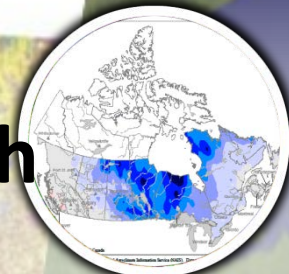




Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

Agroclimate Geomatics & Earth Observation



Climate Extremes Related Activities: AAFC's Agroclimate, Geomatics and Earth Observation (ACGEO) Division

Presentation to the GWF Climate Extremes Project Meeting
March 26, 2019

Allan Howard

Associate Director

Agroclimate, Geomatics and Earth Observation

Science and Technology Branch

March, 2019

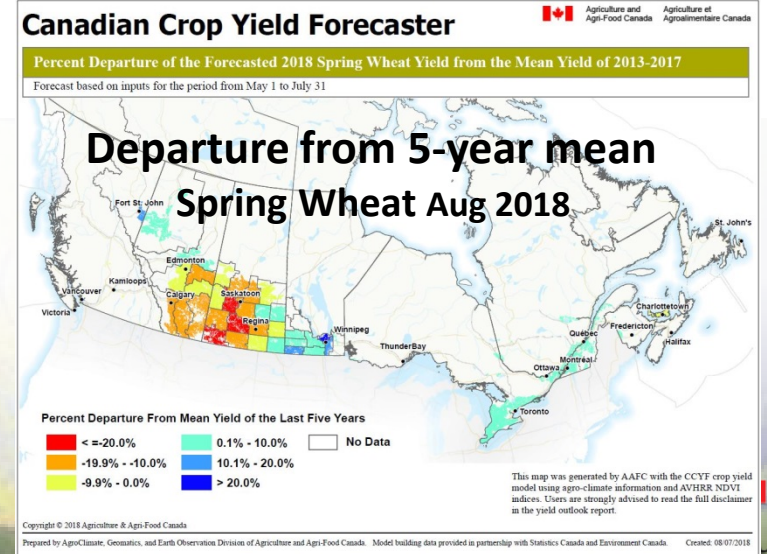
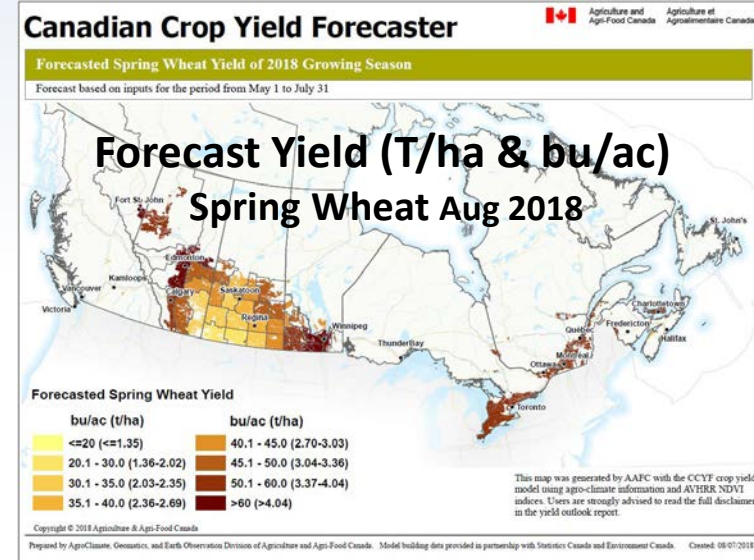
Canada

Examples of ACGEO's Operational Systems

Canadian Crop Yield Forecaster

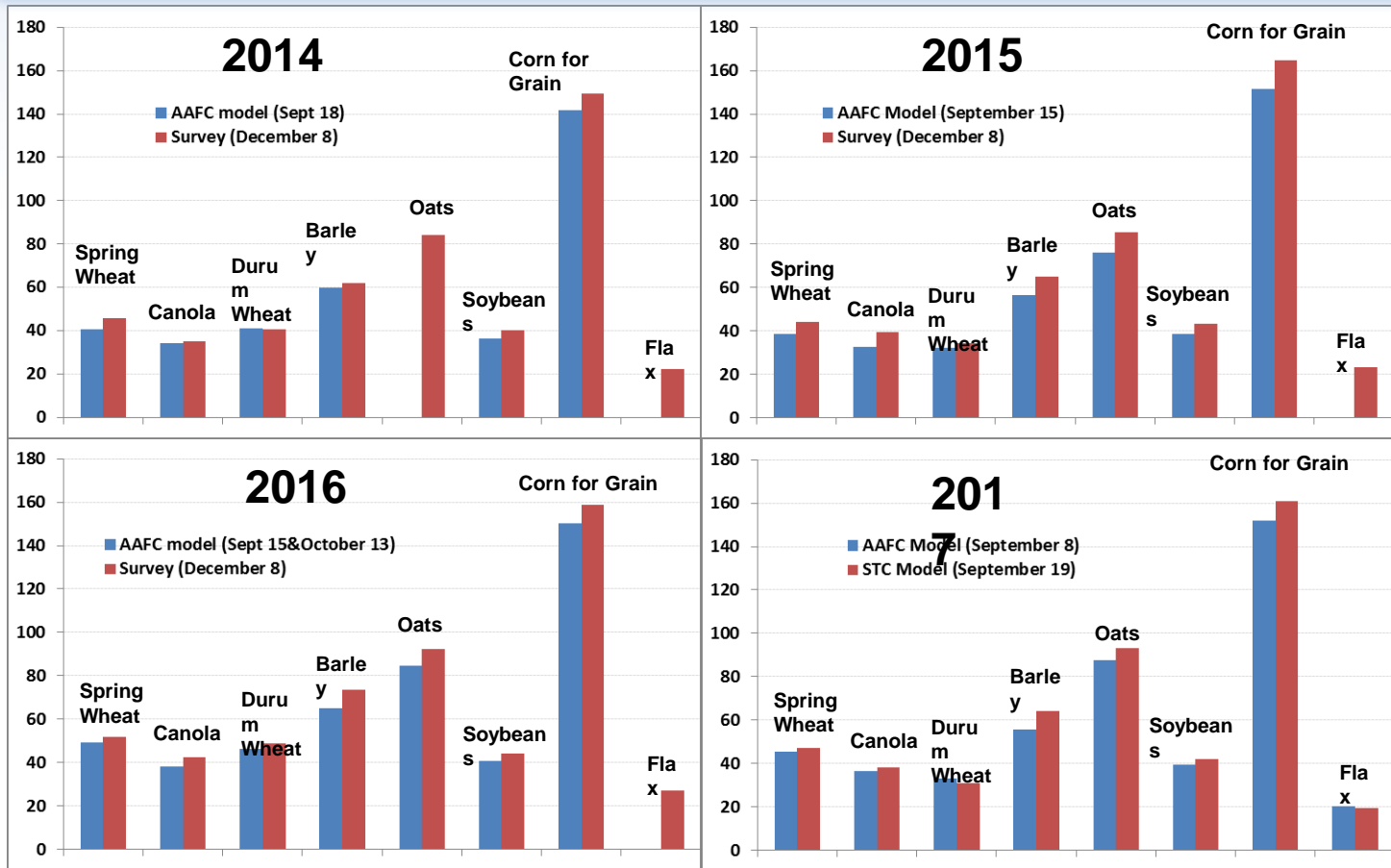
- **Model-based system forecasts regional field crop yields at monthly intervals.**
 - Modelled crops are spring and durum wheat, canola, barley, corn (for grain), soybeans, oats, flaxseed and lentils.
- **The AAFC model provides a forecast in mid-July with > 90% accuracy of September yields.**
- **Model is now used by Statistics Canada to replace the September Farm Survey.**
- **Key priorities that it can help address:**
 - Threats to the value chain: e.g. grain backlog risk
 - To inform producers and give them more lead time to make marketing decisions, improving sector health.
 - Through a healthy sector, increasing agricultural productivity; fostering innovation

Maps for each of 9 crops



Comparison of yield estimates since 2014

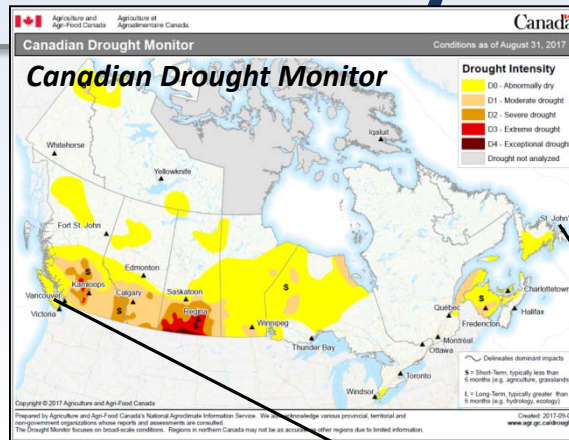
AAFC Model (Sep. & Oct.) and STC Survey (Dec.). Yields are in Bu/Ac



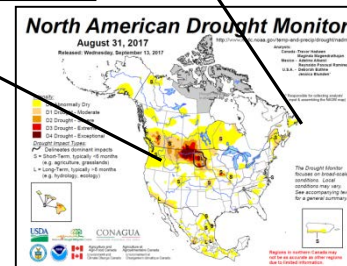
Examples of ACGEO's Operational Systems

National AgroClimate Monitoring

- ACGEO is the recognized author for drought, through Canadian Drought Monitor (CDM)
- CDM provides data for designation of areas eligible for Livestock Tax Deferral for drought
- ACGEO also provides recommendations for eligibility for excess moisture
- Author of the Climate-Related Production Risk Report



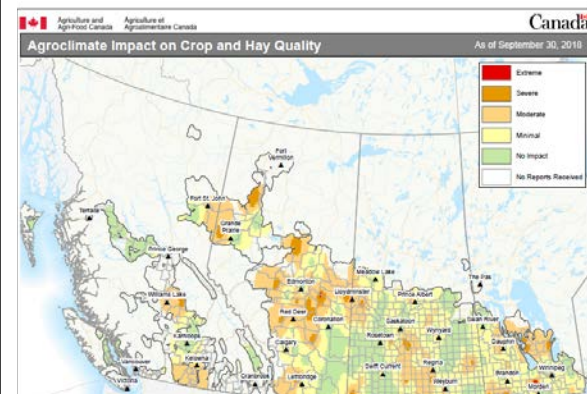
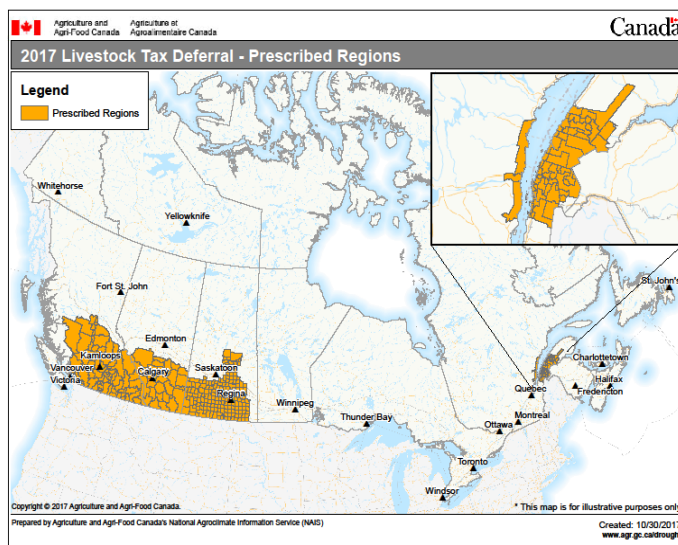
Drought Watch,
www.agr.gc.ca/drought.



National Production Risk Report Dashboard

Two week forecast	BC	AB	SK	MB	ON	QC
September 15 2015	improving	stable	stable	worsening	stable	stable
September 1, 2015	drought, wildfire	drought, excess moisture	excess moisture	dry, frost		
August 18, 2015	drought	drought	drought			excess moisture
August 5, 2015	drought	drought	drought		excess moisture	
July 21, 2015	drought, heat	drought, heat	drought		excess moisture	
July 7, 2015	drought	drought	drought	drought	excess moisture	

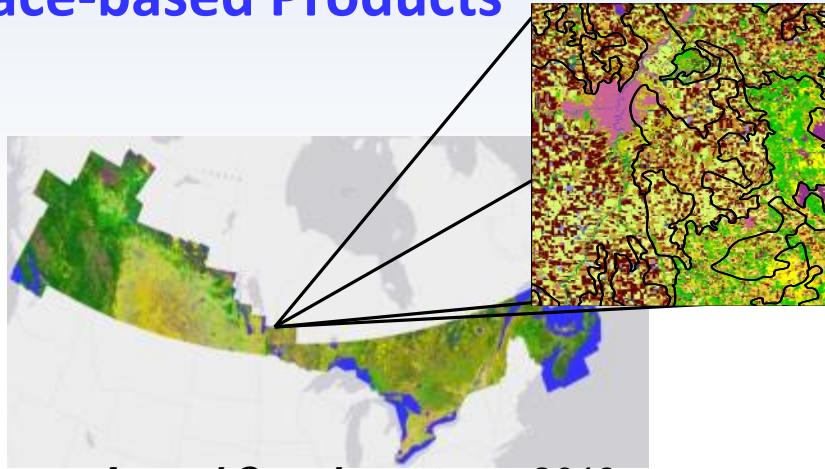
Livestock Tax Deferral Prescribed Areas;



Crowd-Sourced Crop Quality Assessment

Examples of ACGEO's Operational Systems

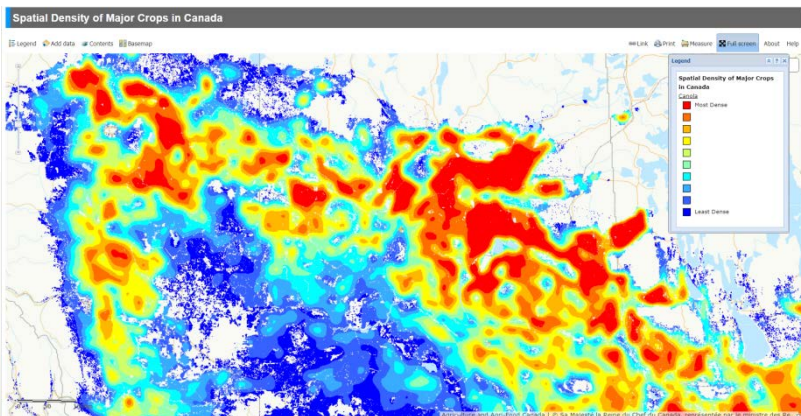
Space-based Products



Annual Crop Inventory - 2016

Annual Crop Inventory (Since 2009)

- High resolution; information at 30m resolution on crop types grown in Canada.
- Allows annual land use changes to be tracked between important cover types.
- Available on Open Data; the archive is used to map growing zones of Canada's major crops.
- Can track movement of cropping trends (e.g. soybean expansion) and most probable areas for different crop types.
- Priority met: Support Canadian production systems by gaining a better understanding of land suitability and health.

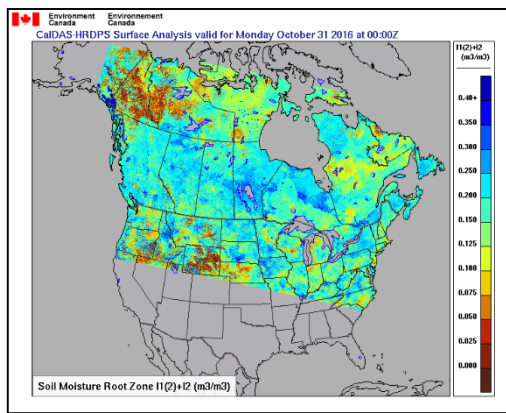


Spatial Density of Canola on the Prairies

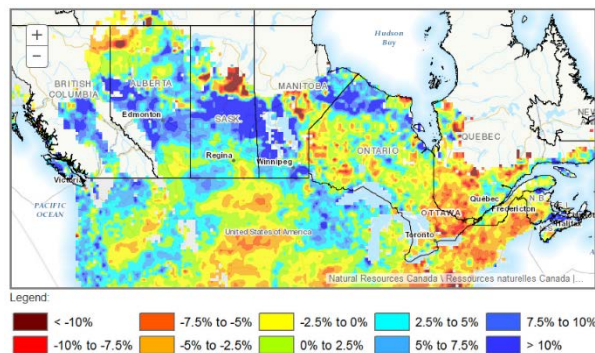
R & D Projects: LEAFNet

AAFC and ECCC Co-developing enhanced information for monitoring and early warning of climate extremes. [Catherine Champagne; AAFC Lead](#)

The project will leverage AAFC's expertise in soil moisture measurement with modelling expertise within the Meteorological Service of Canada (MSC) of Environment and Climate Change Canada (ECCC).



ECCC CALDAS Modeled Root-zone Soil Moisture + 30 Year Reference Data Set



AAFC Satellite Surface Soil Moisture Anomaly Indicator

Canadian Crop Yield Forecast
2018 Modelled Yield Outlook for Spring Wheat, Durum Wheat, Canola, Barley, Oats, Corn for Grain, Soybeans, Flaxseed and Lentils

Last day of climate data: **July 31, 2018**
Last week of NDVI data: **July 23 to July 29, 2018 (Week 30)**
Date of report release: **August 10, 2018**
Report serial number: **NAIS-CCYF-AUGUST-2018**

AgroClimate, Geomatics, and Earth Observation Division (ACGEO)
Science and Technology Branch (STB)

**AAFC Crop Yield Forecast
AAFC Drought Watch Information**

- Objective: to harmonize modelling and data assimilation work between ECCC and AAFC to co-develop soil moisture data sets for monitoring water related extremes impacting agriculture; 3 year joint work plan approved in 2016.
- The project is now integrated into Activity 3.6 of the Federal Targeted Climate Science Strategy with new funding to support continued development of shared data sets

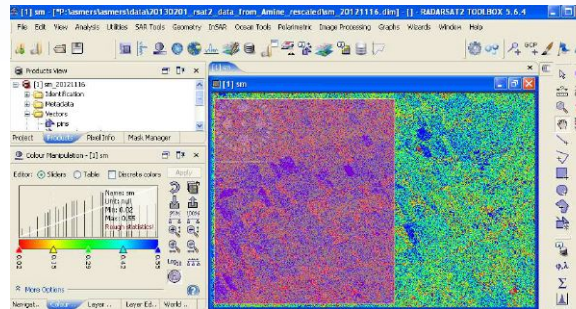
R & D Projects: Monitor risk due to soil moisture extremes

Heather McNairn; AAFC Lead

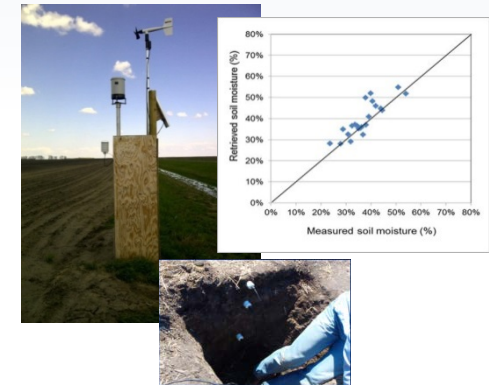
Data from Radar Satellites



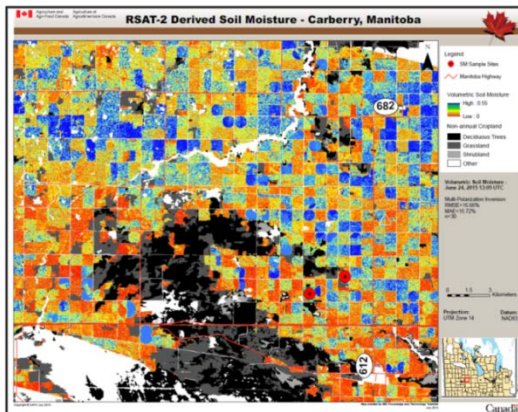
Processing Tools



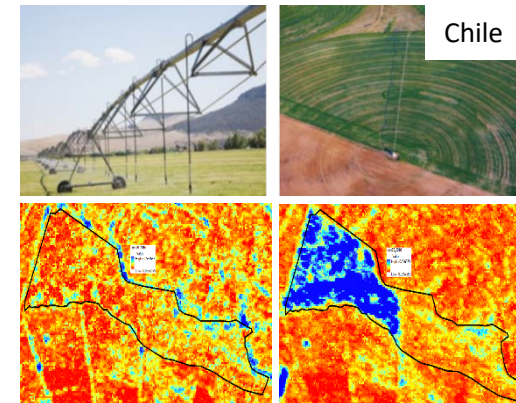
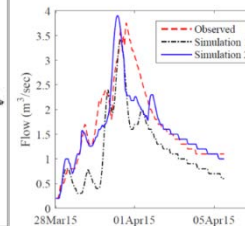
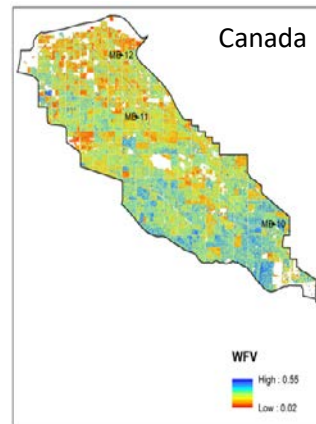
Validation and Calibration



Maps of surface soil moisture



Down stream applications: integrate satellite-based soil moisture in hydrological models and irrigation monitoring



R & D Projects: Agrometeorological Extremes

Aston Chipanshi AAFC Lead

Collaborative work between AAFC and ECCC

- Identified 12 Extreme Weather indices for Agriculture
- Intended to be the basis for operational maps showing short term forecast of extreme weather
- The indices are:
 - **Cool Wave Days:**
 - **Heat Wave Days:**
 - **Frost Free Days:**
 - **Ice Freeze Days:**
 - **Effective Growing Degree Days – cool season crops**
 - **Effective Growing Degree Days – warm season crops**
 - **Greatest 10-day precipitation**
 - **Greatest daily precipitation**
 - **Total precipitation**
 - **Number of strong wind days**
 - **Maximum daily wind speed**
 - **Number of Drying Days**



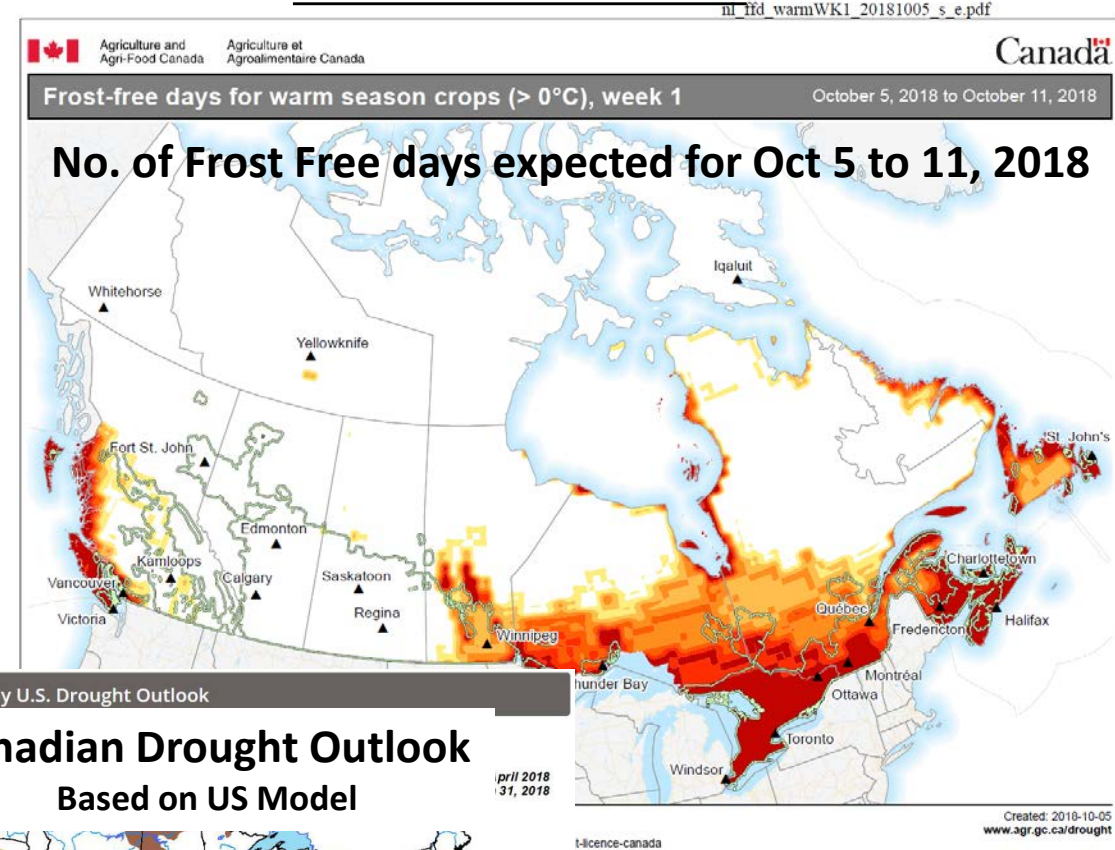
R&D Projects: New ACGEO Products

Patrick Cherneski; AAFC Lead

Forecasting Products

- By November 2018 ACGEO will have up to 30-day forecast information for extreme weather for agriculture.
- Over the next 3 years ACGEO and ECCC will develop an outlook map for Canada based on the US product.
- Will be considered a key product for ECCC's new Canadian Centre for Climate Services.

Extreme Weather Indices



R&D Projects: New ACGEO Products

COMING
SOON

Tim Martin; AAFC Lead

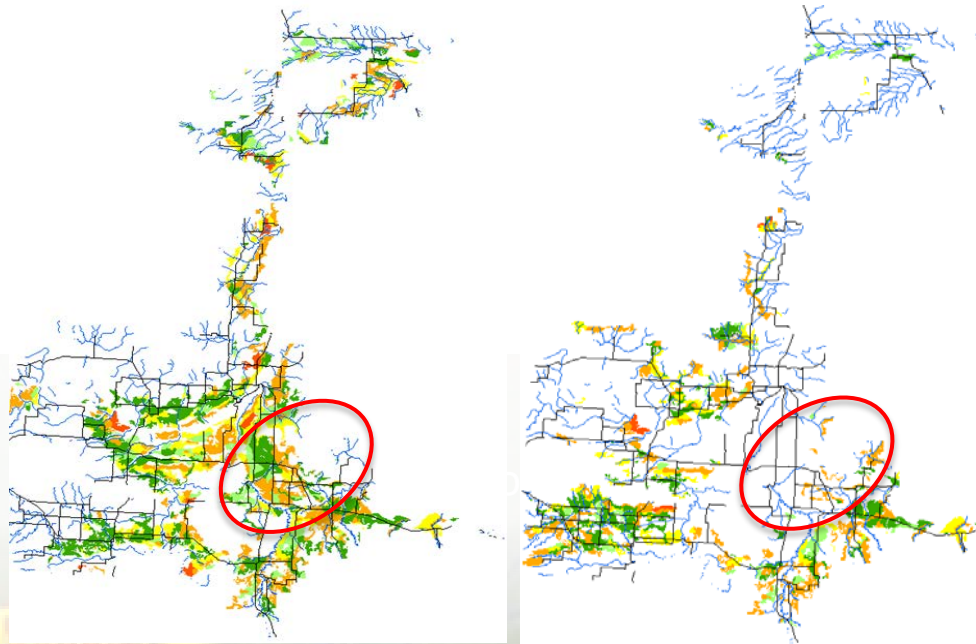
Land Suitability Rating System (LSRS) and Future Land Suitability

- Assessing agricultural land for crop suitability based on soil and climate data
- Allows the use of climate change scenario data

Proof of Concept: Peace Region Analysis: Spring Seeded Small Grains

Global Circulation Model = CanESM2

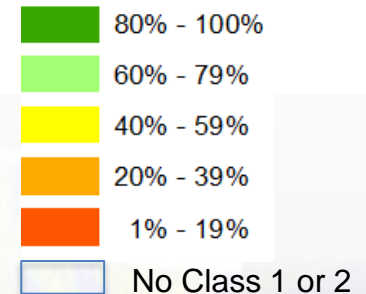
Representative Concentration Pathway = 4.5



1981-2010

2041-2070

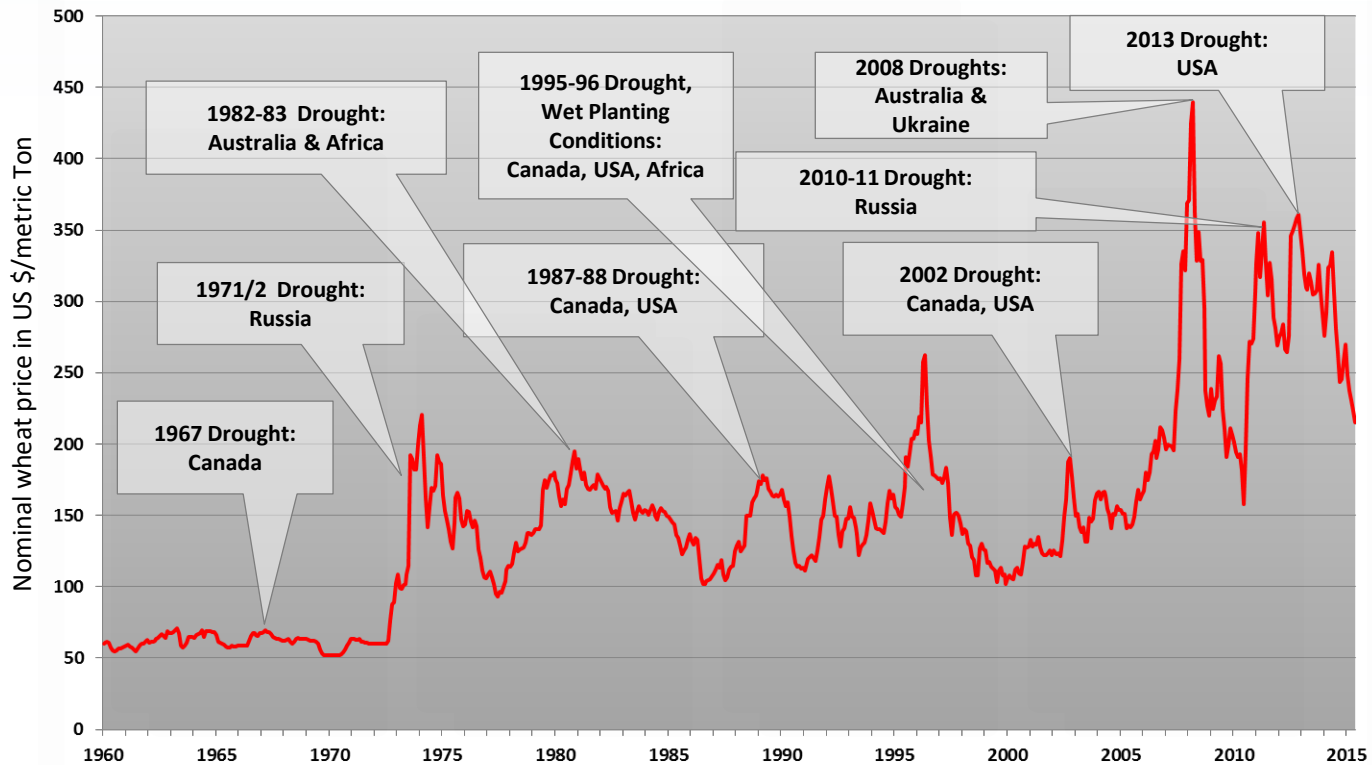
Percentage of total area in soil polygon rated Class 2 or Class 1 (there may 0 hectares rated Class 1)



Drought and Food Security

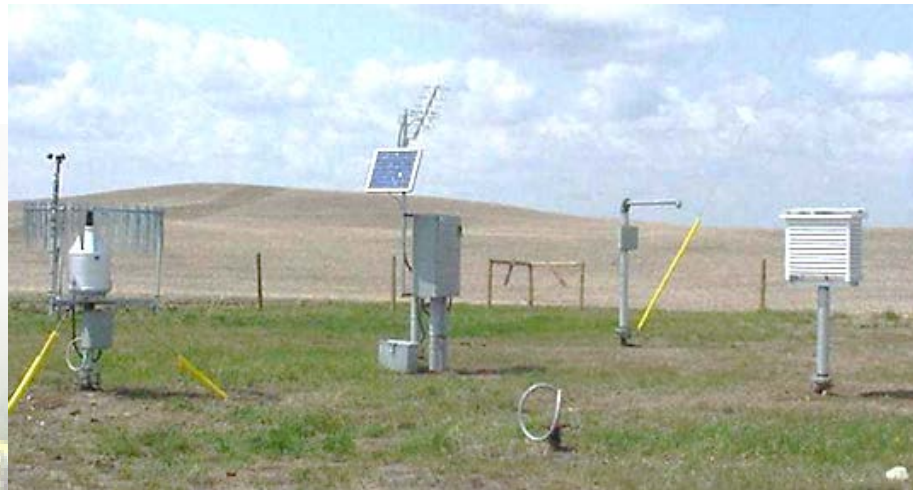
Monthly Wheat Prices 1960-2015 (\$/Metric Ton)

Source: World Bank



Some Thoughts

- **Can we find new indicators to help us anticipate extremes?**
 - E.g. large scale changes in humidity; changes in teleconnections, changes in the jet stream behavior or atmospheric blocking patterns?
- **Is the nature of drought changing?**
 - E.g. rapid onset droughts.
- **What new data will we need?**
 - E.g. upper atmosphere measurements
- **How adequate will our existing data be?**
 - E.g. rust-out

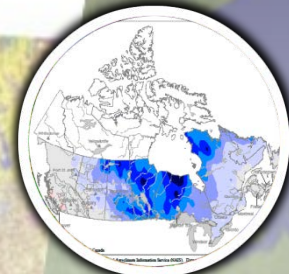




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Thank You!

Allan Howard; Associate Director, ACGEO
allan.howard@canada.ca