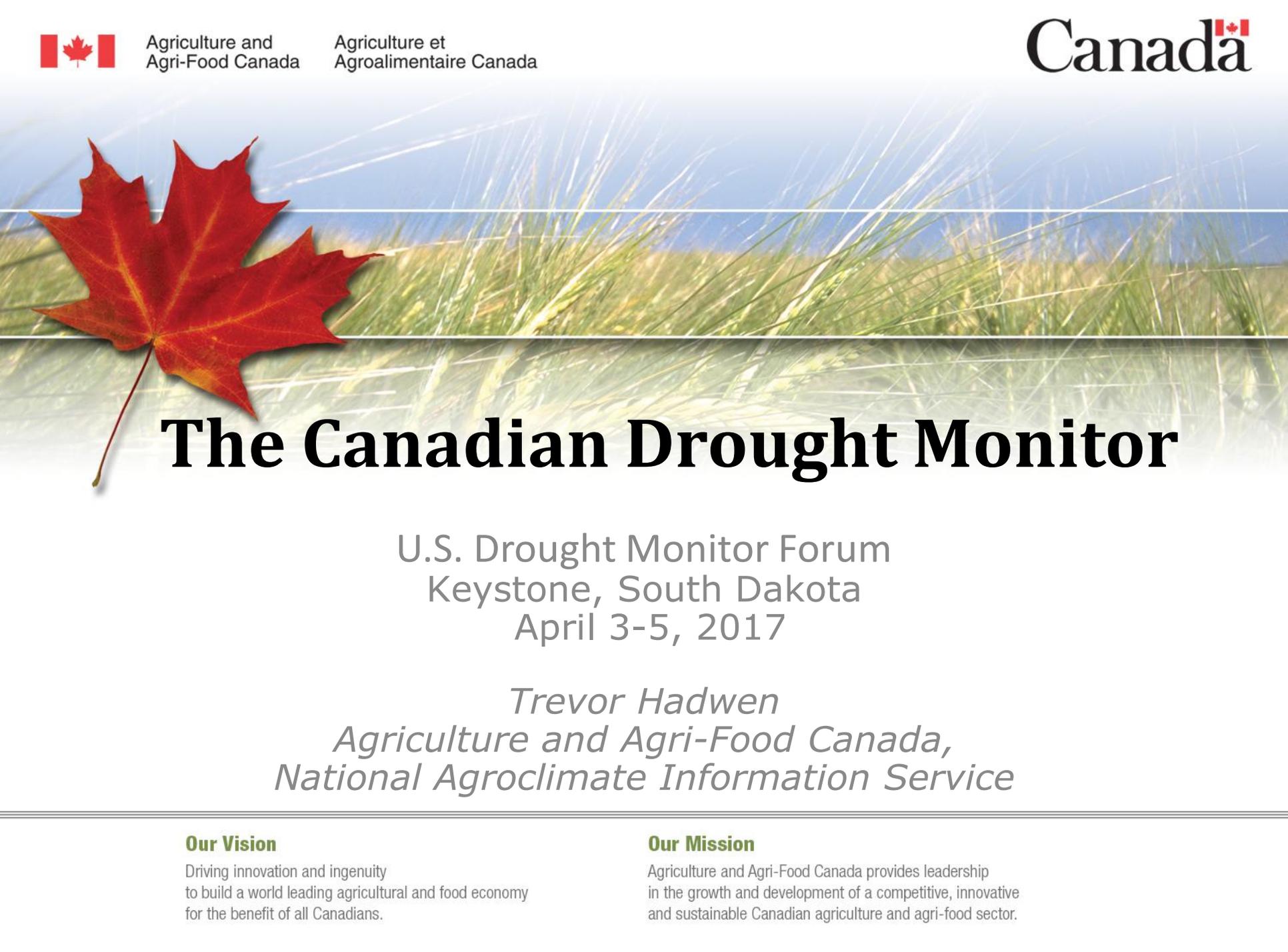




Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

Canada



The Canadian Drought Monitor

U.S. Drought Monitor Forum
Keystone, South Dakota
April 3-5, 2017

Trevor Hadwen
Agriculture and Agri-Food Canada,
National Agroclimate Information Service

Our Vision

Driving innovation and ingenuity
to build a world leading agricultural and food economy
for the benefit of all Canadians.

Our Mission

Agriculture and Agri-Food Canada provides leadership
in the growth and development of a competitive, innovative
and sustainable Canadian agriculture and agri-food sector.

The National Agroclimate Information Service focuses on climate-related risks to agriculture

- **Acquire and process agroclimate data**
 - Timely Climate Monitoring at National & Regional scales
- **Assess climate-related risks to the agriculture industry**
 - extent and intensity
 - probabilities, frequencies and changes in weather and climate trends
 - vulnerability of systems (e.g. watersheds) to climate variability
 - crop yield forecasting
- **Develop Information and Tools**
 - drought preparedness and planning
 - remote sensing, online tools, risk assessment and decision-support
- **Communicate climate-related information, risks and options**
 - online, print, industry events, media interviews

NAIS Research and Project Work

Weather and Climate Indices

- Developing improved drought and extreme weather indices and ways to integrate into risk assessments.

Soil Moisture Monitoring

- Using high-resolution Radarsat data to improve drought and excess wetness monitoring and forecasting.

Crop Inventories

- More accurate classification and early season crop mapping, and acreage estimates from satellite data.

Crop Phenology Metrics

- Development and application of algorithms to extract phenological metrics from EO time series.

Improved Yield Forecasts

- Improved integration of high frequency and high resolution EO data into the Canadian Crop Yield Forecaster.

Harvest Progress Monitoring

- Development of methods to map the progress of harvest on a national scale.

Crop Disease and Pests

- Linking EO data to improve our ability to forecast and monitor outbreaks.

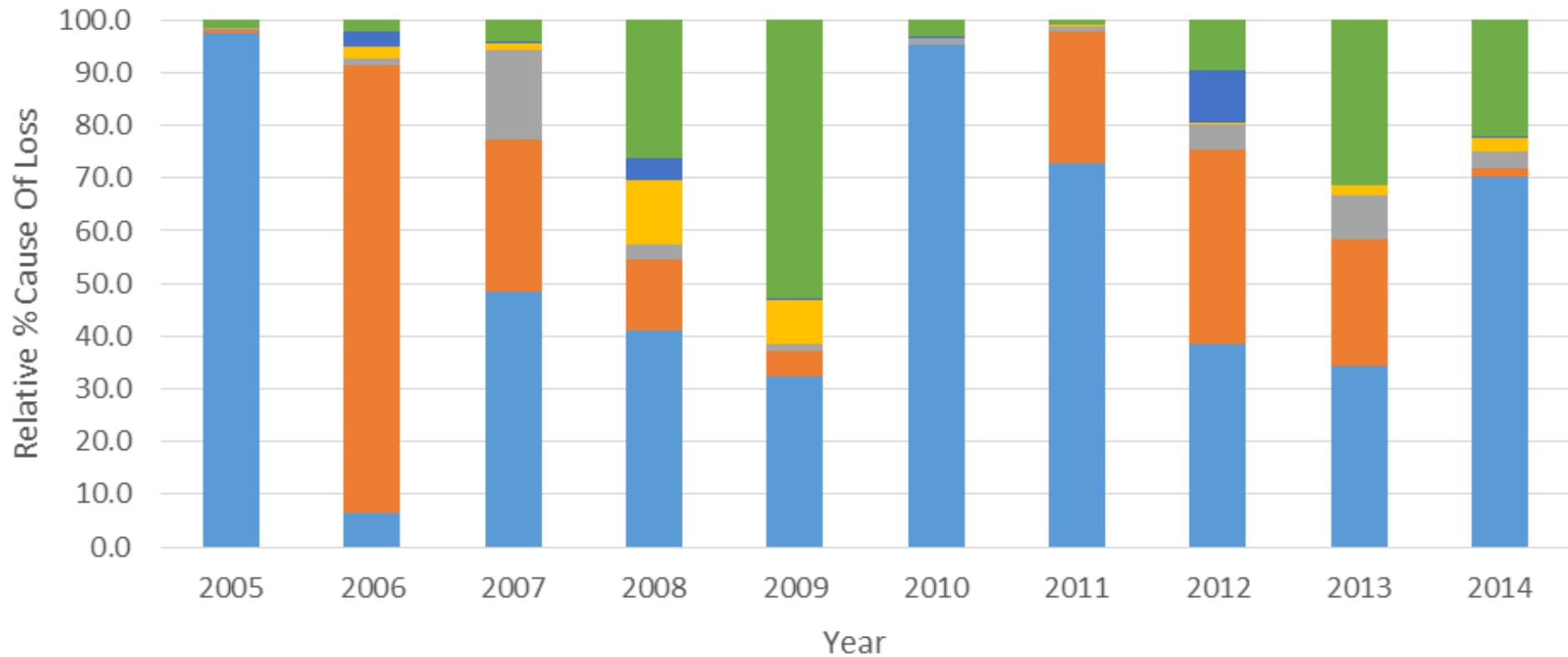
Land Use Change Indicators

- Development of new generation of spatial and scalable EO-based agri-environmental indicators.

NAIS Operational Work...

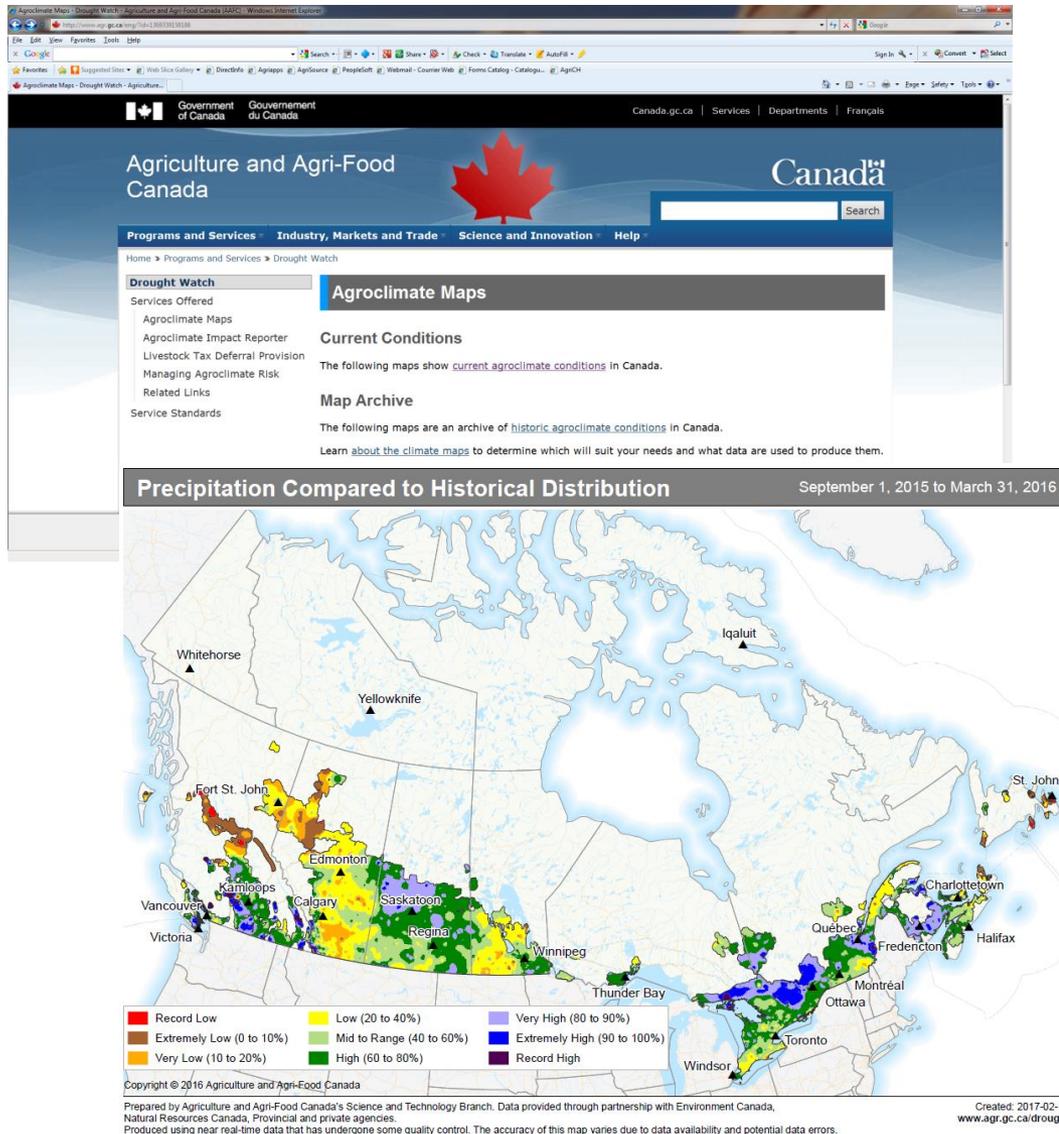
- Monitoring, Assessment and Reporting
 - Drought Watch agroclimate maps
 - Soil Moisture Monitoring (satellite and ground)
 - Canadian/North American Drought Monitors
 - Climate Related Production Risk Committee
 - Global Crop Monitoring (GEOGLAM)
 - Livestock Tax Deferral assessment
 - Agroclimate Impact Reporter
 - Crop Yield Forecasting

Major Annual Combined Causes Of Loss (2005-2014)



■ Excess Moisture ■ Drought/Heat ■ Hail ■ Frost ■ Wind ■ Other

Drought Watch Web Site



Hundreds of map products updated daily. Based on 2000+ climate stations.

Precipitation:
Accumulated
Percent of Normal
Difference from Normal
Percentile

Temperature:
Max/Min
Growing Degree Days
Corn Heat Units

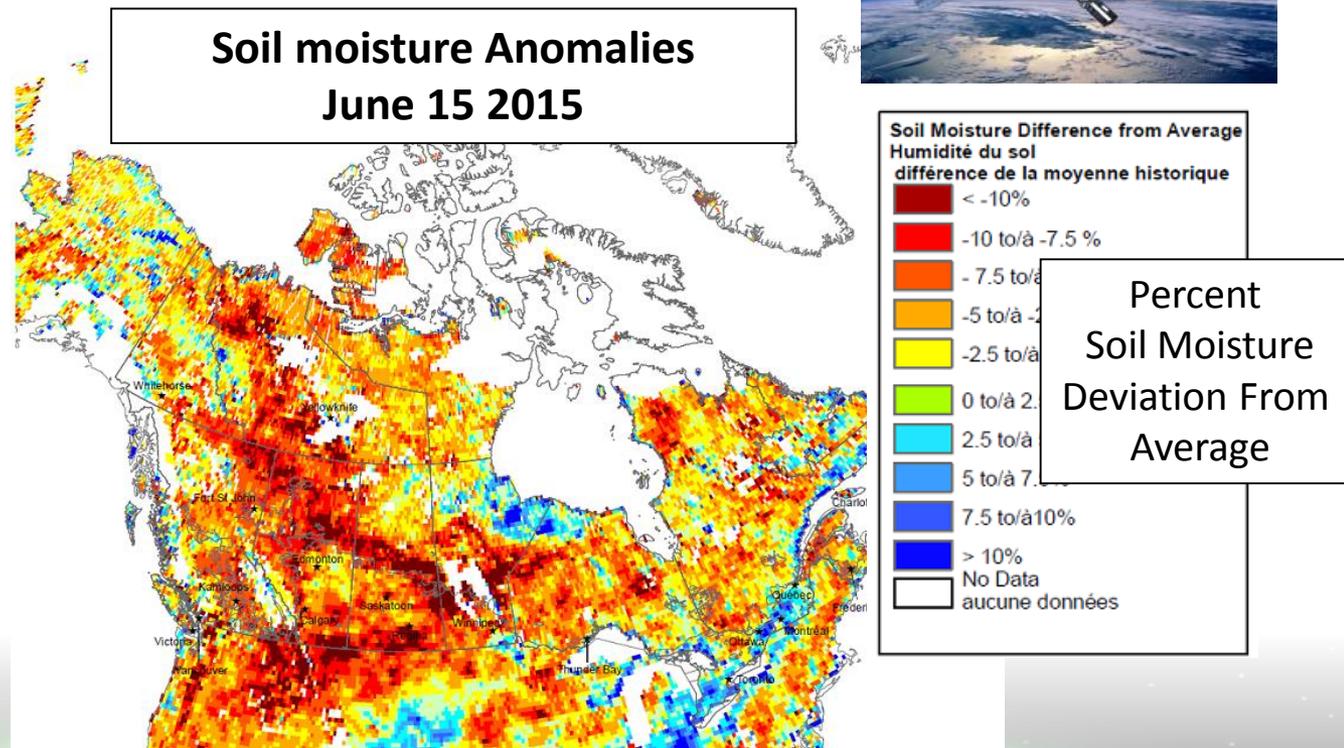
Drought Models:
Standardized Precipitation Index
Palmer Drought Index
Versatile Soil Moisture Budget
Blended Index (in-the-works)

Drought Monitoring:
Production Potential
Forage Supplies
Water Supplies

Satellite Soil Moisture Monitoring

Soil Moisture (Application Example)

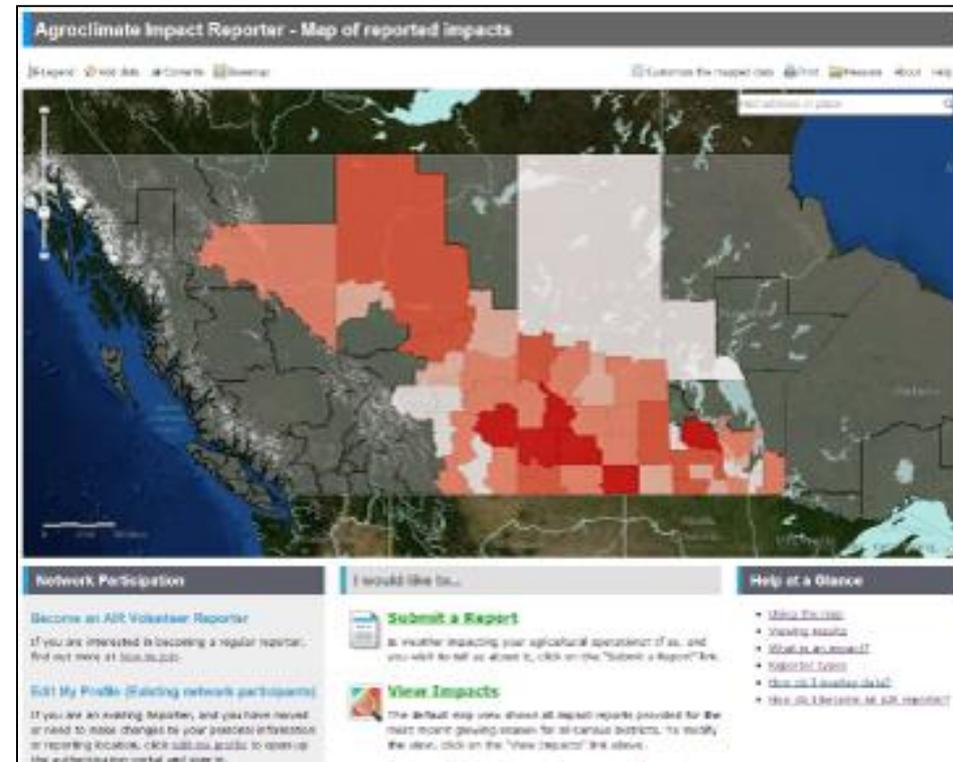
- Weekly surface soil moisture monitoring.
- Regional scale.
- Based on passive microwave data from the European Space Agency (ESA).
- Working with Environment Canada to develop the way forward for EO based soil moisture - Leading Edge Environmental and Agricultural Forecast Network (Leafnet)



This information is used to inform crop production reports and yield forecasting and identify areas with extreme conditions to target and implement programs.

Agroclimate Impact Reporter

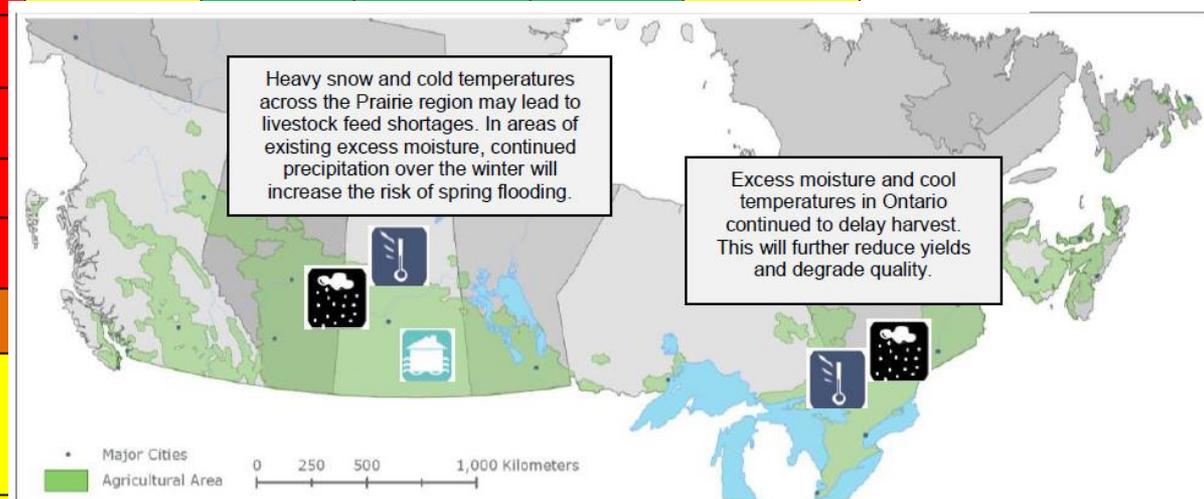
- AIR is an online tool for the collection and reporting of agroclimate impacts resulting from weather events across Canada.
- Is a fundamental change in how we collect impact information and has increased AAFC's ability to collect information through surveys, crowd sourcing and media.
- Enables a better understanding of local and regional impacts and emerging risks.
- Operational since 2013; development continues.



National Production Risk Reporting

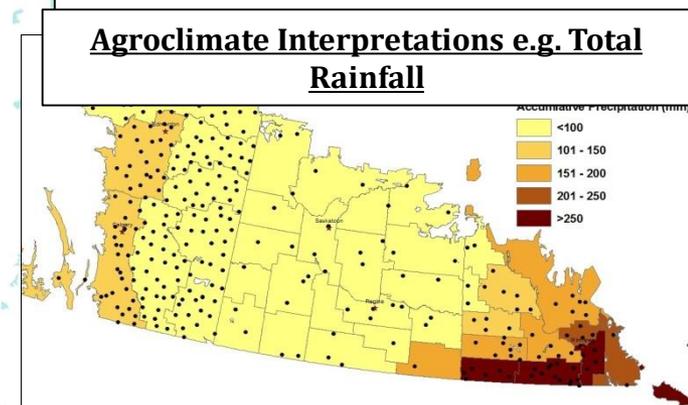
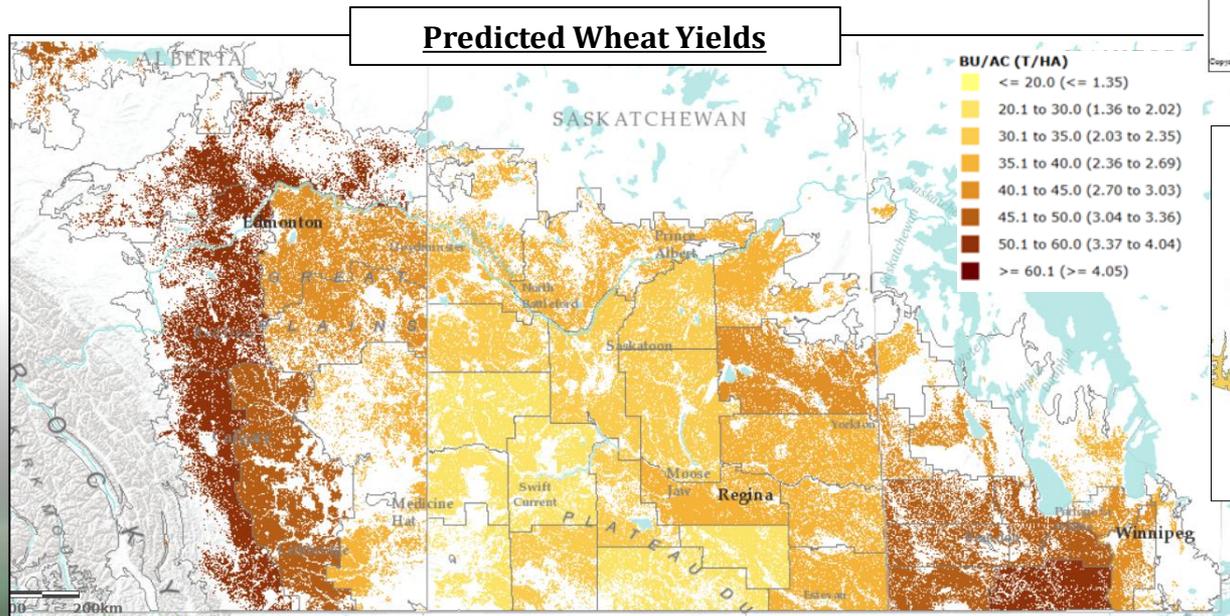
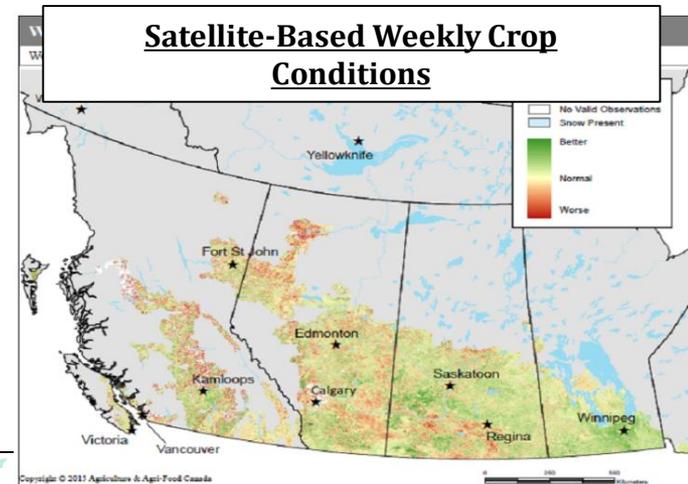
National Dashboards – Climate Related Production Risk Committee (CRPRC)

	BC	AB	SK	MB	ON	QC	ATL
Winter forecast	stable	stable	stable	stable	stable	stable	stable
November 17, 2015							
October 20, 2015	drought	dry			frost		
September 29, 2015	drought	drought, excess moisture	excess moisture				
September 15, 2015	drought	drought, excess moisture	excess moisture				hail
September 1, 2015	drought, wildfire	drought					
August 18, 2015	drought	drought					
August 5, 2015	drought	drought					
July 21, 2015	drought, heat	drought, heat					
July 7, 2015	drought	drought					
June 23, 2015	drought	drought					
June 9, 2015	drought	drought	drought	frost			delayed operations
May 26, 2015	drought	drought	drought	frost	drought		delayed operations



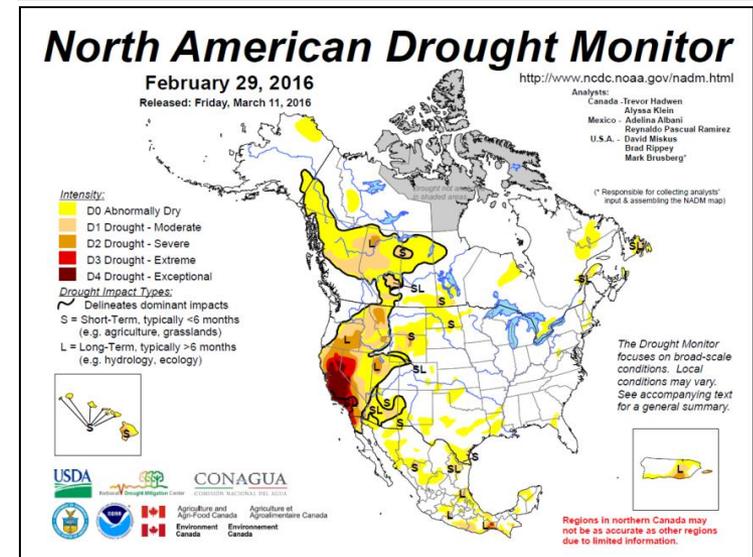
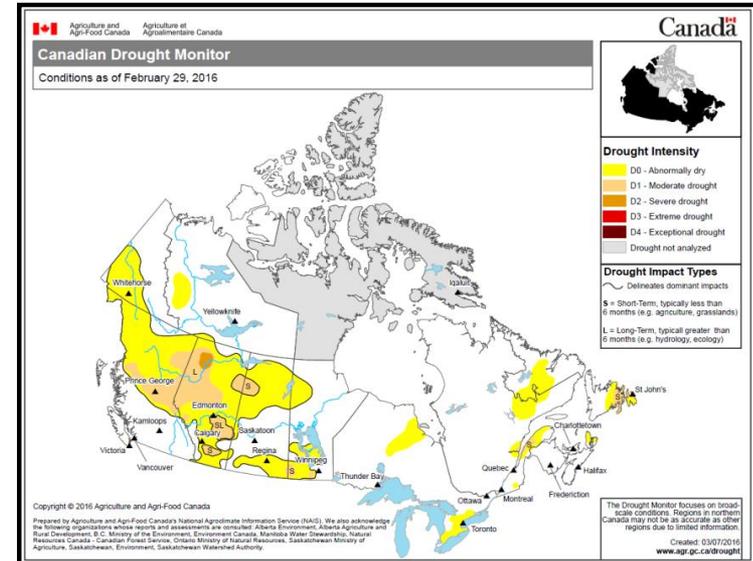
Monitoring Crop Health and Estimating Crop Yields

- Weekly estimates of crop health derived from satellite data
- Agroclimate interpretations from ECCC climate station data
- Data integrated to forecast field crop yields at monthly intervals up to four months ahead of the harvest. This is currently done for 6 crop types.
- Model has been adapted by Statistics Canada to replace the September Farm Survey



Drought Monitoring

- NAIS is the lead for Drought monitoring in Canada.
- Monthly Product produced with input from ECCC, NRCan and provincial agencies.
- Canada is a very large and diverse country
- The CDM covers all of Canada with the exception of the territory of Nunavut
- Drought indicators research and development are ongoing.
- Limited data and information
- Limited human resources

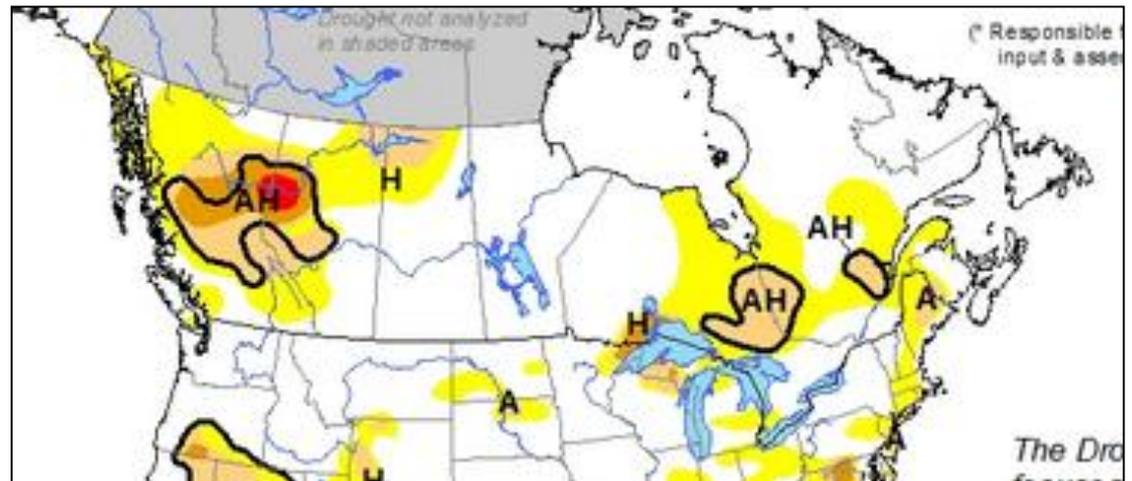
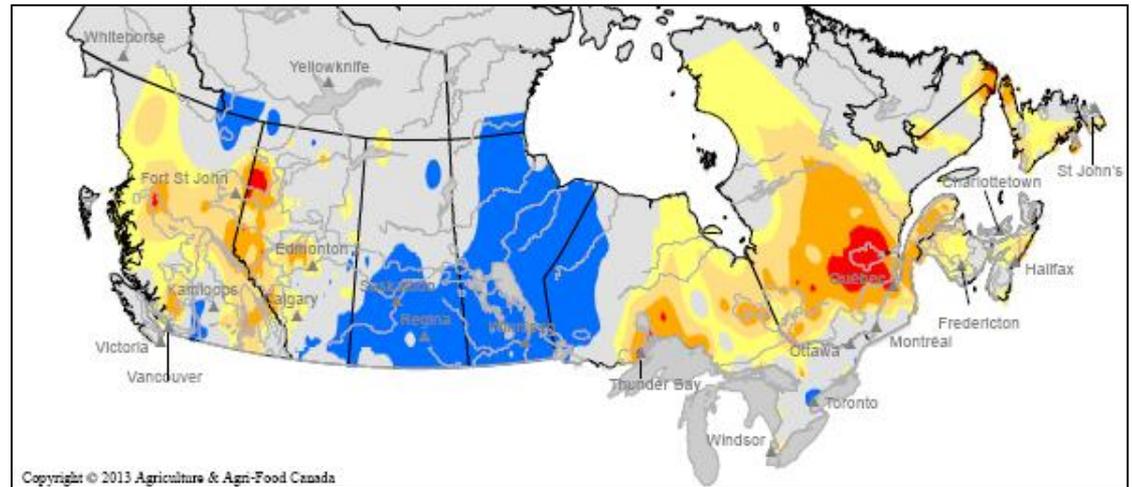


Our focus over the past 2 years...

- **Developing and utilizing additional data**
 - SMOS, VegDRI, CaPA, blended indices and packaging data more appropriately for extremes
- **Finding efficient processes**
 - Utilizing ArcGIS online, web services and scripting
- **Engaging other departments and agencies**
 - Utilizing ArcGIS online
- **Ensuring the products are used by decision makers**
 - CDM website

Canadian Blended Drought Indices

- Canadian drought blends are currently being developed as an experimental product.
- Canada's blends are based on station data rather than climate district data as in the US.
- Currently we are trying to optimize the blends for different regions of the country.

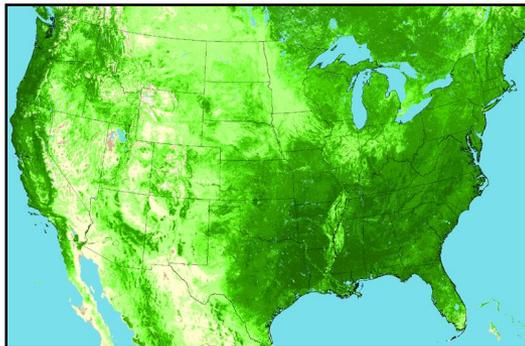


VegDRI Canada

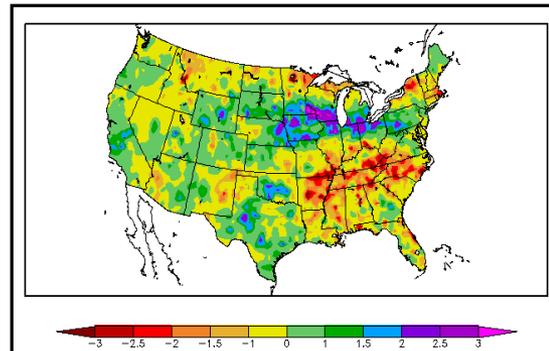
Over the past number of years AAFC has been working with the NDMC and the USGS to determine the feasibility of a Vegetation Drought Response Index (VegDRI) for Canada. In 2017, we will be running Canada VegDRI in a non operational/test mode



Remote Sensing Component



Climate Component

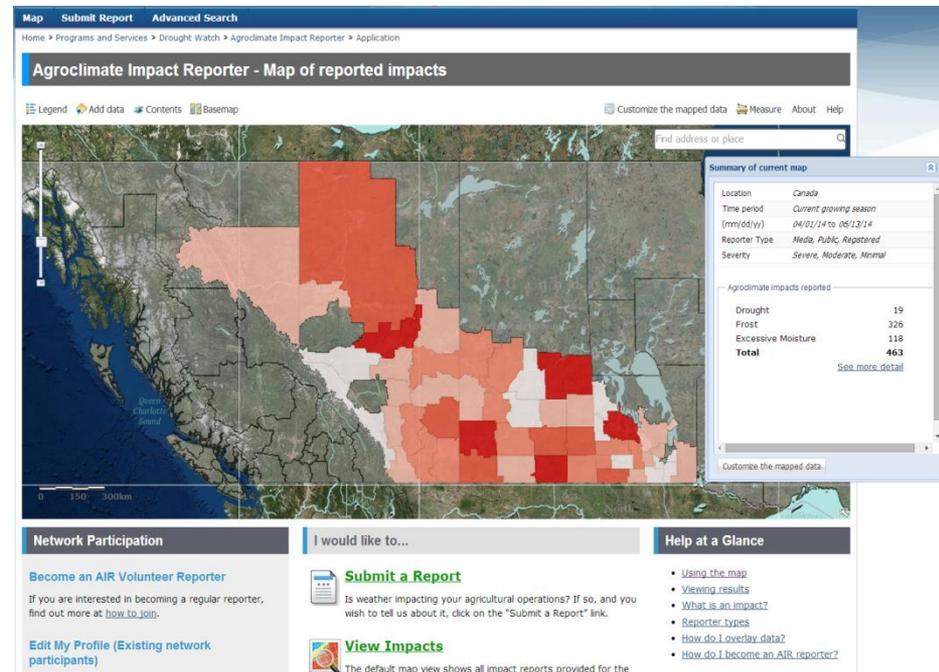


Biophysical Component



Agroclimate Impact Reporter

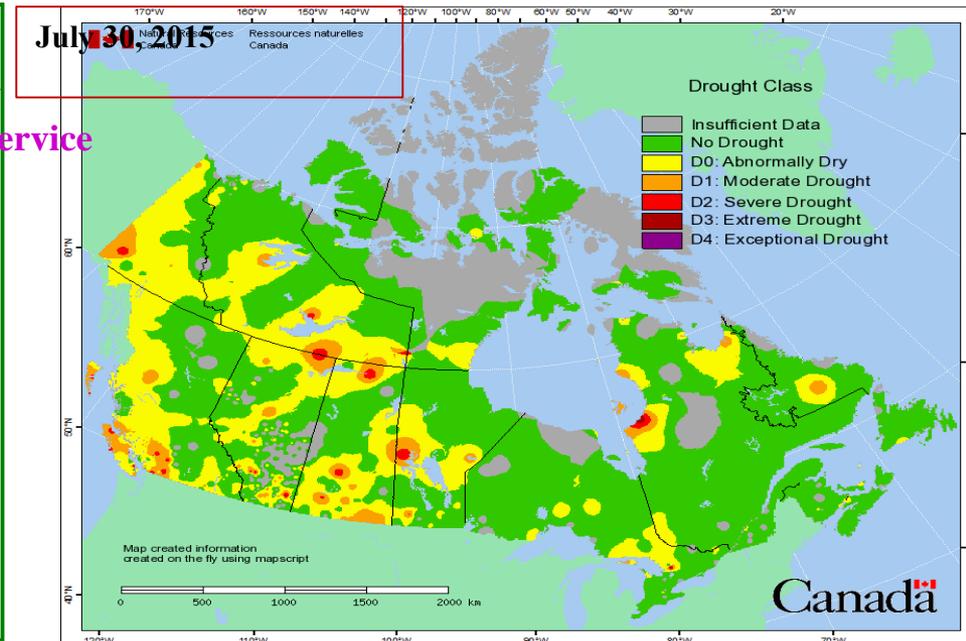
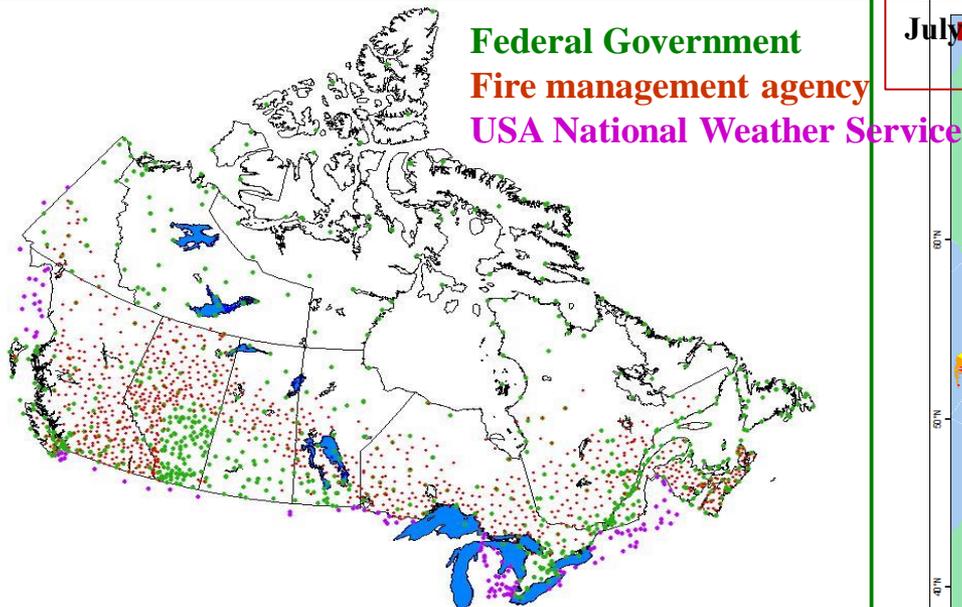
- The Agroclimate Impact Reporter (AIR) application is an online tool for the collection and reporting of agroclimate impacts (including drought) across Canada. AIR is Canada's first online spatial database of agroclimate impacts.
- Impact reports are collected through a network of registered users as well as anonymous and media input.
- The information gathered by AIR plays a significant and valuable role in evaluating weather and climate-related risks to Canadian agriculture and supports multi-million dollar policy and program decisions.



Working with other departments

Forest area is greater than 4 million km² and 45% of Canada's land area

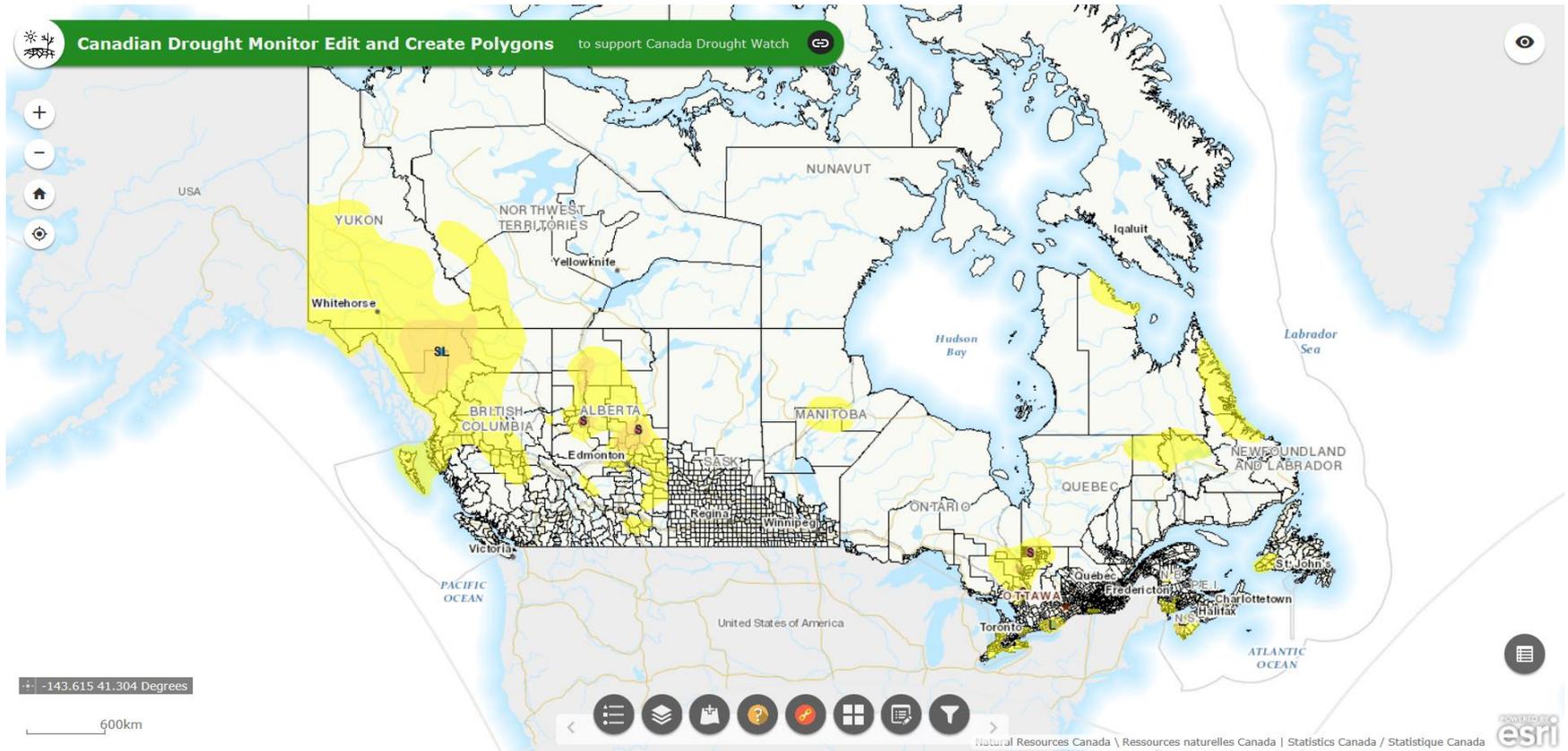
We have been working with the Canadian Forest Service to link the CFS Drought Code. Taking an absolute indicator using in the Fire Weather Index and creating a relative indicator that is usable within the Drought Monitor.

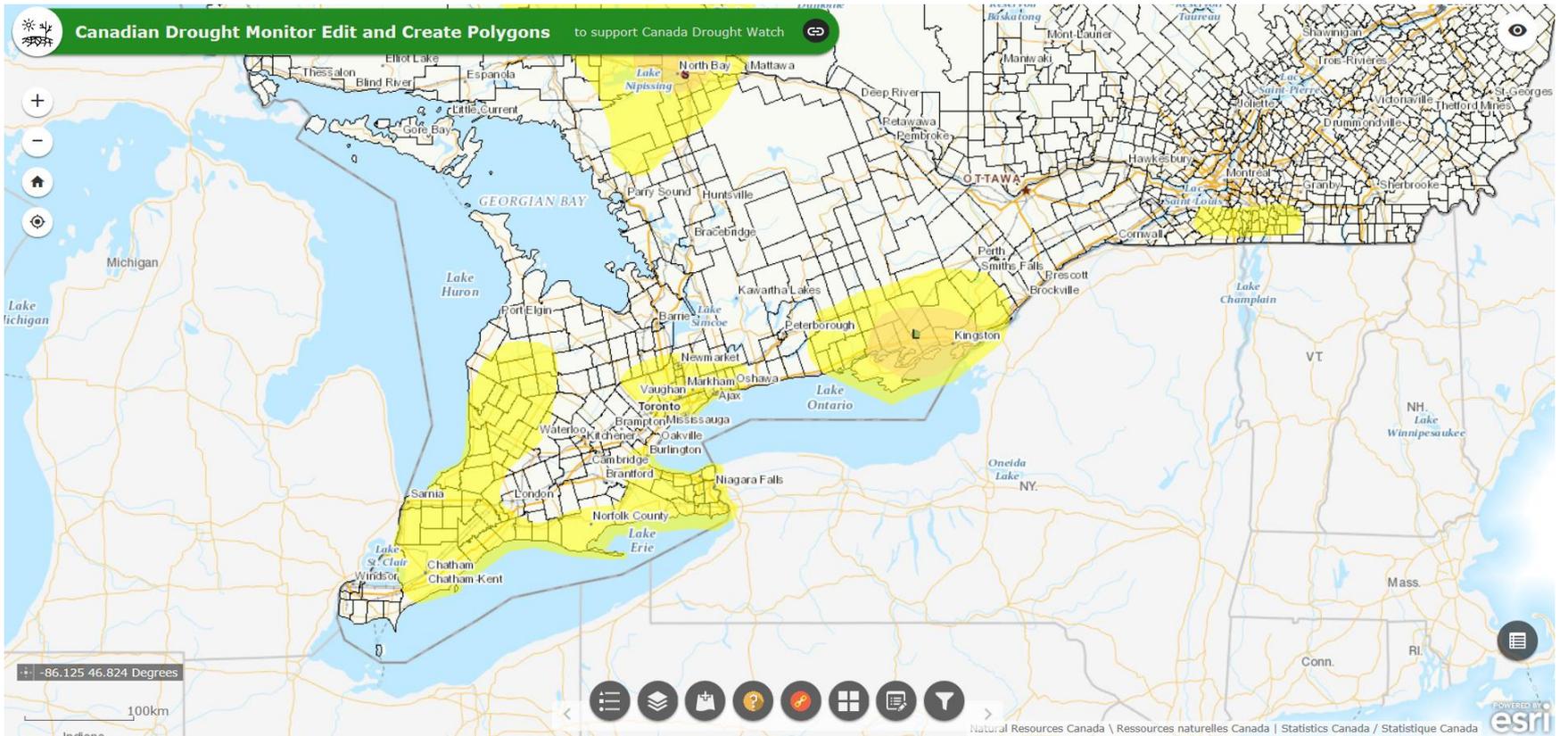


Creating Efficiencies

- Essential to continue to deliver timely assessments with limited resources and increasing demands.
- Made a switch from desktop GIS to online GIS
 - Heavily utilizing ArcGIS Online tools for assessments, editing, and reviewing

CDM Editing Application







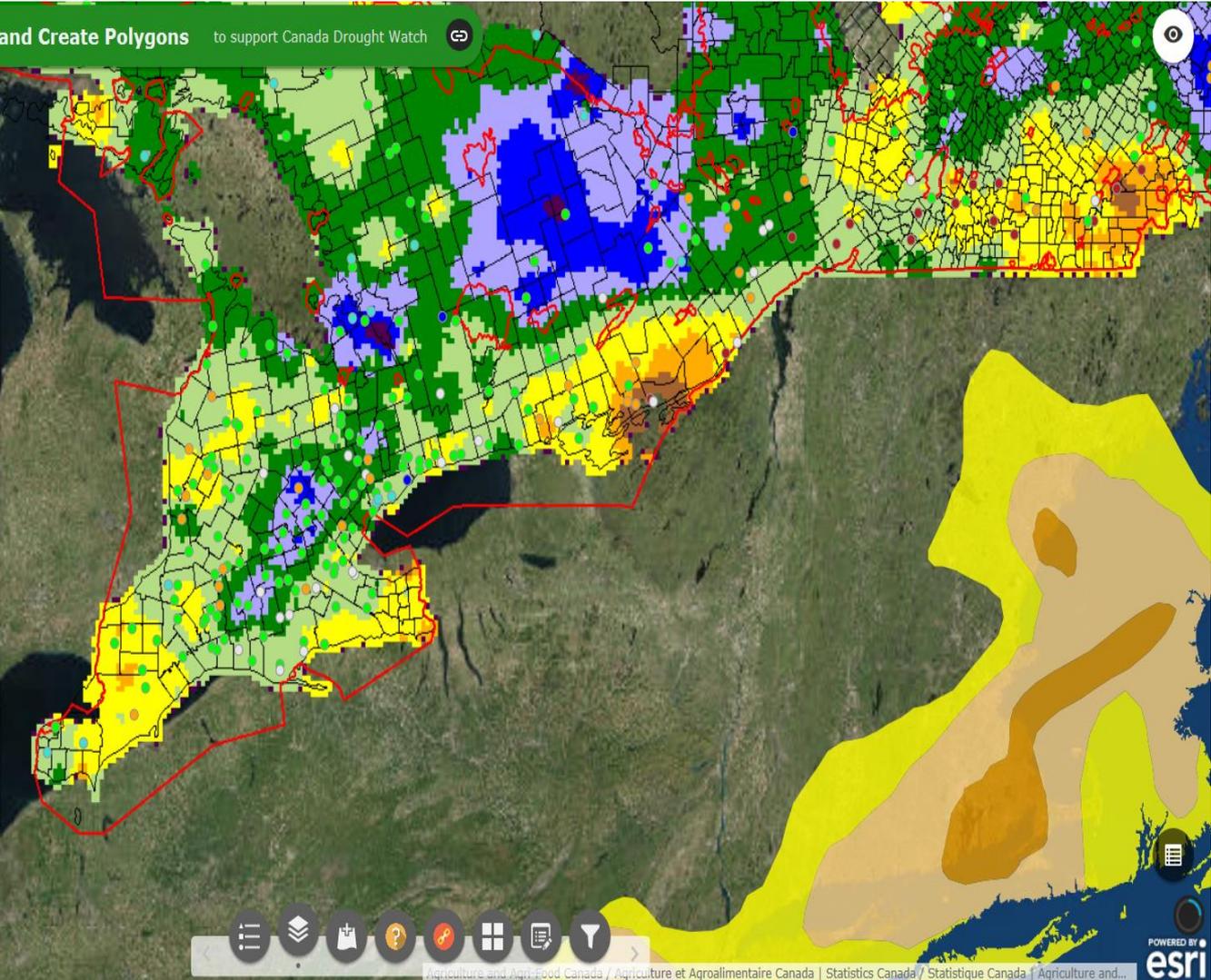
Canadian Drought Monitor Edit and Create Polygons

to support Canada Drought Watch



Layer List

- AAFC Plant Hardiness Zones, 2000 (tiles) ...
- Canada Land Inventory - 1:250 000 Land Capability for Agriculture ...
- Agricultural Extent ...
- Census Consolidated Subdivisions (CCS) ...
- Percentiles - Agricultural Year ...
- Percentiles - Winter Season ...
- Percentiles - Growing Season ...
- Percent of Normal - Agricultural Year ...
- Percent of Normal - Growing Season ...
- Percent of Normal - Winter Season ...
- Departure from Normal (mm) - 180 Day ...



-87.491 46.445 Degrees



Canadian Drought Monitor Edit and Create Polygons to support Canada Drought Watch

Add Data

Search URL File

My Organization Search...

Within map... Type Relevance

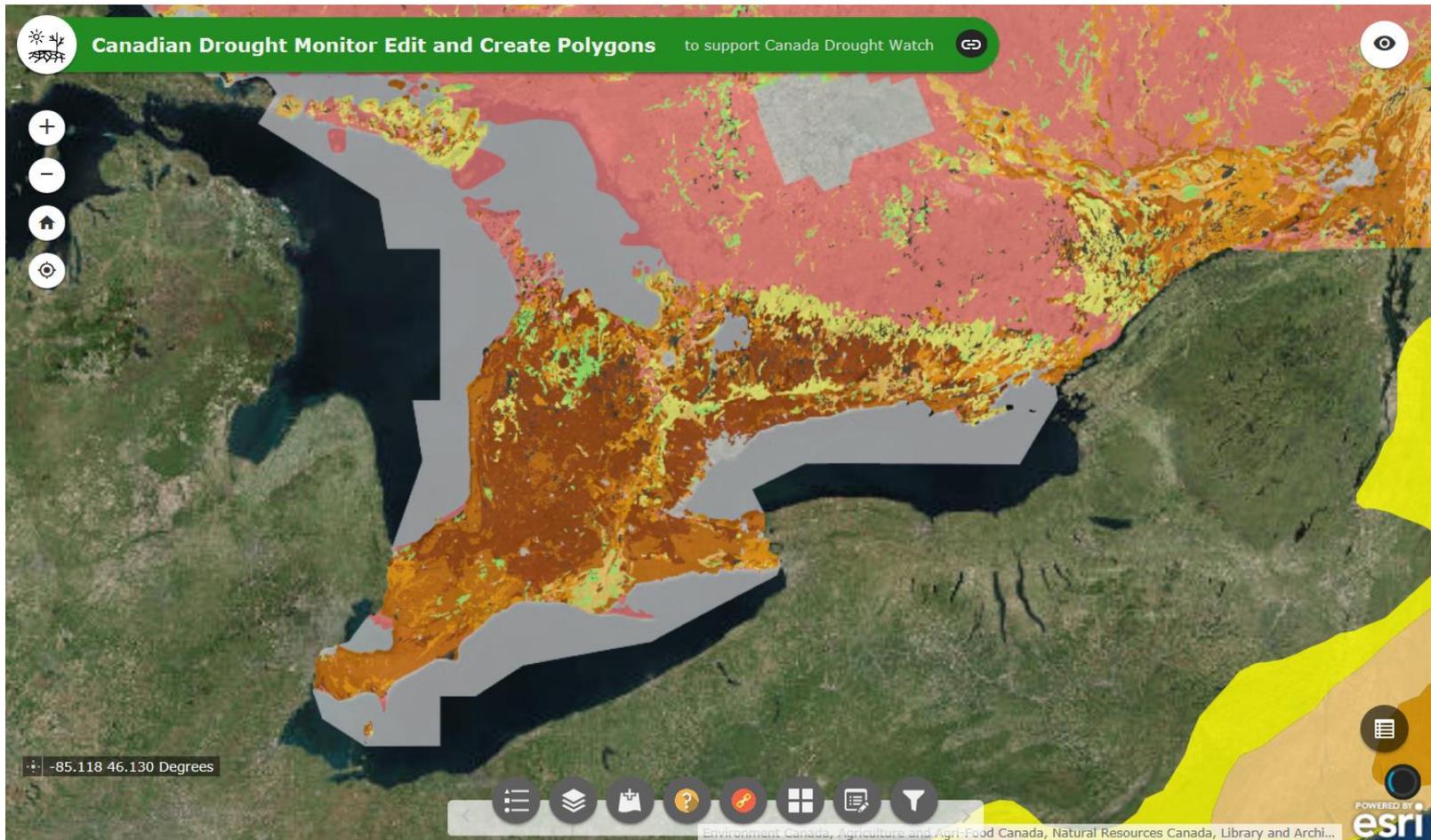
- Map Service by AgCanada ADD DETAILS
- Crop Inventory 2013 (tiles) / In...**
Map Service by AgCanada ADD DETAILS
- Soils of Canada - Luvisols (tiles)**
Map Service by AgCanada ADD DETAILS
- AAFC Ecostratification Boundari...**
Map Service by AgCanada ADD DETAILS
- Soils of Canada - Surface form (t...**
Map Service by AgCanada ADD DETAILS

<< < 1 > 535 Items LAYERS

Map showing drought monitoring polygons in Ontario, Canada, covering areas around Lake Huron, Georgian Bay, and Lake Ontario. Major cities like Toronto, Ottawa, and Kingston are visible. The map includes a search bar, a layer list on the left, and navigation controls at the bottom.

Powered by **esri**

Natural Resources Canada | Ressources naturelles Canada | Statistics Canada / Statistique Canada



Canadian Drought Monitor Edit and Create Polygons to support Canada Drought Watch

Edit

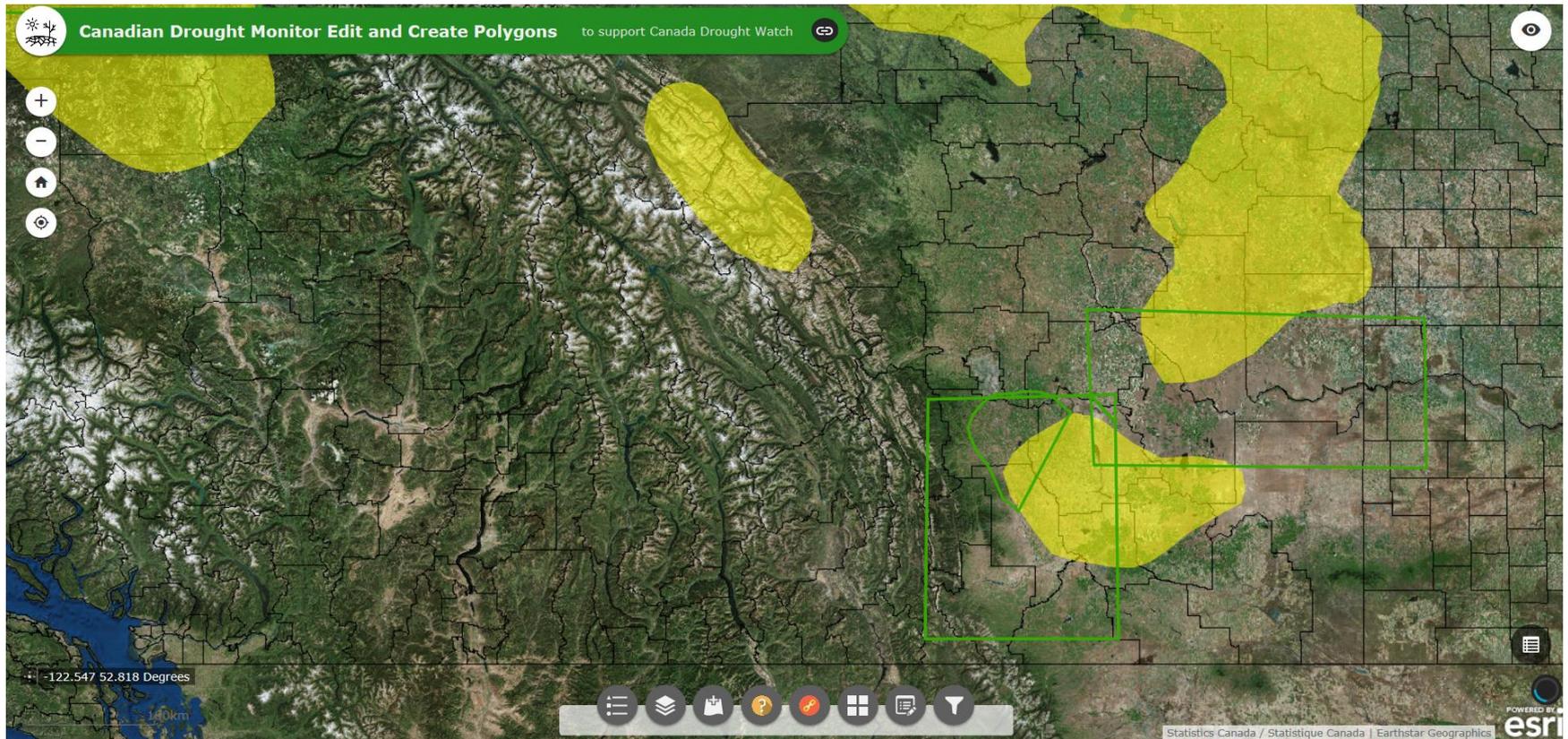
Select a template to create features

- Point
 - S
- Impact Labels
 - SL
 - L
- Impact Lines
 - S
 - SL
 - L
- Exceptional Drought (D4)
 - D4
- Extreme Drought (D3)

The screenshot displays a web-based map interface for editing drought polygons. The main map shows a satellite view of a region in Canada, with several colored polygons representing different drought levels: a large blue area, a smaller yellow area, and a red area. A red 'S' label is visible on the yellow polygon. A circular boundary of red and white dots is overlaid on the blue area. The 'Edit' menu is open on the left, showing various templates for creating features, including points, impact labels, impact lines, and drought levels (D4 and D3). The bottom of the screen features a toolbar with icons for map navigation and a coordinate display showing '-123.699 52.474 Degrees'. The bottom right corner includes the text 'Statistics Canada / Statistique Canada | Earthstar Geographics' and the 'esri' logo.

Statistics Canada / Statistique Canada | Earthstar Geographics **esri** POWERED BY

Review Application



Canadian Drought Monitor Website

- NAIS has been creating monthly Drought Assessment since 2003 for the NADM.
- In 2009 started creating a national product, but not used externally until 2015.

Agriculture and Agri-Food Canada  Canada

Programs and Services ▾ Industry, Markets and Trade ▾ Science and Innovation ▾ Help ▾

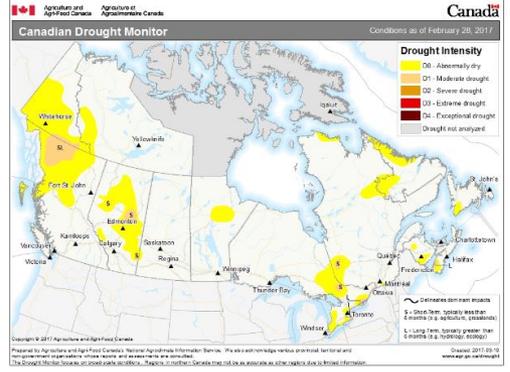
Home ▾ Programs and Services ▾ List of Programs and Services ▾ Drought Watch ▾ Canadian Drought Monitor

Drought Watch

- Agroclimate Maps
- Canadian Drought Monitor**
- Satellite Soil Moisture
- Agroclimate Impact Reporter
- Livestock Tax Deferral Provision
- Managing Agroclimate Risk
- Related Links

Canadian Drought Monitor

The Canadian Drought Monitor (CDM) is Canada's official source for the monitoring and reporting of drought in Canada. From this page you can access a variety of products and information about current drought conditions across the country.



Drought Intensity

- D0 - Abnormally dry
- D1 - Moderate drought
- D2 - Severe drought
- D3 - Extreme drought
- D4 - Exceptional drought
- Drought not analyzed

Conditions as of February 28, 2017

► Description of the above image

► Description of the above image

[Current drought conditions](#)
View an interactive map of current drought conditions across the country. Read narratives describing drought conditions in each region of Canada.

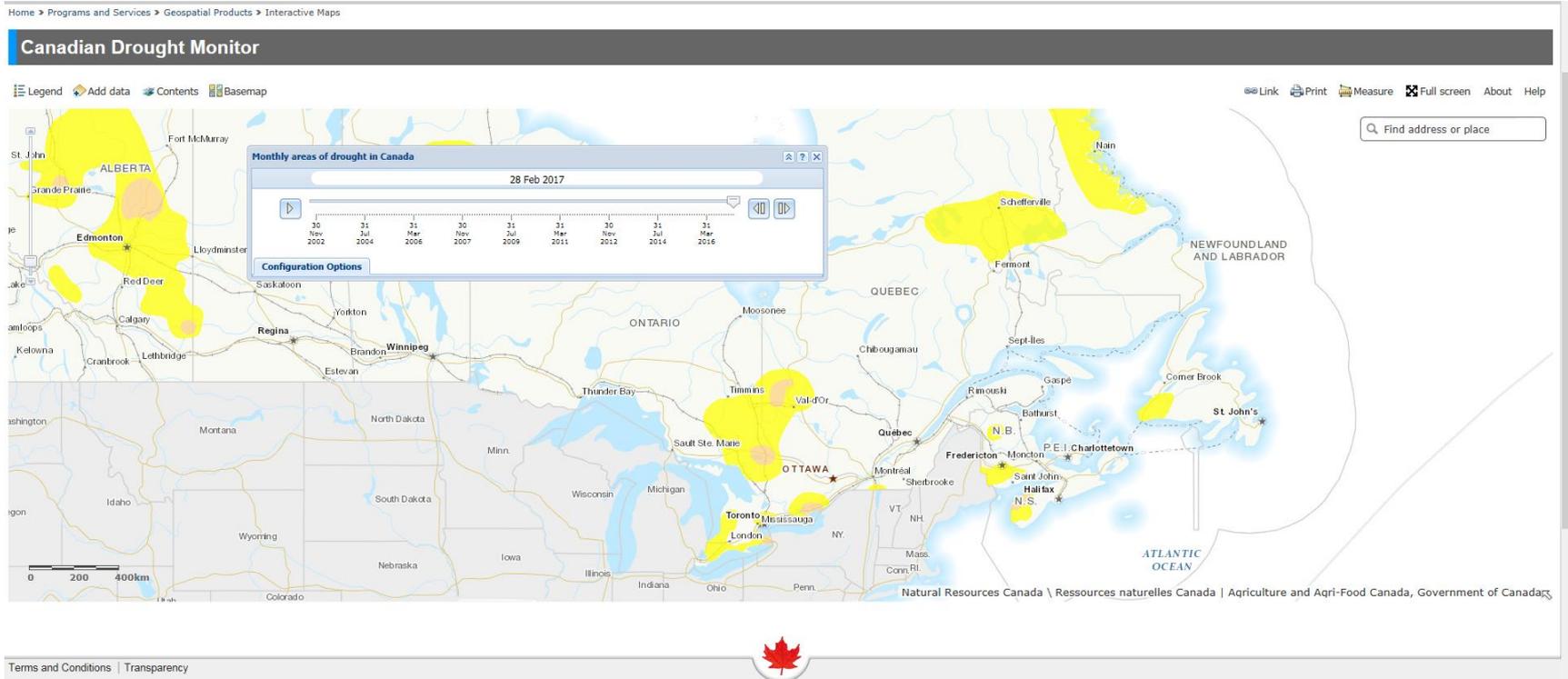
[Historical drought maps and data \(Open Data\)](#)
Browse through historic drought data and downloadable monthly maps showing the extent and intensity of drought across Canada.

[Canadian Drought Monitor Application](#)
Use the interactive application to cycle through a timeline of drought conditions or add your own data to the map.

[About the Canadian Drought Monitor](#)
Learn about the CDM and how it classifies drought. Explore links to Canada's partners in continental drought monitoring.

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Time series enabled



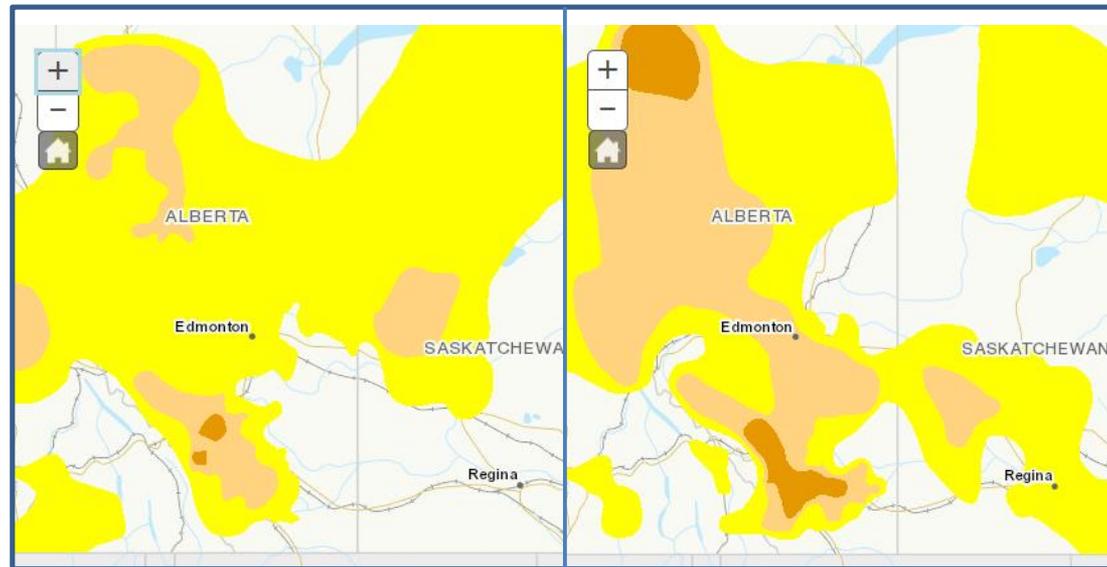
Proposed “Monthly Comparisons” Page

Drought Watch
Services Offered
Agroclimate Maps
Canadian Drought Monitor
Agroclimate Impact Reporter
Livestock Tax Deferral Provision
Managing Agroclimate Risk
Related Links
Service Standards

To begin, select the region you would like to compare, along with the time period for both Maps, and select Retrieve Map.

Year: 2016 Month: May

Year: 2016 Month: April

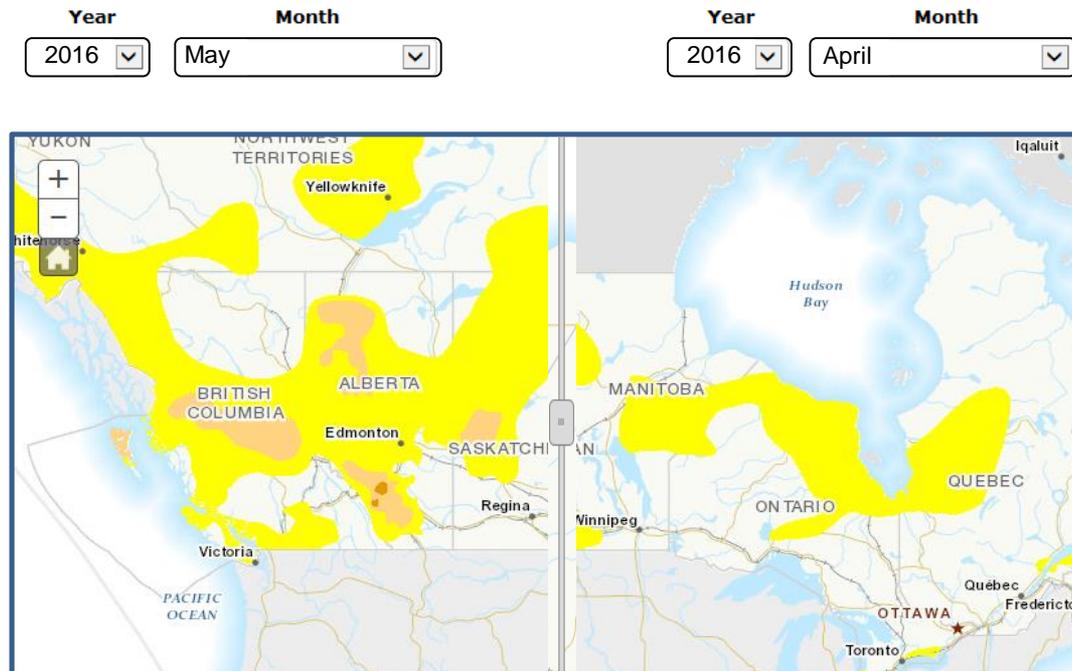


Proposed “Monthly Comparison Slider” Page

Drought Watch
Services Offered
Agroclimate Maps
Canadian Drought Monitor
Agroclimate Impact Reporter
Livestock Tax Deferral Provision
Managing Agroclimate Risk
Related Links
Service Standards

Monthly Comparison Slider

To begin, select the time periods that you would like to compare, and select the slider to switch between the two different maps.



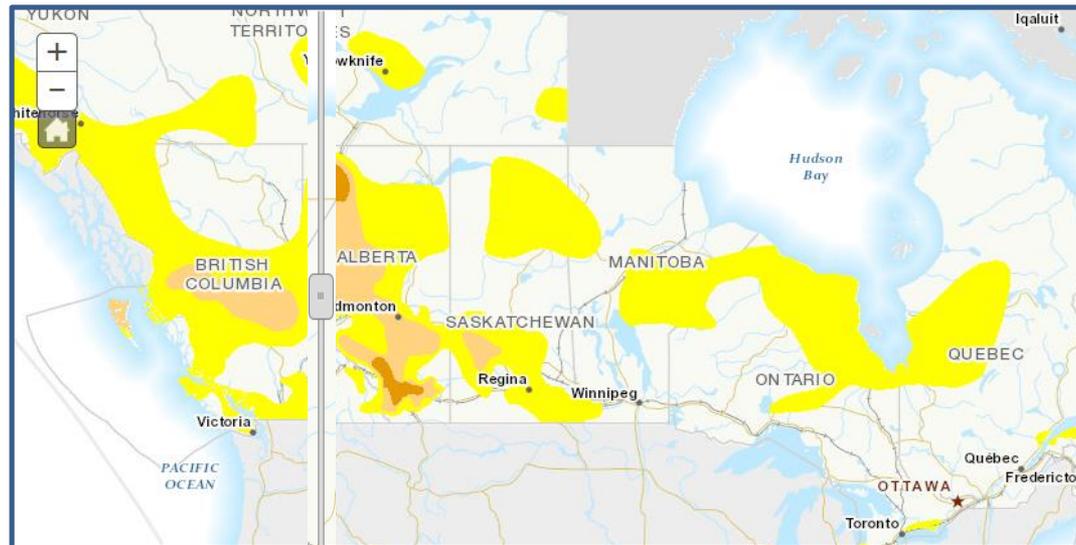
Proposed “Monthly Comparison Slider” Page

Drought Watch
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Livestock Tax Deferral Provision
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Related Links
Service Standards

Monthly Comparison Slider

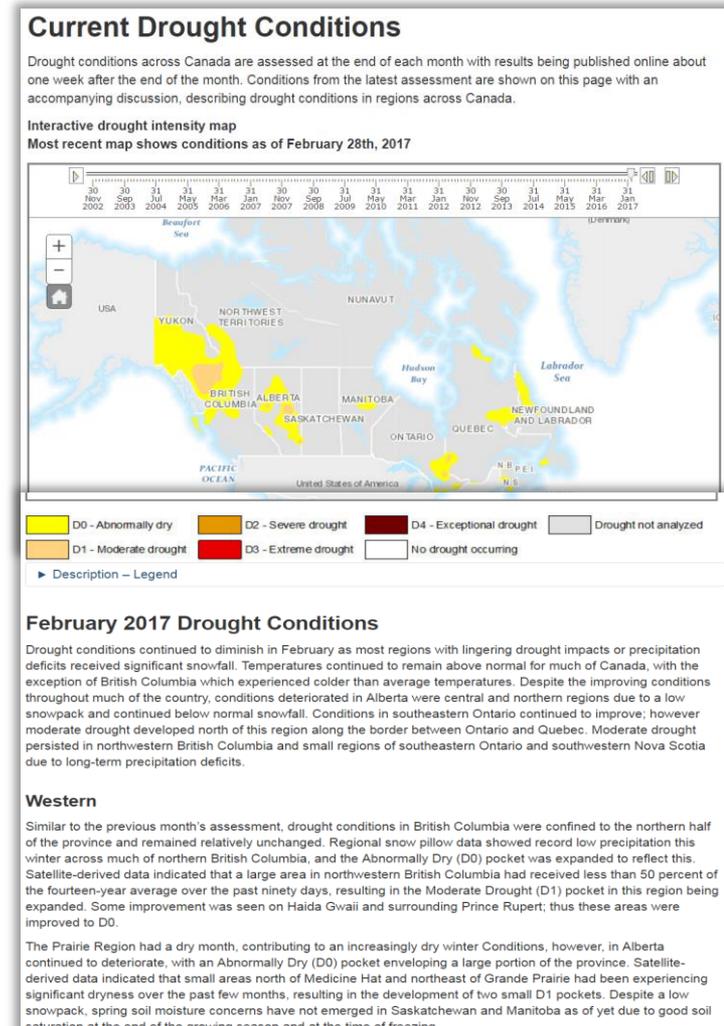
To begin, select the time periods that you would like to compare, and select the slider to switch between the two different maps.

Year	Month	Year	Month
2016 <input type="button" value="v"/>	May <input type="button" value="v"/>	2016 <input type="button" value="v"/>	April <input type="button" value="v"/>



Working on Using Map Story to better explain the drought

- Replace the embedded map and the narrative with an interactive application
- Esri Story Maps let you combine maps with narrative text, images, and multimedia content



Page 2 – Western

Français

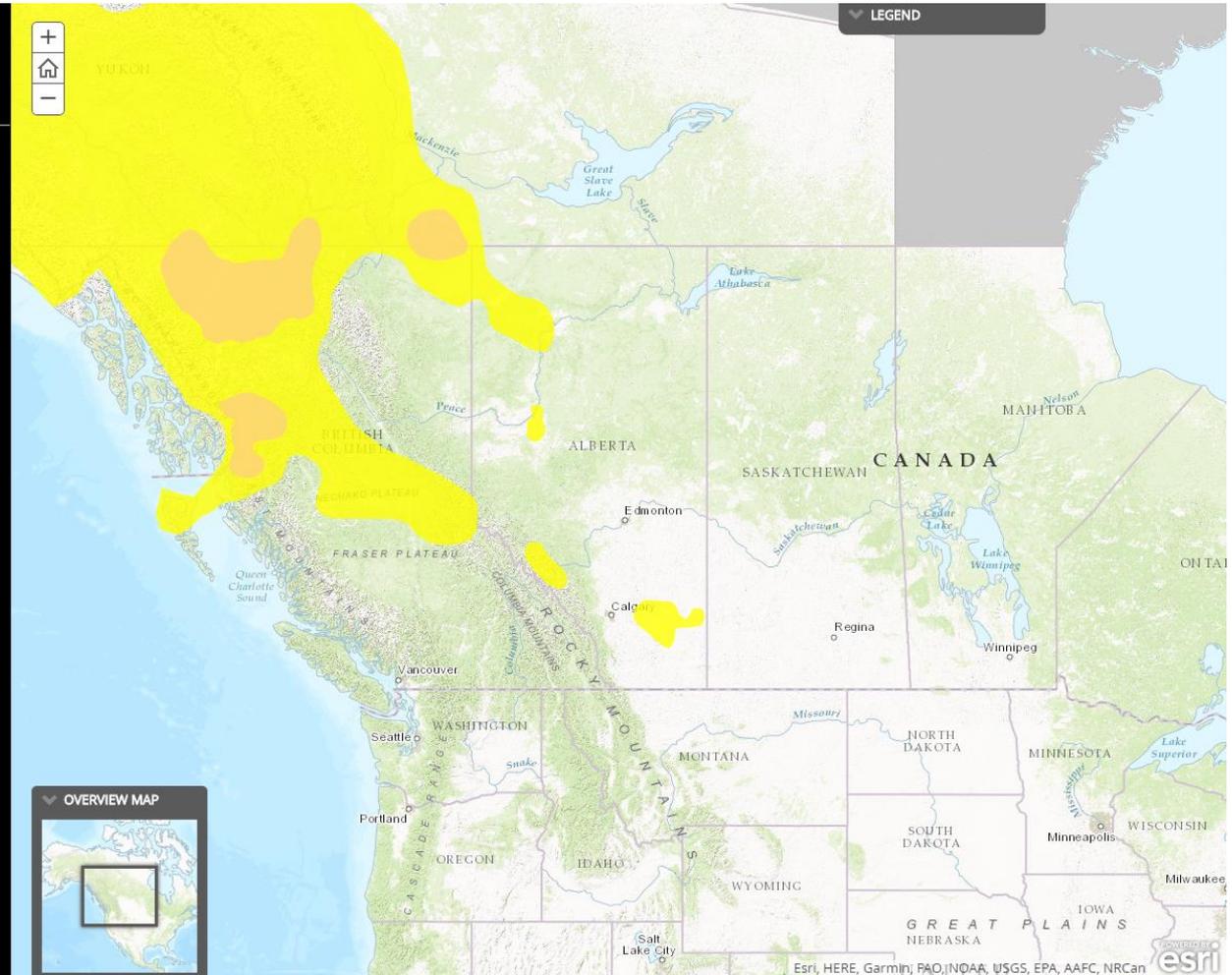
December 2016 Drought Assessment

Western Conditions

Drought conditions in British Columbia remained generally unchanged in December. Areas of concern were confined to the northern half of the province.

The **Severe Drought (D2)** pocket north of Prince Rupert was removed due to improved streamflow, although a pocket of long-term **Moderate Drought (D1)** lingers in this region. Snow pillow data indicated that northwestern B.C. had received record low snow in the month of December; hence the D1 pocket along the southern border of Yukon Territory also persisted. Satellite and radar derived data suggested continued dryness in northeastern B.C.; thus, a **Moderate Drought (D1)** pocket was added.

The western Prairie region had an abnormally dry couple months; however this did not result in the development of any drought concerns. An **Abnormally Dry** pocket increased slightly in Southern Alberta, representing precipitation deficits over the fall and early winter period. The **Abnormally Dry** regions in northwestern Alberta persisted due to long term precipitation deficit in this area. Satellite and radar derived data indicated dryness around Peace River and between Jasper and Banff; thus two additional **D0** pockets developed in these areas. Eastern Saskatchewan and southern Manitoba received above normal precipitation in December which added to spring flood risks, as their soils remained saturated from a wet summer and early fall.



Page 3 – Central

Français

December 2016 Drought Assessment

Central Conditions

Portions of the Central region of Canada received much-needed precipitation this month; however drought in southern Ontario persisted. All **Severe Drought (D2)** concerns in this region were alleviated, but a large **Moderate Drought (D1)** region persisted over the southern part of the province due to long-term precipitation deficit and unchanged soil moisture levels. Southern Ontario had a very dry month and **Abnormally Dry** conditions have returned to portions that we previously removed from the assessment.

The province of Québec benefitted from the increased precipitation in December. The long-term moderate drought conditions in and around Sherbrooke improved significantly. Northern Québec also saw some improvement, and the **Abnormally Dry (D0)** pocket in this region was reduced.

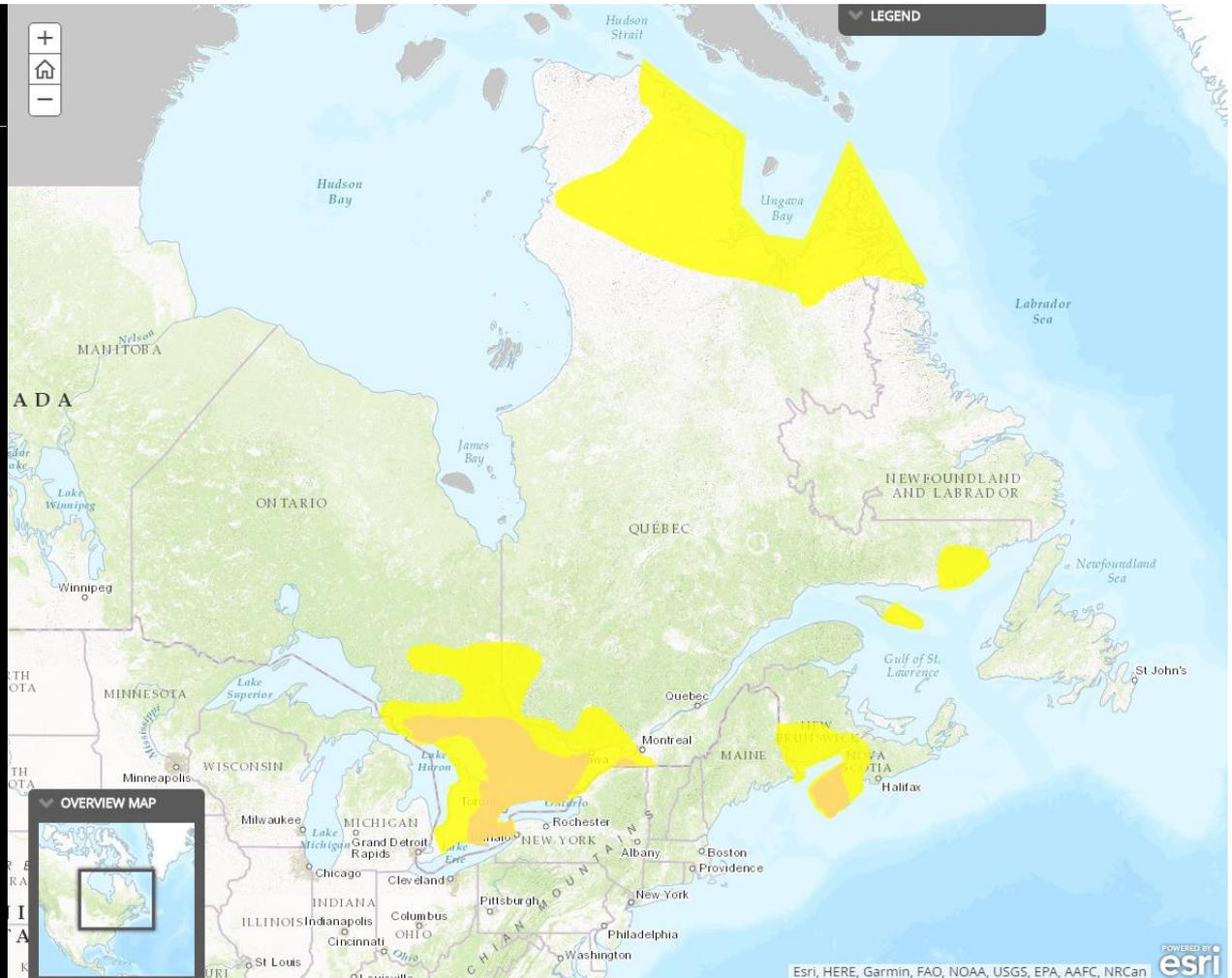
Legend

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought
- Drought Not Analyzed

[map default]

Atlantic Conditions

Above average precipitation throughout December and exceptional streamflow led to improved drought



Page 4 - Atlantic

Français

December 2016 Drought Assessment

Atlantic Conditions

Above average precipitation throughout December and exceptional streamflow led to improved drought conditions across Atlantic Canada. All drought concerns were alleviated, with the exception of a small lingering long-term Moderate Drought (D1) pocket in southern Nova Scotia. **Abnormally Dry (D0)** conditions in New Brunswick improved, and were restricted to the southern half of the province.

Legend

- D0 - Abnormally Dry**
- D1 - Moderate Drought**
- D2 - Severe Drought**
- D3 - Extreme Drought**
- D4 - Exceptional Drought**
- Drought Not Analyzed

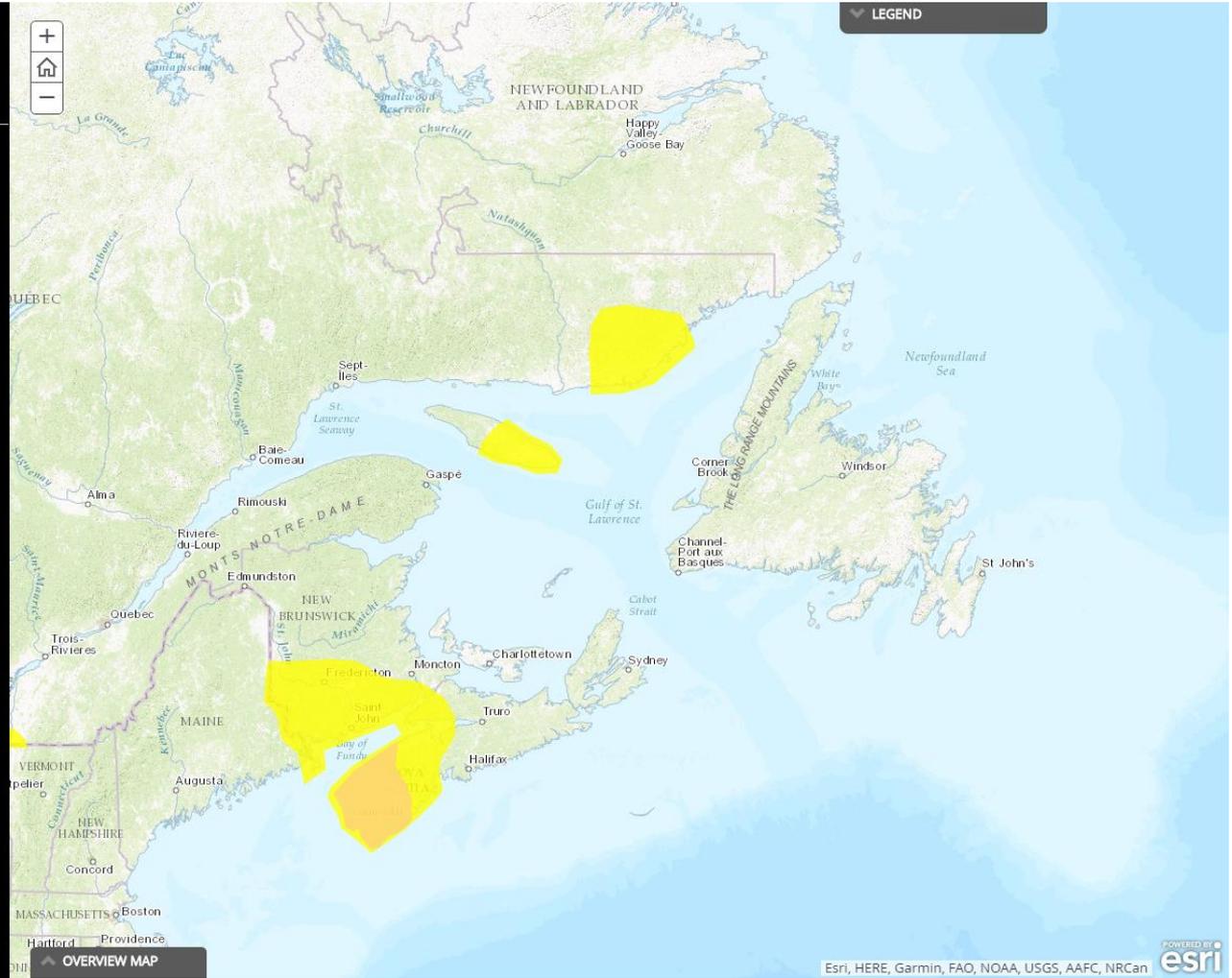
[map default]

Northern Conditions

Conditions in the northern region remained relatively unchanged throughout December. Dryness persisted across much of Yukon Territory and southwestern Northwest Territories, with many areas experiencing less than 50 per cent of the fourteen-year average precipitation. Due to this, some pockets along the northern border of British Columbia degraded to Moderate Drought (D1).

Legend

- D0 - Abnormally Dry**



Wind

Insects

Hurricanes

Drought

Disease

Humidity

Wildfires

Thunderstorms

Heat Waves

FLOOD

Lightning

Tornadoes

Excess Moisture

Frost

Snow

Hail