SWE) at three of the 14 long-term snow survey sites analyzed across Yukon. Overall, snow water equivalent is increasing by three per cent per decade, on average. None of the monitored sites show significant decreasing trends. It is important to note that no site with long-term records are available in basins draining directly into the Arctic Ocean.

Recent years (2016 to 2019) have experienced below average snow throughout much of the territory. This has resulted in three locations that previously indicated significant increasing trends (Watson Lake, Frances River and King Solomon Dome) falling 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 generally suggest an increasing maximum snowpack over time, resulting from an increase in winter precipitation despite winters become shorter.

Tweedsmuir Glacier, Tatshenshini-Alsek Park, BC.
The glacier affects the Alsek River, which flows through Yukon.

- 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 basin.
- There were no significant trends in snow accumulation noted at any of the Central Yukon stations.
- Mayo Airport shows a significant increasing trend in snow accumulation of +5 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.

+5%

snow accumulation per decade in Mayo

Data quality

- Access archived snow survey bulletins: Yukon.ca/en/snow-surveys-and-water-supply-forecasts#snow-and-water-supply-data.
- 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 www.nrcs.usda.gov/wps/portal/nrcs/ak/snow/.
- There are currently 53 snow survey sites located across Yukon, with an additional five in adjacent areas of Alaska and British Columbia that are used by the Water Resources Branch. Most areas of Yukon have good spatial coverage with the exception of the far north.

Trapper cabin under heavy snow.

References

McLeod A.I. 2011. Kendall: Kendall rank correlation and Mann-Kendall trend test. R package version 2.2. Available from: cran.r-project.org/web/packages/Kendall/Kendall.pdf.

Wickham H. 2009. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag, New York, USA.

Extreme high and low water in lakes and rivers

Significance

Water levels in Yukon lakes and rivers are affected by a range of short and long-term processes, including:

- the timing and magnitude of snowmelt;
- the phase, quantity 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 changing river ice break-up conditions in river systems can cause the following.

- Increased sediment and contaminant mobilization and transport, affecting human health, drinking water and ecosystems.
- Increased flooding potential, directly impacting the health and security of people, infrastructure integrity, transportation and other economic values.

In turn, low flows in lakes and rivers can cause the following.

- 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 (e.g., agriculture, municipal, industrial) and aquatic life.

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

What is happening?

Annual river flow

Twenty-nine stations across Yukon are monitored for trends in annual minimum and maximum river flows. The majority of stations examined are monitoring hydrological conditions on large rivers (i.e., have drainage areas greater than 1,000 km^2). These stations are:

- **Yukon River: 17 stations;**
- **Alsek River: 3 stations;**
- **Liard River: 3 stations;**
- **Peel River: 2 stations; and**
- **Porcupine River: 2 stations.**

Annual minimum flows have increased at 25 of 29 long-term river stations; no station indicates the opposite (Figure 1).

Out of the 29 long-term river stations, 26 do not not show significant trends in annual maximum river flow (Figure 2).

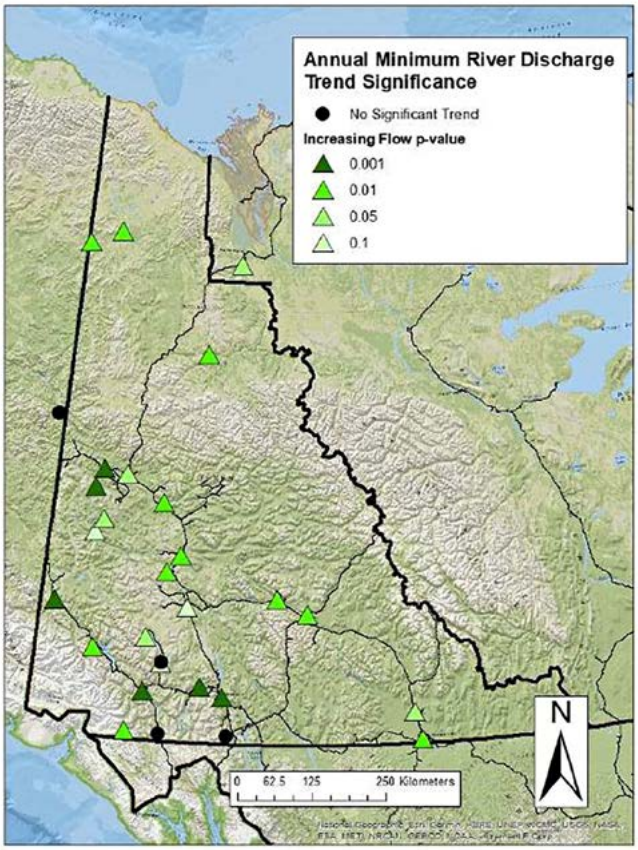


Figure 1: Trends in annual **minimum** river flow.

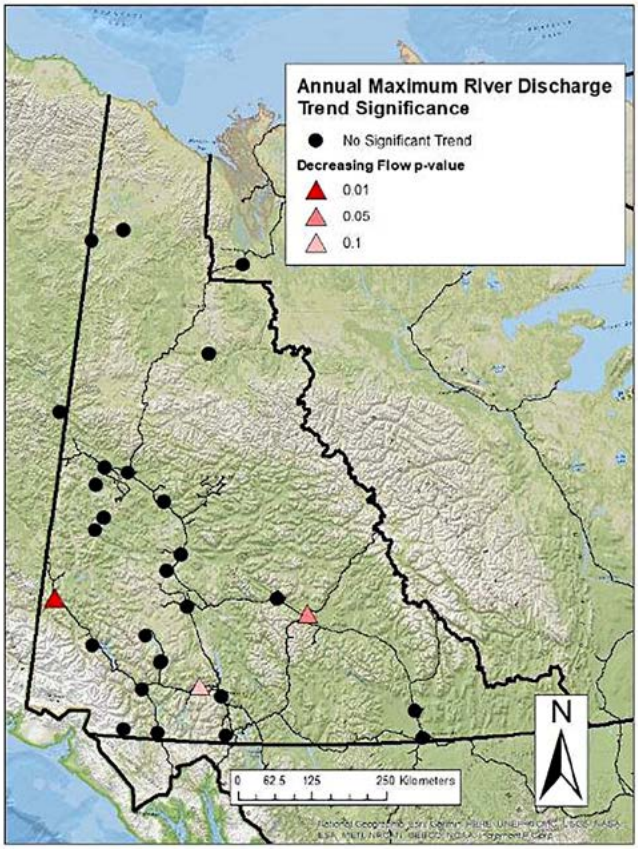


Figure 2: Trends in annual **maximum** river flow.

Trend significance is represented by p-values, where decreasing p-values indicate an increase in trend significance. The period of record varies by station and includes information until 2017.

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**; and
- **Teslin Lake**.

Two lakes (Bennett and Kluane) show significant declines in minimum water levels over time, while Teslin Lake shows significant increases in minimum water levels. None of the sites have significant changes in annual maximum water levels over time; however, maximum Kluane Lake water levels have dramatically decreased since 2016 from the movement of headwater glaciers that has diverted water away from the Slims River.

A recent study suggests that water levels will remain low in the Lake and in Kluane River from now on (Loukili and Pomeroy 2018).

Taking action

The water level drop in Łù'àn Mān (Kluane Lake) has implications for 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 (DFO 2018). Since Chum Salmon only spawn in groundwater discharge areas, the project investigated how well Chum Salmon are adapting to changes in their spawning environment.

Data quality

- The Water Survey of Canada conducts long-term monitoring of large rivers and lakes. They provide both daily mean and instantaneous flows and water levels.
- All stations included in the analysis are active sites that have at least 30 years of 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 2017.
- 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.

References

Fisheries and Oceans Canada (DFO). 2018. Impacts to Kluane Fall Chum Salmon Stock from a Major Hydrological Change, CRE-145-17N Final Report. Fisheries and Oceans Canada Yukon / Transboundary Rivers Area, Whitehorse, Yukon, Canada.

Environment and Climate Change Canada. n.d. Water Survey of Canada Historical Hydrometric Data [modified 2020 Feb 3, cited 2020 Feb 13]. Available from: wateroffice.ec.gc.ca.

Helsel D.R., D.K. Mueller and J.R. Slack. 2006. Computer Program for the Kendall Family of Trend Tests: US Geological Survey Scientific Investigations Report 2005–5275. US Geological Survey, Reston, Virginia, USA. Available from: pubs.usgs.gov/sir/2005/5275/pdf/sir2005-5275.pdf.

Loukili Y. and J.W. Pomeroy. 2018. The Changing Hydrology of Lhù'ààn Mān-Kluane Lake - under Past and Future Climates and Glacial Retreat. Centre for Hydrology Report No. 15. Prepared for Government of Yukon, Yukon Community Services, Infrastructure Branch, Whitehorse, Yukon.

Water quality

Significance

The Water Quality Index (WQI), developed by the Canadian Council of Ministers of the Environment, summarizes complex water quality data using a scale from 0 to 100. Scores are categorized as:

Excellent (95-100)
Aquatic life is not threatened or impaired. Measurements never or very rarely exceed water quality guidelines.

Good (80-94)
Aquatic life is protected with only a minor degree of threat or impairment. Measurements rarely exceed water quality guidelines and, usually, by a narrow margin.

Fair (65-79)
Aquatic life is protected, but at times may be threatened or impaired. Measurements sometimes exceed water quality guidelines and, possibly, by a wide margin.

Marginal (45-64)
Aquatic life frequently may be threatened or impaired. Measurements often exceed water quality guidelines by a considerable margin.

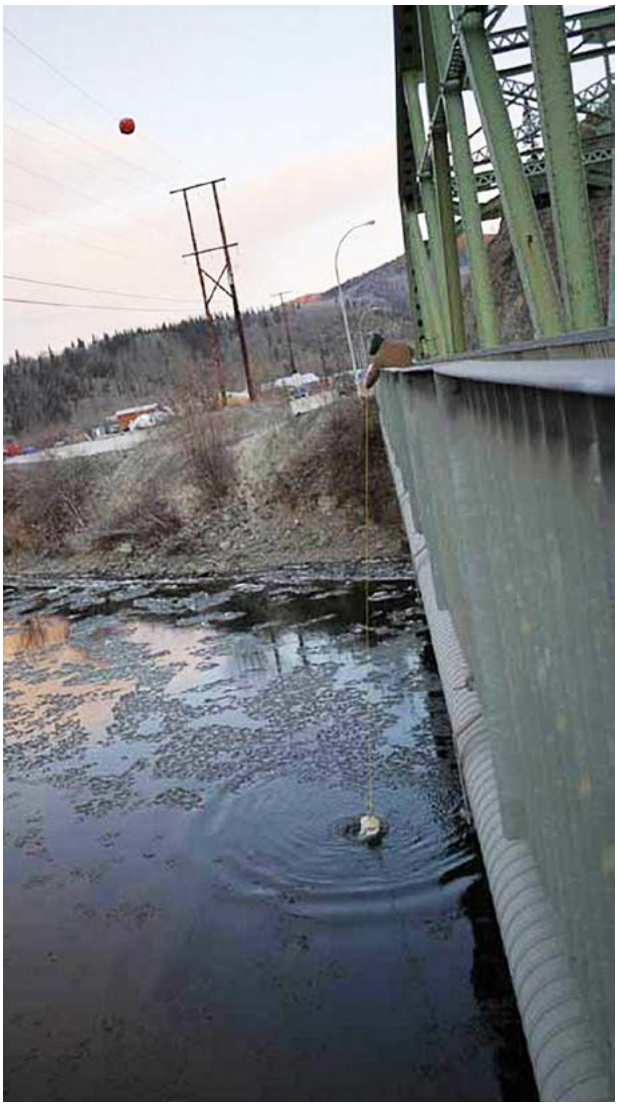
Poor (0-44)
Aquatic life is threatened, impaired or even lost. Measurements usually exceed water quality guidelines by a considerable margin.

The WQI provides the public with information about the status of water quality in Canada and identifies emerging trends. It condenses data about the quality of a water body to a number scale corresponding with a straightforward rating.

The WQI also indicates the suitability of streams to support aquatic life. It measures the frequency and extent to which selected parameters exceed water quality objectives at individual monitoring sites (Canadian Council of Ministers of the Environment 2001).

What is happening?

Environment and Climate Change Canada calculates the WQI scores at four monitoring stations in the Yukon (Figure 1). The WQI is calculated as an average over successive three-year periods. Averaging over multiple years provides additional confidence in ratings. The most recent WQI scores are available for the period 2016 to 2018.



Water quality sampling on the Klondike River.

Figure 1: WQI scores for Yukon monitoring stations calculated as three-year rolling averages.

Water Quality Rating	Excellent (95-100)	Good (80-94)	Fair (65-79)	Marginal (45-64)	Poor (0-44)							
	Three-Year Measurement Period											
Location	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018
Klondike River upstream of Bonanza Creek	66,8	66,4	67,4	74,2	74,2	74,2	74	73,8	73,7	73,7	86,6	80,1
Liard River at Upper Crossing	87,2	93,6	93,6	87,2	85,5	80,6	80,6	n/a	80,6	80,6	80,5	80,6
South McQuesten River downstream of Flat Creek	64,4	64,3	64	70	69,5	70,1	70,4	70,6	70	63,8	63,7	63,5
Yukon River upstream of Takhini River	100	100	100	93,6	93,6	93,6	93,6	93,6	93,6	100	100	93,6

Taking action

In 2019, Yukon signed the Water Quality and Aquatic Ecosystem Monitoring Agreement with the Government of Canada. This agreement will make it easier to collect and share water quality data within Canada and supports community water monitoring arrangements with First Nations governments.

Further information

- Information on the national WQI used to report water quality data is available through Environment and Climate Change Canada.
- Data access to these monitoring stations can be found through Environment and Climate Change Canada's Open Data Portal.
- You can find water quality information for Yukon at Yukon.ca/en/water-quality-monitoring.

References

Canadian Council of Ministers of the Environment. 2014. Canadian Environmental Quality Guidelines [cited 2020 Jan 23]. Available from http://ceqg-rcqe.ccme.ca/en/index.html.

Canadian Council of Ministers of the Environment. 2001. Canadian water quality guidelines for the protection of aquatic life: CCME Water Quality Index 1.0, Technical Report. In: Canadian Environmental Quality Guidelines. 1999, updated 2002. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba, Canada.

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.

- An early rise in river discharge results in the mobilization of a very resistant ice cover, which can translate into damaging ice jams.
- A delayed snowmelt period may generate a sudden and significant runoff and a large-scale mobilization of river ice, which can also lead to ice jam floods.

Both conditions can have detrimental impacts on communities and infrastructure. Over the past centuries, break-up has been occurring earlier in the spring, which represents a strong indicator of a changing climate. Even if warmer winter temperatures contribute to reduced ice cover thickness and therefore its resistance, the combined effect of a larger snowpack and increased air temperature variability will have an impact on ice jam frequency and intensity. The extent of this is yet to be confirmed.

River ice conditions also affect transportation routes, both for winter roads and wildlife corridors; the reduced river ice season is already having an impact on the Yukon population. In recent years, changing freeze-up patterns have resulted in challenges to certify an ice bridge to connect West Dawson and Dawson.

What is happening?

River 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). This trend towards earlier break-up dates is significant. Nine of the eleven earliest recorded break-up events at Dawson City have occurred in the past 30 out of 124 years. The two earliest break-ups on record occurred in the past five years (2016 and 2019, both on April 23).

Taking action

Over the past five years, the Government of Yukon's Water Resources Branch has expanded its ice break-up monitoring program on the Yukon River near Dawson with the use of real-time satellite imagery. This work is being carried out in partnership with Public Safety Canada, the Canadian Space Agency and the private sector. High-quality maps of current river ice conditions are produced on a regular basis prior to and during the break-up period.

The imagery differentiates between intact ice, open water and consolidated ice (ice jam) locations. This, in combination with daily observation flight surveys of ice conditions, allows for improved identification and forecast of ice jam hazards in the community. A break-up timing and intensity forecast model is also being updated to provide early flood warning.

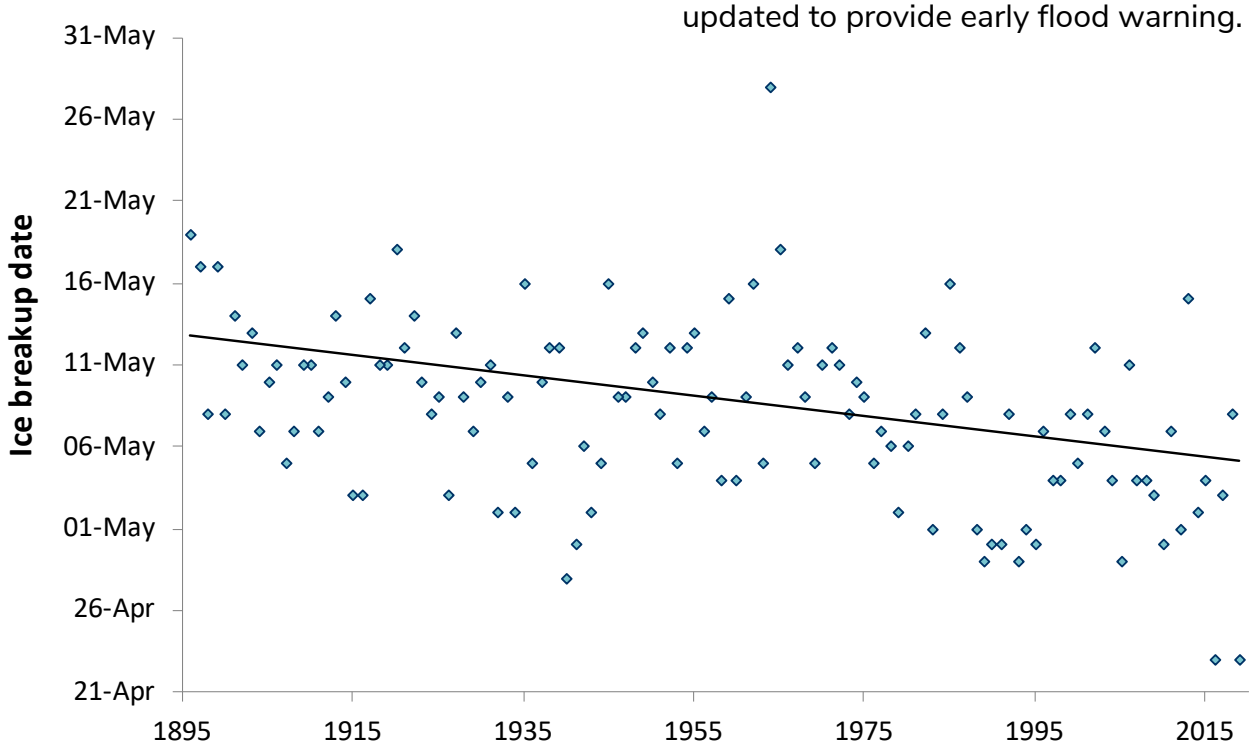


Figure 1: Date of ice break-up on the Yukon River at Dawson City, 1896-2019.

May 2019 break-up of the Yukon River at Dawson City.

Photo: Benoit Turcotte.

Data quality

At first a betting tradition, the exact time and date of break-up has been recorded at Dawson since 1896. More recently, 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 break-up time.

Statistics and a photo documentary about Yukon River ice break-up at Dawson City are available at: yukonriverbreakup.com/statistics. Maximum water levels during break-up have been recorded since 1944.

Land

Population of Yukon

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 Yukon.ca/bureau-of-statistics. 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 kilometre in Yukon.

Population, growth and density of Yukon communities

Area	Population 2019	Population growth from 2018 / (2009)		Population density 2016 (people per km^2)
Yukon	**41,297**	**1.7%**	(21.1%)	**0.1**
Whitehorse / Marsh Lake	**32,304**	**1.9%**	(23.9%)	**3.3**
Dawson City	**2,364**	**1.8%**	(24.2%)	**42.4**
Watson Lake	**1,486**	**-0.7%**	(-4.8%)	**129.4**
Haines Junction	**981**	**2.2%**	(18.5%)	**17.8**
Carmacks	**574**	**1.8%**	(19.6%)	**13.3**
Teslin	**522**	**0.2%**	(11.1%)	**64.6**
Carcross	**521**	**3.0%**	(16.8%)	**18.7**
Mayo	**500**	**-2.7%**	(8.5%)	**188.7**
Faro	**419**	**1.5%**	(3.7%)	**1.7**
Ross River	**407**	**0.5%**	(8.5%)	**14.2**
Pelly Crossing	**394**	**1.8%**	(21.6%)	**10.9**

Tagish	**281**	**2.2%**	(24.9%)	**5.5**
Old Crow	**265**	**0.0%**	(6.0%)	**15.6**
Beaver Creek	**116**	**4.5%**	(11.5%)	**3.4**
Burwash Landing	**108**	**0.9%**	(1.9%)	**2.4**
Destruction Bay	**55**	**-1.8%**	(14.6%)	**4.1**

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. 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).

Comparing September 30, 2019 to September 30, 2009, Yukon's population increased by 7,216, or 21.1 per cent. Over the past year (June 2018 to June 2019), the total Yukon population increased by 709 people, or 1.7 per cent. As a percentage, the greatest increases in population growth occurred in Beaver Creek, Carcross, Haines Junction and Tagish. Population density is only one person per 10 square kilometres.

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 socio-economic statistics visit the Government of Yukon Socio-Economic Web Portal.

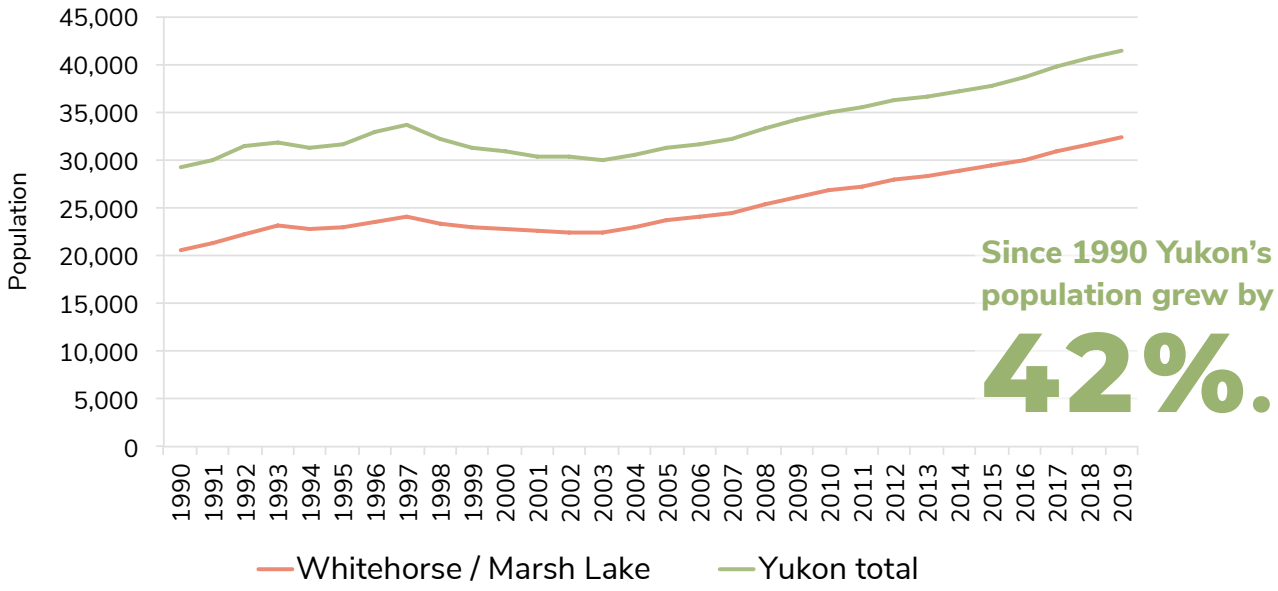


Figure 1: Population of Whitehorse compared to total population in Yukon.

* 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.

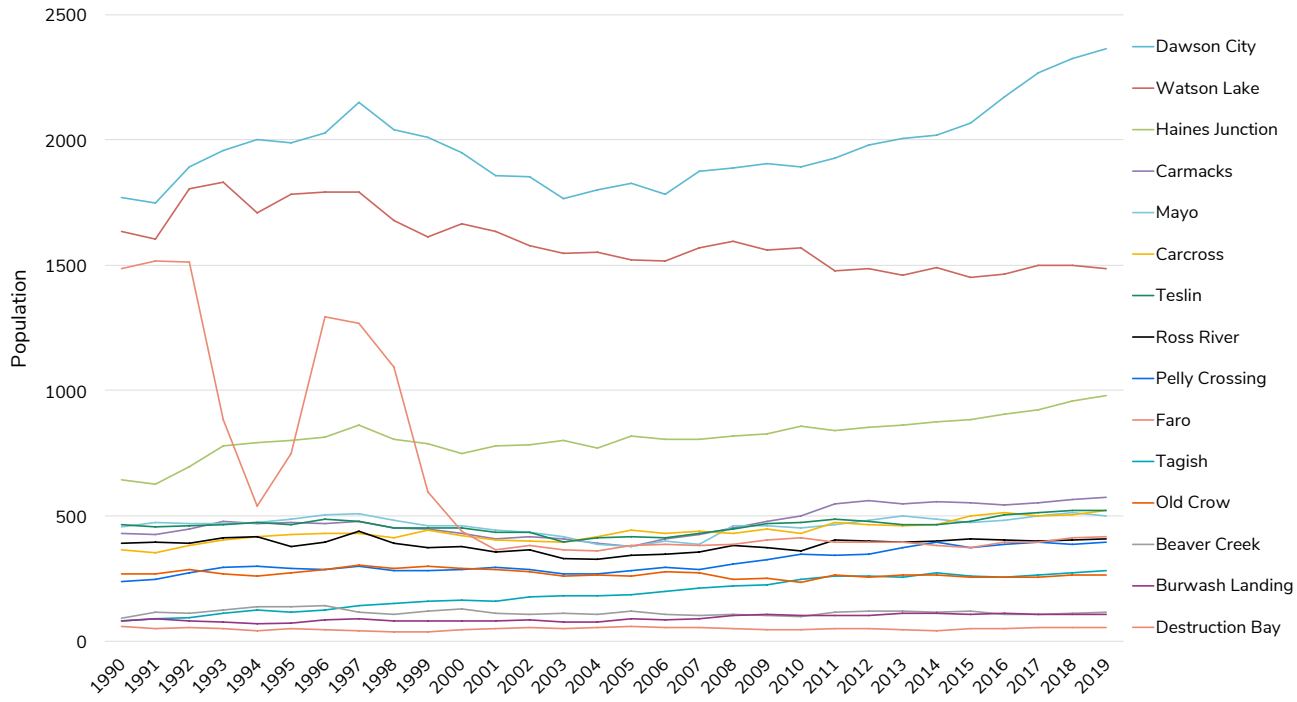


Figure 2: Yukon community populations, 1990-2019.

* 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.

78%

of Yukon's population lives in Whitehorse.

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 Yukon Bureau of Statistics uses for population estimates. For this reason, use population density information with care.

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 Nations Final Agreements. Chapter 11 of the Yukon First Nations 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 the Yukon and First Nations governments, prepares a regional land use plan in consultation with First Nations, stakeholders and residents. The plans are approved by the Yukon and First Nations 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.

- Two regional plans, the ***North Yukon Regional Land Use Plan*** and the ***Peel Watershed Regional Land Use Plan***, have been completed and are being implemented.
- The Dawson planning process has been relaunched. The Commission has been established and planning work is underway.

Regional land use plans

Dawson

Status: Current

The Dawson Planning Commission has been established and is doing preliminary planning research and community engagement.

The Vuntut Gwitchin First Nation and Tr'ondëk Hwëch'in have approved an overlap agreement for a new boundary for the planning region.

North Yukon

Status: 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

Status: Current 2019

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 of Canada 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 expired on April 1, 2020.

Following the Supreme Court of Canada's decision, the planning process was relaunched. In late 2018, final consultation occurred with affected communities, public and stakeholders on the final recommended plan. The plan was approved by all parties in August 2019.

Teslin

Status: Not Started

A previous planning process for the Teslin region was suspended.

Northern Tutchone

Status: Not Started

Planning in this region has not been initiated.

Kluane

Status: Not Started

Planning in this region has not been initiated.

Whitehorse

Status: Not Started

Planning in this region has not been initiated.

White River

Status: N/A

Regional planning as envisioned under the Umbrella Final Agreement does not apply to White River as the White River First Nation does not have a land claim agreement in Yukon.

North Slope

Status: 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

Status: N/A

Regional planning as envisioned under the Umbrella Final Agreement does not apply to asserted Kaska traditional territory, as Kaska Nations do not have land claim agreements in Yukon.

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 Nations 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 Government of Yukon and First Nations governments 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 (OCP).

Status of planning for municipalities in 2019

Community	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) New OCP under review
Mayo	2016 (Amendment to original plan)
Faro	2014
Carmacks	2013
Haines Junction	2013 New OCP under review
Teslin	2010 New OCP under review

Thaw di Gras Festival, Dawson City, 2019.

Haa Kusteeyi Celebration, Carcross, 2019.

Haa Kusteeyi Celebration, Carcross, 2019.

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 establishment of development area (zoning) regulations be 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.

- Additional local area planning processes are currently underway for five areas: Marsh Lake, Fox Lake, Tagish, Alaska Highway West and Fish Lake.
- For up-to-date information about local area plans and to access completed plans, visit Yukon.ca.

Status of local area plans and development area (zoning) regulations for unincorporated communities

Note: Underlined areas indicate where area plans have been or are being developed between the Government of Yukon and First Nations governments.

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	2014 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

Development area	Local area plan (date of approval)	Zoning regulation (date of approval or last comprehensive update)
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		2018
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

References

Government of Yukon, Department of Energy, Mines and Resources. 1988-2020. Find a local area plan [modified 2019 Dec 27; cited 2020 Feb 13]. Available from: Yukon.ca/en/housing-and-property/land-and-property/find-local-area-plan.

Buildings in Faro, Yukon.

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.

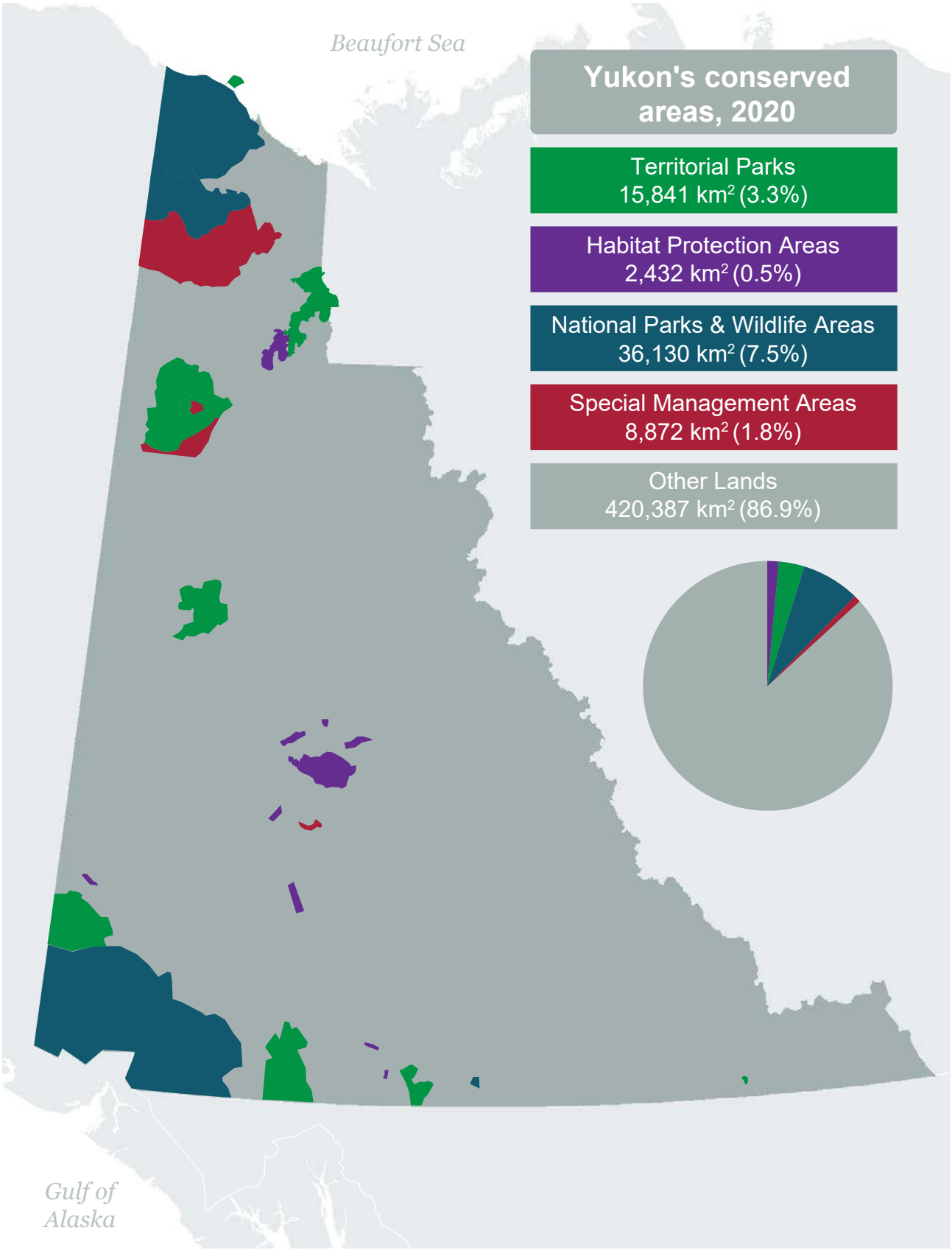
A protected area is land that has been withdrawn from resource and industrial development – mining, oil and gas, logging, dams and land dispositions – and where conservation is the primary objective within the area.

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 km^2 of land designated for conservation purposes – just over 13 per cent of Yukon's total area. Of that, 61,486 km^2 are protected lands, which include territorial parks, habitat protection areas, national parks, national wildlife areas and special management areas.

Sunset at Herschel Island-Qikiqtaruk Territorial Park.


Beaufort Sea
Yukon's conserved areas, 2020
Territorial Parks
15,841 km² (3.3%)
Habitat Protection Areas
2,432 km² (0.5%)
National Parks & Wildlife Areas
36,130 km² (7.5%)
Special Management Areas
8,872 km² (1.8%)
Other Lands
420,387 km² (86.9%)
Gulf of Alaska

Territorial parks

- All territorial parks under the classifications of natural environment parks (with the exception of Agay Mene), wilderness preserves and ecological reserves have permanent withdrawals from mining, oil and gas and surface dispositions.
- Management planning for Asi Keyi and Dàadzàii Vàn territorial parks will be ongoing through 2020.
- The Herschel Island-Qiqiktaruk 10-year management plan review was completed with new plan approved in 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 eleven habitat protection areas identified or established:

Established

Nuna K'óhonete Yédäk Tah'é (Horseshoe Slough)

Tsâwnjik Chu (Nordenskiold)

Devil's Elbow and Big Island

Ddhaw Ghro

Ni'iinlii Njik (Fishing Branch)

Van Tat K'atr'ananhtii (Old Crow Flats)

Łútsäw Wetland

Ch'ihilii Chìk (Whitefish Wetlands)

Mandanna Lake

Planning underway

Pickhandle Lakes

Tagish River

Planning in future

Lewes Marsh

- Ch'ihilii Chik is the first Habitat Protection Area identified through the regional land use planning process. Management planning for this Habitat Protection Area was completed and the plan was approved in 2019, resulting in it being designated under the ***Wildlife* Act**. The status of this Habitat Protection Area went from an interim protected area to a permanent protected area.

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 a 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, Champagne and Aishihik First Nations and 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 management plan that has been approved.

Yukon has four designated Canadian heritage rivers:

- **Alsek** (within Kluane National Park and Reserve);
- **Bonnet Plume;**
- **The Thirty Mile Section of the Yukon River; and**
- **Tatshenshini**

Peel Watershed

The Peel watershed covers 67,431km^2 of wilderness that is rich in biodiversity. Among large North American watersheds, the Peel is special as there are no permanent residents, few roads and very limited development. There are many culturally, historically and ecologically important and significant areas throughout the region. They include, but are not limited to:

- habitat for Boreal and Barren-ground caribou (the Porcupine caribou herd);
- extensive wetlands, six major rivers and their headwaters;
- historic and prehistoric settlements and travel routes;
- long-term subsistence use and cultural activity areas;
- national hotspots for plant endemism; and
- key habitat for a large number of important wildlife species.

The ***Peel Watershed Regional Land Use Plan*** was approved after a lengthy planning process, court proceedings and reinitiating the collaborative relationship between the parties, including the

Government of Yukon and four First Nation governments: First Nation of Na-Cho Nyäk Dun, Tr'ondëk Hwëch'in, Vuntut Gwitchin Government and the Gwich'in Tribal Council. Together these five governments signed the plan at a ceremony held in Mayo on August 22, 2019. The cornerstone of the plan is sustainable development that guides environmental protection, heritage and culture protection and economic development.

The parties have now begun the implementation phase of the plan together. Conservation areas make up 83 per cent of the plan's area. Implementation will include the formal designation of 3,457,100 hectares of permanently protected areas, otherwise known as special management areas, which make up 55 per cent of the plan area. An additional 28 per cent of the plan area will have interim protection through two land use designations: 1) wilderness areas; and 2) wilderness areas – Boreal Caribou, as outlined in the plan.

The next step is to develop an implementation plan that will prioritize several things including:

- prohibiting mineral staking in the conservation areas; and
- legally designating the special management areas and wilderness areas – Boreal Caribou and creating management plans for them.

Data quality

The total area of Yukon is 483,662 km^2 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 Peel Watershed Regional Land Use Plan Signing Ceremony on Thursday, August 22, 2019, at Galena Park on the Traditional Territory of the Na-Cho Nyäk Dun First Nation in Mayo, Yukon.

Photo: Government of Yukon/Alistair Maitland Photography.

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. International Union for the Conservation of Nature, Gland, Switzerland. Available from: portals.iucn.org/library/sites/library/files/documents/PAG-021.pdf.

Peel Watershed Planning Commission. 2019. Peel Watershed Regional Land Use Plan. Government of Yukon, Whitehorse, Yukon, Canada. Available from: Yukon.ca/en/download-peel-watershed-regional-land-use-plan.

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 adverse 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 – federal, territorial or First Nations 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 2018, 214 project proposals were submitted to YESAB for assessment. The Kudz-Ze-Kayah Mine and Coffee Gold Mine proposals submitted for screening by the YESAB Executive Committee are still in progress.

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

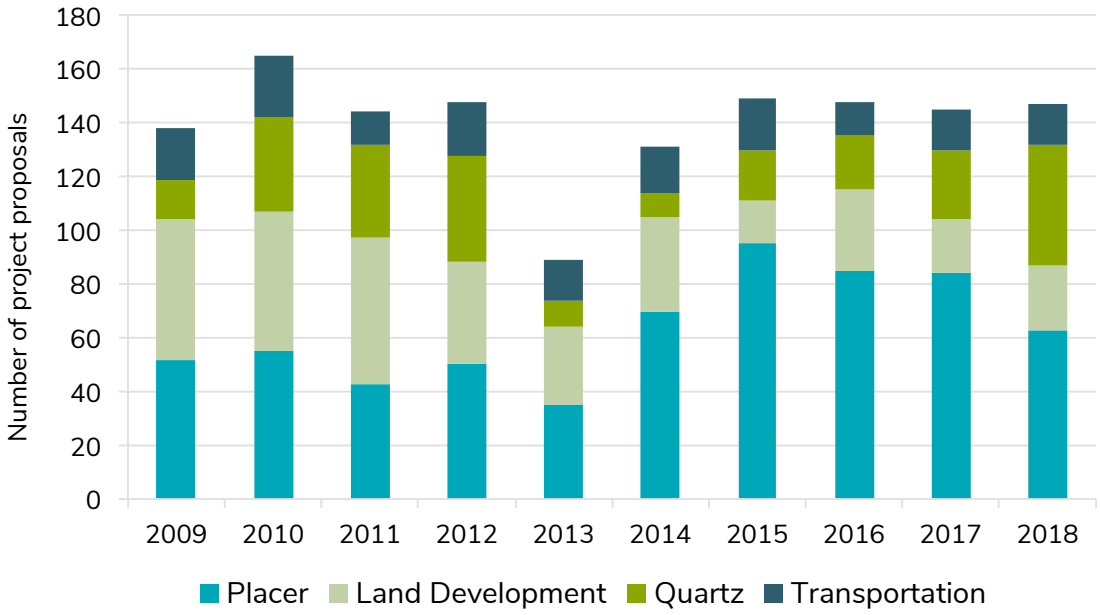


Figure 1: Number of project proposals for the four common sectors.
Source: YESAB.

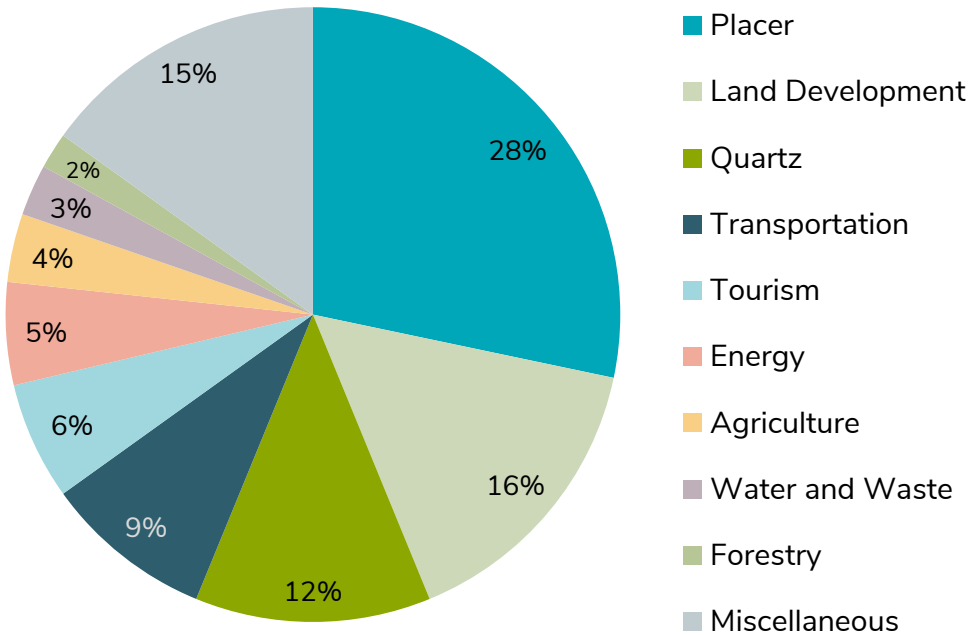


Figure 2: YESAB percentage of projects assessed by sector, 2005 to 2018.
Source: YESAB.

In 2018, the majority of project proposals were received in the Dawson City and Mayo areas (Figure 3). Whitehorse, given its population density, generates a large number of project submissions for residential 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 11 placer and 22 quartz proposals in 2018. Overall, placer mining and quartz projects made up 29.4 and 21 per cent respectively of the total project proposals submitted to YESAB in 2018. This is in contrast to an average of 28 per cent placer and 12 per cent quartz for the period 2005 to 2018.

Additional YESAB statistics are available on YESAB's website. Information regarding individual projects can be found on the YESAB Online Registry (yesabregistry.ca).

Rancheria Falls.

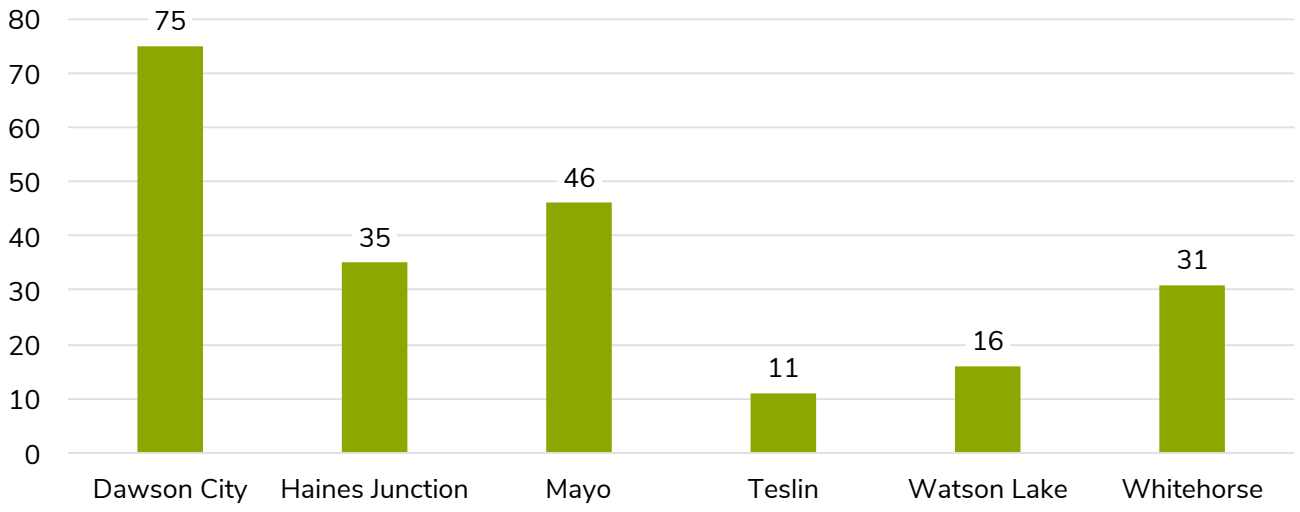


Figure 3: YESAB, project proposal submissions by designated office.

Source: YESAB.

Canoeing at Tatchun Lake campground.

Recreational land use

Significance

The Government of Yukon operates and maintains 42 roadside 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" (UNEP n.d.).

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

What is happening?

- In 2019, the Government of Yukon's territorial parks included:
  - 57 territorial parks classified into four types (natural environment parks, recreation parks, wilderness preserves and ecological reserves);
  - 42 campgrounds;
  - 11 day-use recreation sites.
- Use of territorial parks, by both residents and visitors, has grown dramatically in the past decade. From 2008 to 2018:
  - The number of people camping in our campgrounds increased by 80 per cent to more than 89,000 per year (Figure 1).
  - There are more than twice as many non-resident campers as resident Yukon campers camping in the territorial campgrounds. However, residents spend twice as much time in the campgrounds, so the person

nights of residents and non-residents are roughly equal.

- The use of our campground facilities more than doubled. The occupancy of campsites increased 103 per cent to more than 57,000 nights.
- Backcountry camping in the popular backpacking areas of Tombstone Territorial Park increased by 137 per cent.
- The number of visits to the Tombstone Interpretive Centre increased by 176 per cent to more than 27,000 (Figure 2).

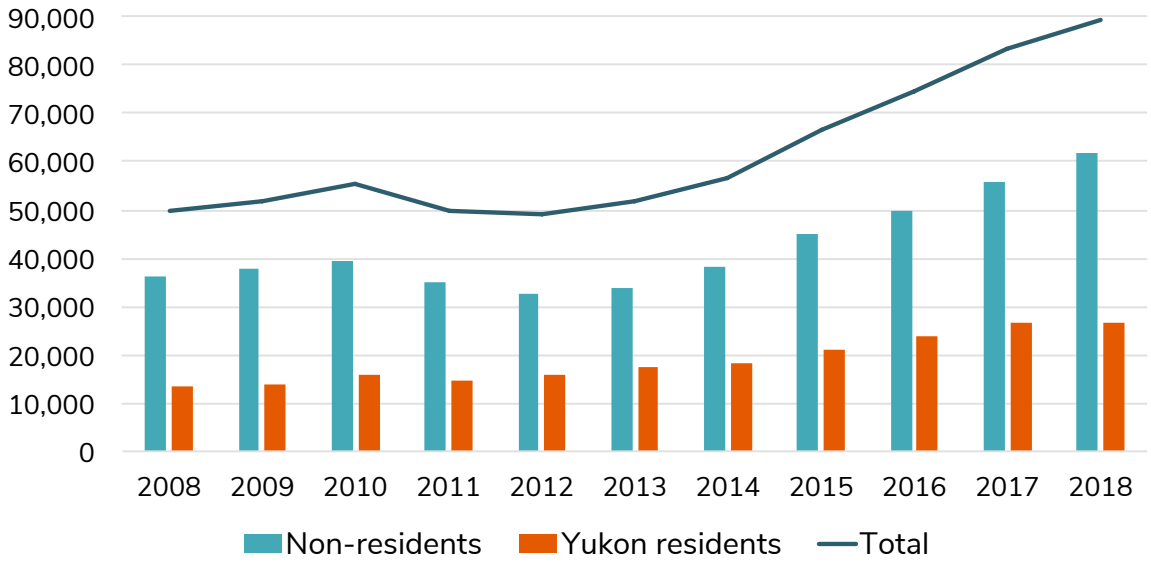


Figure 1: Number of people camping in territorial campgrounds each year.

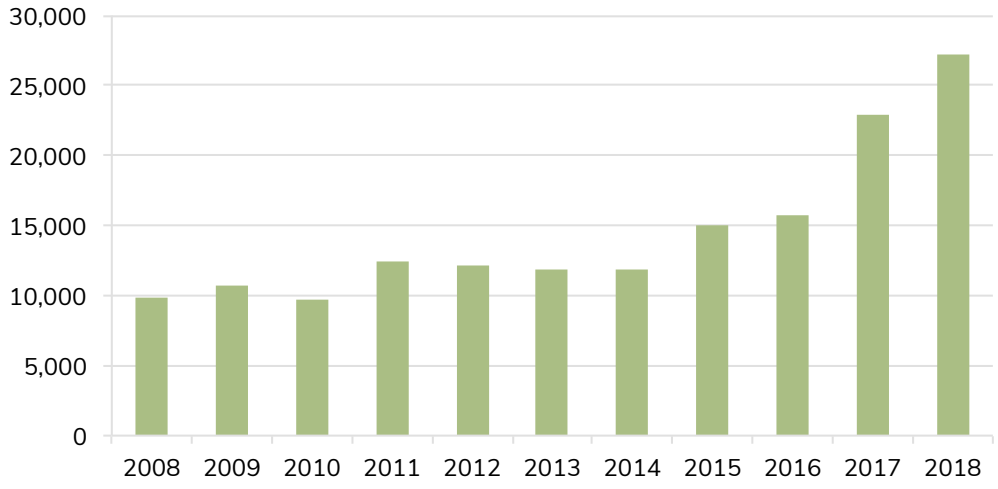


Figure 2: Visitors to the Tombstone Interpretive Centre each year.

Taking action

The Government of Yukon has worked to increase the number of campsites available to visitors and residents. From 2017 to 2019, 51 new campsites have been added to the existing system.

- **Congdon Creek: 2 campsites and 20 tent-only sites.**
- **Five Mile Lake: 6 campsites.**
- **Little Salmon Lake: 7 campsites.**
- **Tombstone Mountain: 15 campsites.**
- **Lapie Canyon: 1 campsite.**

Data quality

- The Government of Yukon's Parks Branch tracks overnight visitation 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 Yukon including Kathleen Lake Campground in Kluane National Park and Reserve and several private RV campgrounds. Data from these sites are not included in this summary.

References

United Nations Environmental Programme (UNEP). n.d. Tourism's Three Main Impact Areas [cited 2020 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 comes 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.

Fast Facts

- **600 kg**: the total average, annual amount of waste per person landfilled in Whitehorse in 2018. This is a 15 per cent decrease from 2017 (710 kg per person).
- **30 per cent**: the percentage of waste diverted from the Whitehorse landfill through recycling and composting efforts. This is a four per cent increase from 2017.
- 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 0.60 tonnes.

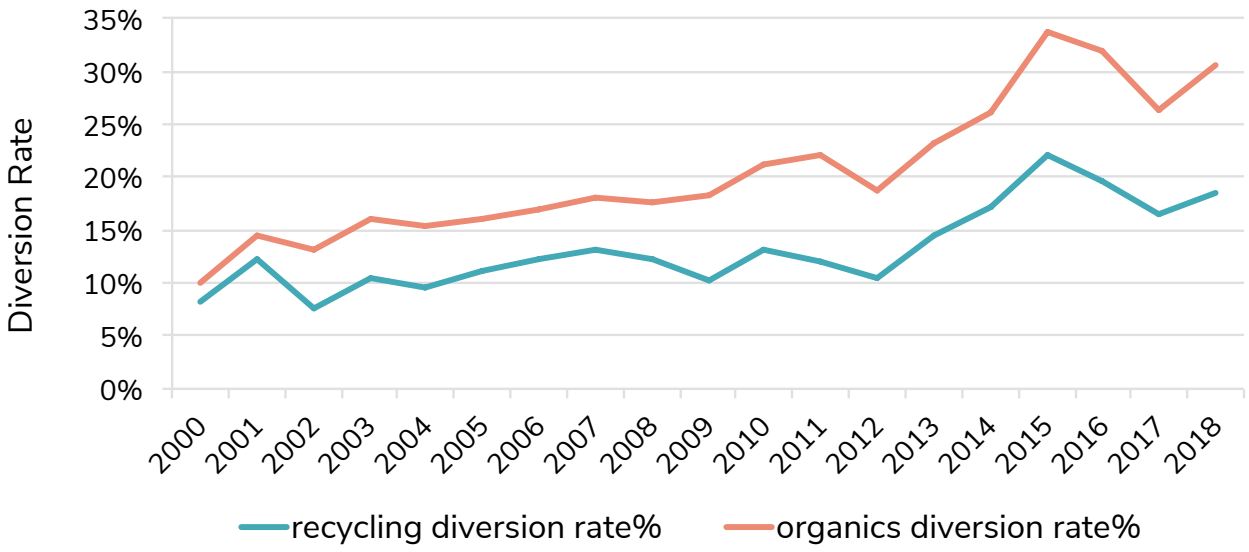


Figure 1: Diversion rate of recycling and organics materials from the City of Whitehorse Waste Management Facility.

- 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 2018 can be attributed to increase waste landfilled, in particular construction waste.

Taking action

- In 2019, Whitehorse has expanded service to the vast majority of food service businesses and will continue the program expansion with multi-family residential users in 2020. Preliminary data for the growth of organics diversion is promising.
- 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 began in 2019.
- 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.
- In 2015, the City undertook "back-end enforcement" of solid waste, establishing a compliance program at the working face of the landfill. Loads are inspected for compliance with the Waste Management Bylaw and a mixed load fee is charged to create an economic incentive to divert waste properly.
- Other initiatives include the creation of a multilingual waste sorting guide using visual education to help residents and businesses comply with the Waste Management Bylaw, offering one-on-one assistance to businesses to identify waste diversion opportunities and the creation of a waste-sorting app called "What Goes Where?"
- 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. The City of Whitehorse has now qualified its compost as an Organics Management Review Institute listed product. This means the quality of the compost is very high and can be used in organic gardens.
- The compost facility is being upgraded to accommodate the growth of the program with funding support from the Government of Canada and Government of Yukon. The $4.4 million upgrade began in 2019 and is expected to be complete in 2020. The upgrade, which includes a concrete pad for processing, will increase processing capacity and reduce environmental impact of the compost process by capturing process water for re-use.

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 17-10-0009-01 - Estimates of population, Canada, provinces and territories, quarterly (persons). CANSIM [modified 2020 Feb 13, cited 2020 Feb 13]. Available from: www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000901.

Statistics Canada (2015b). Table 38-10-0032-01 - Disposal of waste, by source, Canada, provinces and territories, every 2 years (tonnes), CANSIM [modified 2020 Feb 13, cited 2020 Feb 13]. Available from: www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810003201.

Forest health

Significance

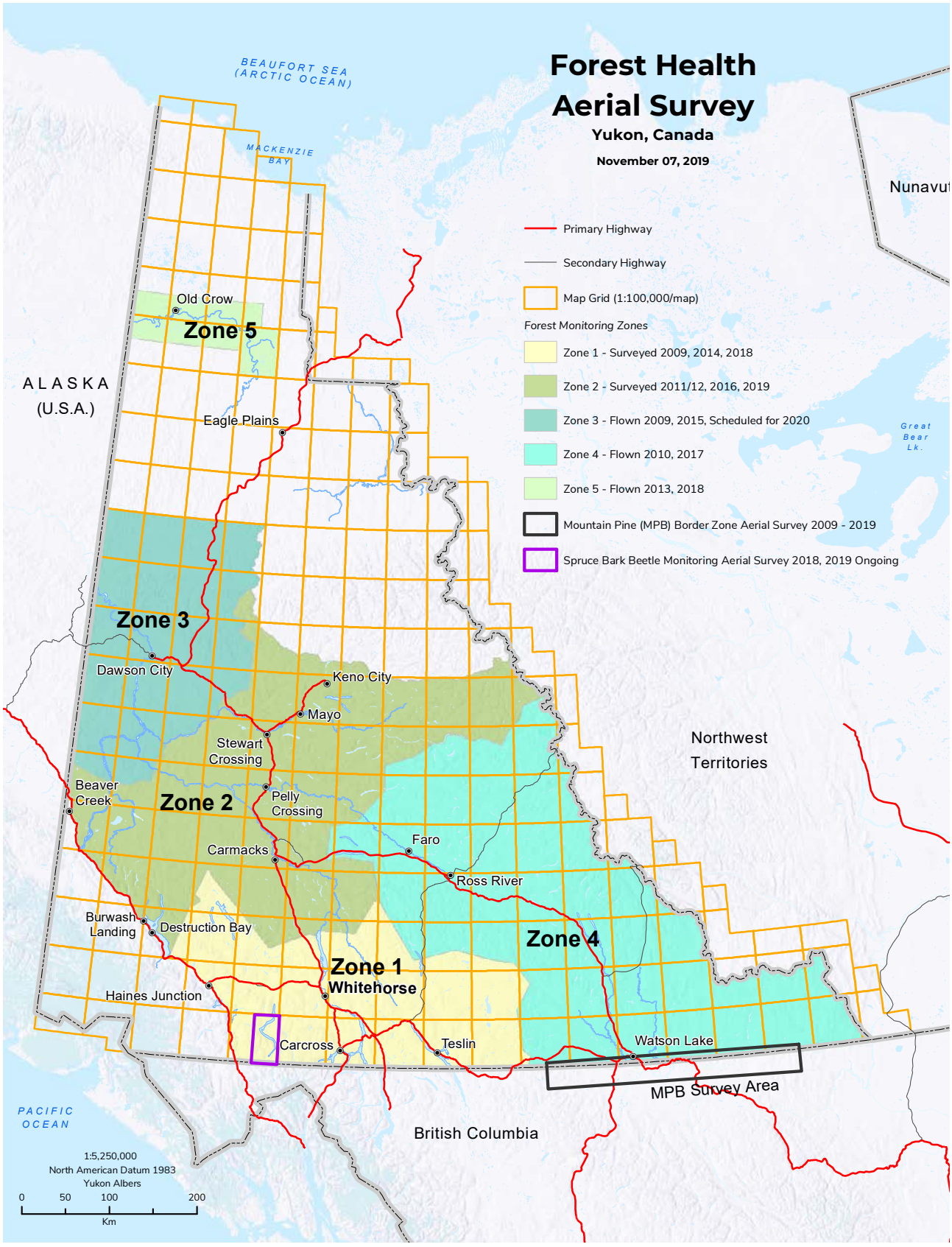
Native forest insects and diseases are generally of little concern when they exist at non-damaging population levels. It is when populations of these native species increase beyond an acceptable threshold or when alien or native species behave invasively that concerns arise. If ecological or economic 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 Yukon 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 (NFPS). 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 NFPS goals, one of which is developing early detection and reporting capacity of forest health pests.

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

For a full assessment of Yukon forest health issues, see the Yukon forest health reports.



Map 1: Forest Health Zone map shows areas flown from 2009 to 2019 and planned surveys for 2020 and 2021.

What's happening

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

- aerial overview surveys;
- monitoring of the Yukon-BC 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 Zone 2 (refer to Map 1). In 2019, the Forest Management Branch also responded to a variety of public reports and conducted ground surveys to assess Spruce Beetle risk in an infested area near Kusawa Lake in Forest Health Zone 1, which was mapped in 2018.

Forest health disturbances

The Forest Management 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 2.

Biotic disturbances

Spruce Beetle

- In 2019, aerial surveys recorded 709 hectares of old attack (e.g., red and grey trees) in the Kusawa Lake area that was first recorded in 2018.
    - Ground surveys in 2019 found no new current attacks, indicating that populations have collapsed.

Scattered old (red and grey) Spruce Beetle attack on the west side of Kusawa Lake.

  - Outbreak estimates have been revised to five to six years old, with populations declining around 2016.
  - The Yukon Forest Management Branch will continue to monitor this area as part of their proactive approach to forest health management.

- Elsewhere in 2019, two patches totalling 54 hectares were noted southeast of Keno City near Stewart River.

Western Balsam Bark Beetle

- Western Balsam Bark Beetle is a new bark beetle to Yukon Sub-alpine Fir forests with northern spread with expansion occurring over the last 20 years.
- Areas infested in 2019 decreased slightly to 10 hectares from 27 hectares in 2016. This bark beetle was also mapped over 34 hectares in Forest Health Zone 1 while conducting special surveys for Spruce Beetle in the Kusawa Lake area.
- Endemic populations can cause single tree mortality; however, outbreak populations can cause extensive group tree or stand-level mortality over successive years of attack.
- Trees retain red foliage for up to five years making it difficult to determine trends.

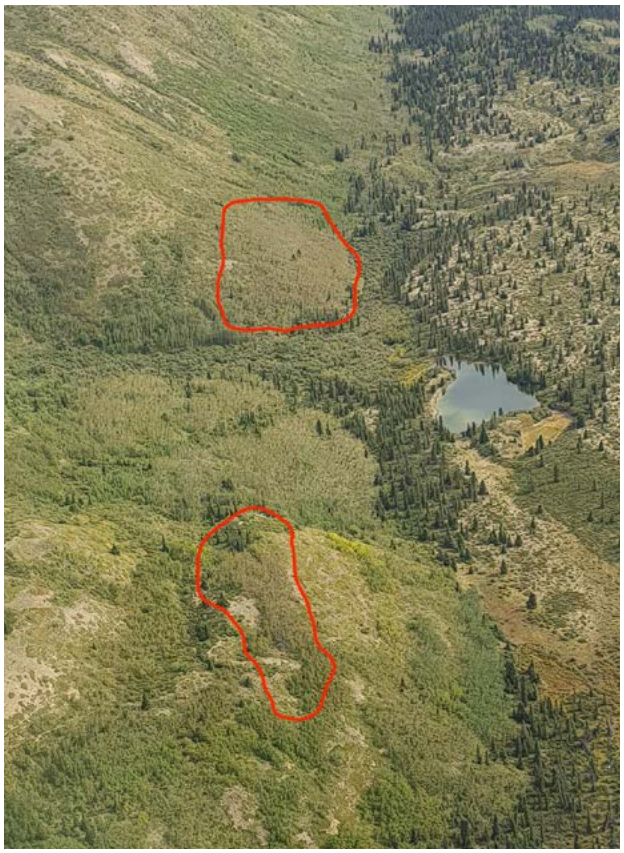
Aspen Serpentine Leafminer

- 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 2019, area infested increased slightly to 186,215 hectares, up from 178,603 hectares.
- The longevity of this outbreak is thought to be contributing to aspen decline as half of the infested stands showed signs of decline. Reduced growth due to reduced photosynthetic activity associated with underside leaf mining was also noted.
- The silver leaf tone characteristic of Aspen Serpentine Leafminer was noted throughout the host range.

Moderate Aspen Serpentine Leafminer with light aspen decline northeast of Wellesley Lake.

Large Aspen Tortrix

- The Large Aspen Tortrix outbreak in the highway corridor between Pelly Crossing and McQuesten has collapsed with only 726 hectares noted in 2019, versus 18,754 hectares in 2016.



Moderate defoliation near Alligator Lake, southwest of Whitehorse.

- Defoliation was noted:
  - south of Minto near Big Creek, Rosebud and Scroggie Creek west of Pelly Crossing; and
  - south of McQuesten River and Lake and Willow creeks between McQuesten and Stewart Crossing.
- Dieback associated with successive years of defoliation persists in previously defoliated stands.
- Defoliation totalling 342 hectares was also noted south of Whitehorse in the Alligator and Annie lakes area in Forest Health Zone 1.

Willow Blotch Leafminer

- This common leafminer was first recorded in Yukon in 2007 adjacent to the Stewart River at Stewart Crossing. In 2019 this defoliator was widespread, recorded in drainages from Whitehorse to Mayo to McQuesten, causing moderate to severe defoliation over 5,823 hectares up from 526 hectares in 2016.

Severe Willow Blotch Leafminer in a riparian zone just east of Tetl'ámān (Tatlmain Lake).

- In Forest Health Zone 1 near Kusawa Lake, 28 hectares were mapped near Rose Lake.
- A recent study in Alaska found that there was a general decline in the productivity of salix species and suggest that repeated outbreaks have the potential to impact the food supply of browsers, including Moose.

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 discoloration/defoliation of 1,396 hectares, up from 85 hectares in 2016.
    - Higher incidence coincides with optimum dispersal and infection conditions due to higher precipitation in Minto in 2018.
    - Infected lodgepole pine stands were located between Stewart Crossing and Big Salmon River.

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).
- In 2019 flooding was recorded at 11 different sites, totaling 132 hectares. This is up from 48 hectares in 2016. The majority occurred in spruce stands but Lodgepole Pine was also affected in a few areas.

Moderate discoloration of young Lodgepole Pine by pine needle cast, southwest of Stewart Crossing near Willow Lake.

Windthrow and landslides

- Shallow-rooted tree species, such as spruce, are more prone to windthrow. In 2019 only five hectares of spruce windthrow were mapped near Caribou Creek, Pelly River area.
- In 2019, a five-hectare landslide was recorded at Owl Creek, near Mayo Lake.

Pest complexes

Aspen decline

- Aspen decline or dieback refers to mortality or damage to forests due to a 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.
    - Reconnaissance plots in the highway corridor between Dawson and Whitehorse confirmed the spatial analysis results: stands which experienced two or more years of defoliation showed signs of decline.
- In Forest Health Zone 2 the area with symptoms of aspen decline decreased to 94,852 hectares, with 95 per cent also having Aspen Serpentine Leafminer.
    - This is down from 158,880 hectares recorded in 2016: however poor lighting due to smoke likely led to an underestimation of the area affected in 2019.
    - Subtler symptoms of aspen decline require perfect lighting for aerial detection, while stands with advanced symptoms are not as noticeable as all of the stems have fallen to the ground. Hence it is possible that some stands which were severely affected in 2016 have since fallen apart.

Landscape level aspen decline with Serpentine Leafminer along Dip Creek, just east of the Donjek River.

	FHZ 2			FHZ 1
Disturbance type	**2011/12**	**2016**	**2019**	**2019**
Biotic				
Aspen Serpentine Leafminer	181,900	32,884	96,132	
Large Aspen Tortrix	730	6,106	726	342
Birch Leaf Roller		468	847	
Spruce Beetle	48		54	709 (old)
Western Balsam Bark Beetle	6	27	10	34
Willow Blotch Miner	168	526	5,823	28
Northern Spruce Engraver Beetle		36		
Pine needle cast	7,116	85	629	
Abiotic				
Aspen decline	906	513	4,769	
Flooding	213	48	132	
Drought - spruce		35		
Drought - aspen	20			
Landslide	234		5	
Windthrow			5	
Pest complexes				
Aspen Serpentine Leafminer/ aspen decline		145,719	90,083	
Large Aspen Tortrix/aspen decline		12,648		
Porcupine/bark beetles	26	15	3	0.5
Pine needle cast/abiotic			767	

Table 1. Summary of forest health disturbances recorded in Forest Health Zone 2 in 2011/2012, 2016 and 2019, and a small portion of Forest Health Zone 1 where special surveys were conducted for Spruce Beetle.

Porcupine/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 murrayane***) or Pine Engraver Beetle (***Ips pini***) attack and further weaken or kill the trees
- Porcupine/bark beetle damage on lodgepole pine was mapped over three hectares in Forest Health Zone 2, down from 15 hectares in 2016.

Taking action

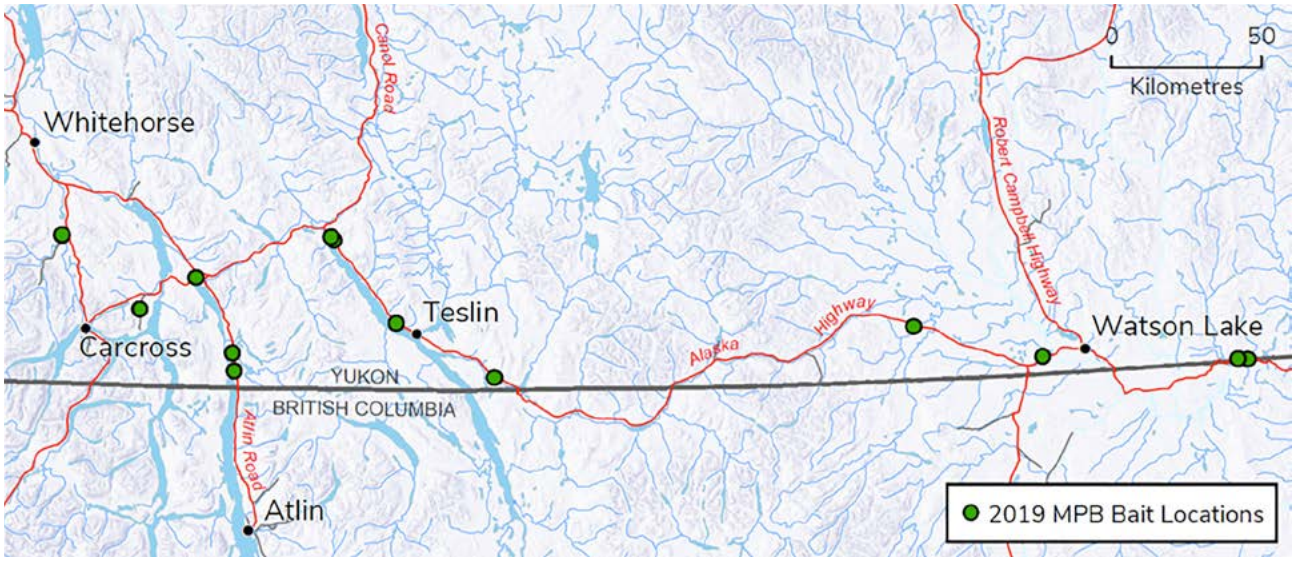
Proactive management of Mountain Pine Beetle (MPB)

Aerial surveys

- This marks the tenth consecutive year that Forest Management Branch has been conducting aerial surveys in northern BC (See Map 1).
- In 2010, when aerial surveys were initiated, MPB populations and subsequent pine mortality within the Rocky Mountain Trench of BC were very high (within 150 kilometres of Yukon border).
- Since that time severe winter cold has killed beetle broods within the trees. That, combined with the absence of large feeder populations in northern BC, has slowed significant northward movement of MPB populations.

Pheromone bait tree stations

- Since 2009, the Forest Management Branch has been setting up and monitoring 15 pheromone bait tree stations in southern Yukon and northern BC to detect the presence of MPB (Map 2).
- These pheromone baits do not attract MPB 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 MPB was found in 2019.



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

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 BC in 2011.

Pheromone trapping in historical outbreak area.

- In 2018 a Spruce Beetle monitoring program was established in the Haines Junction area and continued in 2019.
- The objective of the program is threefold:
  1. track the presence or absence of Spruce Beetle in the Haines Junction Timber Harvesting Plan areas;
  2. better understand the timing of the Spruce Beetle flight period in the Haines Junction area; and
  3. determine if Spruce Beetle populations are higher in some areas than others.
- Trap (Lindgren funnel traps) catches in 2019 were very low with only 76 Spruce Beetles caught in nine traps spanning eight locations; down from 146 beetles caught in 10 traps in the same locations.

Data quality

- From 1950 to 1995, the Forest Insect and Disease Survey (FIDS) was conducted by the Canadian Forest Service (CFS). From 1995 both CFS and the Forest Management Branch conducted aerial surveys to monitor Spruce Beetle near Haines Junction. In 2009, with National Forest Pest Strategy funding, the Forest Management Branch adopted the aerial overview survey program and have been conducting annual aerial surveys since then. 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; Mitton and Grant 1980). 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, Lands and Mines 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 BC 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, since 2014 mapping resolution moved from eight kilometre gridlines to 14 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 evaluate the potential risk from various insect pests.

Lindgren funnel trap at Pine Canyon, 2018.

Further information

Forest Management Branch website: Yukon.ca/en/science-and-natural-resources/forests/learn-about-forest-health

References

Anon. 2008. Understanding the effects of flooding on trees. Sustainable Urban Landscapes. Iowa State University, University Extension, Ames, Iowa, USA.

BC Ministry of Forests and Canadian Forest Service. 2000. Forest Health Aerial Overview Survey Standards for British Columbia. Prepared for the Resources Inventory Committee.

Ciesla W.M. 2000. Remote sensing in forest health protection. USDA Forest Service, Forest technology Enterprise Team, FHTET Report No. 00-03.

Mitton J.B. and M.C. Grant. 1980. Observations on the Ecology and Evolution of Quaking Aspen, Populus tremuloides in the Colorado Front Range. Amer. J. Bot. 67 (2): 202-209.

Natural Resources Canada. n.d. National Forest Pest Strategy [modified 2015 Jun 15, cited 2020 Feb 13]. Available from: nrcan.gc.ca/our-natural-resources/forests-forestry/wildland-fires-insects-disturban/forest-pest-Management/national-forest-pest-strategy/13409.

Wetlands

Significance

Wetlands are essential for maintaining water flows, flood protection, purifying water, recharging/discharging groundwater, and providing habitat for fish and wildlife. 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;
- functions as a net carbon sink;
- 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 Wetland 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.

Aishihik Lake wetlands.

The Canadian Wetland Classification System works by grouping wetlands with similar vegetation. 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. However, it does not address the environmental, social or economic importance of a wetland.

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 are 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 continued in 2019. Find more about the process on engageyukon.ca.

The Land Planning Branch of the Department 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, a 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 Wildlife Key Area database.
- Many of our existing and proposed protected areas include important wetland habitat.
- The Wildlife Key Area database includes a number of wetlands that have been identified as important for wildlife species.

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 the 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 completed studies 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.

The Government of Yukon is establishing a database of reference (baseline) conditions for Yukon wetlands and developing a protocol for measuring changes to wetlands through the Wetland Reference Condition Approach (RCA) project. The RCA project requires numerous environmental measures such as water chemistry, vegetation, soil and invertebrates.

Through this project, the environmental measures that convey wetland health the best will be used in the future to monitor wetlands. The RCA project also aims to understand how wetlands naturally change over time and space, in order to differentiate between changes caused by natural processes and change caused by human activity and climate change. The results and products created by the RCA project, which references database and the measurement indicators, will enhance our ability to respond to environmental assessment of projects impacting wetlands and will support development and implementation of a new Yukon wetlands policy.

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.

Beaver River

The Government of Yukon, led by the Department of Environment, developed a wetland inventory and mapping program to support the Beaver River sub regional land use planning process. An information gap relating to wetlands was identified early in the planning process, which led to the inventory program of wetlands as they provide key fish and

wildlife habitat and play an important role in traditional land use. An intensive field program and desktop modeling exercise were completed in 2019 to inventory and predicatively map wetland areas to the five major classes of the Canadian Wetland Classification System. The final map product and wetland characterization will provide regional information to support the decision-making process for land use planning in the Beaver River area.

References

National Wetlands Working Group. 1997. The Canadian Wetlands Classification System, 2nd edition. Wetland Research Centre, University of Waterloo, Waterloo, Ontario, Canada.

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 December 2019, an estimated 178 alien plant species have been identified in Yukon. Of these, 112 are currently believed to be present, 65 are believed to be absent, and the presence of one additional species is unknown (Figure 1).
- Thirty-four of these plant species have a medium to high invasiveness rating in Yukon (Government of Yukon 2020).
- 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 new species of plants, beetles, flies and earthworms.

- 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).

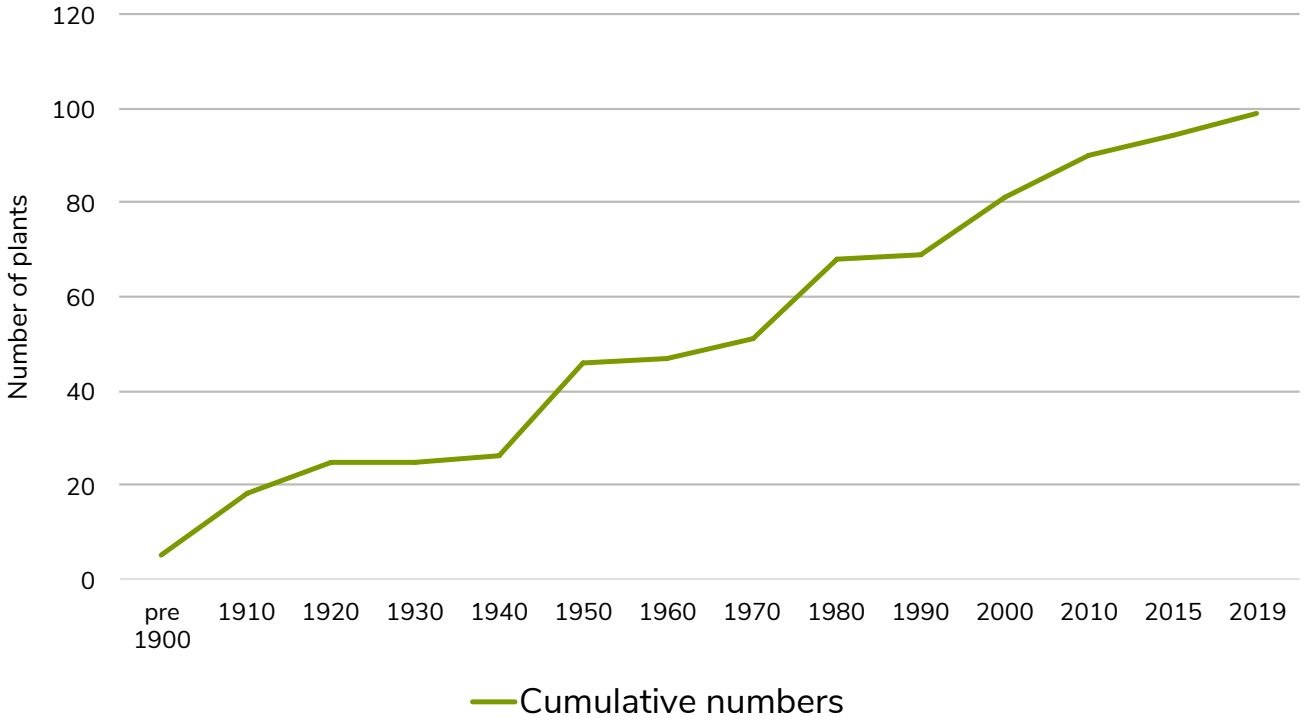


Figure 1: Introduced plant species persisting in Yukon.

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.

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 (Government of Yukon 2020).

Elk.

Photo: J Bergold.

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).

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

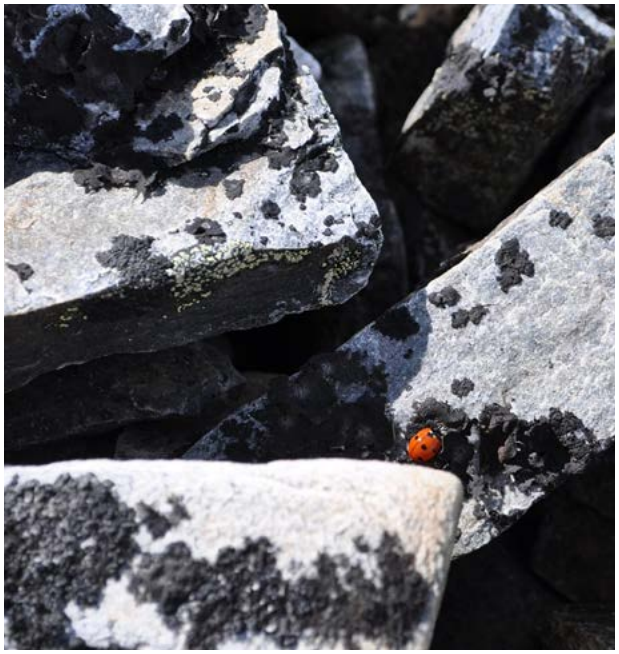
Species	Native to	Introduced in
Arctic Char	Two lakes in Ivvavik, northern Yukon	Southern Yukon
Bull Trout / Dolly Varden	Yukon and Liard drainages	Pothole Lakes
Kokanee	Alsek drainage	Scout Lake
Rainbow Trout	Alsek drainage	Yukon River

Threespine Stickleback.

Photo: NOAA Fisheries, Auke Bay Laboratories.

Invertebrates

- Less is known about alien invertebrates in Yukon.
- The Government of Yukon's Conservation Data Centre currently has about 4,550 invertebrate species recorded in their database; 50 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.



Seven-spotted Lady Beetle.

Photo: Kelcy Tousignant.

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 of the Government of Yukon asks Yukoners to report aquatic invasive species. They actively promote information at boat launches throughout Yukon.

Data quality

- Through the Spotter's Network, there is a formal protocol for invasive alien species data collection within Yukon.
- The Government of Yukon's 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 Department of Environment provides additional information about Yukon's aquatic invasive species and invasive plants.

References

Convention on Biological Diversity (CBD) Secretariat. n.d. Invasive species [cited 2020 Mar 3]. Available from www.cbd.int/invasive.

Government of Yukon. 2019. Rare species database. Yukon Department of Environment, Whitehorse, Yukon, Canada.

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

Yukon Invasive Species Council. n.d. Yukon Invasive Species [cited 2020 Feb 13]. Available from: yukoninvasives.com.

Fish and wildlife

Species management plans

Significance

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

Management plans and recovery strategies 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 these plans helps to demonstrate commitment to continued action on managing species.

Global range of grizzly bears has declined by 50% since 1800.

Two Grizzly Bears in the grass.

Photo: J. Bergold/Government of Yukon.

What is happening?

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

A Conservation Plan for Grizzly Bears in Yukon

Approved: 2019
Status: Current

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. The plan was approved in 2019. The Grizzly Bear is listed under the federal ***Species at Risk Act*** as a Species of Special Concern.

Management Plan for Elk in Yukon

Approved: 2016
Status: Current

This plan provides an adaptive framework to guide the management of the Takhini and Braeburn elk herds.

Management Plan for Yukon Amphibians

Approved: 2013
Status: 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

Approved: 2012
Status: Renewal underway

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

Approved: 2012
Status: Progress assessment underway

This plan guides wolf conservation and management throughout Yukon, ensuring that the roles of wolves and their prey species are respected.

Management Plan for the Chisana Caribou Herd

Approved: 2011
Status: Renewal underway

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)	Management Plan (in place)
Baikal Sedge	Northern Mountain Caribou
Eskimo Curlew	Short Eared Owl
Wood Bison	Rusty Blackbird
Little Brown Myotis and Northern Myotis	Peregrine Falcon
Alkaline Wing-nerved Moss	Western Toad
Canada Warbler	
Caribou, Boreal	
Common Nighthawk	
Olive Sided Flycatcher	
Recovery Strategy (in progress)	**Management Plan (in progress)**
Red Knot roselaari type	Polar Bear
Gypsy Cuckoo Bumble Bee	

Between 2012 and 2019, 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***. Additionally, the Government of Yukon participated in the development of completed national management plans for several species at risk, including Boreal Caribou, Northern Mountain Caribou, Wood Bison, Western Toad (and others). The Government of Yukon also contributed to the completion of the ***Inuvialuit Settlement Region Polar Bear Joint Management Plan***, in collaboration with the Government of Northwest Territories and the Inuvialuit.

Taking action

View the species management plans for specific action items on species.

Profile

Management Plan for the Aishihik Wood Bison Herd in Southwestern Yukon

Two subspecies are recognized within the American bison: Plains Bison (***Bison bison bison***) and Wood Bison (***Bison bison athabascae***). Between 1988 and 1992, 170 Wood Bison were released from the enclosure in the Nisling River Valley, establishing the Aishihik herd of Wood Bison that now ranges in southwestern Yukon.

Since introduction, the herd size has increased and under the current plan is managed through harvest to a target of 1,000 animals. Since 2012 several studies have been conducted to ascertain the impact, if any, of the Aishihik wood bison herd to surrounding ecology. Research shows that there is little competition between bison and other ungulates, like Moose or Caribou. Bison also have a positive impact on native grasses. For more information on these studies, contact fish.wildlife@gov.yk.ca. The renewed plan will look at all the information collected since 2012 and provide a path for the future of the Aishihik wood bison herd in Yukon.

Wood Bison are nationally assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Threatened. Globally, bison species also red listed by the International Union for Conservation of Nature and therefore present an interesting management paradigm: managing a locally abundant endangered species. In Yukon, the Aishihik wood bison herd has rapidly grown and is a popularly hunted species, despite their global rarity. In fact, the herd is one of the largest free-ranging, disease-free bison populations in the world. As new management planning for this species evolves, these factors – including the potential for conflict between various groups – are all under consideration to ensure the best outcome for Wood Bison and Yukoners.

Wood Bison.

Wood Bison research.

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 which covers Yukon, Alaska and the Northwest Territories.

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 caribou).

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***.

Woodland caribou.

- 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 herds 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 Department of Environment 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 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 Department of Environment 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***.
- A harvest management plan has been developed for the Porcupine caribou herd and one is currently under development for the Fortymile caribou herd 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 photocensus techniques. The Government of Yukon partners with the Government of Alaska, which leads these surveys.

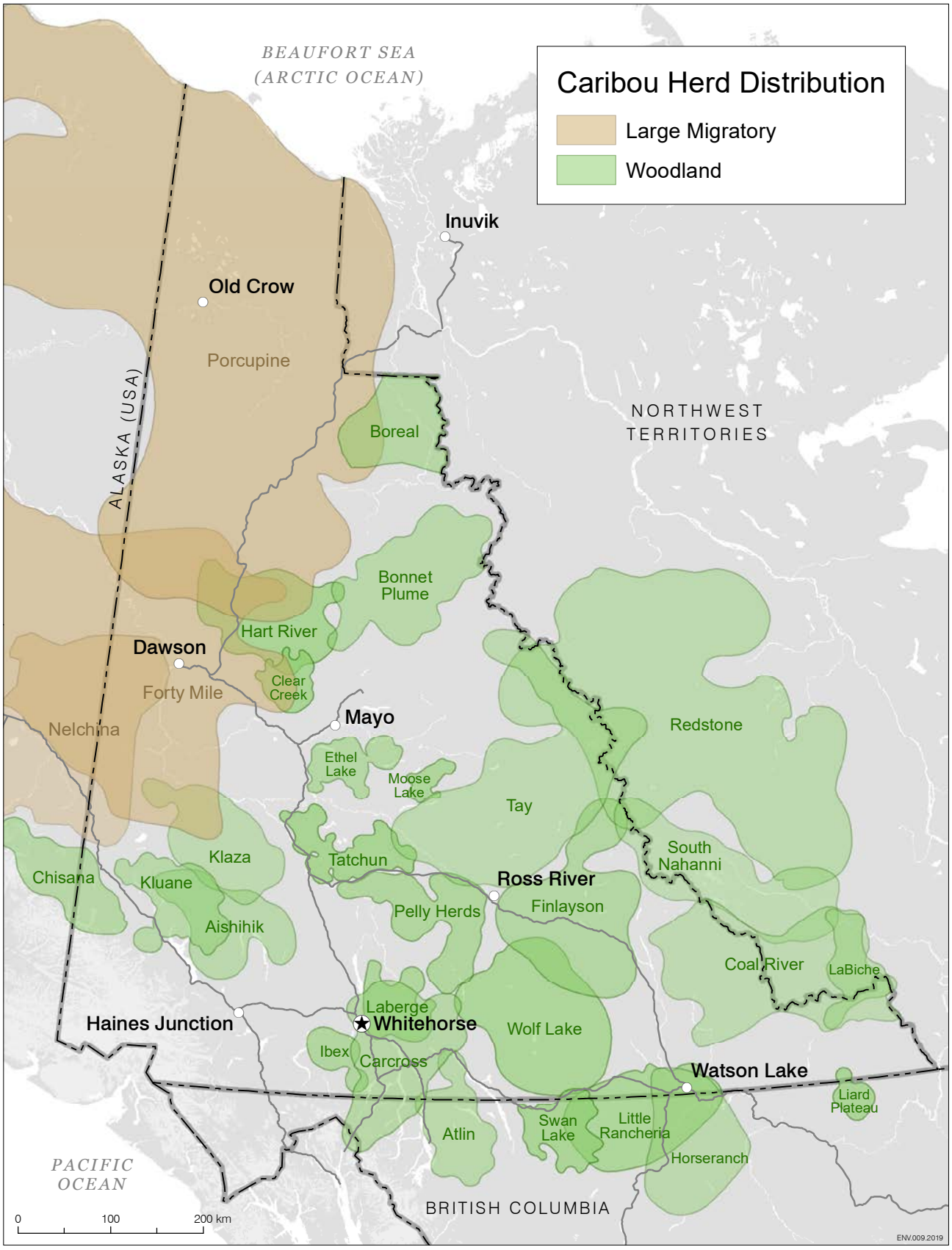


Figure 1: Distribution of caribou herds in Yukon, 2017.

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 2019, samples were collected from 16 Porcupine caribou.

Mercury concentrations in liver are generally lower than in kidneys, averaging 0.35 µg/g dry weight as compared with 1.8 µg/g dry weight in kidneys. Mercury does not tend to accumulate in muscle tissue (average is 0.038 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.

Caribou herd.

- 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, per person).

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 Contaminants 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

- Mercury concentrations can be affected by the gender of the animal as well as season of collection.
- Generally, this program collects samples in the fall.
- Annual variation in mercury concentrations is common.

References

Arctic Monitoring and Assessment Program (AMAP). 2015. AMAP Assessment 2015: Human Health in the Arctic. AMAP, Oslo, Norway. Available from: amap.no/documents/doc/amap-assessment-2015-human-health-in-the-arctic/1346.

Environment and Climate Change Canada. 2016. Canadian Mercury Science Assessment [modified 2017 June 12, cited 2019 Nov 29]. Available from: canada.ca/en/environment-climate-change/services/pollutants/mercury-environment/science-assessment-summary-key-results.html.

Northern Contaminants Program. 2015. Northern Contaminants Program [modified 2016 Jan 25, cited 2019 Nov 13]. Available from: aadnc-aandc.gc.ca/eng/1323294036202/1323294099541.

United Nations Environmental Programme (UNEP). 2015. Minamata Convention on Mercury [cited 2020 Mar 3]. Available from: mercuryconvention.org.

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 that they eat, and other small mammals that predators eat when Snowshoe Hare numbers are low.

The number of Snowshoe Hares fluctuates 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 (e.g., 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.

Figure 1: Predators of Snowshoe Hare.

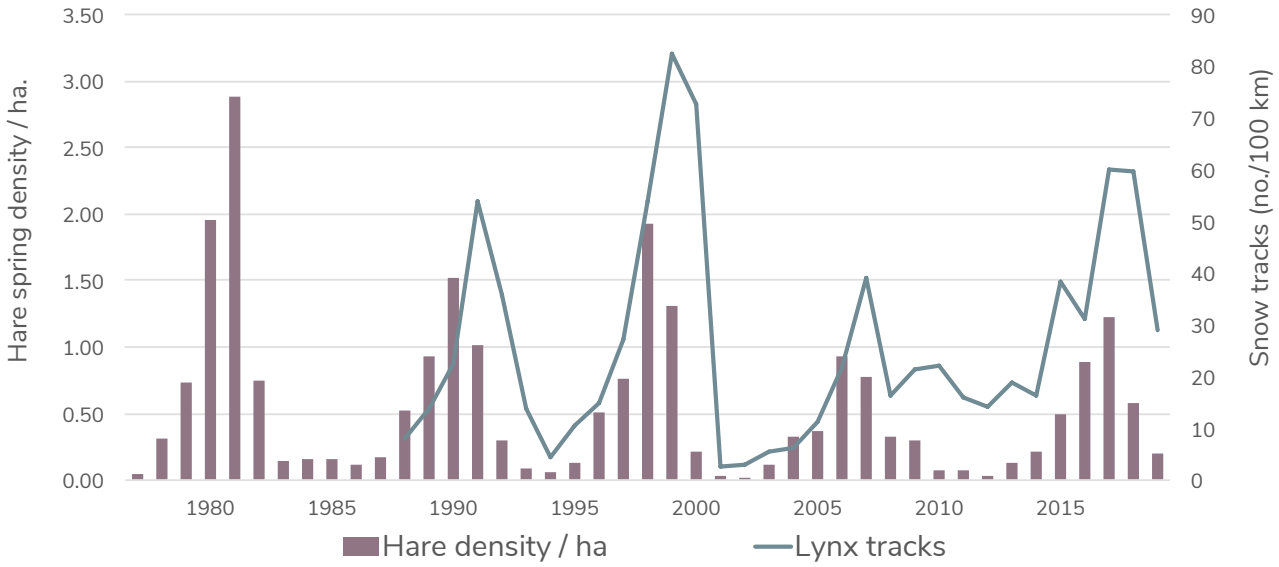


Figure 2: Population density estimate for Snowshoe Hare in Kluane region, 1977–2019. Mark-recapture data for hares are given as histogram bars, and estimates of lynx abundance are given as points (95 per cent confidence limits).

What is happening?

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

Snowshoe Hare cycles appear to be in sync across Yukon (i.e., population highs and lows occur at the same time in Kluane, Whitehorse and Mayo). 2006 and 2017 were the last peaks in the Snowshoe Hare cycle; currently the hare population cycle is in decline phase and will likely enter cyclic low next year.

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.

KBST 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 continues to decline. In the absence of hare, lynx movements may increase while they search for food.

Taking action

- The Keystone Boreal Species Trends project 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. 2018), and various researchers utilize these data to assist in understanding the dynamic food web of the boreal forest ecosystem. Access to this information is provided by the Government of Yukon's Biodiversity Programs.

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

Krebs C.J., R. Boonstra, S. Boutin, A.R.E. Sinclair, J.N.M. Smith, B.S. Gilbert, K. Martin, M. O'Donoghue and R. Turkington. 2014. Trophic dynamics of the boreal forests of the Kluane Region. Arctic 67, Supplement 1:71-81.

Krebs C., T. Powell, T. Jung, M. O'Donoghue, P. Kukka, J. Staniforth, S. Gilbert, S. Taylor, A. Francis, R. Boonstra, S. Boutin and A. Kenney. 2018. The Community Ecological Monitoring Program Annual Data Report 2018. Government of Yukon, Whitehorse, Yukon, Canada.

Snowshoe Hare in summer.

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, the Government of Yukon is 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.

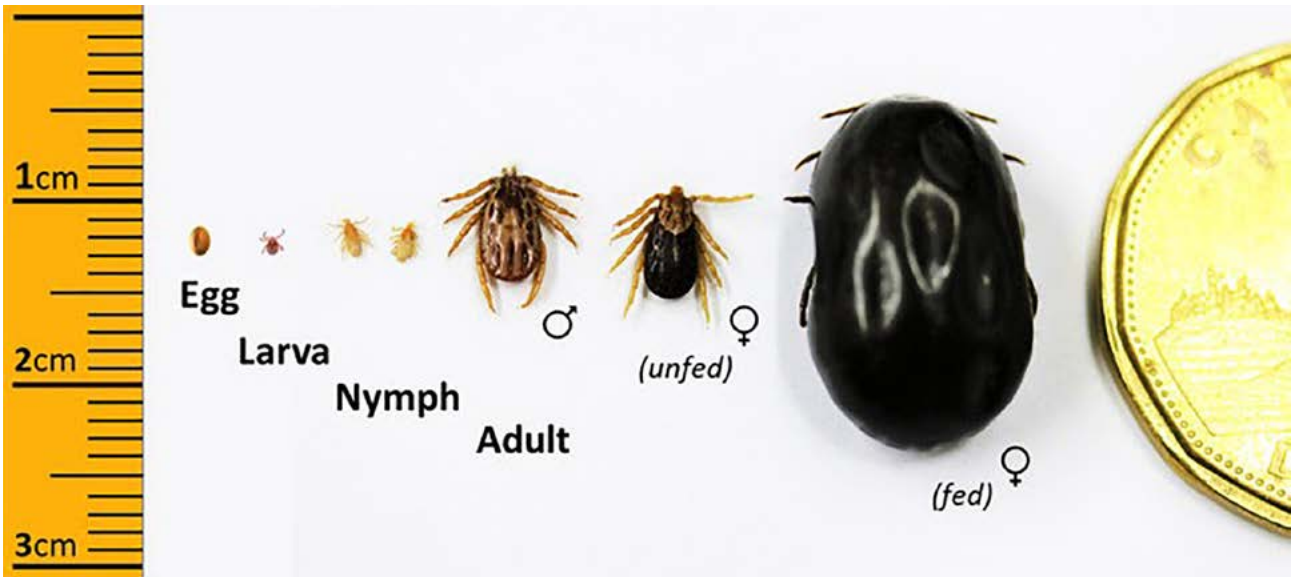
Winter Ticks do not carry diseases of concern to humans or wildlife, nor do they negatively affect the meat of harvested animals. Winter Ticks rarely feed on people or domestic animals.

A changing climate may be an important factor in the tick-cervid relationship. Warmer temperatures in summer and milder, wetter winters and springs may support larger populations of cervids that carry ticks and allow larval ticks to survive longer in the environment. Seasonal changes may also influence vegetation patterns and cervid host habitat use, 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.



Relative sizes of Winter Ticks.

Photo: Emily Chenery (University of Toronto and Government of Yukon).

- 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 2011, the Animal Health Unit has examined cervid hides to monitor winter tick geographical presence over time (Figure 1) and presence in different cervid species.

Winter Tick life cycle.

Photo: Emily Chenery (University of Toronto and Government of Yukon).

Hides examined for Winter Ticks between 2011 and 2019

Species	Number of hides sampled	Per cent hides found with Winter Ticks (actual number)
Mule Deer	67	51% (34)
Moose	21	9.5% (2)
Elk	73	63% (46)
Caribou	16	6.3% (1)

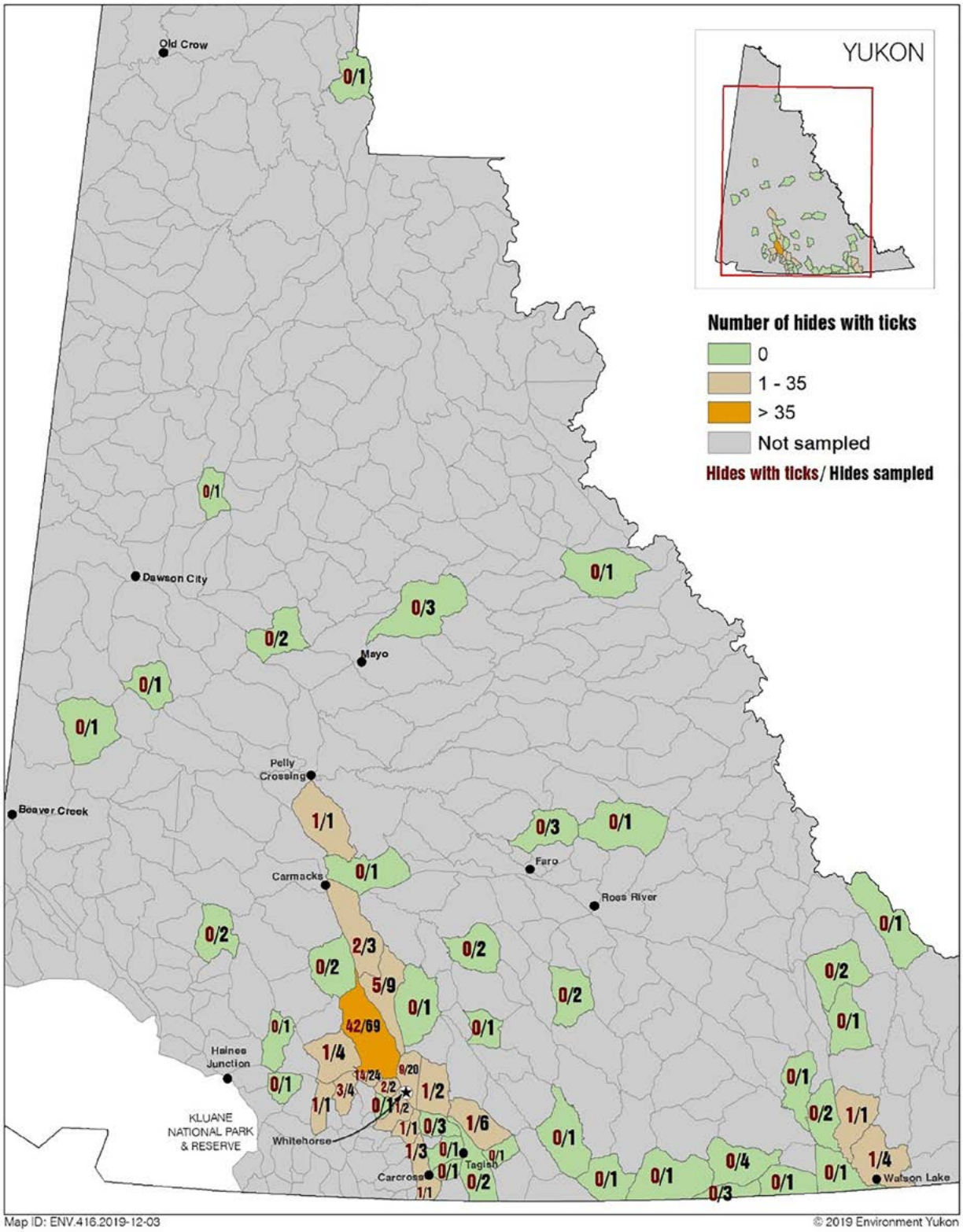


Figure 1: The known distribution of Winter Ticks based on hides examined to date (collected between 2011-2019).

- 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 of cervids from northern BC and Alberta (Leo et al. 2014).
- Winter Ticks have been found on cervids in 17 out of the 37 Game Management Zones where hides have been examined.
- The Animal Health Unit also monitors the severity of Winter Tick burdens on the hides that are sampled. While most hides have light burdens, a few have heavier burdens. So far, the heaviest tick burden detected in Yukon was on a Moose.

Taking action

Detecting Winter Ticks on cervid hides

The Government of Yukon's Animal Health Unit continues to monitor for Winter Ticks through assessment of cervid hides. Elk and deer hides are a mandatory harvest submission, while Caribou and Moose hides are submitted voluntarily.

To date, all hides examined have been from Southern Yukon (Figure 1), which has provided 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. Hunters from all over Yukon are encouraged to contact the Department of Environment to submit cervid hides for examination.

Hides are examined for the presence of Winter Ticks by visually counting nymphs and adults. Larvae are very small and difficult to detect with the naked eye. In 2018 and 2019, a new method of vacuuming hides was also used to collect larvae. This method is more effective for detecting larvae on hides, which provides information on the timing of larval presence on host species.

Detecting Winter Ticks in the field

Since 2017, the Government of Yukon's Animal Health Unit has collaborated with the University of Toronto to better understand the geographical distribution of Winter Ticks in Yukon. Using a combination of field work and mathematical modeling, the objectives of this project are to:

1. determine the current Winter Tick distribution in Yukon and predict potential changes;
2. better understand the survival of Winter Ticks in changing environmental conditions; and
3. understand the current and ongoing risks Winter Ticks may pose to the health of Yukon cervids.

During the first field season, larval Winter Ticks were found on vegetation for the first time in Yukon. Throughout consecutive field seasons, larval ticks were repeatedly detected near high-use game trails on south-facing slopes within the Takhini and Braeburn elk herd ranges.

To better understand when larvae are active in the environment, field technicians search for larval ticks during the summer season and into late fall and early winter. Larvae were found throughout the fall season and remained active even when the

ambient temperatures were below freezing. To monitor host animal movements and assess Winter Tick induced hair loss, a set of wildlife cameras were installed at known sites of larval tick activity and in other areas frequently used by cervids.

References

Leo S., W. Samuel, M. Pybus and F. Sperling. 2014. Origin of *Dermacentor albipictus (Acari: Ixodidae)* on Elk in the Yukon, Canada. Journal of Wildlife Diseases 50(3):544-551.

Sustainability of Lake Trout fisheries

Significance

Lake Trout are a highly valued freshwater species for Yukon recreational and subsistence fisheries. As a top freshwater predator, monitoring the health and population levels of this species can provide valuable information that reflects the state of our freshwater ecosystems. This is due, in part to several aspects of their life cycle including:

- their need for cold, clean habitat;
- slow growth rates; and
- availability of prey fish.

Due to these needs, Lake Trout can be a key indicator, not only of our freshwater ecosystem health, but also the effects that climate change has on these systems. As such, these fish are monitored closely for population changes to maintain sustainable harvest limits.

Lake Trout captured through population assessment.

What is happening?

Lake Trout population assessments are conducted on lakes in Yukon that experience recreational angling as well as on lakes that have been identified as vulnerable to overharvest. Population levels and harvest rates are then calculated in terms of predicted sustainable levels.

Sustainability for Lake Trout harvest is defined as the amount of harvest that can continue on a yearly basis, while still enabling the population to remain healthy and reproduce without showing signs of decline. When harvest levels are shown to be greater than the sustainable harvest, management through regulations of limits or slot size is implemented.

In 2019:

- The majority of the recreational Lake Trout harvest in Yukon was sustainable and these lakes are maintaining quality Lake Trout fisheries.
- Lake Trout harvest in Ethel, Fox, Caribou, Fish and Little Fox lakes appear to exceed sustainable limits, based on the most recent available data, as shown in Figure 1.

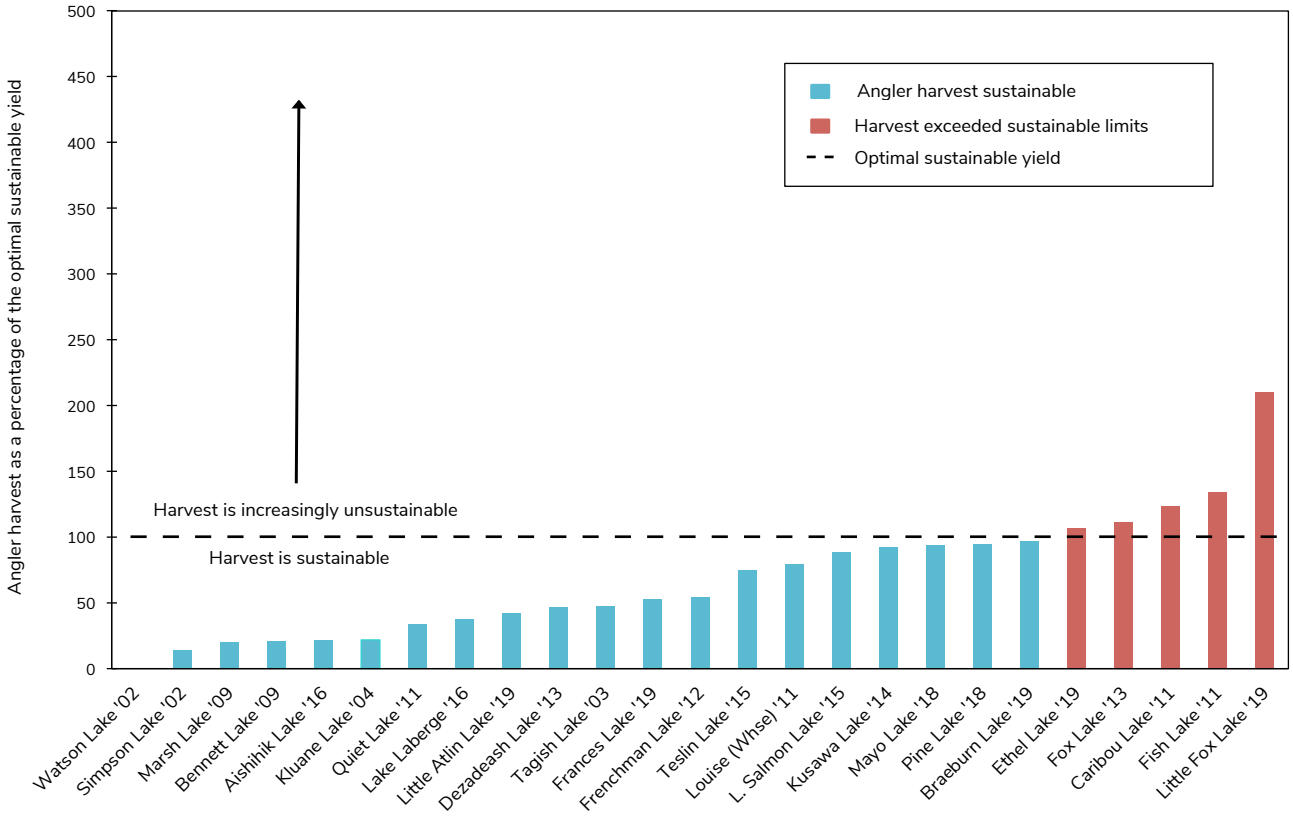


Figure 1: Lake Trout predicted harvest sustainability across various Yukon lakes.

Taking action

- In 2019, the Government of Yukon's Fish and Wildlife Branch performed Lake Trout and Lake Whitefish population assessments on two Yukon lakes.
- Angler Harvest Surveys were conducted at five Yukon lakes. Data from these surveys can help indicate the level of recreational fishing pressure as well as the value of lakes to recreational fisheries.
- A multi-year study within the Southern Lakes system in Yukon and BC continued to monitor previously tagged Lake Trout. It is being undertaken to assist in determining movement patterns in these interconnected lakes. This study is also reviewing genetic samples from these lakes to determine how these populations are connected.

Data quality

- The current Lake Trout population assessment methods and data have been maintained since 2010.
- The data from these assessments will be reported on and fully up to date in 2020.

Number of spawning Chinook Salmon

Significance

Yukon River Chinook Salmon are among the longest-distance migrating salmon in the world. They are an important resource for numerous wildlife species including bears and eagles. During their long migration, salmon transport marine-derived nutrients from their ocean feeding ground to freshwater and terrestrial ecosystems, where they are released after they die. Salmon runs have been an integral component of First Nations history, diet and culture for thousands of years and provide an important source of livelihood to many Yukon communities.

Annual Chinook Salmon returns vary considerably due to a number of factors including:

- juvenile survival through incubation, emergence and outmigration to the Bering Sea;
- survival and growth in marine feeding grounds to adult stages;
- predation;
- disease;
- environmental variables including water level, temperature and climatic events such as the Pacific Decadal Oscillation and El Niño; and
- marine and in-river harvest.

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 an interim spawning escapement goal that identifies the number of Chinook Salmon that should be allowed to return and spawn in the Canadian portion of the Yukon River.

The goal is to allow 42,500 to 55,000 Chinook to return to the Canadian portion of the Yukon River. Each year the federal government through Fisheries and Oceans Canada monitors if this target has been achieved, mainly through a border assessment project located in Eagle, Alaska that is operated in partnership with the Alaska Department of Fish and Game.

What is happening?

- In 2019, it is likely the spawning escapement goal for Yukon River Chinook Salmon was not met, with a preliminary estimate of approximately 42,000 fish reaching their spawning grounds in the Yukon (Figure 1).
- This would be the first time the spawning escapement goal was not achieved since 2013.
- The 2019 drainage-wide run size (i.e., the number of Chinook Salmon that entered the lower river which includes both United States and Canadian salmon stocks) indicated a larger Canadian-origin Chinook Salmon run size than what was observed at the border. Potential reasons for this discrepancy could include elevated levels of in-river mortality due to record high water temperatures in the lower Yukon River and/or elevated levels of harvest in the United States portion of the Yukon River.

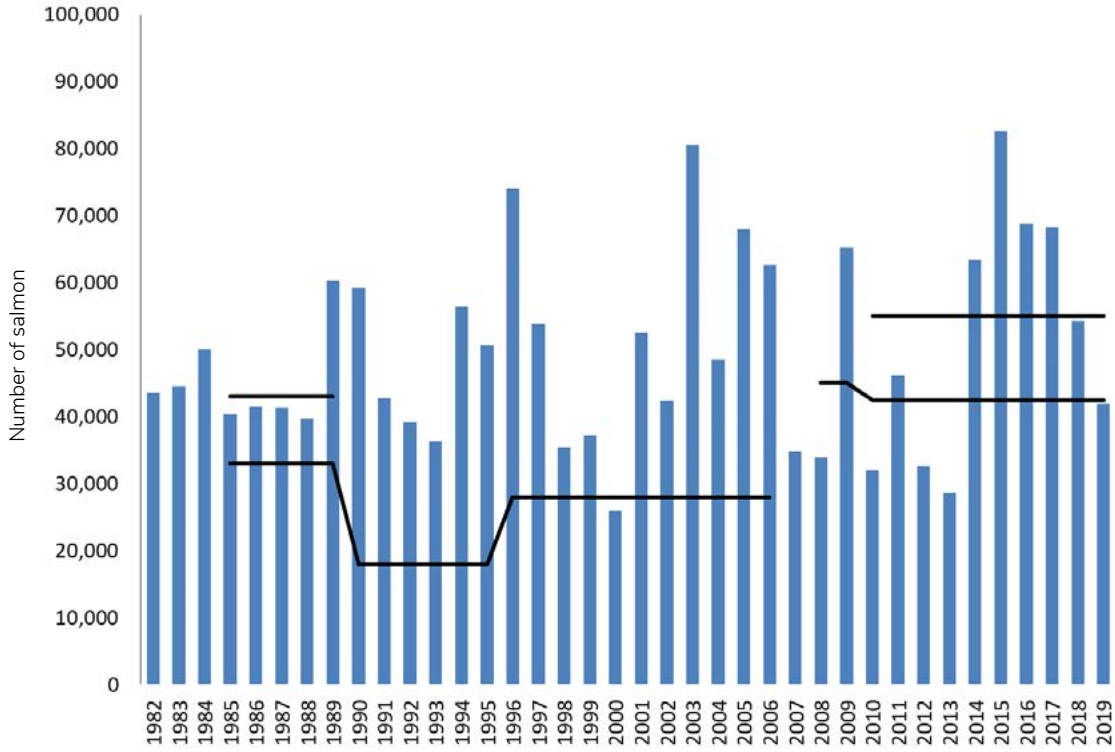


Figure 1: Number of Chinook Salmon spawning in the Canadian portion of the Yukon River, excluding the Porcupine River drainage. Blue bars represent yearly spawning escapement estimates and black lines represent spawning escapement goals. The 2019 spawning escapement estimate is preliminary until final numbers can be confirmed in 2020.

Taking action

To maintain a healthy number of spawning salmon in times 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 salmon spawning areas to angling;
- decreasing gill net mesh sizes to focus effort on smaller and younger fish; and
- selective release of female salmon.

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.

Data quality

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

In addition, a number of assessment projects in the upper Yukon River watershed are used to monitor the number of adult salmon returning to specific spawning tributaries. These projects also monitor the ratio of females to males, and the size and age composition of adult salmon returning to spawn.

References

The United States and Canada Yukon River Joint Technical Committee. March 2019. Yukon River 2018 Salmon Season Summary and 2019 Season Outlook. Alaska Department of Fish and Game, Anchorage, Alaska, USA. Available from: yukonriverpanel.com/publications/yukon-river-joint-technical-committee-reports/.

Assessing the 2019 Canadian-origin Chinook Salmon run at Eagle, Alaska.

Photo: Denny Bohmer.

Trumpeter Swans at Swan Haven.

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 British Columbia.
- The Rocky Mountain Population breeds mainly in Alberta, western Saskatchewan, southern Yukon and the Northwest Territories.

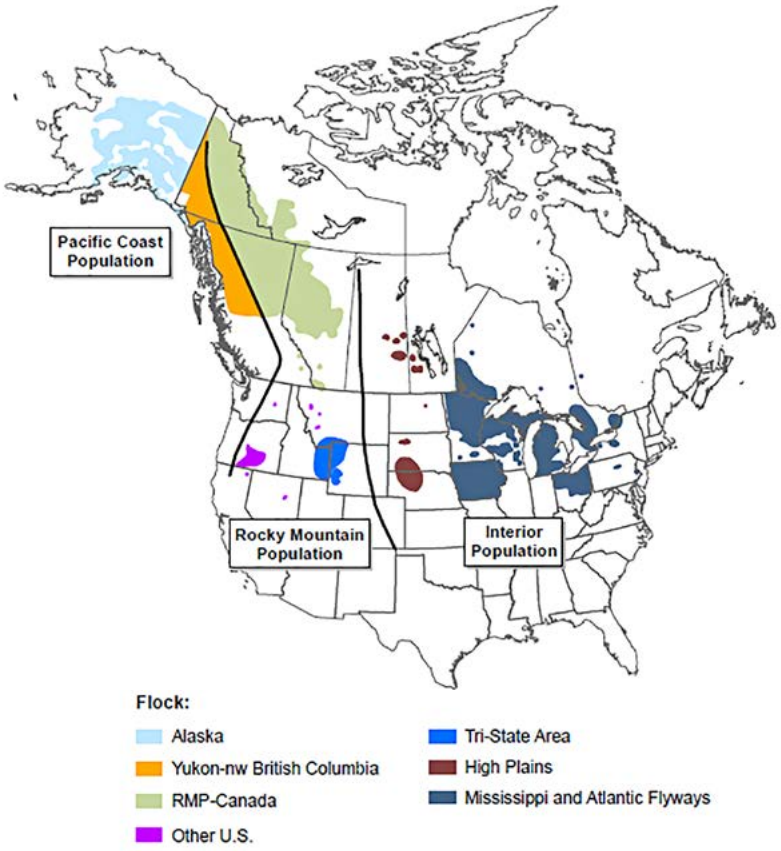


Figure 1: Breeding distribution of Trumpeter Swan populations in North America sampled in Yukon as part of the 2015 North AmericanTrumpeter Swan Survey.

Source: Groves 2017.

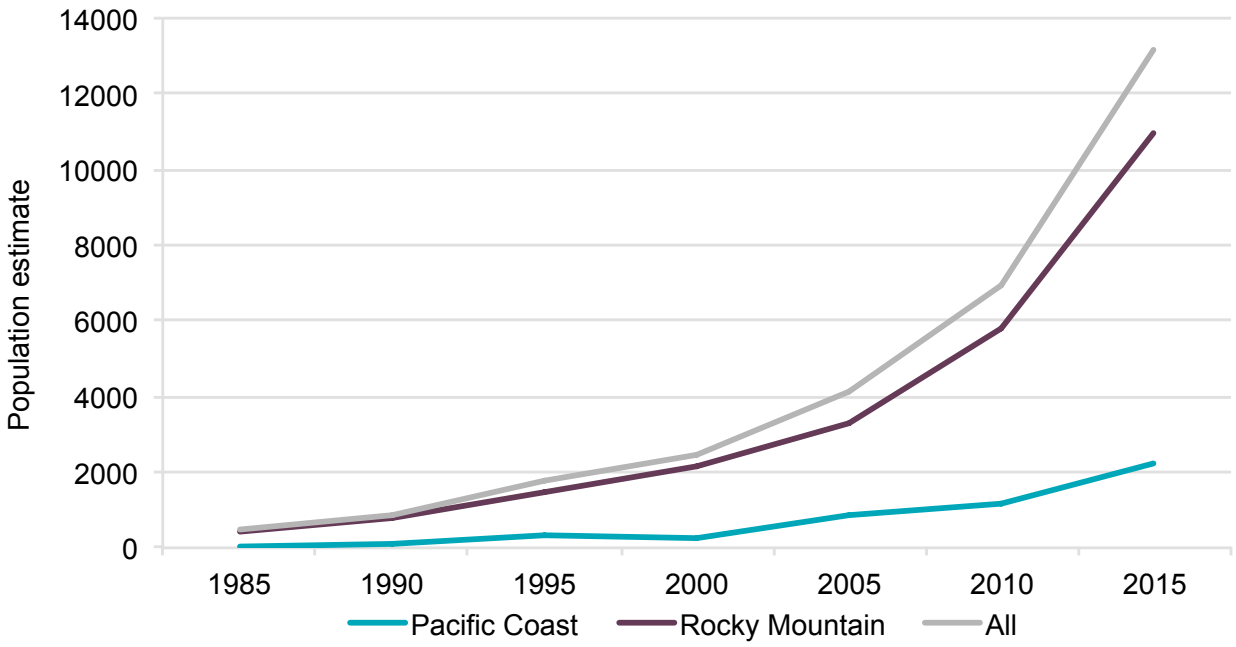


Figure 2: Population estimates for Canadian Trumpeter Swans.

- 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 trends 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. 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).

References

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.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2011. Canadian Wildlife Species at Risk. Environment Canada, Gatineau, Quebec, Canada.

Groves D.J., compiler. 2017. The 2015 North American Trumpeter Swan Survey. US Fish and Wildlife Service, Juneau, Alaska, USA. Available from: fws.gov/migratorybirds/pdf/surveys-and-data/NATrumpeterSwanSurvey_2015.pdf.

Lesser Scaup. Photo: Gordon Court.

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 the following.

- 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 eliminates 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 (i.e., no open water in spring time) or by changing the accessibility of food (i.e., 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.

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 km^2 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.

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 edge. 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 2019 combined Lesser and Greater Scaup total adult population estimate was 42,970 (SE = 13,688.07), seven per cent below the estimate from 2018. This is also 64 per cent below the long-term average (1955 to 2019) of Scaup in this area (Figure 1).

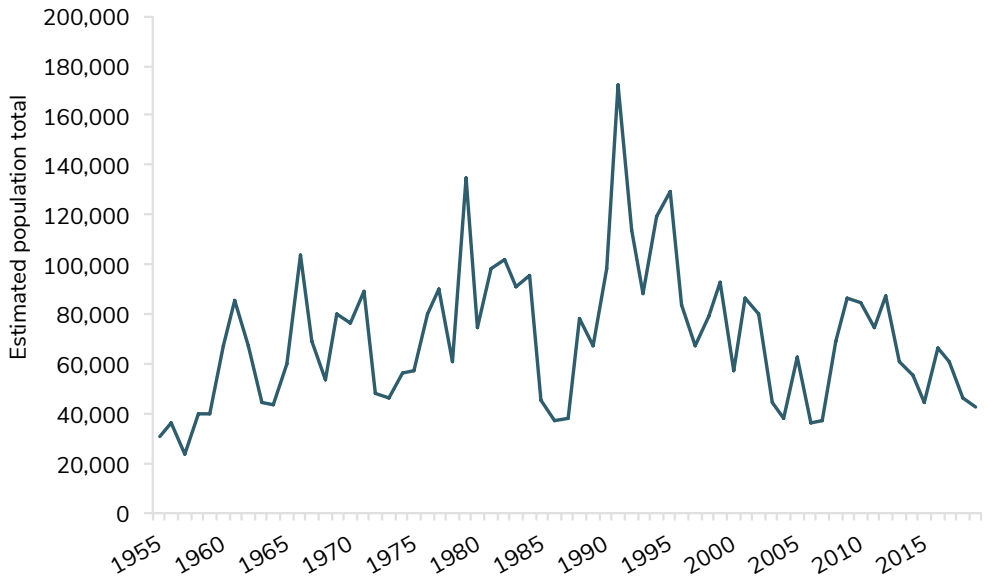


Figure 1: Adult population estimate for Lesser and Greater Scaup at Old Crow Flats.

- 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.

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 5,797(SE = 2,841.3) – 100 per cent below the 2018 estimate. The 2019 estimate is 63 per cent below the long term average (1955 to 2019) at Old Crow Flats (Figure 2). Although the overall population of mallards is stable and has been increasing beyond Old Crow Flats, the recent drop is potentially attributed to survey timing or due to mallards being concentrated elsewhere outside the study area.

Mallard.

Photo: Gordon Court.

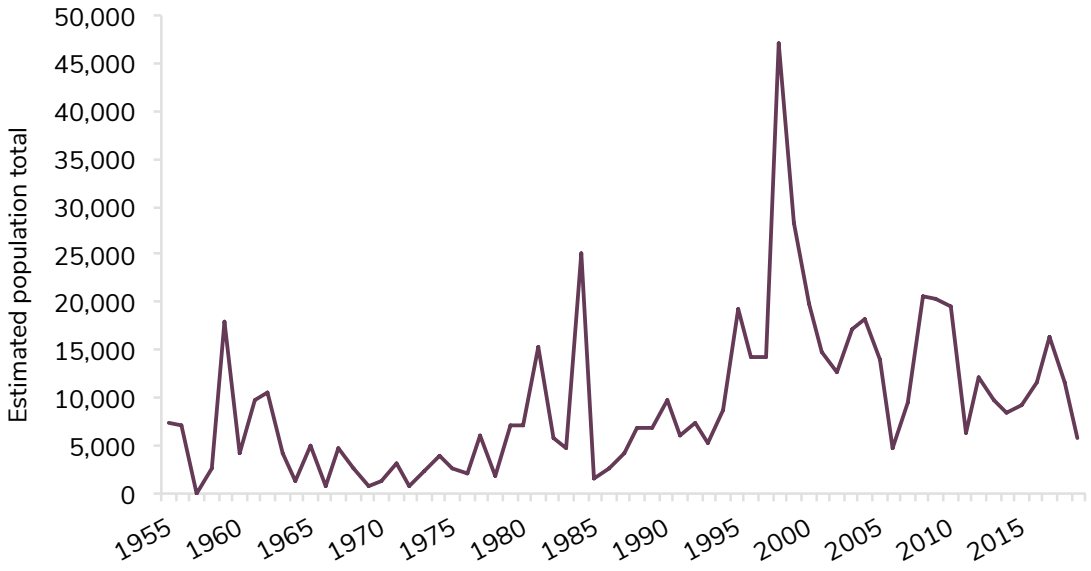


Figure 2: Adult population estimate for Mallard at Old Crow Flats.

- 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.

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.

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
- 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
- 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.

References

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.

North American Wetlands Conservation Council (Canada). 2013. North American Waterfowl Management Plan. Available from: nawmp.wetlandnetwork.ca/.

US Fish and Wildlife Service. 2018. Waterfowl population status, 2018. US Department of the Interior, Washington, D.C. USA. Available from: fws.gov/birds/surveys-and-data/reports-and-publications/population-status.php

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 United States of America and British Columbia, Canada. ***M. ovipneumoniae*** can be carried by apparently healthy domestic sheep and goats, but can cause severe respiratory disease in wild sheep and goats.

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 has been testing nasal swabs collected from thinhorn sheep and mountain goats in Yukon since 2015.

In 2018, ***M. ovipneumoniae*** was detected in free-ranging Dall's Sheep, Mountain Goats, Caribou and Moose in Alaska by the Alaska Department of Fish and Game. To date, no outbreaks of pneumonia have been associated with these results, but work is ongoing to understand the wildlife health implications of these findings. Since 2018, the Animal Health Unit has tested nasal swab samples from Mountain Goats, Caribou, Moose, Elk, Muskox and Mule Deer from Yukon.

Ewe and lamb Fannin's Sheep on calving cliffs.

As of January 1, 2020, an order under the ***Animal Health Act*** is in effect in Yukon. This order requires that anyone owning domestic sheep or goats must have their animals tested for pathogens capable of causing respiratory disease, specifically ***M. ovipneumoniae***. Positive animals are ordered destroyed and owners compensated. This will result in a much lower prevalence of ***M. ovipneumoniae*** in domestic flocks and herds in the territory, reducing the risk to wild sheep and goat health. Owners must also contain domestic sheep and goats to reduce the risk of contact with Dall's Sheep and Mountain Goats.

What is happening?

- ***M. ovipneumoniae*** was not detected in the 341 thinhorn sheep and two Mountain Goats tested between 2015 to 2019.
- ***M. ovipneumoniae*** was not detected in the 83 Mountain Caribou, 50 Barren-ground Caribou, five Moose, eight Elk, eight Muskox and three Mule Deer tested in 2018 and 2019.

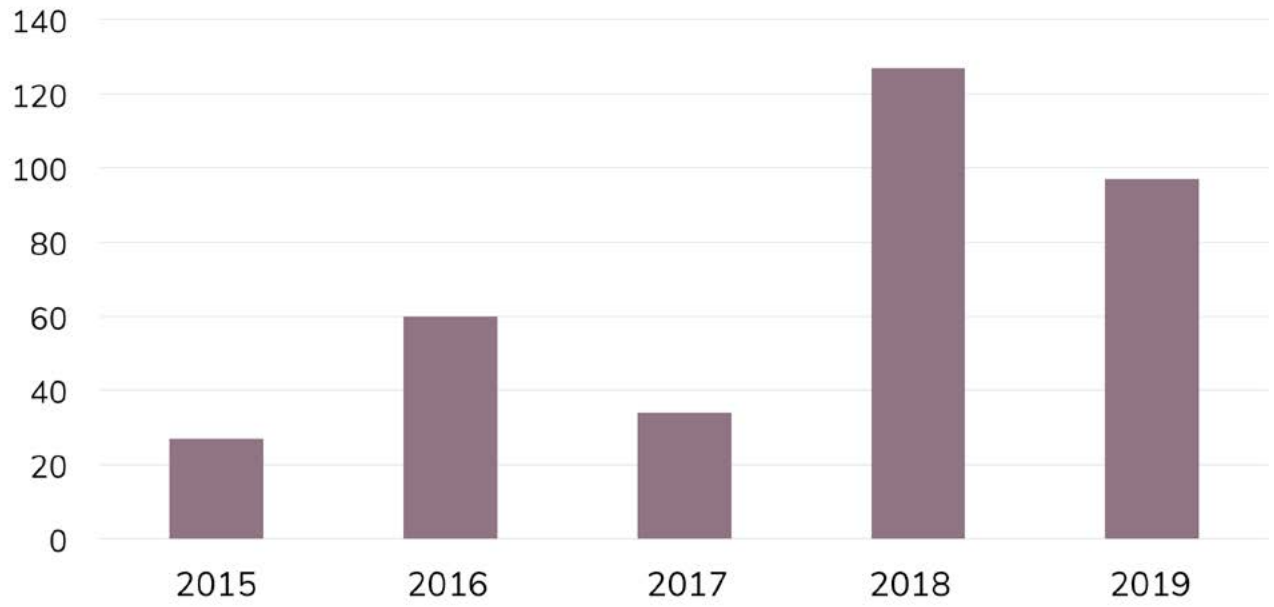


Figure 1: Number of thinhorn sheep tested annually for ***M. ovipneumopniae***

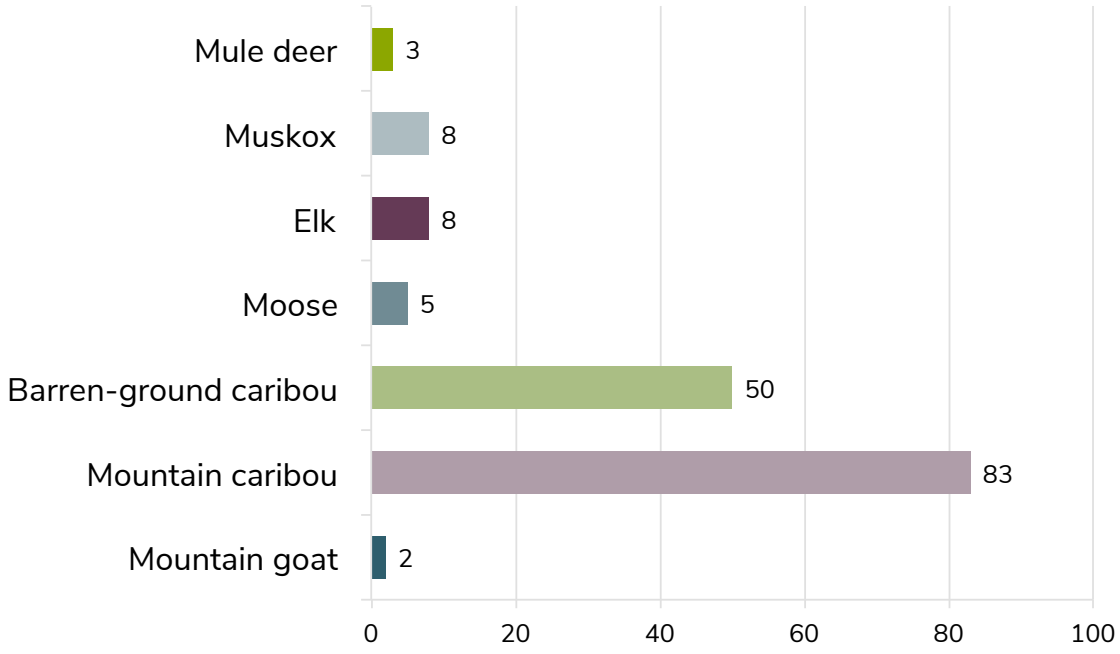


Figure 2: Number of wildlife samples from Yukon ungulates tested for ***M. ovipneumopniae*** in 2018.

Taking action

- The Government of Yukon's 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 and other wildlife, the Animal Health Unit 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.
- Most sheep and goat owners in Yukon are now in compliance with the control order which came into effect on January 1, 2020. The Animal Health Unit and the Agriculture Branch (Department of Energy, Mines and Resources) will continue to work closely with Yukoners who wish to import or raise sheep and goats to reduce the risk of respiratory pathogens, such as ***M. ovipneumoniae***, being spread to wildlife.

Nasal swab collection and analysis

- Nasal swabs are collected by sheep hunters in the field or by Department of Environment staff from heads of harvested sheep that are brought into government offices for mandatory verification of age.
- 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. In 2018, the Animal Health Unit collected nasal swab samples in duplicate using two different preservation techniques to better ensure that ***M. ovipnuemoniae*** DNA can be detected. Both techniques yielded identical results. Nasal swabs for both domestic and wild species are collected using the same collection method and preservation techniques.

Yukon.ca