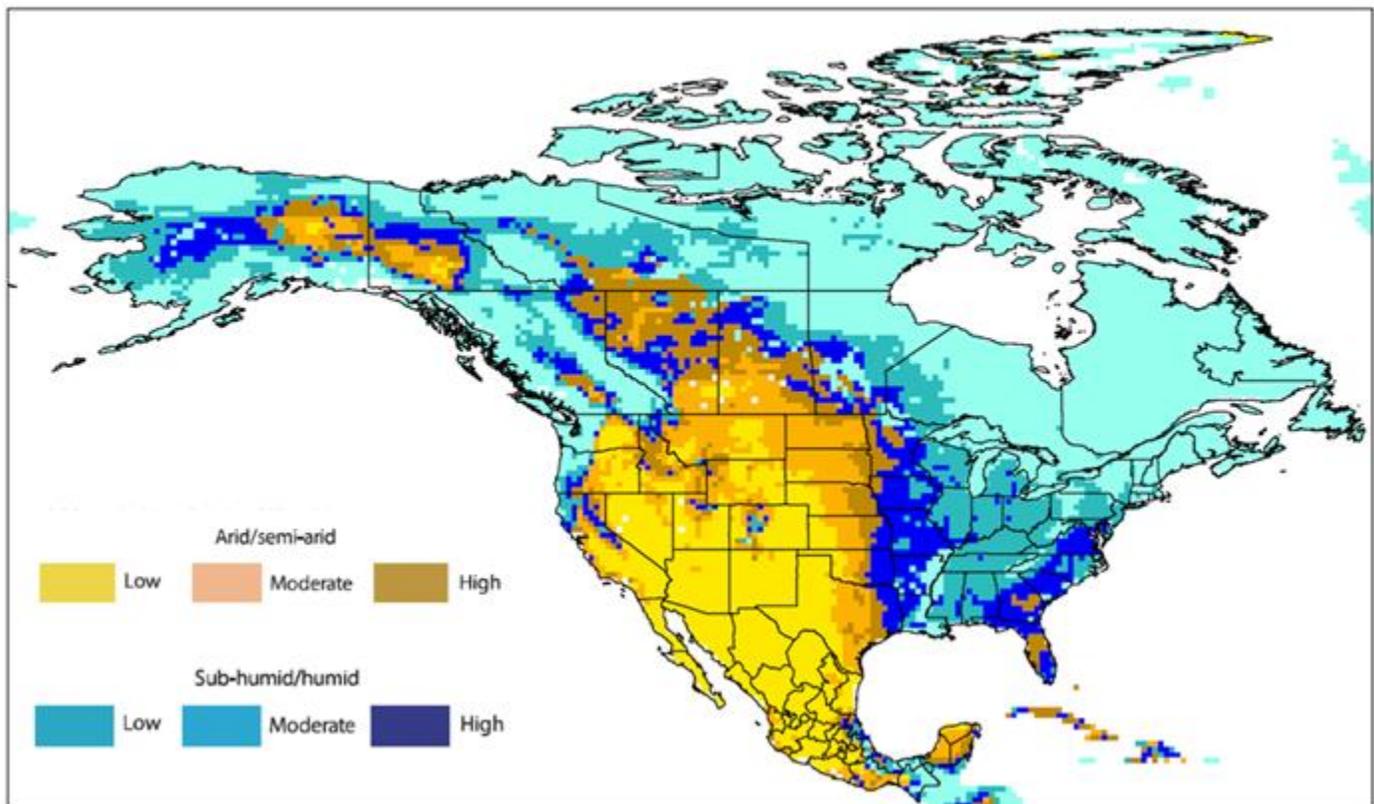


### 3. Recent Observations and Future Projections of Climate Change Impacts in Saskatchewan

The Saskatchewan Citizens' Hearings on Climate Change were fortunate to receive testimony on the effects of climate change on the Prairies from both a scientific and traditional knowledge perspective.

David Sauchyn, head of the Prairie Adaptation Research Collaborative, emphasized Saskatchewan's enormous natural variation in weather conditions. For example, some of the largest variations in rain and snow in the world are in Saskatchewan and Alberta. As a result of this, global trends driven by climate change are often less clearly discerned in our province. He stressed, however, that at a global level the signals being given by climate change are very clear. By the time those signals are equally clear in Saskatchewan, it could be the 2050's or 2060's. This is not a reason, however, for Saskatchewan to delay action on reducing greenhouse gas emissions or on adaptation work.

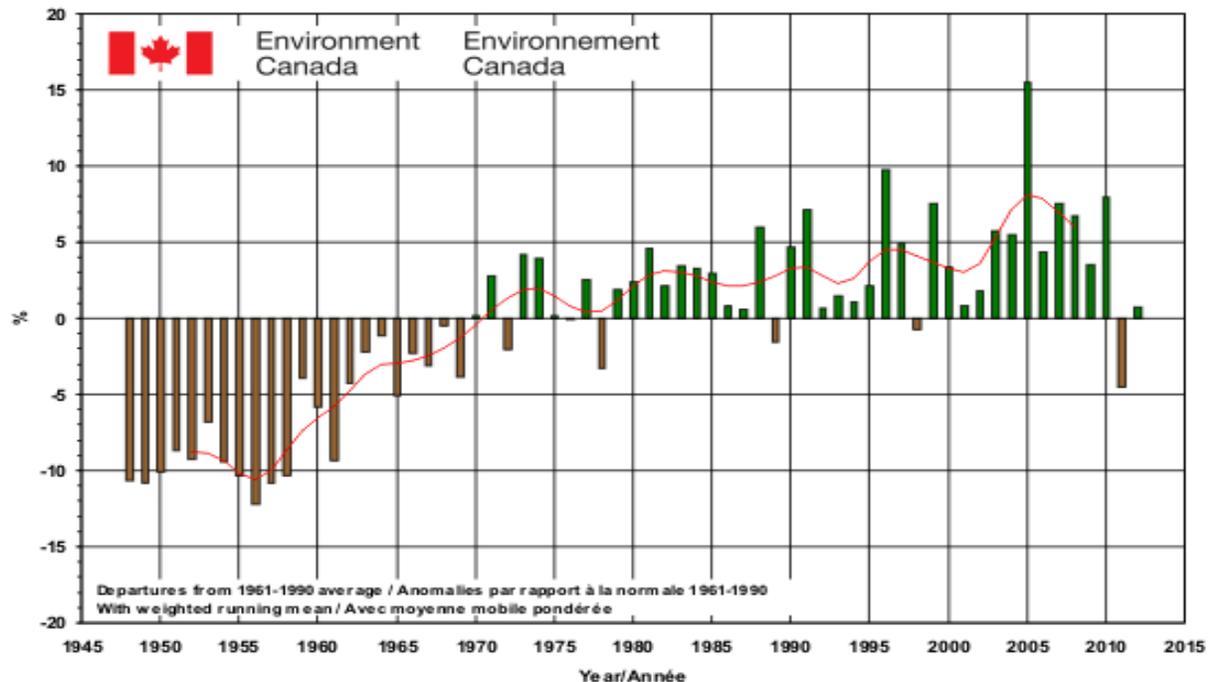
#### Inter-Annual Moisture Variability, North America



SLIDE PRESENTED AT THE HEARINGS BY DR. DAVID SAUCHYN

Toddi Steelman, Executive Director of the School of Environment and Sustainability at the University of Saskatchewan provided a national context for our discussion by explaining that **both annual average temperature and annual precipitation have been on the rise in Canada since 1950**. Annual temperatures have warmed by 1.7 degrees Centigrade over the past 65 years, and with the exception of four years, precipitation levels in Canada have been above the 1961-1990 average ever since 1973, and have been rising during that time.

## Annual National Precipitation Departures with Weighted Running Mean, 1948 - 2012



SLIDE PRESENTED AT THE HEARINGS BY DR. TODDI STEELMAN

Toddi Steelman noted that the prairies had the highest variability in water yield in Canada between 1971 and 2004. She highlighted the projection of her colleague, Dr. John Pomeroy (Centre for Hydrology) that **we can expect to have increased flooding on the prairies due to climate change between now and 2030, and then more drought on the prairies between 2030 and 2050**. She reminded us of the inter-provincial nature of the Saskatchewan River system, and stressed that any solution to manage flooding and drought will need to involve collaboration across political borders to achieve workable solutions.

Elaine Wheaton, Adjunct Professor at the University of Saskatchewan and Emeritus Researcher at the Saskatchewan Research Council noted that one of the results of the increasing temperatures is that the frost free season in central Saskatchewan has increased by at least 25 days over the past 50 years. The number of hot days – in excess of 35 degrees Centigrade – has also increased in Saskatchewan: from 1 to 3 days in the 1960's to 2 to 5 days in the 2000's.

As climate change impacts continue over the course of coming decades, these trends are likely to accelerate. Elaine Wheaton indicated that we can expect more switches of dry/wet and hot/cold, and increased atmospheric capacity for major rainstorms in Saskatchewan with higher intensity, duration and frequency of precipitation. Thus there will be more risk of flooding. Saskatchewan crop yields are likely to increase in the near future with a longer growing season and a higher number of heat units. However, Elaine Wheaton noted that the wild cards in this scenario are increased drought, intense rainfall, and heat waves, which taken together could remove these

yield gains, or worse. Milder winters could also result in increased risk of pests and disease, while higher summertime temperatures are likely to increase water use and result in higher evaporative losses.

Naveed Khaliq of the University of Saskatchewan School of Environment and Sustainability presented evidence on his assessment of future changes to precipitation characteristics over the Canadian prairies provinces using climate models. He sought to predict changes to characteristics of winter, spring, summer and fall precipitation, as well as rain and snow dominated extremes. To do so, he used a multi-Regional Climate Model ensemble available through the North American Regional Climate Change Assessment Program, and did analytical work for 47 watersheds. He worked to compare the 2041-2070 period with the period 1971-2000.

Analysis using the climate model “ensemble-averaged” projected changes showed an increase in mean seasonal precipitation and in rain and snow dominated extremes. He explained that the projections of the models for changes to seasonal precipitation are not outside the range of natural variability. However, the projections for changes to rain and snow dominated extremes do lie outside the range of natural variability.

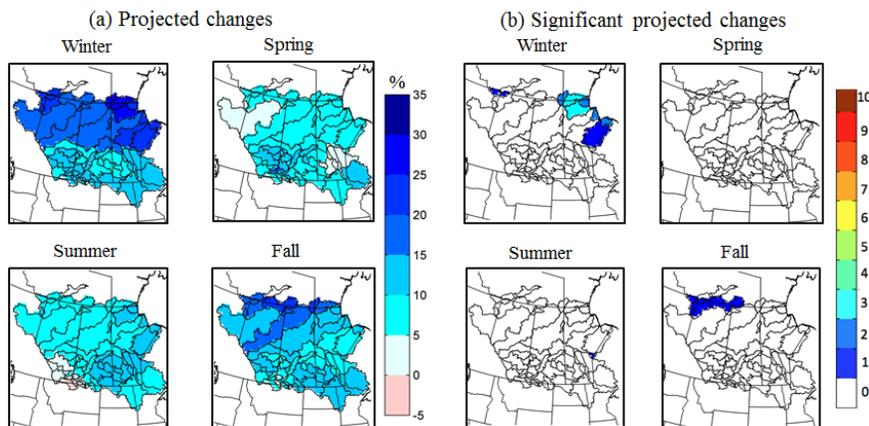
“For warm and cold season precipitation extremes, mostly increases in the intensity of extremes are noted. Decreases in the intensity of precipitation extremes appear to be a less likely case” he said. Naveed Khaliq emphasized that these changes in seasonal and extreme precipitation characteristics will have important implications for managing regional water security-related issues in Alberta, Saskatchewan and Manitoba.

# Results ...



## Projected change: seasonal precipitation

### Ensemble averaged values



[(2041–2070) vs. (1971–2000)]

[www.usask.ca/water](http://www.usask.ca/water)

SLIDE PRESENTED AT THE HEARINGS BY NAVEED KHALIQ

Rose Richardson shared with the Hearings her observations of the changes that are occurring in parts of northwest Saskatchewan based on her intimate knowledge of the land, gained from trapping and harvesting traditional plants. She reported that she is beginning to see more wood ticks in the northern forest. She is also observing fewer song birds, and is noticing fewer frogs and bees.

She noted that extreme weather conditions and dramatic changes in weather patterns have affected traditional medicinal wild plants and the beauty of the environment. Areas that were previously natural forest are gradually becoming tree plantations or sand dunes. **Willows and tree buds, which are used in traditional healing, are being affected by extreme and fluctuating weather patterns, and this is playing havoc on plant regeneration.** For example, over the past 4-5 years, she has noticed that December warm spells have invited willows to start budding, only to freeze and drop their buds when a severe cold snap ensues.

Rose Richardson reported that **extreme storms, never seen before in her area, are affecting ecosystems.** Large forest areas have blown down with increases of plow winds, damaging the nesting and breeding ground of animals, and destroying many plants that rely on an upper canopy to survive. This includes damage to some small plants used in traditional medicine, which need the protection of larger trees for shade. Rose also observed that flooding patterns are changing, and seem to be more intense. The waters are higher, washing away roads and bridges and natural wildlife habitats. Prolonged flooding is changing flood courses and turning dry lands into wetlands, altering plant life patterns. Flooding is also impacting bears, making fishing more difficult because of high waters.

Traci Braaten discussed changes in extreme weather being experienced in First Nations communities. She observed that far northern communities are experiencing more thunder storms, and in southern Saskatchewan several First Nations communities have experienced flooding at levels that require declaration of a state of emergency. Sometimes, communities are facing extreme flood events over multiple years.

Her experience from the Saskatchewan floods of 2010 is that the Government of Saskatchewan needs to get more information from First Nations people on natural processes that are unfolding in their communities. This will assist with preparing an adequate public safety response.

For example, in 2010 ice on rivers was peaking several inches higher than predicted by the Saskatchewan Watershed Authority (now Saskatchewan Water Security Agency). As an example of the difficult extremes being experienced, Traci Braaten pointed to Jumping Deer Creek where temperatures rose 18 degrees Centigrade in one day, so that water covered trees in coulees. The next day blizzard conditions ensued, leaving the local First Nations community fighting flood conditions in a blizzard.

Peter Prebble, Director of Environmental Policy at the Saskatchewan Environmental Society noted that one sign of the growing impact of more extreme weather in Saskatchewan is the rise in spending under the Provincial Disaster Assistance Program (PDAP). Prior to 2005, annual PDAP spending in Saskatchewan was typically under \$2,500,000 dollars, depending on the specific nature of the severe weather events that occurred. Following major flooding in eastern Saskatchewan in the summer of 2005, PDAP expenditures jumped to \$15,154,000 in fiscal year 2005-06. Expenditures have been escalating significantly ever since. Modest improvements were made to the PDAP program by the Government of Saskatchewan in 2010, but the vast bulk of PDAP expenditure increases have been necessitated by widespread flooding problems in many parts of Saskatchewan.

# SASKATCHEWAN'S PROVINCIAL DISASTER ASSISTANCE PROGRAM SPENDING

Fiscal Year Ending March	Total Spending
2002	\$1,500,000
2003	\$1,675,000
2004	\$ 618,000
2005	\$ 276,000
2006	\$15,154,000
2007	\$ 9,866,000
2008	\$31,378,000
2009	\$14,486,000
2010	\$10,440,000
2011	\$48,150,000
2012	\$157,115,000
2013	\$72,597,000

Source: Volume 2 Saskatchewan Government Public Accounts for the fiscal years 2001-2002 through to 2012-13. Slide prepared by Peter Prebble, Director of Environmental Policy, Saskatchewan Environmental Society



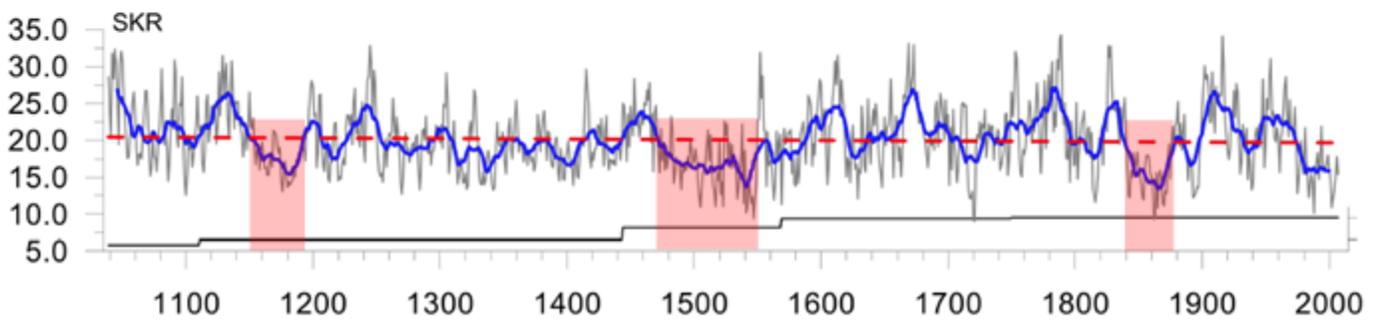
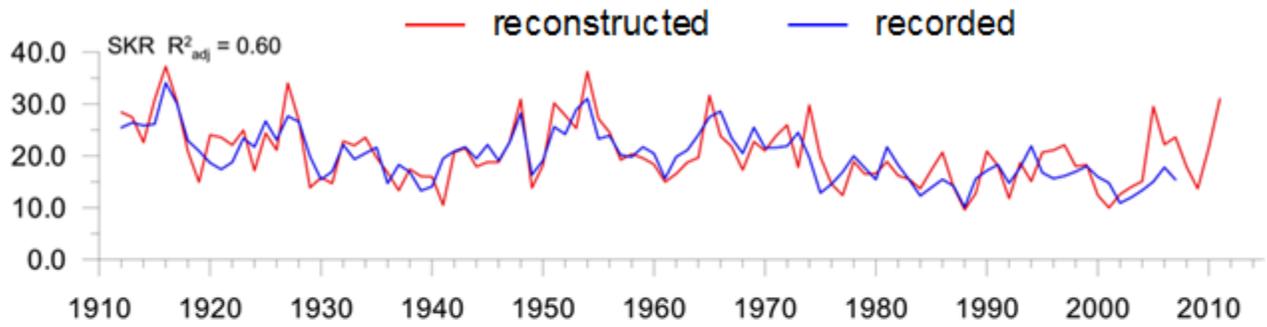
SASKATCHEWAN ENVIRONMENTAL SOCIETY

SLIDE PRESENTED AT THE HEARINGS BY PETER PREBBLE

David Sauchyn, head of the Prairie Adaptation Research Collaborative, emphasized that despite increased precipitation and flooding risks currently being experienced, **drought will reoccur, and when it does, there is potential for very severe effects.** Looking back at the last 1,000 years, extended droughts of 20-30 years have occurred on the South Saskatchewan River on several occasions. For instance, in 1850 the river fell and stayed low for 25 years.

David Sauchyn explained that next time such an event occurs, **the difference will be that it will be taking place in a warming climate,** and that has the potential to compound the effects. He therefore emphasized that it is important for us to ask ourselves what we will do in the face of a potential drought of 25 or 30 years later in this century.

# Annual Flow, South Saskatchewan River at Medicine Hat



SLIDE PRESENTED AT THE HEARINGS BY DR. DAVID SAUCHYN