



Natural Hazards: Droughts



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Wheaton 2003

Overview

Purpose: This presentation is to provide an introduction to the nature of droughts in Saskatchewan

To do this I will give some information on the nature of droughts including:

- Characteristics, e.g., Frequency, intensity, duration, timing
- Examples of impacts
- Examples of mitigation measures

Types of Droughts and their Definitions

(Maybank et al. 1995, Bonsal et al. 2011)

Drought is a complex phenomenon with no standard definition.

Drought is a prolonged period of abnormally dry weather that depletes water resources for human, social, economic and environmental needs

- Atmospheric – long term lack of precipitation
- Hydrologic – prolonged period of unusually low surface run-off and/or declining groundwater levels
- Agricultural – period during which soil moisture levels are insufficient to support crop / pasture growth
- Socio-economic – the shortage of water results in adverse effects on society and economy

Some Main Characteristics of Drought

- High variability (e.g., annual and seasonal)
- Drought often affects a wider area than excess moisture but not always
- Droughts have been known to migrate from the USA to Canada
- Different characteristics e.g., duration, intensities and areas
- Different frequencies, depending on the severity and area drought
- Timing of peak events, onset and termination of events
- Some indication of increased variability from dry to wet periods since the mid-1980s (Bonsal et al 2017).

To determine these characteristics we use historic information

The Prairies have always had Droughts

Inter-annual Variability
~250 of Tree Rings;
0 Baseline: 1971-2000 Median

Above "0" is wetter

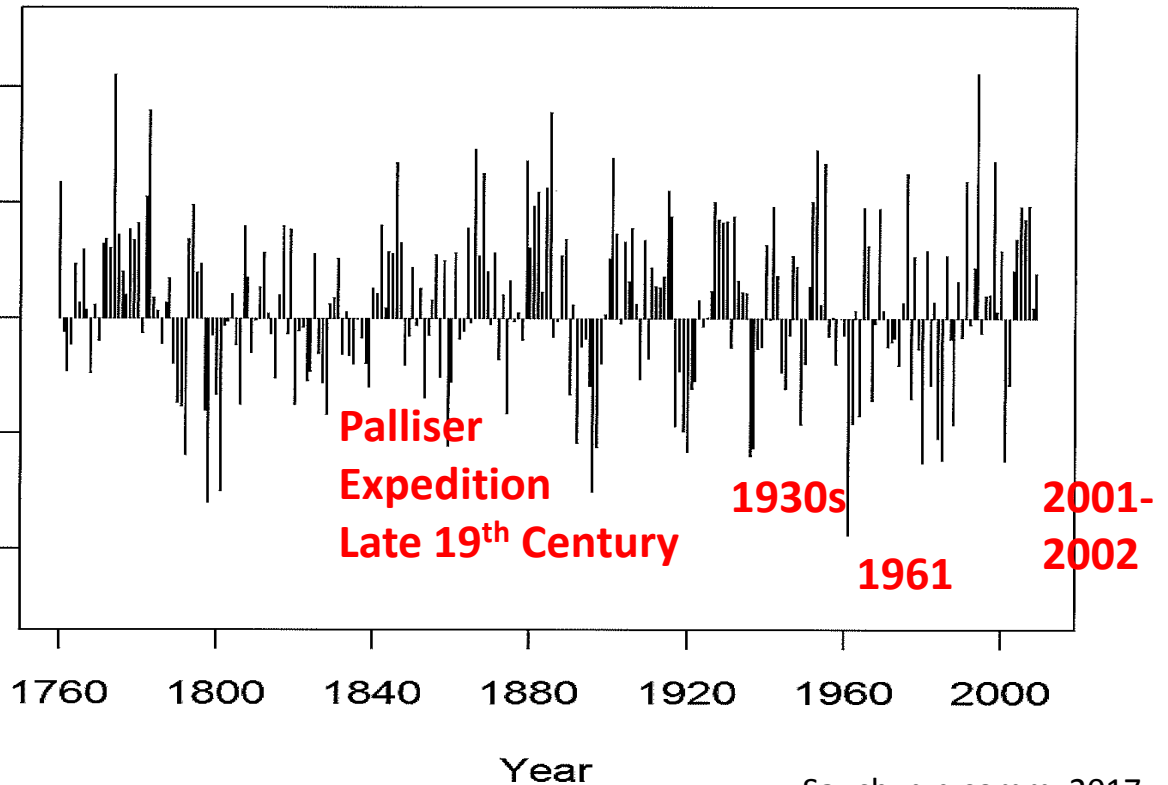
Below "0" is drier

- The more severe the departure, the more extreme (wet or dry).
- Repeated years of departures indicate drier or wetter multi-year exposure (e.g. 2001-02; late 1980s, 1920s-30s, 1850s are all recorded historic extreme drought periods.)

Cypress Hills Tree Ring Anomaly

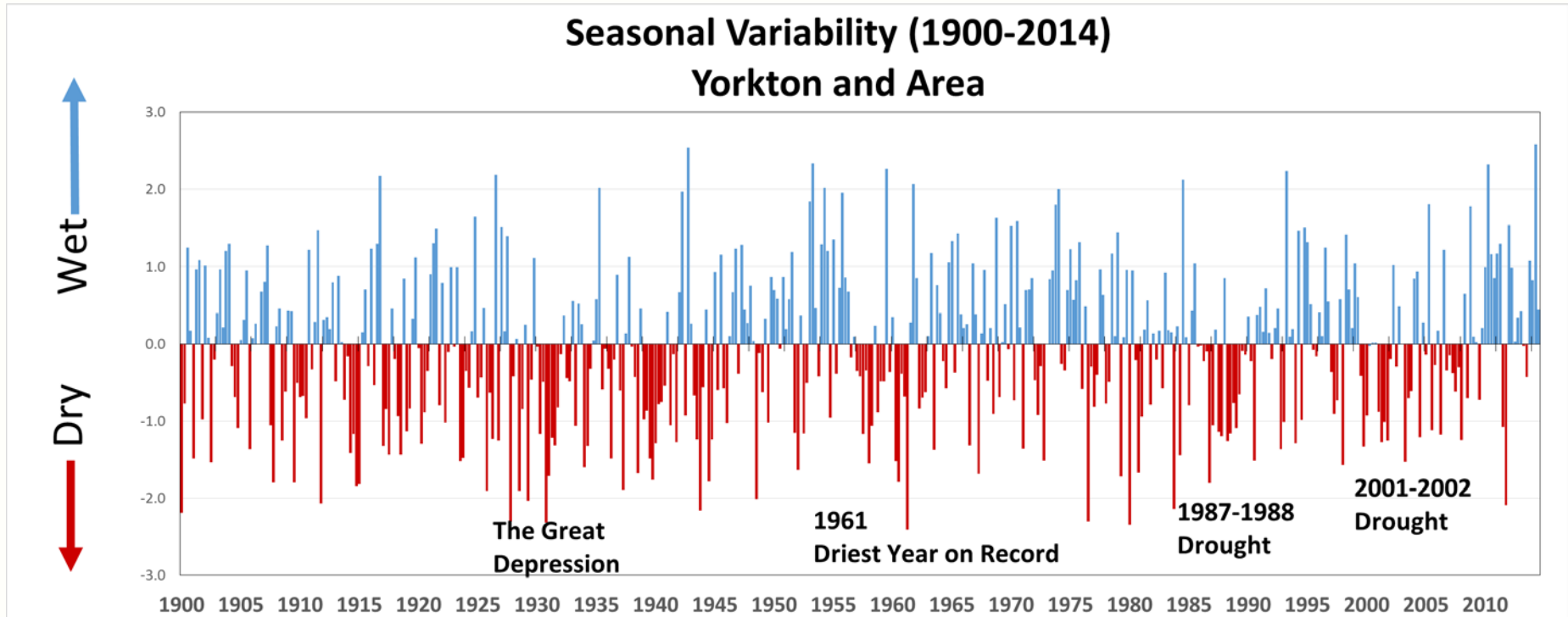
Departure from 1971 - 2000 Normal

0.4
0.2
0.0
-0.2
-0.4



Sauchyn p.comm. 2017

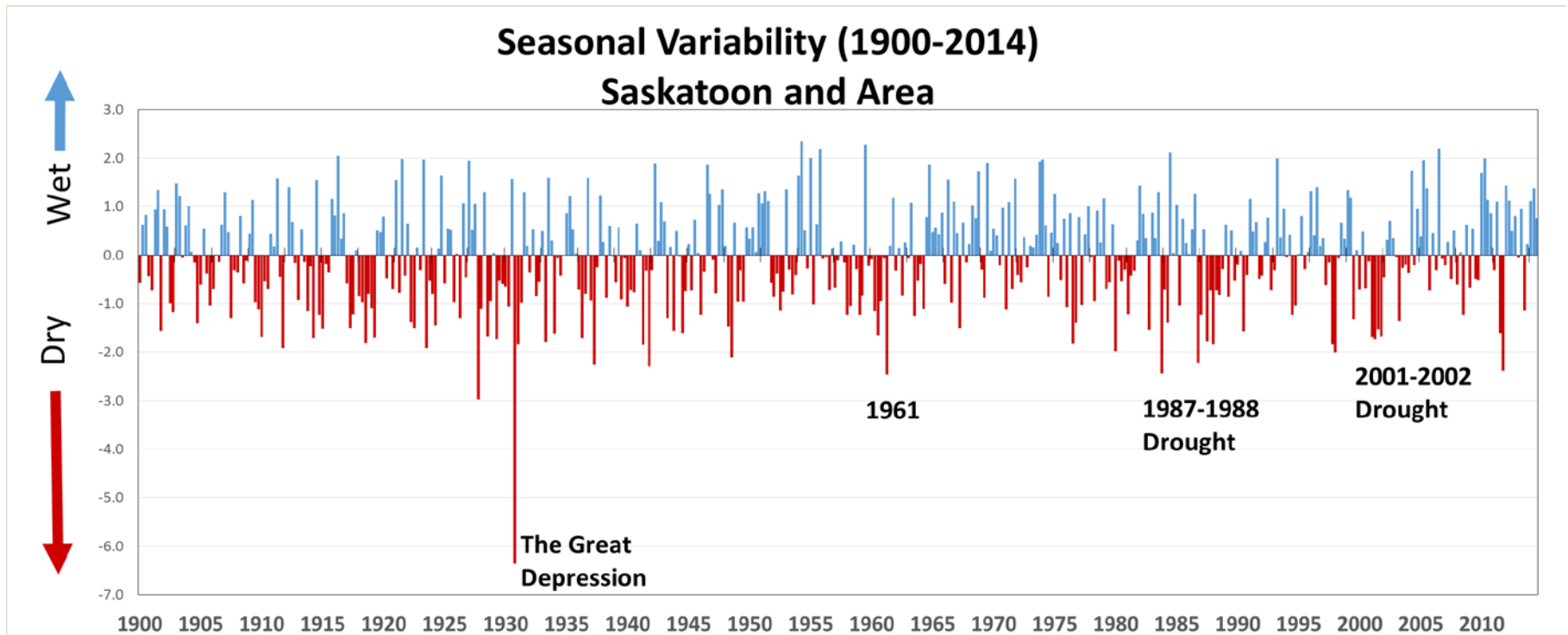
Drought and Excessive Moisture Severity



Data: ECCC 2017 SPEI

- Each drought is different from the others

Drought and Excessive Moisture Severity

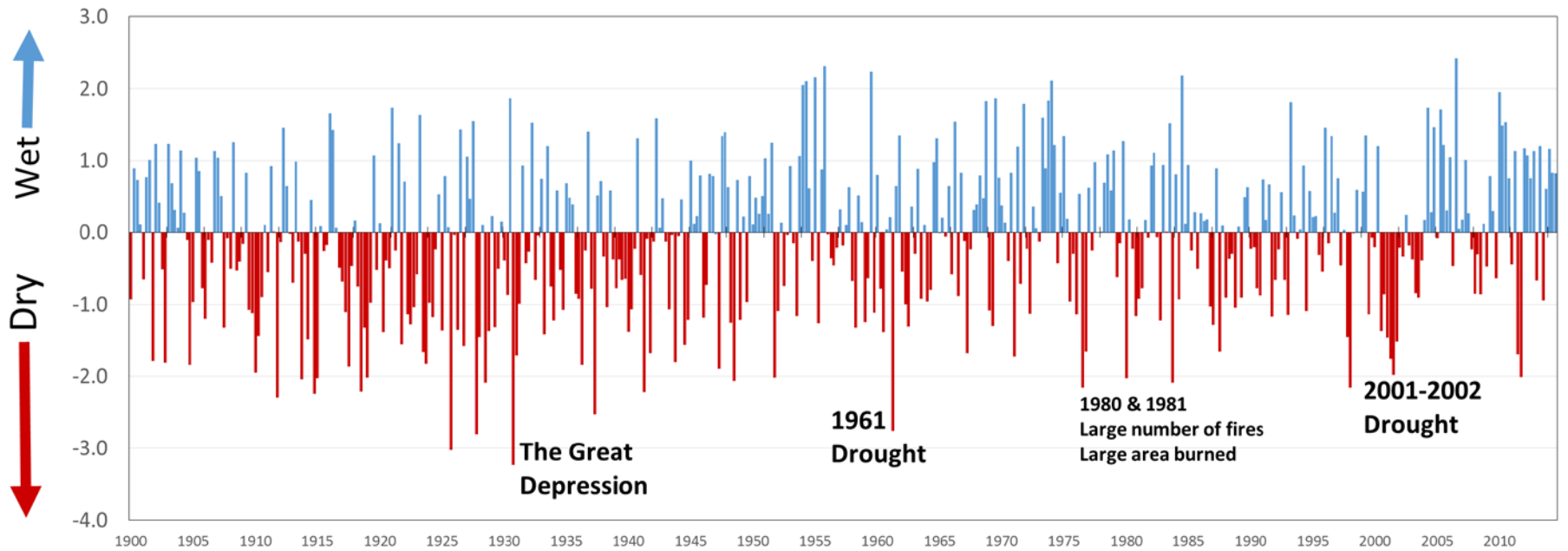


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Drought and Excessive Moisture Severity

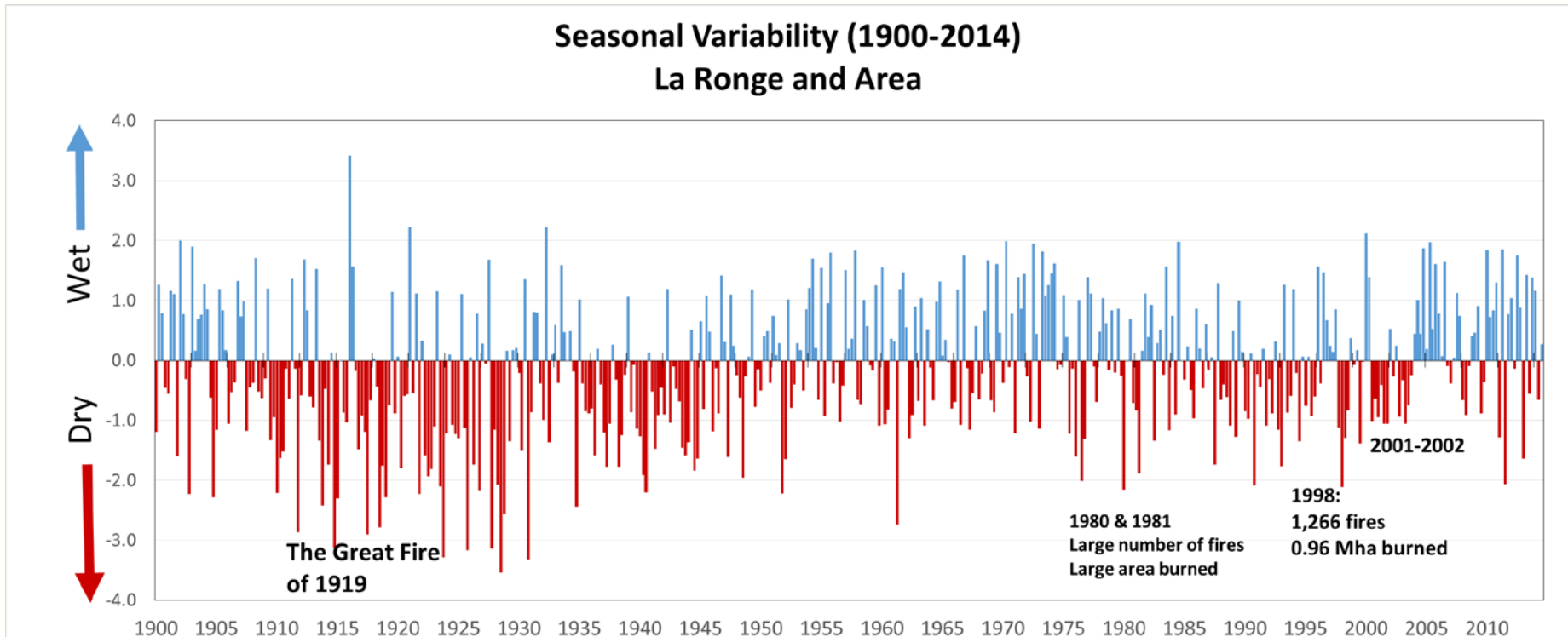
Seasonal Variability (1900-2014)
Prince Albert and Area



Data: ECCC 2017 SPEI

- Each drought is different from the others

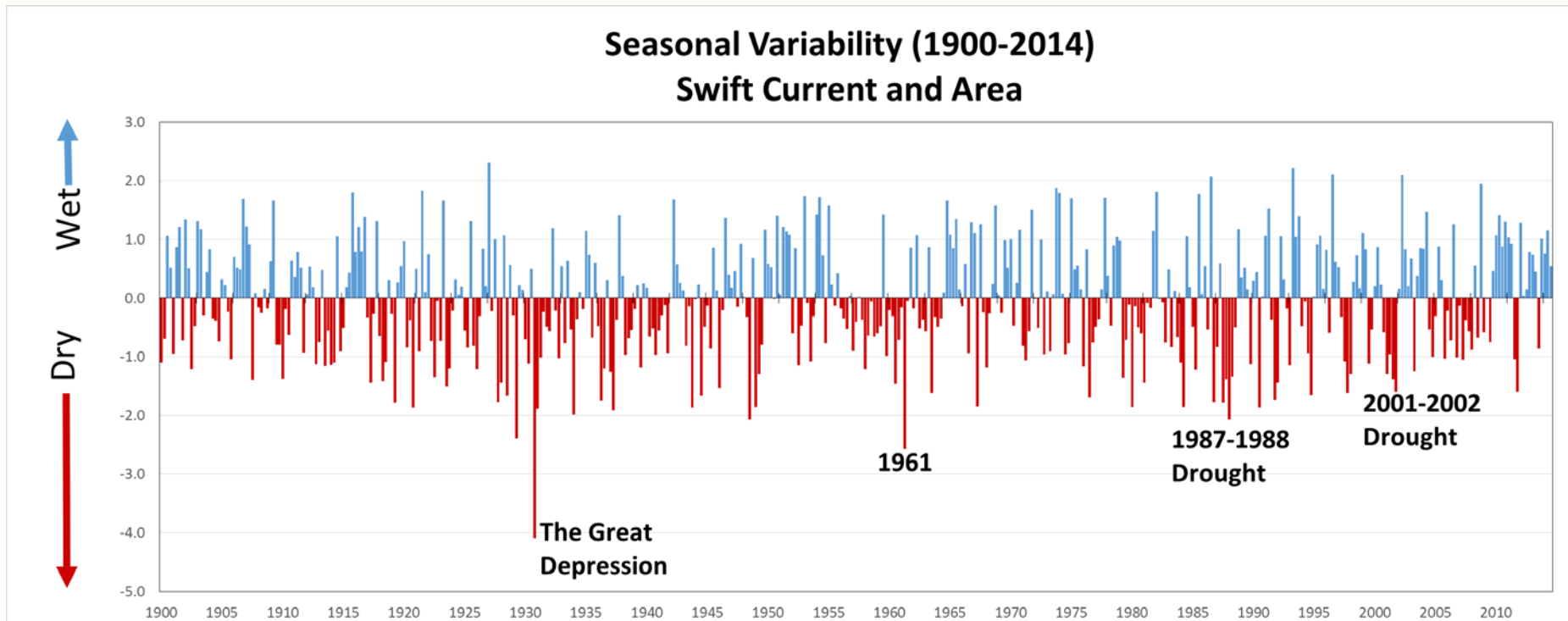
Drought and Excessive Moisture Severity



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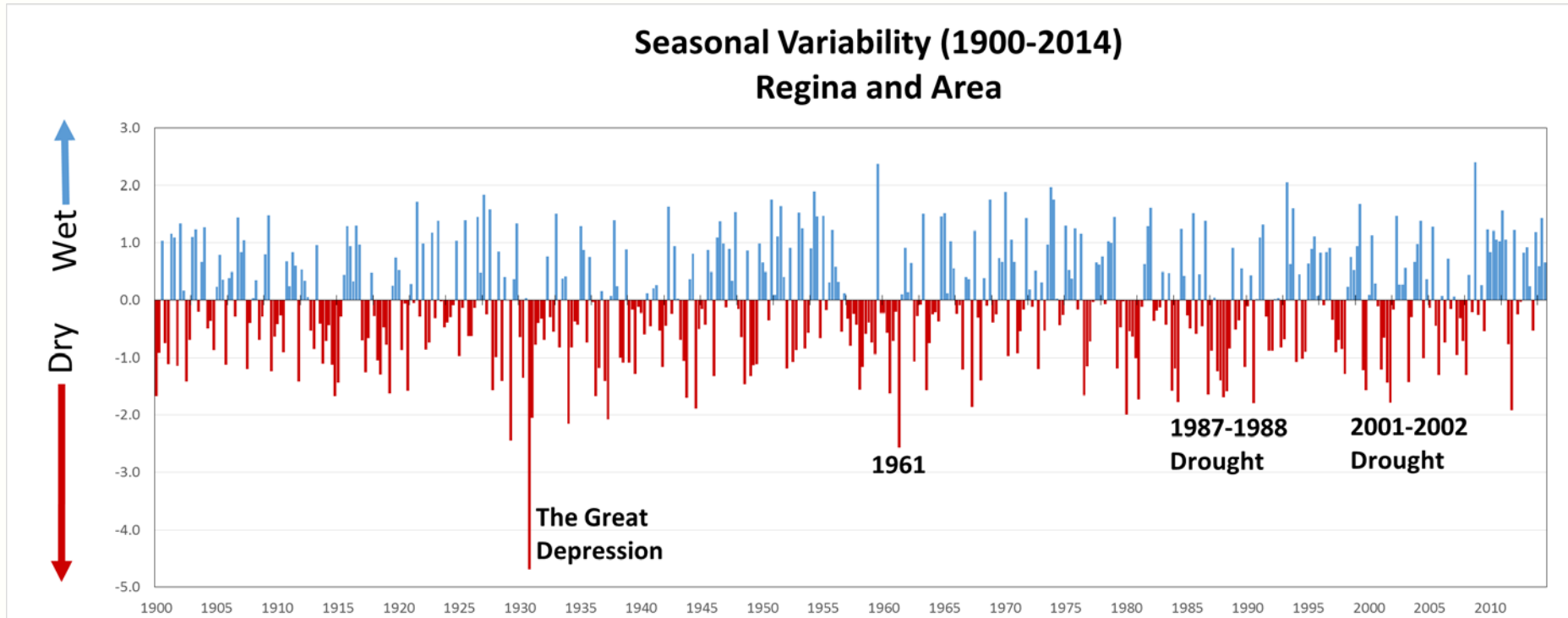
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Drought and Excessive Moisture Severity

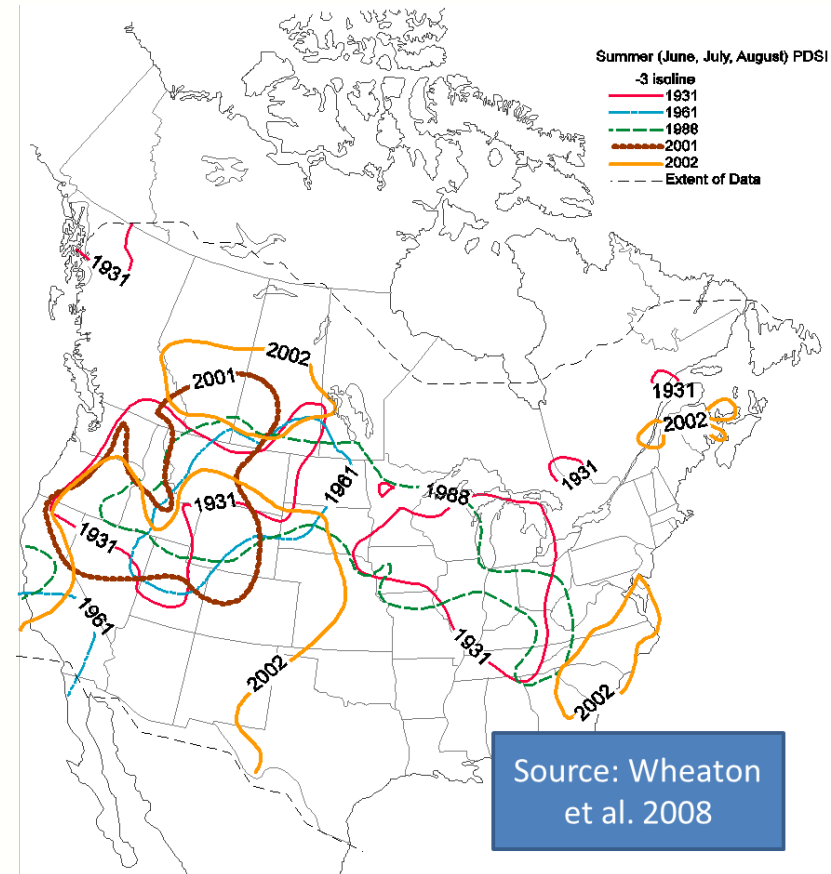


Data: ECCC 2017 SPEI

- Each drought is different from the others

Drought Spatial Patterns

- ↳ Droughts affect different regions
- ↳ Preferred area for droughts in Canada is southern prairie provinces
- ↳ Droughts seem to migrate into the prairies from the USA
- ↳ Northward extension of recent droughts appears to be unusual



Bonsal et al. 2011; Wheaton et al. 2008

Examples of Impacts

- Human and Social Impacts
 - Displaced people such as in the 1930s; any from the 2001-2002 drought?
 - Health issues – West Nile Virus; asthma; etc
 - Psychological issues such as stress
 - Disrupted community support systems
- Economic Impacts
 - Property damage due to fires (grass & forest) damage or destroy buildings etc, dust storms damage ventilation systems
 - Infrastructure disruptions such as water use restrictions; water treatment facilities issues due to low water levels
 - Business losses/closures and job losses
- Bio-Physical Impacts
 - low groundwater levels, low surface water, vegetation damages, insect & disease infestations

Drought of 2001-2002 - estimated reduction in GDP in Canada to be \$5.8 Billion (Wheaton et al. 2008).

Current Precipitation Compared to Historical Distribution

September 1, 2000 to August 31, 2001 (A.M.)

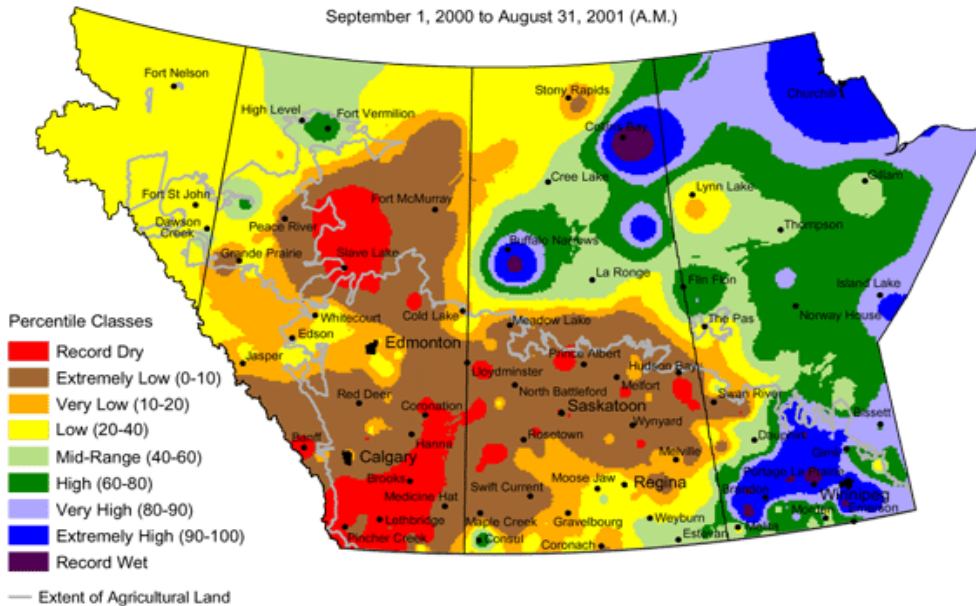


Photo: Istock

Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincial agencies and volunteers that support it.

Map: AAFC 2002

Examples of mitigation strategies

Hydrologic (more in Halliday presentation)

- Constructed (e.g, Dugouts; Dams / reservoirs; Sloughs)
- Non-constructed (e.g., water conservation, re-use)

Agricultural

- Crop production (e.g., switch timing of operations, use drought tolerant crops, change tillage practices, utilize irrigation where possible)
- Enhance use of weather and climate information (e.g., seasonal forecasts, crop modelling)
- Agricultural water supplies (e.g. enhance conservation and efficiencies, improve infrastructure such as wells).
- Reduce soil erosion risk (e.g., conservation tillage, cover crops)

Socio-economic

- Crop insurance (used in both droughts and excessive moisture conditions)
- Social (community) support systems (e.g., Red Cross, Call-in help line for health concerns)
- Financial (e.g., loans; government programs; insurance)

Wittrock and Wheaton 2007; Kulshreshtha and Wheaton 2013; Wheaton and Kulshreshtha 2010

Conclusions

- Saskatchewan has always had droughts and several were widespread and intense
- Saskatchewan has been negatively impacted by drought but depend on several aspects, such as the region in Saskatchewan
- Saskatchewan has also established various mitigation strategies to assist with the negative impacts of drought but some of these work better than others.
 - We need your help in determining if you think the current level of mitigation measures are adequate...

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