ClimateWest, a central hub for climate services in Manitoba, Saskatchewan, and Alberta, is proud to host Alberta's Adaptation Resilience Training module recordings and resources.

Check out climatewest.ca for all training material available through ART and other initiatives.





The aim of the Adaptation Resilience Program (ART) is to build the capacity of professionals in Alberta to adapt to climate change. This module was recorded in September, 2021.

Professionals across the Prairie region may find this training useful.

Supported by the Natural Resources Canada's Building Regional Adaptation Capacity and Expertise (BRACE) Program and the Government of Alberta



Alberta







### **Adaptation Resilience Training**

The Weather Isn't What It Used to be: Separating Fact from Fiction and Changing Climate

David Sauchyn, Ph.D., P. Geo, Prairie Adaptation Research Collaborative Jeremy Fyke, Ph.D., P.Geo., Canadian Centre for Climate Services

**September 7, 2021** 



### **ART Training Progress**



Watershed Management Infrastructure

Agriculture and Business

Community Planning

### **Module Outline**

- Climate Change Basics
- Climate Impacts
- Tools and Resources
- Q&A and Discussion



### **Topic 1: Climate Change Basics**



projections S ion Imat biasMode mi correction downscaling historical



Malte Meinshausen/Potsdam Climate Institute

### Jean-Baptiste-Joseph Fourier, 1824 "General Remarks on the Temperature of the Terrestrial Globe and Planetary Spaces"



John Tyndall, <u>1861</u> "On the Absorption & Radiation of Heat by Gases & Vapours, & on the Physical Connexion of Radiation, Absorption, &

Conduction"

Svante August Arrhenius, <u>1896</u> "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground"

Wikipedia.com

### National temperature trends





Canada's Changing Climate Report (CCCR, 2019)

### National precipitation trends





Canada's Changing Climate Report (2019)

### "Humans on Earth"



Gillett et al. (2021)





CCCR (2019), Community Earth System Model, Compute Canada

<u>Downscaling and bias adjustment:</u> ways to move from predictions at large scales to predictions at local scales.



#### Canadian Earth System Model, Sobie and Murdock (2016)

### <u>Downscaling and bias adjustment:</u> ways to move from predictions at large scales to predictions at local scales.



Canadian Regional Climate Model



# **RCP 8.5**:

<u>Representative</u> <u>Concentration Pathway</u> 8.5: "A scenario of comparatively high greenhouse gas emissions"



# **RCP 2.6**

<u>Representative</u> <u>Concentration</u> <u>Pathway 2.6: "the</u> scenario with the most stringent climate policy"

CCCR (2019)



CCCR (2019)



CCCR (2019)



Climate adaptation: actions to reduce climate change risks

### **Polling Question**

### **Topic 2: Climate Impacts What does climate change look like in Alberta?**



#### Monthly Temperature Anomalies (°C), Edmonton, 1900-2018



#### Average Daily Minimum Winter (DJF) Temperature (°C) at Edmonton, 1880 to 2020





### **Bow Glacier**

**1902** Photo: Whyte Museum of the Canadian Rockies (V653/NA-1115, Vaux Family Fonds)

#### Henry Vaux (2014) "Legacy in Time"



#### Average Annual Flow (m<sup>3</sup>/s), Bow River at Banff, 1911 to 2016



#### Annual Precipitation Anomalies (%), Edmonton, 1900-2014



### **Projected temperature change in Alberta**



By the end of the century\*:

High Emissions Scenario (RCP 8.5):+5.8°C

Moderate Emissions Scenario (RCP 4.5): +2.9°C

Low Emissions Scenario (RCP 2.6):+1.7°C

\*Median values, relative to 1986-2005 baseline



### Why is Alberta the "Land of Extremes", and what does that have to do with climate change? Change versus variability in the Albertan context.

### **Climate change and extreme events?**



### **Climate change and extreme events?**





### **Climate change and extreme events?**



# Climate change and extreme events?



# Climate change and extreme events?



### Number of wet days (> 10 mm) at Red Deer AB, 1950-2100



MODELED HISTORICAL

RCP 2.6 MEDIAN - RCP 4.5 MEDIAN

RCP 8.5 MEDIAN

#### **Ten Most Costly Weather Disasters in Canada Since 1983**

DATE	PLACE	EVENT TYPE	LOSSES*
May 3–19, 2016	Fort McMurray AB	Fire	3,899.1
January, 1998	Southern Quebec	Ice storm	2,022.3
June 19–24, 2013	Southern Alberta	Flooding	1,737.4
July 8, 2013	Greater Toronto Area ON	Flooding / Lightning	1,004.6
Aug. 19, 2005	Southern Ontario	Hail / Tornadoes / Wind	779.7
May 4, 2018	Hamilton and GTA ON; Southern Quebec	Windstorm / Water	680.0
May 15–16, 2011	Slave Lake AB	Fire / Windstorm	587.6
Aug. 7, 2014	Central Alberta	Hail / Windstorm / Lightning	582.3
Aug. 12, 2012	Calgary AB	Hail / Lightning / Water	571.8
July 12, 2010	Calgary AB	Hail / Flooding / Windstorm	557.7

\* Insured losses in \$M 2018

Source: IBC Facts 2019

#### Inter-annual Variation in the Climate Moisture Index (P-PET)



GWSP Digital Water Atlas (2008); http://atlas.gwsp.org

#### Projections of Annual Climate Changes for Alberta, From 1976-2005 to 2021-2050



Change in Temperature (°C)

#### Projections of Annual Climate Changes for the NSRB Above Edmonton

From one model (CanRCM4) and one RCP (8.5)

near future (2021-2050)







#### Mean Annual Flow Anomalies (m<sup>3</sup>/s), South Saskatchewan River at Medicine Hat, 1912-2016



#### Annual Flow Anomalies (m<sup>3</sup>/s), South Saskatchewan River 888-2019





#### **Take Away**

Climate change

- is both long-term incremental changes (e.g., declining water levels) and shifts in the intensity of extreme events
- · does not create extreme events but it amplifies their severity



### What are biggest climate change impacts for Albertans today?





### **PRAIRIE PROVINCES CHAPTER**

Canada in a Changing Climate: Sauchyn et al. (2020) Advancing our Knowledge for Action

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### **Prairie Provinces Chapter – Key Messages**



#### Prairie ecosystems will shift and transform as the climate warms

As species respond to climate change, large regions of boreal forest could transition to aspen parkland and grassland ecosystems, while entire mountain ecosystems could disappear. Although biodiversity could increase overall, some species will be lost if the rate of warming exceeds their ability to adapt. Adaptation interventions are based mainly on standard conservation strategies— such as reduction of anthropogenic and other stressors and <u>disturbances</u>—and minimizing barriers to movement.

Sauchyn et al. (2020)

#### Shift in Alberta's Ecological Regions in Response to Climate Change

Schneider and Bayne (2013)

The bioclimatic envelope model projections for the 2050s are based on a medium emissions scenario (A2) and Global Climate Model (ECHAM5) that produces median climate projections for Alberta



2050



### **Prairie Province Chapter – Key Message**



Climate change brings both benefits and threats to agriculture

Prairie agriculture, particularly crop production, may benefit from higher temperatures and a longer growing season. Achieving net benefits will require adaptation to limit the impacts of climate extremes, including on water availability, and the increased risk of pests, vector-borne diseases and invasive species.

#### Forage Yield (kg/ha) Onefour, AB, 1930-2014



### **Prairie Provinces Chapter – Key Messages**

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orse

Extreme weath provides of amplified severity will likely be the most characteristic consequence of climate change in the Prairie provinces. The impacts of drought and wildfire in recent years are accedented, and climate models suggest an increased risk of these events in the future. Provincial and municipal governments have responded by proposing policies, structures and practices to reduce the impacts of future extreme weather events.







Anis et al. (2021)

#### Past and Future Water Year Hydrographs, NSR at Edmonton



Daily river flow (m<sup>3</sup>/s)

### **Prairie Provinces Chapter – Key Messages**



# Social groups have unique vulnerabilities and strengths

The impacts of climate change may exacerbate existing societal inequities, especially among Indigenous peoples, women, people of low socio-economic status, youth and the elderly. Public policy and adaptation planning should consider the unique vulnerabilities and strengths of these social groups, and also the means by which race, age, gender and poverty amplify vulnerability or resilience to climate hazards.

### **Q&A Time/Polling Questions**





### **Topic 3: Tools and Resources**



# National codes and standards

### Climate Resilient Buildings & Core Public Infrastructure

- Updating codes/guides/models to address future climate change and extreme weather events
  - Buildings
  - Bridges
  - Roads
  - Water/wastewater
  - Transit
  - Decision support
  - Climate data



#### www.infrastructure.gc.ca/plan/crbcpi-irccipb-eng.html

## **National infrastructure funding**

### Climate Lens

- Infrastructure Canada requires climate assessments with applications for Investing in Canada Infrastructure Program (ICIP) support
  - Resilience Assessments
  - GHG Mitigation Assessments





www.infrastructure.gc.ca/pub/other-autre/cl-occ-eng.html

### Where to go for basic climate information? Guidance

Following slides...

- When to use the information
- What are the differences
- How do people use this information
- Level of details Basic information if you're not a modeler.
- Can we include Alberta Climate Records?

### Where to find climate information

### **Climate Atlas of Canada**

#### www.climateatlas.ca

Maps, data, videos and narratives that support climate decision-making and storytelling.



#### **Climate Data:**

- Climate data by "small grid cell" (30 x 60km), "large grid cell" (100km<sup>2</sup>), province or from a selection of cities
- Data by season
- Temperature and precipitation variables and climate indices

#### **Helpful Resources**

- Climate science articles, videoson climate change and "how to take climate action"
- Reports summarizing issues
- City climate reports

### Where to find climate information

### **Canadian Climate Data**

www.climatedata.ca

High-resolution climate data to help decision makers build a more resilient Canada



ClimateData.ca provides high-resolution climate data to help decision makers build a more resilient Canada.

#### **Climate Data:**

- 10x10km resolution climate data
- Temperature and precipitation variables and climate indices
- Observed climate normalsand daily data download
- IDF curves

#### **Helpful Resources:**

- Location-based summaries
- Local and national scale charts and maps
- Ability to compare emission scenarios
- Custom heat wave analysis tool
- Sector modules with tailored case studies
- Training modules

#### Scope: National

### **Canadian Centre for Climate Services**



### Environment and Climate Change Canada

https://<u>www.canada.ca/en/environment-climate-</u> change/services/climate-change/canadian-centreclimate-services.html



#### **Alberta Climate Information Services (ACIS)**

An **interactive tool** that helps producers, farm consultants, and researchers to see Alberta weather forecasts, browse over **10000 maps** of Alberta weather and Alberta climate related information, and access near **real time station data** from over 350 meteorological stations operating in the province of Alberta. The maps and weather data describe Alberta's weather, climate and related agriculture features to help with **your long-term planning and decision-making** throughout the growing season.

https://acis.alberta.ca/



### Meet ClimateWest



- A non-profit and regional hub for climate services in Manitoba, Saskatchewan and Alberta.
- We provide access to regionally relevant climate information for the Prairies.



- Our mission is to empower people, communities, businesses and governments to address climate risk through planning and action.
- ClimateWest joins a network of regional climate service providers associated with the <u>Canadian Centre for Climate Services</u> (CCCS). <u>PCIC</u> serves BC/Yukon. <u>Ouranos</u> serves Quebec.

### Key Take Aways

- Human-caused climate change is: based on well-established science, causing significant present-day impacts and will continue until carbon emissions fall to zero
- Climate model simulations, downscaling and bias adjustment provide estimates of future climate conditions, for different greenhouse gas concentration scenarios
- <u>Climate adaptation</u> and <u>climate mitigation</u> are two ways society is responding to climate change
- Resources are readily available for your information



### **THANK YOU!**



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## **THANK YOU!**

If you have any questions, please contact info@climatewest.ca

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