Prairie Climate Centre

Introduction to the Prairie Climate Centre: Implications for Planning

June 21, 2016 – Rural Development Institute

THE UNIVERSITY OF WINNIPEG

IISD
International Institute for Sustainable Development

Acknowledgements

Prairie Climate Centre

THE UNIVERSITY OF WINNIPEG

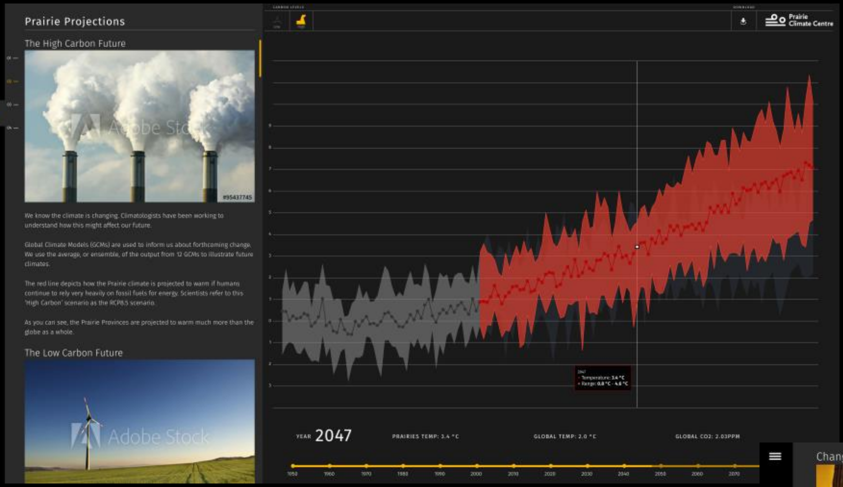
IISD
International Institute for Sustainable Development

THE Great-West Life ASSURANCE COMPANY

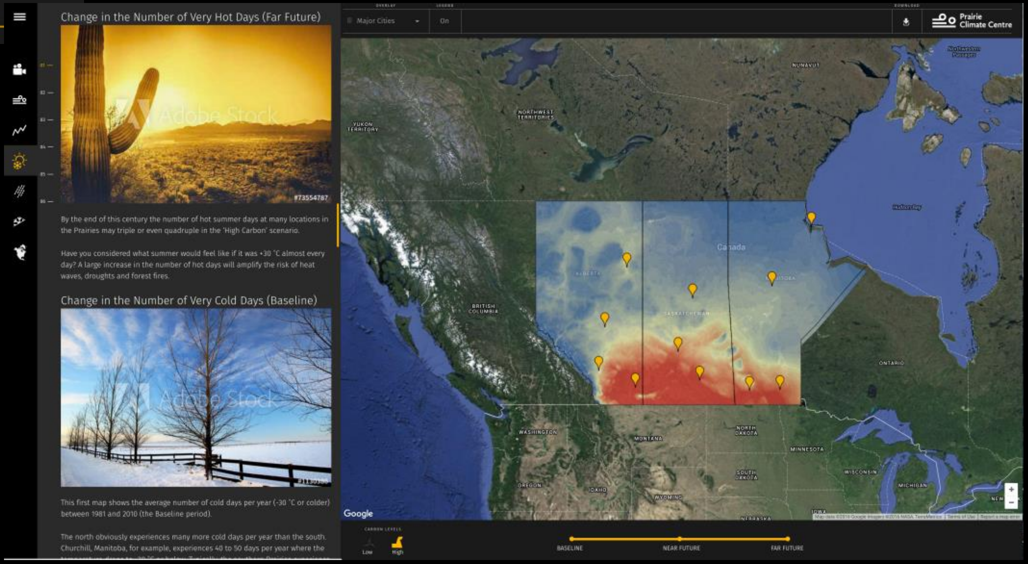
Manitoba

Interactive Atlas

Prairie Climate Centre



2047: 2^0 Globally = 3.4^0 in Prairies



Spatial Documentary Video

Days -30° or Colder

Shifting Extremes

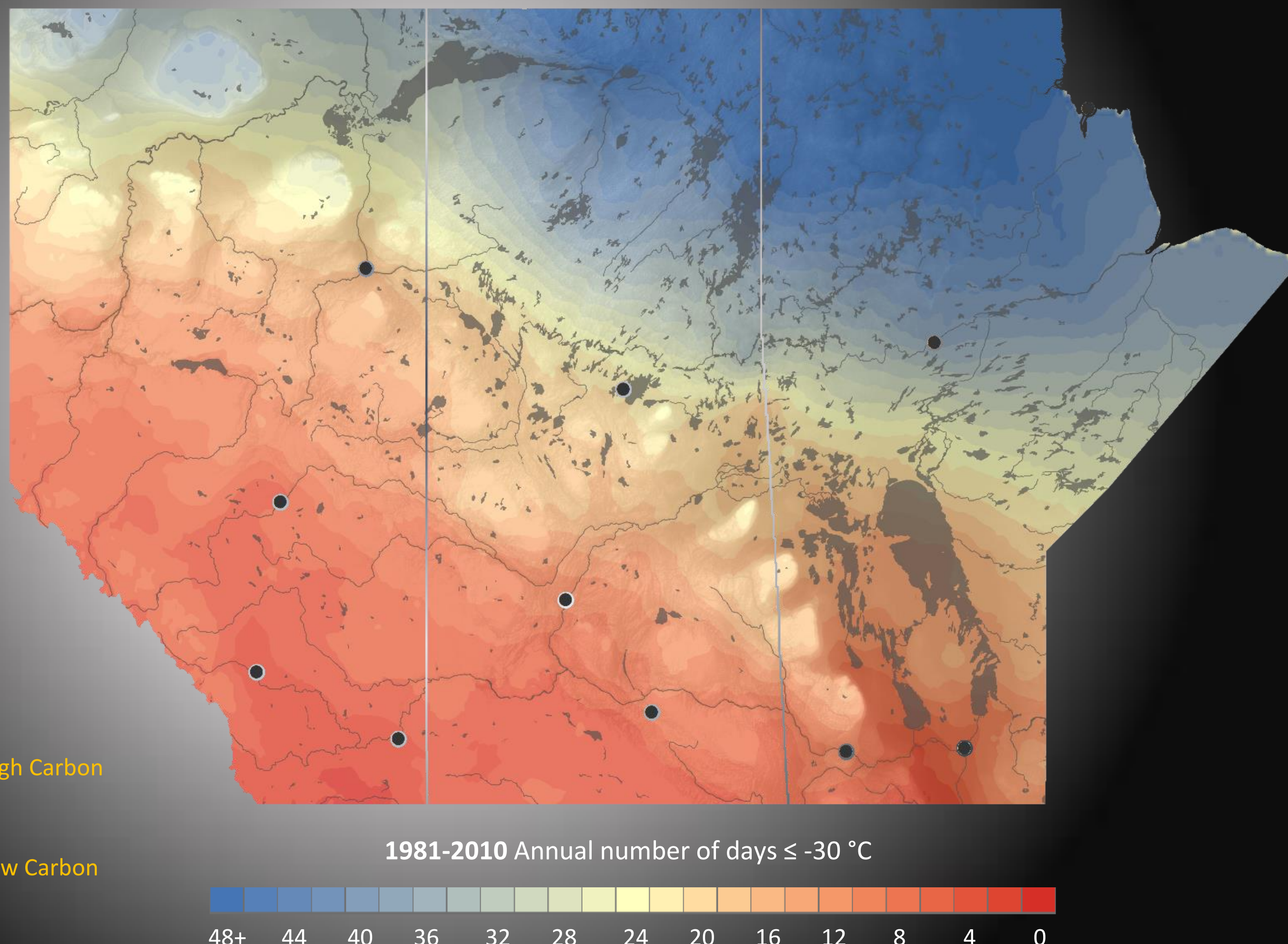
Change in the Number of Very Cold Days

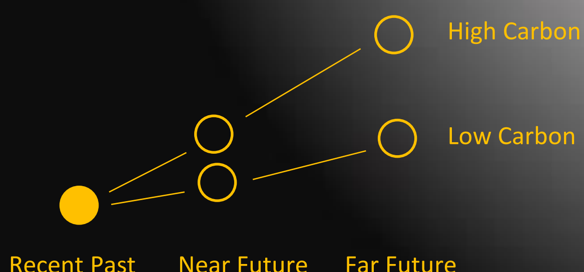
Prairie Climate Centre

This is the type of image that will be on our website.

Draped over scalable Google Earth images.

Major centres will be clickable, to obtain data details.





Data Source: Pacific Climate Impacts Consortium (PCIC), University of Victoria, (2014). Statistically Downscaled Climate Scenarios. Downloaded from pacificclimate.org.

Shifting Extremes

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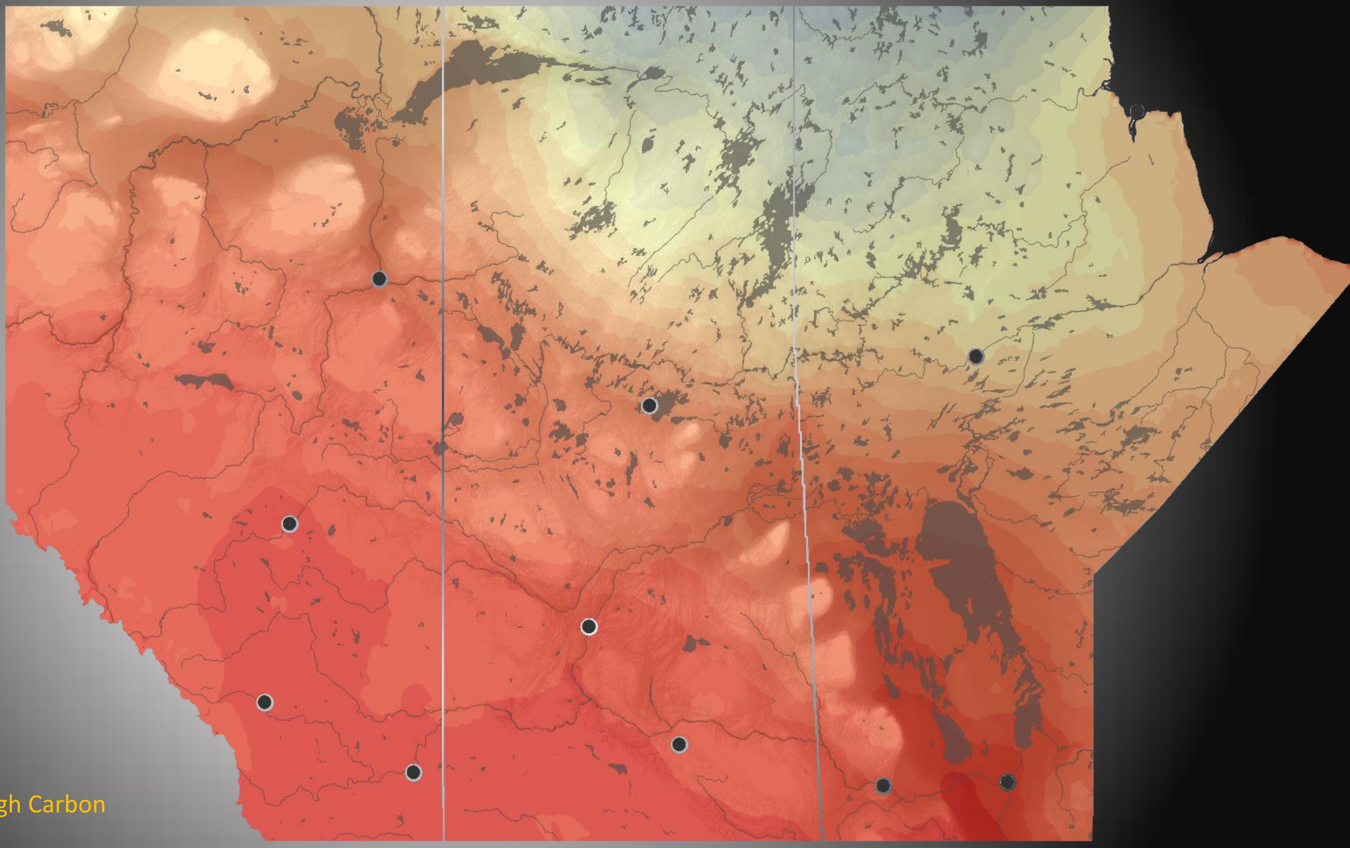
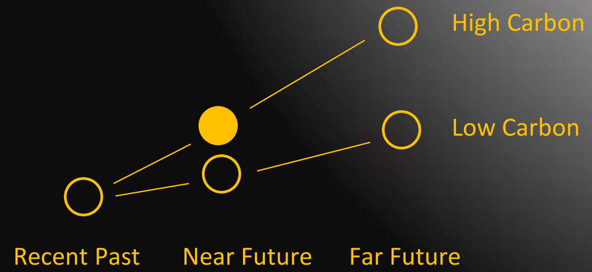
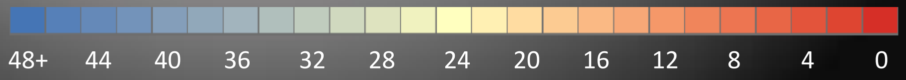




2021-2050 Annual number of days ≤ -30 °C



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Shifting Extremes

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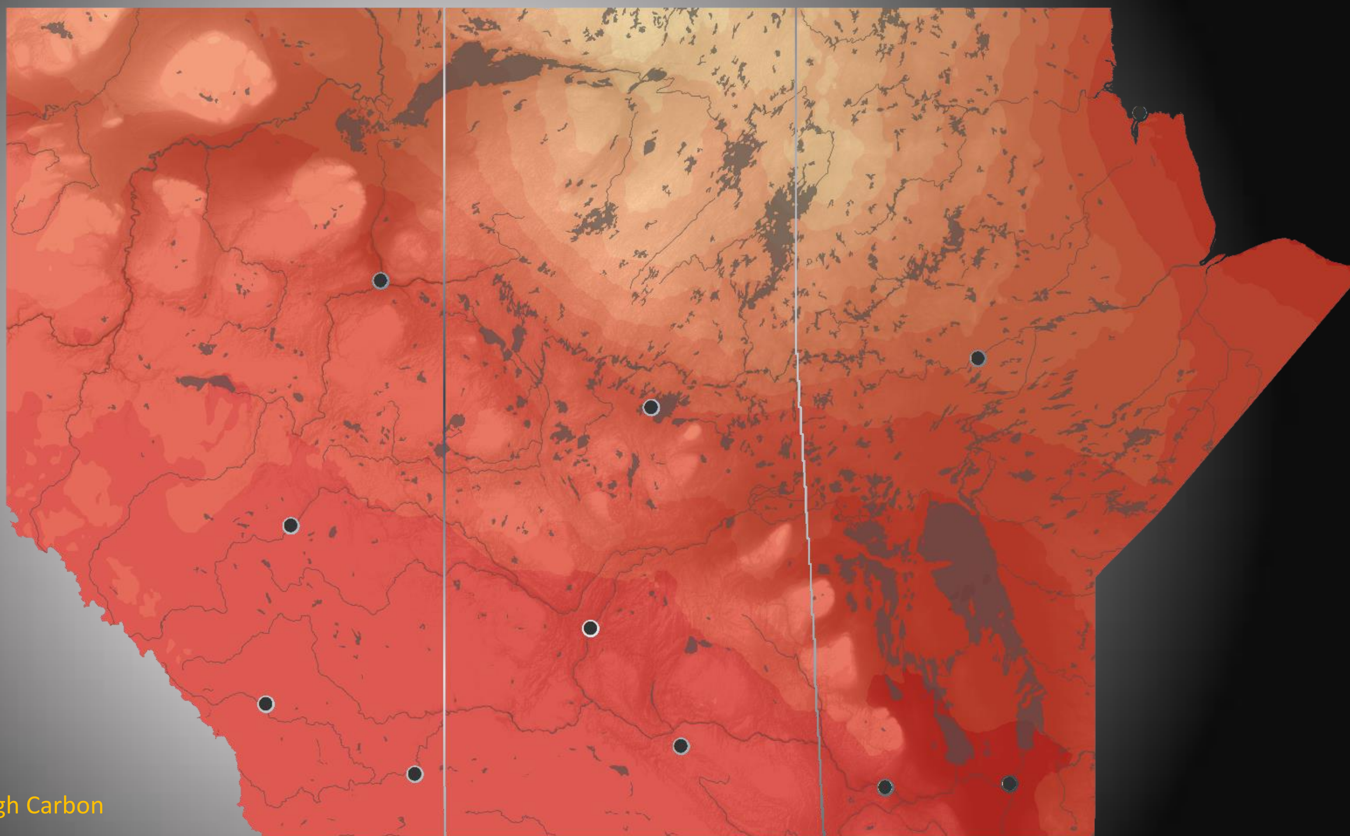
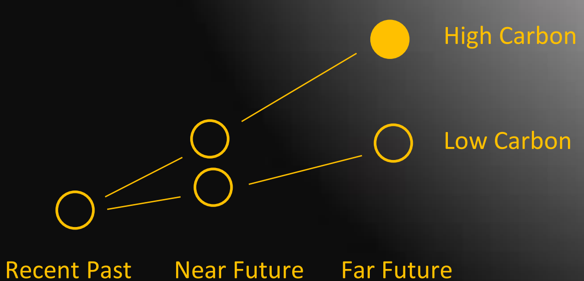


2051-2080 Annual number of days ≤ -30 °C

48+ 44 40 36 32 28 24 20 16 12 8 4 0



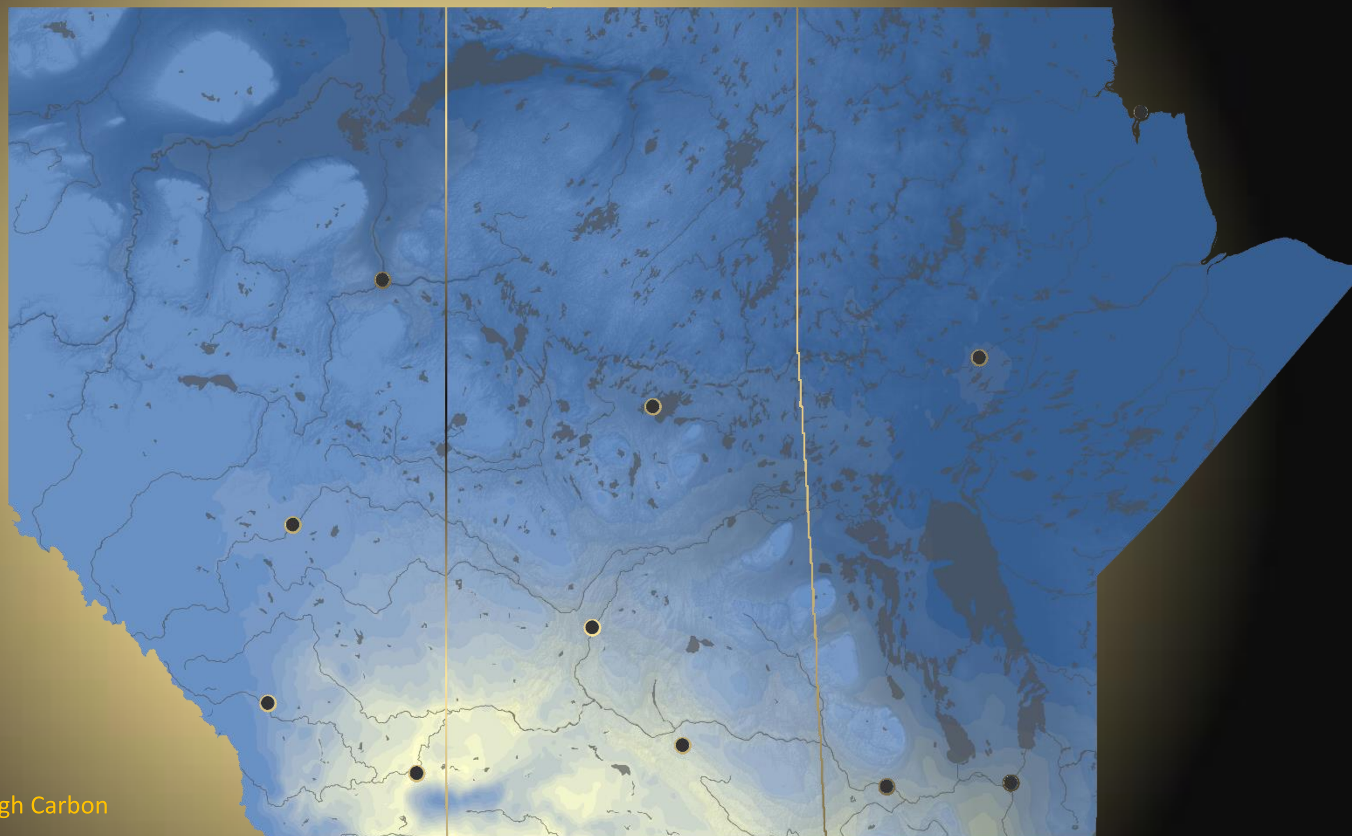
Data Source: Pacific Climate Impacts Consortium (PCIC), University of Victoria, (2014). Statistically Downscaled Climate Scenarios. Downloaded from pacificclimate.org.

Days +30° or Warmer

Shifting Extremes

Change in the Number of Very Hot Days

Prairie Climate Centre



High Carbon

Low Carbon

Recent Past Near Future Far Future

1981-2010 Annual number of days ≥ 30 °C

0 4 8 12 16 20 24 28 32 36 40 44 48+

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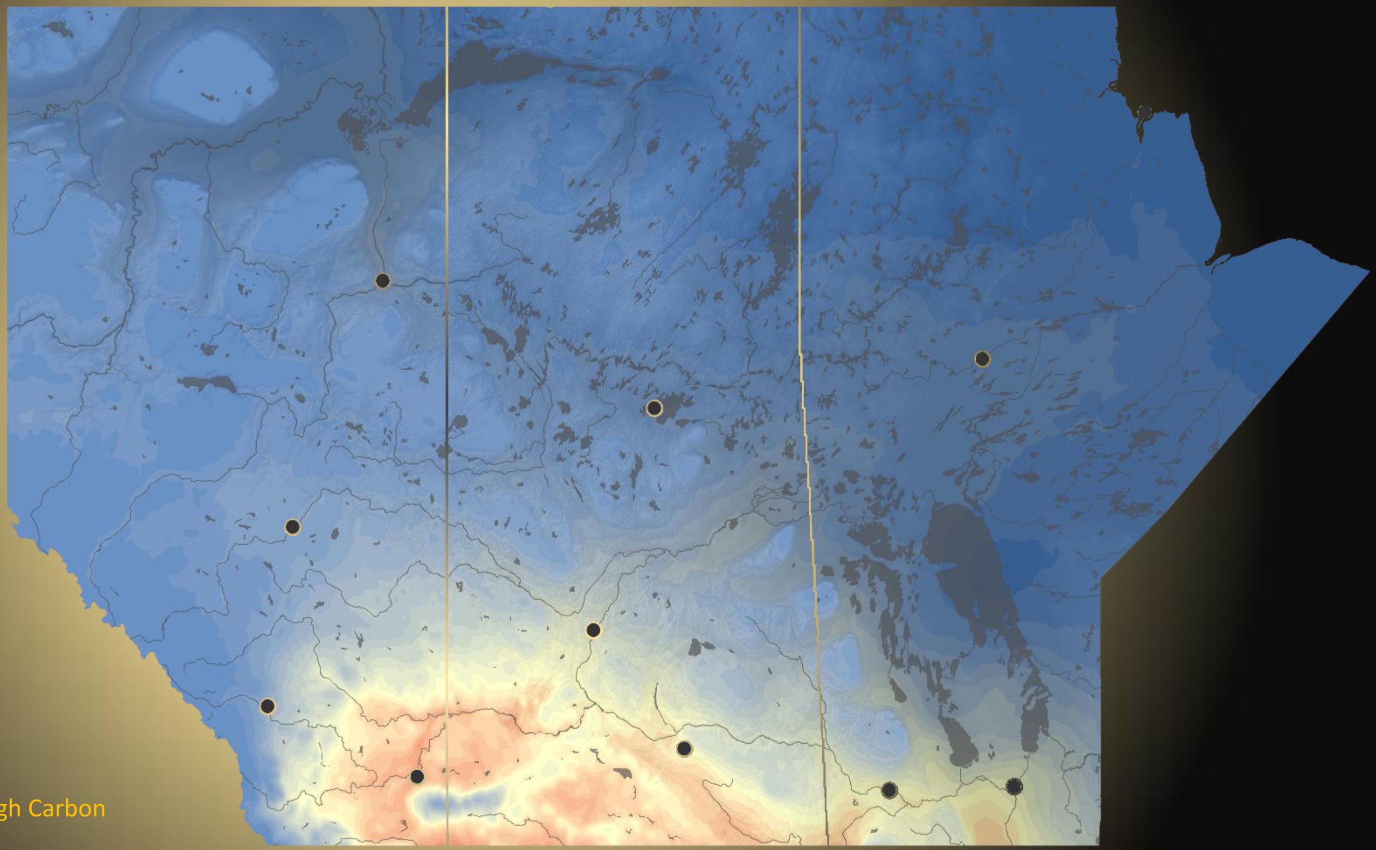
Shifting Extremes

Change in the Number of Very Hot Days

Prairie Climate Centre



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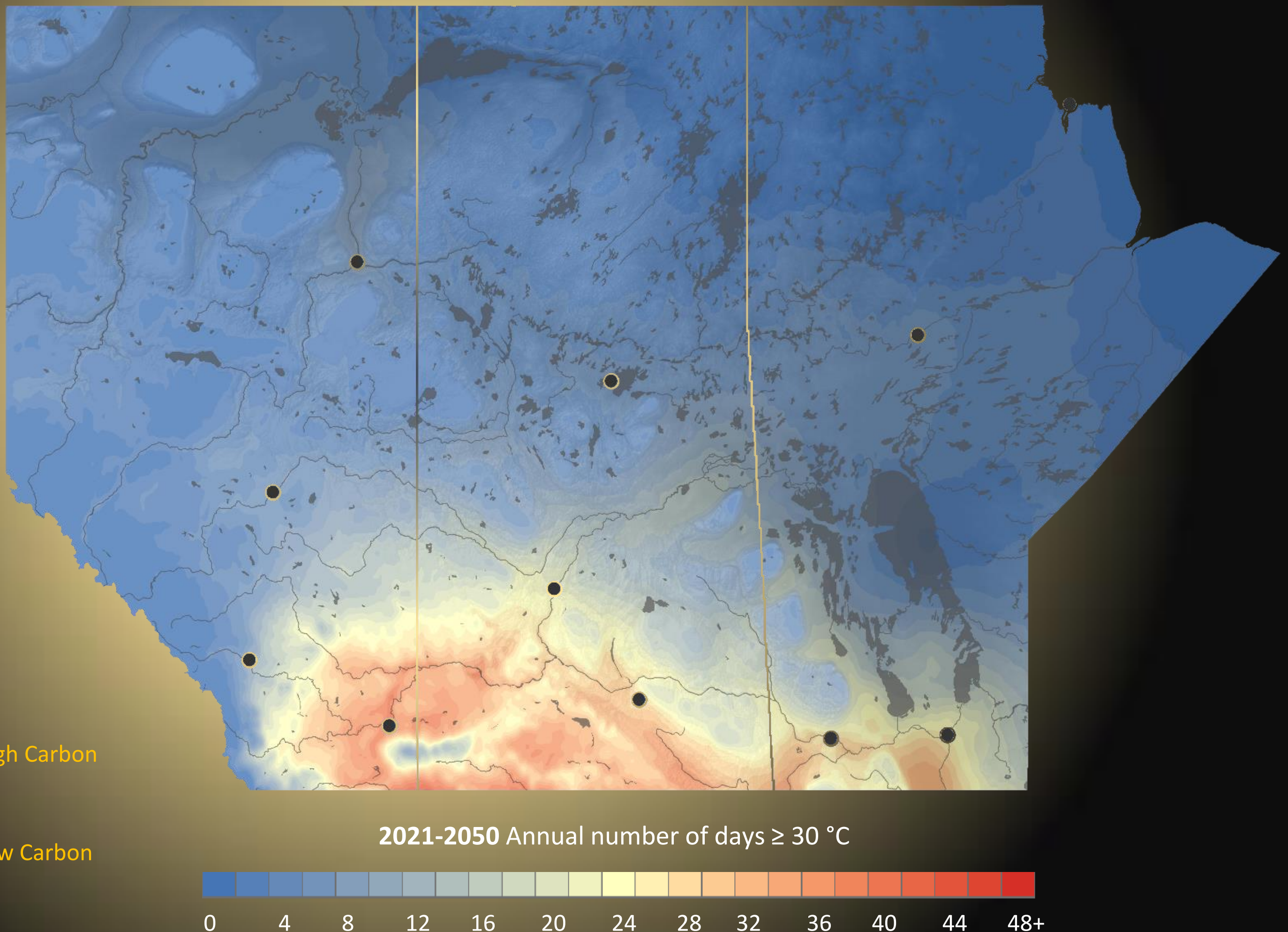

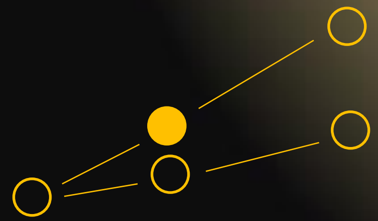

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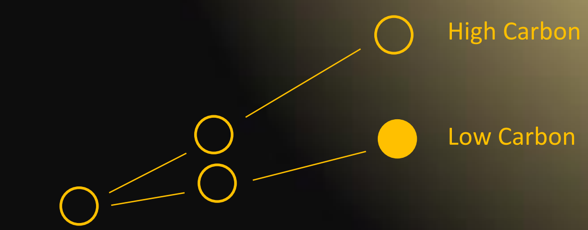

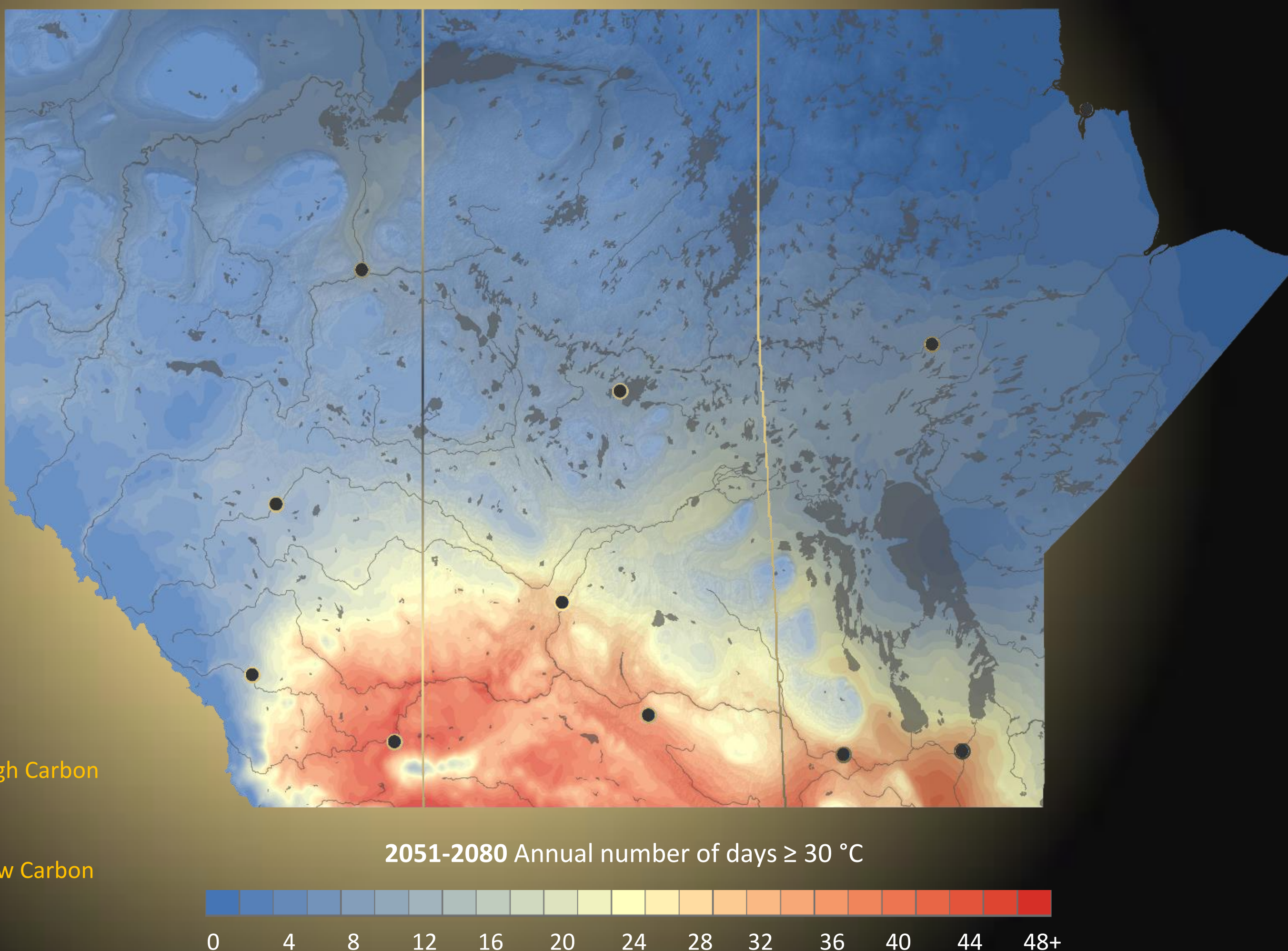

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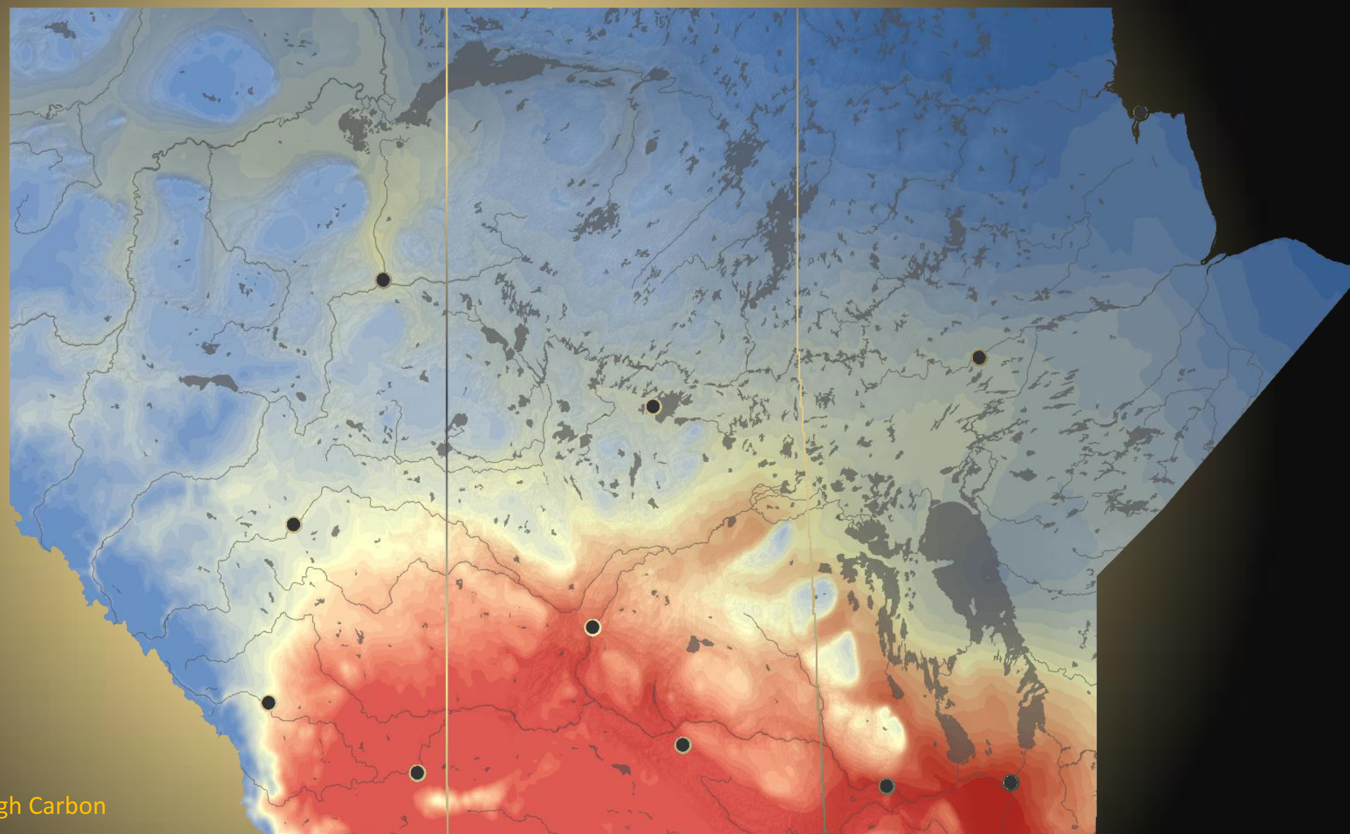
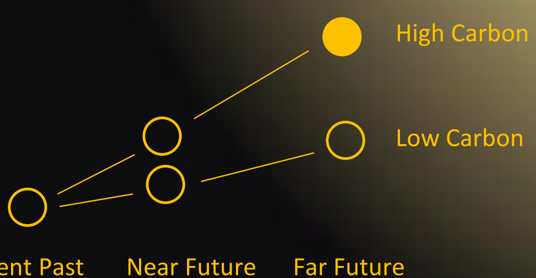
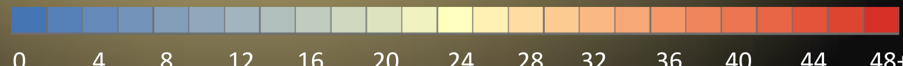




2051-2080 Annual number of days ≥ 30 °C



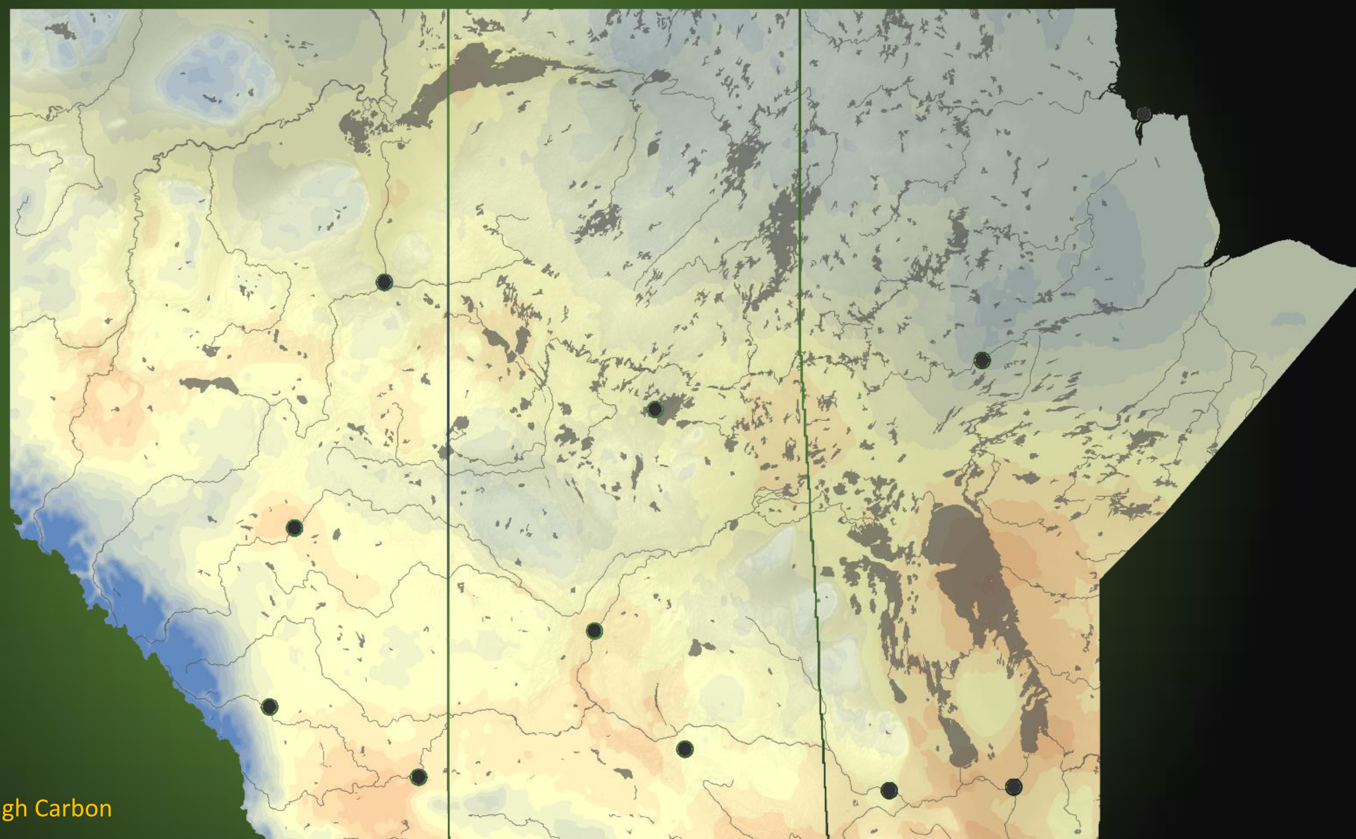
Data Source: Pacific Climate Impacts Consortium (PCIC), University of Victoria, (2014). Statistically Downscaled Climate Scenarios. Downloaded from pacificclimate.org.

Frost-Free Period

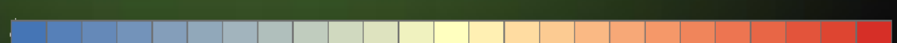
Frost-Free Period

A Much Longer Growing Season

Prairie Climate Centre



1981-2010 Length of the Frost-Free Period (days)



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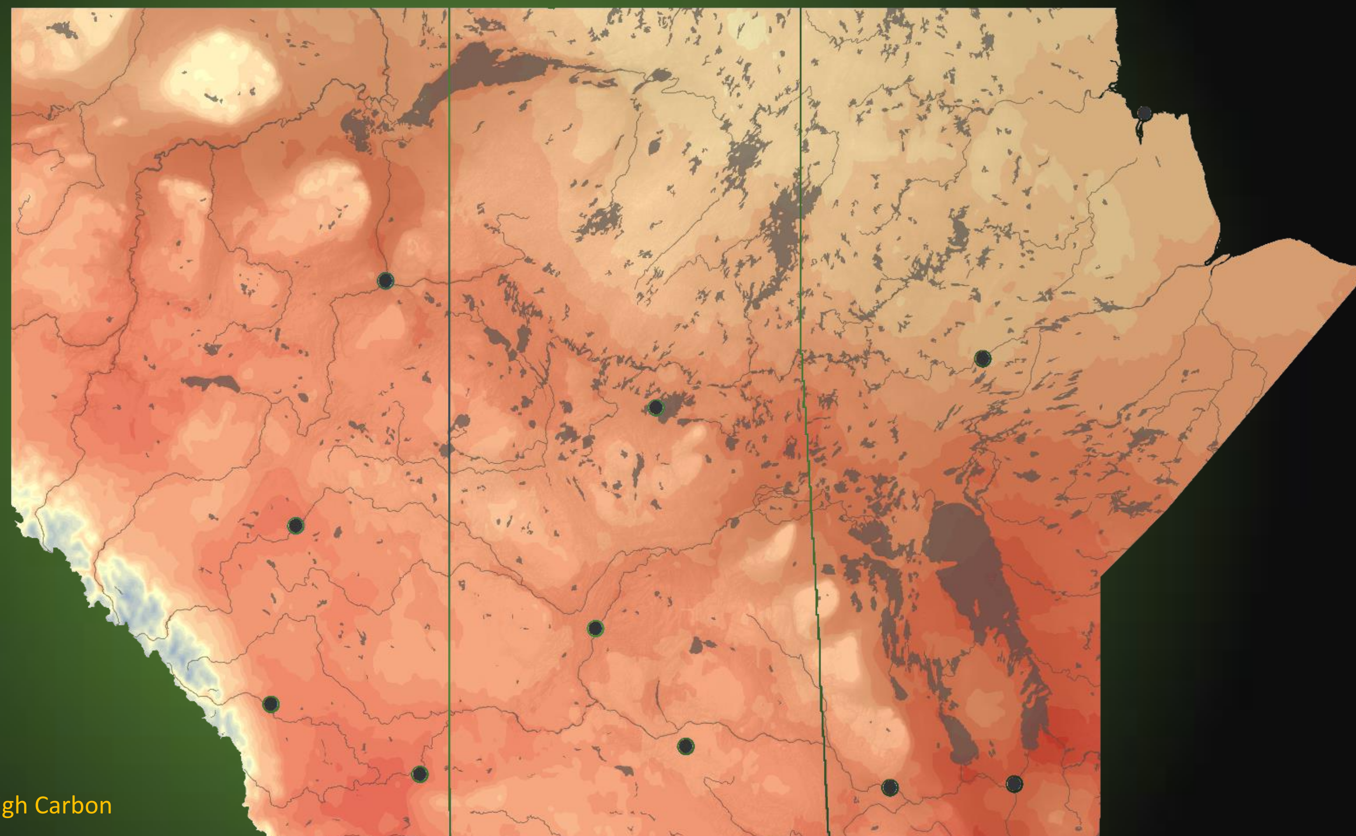

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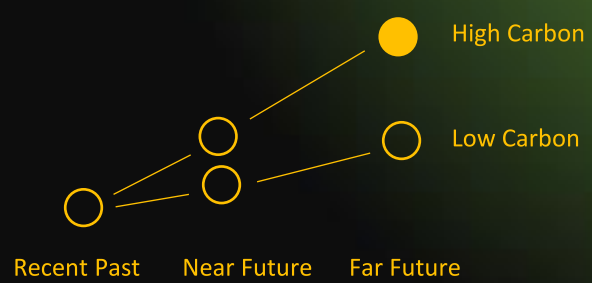

Data Source: Pacific Climate Impacts Consortium (PCIC), University of Victoria, (2014).
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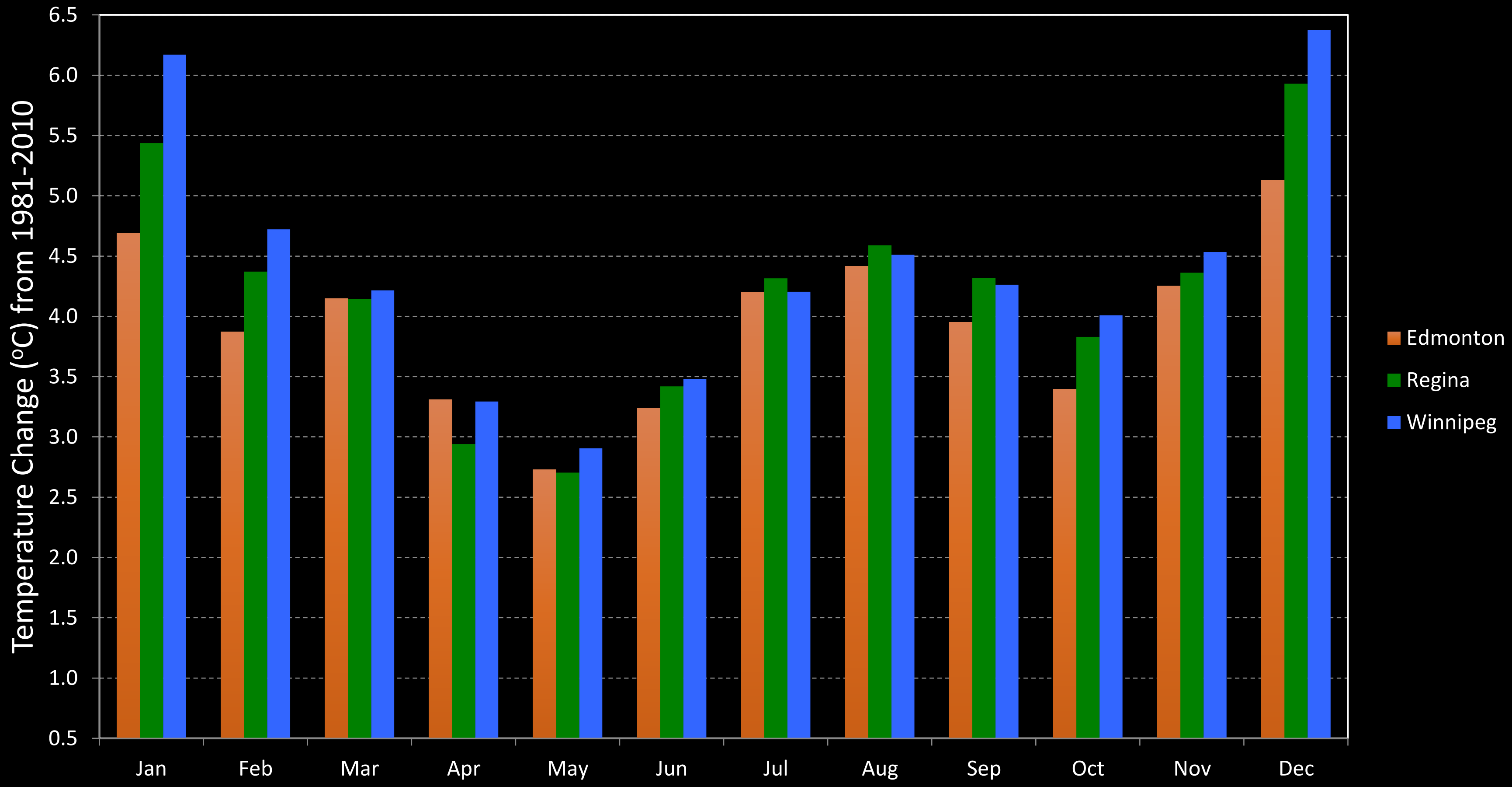
2051-2080 ΔT: RCP8.5

Prairie Climate Centre

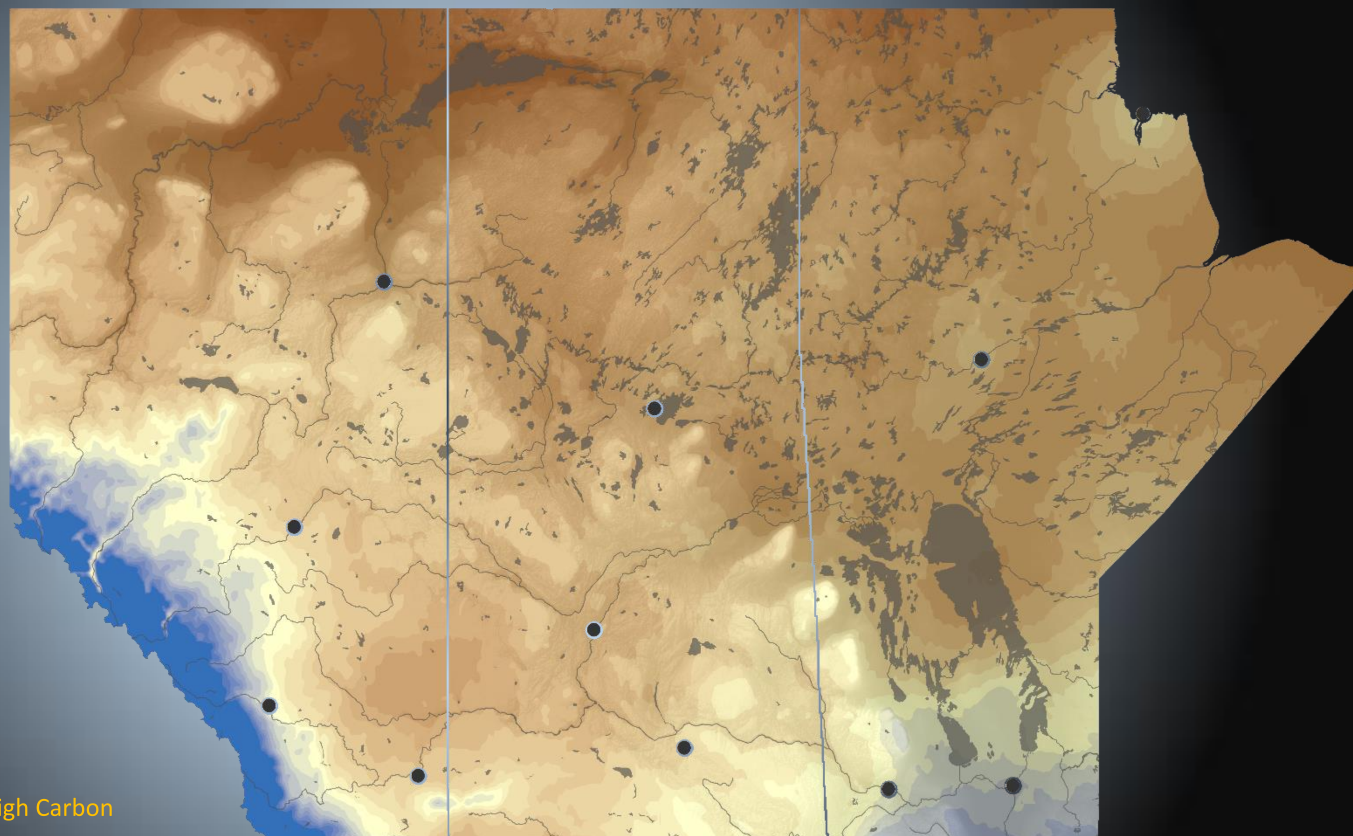


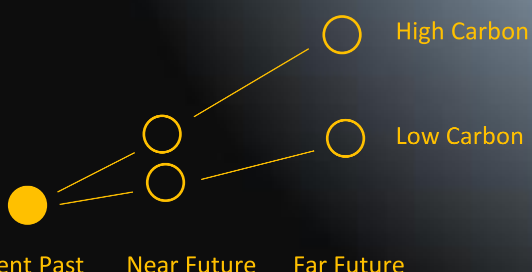
Spring Precipitation

Prairie Precipitation

Projected Changes in Total Spring Precipitation

Prairie Climate Centre





1981-2010 Total Spring Precipitation (mm)

50 60 70 80 90 100 110 120 130 140 150+

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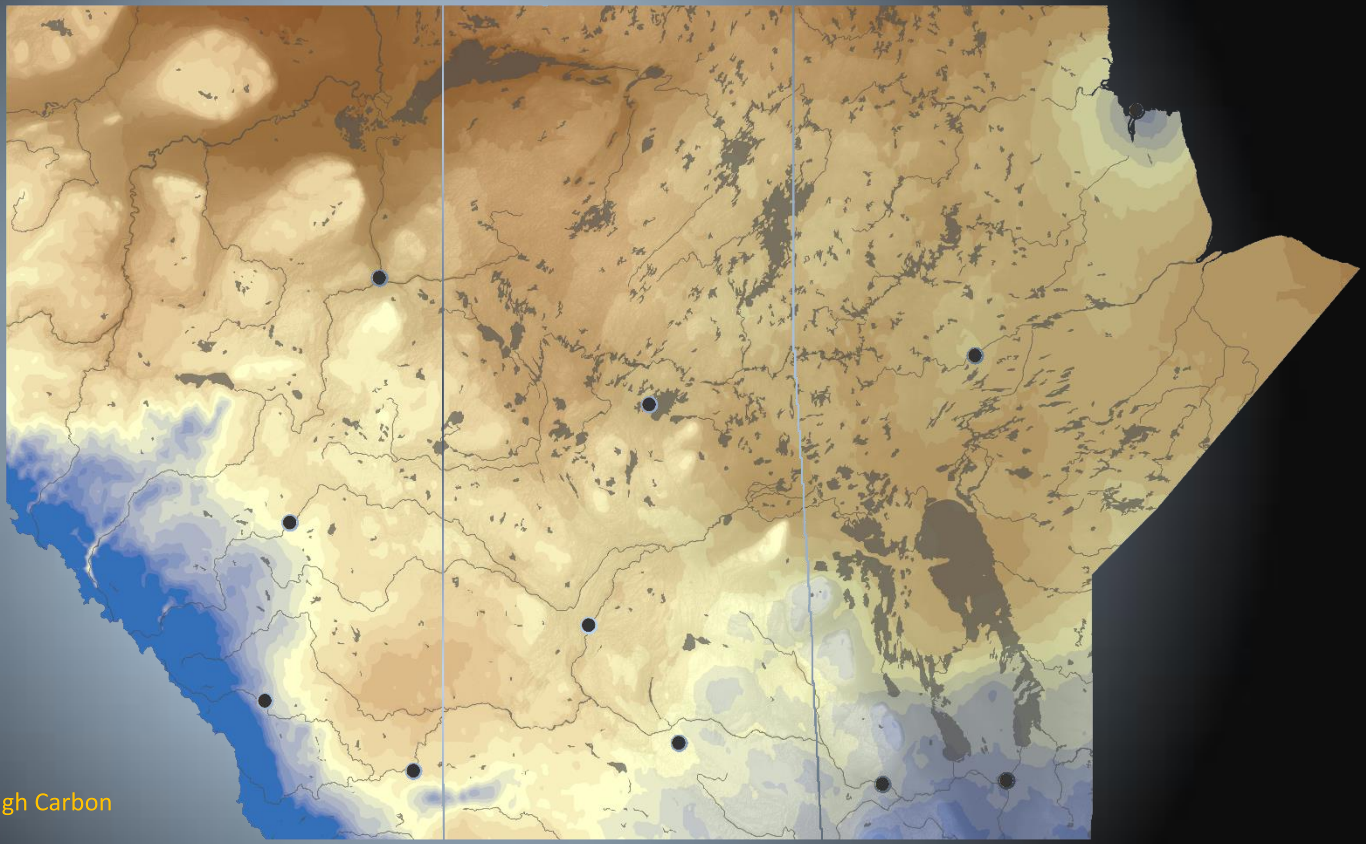
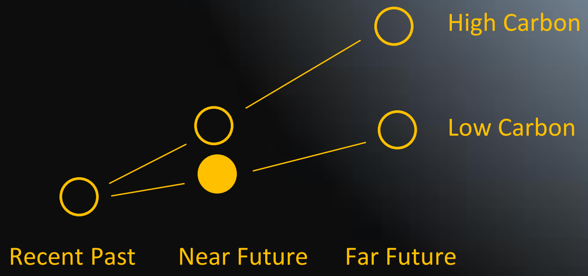
Prairie Precipitation

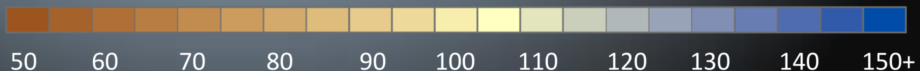
Projected Changes in Total Spring Precipitation

Prairie
Climate Centre





2021-2050 Total Spring Precipitation (mm)



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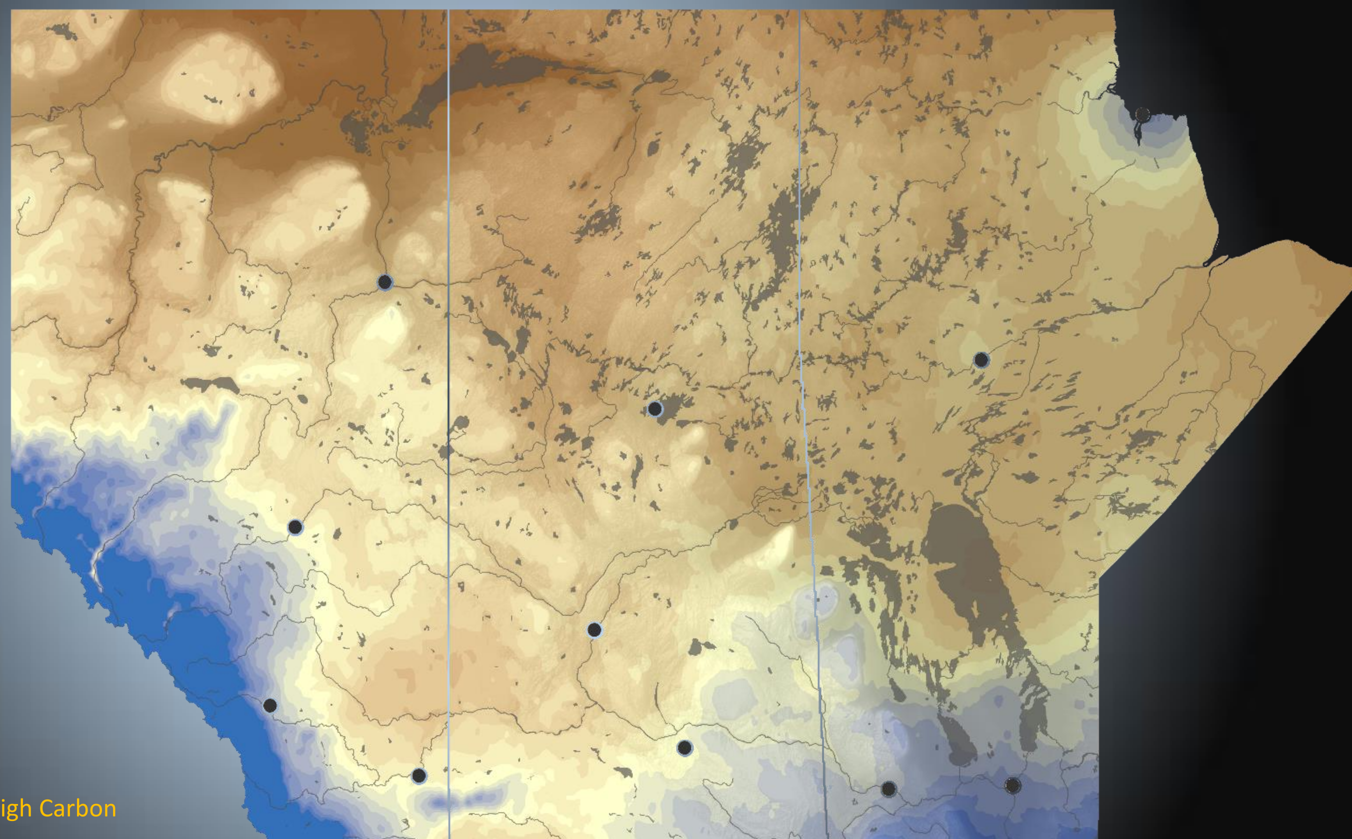

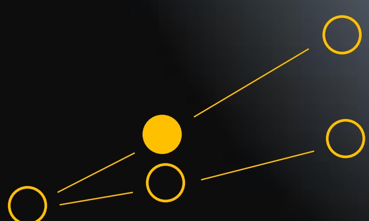

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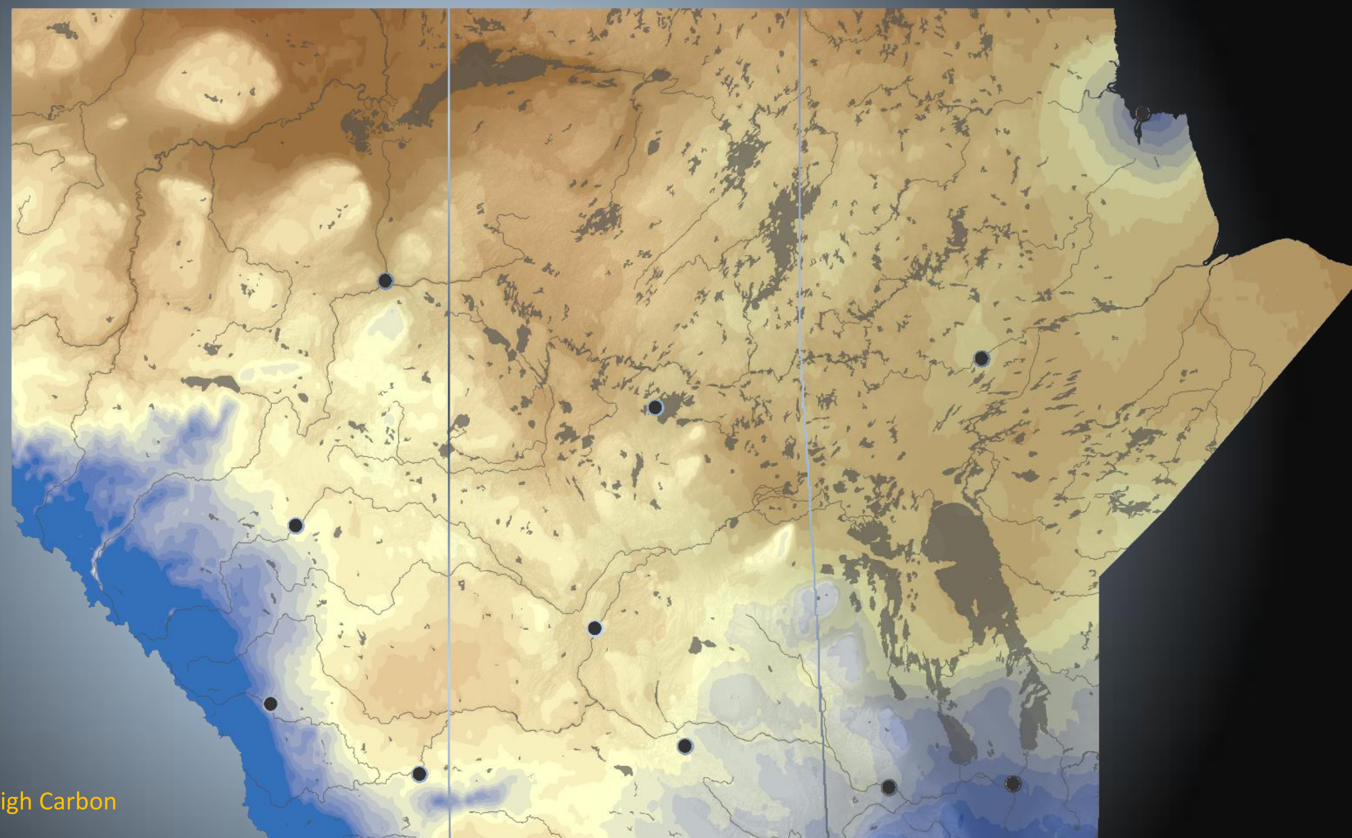

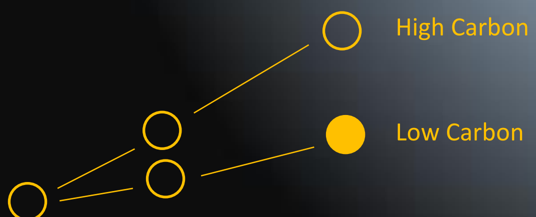

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Projected Changes in Total Spring Precipitation

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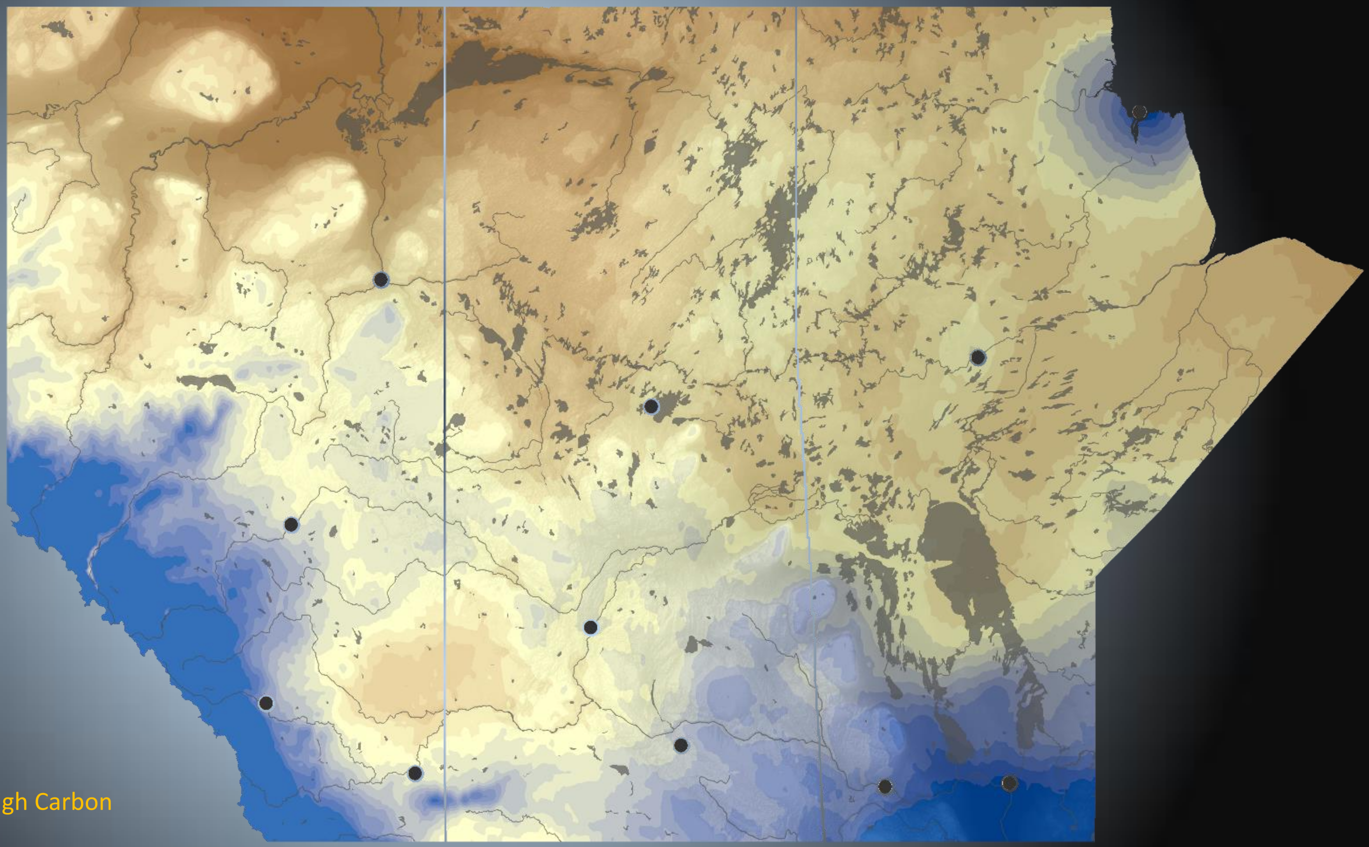

High Carbon

Low Carbon

Recent Past Near Future Far Future

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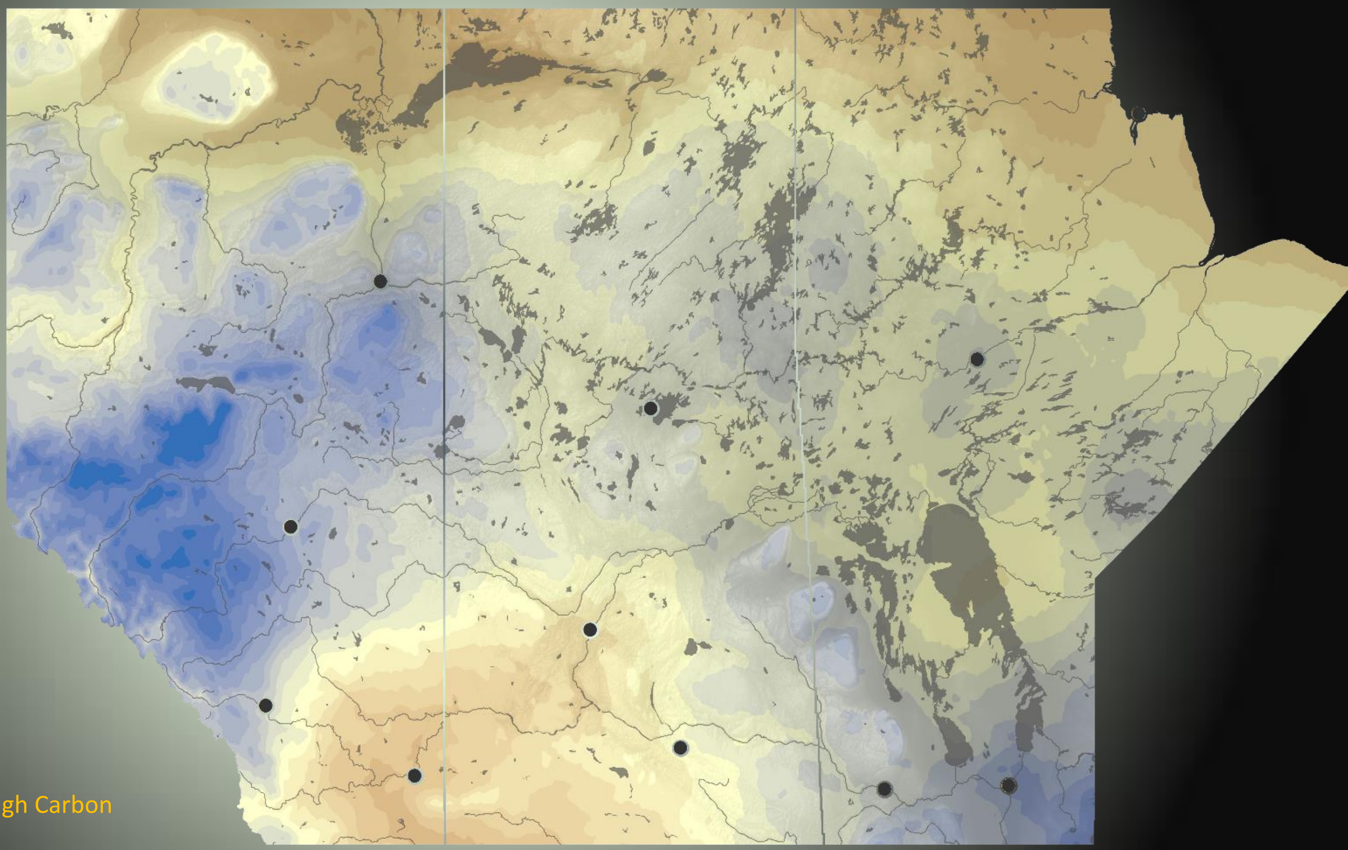
Summer Precipitation

Prairie Precipitation

Projected Changes in Total Summer Precipitation

Prairie Climate Centre



High Carbon

Low Carbon

Recent Past Near Future Far Future

1981-2010 Total Summer Precipitation (mm)

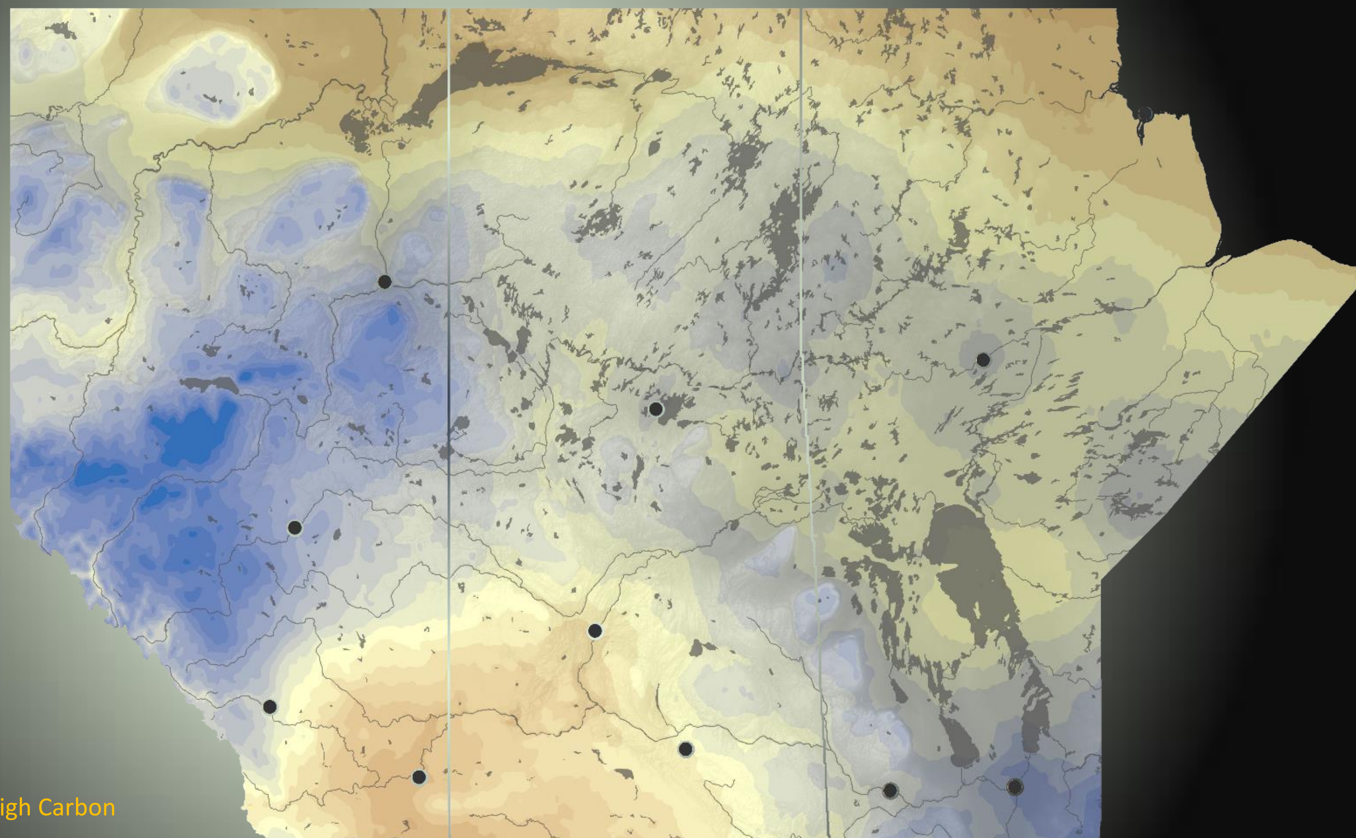
70 90 110 130 150 170 190 210 230 250 270 290+

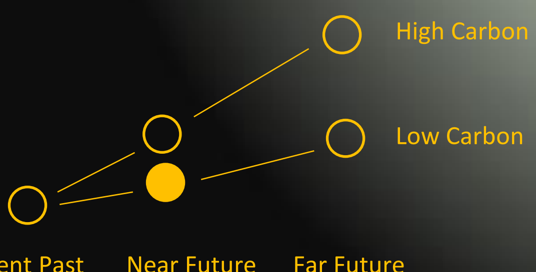
Data Source: Pacific Climate Impacts Consortium (PCIC), University of Victoria, (2014). Statistically Downscaled Climate Scenarios. Downloaded from pacificclimate.org.

Prairie Precipitation

Projected Changes in Total Summer Precipitation

Prairie Climate Centre





2021-2050 Total Summer Precipitation (mm)

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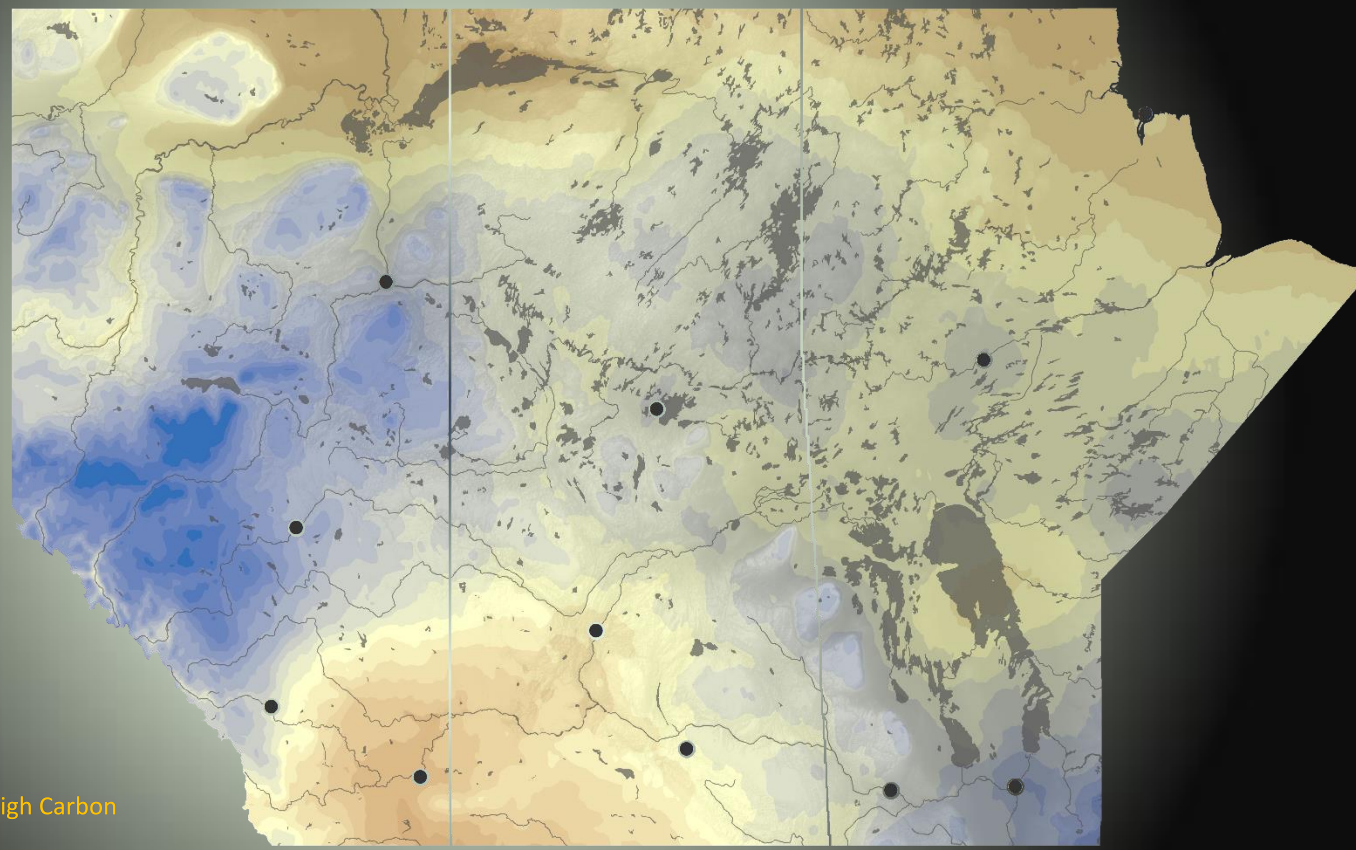
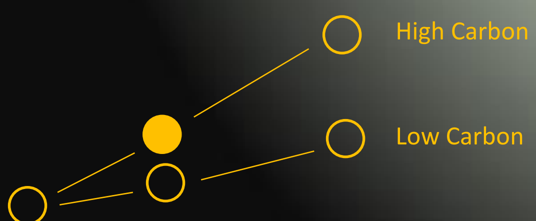
Prairie Precipitation

Projected Changes in Total Summer Precipitation

Prairie Climate Centre





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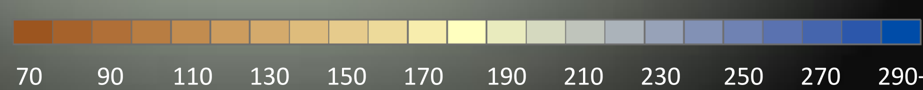

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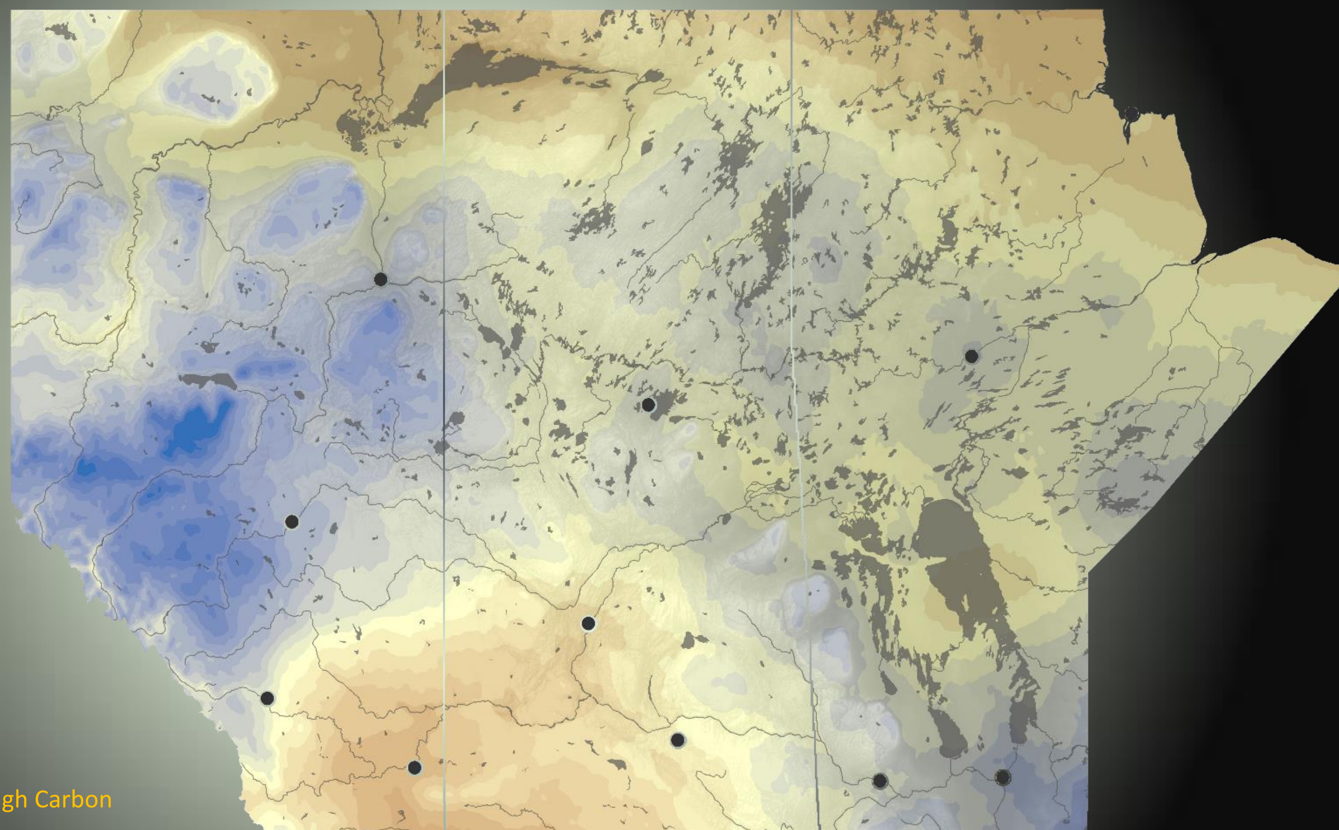
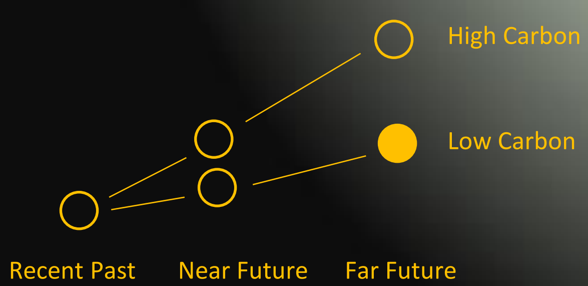
Prairie Precipitation

Projected Changes in Total Summer Precipitation

Prairie Climate Centre





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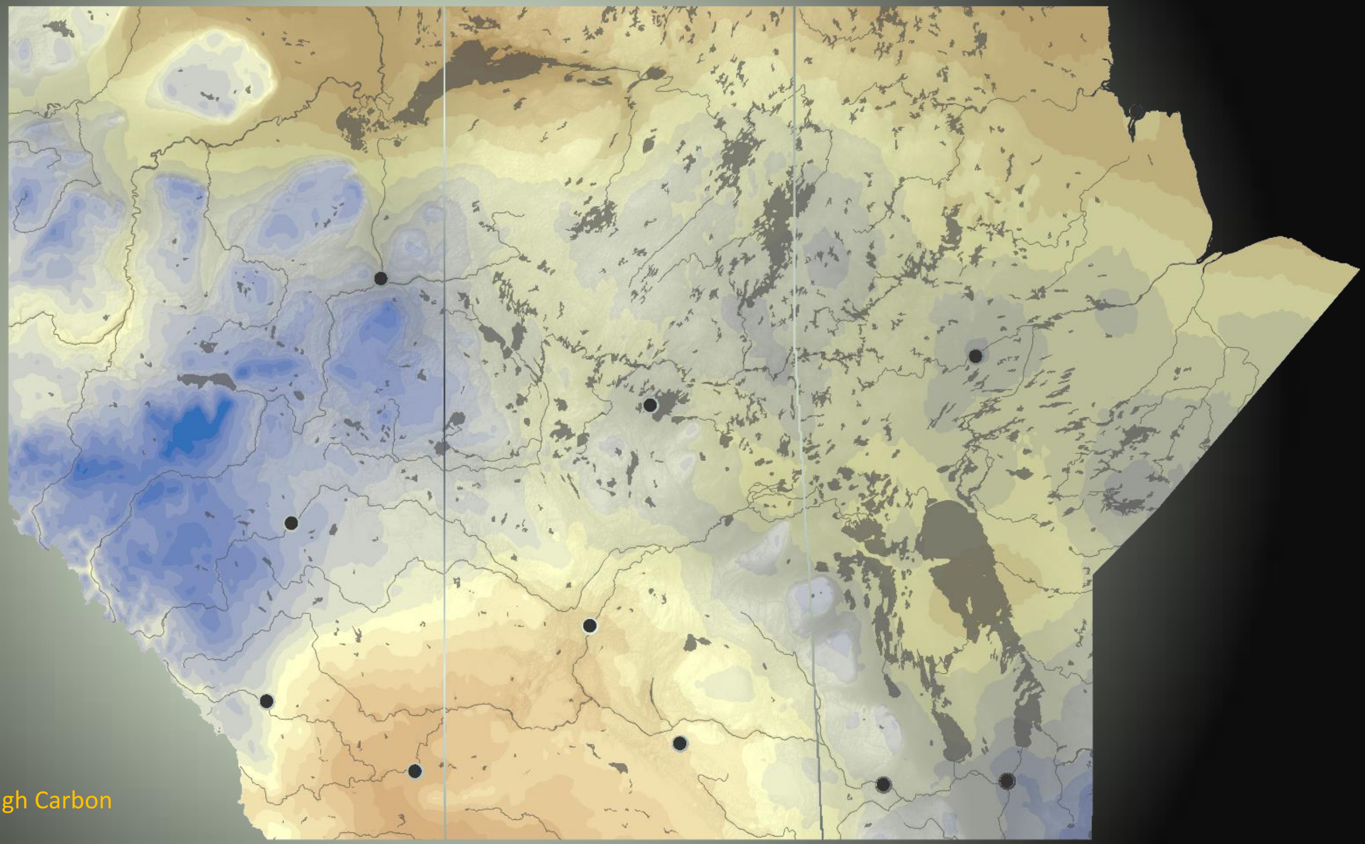

High Carbon

Low Carbon

Recent Past

Near Future

Far Future

2051-2080 Total Summer Precipitation (mm)

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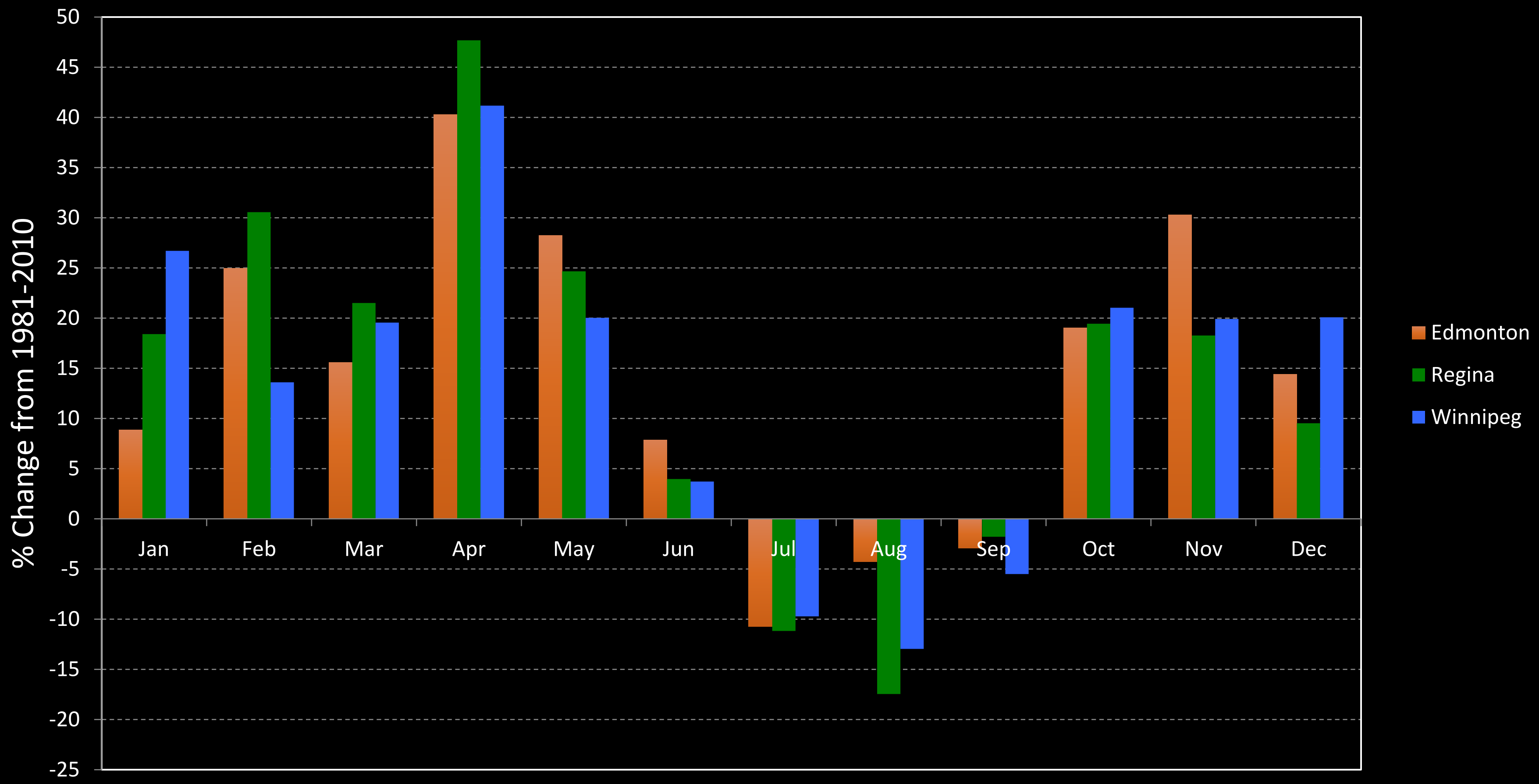
2051-2080 ΔPPT: RCP8.5

Prairie Climate Centre



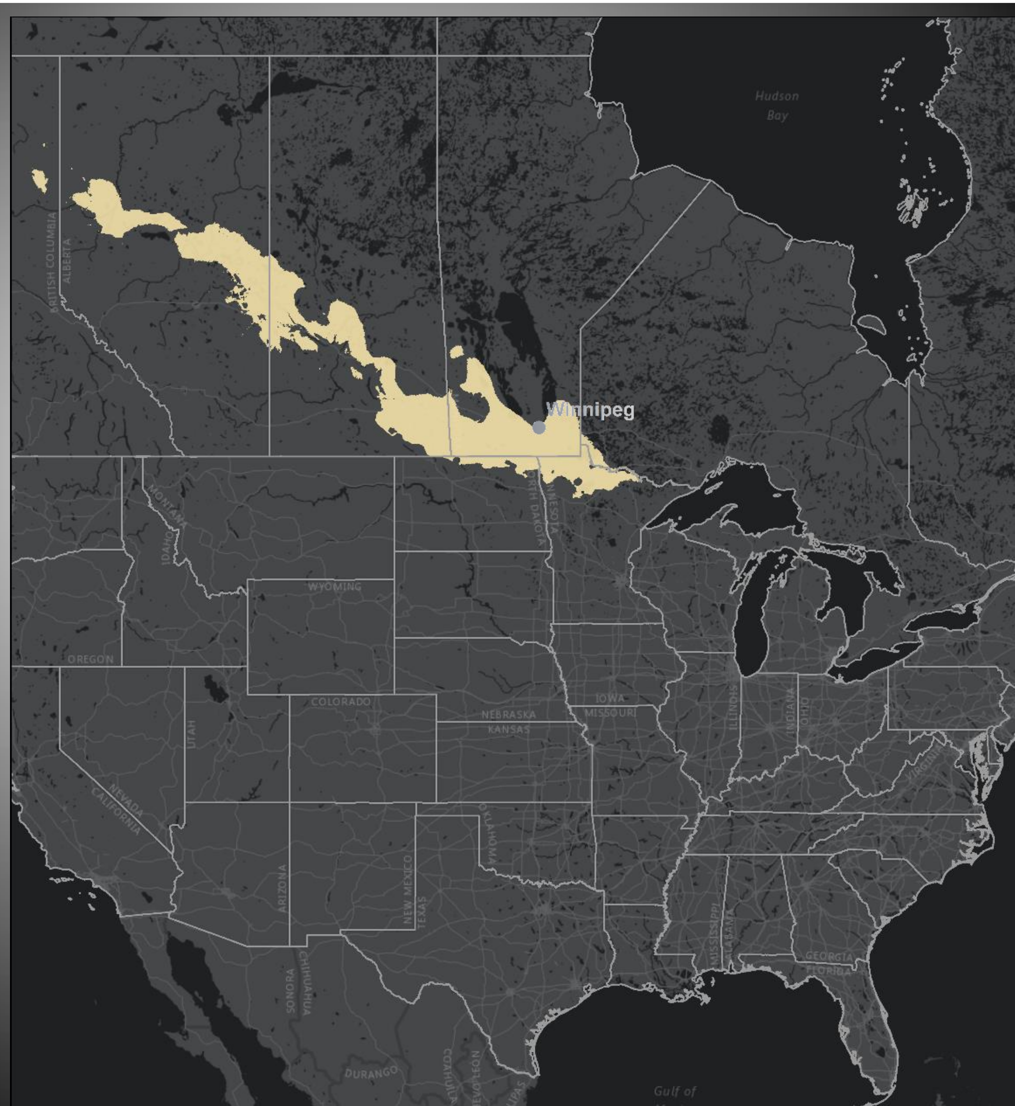
An Example of Climate Analogues

Winnipeg

Winter Climate Analogues

Prairie Climate Centre

AdaptWest data was used to identify whose climates we will have in the future, using seasonal temperature and precipitation projections.



Summer

Winter

High Carbon

Low Carbon

2020s 2050s 2080s

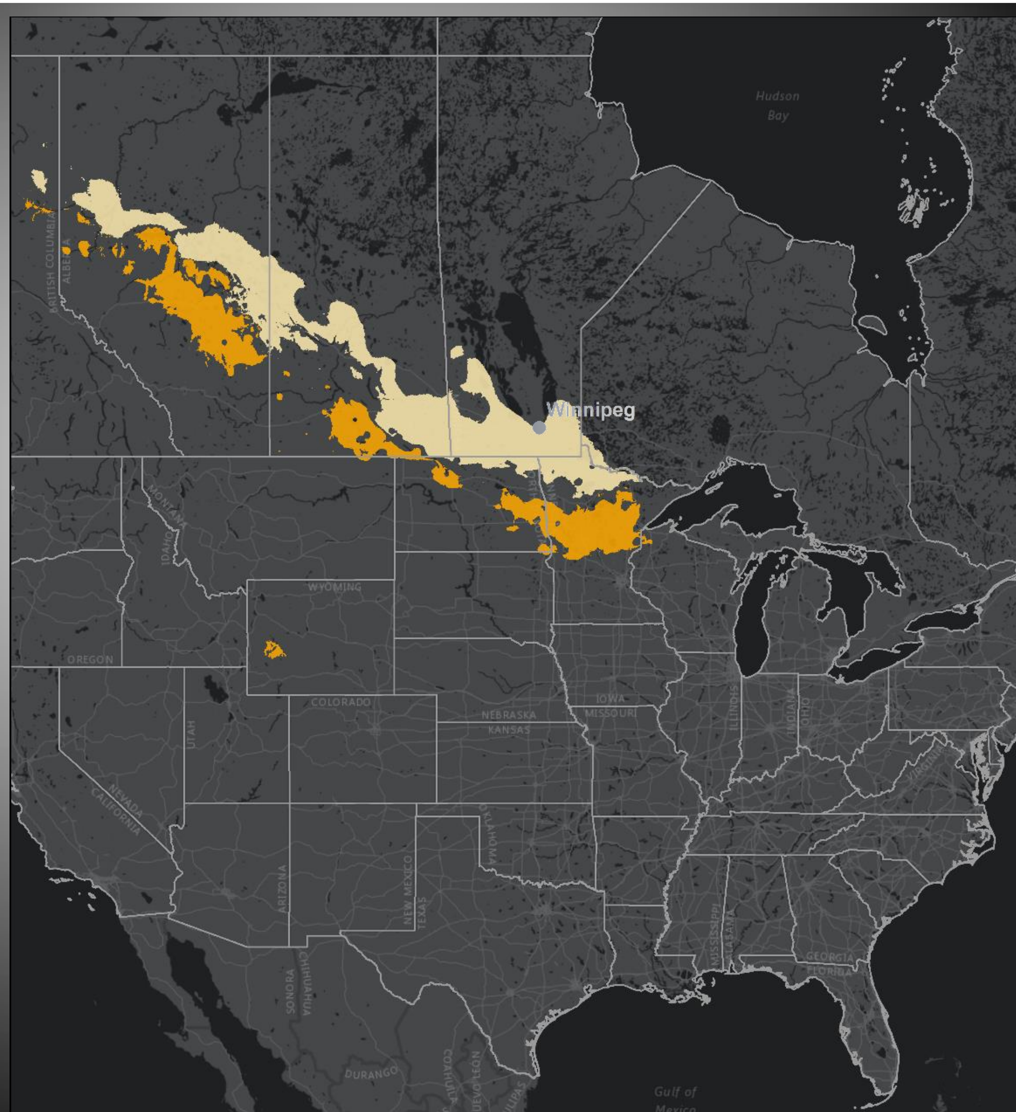
Winnipeg

Winter Climate Analogues

Prairie Climate Centre

Similarity index:

- Mean temperature within 1 ° C
- Total precipitation within 20%



Summer

Winter

High Carbon

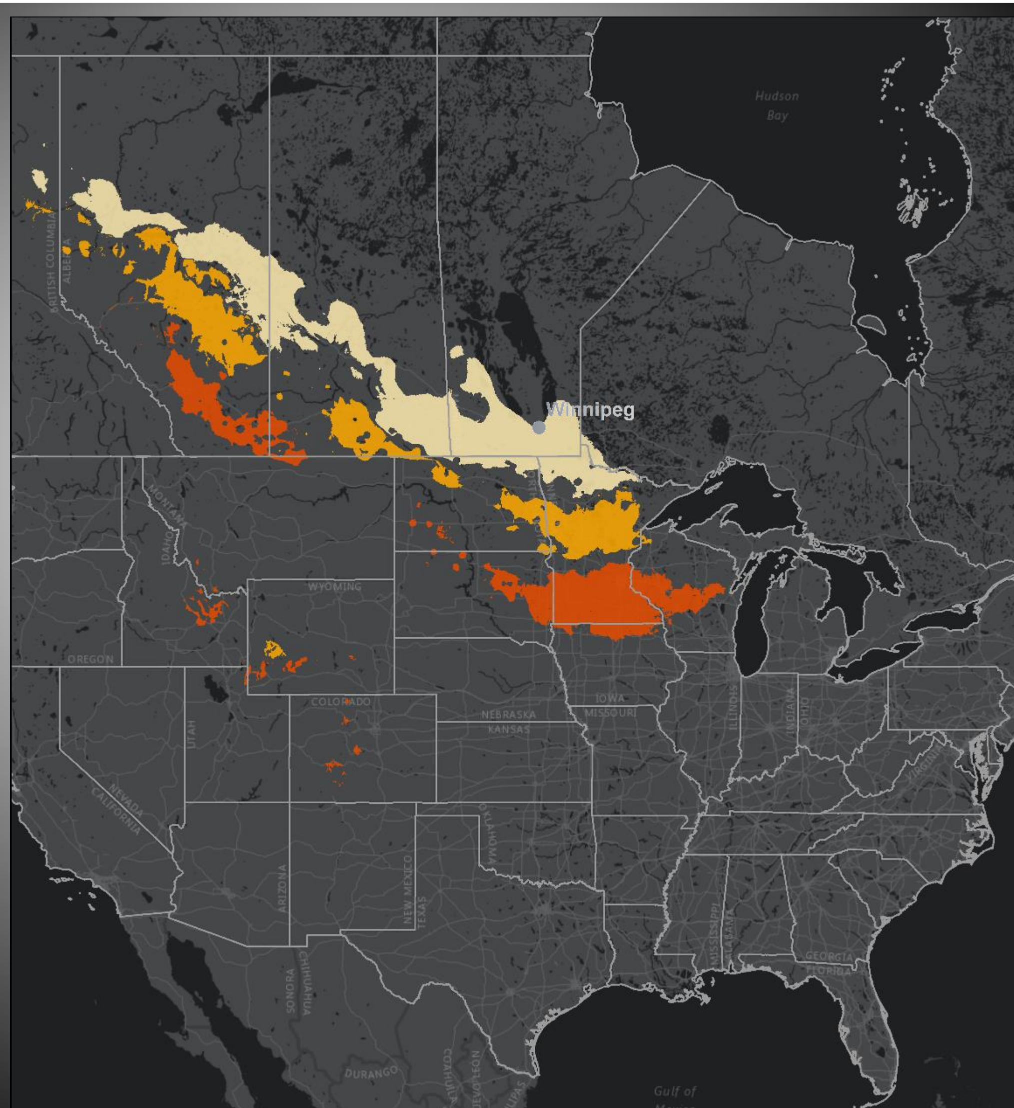
Low Carbon

2020s 2050s 2080s

Winnipeg

Winter Climate Analogues

Prairie Climate Centre



Summer

Winter

High Carbon

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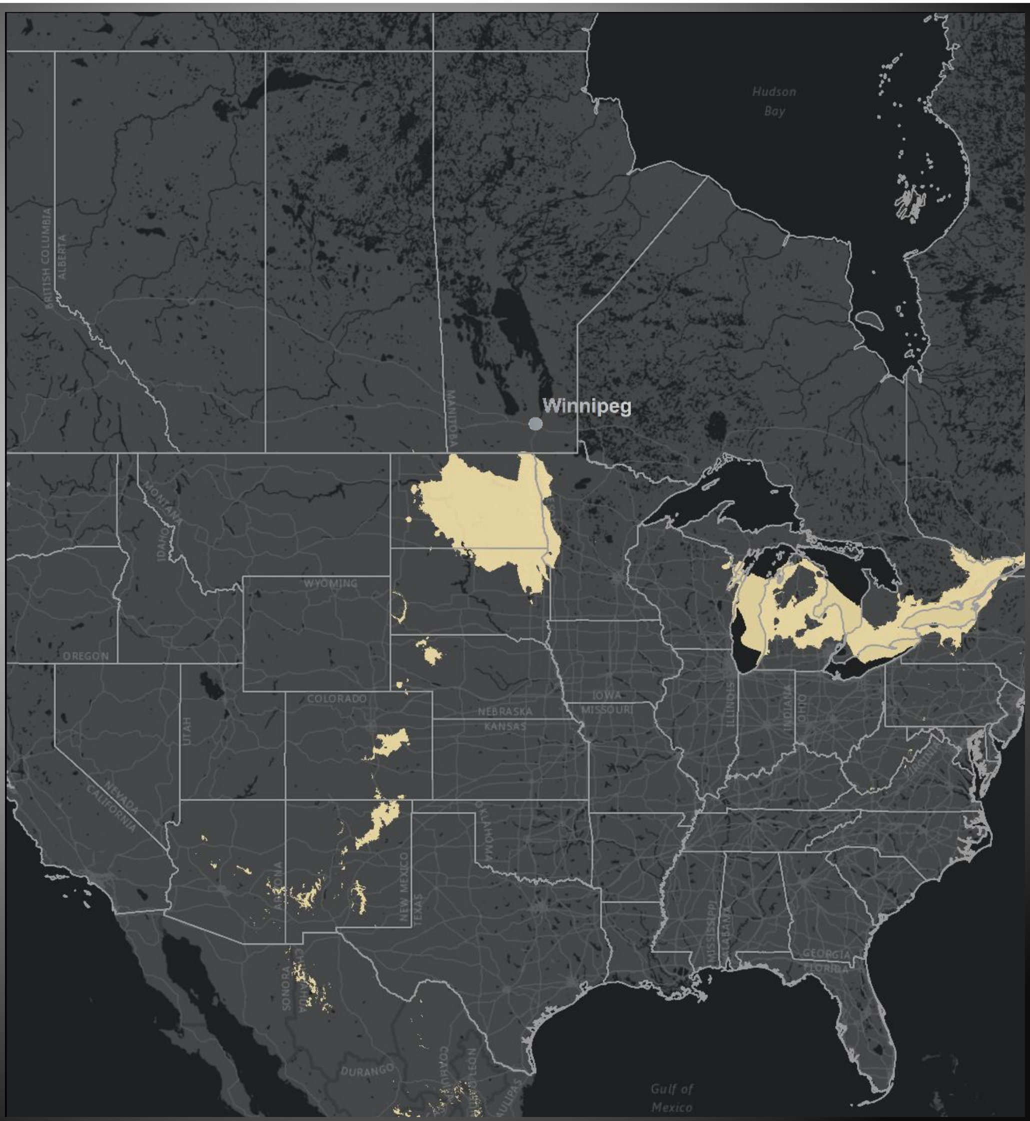
2020s 2050s 2080s

Winnipeg

Summer Climate Analogues

Prairie
Climate Centre



Summer

Winter

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2020s 2050s 2080s

Winnipeg

Summer Climate Analogues

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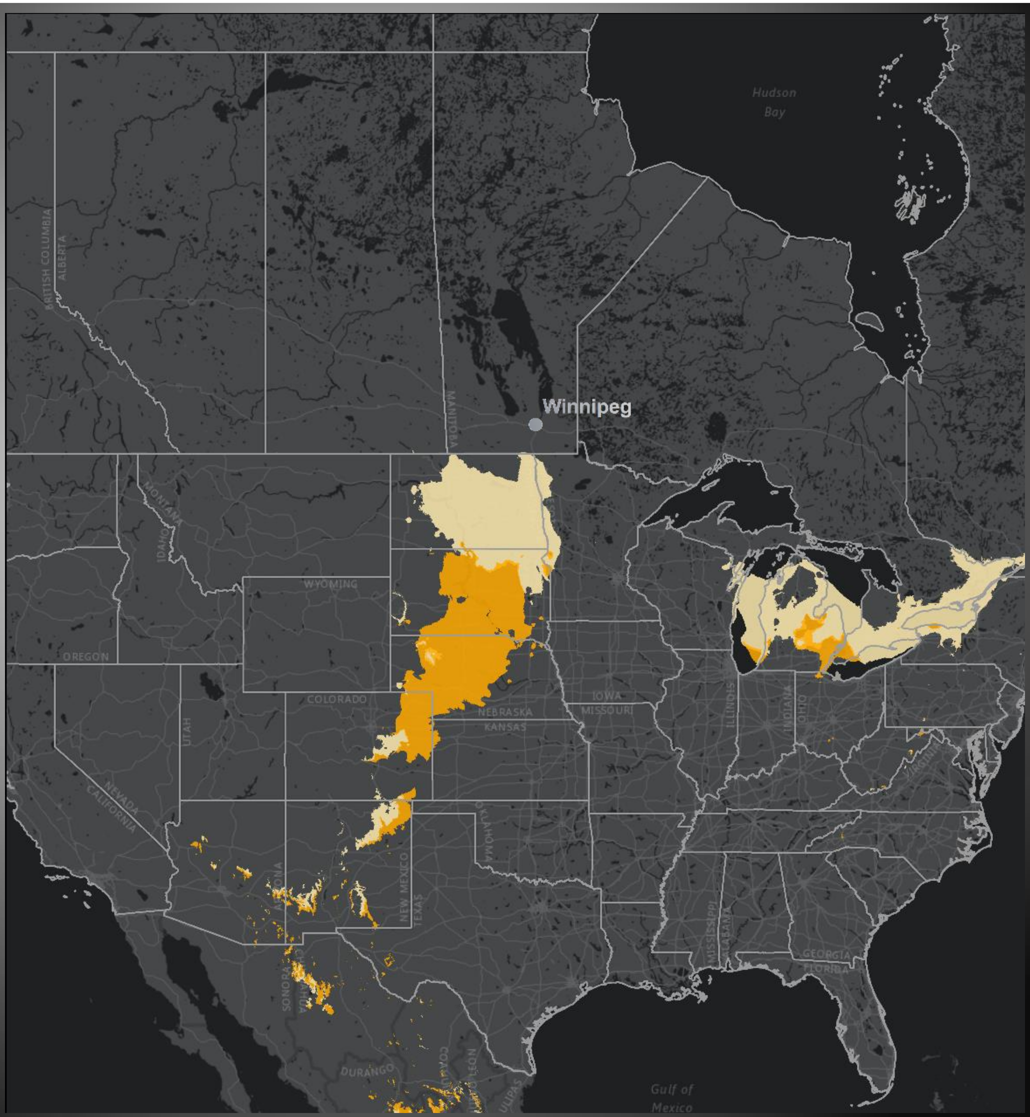

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Winnipeg

Summer Climate Analogues

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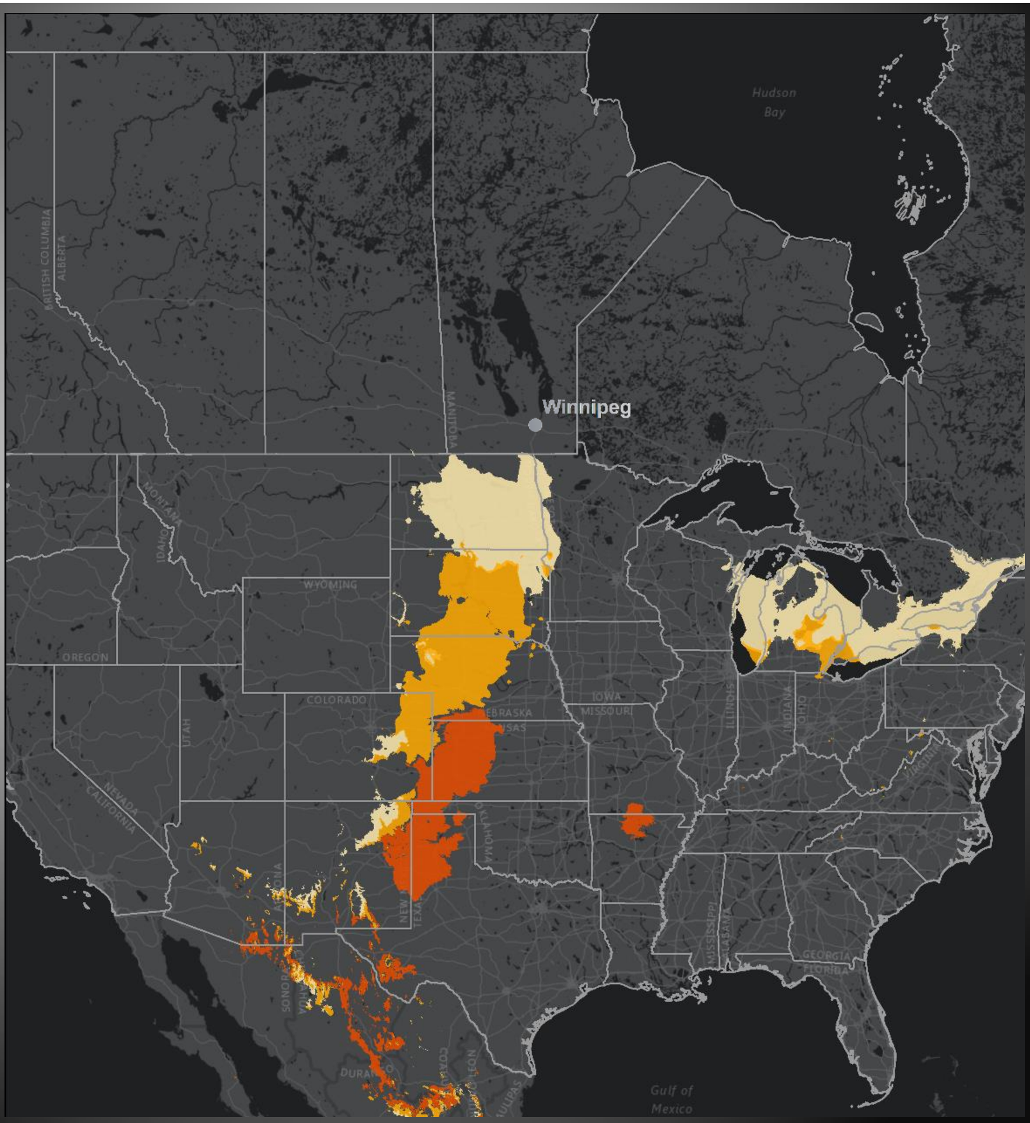

Summer

Winter

High Carbon

Low Carbon

2020s 2050s 2080s

Role of the Prairie Climate Centre

- Inform policy and develop solutions
- Inspire adaptation and mitigation
- Make climate change data accessible to all
- Build decision making tools
- Produce peer-reviewed research results
- Foster Prairie-wide collaborations and partnerships
- Conduct workshops and training sessions
- Educate the public

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Implications

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- Shifting seasons
- Shorter, warmer winters
- Longer, hotter summers
- More precipitation in winter, spring, fall
- Less precipitation in summer
- More intense precipitation events
- More severe weather
- More heat waves
- A less stable climate

Risks

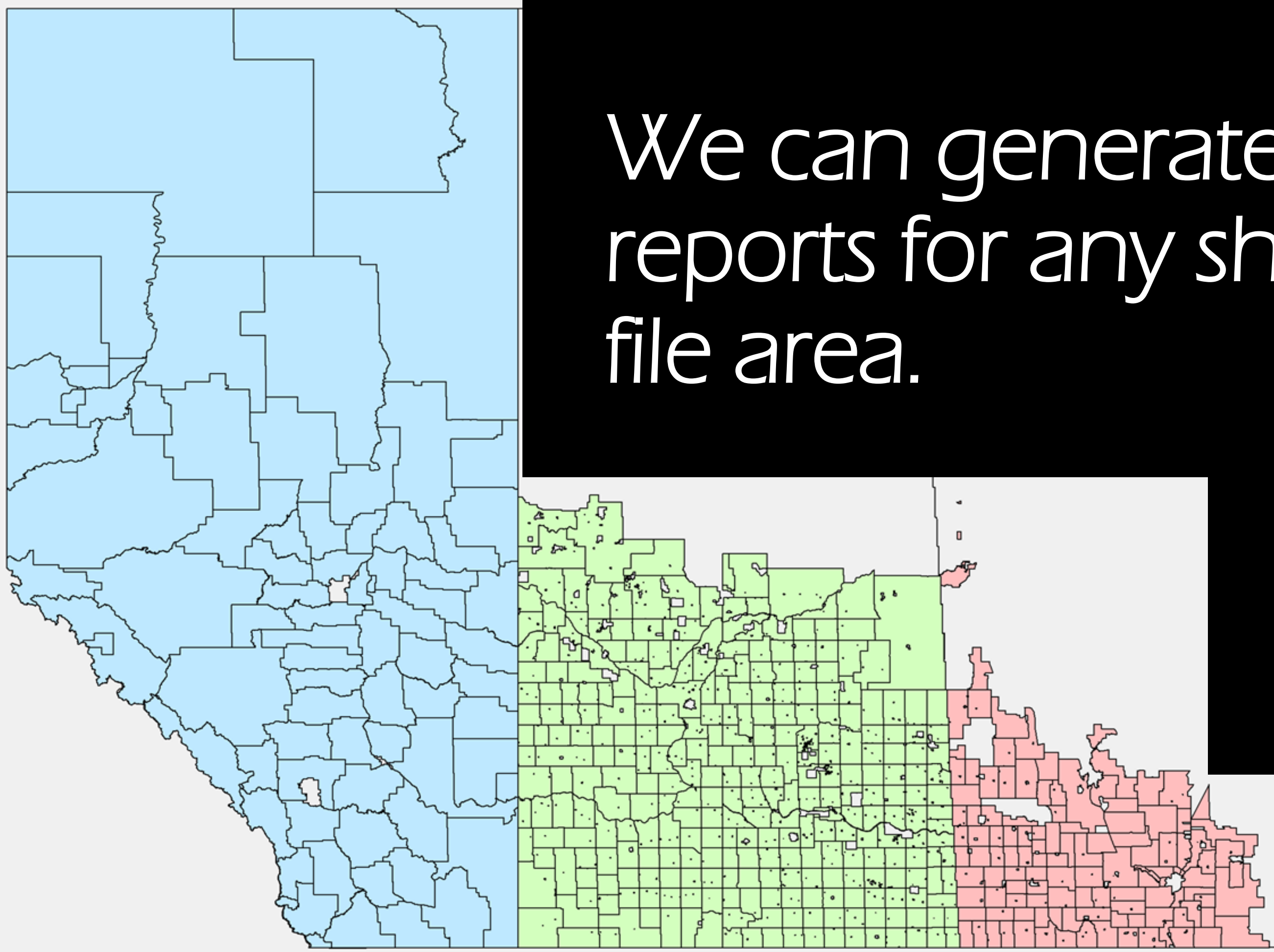
Prairie Climate Centre

- Floods and droughts
- Water resource management
- Human health
- Crop failure
- Invasive species
- Forest fires
- Winter roads
- Infrastructure and building codes
- Disaster management and response
- Summer energy demand

Tailor-made Reports

Prairie Climate Centre

We can generate reports for any shape-file area.



Tailor-made Reports

Prairie Climate Centre

Winnipeg

High Carbon Emissions (RCP8.5)

Prairie Climate Centre
From Risk to Resilience

Climate Variable	Season	1981-2010 (Baseline)	2021-2050 Projections L	2021-2050 Projections M	2021-2050 Projections H	2021-2050 +/-	2051-2080 Projections L	2051-2080 Projections M	2051-2080 Projections H	2051-2080 +/-
Days ≥ 30 °C	Annual	11.0 days	19.0 days	25.6 days	36.0 days	+14.6 days	34.0 days	46.4 days	60.0 days	+35.4 days
Nights ≥ 20 °C	Annual	1.0 days	2.0 days	5.1 days	9.0 days	+4.1 days	10.0 days	15.8 days	22.0 days	+14.8 days
Days ≤ -30 °C	Annual	8.2 days	1.0 days	2.9 days	5.0 days	-5.3 days	0.0 days	0.7 days	2.0 days	-7.5 days
Last Spring Frost	-	May-19	May-02	May-11	May-20	-8 days	Apr-24	May-02	May-11	-17 days
Frost-Free Period	Annual	128.4 days	128.0 days	145.8 days	162.0 days	+17.4 days	147.0 days	161.4 days	177.0 days	+33.1 days
First Fall Frost	-	Sep-24	Sep-23	Oct-04	Oct-19	+9 days	Oct-02	Oct-10	Oct-22	+16 days
Frost Period	Annual	211.2 days	150.0 days	165.2 days	178.0 days	-45.9 days	145.0 days	157.7 days	174.0 days	-53.5 days
Frost Days	Annual	186.2 days	157.0 days	167.0 days	179.0 days	-19.2 days	134.0 days	148.2 days	159.0 days	-38.0 days
Icing Days	Annual	117.8 days	92.0 days	104.2 days	115.0 days	-13.6 days	71.0 days	86.7 days	98.0 days	-31.1 days
Freeze-Thaw Cycles	Annual	58.7 cycles	45.0 cycles	54.1 cycles	61.0 cycles	-4.6 cycles	46.0 cycles	53.1 cycles	58.0 cycles	-5.6 cycles
5 °C Degree Days	Annual	1826.1	2086.9	2188.9	2314.7	+362.9	2402.5	2601.5	2807.6	+775.4
10 °C Degree Days	Annual	1015.7	1225.9	1301.6	1401.8	+285.9	1490.1	1640.7	1823.2	+624.9
16 °C Degree Days	Annual	325.6	453.3	506.1	563.1	+180.5	641.9	748.8	881.4	+423.2
Max 1-day Precip	Annual	67.0 mm	54.7 mm	75.3 mm	99.2 mm	+12.5 %	50.9 mm	77.4 mm	108.6 mm	+15.6 %
Max 3-day Precip	Annual	139.9 mm	118.2 mm	160.4 mm	198.4 mm	+14.6 %	102.8 mm	168.3 mm	226.8 mm	+20.3 %
PET	Annual	632.2 mm	658.7 mm	672.3 mm	684.1 mm	+6.3 %	689.1 mm	714.1 mm	737.1 mm	+12.9 %
P:PET Ratio	Annual	0.83	0.76	0.82	0.88	-0.01	0.74	0.79	0.83	-0.04

L = Low Projection (10th Percentile) M = Mean Projection H = High Projection (90th Percentile)

Water Infrastructure

Prairie Climate Centre

POLICY FORUM on SCIENCE VOL319 2008.02.01

CLIMATE CHANGE

Stationarity Is Dead: Whither Water Management?

P.C.D. Milly,[1]* Julio Betancourt,[2] Malin Falkenmark,[3] Robert M. Hirsch,[4] Zbigniew W. Kundzewicz,[5] Dennis P. Lettenmaier,[6] Ronald J. Stouffer[7]

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Climate change undermines a basic assumption that historically has facilitated management of water supplies, demands, and risks

Climate, Water and Infrastructure

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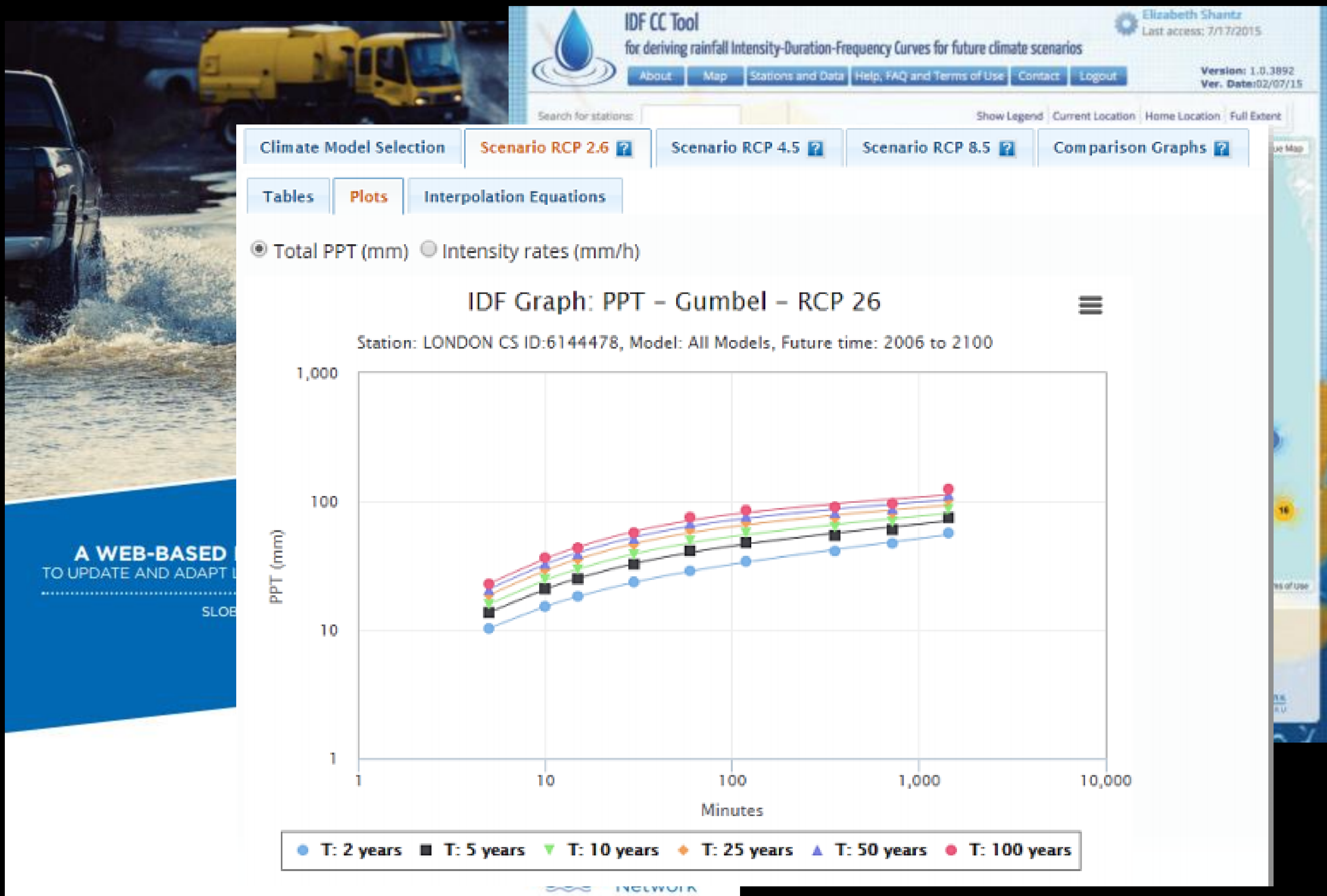

Agricultural Water Management

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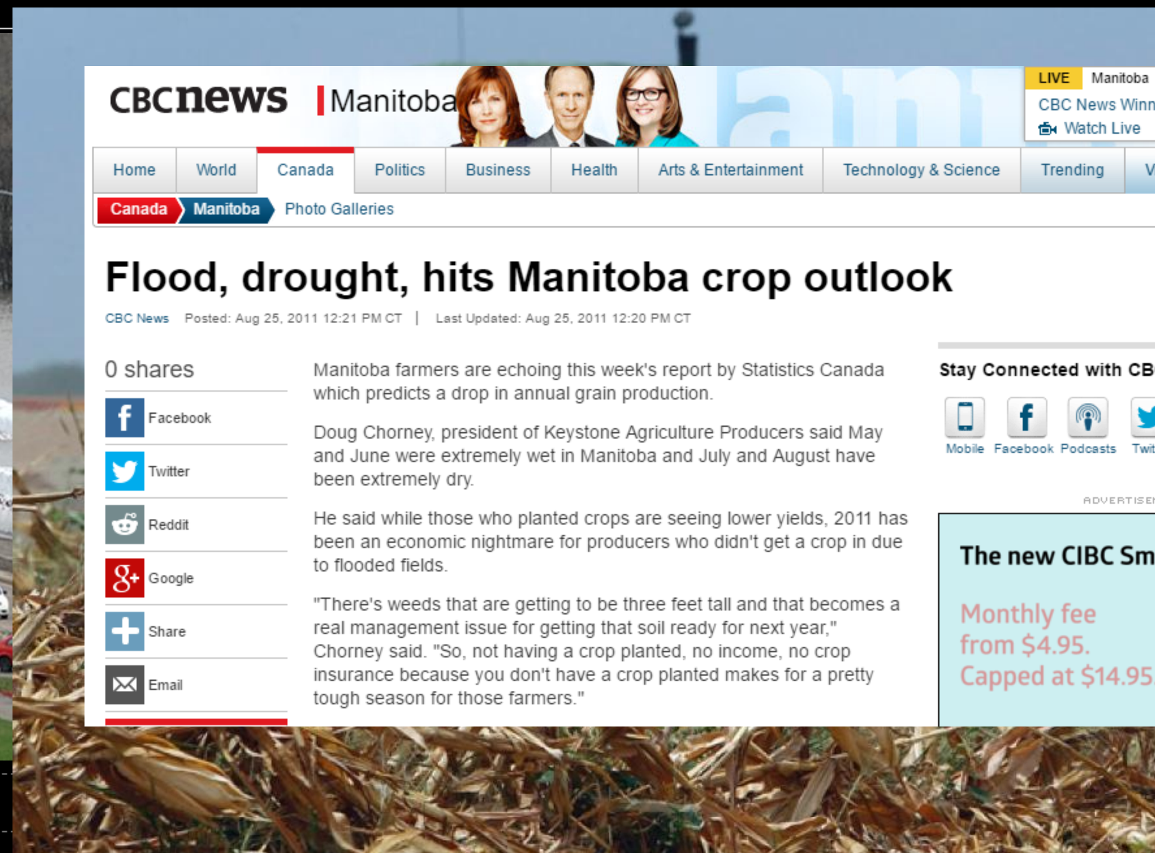

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Flood, drought, hits Manitoba crop outlook

CBC News Posted: Aug 25, 2011 12:21 PM CT | Last Updated: Aug 25, 2011 12:20 PM CT

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Manitoba farmers are echoing this week's report by Statistics Canada which predicts a drop in annual grain production.

Doug Chorney, president of Keystone Agriculture Producers said May and June were extremely wet in Manitoba and July and August have been extremely dry.

He said while those who planted crops are seeing lower yields, 2011 has been an economic nightmare for producers who didn't get a crop in due to flooded fields.

"There's weeds that are getting to be three feet tall and that becomes a real management issue for getting that soil ready for next year," Chorney said. "So, not having a crop planted, no income, no crop insurance because you don't have a crop planted makes for a pretty tough season for those farmers."

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Agricultural Water Management

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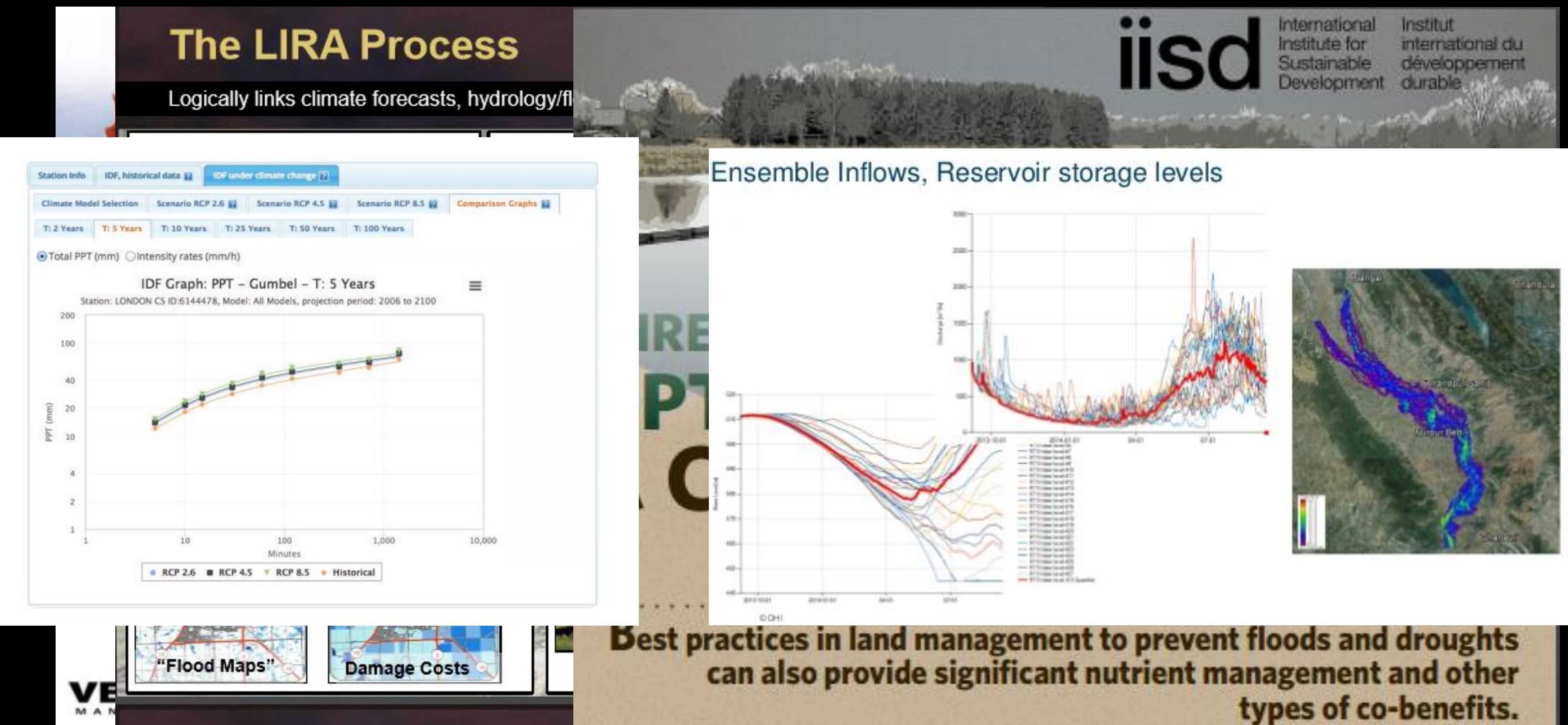

Green Infrastructure: Investment case for water harvesting under climate change

Agricultural Water Management

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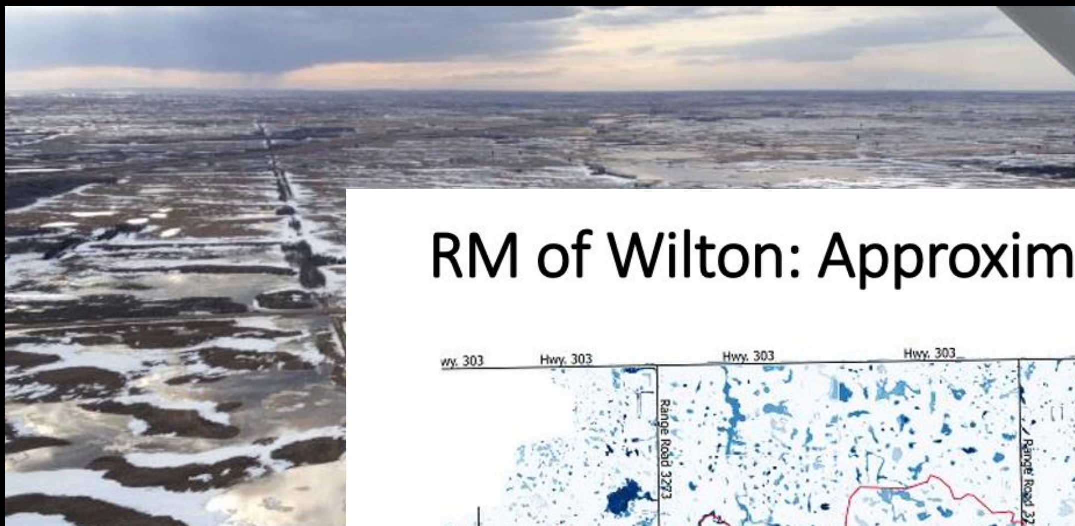
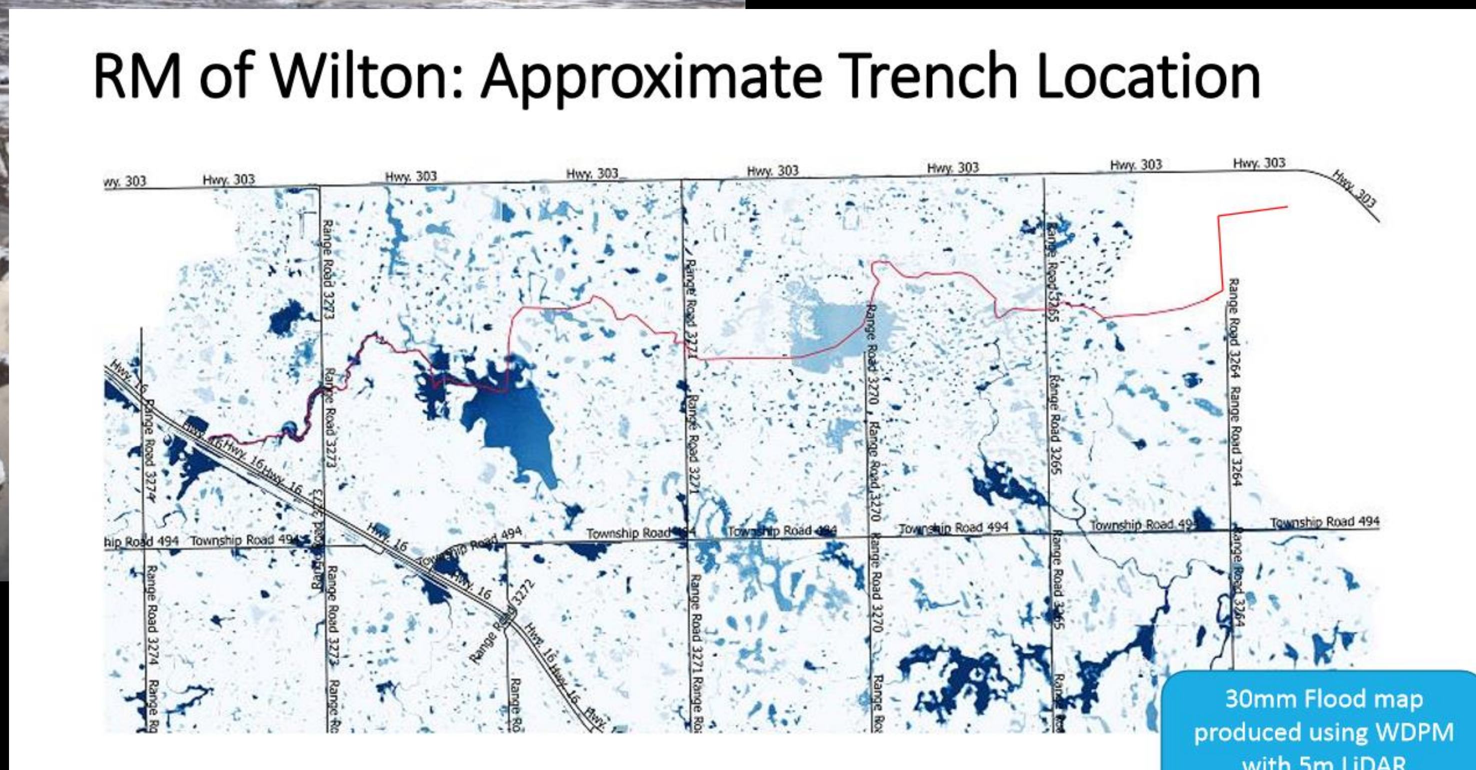
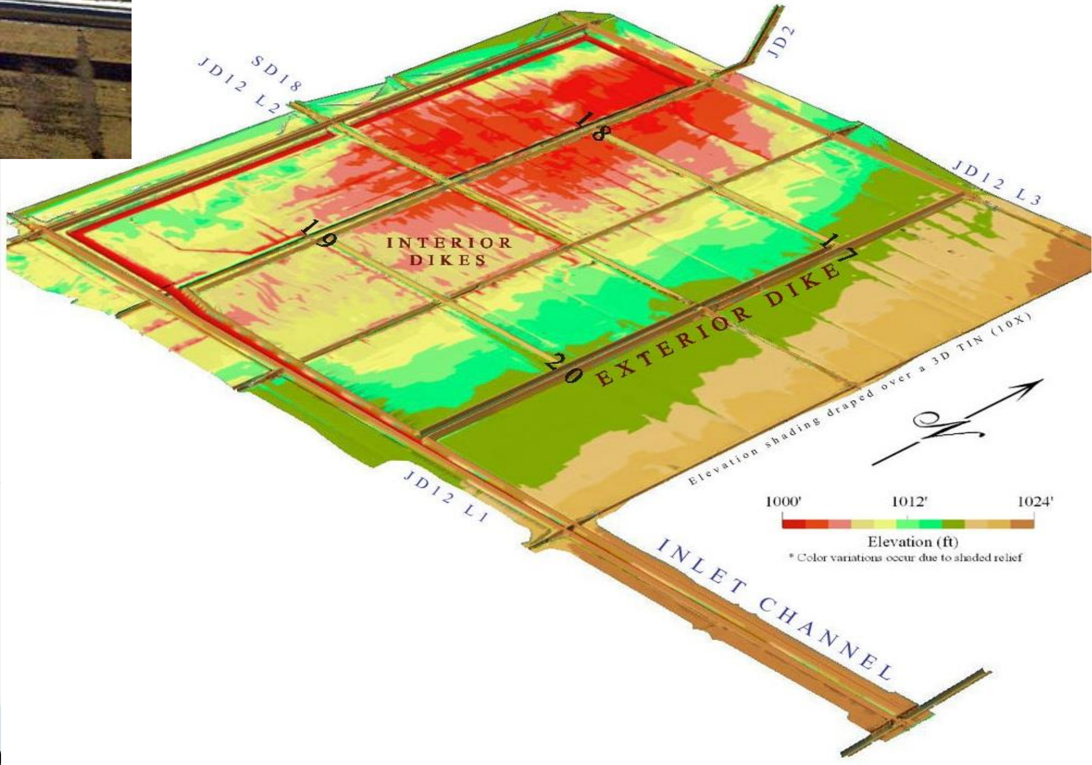




The future:
Combining flood protection, drought resiliency and water quality



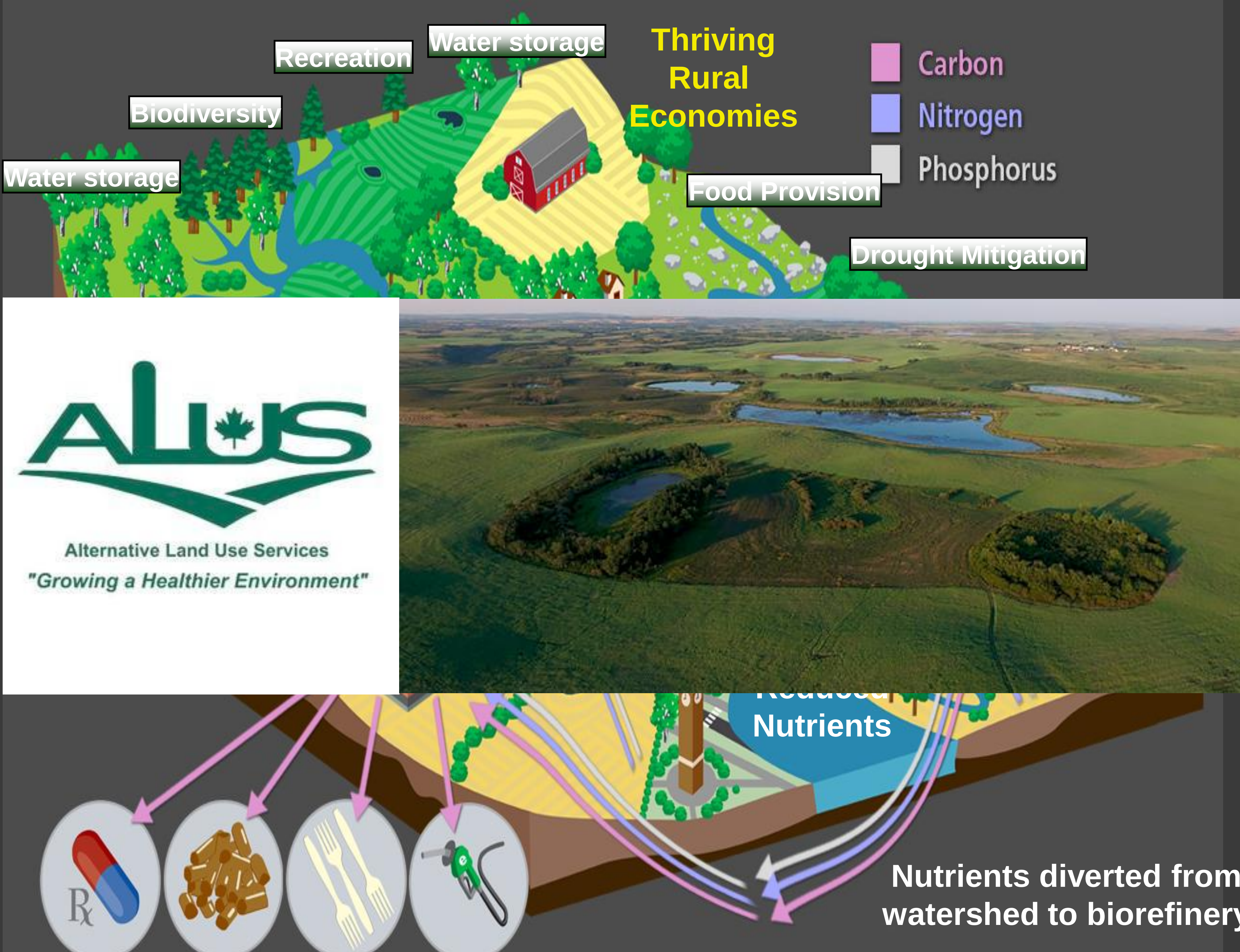
- Stores spring runoff water
- Has resulted in increased production in surrounding farmland
- Reduced peak flooding and reduction in downstream water flow

The Investment Case: Public + Private Benefits

Back flood dams

- Net benefits = EGS benefits – annualized costs

Variable	Units	Monetary Value	Impact (in units)	Monetized Impact
Benefits				
New wetland habitat	Acres of wetland	$ 82.13	80.00	$ 6,570
Cattails produced	Tonnes of cattails (total biomass)	$ 16.59	388.50	$ 6,445
Carbon credits	Tonnes of carbon	$15.00	407.93	$ 6,119
Avoided flooding costs	Megaliters of flood mitigation	$ 1,297.14	12.77	$ 16,561
Reduced eutrophication	Kilograms of Phosphorus	$ 10.00	854.70	$ 8,547
TOTAL				**$ 44,242**
Costs				
Capital Costs (annualized)	Capital costs	$ 7,000.00	1	$ 7,000
Annual operating costs	Capital costs	$ 140.00	1	$ 140
Opportunity costs	Acres of lost farmland	$ 60.00	80	$ 4,800
TOTAL				**$ 11,940**
ANNUAL BENEFIT	**Section**			**$ 32,302**
BENEFIT:COST	Ratio			371%



Alternative Land Use Services

"Growing a Healthier Environment"

Case Study: Virden, MB

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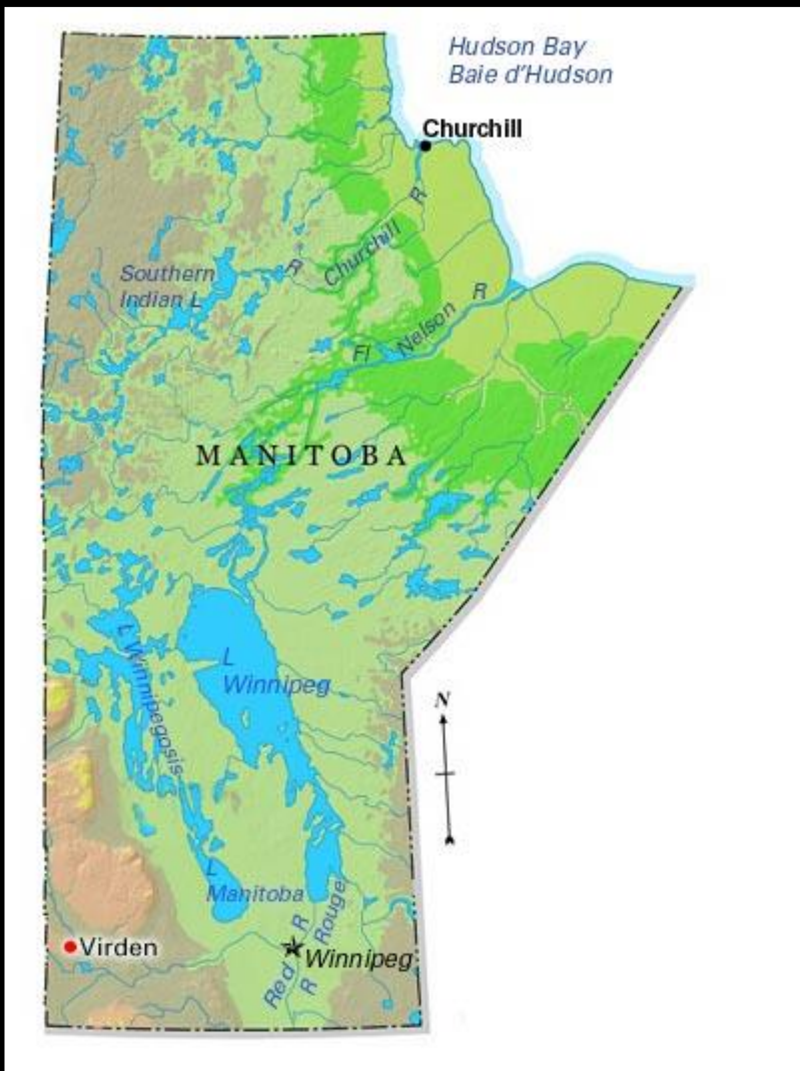

Case Study: Virden, MB

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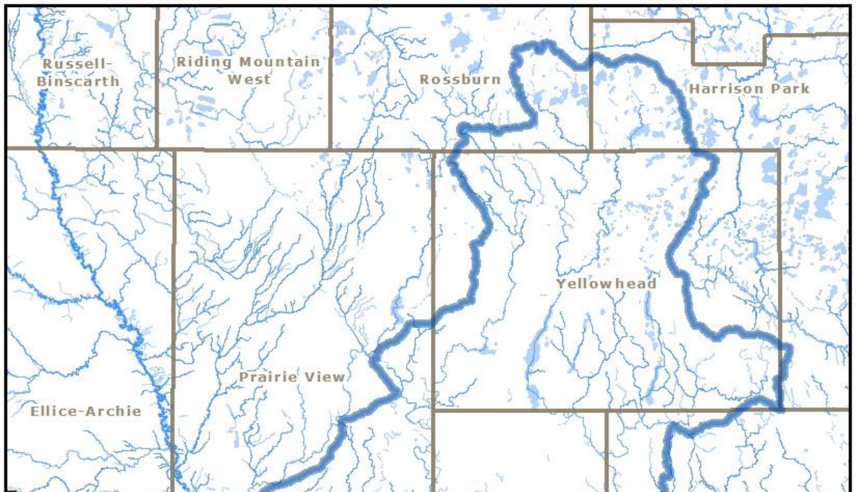
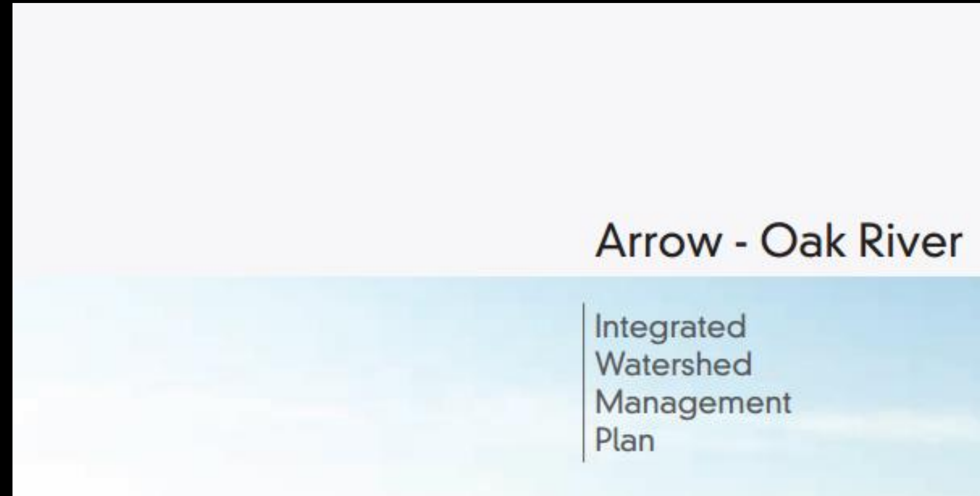
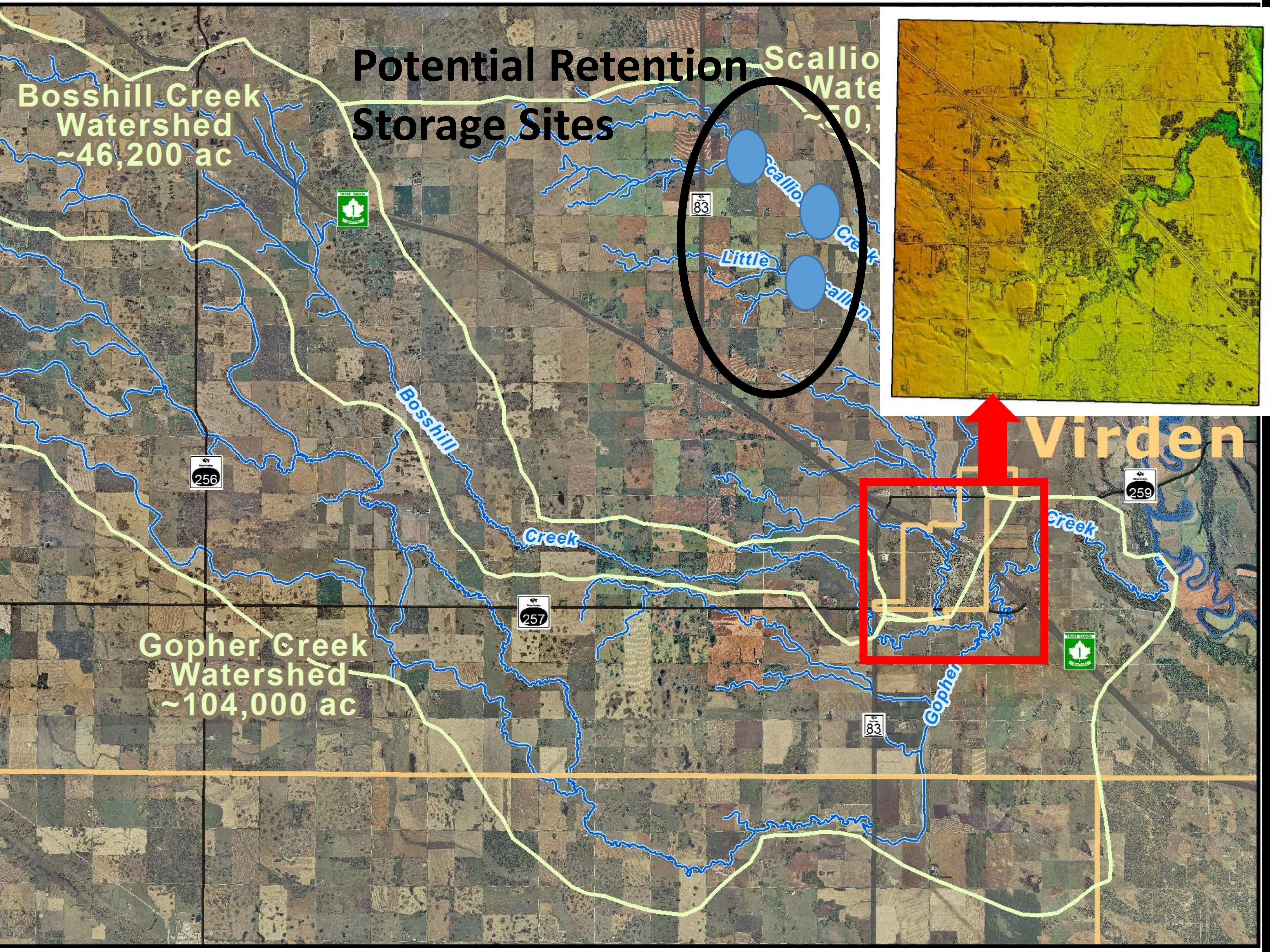




- Conduct flood frequency analysis to determine probable runoff volumes, and
- Provide incentives to convert flood prone land from annual crop production to permanent cover
- Restore wetlands in the affected catchments,
- Encourage small water retention/storage projects in the target catchments.



Potential Retention Storage Sites
Bosshill Creek Watershed ~46,200 ac
Scallio
Wate
~50,
Scallion Creek
Little Scallion
Bosshill Creek
Gopher Creek Watershed ~104,000 ac
Gopher
Creek
Virden
1
83
256
257
259

Adaptation as Systems Thinking

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PROVINCIAL GOVERNMENT

- Department of Agriculture (shared responsibility for ALUS)
- Department of Sustainable Development (shared responsibility for ALUS)
- Department of Municipal Government (Virden flood risk management)
- Department of Infrastructure (PTH#1 crossings).

LOCAL GOVERNMENT

- Town of Virden
- Rural Municipality of Wallace-Woodworth
- Upper Assiniboine Conservation District
- Manitoba Conservation Districts Association

Some Adaptation Principles

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- have the project's proponents identified key climate risks and potential impacts?
- Has the change in frequency of those impacts been estimated using the best available climate science? **Climateatlas.ca**
- And is the cost-benefit analysis robust within the projected range of key climate impacts?

Why it Matters

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- Procurement
- Insurability
- Liability