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Canada



# The Impacts and Costs of Drought to the Canadian Agriculture Sector

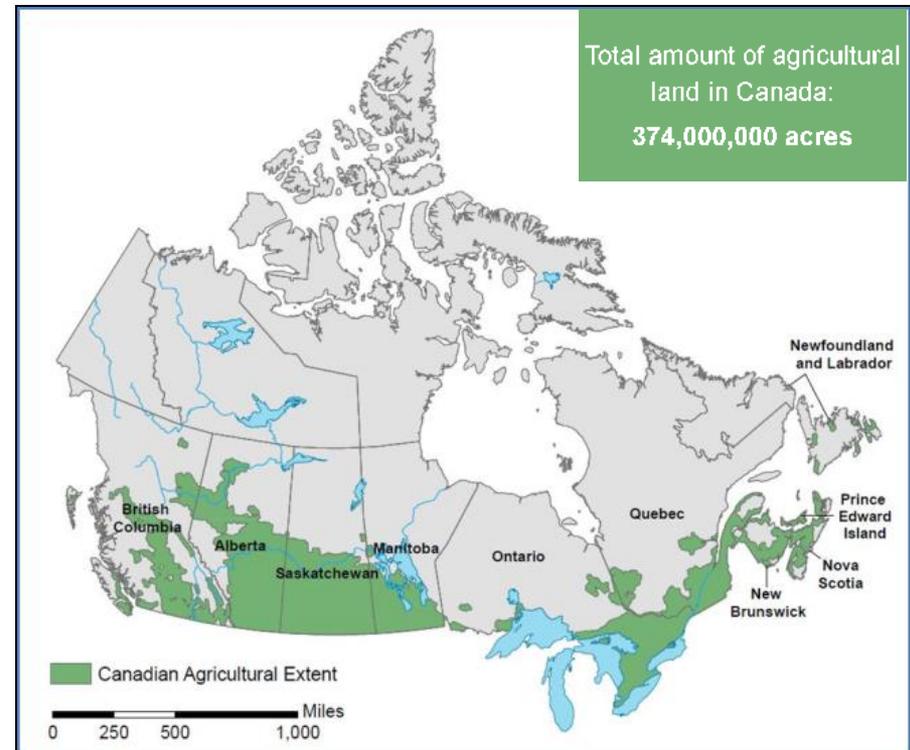
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# Canadian Agriculture

- Canada's Agriculture and Agri-food sector accounts for about 7% of the national GDP (2016) and employs around 12.5% of Canada's workforce
- Canada is the fifth-largest exporter of agriculture and agri-food products in the world, with exports in 2016 valued at around \$56 billion
- About 80% of the agricultural land is in the West; highest-value crops are typically in the East
- Weather and climatic variability still have a significant effect on Canada's agriculture - most agriculture is still 'rain-fed'
- Irrigation is developing, but is still limited



# Types of Drought

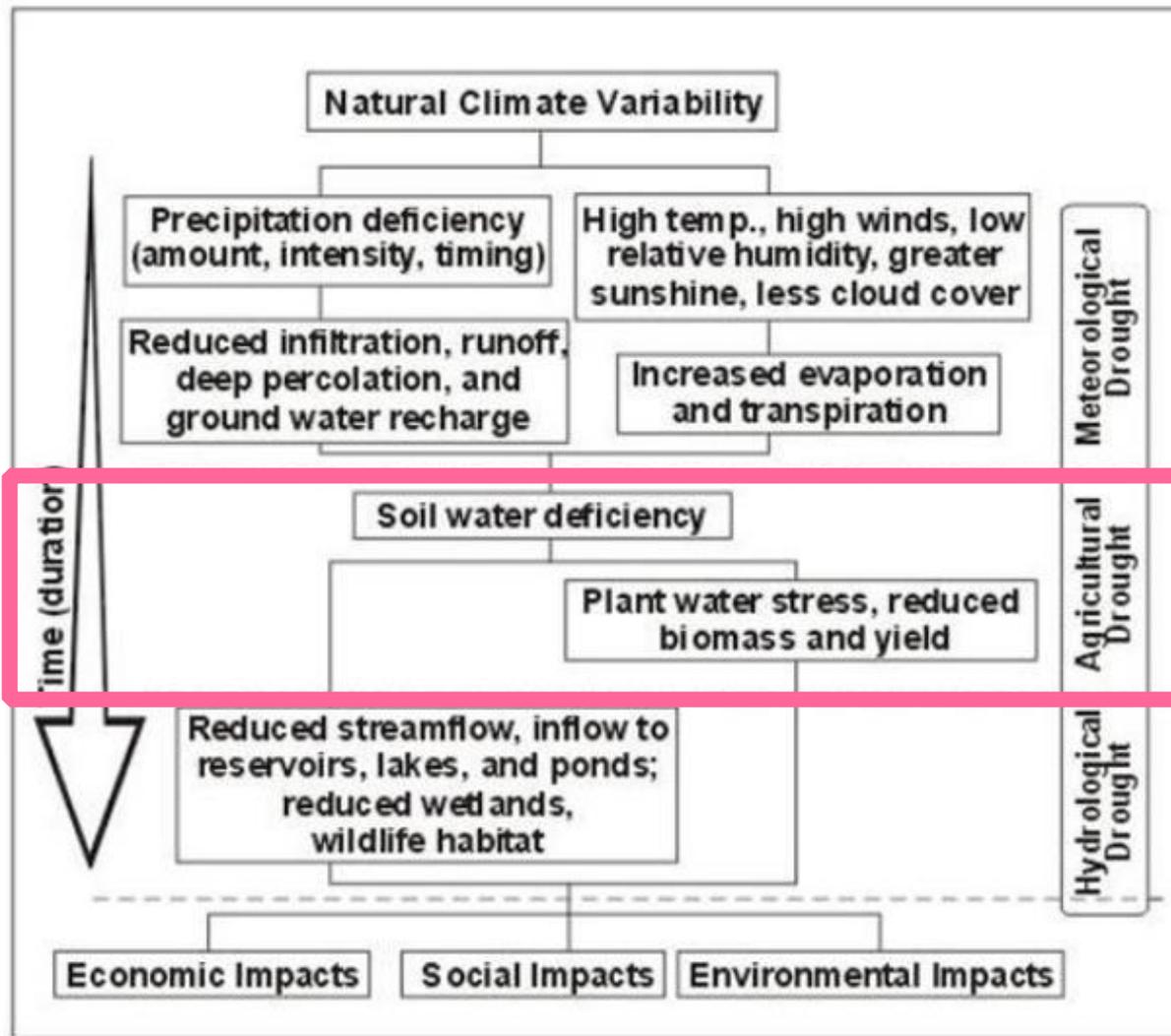
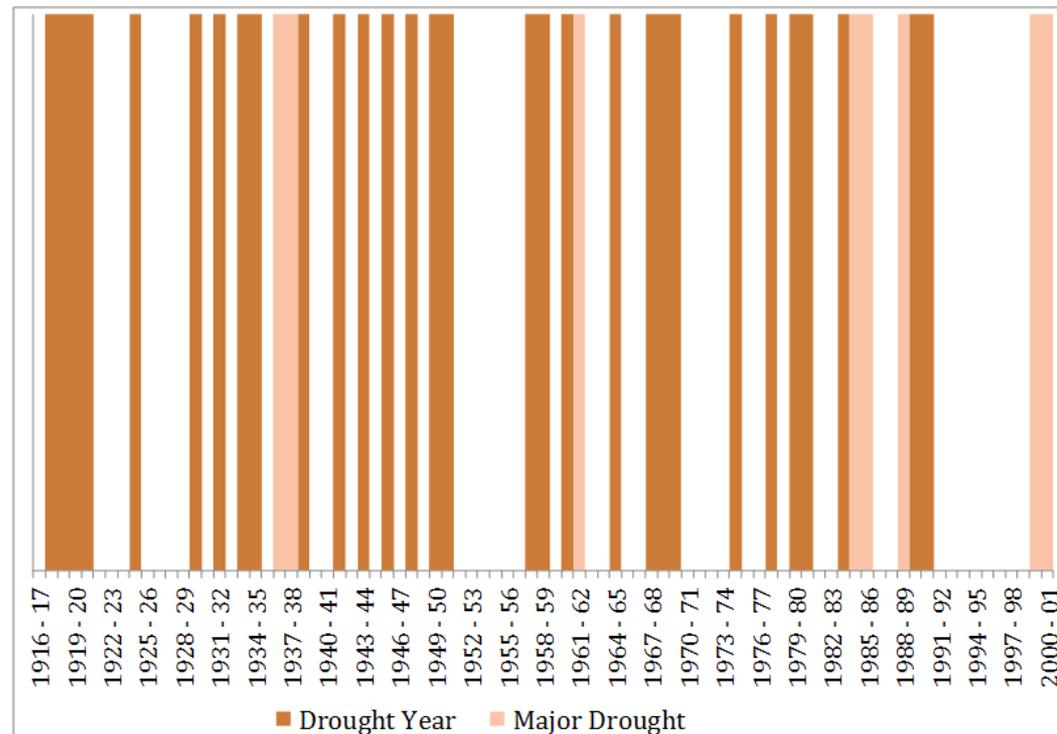


Figure 1. Relationship between meteorological, agricultural and hydrological drought (NDMC, 2006)

# Drought is a common but unpredictable occurrence in Canada

- Drought can occur anywhere in Canada, but is most frequent in the Prairie region
- Over the past two centuries, at least 40 droughts have occurred in western Canada. In the past 100 years, multi-year droughts were observed in the 1910s, 1930s, 1960s, 1980s and 2000s.



Palliser's Triangle, original delineation by soil type and ecoregion  
(Canadian Plains Research Centre Mapping Division, 2013)

# Drought Impacts on Agriculture

- Systemic, 3-dimensional and involves time
- Environmental, Social and Economic
- Reduced, depleted soil moisture/water supplies/flows
- Reduced water quality
- Increased soil erosion and salinization
- Reduced crop/feed growth, yields and quality
- Increased heat stress, reduced weight, mortality in livestock
- Increased decisions to reduce herd sizes
- Increased incidence of insects
- Increased incidence of wildfires
- Increased human health impacts, dust, stress, accidents
- It can take years to recover fully from the impacts.

# The 1930s drought

- A decade of drought in the Northern Great Plains, Canada and the US
- Impacts
  - Environmental degradation, dust storms, soil erosion
  - Ecosystem imbalance, grasshoppers and Russian thistle
  - Economic decline and social upheaval, farm failure and relocations
  - By 1937 drought covered 25% of all arable land in Canada
- Costs
  - Canada's agricultural exports fell from \$783 million in 1928 to \$253 million in 1932
  - Farm incomes in the Prairies dropped from \$363 million in 1928 to minus \$10.7 million in 1931.
- Lessons Learned
  - Government created the Prairie Farm Rehabilitation Administration (PFRA)
  - Producers adapted with different tillage methods and crop rotation

# The 1980s drought

- Affected Western Canada; 1988 was the worst year
- Impacts
  - In 1984 insufficient water supplies required Saskatchewan ranchers to move cattle to northern area or to Manitoba; Dryland hay yields were reduced by 40-60% in central Saskatchewan
- Costs
  - \$4.1 billion total costs across the Prairies in 1988
  - Significant response in 1988: additional PFRA funding of \$12M
  - In 1988, Livestock Drought Assistance of \$100M and Crop Drought Assistance of \$850M by Federal-Provincial crop insurance
- Lessons learned
  - Established Federal/Provincial drought response process to include the following provisions: multi-year disaster provision for basic crop insurance allowing 10% increase, increased coverage to forage crop insurance, establishment of the PFRA Rural Water Development Program

# The 2001-2002 Drought

- 2001-2002 was a national drought
- Impacts
  - Record low water levels in Prairies sloughs and dugouts
  - Feed supply shortages, large areas of poor pasture growth in Prairies
  - Wind erosion and soil loss across the Prairies
  - Massive outbreak of grasshoppers in Alberta and Saskatchewan
  - In Alberta both 2001 and 2002 saw below average herd sizes



Vegreville, Alberta, July 2002; drought-stressed grasslands (AAFC)



Dry dugout near Paradise Hill, Saskatchewan, August 2002 (AAFC)

# The 2001-2002 Drought

- Costs

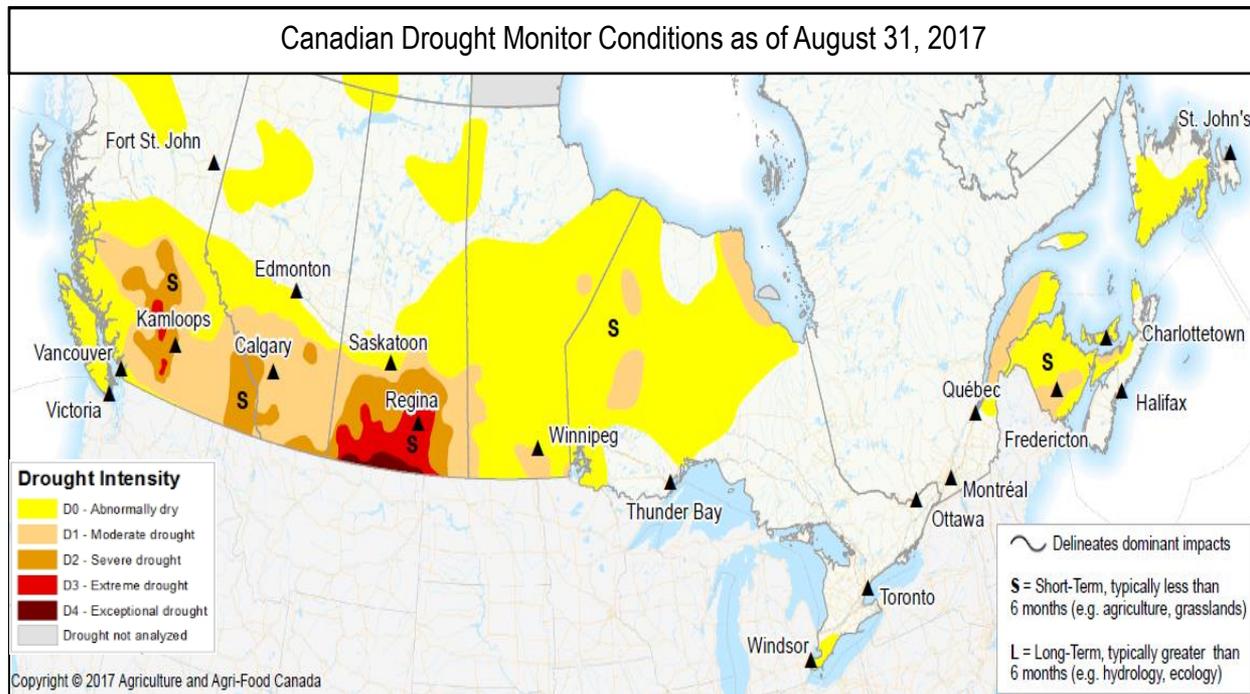
- \$3.6 billion in losses for agricultural production with \$5.8 billion in GDP loss over a 2 year period
- Employment losses of more than 41,000
- Negative or zero net farm income for the first time in 25 years for Prince Edward Island, Alberta and Saskatchewan
- Crop insurance payments exceeded \$2 billion for 2002 (500% above 10 year average)
- Total reduction in production value was approximately \$13 billion over 2001 and 2002 due to significant yield declines

- Lessons Learned

- Several adaptation techniques against wind erosion, such as strip farming or low till methods, were applied
- Due to feed shortages, cattle were able to graze on Prairie grasslands dedicated to conservation efforts at the generosity of community groups
- Reliance on irrigation proved to be the best mitigation strategy, however many farms still lack adequate irrigation infrastructure
- Emphasized the need for a comprehensive national drought monitoring service

# The 2017 Drought

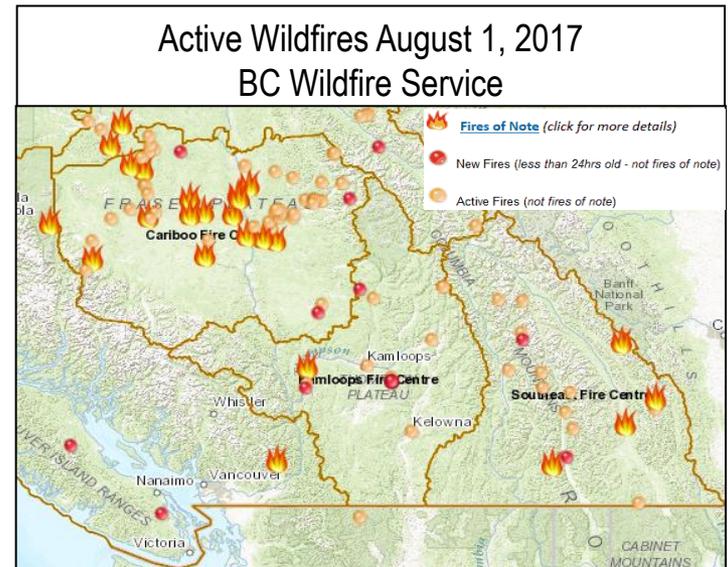
- A rapid-onset drought in western Canada. Record-breaking.



- Saskatchewan experienced one of the driest Julys in >100 years. Swift Current – driest year on record (132 years of climate data). Moose Jaw – driest year on record (117 years of climate data). Regina – 2<sup>nd</sup> driest year on record (112 years of climate data).

# The 2017 Drought - Impacts

- The 2017 wildfire season in British Columbia was the worst on record. More than 1,300 wildfires burned approximately 1.2 million hectares of land across south and central regions between April and November
- Late in the summer, wildfires also occurred on rangeland in Alberta and Saskatchewan damaging infrastructure and killing livestock
- In the Prairies, crop production: reduced yields, particularly canola and first cut forage, heat stress, poor grain fill.
- In the Prairies, livestock production: water scarcity and salinization, feed shortages, heat stress



# The 2017 Drought - Costs

- Costs:
  - Still tallying
  - The 2017 Canada-British Columbia Wildfires Recovery Initiative, valued at up to \$20 million, was established to provide emergency feed to 18,000 cattle
  - Relocation of 2,800 cattle with provincial government efforts
  - Around \$2 million by British Columbia provincial government to replace damaged fencing on crown land
- Lessons Learned
  - Heightened awareness of forest fire risk to agricultural production, in addition to drought risk. Need to develop best practice mitigation strategies against forest fires, particularly for livestock.
  - Increased need for drought outlook and forecasting to better inform decisions by producers at start of growing season.

# Other Significant Numbers

- Between 2001 and 2016, ONLY 2005 and 2013 had no significant drought impacts and costs.
- Between 2008 and 2012, federal-provincial disaster relief payouts for climate-related events totaled more than \$785 million. More than \$16.7 billion in crop insurance was paid out.
- In 2010 and 2011, the economic impacts to producers as a result of drought, flood and excess moisture was more than \$700 million across Canada in disaster support alone.

# Drought: a Costly Natural Hazard

<b>Disaster</b>	<b>Year(s)</b>	<b>Location</b>	<b>Cost (billions 1999\$)</b>
<b>Drought</b>	1980	Prairies	5.8
<b>Freezing Rain</b>	1998	Ontario to New Brunswick	5.4
<b>Drought</b>	1988	Prairies	4.1
<b>Drought</b>	1979	Prairies	3.4
<b>Drought</b>	1984	Prairies	1.9
<b>Flood</b>	1998	Saguenay, Quebec	1.7
<b>Flood</b>	1950	Winnipeg, Manitoba	1.1
<b>Drought</b>	1931-38	Prairies	1.0
<b>Drought</b>	1989	Prairies	1.0
<b>Hailstorm</b>	1991	Calgary, Alberta	1.0

# Reducing Drought Impacts

- The impacts on agricultural production have been reduced over time due to various mitigation and adaptation efforts
- Planning is critical
- Actions to reduce drought risks and impacts involves a wide range of tools including:
  - Research and innovation
  - Monitoring and early warning efforts
  - Beneficial management practices
  - Insurance and risk management/recovery programs

# Monitoring and Early Warning

- You can't improve what you don't monitor/measure
- AAFC Drought Watch website operations play a key role in maintaining records of drought conditions and events
  - Canadian Drought Monitor
  - Agroclimate Impact Reporter
  - Satellite monitoring of soil moisture and crop conditions
  - Library of beneficial management practices and related links
- Sustainability/Crop Metrics, Extreme Weather Indices projects
- You cannot plan for what you cannot see
  - Canadian Crop Yield Forecaster
  - Planned Drought Outlook Project

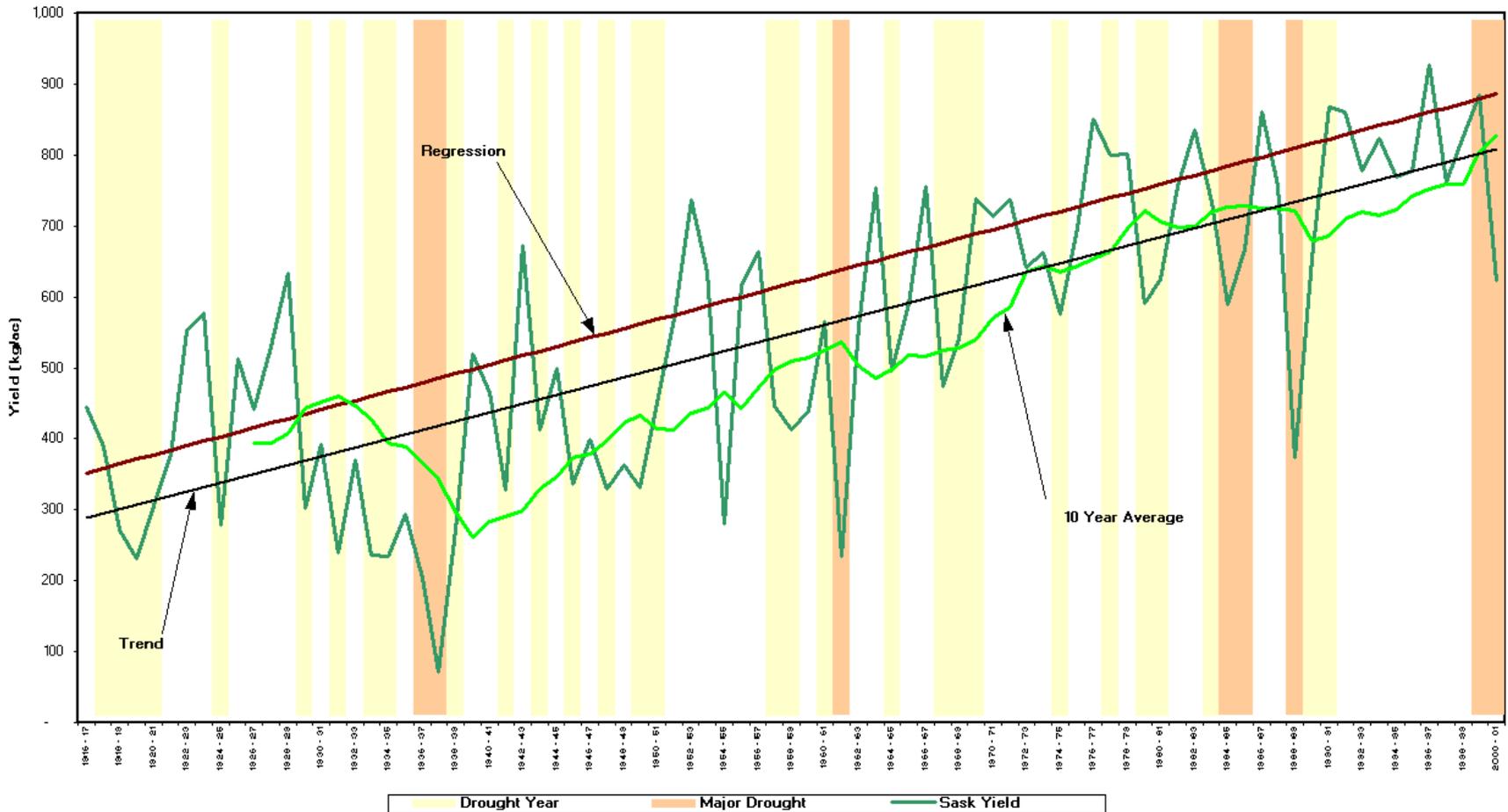
# AAFC Policy Framework: Canadian Agricultural Partnership

- Policy and funding framework between federal and provincial/territorial governments to enhance programs that:  
*“help farmers manage significant risks that threaten the viability of their farm and are beyond their capacity to manage”*
- Includes various Business Risk Management Programs such as:
  - **AgriInsurance, AgriStability, AgriRecovery**



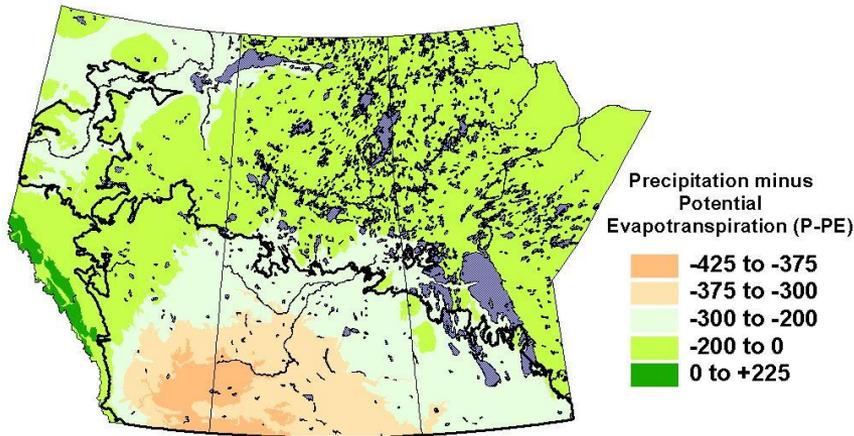
# Adaptation is a Continuous Process

## Yield of Wheat and Drought Years



# Climate models are generally predicting a drier future...

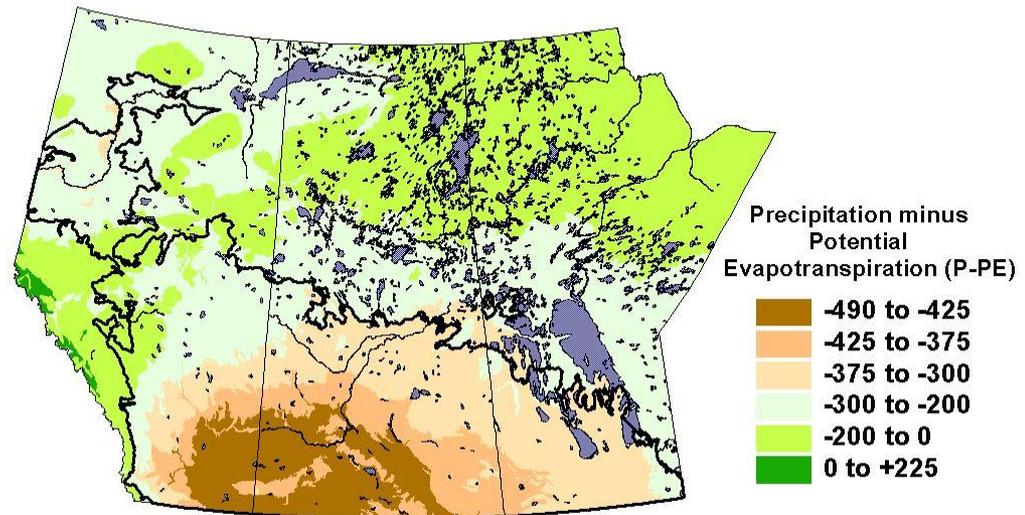
## Moisture Deficit (P-PE) (1961-90)



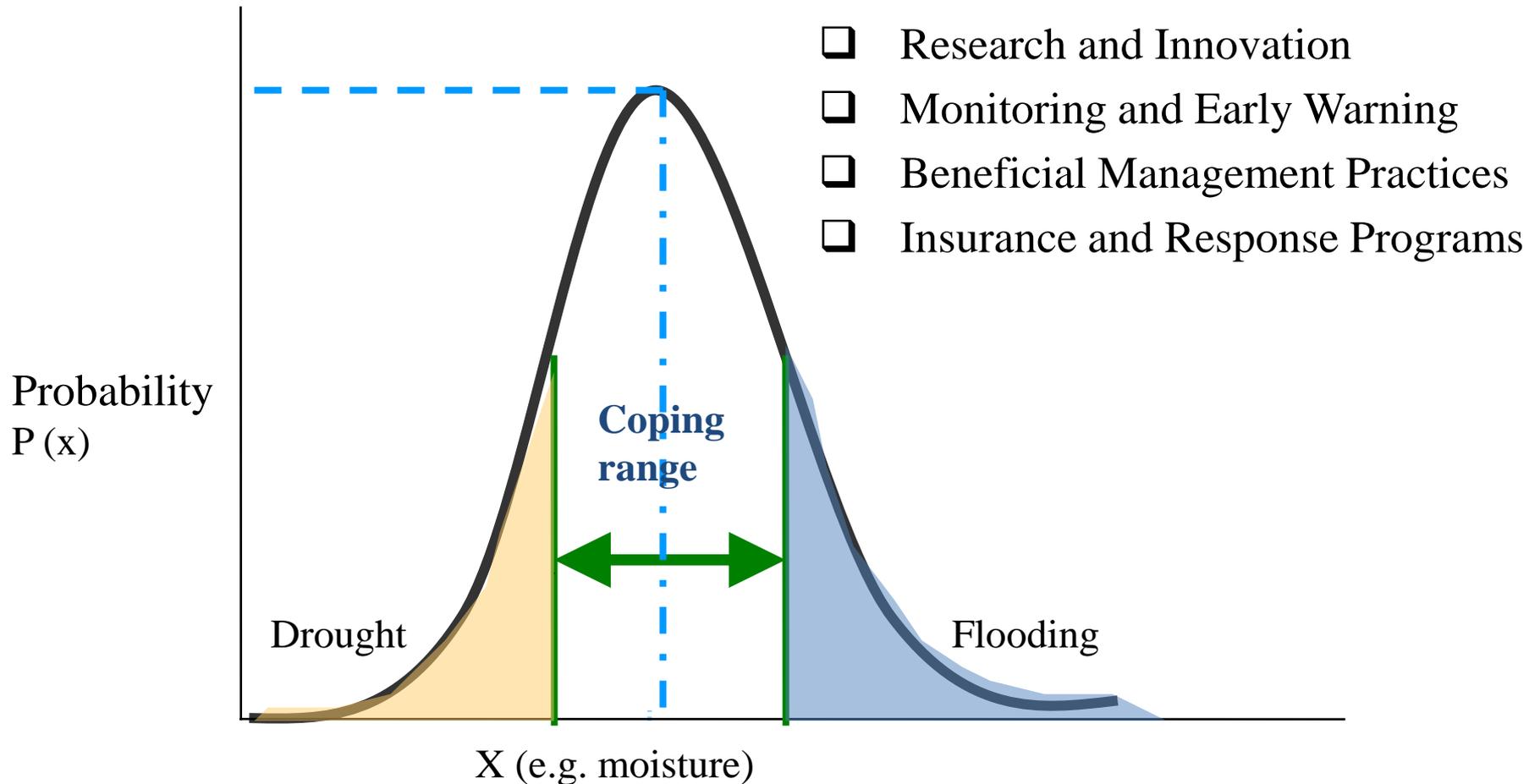
Results are varied, but most tell us a 2.5-4<sup>0</sup>C increase in temperature and 2-10 per cent increase in precipitation.

Frequency and magnitude of drought is expected to increase in the future; greater chance of multi-year drought events

## Moisture Deficit (P-PE) (2040-69)



# Reducing Vulnerability



# Challenges in Linkages

- Impacts not easily monitored – socio-econ-enviro
- Impacts vary with local conditions
- Often have a lag time
- Some impacts are qualitative and subjective
- Cost valuations can be ‘sensitive’
- Cost valuations include only what is monitored.
- Due to unpredictable nature of drought, cannot include them in economic forecasts or adjust monetary policy in advance.

# Summary

- Drought is a costly event, with significant impacts on Canadian agriculture production
- There are a number of challenges to monitoring and costing the impacts of droughts
- The frequency and magnitude of drought is expected to increase in the future with climate change
- A multi-strategy approach is necessary to continue to prepare for, mitigate and adapt to future droughts. These strategies have costs too.

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