Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Climate Service for Agriculture:
The National Agroclimate Information Service

Allan Howard

Manager, National Agroclimate Information Service,

Agriculture Agri-Food Canada,

Regina Saskatchewan

August, 2011

Canada

Vulnerability of Agriculture in Canada

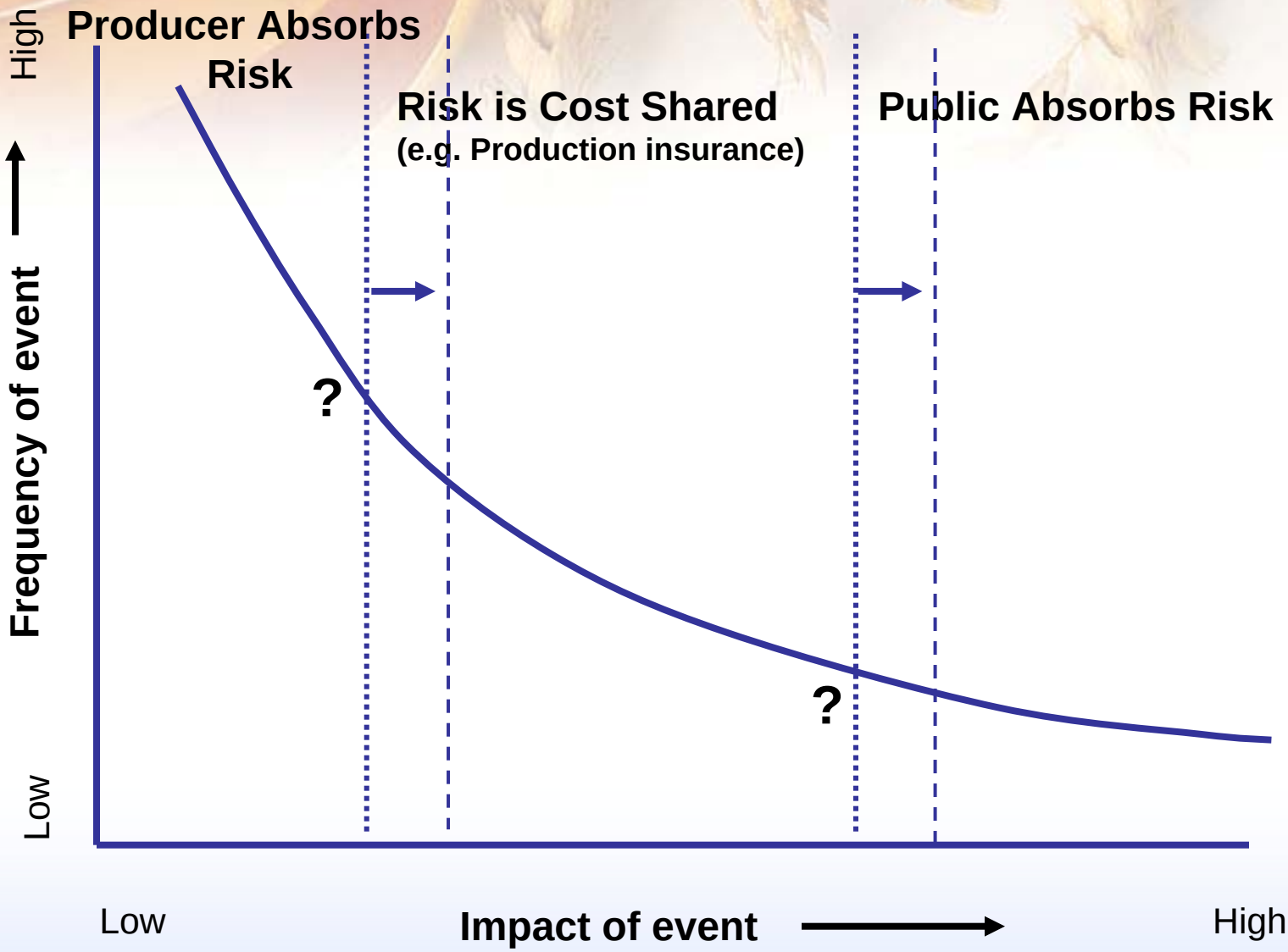
Cost of climate extremes

- 2010: July: $311M paid for flooded land
- 2010: June $67 paid for drought relief
- 2006- 2009: income tax deferral for livestock sales forced by drought or excess moisture
- 2006: $110M paid for excess wetness
- 2001-02: cost of drought was $5.8B to Canada's GDP

What is the impact on Canada's ability to advance the industry?

Better understanding of climate is essential to build resiliency to extremes.

Disaster Management in Agriculture



Agriculture Adaptation to Climate

- Improved monitoring and prediction
  - Prediction is a work in progress
  - Better understanding of the extent location and severity of impacts allow better responsiveness to disasters
    - Data network is sparse;
    - New monitoring stations have no historical record; without historical context, data loses value


Central Butte, SK July 2010

- Modeling can provide some predictive capacity
  - Potential impact of drought on annual crop yield understood; less so on pastures; agricultural water resources and ecosystems
  - Impact of floods on production is more difficult to predict
  - Can identify opportunities


Pincher Creek, AB June 2009

Agriculture Adaptation to Climate (cont'd)

- Long term planning is needed for adaptation
  - Intensity, duration and frequency are key factors in assessing risk of climate extreme events
  - Downscaling of climate change scenarios

- Must get the industry to understand and adapt

> *"It's darn near impossible to glean anything useful from climate forecasts".*
>
> *"I find very little in the climate change projections that's actually useful in farm management decisions"*
>
> * Kevin Hursh: Quoted from the Prince Albert *Daily Herald* Oct 13, 2010

AAFC's Agro-Climate Information Service

Monitoring (Near real time data)

Research

NAIS

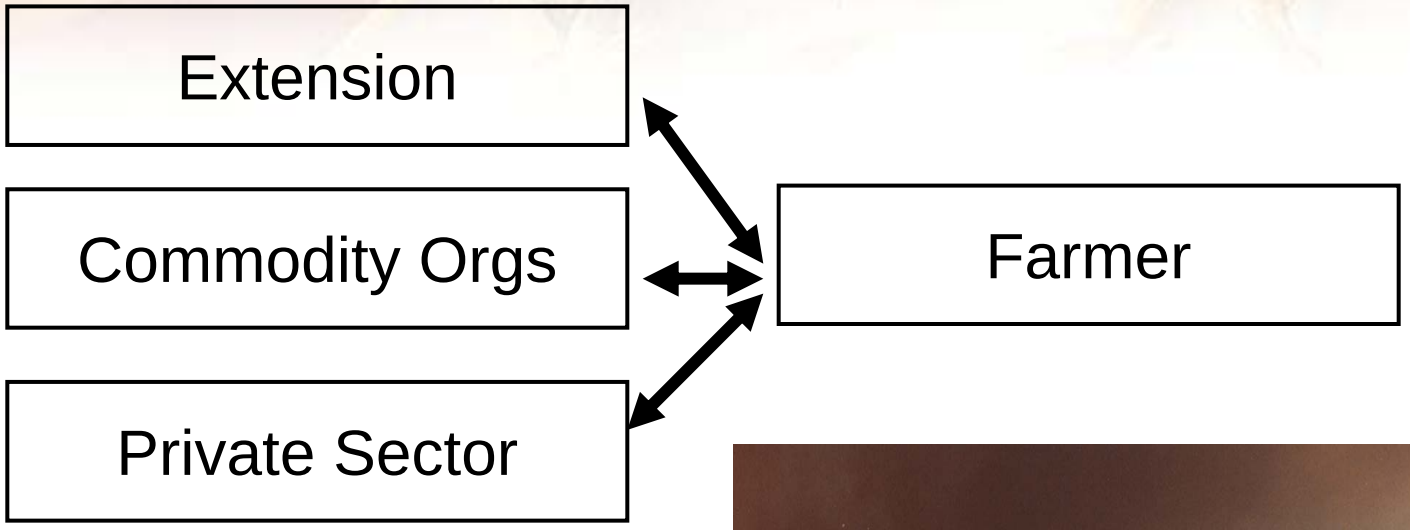
Public & Media

Policy & Disaster Support

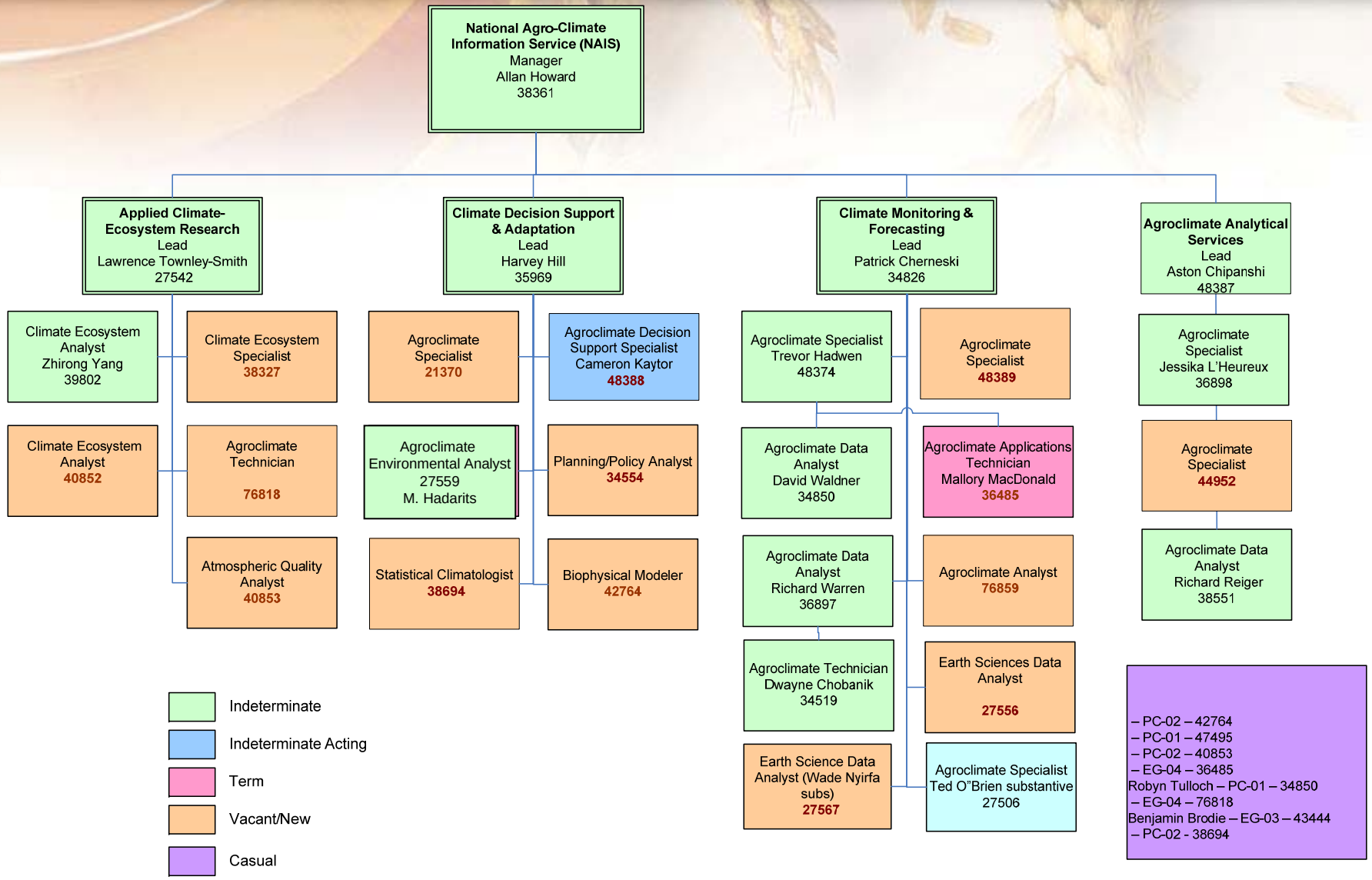
Regional Extension

Other Agencies

AAFC's Agro-Climate Information Service, cont…



NAIS: Org Structure and Staffing Strategy



Key Activities for NAIS:

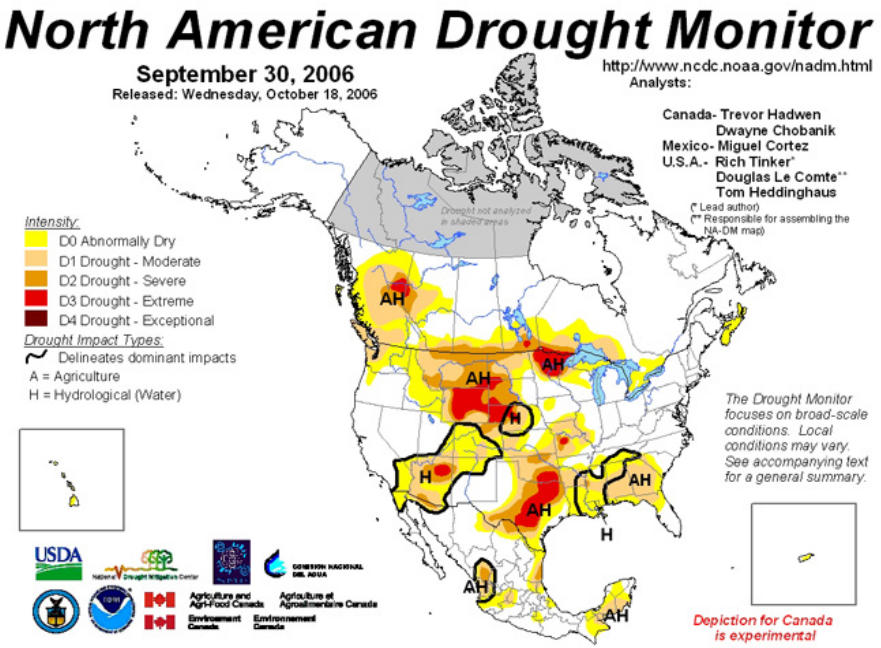
1. Assess climate related risk to the Agriculture industry
   - Timely Climate Monitoring: National & Regional Scale
     - Feeds support programs
     - Policy and Planning
     - Decision Support
2. Improve management of climate related risk
   - Yield forecasting, vulnerability of agriculture
   - Drought: Preparedness & planning
   - Vulnerability of systems to climate variability (e.g. watersheds)
3. Data acquisition, development, web applications & web based delivery
   - Help to identify probabilities, frequencies & potential changes in climate trends and extreme event patterns
   - Improved usage of remote sensing and other related information to assist in monitoring
4. Analysis to support climate change adaptation
   - Support to policy (primarily)

Key Partnerships

- Environment Canada
  - Climate data
    - Weather station operation, data storage, QA/QC, Climate research
  - Forecasting
    - A key area for development
- NOAA
  - North American Drought Monitor
  - GEO, Drought Indices, data/science exchange
- Several universities, government departments, private sector agencies
  - Various research & application projects

International Linkages

- North American Drought Monitor
  - Canadian author for drought
- GEO – CGEO projects
  - soil moisture monitoring
  - drought monitoring, indicators, definition
- WMO; CAgM
- UNCCD
- UN-CSD
  - Department contact for drought & desertification



NAIS Priority Projects for 2010 - 2012

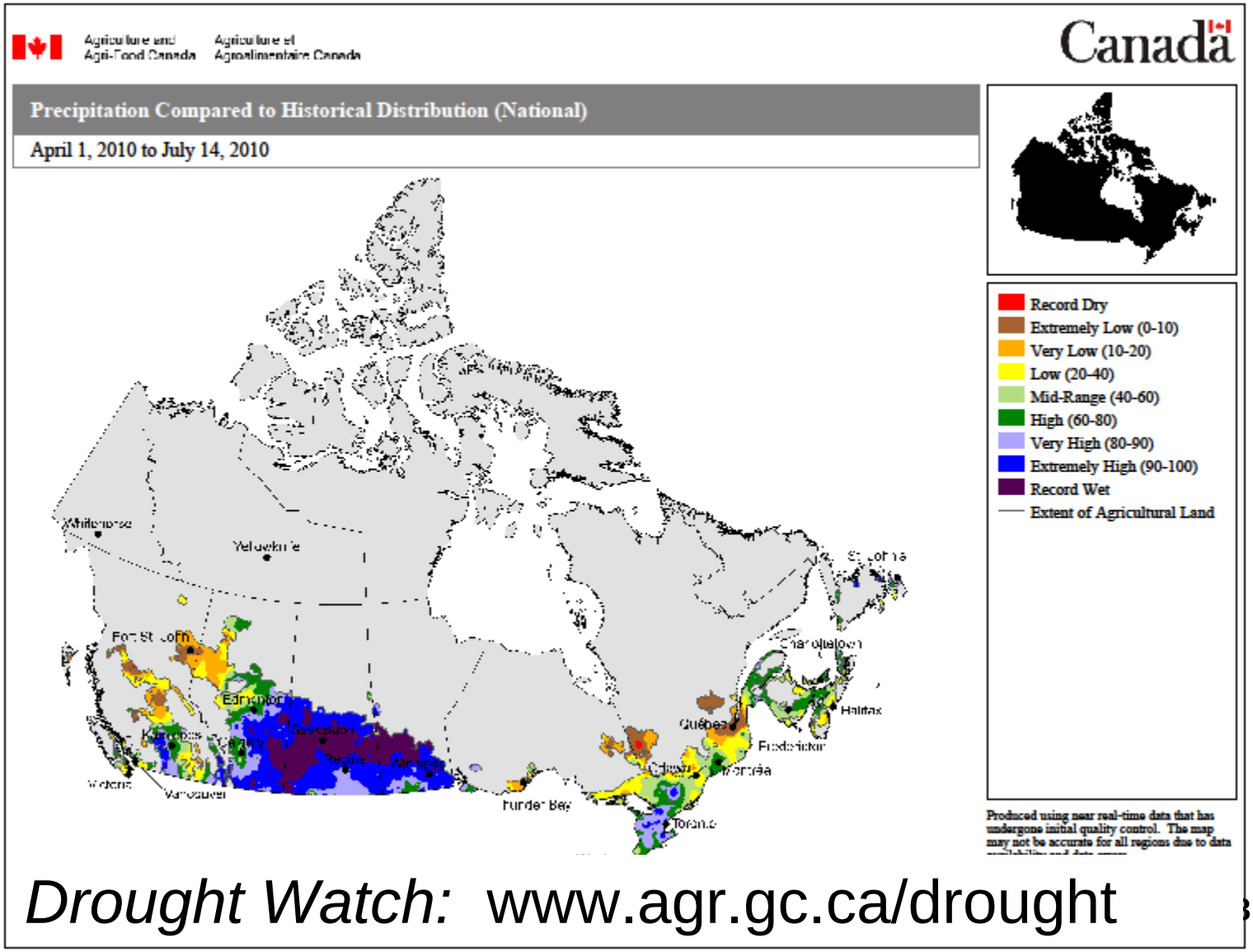
Operational

- Current condition updates
- Extent location & severity of extreme events
- Emphasis on
  - Support to disaster relief
  - Drought early warning
- “Drought Excellence”
  - Partnerships
  - International resource

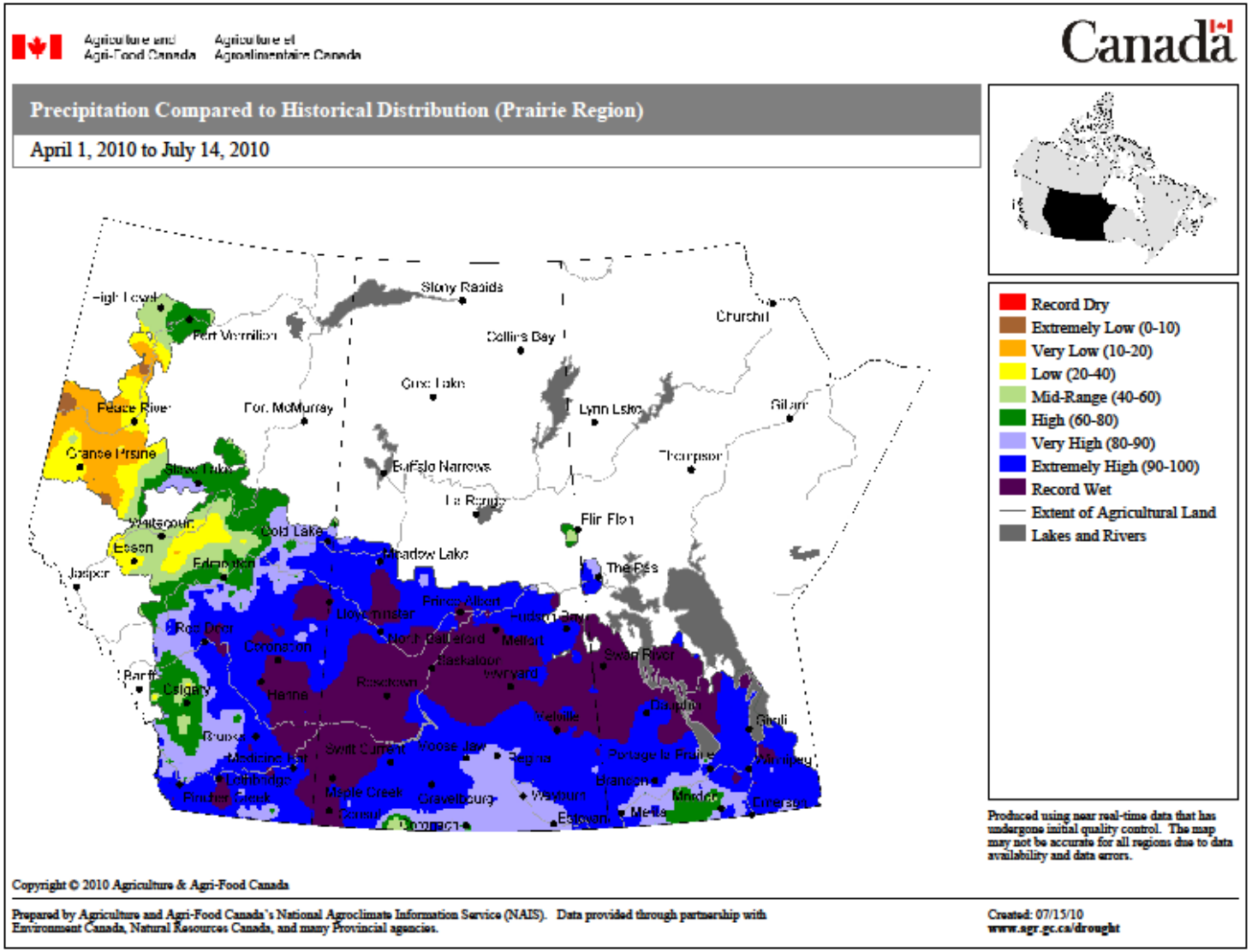
Development

- Focus on adaptation
  - Yield modeling
  - Drought preparedness & planning
  - Landscape vulnerability
- Soil moisture monitoring
- Biomass potential
- NRT Monitoring & Mapping Enhancements

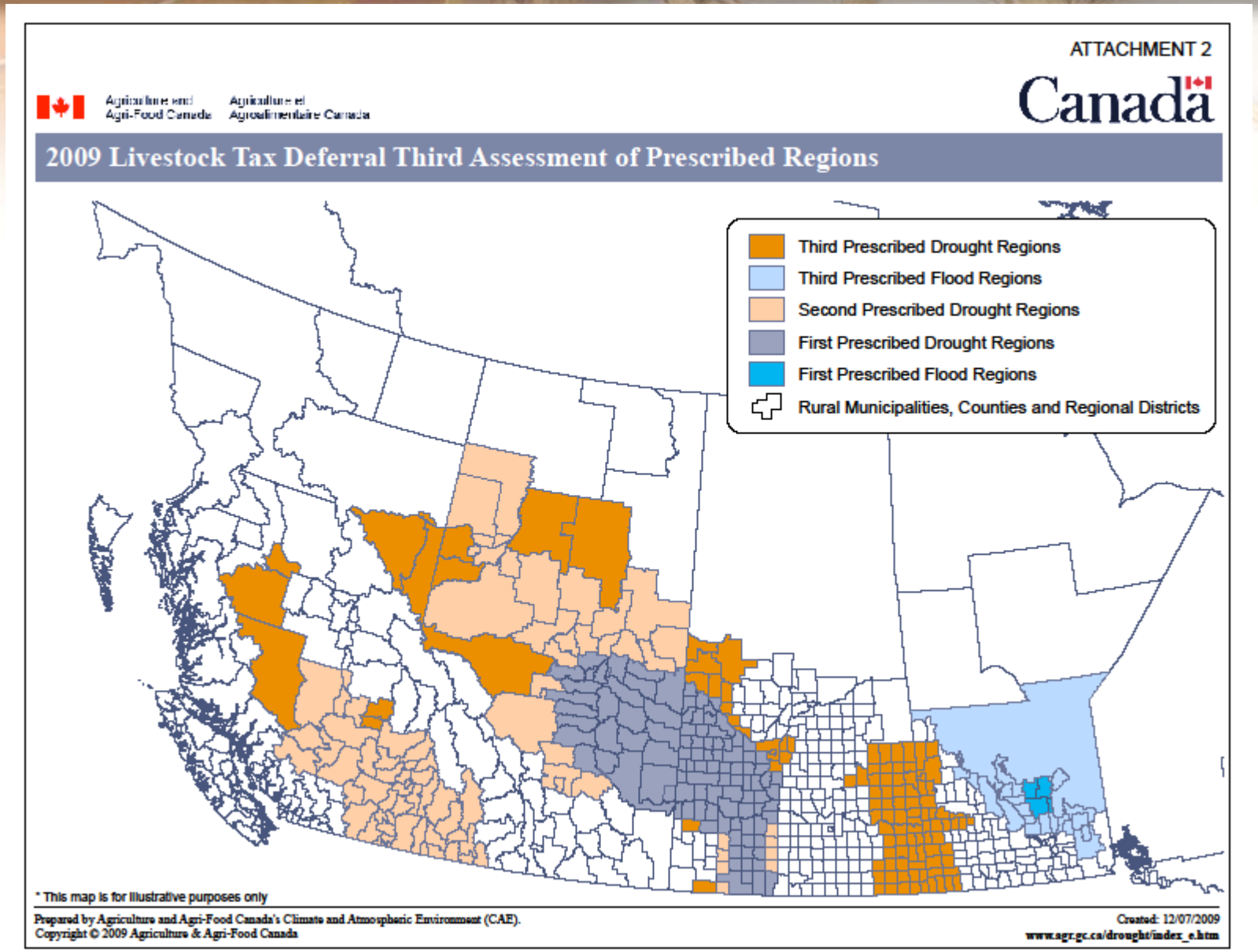
Operational Products



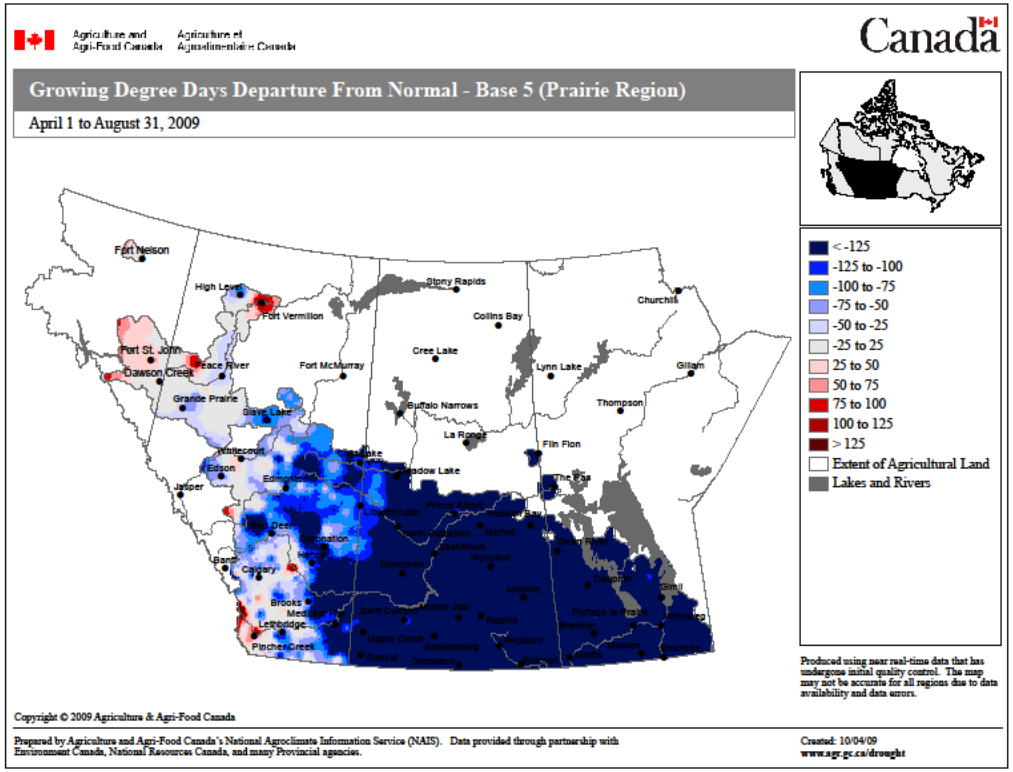
Drought Watch: www.agr.gc.ca/drought


Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
Canada
Precipitation Compared to Historical Distribution (Prairie Region)
April 1, 2010 to July 14, 2010
Stony Rapids
Churchill
Dollins Bay
Peace River
Fort McMurray
Lynn Lake
Gillam
Cranse Prairie
Buffalo Narrows
Thompson
La Ronge
Flin Flon
Cold Lake
Shadow Lake
The Pas
Jasper
Prince Albert
Lloydminster
Melfort
Swan River
Coronation
Saskatoon
Banff
Calgary
Rosetown
Hanna
Dauphin
Gimli
Swift Current
Moose Jaw
Regina
Portage la Prairie
Winnipeg
Medicine Hat
Lethbridge
Maple Creek
Gravelbourg
Weyburn
Brandon
Minnedosa
Emerson
Estevan
Record Dry
Extremely Low (0-10)
Very Low (10-20)
Low (20-40)
Mid-Range (40-60)
High (60-80)
Very High (80-90)
Extremely High (90-100)
Record Wet
Extent of Agricultural Land
Lakes and Rivers
Produced using near real-time data that has undergone initial quality control. The map may not be accurate for all regions due to data availability and data errors.
Copyright © 2010 Agriculture & Agri-Food Canada
Prepared by Agriculture and Agri-Food Canada's National Agroclimate Information Service (NAIS). Data provided through partnership with Environment Canada, Natural Resources Canada, and many Provincial agencies.
Created: 07/15/10
www.agr.gc.ca/drought

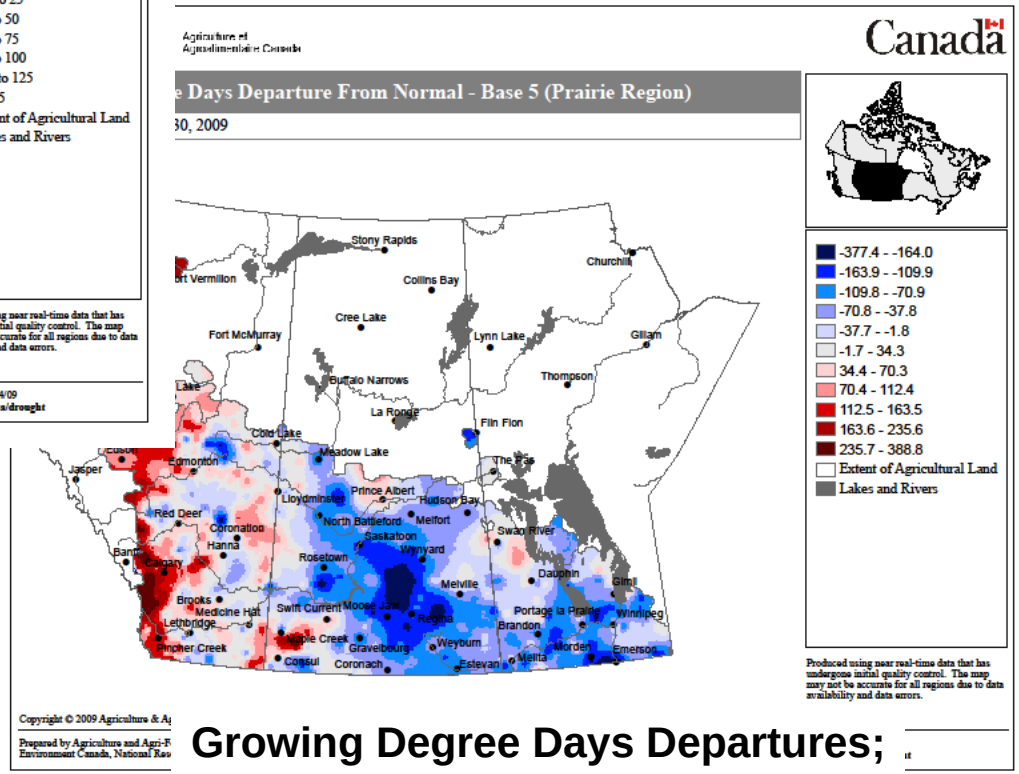
2009 Prescribed Regions for Tax Deferral



Growing Conditions

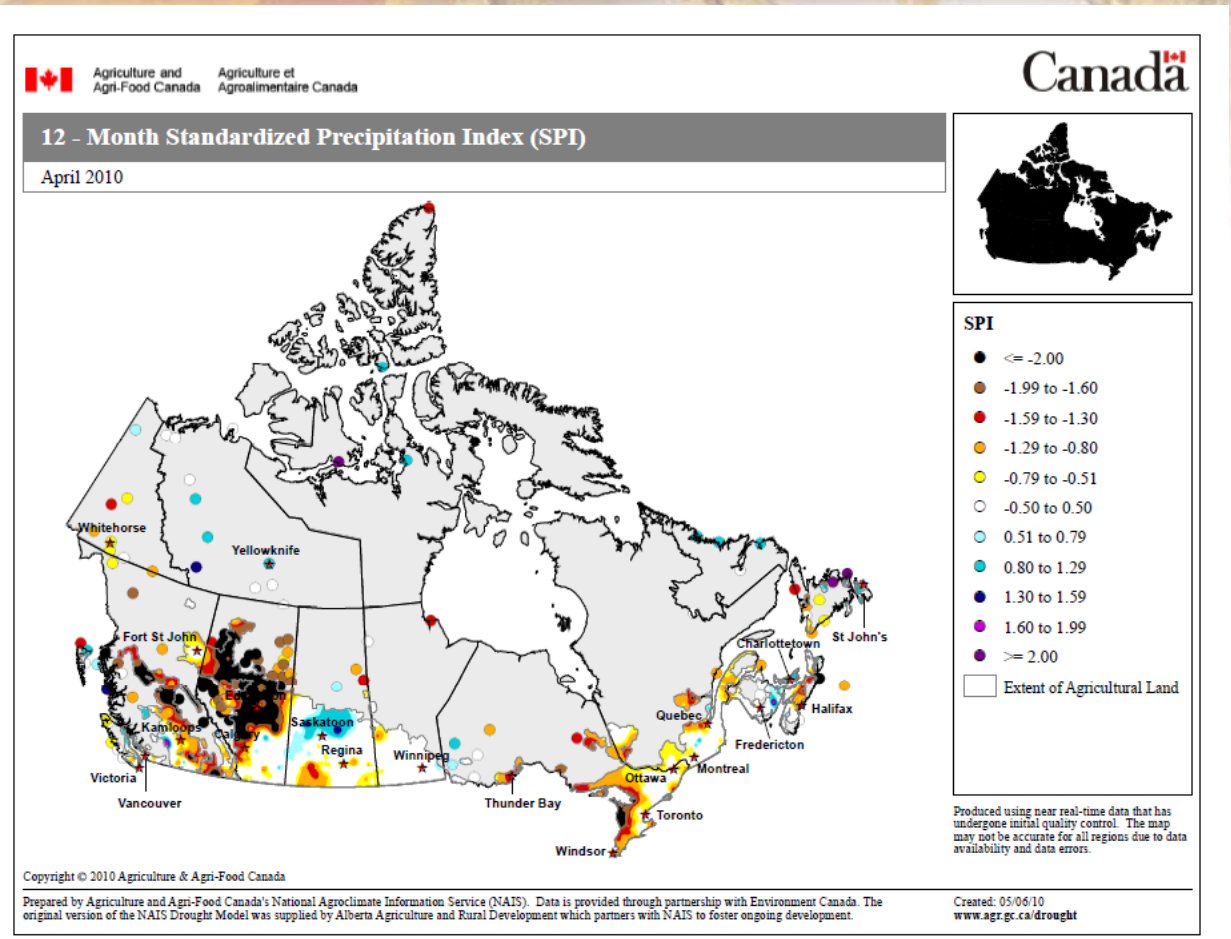


Growing Degree Days Departures; April – August 2009



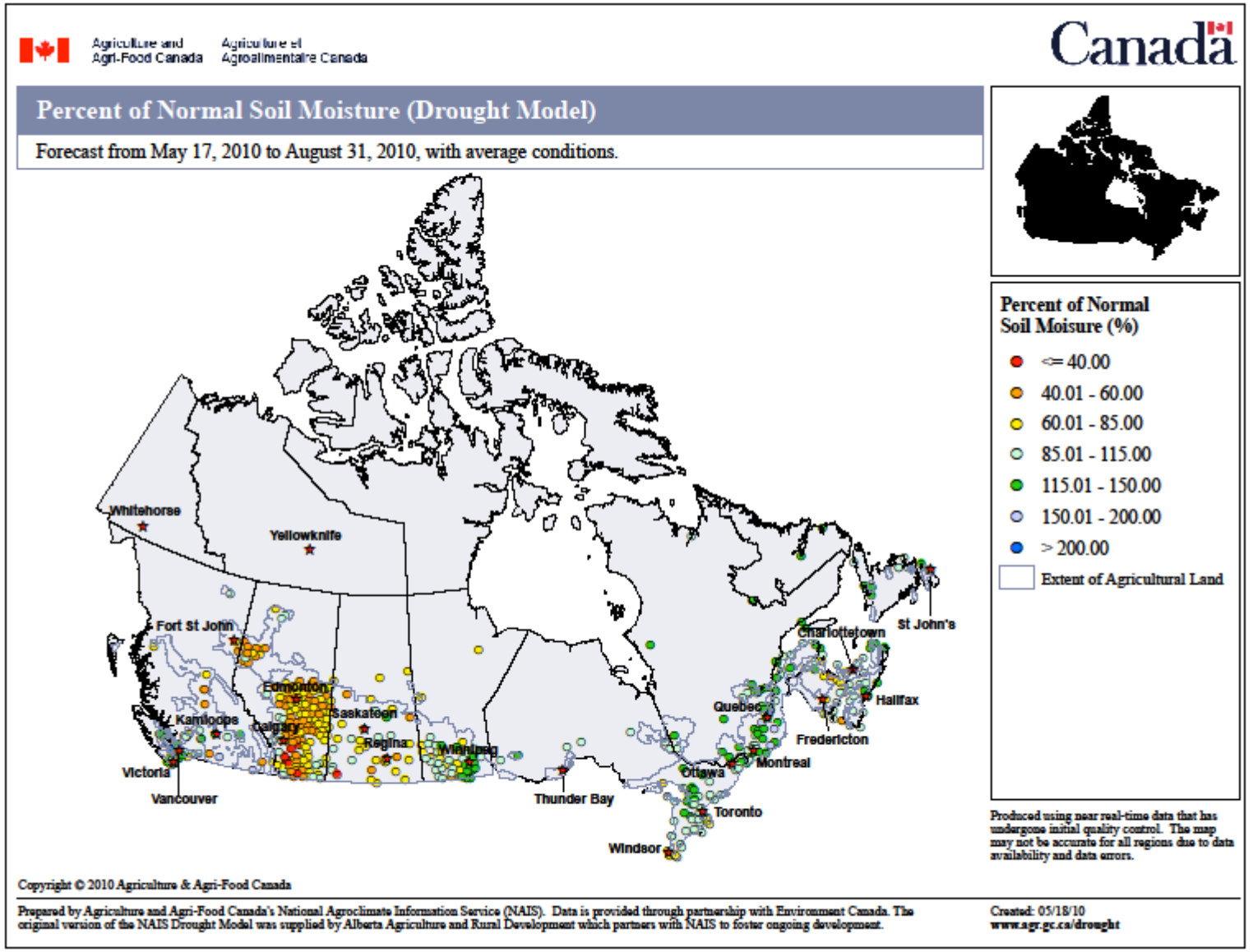
Growing Degree Days Departures; April – September 2009

12 Month Standardized Precipitation Index April 2010

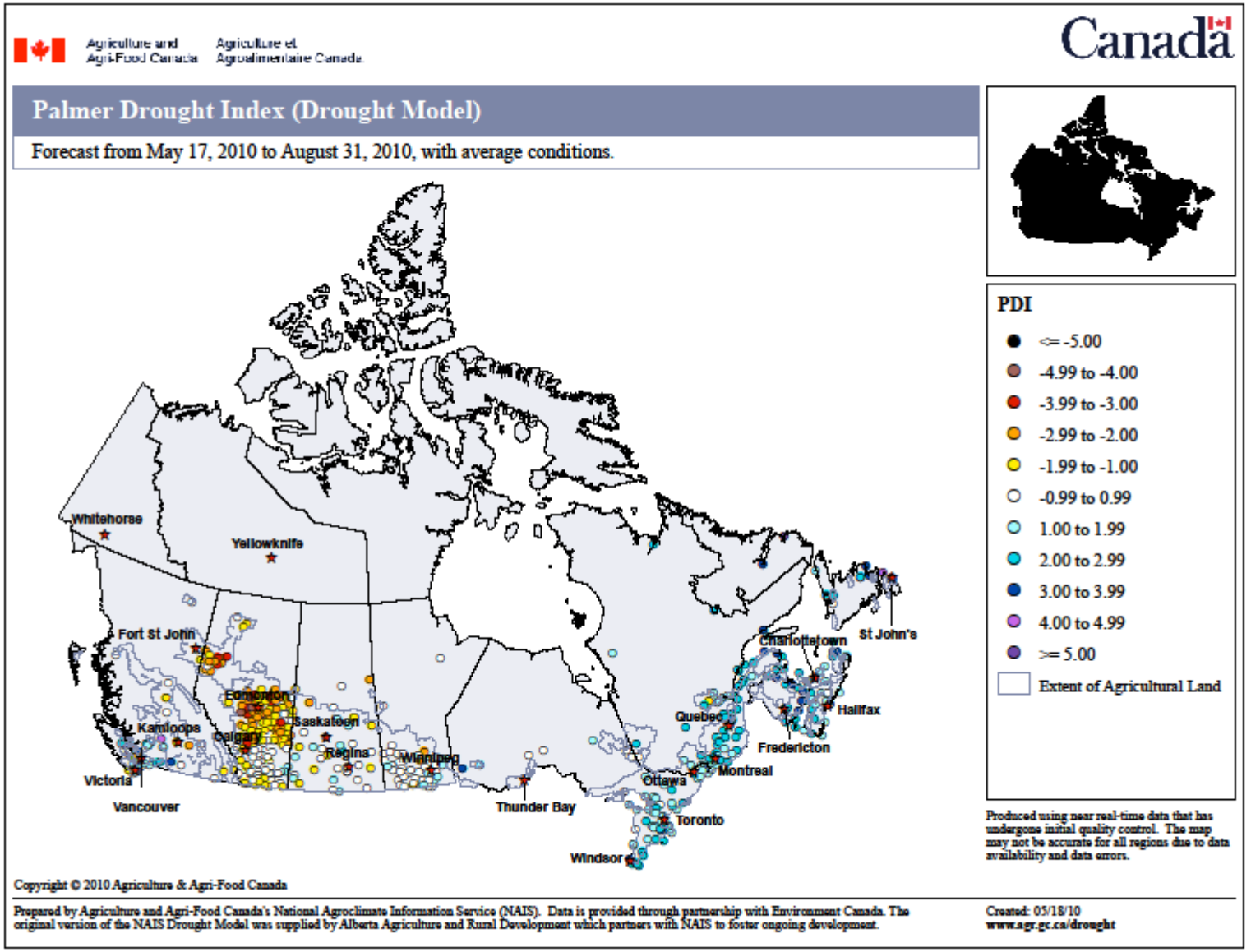


- Significant precipitation deficits of less than -2.00 persist across northern and central Alberta, and southwest Ontario.

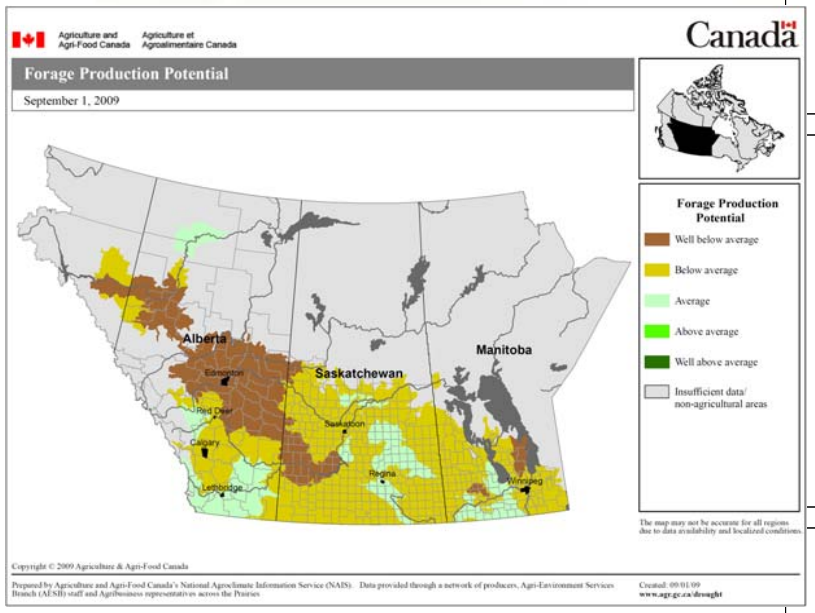
Modeled soil moisture to end of summer (assuming average P & T)

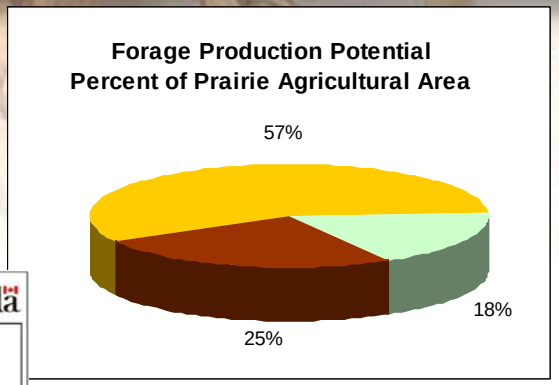


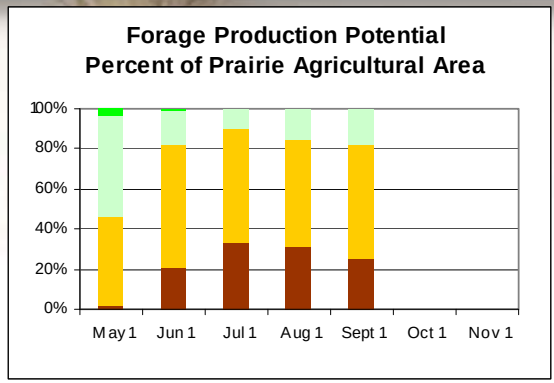
Modeled Drought Index (PDSI) to end of summer (assuming average P & T)

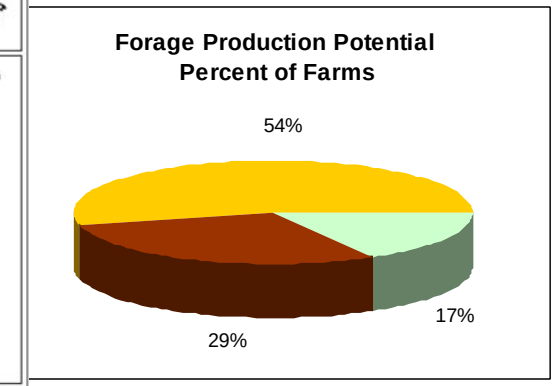


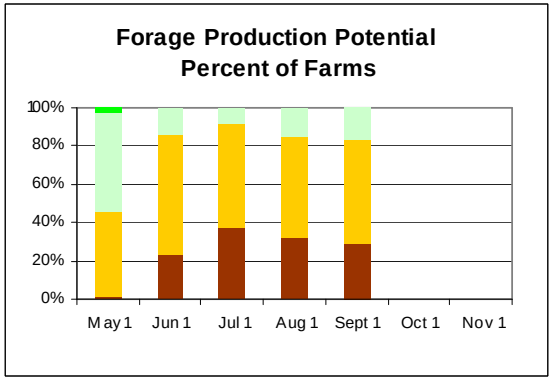
Quantifying the Impacts of Drought

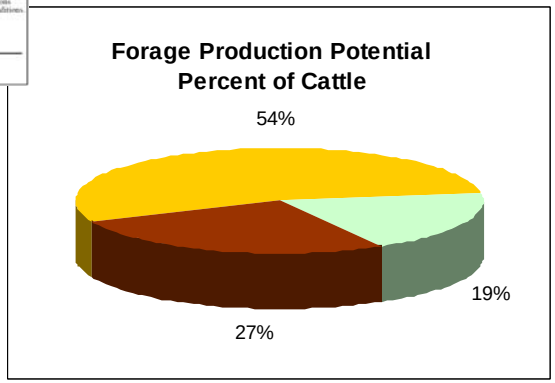


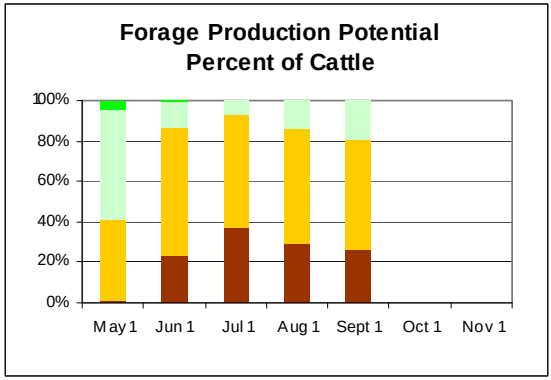








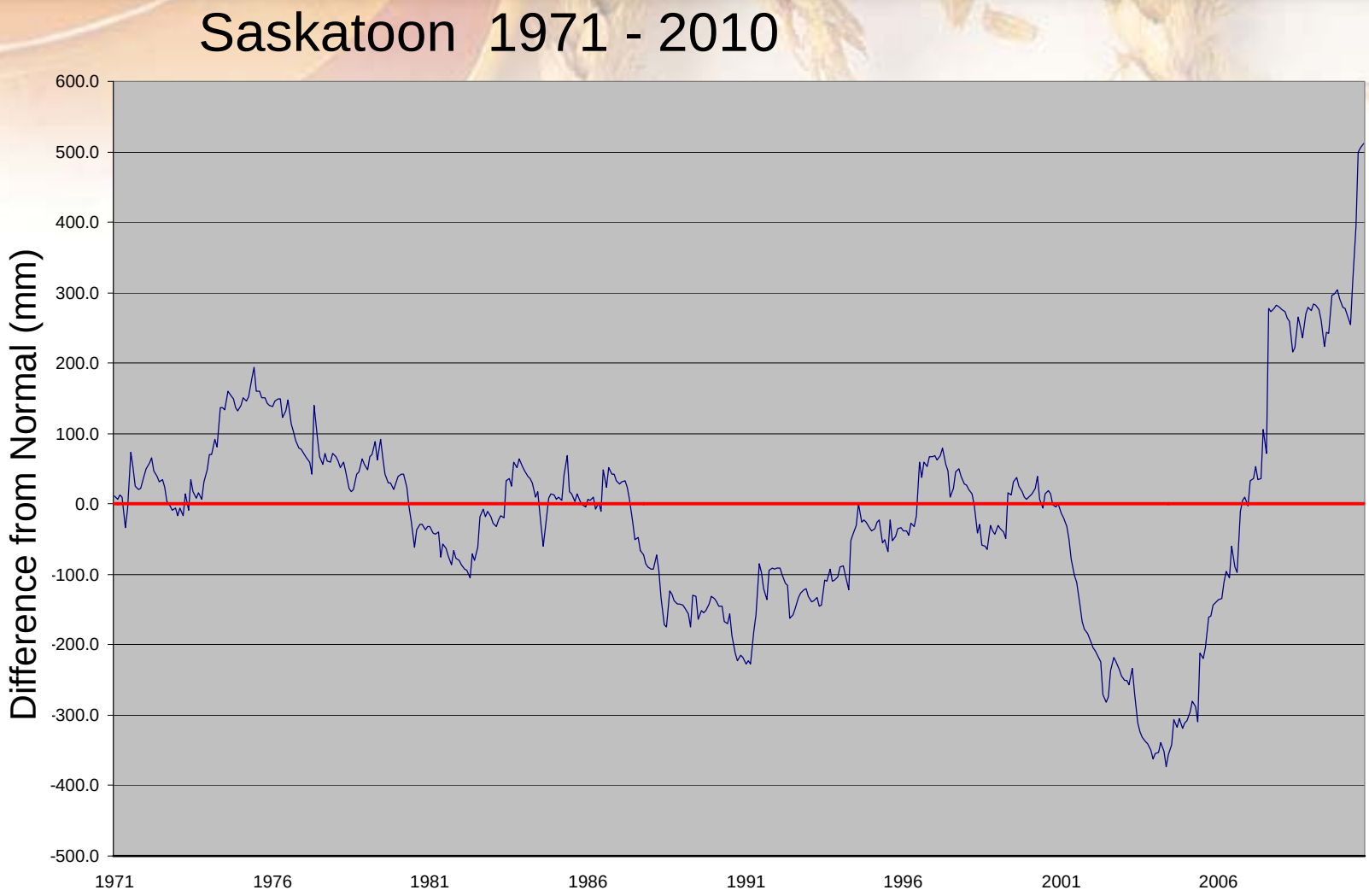




Over 500 maps produced daily

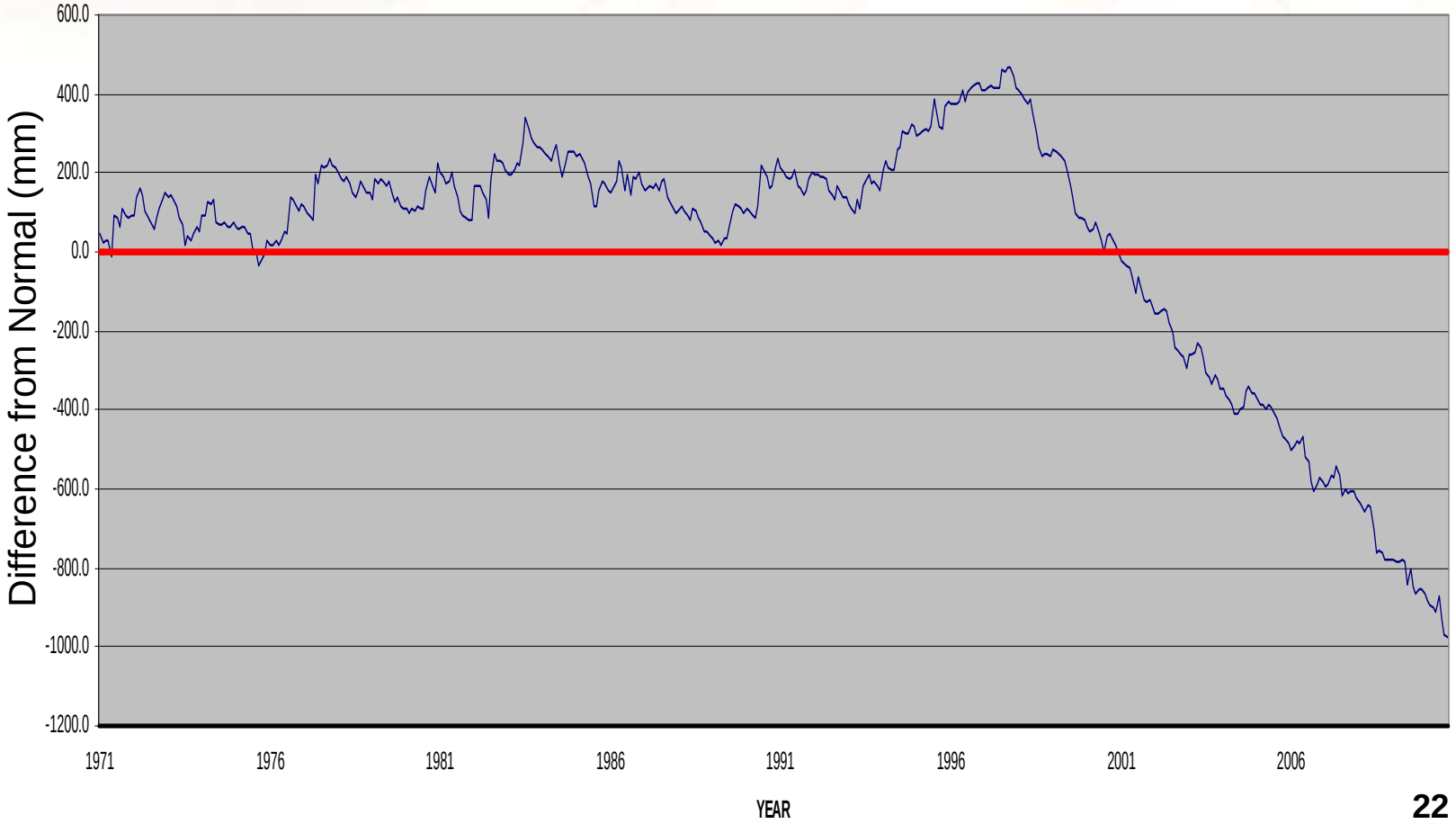
www.agr.gc.ca/drought

Cumulative effects of wet and dry years



Cumulative effects of dry years

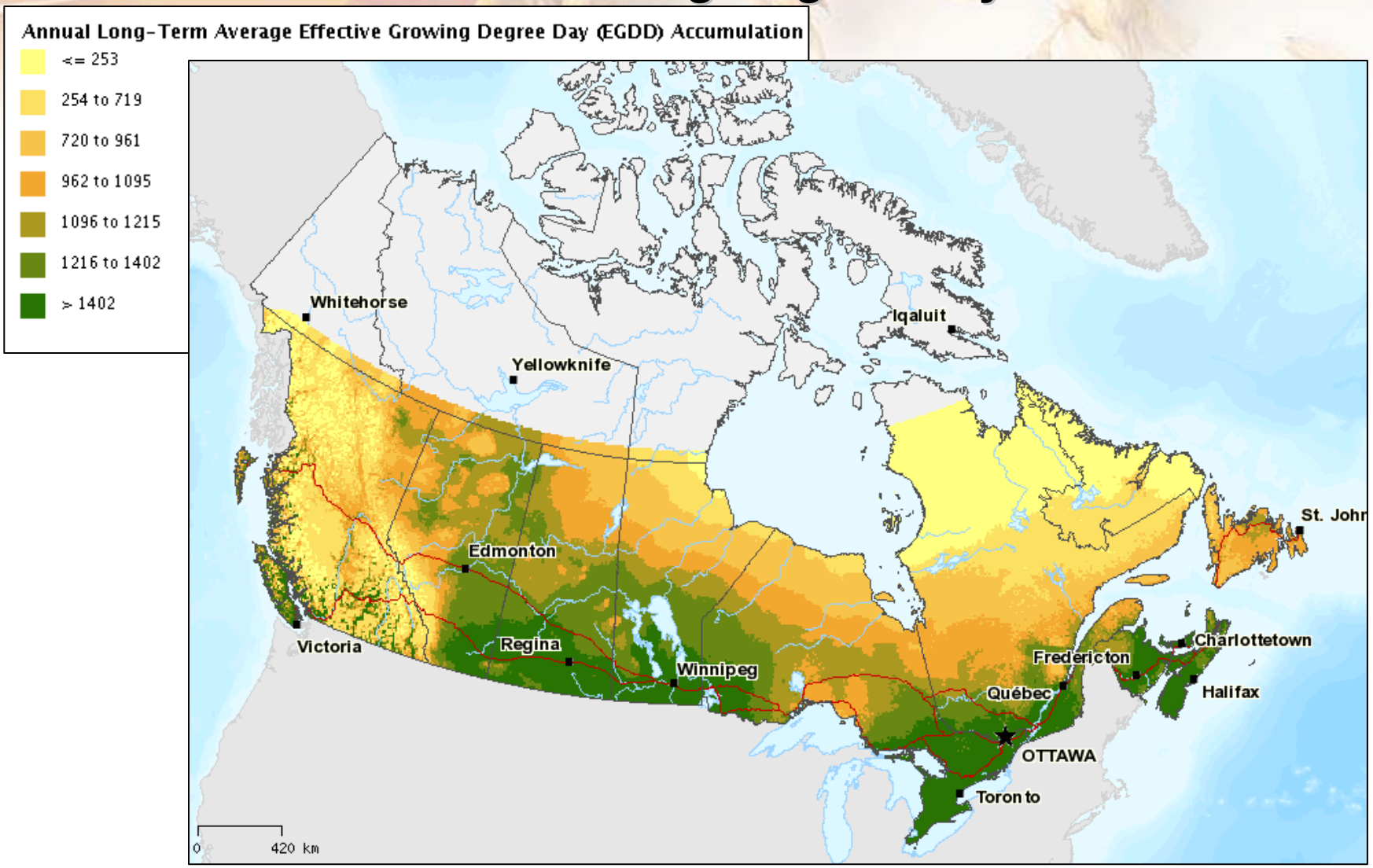
Beaverlodge, Alberta 1971 - 2010



Daily Gridded Climate Data (10 Km)

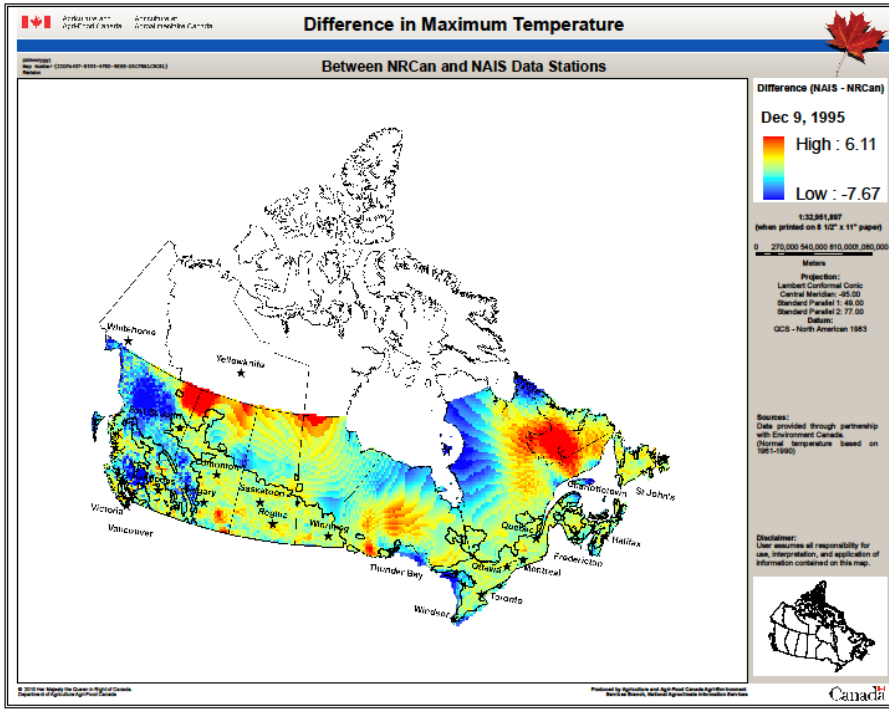
1961 - 2004

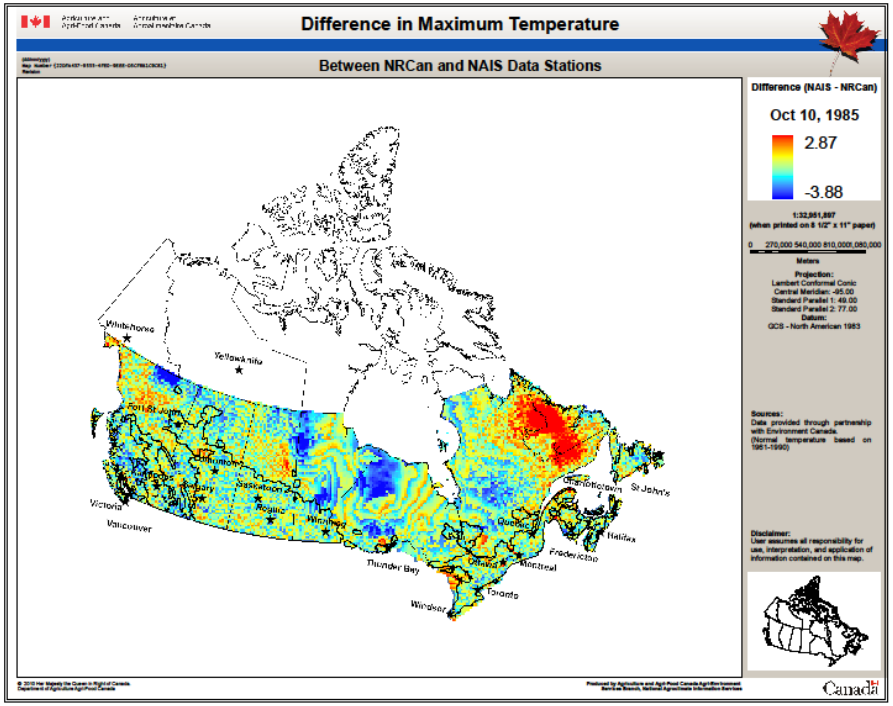
Effective Growing Degree Days



Next Version

- EC currently calculating similar output for 1950-2010
  - Surfaces rather than point data
  - Comparison underway of overlapping period
    - Results are very preliminary





National Soil Moisture Monitoring

- Way Forward for Soil Moisture Monitoring in Canada
  - GEO Initiative; AAFC & EC co-lead
- Led to support for a Pilot Project (SAGES)
  - Emphasis on Agriculture: Soils & crop yield modeling
  - Identify best practices for monitoring soil moisture for crop water use
- Several questions:
  - Time scale: Hourly, daily, weekly?
  - How do we link surface & subsurface?
  - What scale is appropriate for
    - AAFC' needs? EC's needs?
  - What data volumes are involved?

Relevance to Agriculture in the Environment

- Soil Moisture is a key factor in:
  - Infiltration vs runoff
  - Mitigation of pollutants in the soil
  - Probability of macropores, fractures and channels in the soil
- Improved soil moisture monitoring will assist agricultural Best Management Practices become sustainable by predicting high risk:
  - Timing of BMPs
  - Locations of BMPs in the landscape

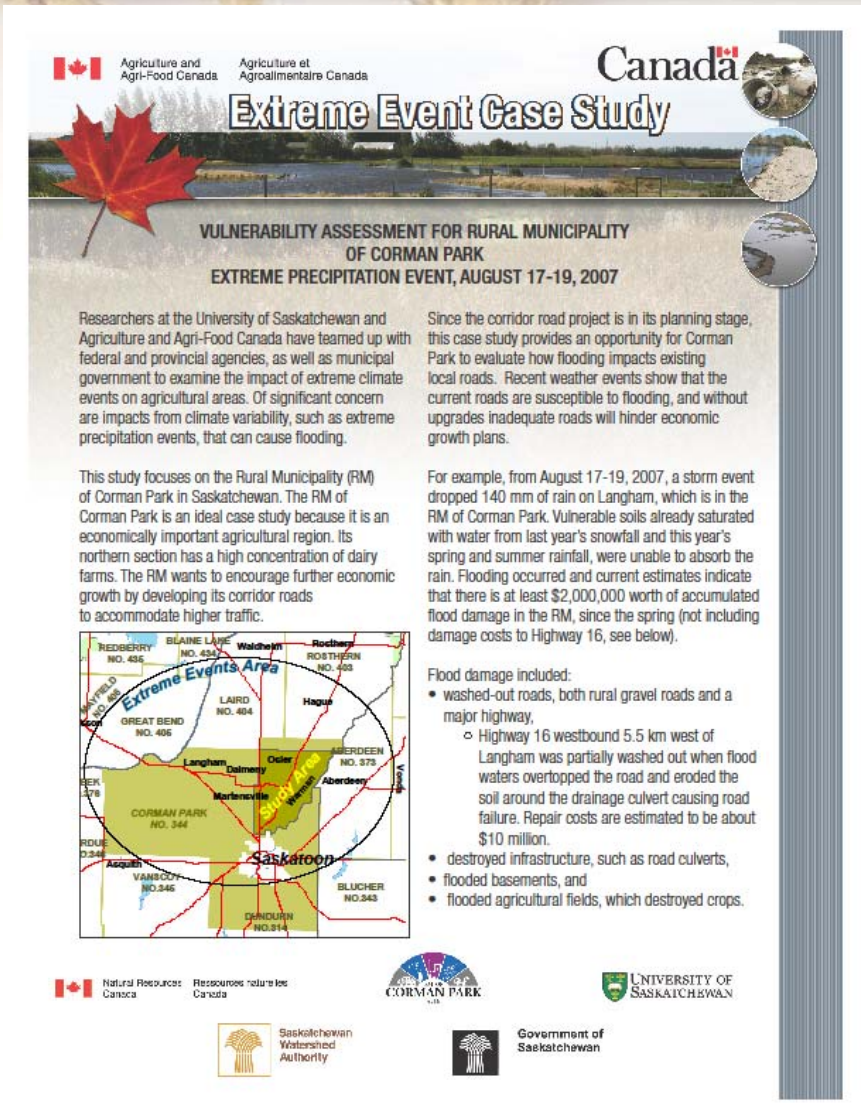
Key growth area for AAFC-EC to jointly collaborative develop

Landscape Infrastructure Resiliency Assessment (LIRA)

Standardize a methodology to help communities and regions:

1. Assess their **risk** to infrastructure systems and the environment to extreme rainfall events, and

2. Develop and ranking adaptation responses that reduce socio-economic and environmental costs



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Extreme Event Case Study

VULNERABILITY ASSESSMENT FOR RURAL MUNICIPALITY OF CORMAN PARK EXTREME PRECIPITATION EVENT, AUGUST 17-19, 2007

Researchers at the University of Saskatchewan and Agriculture and Agri-Food Canada have teamed up with federal and provincial agencies, as well as municipal government to examine the impact of extreme climate events on agricultural areas. Of significant concern are impacts from climate variability, such as extreme precipitation events, that can cause flooding.

This study focuses on the Rural Municipality (RM) of Corman Park in Saskatchewan. The RM of Corman Park is an ideal case study because it is an economically important agricultural region. Its northern section has a high concentration of dairy farms. The RM wants to encourage further economic growth by developing its corridor roads to accommodate higher traffic.

Since the corridor road project is in its planning stage, this case study provides an opportunity for Corman Park to evaluate how flooding impacts existing local roads. Recent weather events show that the current roads are susceptible to flooding, and without upgrades inadequate roads will hinder economic growth plans.

For example, from August 17-19, 2007, a storm event dropped 140 mm of rain on Langham, which is in the RM of Corman Park. Vulnerable soils already saturated with water from last year's snowfall and this year's spring and summer rainfall, were unable to absorb the rain. Flooding occurred and current estimates indicate that there is at least $2,000,000 worth of accumulated flood damage in the RM, since the spring (not including damage costs to Highway 16, see below).

Flood damage included:

- washed-out roads, both rural gravel roads and a major highway,
  - Highway 16 westbound 5.5 km west of Langham was partially washed out when flood waters overtopped the road and eroded the soil around the drainage culvert causing road failure. Repair costs are estimated to be about $10 million.
- destroyed infrastructure, such as road culverts,
- flooded basements, and
- flooded agricultural fields, which destroyed crops.

Natural Resources Canada | Ressources naturelles Canada

CORMAN PARK

University of Saskatchewan

Saskatchewan Watershed Authority

Government of Saskatchewan

LIRA Project Phase's

Phase 1 – Scoping Study

Phase 2 – Develop course methodology – Regional Analysis only
(RM of Corman Park 2006-07)

Phase 3 – Develop detailed methodology – Economic analysis, adaptation options and costing, RM participation.
- RM of Corman Park Pilot Site – funded by NRCAN

Phase 4 – Current Phase
- Refine methodology/test replicability
- Develop manual and test a standardized methodology in pilot sites in Sask and Nova Scotia

Phase 5 – Adoption by provinces;
- Decision makers across Canada utilizing methodology

Realistic Expectations

A planning study, not a detailed engineering study

- It will identify “hotspots” where more detailed analysis should occur
- Infrastructure systems, not a single piece of infrastructure

Practicality: Real world tool for decision makers

- Local knowledge must be valued

Uncertainty must be embraced

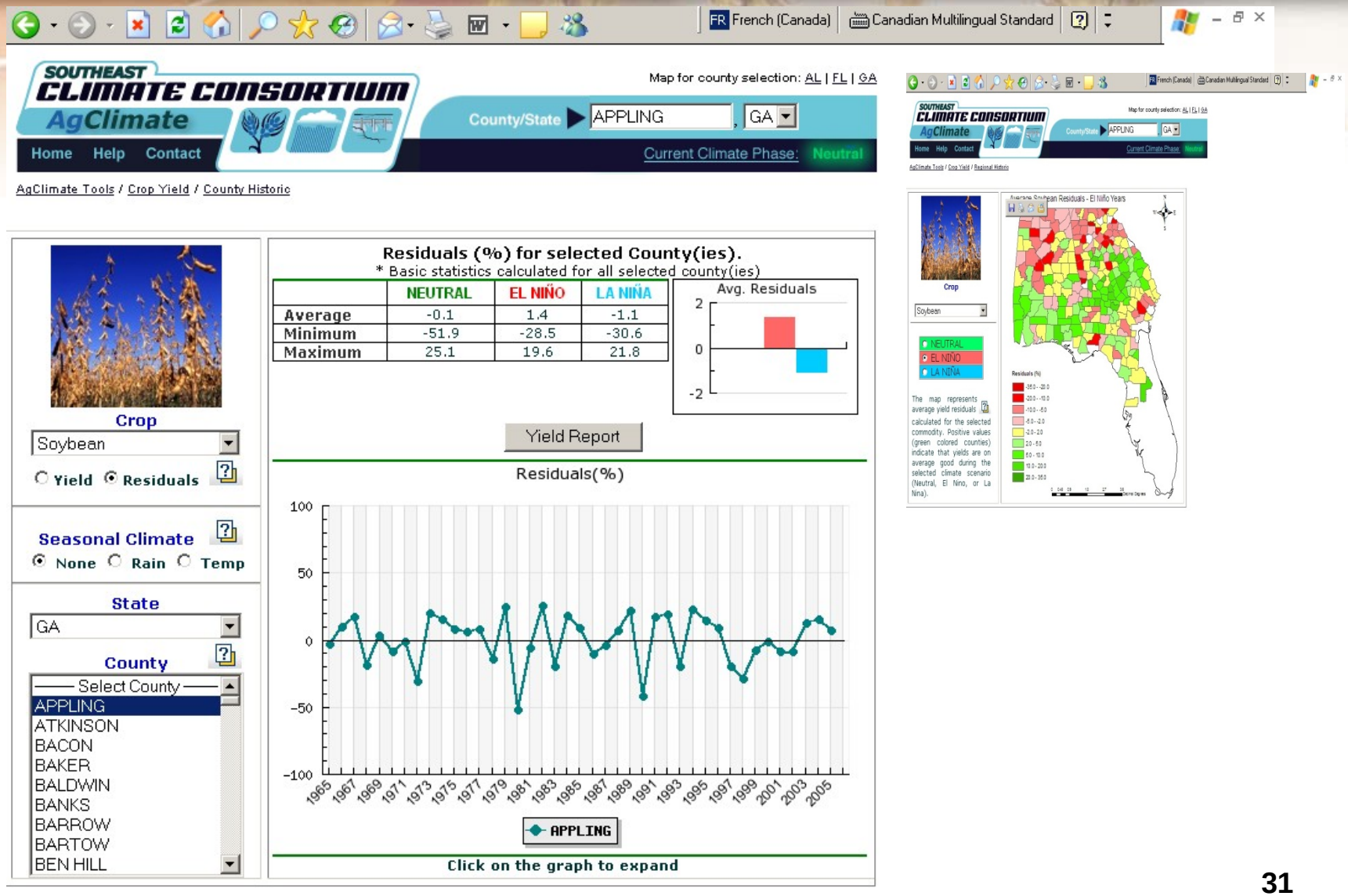
- Educated assumptions are a reality
- What level of precision is adequate?

Drought & Extreme Event Preparedness

Invitational Drought Tournament

- Tool to raise awareness of the need for developing extreme climate events preparedness and adaptation decision support
- The tournament brought together multiple stakeholders in the same room to discuss drought preparedness
- Teams were:
  - guided through a multi-year drought scenario in a fictitious basin
  - given a budget to invest in adaptation options that would reduce ecological, social and economic drought risk and address short-term and long-term needs
  - received a score at the end of each round based on which adaptations they chose to invest
- The team with the lowest score (most effective reduction in risk) won the tournament

Regional Yield Modeling



Agriculture's Needs for Climate Data Analysis

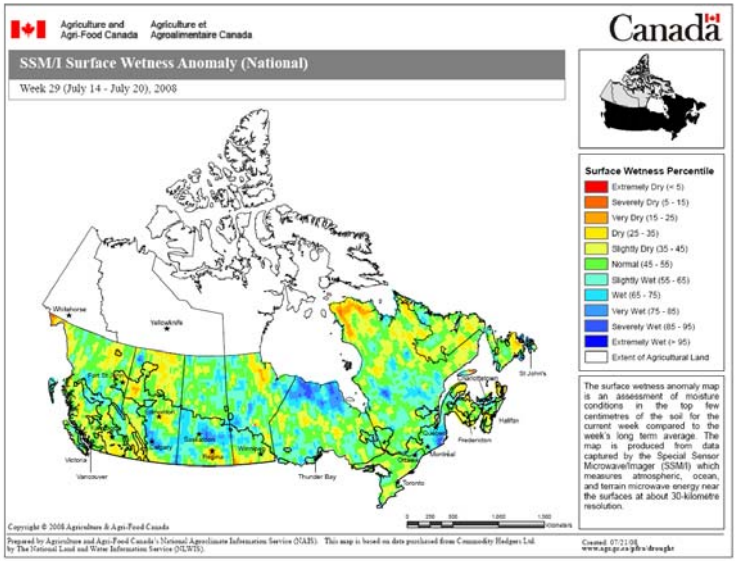
- Trends and means are important for general assessment of suitability of crops…
- But.. Agriculture's true vulnerability is to extremes

- Reconstructed climate data must not flatten or exaggerate extremes as these are key elements for risk management

- Need to better understand error estimates… can live with known error

- Finer scale information and more emphasis on meteorologic processes.

- Better understanding of data.
  - What does it represent?
  - What is the quality at a given station
  - Need more reliable snow measurements



Agriculture's Needs for Weather & Climate Research

Forecasting

- Short term (7-14 days) is important but seasonal (90-120 D) and subseasonal (30 D) are very important
- Need to better understand factors influencing our weather

Extreme Event Risk

- What are the types of disasters we can expect in our climate change adaptation planning horizons:
    - Seasonal, 2 years, 5 years, 10 years, 25 years

Better understanding of climate

- What are opportunities for new crops and where?
- Can we improve existing productivity?
- We need to better manage our impact on the environment

Strategic Direction for NAIS

- Support to Disaster Management
  - Near real time information, tax deferral, preparedness planning, yield modeling, need new monitoring & forecasting tools
  - Minister and Department, Agri-Recovery, E.C., crop insurance,
- Delivery to the End User
  - How do we strengthen AAFC's regional capacity to deliver agroclimate information and tools to their clients?
  - We need new adaptation tools; new ideas
  - Stronger role in adaptation of forecasting information
- Strengthening Credibility (AAFC, agriculture industry)
  - International projects, expertise sharing, adoption of standards
  - Defining and enhancing our role in research, utilizing our modeling capacity
  - Subject matter expert analysis on issues (agroclimate variability & change)
  - Capitalize on our effective partnerships (EC, NOAA, PARC) & build new ones

Key contribution

Linkage of physical science with socio-economic science.

Can we translate physical science into meaningful tools that farmers, policy and society can use for climate change adaptation?

Thank You!

Allan Howard
Allan.Howard@agr.gc.ca

Canada

NAIS Priority Projects for 2010 - 2012

1. Climate Data
   - Improved climate data density (new networks, stations), value added products, & access to data & products
2. CARA (Climate Adaptation for Resilience in Agriculture)
   - Drought preparedness & planning
   - Landscape vulnerability
3. Internet Tools: *Cancelled July 29/11*
   - New tools for online data collection, analysis, and report preparation (e.g: Drought Impact Reporter, improved Drought Watch tools, crop modeling internet tools)
4. Integrated Monitoring, Reporting and Assessment of Agroclimate Impacts
   - Monitoring (e.g. NADM) drought and excess moisture,
   - assessing eligible areas for Tax Deferral
   - Incorporation of EO into monitoring
5. SAGES: Soil Moisture and Crop Modeling
   - Development of a crop modelling & yield forecasting system
   - Development of a system for monitoring soil moisture
6. SAGES: Weather Extremes

Biomass Inventory Mapping & Analysis Tool (BIMAT)

- Objectives
  - Provide access to Canadian biomass and landscape information via the Internet
  - Facilitate its analysis for sustainable use.
- It will help
  - Policy development;
  - Impact assessments, carbon accounting; regulation
  - Make more informed decision-making regarding the location and operation of biomass based processing plants
- Partners: AAFC Research Branch, NRCan, E.C.