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WATER QUANTITY IN CANADIAN RIVERS

CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

Canada

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CANADIAN ENVIRONMENTAL SUSTAINABILITY INDICATORS

WATER QUANTITY IN CANADIAN RIVERS

April 2022

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Water quantity in Canadian rivers

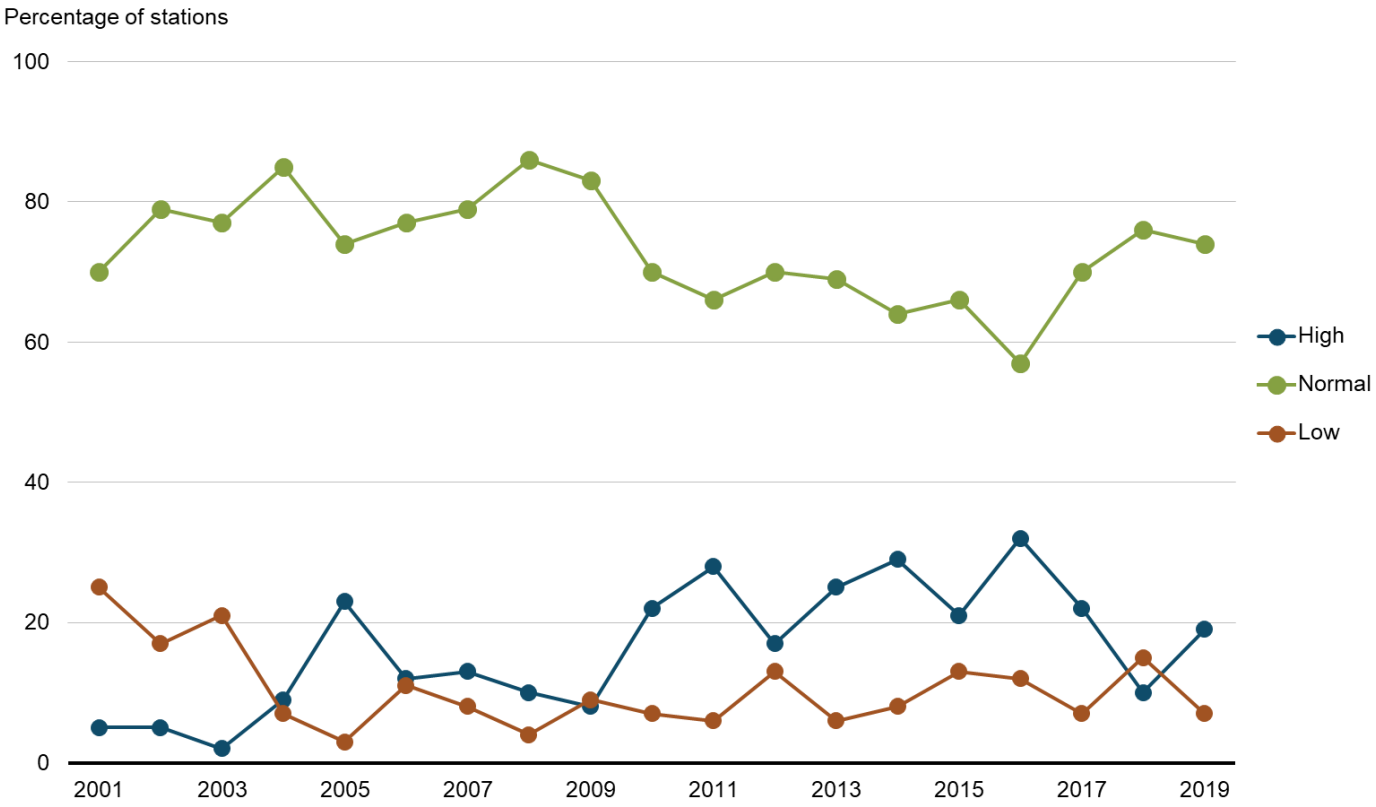
Canada is a water-rich country. However, too much or too little water can lead to serious problems. When there is too little water, there may not be enough water to irrigate farmland and there may be drought. When there is too much, rivers may flood. Depending on the region in Canada, changes to the amount of water flowing in rivers can be linked to changes in weather and climate along with other key drivers. These indicators provide information about water flows in rivers across Canada from 2001 to 2019 and by monitoring station in 2019. Longer-term trends provide an assessment of significant changes in flows, including very-high flows that can result in flooding, from 1970 to 2019.

National water quantity in Canadian rivers

Key results

- From 2001 to 2019,
  - most rivers in Canada had normal water quantity
  - there has been an increase in the number of monitoring stations with a higher-than-normal water quantity
  - the percentage of stations with a lower-than-normal water quantity has declined since 2001

Figure 1. Water quantity at monitoring stations, Canada, 2001 to 2019



Data for Figure 1

Note: The water quantity classification for a station is based on a comparison of the most frequently observed flow condition in a given year with typical water quantity at that station between 1981 and 2010. Data from Alberta from 2015 to 2017, as well as recent data from northern Canada are missing for 2019 because of delays in getting data into the database. The results for this indicator vary slightly from those in the Trends in annual water quantity in Canadian rivers indicator and the Trends in the number of flood days in Canadian rivers indicator because of differences in the methods used to calculate the indicators. For more information, please see Data sources and methods.
Source: Environment and Climate Change Canada (2021) National Water Data Archive (HYDAT).

Overall, in 2019, water quantity was:

- higher-than-normal at 19% of the stations
- normal at 74% of the stations
- lower-than-normal at 7% of the stations

Water quantity in Canadian rivers is measured as water flow, or the volume of water moving over a point, over a fixed period of time. Water flows in rivers generally follow changes in temperature, rainfall and snowfall throughout the year. More precipitation increases the amount of water in rivers, whereas warmer temperatures and less rainfall or snowfall will result in less water.

Generally, water flows are highest right after the snow melts in the early spring and gradually dry up through the summer and fall. These flows can result in flooding or water shortages.

Over longer time scales, the amount of water in rivers is also affected by weather patterns and ocean surface temperatures which interact to influence the amount of rain or snow that falls. For example, extended summer droughts on the Prairies tend to take place when the southern Pacific Ocean warms during El Niño Southern Oscillation events. In an El Niño year, lower-than-normal water flows are generally seen on the Prairies. The Prairies experience more rain and snow when the ocean cools during La Niña events.[1] When this happens, higher-than-normal flows are found in the Prairies. Climate change may increase the strength and occurrence of the El Niño Southern Oscillations.

[1] Bonsal B and Shabbar A (2010) Large-scale climate oscillations influencing Canada, 1900-2008. Canadian Biodiversity: Ecosystem Status and Trends 2010, Technical Thematic Report No. 4. Retrieved on October 12, 2021.

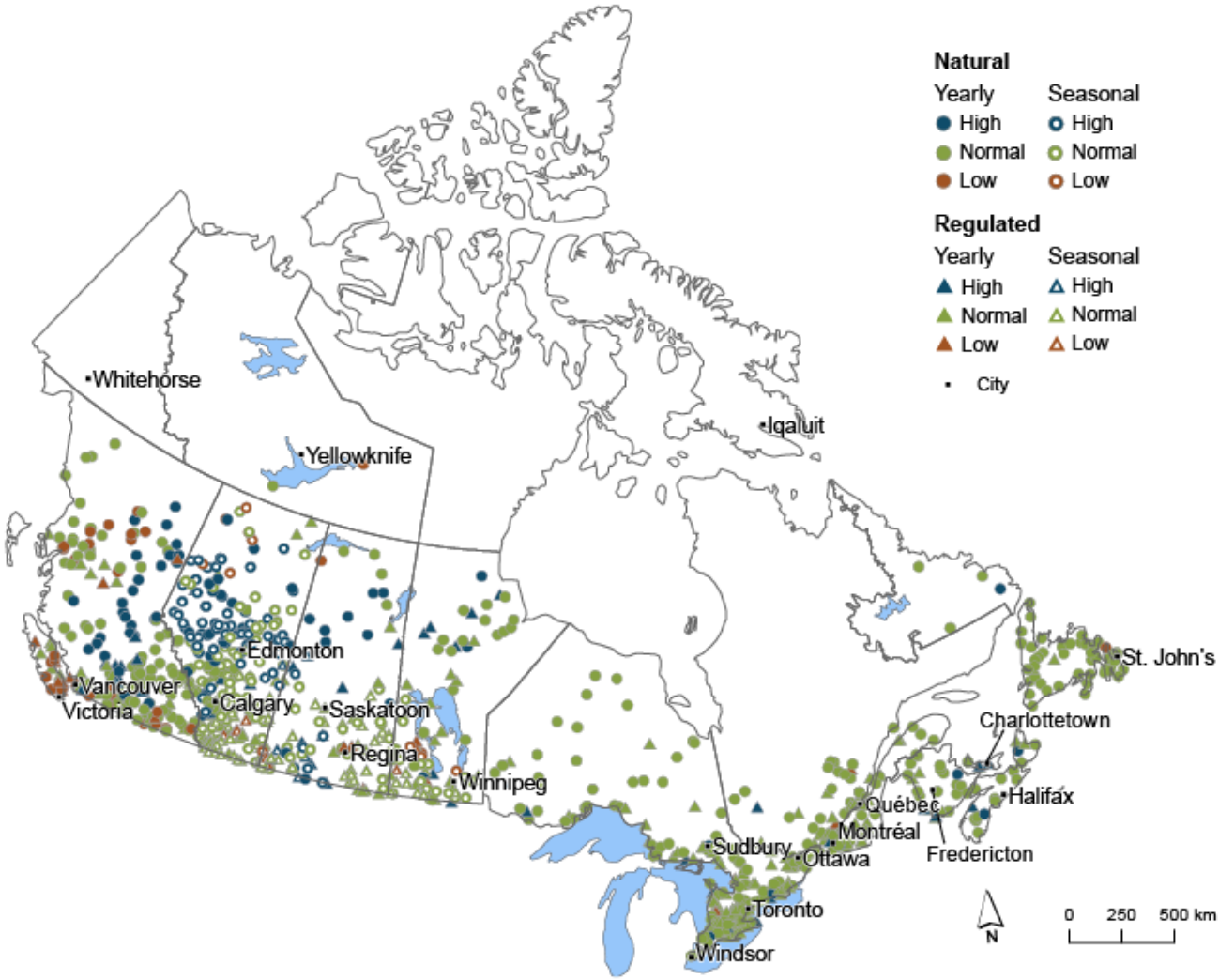
National water quantity at monitoring stations

Key results

In 2019,

- higher-than-normal water quantity was more frequent at monitoring stations in the interior of southern British Columbia, central Alberta and northern Saskatchewan and Manitoba
- lower-than-normal water quantity was more frequent at monitoring stations in south-western British Columbia and scattered stations in northern British Columbia and the southern Prairies[2]

Figure 2. Water quantity at monitoring stations, Canada, 2019



Navigate data using the interactive map

Note: The 2019 water quantity classification for a station is based on a comparison of the most frequently observed condition in that year with the typical water quantity at that station between 1981 and 2010. Normal water quantities are specific to each region and do not refer to the same amount of water in each drainage region (for example, the normal water quantity on the Prairies is different from the normal water quantity in the Maritimes). Natural stations are those where human activity upstream of the station has little impact on water flows. Regulated

[2] The Prairies include the provinces of Alberta, Saskatchewan and Manitoba.

stations have water withdrawals, dams, diversions or other structures upstream that may change the water quantity in the river. Water quantity data for seasonal stations are only collected for part of the year. Data for 2019 for northern Canada are missing because of delays getting data into the database. The results for this indicator vary slightly from those in the Trends in annual water quantity in Canadian rivers indicator and the Trends in the number of flood days in Canadian rivers indicator because of differences in the methods used to calculate the indicators. For more information, please see Data sources and methods.
Source: Environment and Climate Change Canada (2021) National Water Data Archive (HYDAT).

Where water quantity is classified as low, drought conditions likely exist. In Canada, droughts normally last for 1 or 2 seasons and can be very damaging. Agriculture, industry and municipalities are especially affected by long-term droughts because they rely on water. Droughts can also affect water quality in lakes and rivers, and threaten fish survival.

High water quantity at a water quantity monitoring station indicates a wet year, but does not mean flooding has occurred. Floods tend to be short-lived, lasting on average about 10 days,[3] and may not change the water quantity classification in this indicator.

An exception to this was the spring flooding experienced in eastern Ontario and Quebec in 2019. Unusually heavy rainfall, coinciding with melting snow that had already saturated the ground and swollen waterways, generated record volumes and major peak water levels in the Ottawa River and its tributaries, exceeding those set in 1974, 1976 and 2017.[4]

In Canada, every year is marked by weather extremes. These extreme events do not always translate into major changes in seasonal or long term water quantity.

[3] Dartmouth Flood Observatory (2004) Interannual Evolution of Flood Duration (since 1985). Retrieved October 12, 2021.

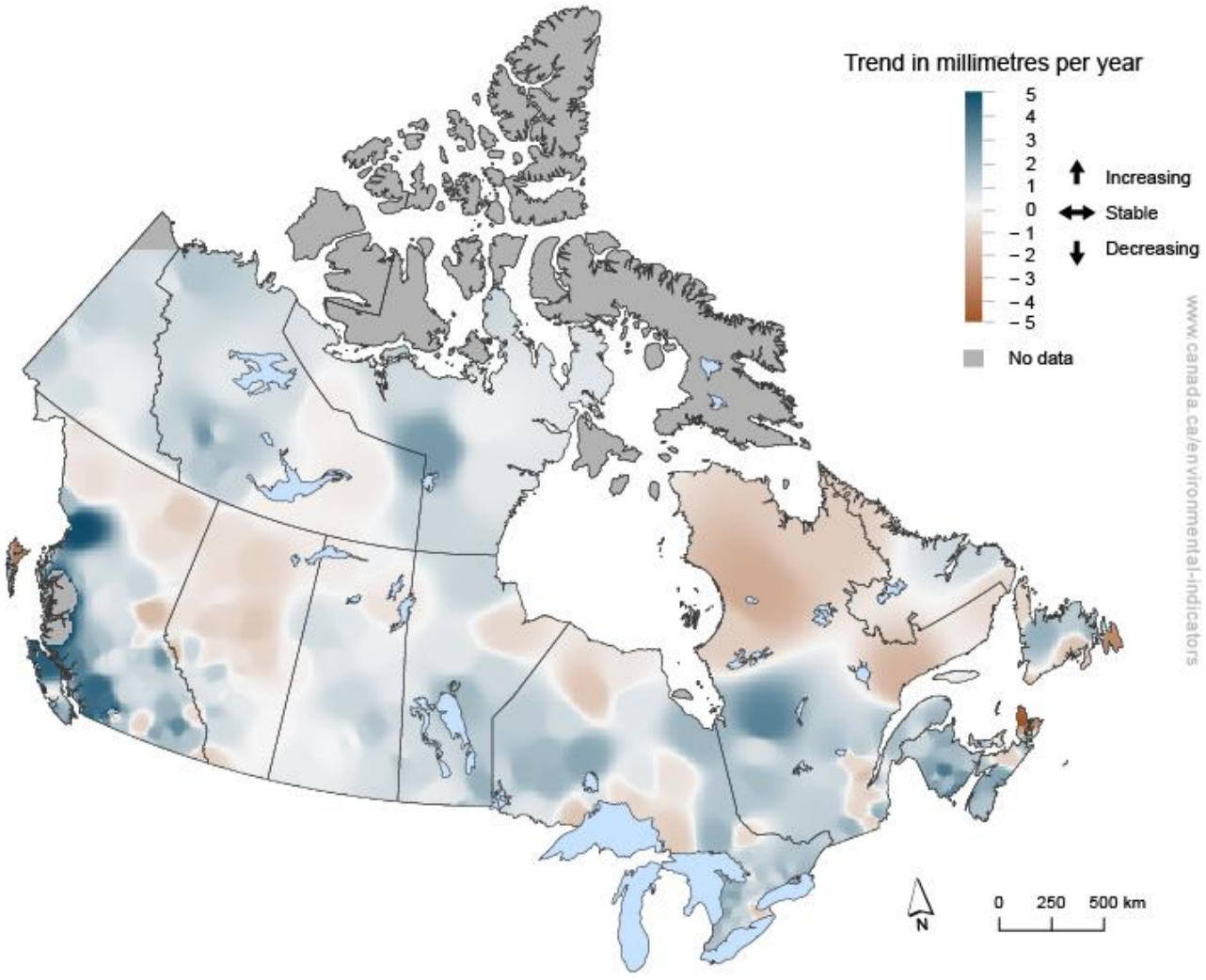
[4] Canadian Meteorological and Oceanographic Society (2019) Canada's Top Ten Weather Stories for 2019. Retrieved on October 12, 2021.

Trends in annual water quantity in Canadian rivers

Key results

- Across Canada over the 1970 to 2019 period:
  - increasing trends in annual water quantity were observed at monitoring stations in western British Columbia, Nunavut west of the Hudson Bay, southern Quebec and New Brunswick
  - decreasing trends were observed in the Haida Gwaii archipelago off the north coast of British Columbia, northern Quebec and Cape Breton Island in Nova Scotia
- Over the period, the greatest increases in water flows were observed over the Coastal Mountains of British Columbia

Figure 3. Annual rate of change in water quantity at monitoring stations, Canada, 1970 to 2019



Data for Figure 3

Note: The indicator is based on a statistical analysis of annual water quantity at monitoring stations over the 1970 to 2019 period. Annual water quantity for each monitoring station was determined by adding the daily water flows for stations over an entire year and then dividing the annual totals by the area of the contributing watershed for a depth in millimetres. A statistical analysis was then applied to the resulting values to determine if there was a trend. Positive trend values indicate that the annual water quantity at a station has increased over time, negative values indicate a decrease and zero values indicate that the annual water quantity has remained the same over time. For more information, please see Data sources and methods.
Source: Environment and Climate Change Canada (2021) National Water Data Archive (HYDAT).

Across Canada, trends[5] in annual water quantity mirror trends in precipitation. Long term increases in precipitation have been observed over southern coastal British Columbia and in Ontario. This is consistent with the increasing trends in annual flows observed over these regions.

For example, from 1970 to 2019, a positive trend of 3.6 millimetres per year in annual water quantity was observed at a station at the mouth of the Homathko River in the Coastal Mountains of British Columbia. This positive trend translates into an increase in total water quantity of 180 millimetres (or about 13%) over the 50-year period.

In contrast, decreases in precipitation have been recorded in the eastern slopes of the Rocky Mountains in Alberta, where the Athabasca River originates. In this region, a decreasing trend of -1.1 millimetres per year in annual flows was calculated for the station near the mouth of the Waskahigan River. Over the 50-year period, this negative trend translates into a total decrease in water quantity of 55 millimetres (or about 33%).

Other climate factors can play a role in water quantity variations. For example, in the Mackenzie River basin in the Northwest Territories, melting permafrost may also be contributing to increasing water quantity.[6]

[5] The existence of a trend does not necessarily predict future trends in annual water quantity across Canada. For information on projections of future freshwater trends in Canada, see Canada's Changing Climate Report Chapter 6: Changes in freshwater availability across Canada.

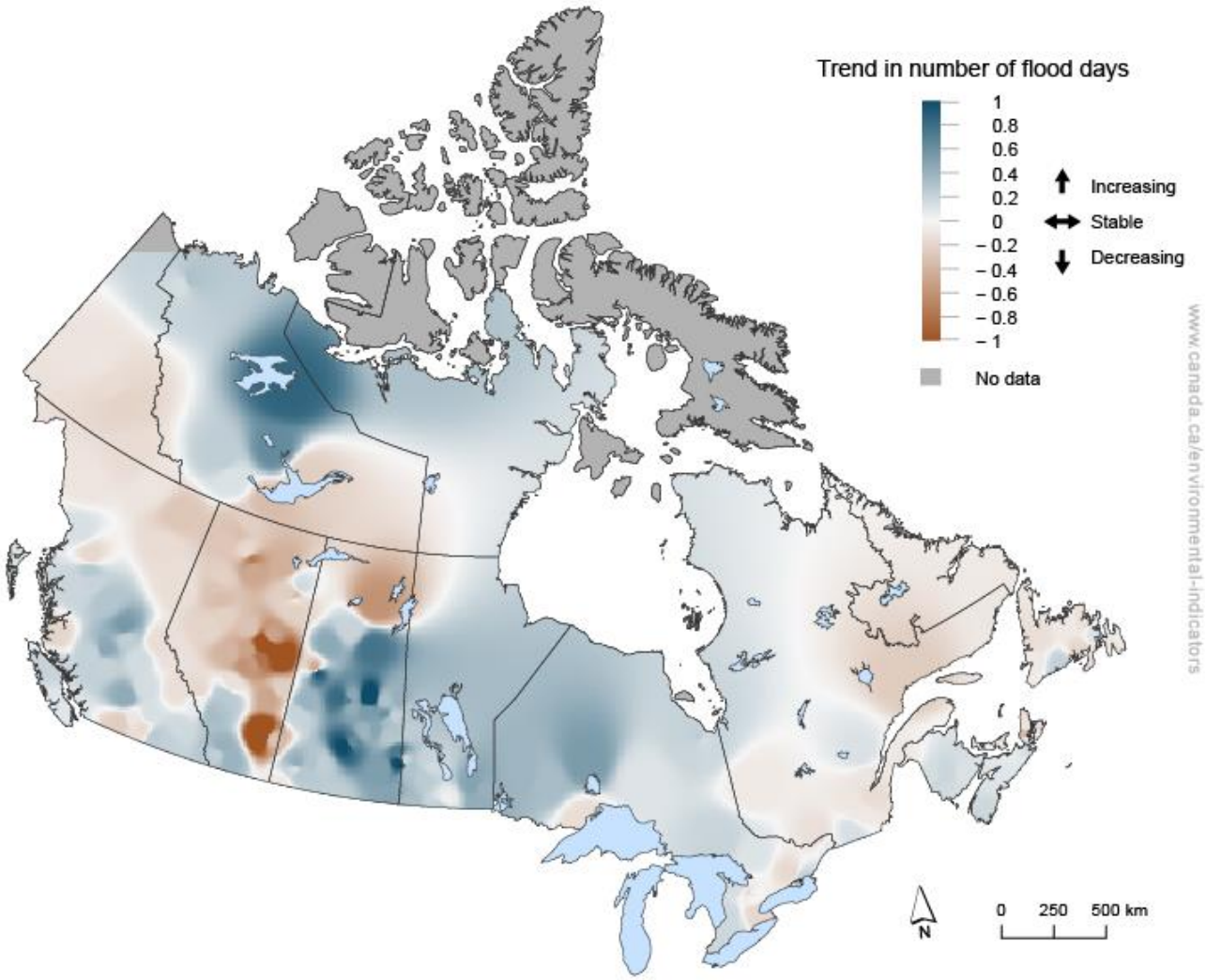
[6] Government of Canada (2019) Canada's Changing Climate Report; Chapter 6: Changes in freshwater availability across Canada. Retrieved on October 22, 2021.

Trends in the number of flood days in Canadian rivers

Key results

- Across Canada over the 1970 to 2019 period:
  - increasing trends in the number of flood days (days with very-high flows) were observed at monitoring stations in south-central Saskatchewan and Manitoba, with smaller increases in British Columbia, across northern Yukon, Northwest Territories, Nunavut and Ontario
  - decreasing trends were observed at stations in eastern Alberta, with smaller decreases across the northern Prairies, and south-eastern Northwest Territories and southern Yukon

Figure 4. Annual rate of change in the number of flood days at monitoring stations, Canada, 1970 to 2019



Data for Figure 4

Note: The indicator is based on a statistical analysis of the annual number of flood days at monitoring stations over the 1970 to 2019 period. The indicator shows the prevalence of very-high flow conditions (above the 95th percentile of all daily flow values for a monitoring station compared to a 30-year normal period from 1981 to 2010) which may be linked to flooding events, but does not necessarily represent actual recorded or reported events. Positive values indicate that the number of days with very-high flows over the 1970 to 2019 period have increased, negative values indicate a decrease, and zero values indicate that the number of flood days has remained the same. For more information, please see Data sources and methods.
Source: Environment and Climate Change Canada (2021) National Water Data Archive (HYDAT).

Floods may be described by how long they last, how often they occur, or how high they rise onto the land. In the context of this indicator, flood days are used to describe days with very-high flows. The observed trends show the change in the number of days monitoring stations across Canada might have experienced very-high flows (above the 95th percentile) compared to typical flows over a 30-year normal period for those stations.

For example, over the 1970 to 2019 period, the number of flood days on Lewis Creek near the town of Imperial in southern Saskatchewan has increased from an average of 16 flood days per year in the 1970s to an average of 82 flood days per year in the 2010s. This contrasts with Pine Creek near Grassland, Athabasca County in central Alberta where the number of flood days has decreased from an average of 94 days per year in the 1970s to an average of 7 days per year in the 2010s.

Many factors can contribute to flooding, including: intense and/or long-lasting precipitation, snowmelt, ice jams on rivers or rain-on-snow events. Rising temperatures along with reductions in snow cover may also reduce the frequency and magnitude of snowmelt-related flooding.[7] The regional variations observed above could be explained by a combination of these factors.

[7] Government of Canada (2019) Canada's Changing Climate Report; Chapter 6: Changes in freshwater availability across Canada. Retrieved on October 22, 2021.

About the indicators

What the indicators measure

The national indicators provide a summary of the most often observed water quantity status in rivers across Canada from 2001 to 2019 and by monitoring station in 2019.

A station's water quantity status is the category most often observed for a given year. Daily water quantity classifications are determined by comparing the measured value for a date to the flow observed at that site for 1981 to 2010. A station described as having a low water flow on January 31, for example, had a measured value ranking among the lowest 25% of values observed for each January 31 from 1981 to 2010. A station described as having a high water flow had a measured value ranking among the highest 25% of values observed on that date.

The trends indicators provide an assessment of whether there have been significant observed changes over time in water quantity at monitoring stations across Canada from 1970 to 2019.

Why these indicators are important

Canada has 0.5% of the world's population and approximately 7% of the world's renewable freshwater supply. Canada may have a lot of water, but water is in short supply in some parts of the country. Canadians use a lot of water in agriculture, in industry and in their homes.

These indicators provide information about the state of the amount of surface water in Canada and its change through time to support water resource management.

Pristine lakes and rivers

These indicators support the measurement of progress towards the following 2019 to 2022 Federal Sustainable Development Strategy long-term goal: Clean and healthy lakes and rivers support economic prosperity and the well-being of Canadians. These indicators are being proposed to track progress in the draft 2022 to 2026 Federal Sustainable Development Strategy.

In addition, the indicators contribute to the Sustainable Development Goals of the 2030 Agenda for Sustainable Development. They are linked to the 2030 Agenda's Goal 6: Clean water and sanitation.

Related indicators

The Canada's water use in a global context indicator reports on the amount of water removed from the environment per person per year for use in agriculture, manufacturing and in homes, and as a percentage of each country's total renewable water supply for 9 countries, including Canada.

The Water availability in Canada indicator compares the amount of fresh water withdrawn from rivers for human use to the volume of water in Canadian rivers.

The Water withdrawal and consumption by sector indicator shows how much water is used by 7 economic sectors in Canada.

The Residential water use indicator reports how much water is used in homes across Canada.

Data sources and methods

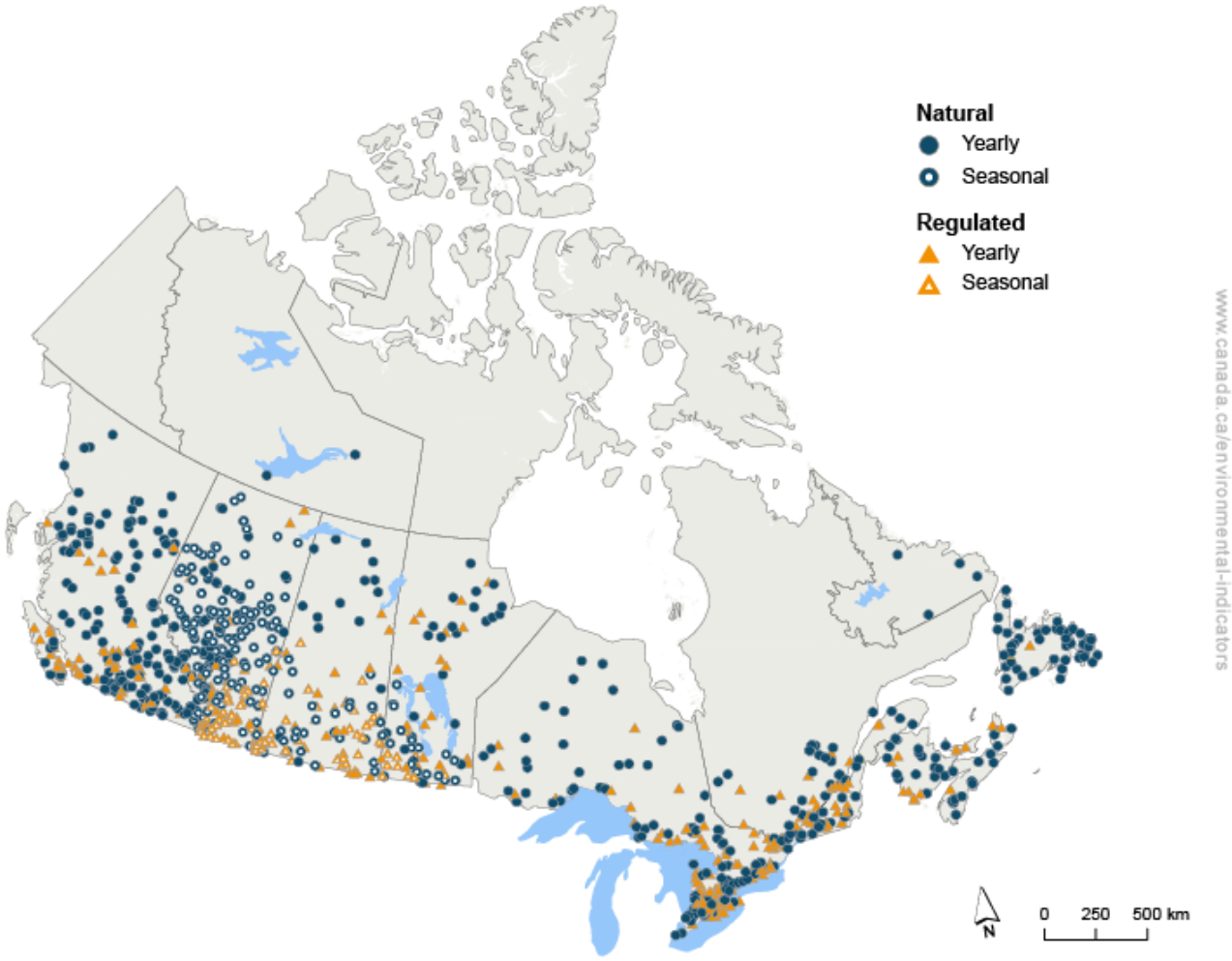
Data sources

Water flow data across Canada for 1970 to 2019 are taken from the Water Survey of Canada's National water data archive (HYDAT).

More information

For 2019, the national indicators include data from 1 027 yearly and seasonal stations across Canada. At yearly stations, water flow data are collected 365 days per year. In general, seasonal stations operate 6 months of the year for a maximum of 217 days per year. Both natural and regulated rivers and all basin sizes were included (Figure 5).

Figure 5. Location of water quantity monitoring stations used for the national indicators, 2019

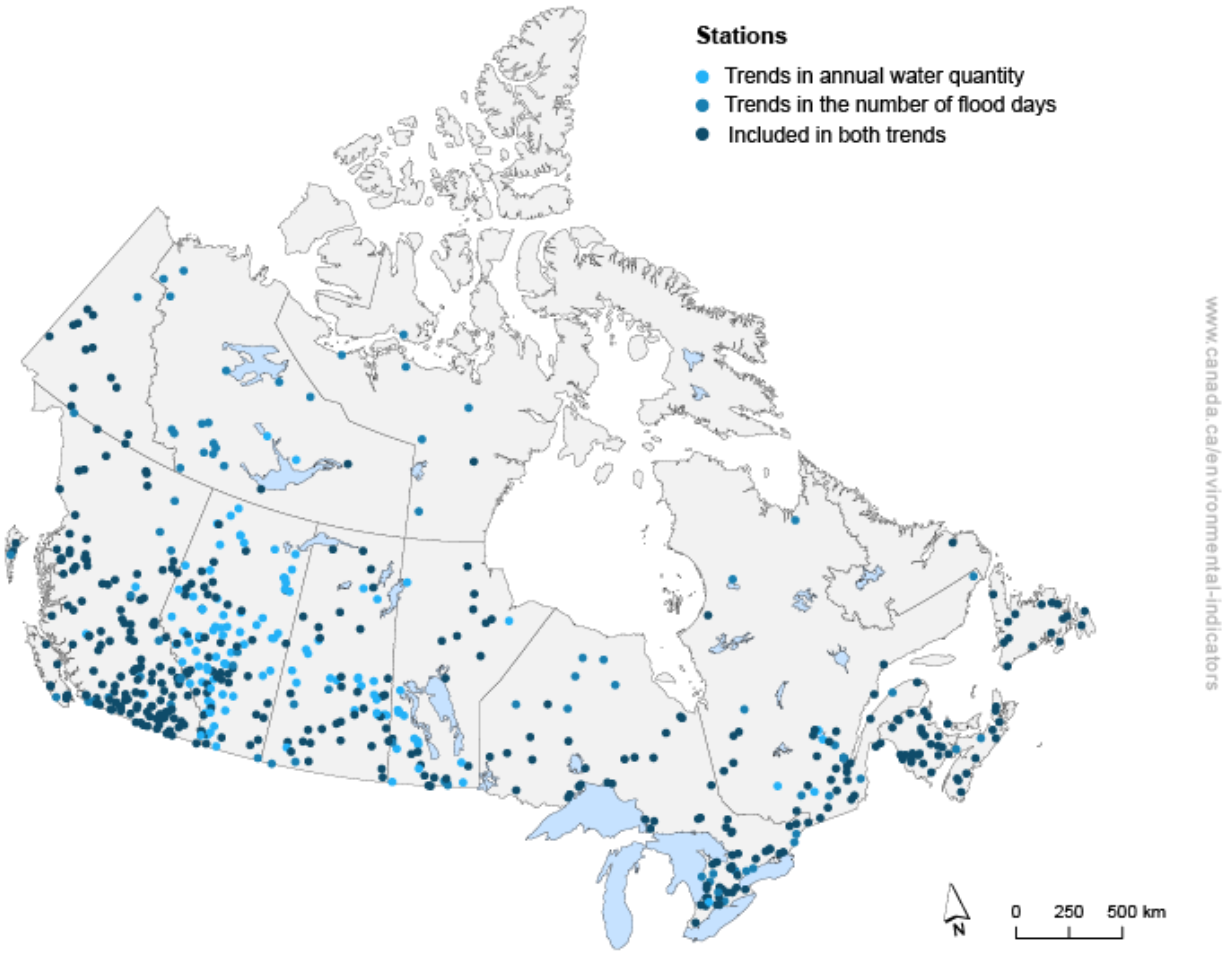


Note: Natural stations are those where human activity upstream of the station has little impact on water flow. Regulated stations have water withdrawals, dams, diversions or other structures upstream that may change the quantity of water in the river. Water quantity data at seasonal stations are only collected for part of the year.
Source: Environment and Climate Change Canada (2021) Water Survey of Canada.

The Trends in annual water quantity in Canadian rivers and the Trends in the number of flood days in Canadian rivers indicators include data from 481 and 543 respectively of 1 014 flow stations across Canada classified as part of the Reference Hydrometric Basin Network (RHBN) which is a subset of HYDAT (Figure 6). The RHBN is a set of stream gauge stations with long records and minimal human

impacts that are considered appropriate for studying the potential impacts of climate change on water quantity in Canada.

Figure 6. Location of water quantity monitoring stations used for the trends indicators, 1970 to 2019



Source: Environment and Climate Change Canada (2021) Water Survey of Canada.

Data completeness

Water flow data from each monitoring station are managed by their respective Environment and Climate Change Canada regional offices and stored in the federal HYDAT database. The data used in the indicators are subject to quality assurance and quality control procedures to ensure they adhere to Environment and Climate Change Canada's national standards.

There are gaps in the water flow datasets due to periodic instrument failure. Where possible, regional offices use standardized protocols to estimate flow data to fill these gaps. Estimated flow values are considered to be reliable and are included in the calculation of the water quantity indicators.

Only when data cannot be estimated are they considered missing. For the national indicators a complete dataset was defined as missing no more than 20% of the year:

- 73 days out of 365 for yearly stations, and
- 43 days out of 217 for seasonal stations

Stations not meeting these criteria for a year were not included in the calculation of the indicators for that year.

For the trends indicators, annual water quantity was calculated for stations with sufficient data for each year from 2001 to 2019. Data were considered sufficient when daily flow data was available for 90% (329 days) of the days with recordings at a station in that year. Exceptions were made to include stations with at least 150 recorded days, highly seasonal flow and a history of very low flow for much of the year. For those stations, missing days were assumed to be zero.

In order for a station to be included in the trend calculations the following conditions had to be met:

- valid data starting in or before 1975, and
- no gaps of more than 10 years in the data record, and
- valid data for at least 30 years in the period 1970 to 2019

Additional requirements were used for the calculations of Trends in the number of flood days, which used a threshold calculated from a 30-year normal period[8] from 1981 to 2010. To be included in indicator calculations, stations had to have at least 150 days of valid flow data per year and at least 20 years of data in the normal period.

Data timeliness

Data for the indicators were taken from the July 2021 version of HYDAT.

There is a time lag of about 2 years between the last year reported and the publication of the indicators. This time lag is due to several factors, including the time required to verify the raw data, compile the data at the national level from all partners, and analyze, review and report the data.

Methods

The water quantity at a station is classified as low, normal or high by comparing daily water flow values for each station to the 30-year normal values for that station. A station's status for the year is the category most often observed for that year. For the national indicators, the percentage of stations in each category is calculated and then presented for each year from 2001 to 2019 as well as the status for each station across Canada in 2019.

For the Trends in annual water quantity indicator, annual water quantity for each monitoring station was determined by adding the daily water flows for stations over an entire year and then dividing the annual totals by the area of the contributing watershed. By dividing the totals by the watershed area, direct comparisons can be made between watersheds of different sizes. The resulting annual water quantity values, expressed in millimetres, can be thought of as the volume of annual flow per contributing area. A Mann-Kendall test was then used to assess whether there was a statistically significant increasing or decreasing trend in the annual water quantity at a station over the 1970 to 2019 period.

For the Trends in the number of flood days indicator, the daily flow values for a station were compared to a threshold set at the 95th percentile of all daily flows during a 30-year normal period from 1981 to 2010 for that station to determine days with very-high water flows. A Negative Binomial or Hurdle-Negative Binomial test was used to determine if there was a trend in the number of days with very-high flow over the 1970 to 2019 period.

More information

Data extraction

Basic station information and water flow data were extracted from HYDAT according to input parameters, such as record length, data type, and drainage area. Scripts in R language[9] were used to extract data from HYDAT and calculate the indicators.

Categorizing water quantity at a monitoring station for the national indicators

Water quantity at a monitoring station is classified based on historical data recorded at Water Survey of Canada hydrometric stations. To start, frequency distributions for each day of the year were calculated

[8] The 30-year normal for a station refers to the typical water quantity values that were observed at that monitoring station between the 1981 to 2010 period.

[9] R Core Team (2019) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Retrieved on October 5, 2021.

using water flow data collected from 1981 to 2010 at each monitoring station. A 30-year period is used to provide a picture of the hydrologic characteristics of a station, while maximizing the number of stations included in the indicators.

Water quantity categories were defined from the frequency distributions:

- low < 25th percentile
- 25th percentile ≤ normal ≤ 75th percentile
- high > 75th percentile

Daily water quantity records for 2001 to 2019 were categorized as low, normal or high by comparing the measured value to the percentiles calculated for the corresponding station and day of the year over the normal period. Accordingly, a station described as having a low water flow on January 31, for example, had a measured value ranking among the lowest 25% of the values observed for each January 31 from 1981 to 2010.

A station's status for a year is the category most often observed (the mode) at a given station in a given year. Thus, a low classification does not mean that water quantity was consistently low throughout the year; it only means that low water quantity conditions were most often observed.

Table 1. Number of water quantity monitoring stations used in the national indicators grouped by province and territory, 2019

Province or territory	Number of stations
Newfoundland and Labrador	53
Prince Edward Island	4
Nova Scotia	19
New Brunswick	23
Quebec	73
Ontario	202
Manitoba	76
Saskatchewan	118
Alberta	261
British Columbia	196
Yukon	n/a
Northwest Territories	2
Nunavut	n/a

Note: n/a = not available. For 2019, there were not enough data to represent water quantity for Nunavut and Yukon. Stations located in the United States are counted in the adjacent territory or province, to which the water flows.

Calculating the Trends in annual water quantity and the Trends in the number of flood days in Canadian rivers indicators

A Mann-Kendall test was used to assess the presence (or absence) of consistently increasing or decreasing trends in annual water quantity over the 1970 to 2019 period. This is a statistical process commonly used to analyze data collected over time. The slope of the trend line is based on the Theil-Sen Estimator[10] which calculates the median of the slopes through all pairs of points and can robustly handle most point distributions. For the resulting trends expressed in millimetres, a positive value indicates that

[10] Theil H (1950) A rank-invariant method of linear and polynomial regression analysis. I, II, III, Nederlandse Akademie van Wetenschappen, Proceedings, 53: 386 to 392, 521 to 525, 1397 to 1412. Retrieved on October 5, 2021., Sen Pranab Kumar (1968) Estimates of the regression coefficient based on Kendall's tau. Journal of the American Statistical Association 63 (324): 1379 to 1389, doi:10.2307/2285891. Retrieved on October 5, 2021.

the annual average water quantity at a station has increased over the period, a negative value indicates a decrease, and zero values indicate no statistically significant change over the period.

In the case of the number of flood days indicator, days with measured flow values above the 95th percentile compared to the 30-year normal values from 1981 to 2010 for that station were classified as flood days. To assess the presence of trends, a Negative Binomial or Hurdle-Negative Binomial test was used. These tests work in cases where the same indicator value occurs in multiple years, as is the case for the number of flood days for many stations. The Negative Binomial test was used for stations with less than 3 years with zero flood days and the Hurdle-Negative Binomial test was used for stations with 3 or more years with zero flood days. The indicator is meant to show the trend in the prevalence of very high-flow conditions across Canada over the 1970 to 2019 period and may not necessarily represent actual recorded or reported flood events.

Recent changes

The water quantity classifications for 2012 onwards have been revised to include missing data from Quebec and Alberta with the exception of data from 2015 to 2017 for Alberta. The data were not available in past reporting of the indicator due to delays in submissions to the HYDAT database.

Two (2) new indicators have been added to the content: Trends in annual water quantity in Canadian rivers and Trends in the number of flood days in Canadian rivers. These new indicators provide an assessment of whether there have been significant observed changes over time in water quantity and in the number of flood days at monitoring stations across Canada from 1970 to 2019.

One (1) previous indicator has been removed from the content: Regional water quantity in Canadian rivers.

Caveats and limitations

Large-scale events of short duration, such as a flood, may not influence the final water quantity classification of a station. Changes to seasonal flow patterns will also affect final classifications.

There are not enough stations in areas such as the North to compute complete, nationally representative indicators.

The status of water quantity assessed by the present indicators is a reflection of the 30-year time period used for the calculations and does not necessarily reflect longer-term trends at the station. Trend maps are only representative of the time period analyzed (1970 to 2019) and may be influenced by long-term climatic fluctuations.

Water flow data collected at a monitoring station are representative of the average conditions of the upstream drainage area. Professional judgment is used to determine whether there were enough stations to describe water quantity in a drainage region.

More information

Extreme short-term events may not be detected with the indicators, since the focus is on frequency of observations in different categories through the year. The Trends in the number of flood days in Canadian rivers indicator has been added to help characterize this important aspect of water quantity.

Water quantity generally follows a predictable seasonal pattern with natural, year-to-year variability. The indicators compare daily values to the 30-year normal and assume that water quantity is approximately the same from one year to the next for the same calendar day. A shift in the predictable seasonal pattern (the hydrograph) for one year will influence the results.

Most water quantity monitoring stations in Canada are located in populated areas and do not represent the country's entire geographic extent or all its watersheds.

While 30 years represent a long time series for water quantity data, it represents a relatively short historical time frame for a given river and does not account for all natural variability in a river system.

The number of water quantity monitoring stations included in these indicators fluctuates from year to year because stations may be closed as monitoring networks are optimized. Whether or not the data have been verified and uploaded into HYDAT by the time the data are extracted to calculate the indicator also influences whether the station is included in the calculation that year.

Resources

References

Environment and Climate Change Canada (2021) Real-time Hydrometric Data. July 2021 version. Retrieved on September 23, 2021.

Environment and Climate Change Canada (2021) Water Survey of Canada. Retrieved on September 23, 2021.

Statistics Canada (2003) Standard Drainage Area Classification. Retrieved on October 12, 2021.

Related information

Canada's changing climate report: Changes in freshwater availability across Canada

Changes to water quantity: drivers and impacts

El Niño

La Niña

Large-scale climate oscillations influencing Canada

Ratio of surface freshwater intake to water yield

Annex

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Water quantity at monitoring stations, Canada, 2001 to 2019

Year	Total number of stations	High quantity (percentage of stations)	Normal quantity (percentage of stations)	Low quantity (percentage of stations)
2001	1 358	5	70	25
2002	1 349	5	79	17
2003	1 369	2	77	21
2004	1 369	9	85	7
2005	1 360	23	74	3
2006	1 357	12	77	11
2007	1 355	13	79	8
2008	1 351	10	86	4
2009	1 354	8	83	9
2010	1 345	22	70	7
2011	1 318	28	66	6
2012	1 319	17	70	13
2013	1 305	25	69	6
2014	1 305	29	64	8
2015	1 249	21	66	13
2016	1 191	32	57	12
2017	1 085	22	70	7
2018	1 198	10	76	15
2019	1 027	19	74	7

Note: The water quantity classification for a station is based on a comparison of the most frequently observed flow condition in a given year with typical water quantity at that station between 1981 and 2010. Data from Alberta from 2015-2017, as well as recent data from northern Canada for 2019 are missing because of delays in getting data into the database. Percentages may not add up to 100 due to rounding. The results for this indicator vary slightly from those in the Trends in annual water quantity in Canadian rivers indicator and Trends in the number of flood days in Canadian rivers indicator because of differences in the methods used to calculate the indicators. For more information, please see Data sources and methods.
Source: Environment and Climate Change Canada (2021) National Water Data Archive (HYDAT).

Table A.2. Data for Figure 3. Annual rate of change in water quantity at monitoring stations, Canada, 1970 to 2019

Province or territory	Total number of stations	Increasing trend (percentage of stations)	Stable trend (percentage of stations)	Decreasing trend (percentage of stations)	Uncertain (percentage of stations)
Newfoundland and Labrador	17	24	0	18	59
Prince Edward Island	1	100	0	0	0
Nova Scotia	12	25	0	25	50
New Brunswick	27	67	0	0	33
Quebec	40	35	0	30	35
Ontario	79	52	0	13	35
Manitoba	23	70	0	4	26
Saskatchewan	38	50	0	8	42
Alberta	52	23	0	40	37
British Columbia	153	31	0	12	57
Yukon	14	71	0	0	29
Northwest Territories	18	72	0	17	11
Nunavut	7	86	0	0	14

Note: Percentages may not add up to 100 due to rounding. The indicator is based on a statistical analysis of annual water quantity at monitoring stations over the 1970 to 2019 period. Annual water quantity for each monitoring station was determined by adding the daily water flows for stations over an entire year and then dividing the annual totals by the area of the contributing watershed for a depth in millimetres. A statistical analysis was then applied to the resulting values to determine if there was a trend. Positive trend values indicate that the annual water quantity at a station has increased over time, negative values indicate a decrease and zero values indicate that the annual water quantity has remained the same over time. Stations located in the United States are counted in the adjacent territory or province, to which the water flows. For more information, please see Data sources and methods.
Source: Environment and Climate Change Canada (2021) National Water Data Archive (HYDAT).

Table A.3. Data for Figure 4. Annual rate of change in the number of flood days at monitoring stations, Canada, 1970 to 2019

Province or territory	Total number of stations	Increasing trend (percentage of stations)	Stable trend (percentage of stations)	Decreasing trend (percentage of stations)	Uncertain (percentage of stations)
Newfoundland and Labrador	17	12	0	12	76
Prince Edward Island	1	0	0	0	100
Nova Scotia	10	10	0	0	90
New Brunswick	27	15	0	0	85
Quebec	33	3	0	12	85
Ontario	64	14	0	3	83
Manitoba	35	37	0	3	60
Saskatchewan	59	46	0	5	49

Province or territory	Total number of stations	Increasing trend (percentage of stations)	Stable trend (percentage of stations)	Decreasing trend (percentage of stations)	Uncertain (percentage of stations)
Alberta	121	4	0	21	75
British Columbia	143	10	0	5	85
Yukon	13	0	0	8	92
Northwest Territories	18	39	0	6	56
Nunavut	2	50	0	0	50

Note: Percentages may not add up to 100 due to rounding. The indicator is based on a statistical analysis of the annual number of flood days at monitoring stations over the 1970 to 2019 period. The indicator shows the prevalence of very-high flow conditions (above the 95th percentile of all daily flow values for a monitoring station compared to a 30-year normal period from 1981 to 2010) which may be linked to flooding events, but does not necessarily represent actual recorded or reported events. Positive values indicate that the number of days with very-high flows over the 1970 to 2019 period have increased, negative values indicate a decrease, and zero values indicate that the number of flood days has remained the same. Stations located in the United States are counted in the adjacent territory or province, to which the water flows. For more information, please see Data sources and methods.
Source: Environment and Climate Change Canada (2021) National Water Data Archive (HYDAT).

Additional information can be obtained at:

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