







Canadian Prairies

Colin Whitfield & Helen Baulch



PRAIRIE WATER
GLOBAL WATER FUTURES



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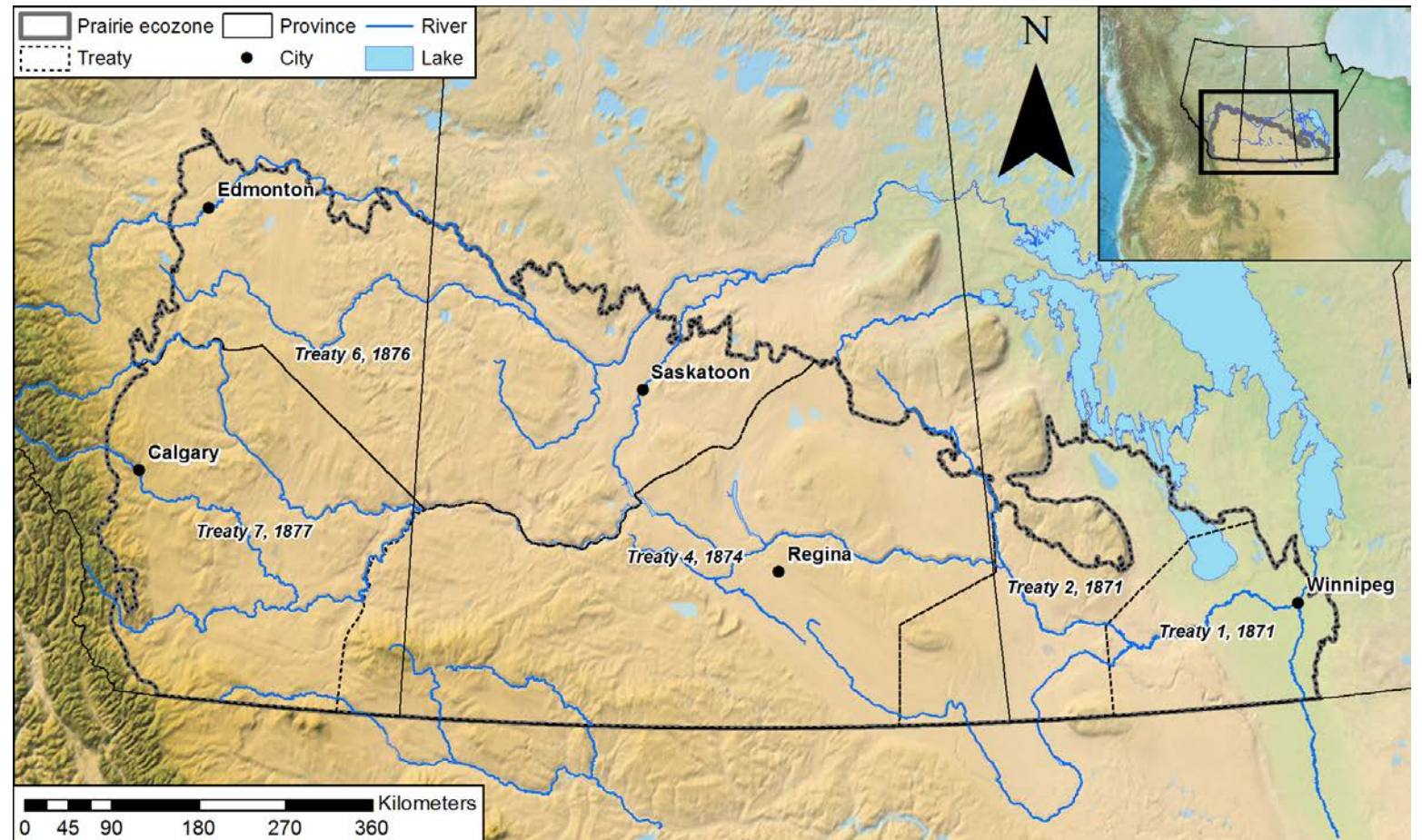


UNIVERSITY OF
WATERLOO



Why water on the Prairies?

- Over 5.5 million people
- 80% of Canada's agricultural land
- Intensive land use



Drought and flood

If hot, dry weather persists in Regina, more electrical fires possible

Unclear who will cover cost of inspections, repairs

CBC News · Posted: Jul 21, 2017 5:08 PM CT | Last Updated: July 21, 2017



G



age, it could be because ground settling has pulled down the

The latest on the flood situation in Saskatchewan

States of emergency in Arborfield, surrounding RM, Carrot River, Estevan

CBC News · Posted: Jul 13, 2016 8:31 AM CT | Last Updated: July 13, 2016

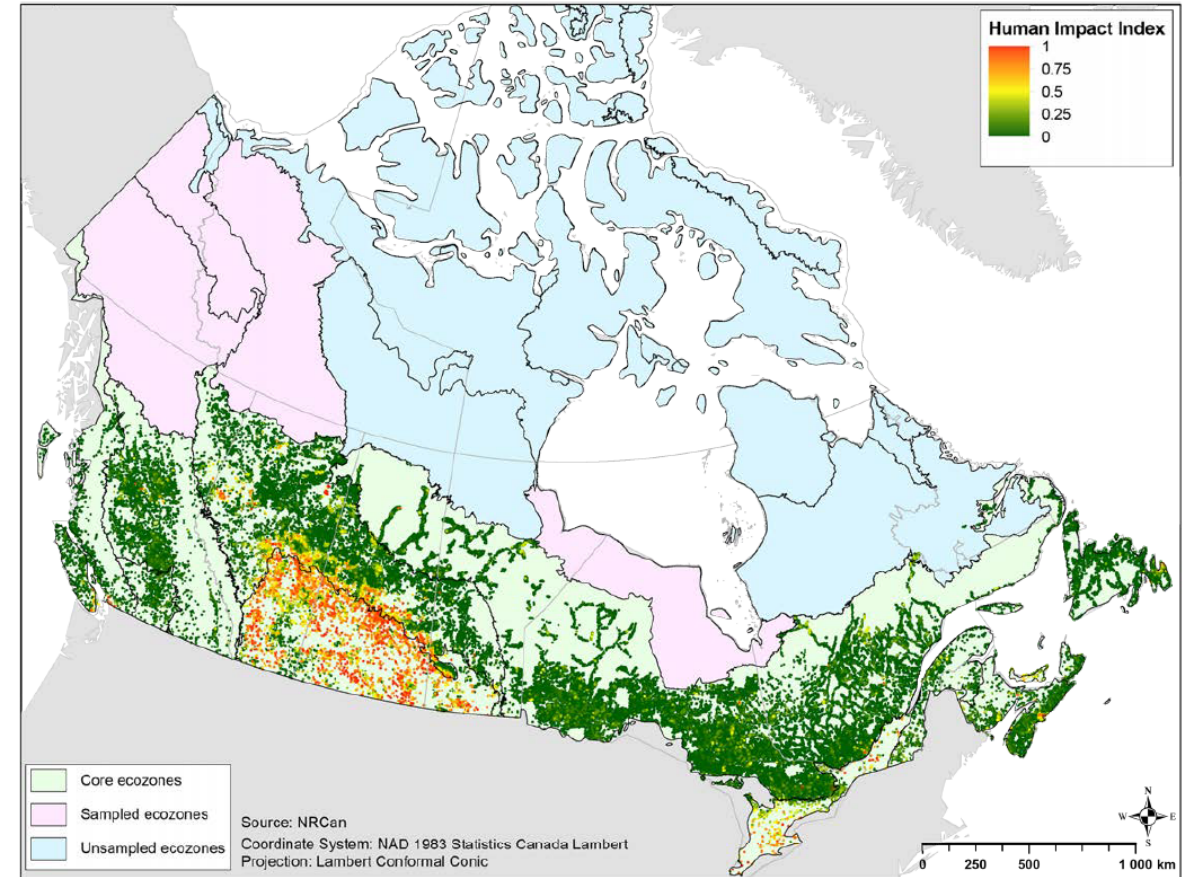
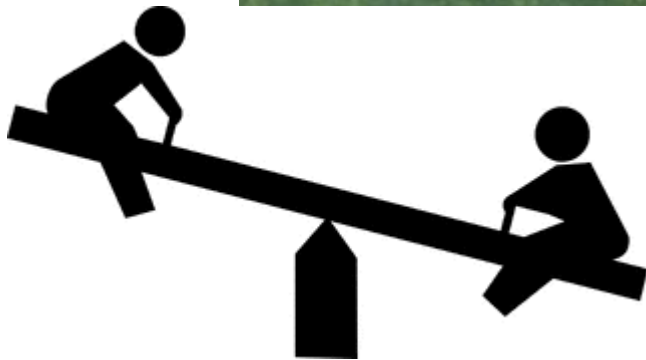
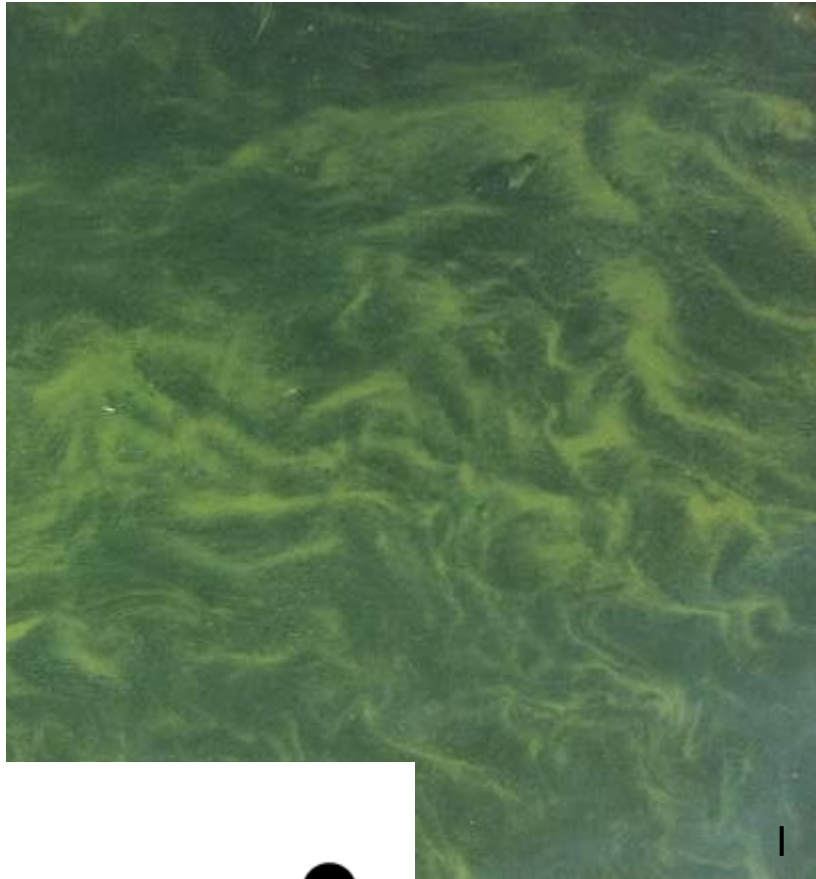


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Pumps have been running non-stop in Carrot River in recent days. Town fire chief Scott Debiegne was up all night Tuesday operating the equipment. Earlier this week, the town declared a local state of emergency. (Devin Heroux/CBC)

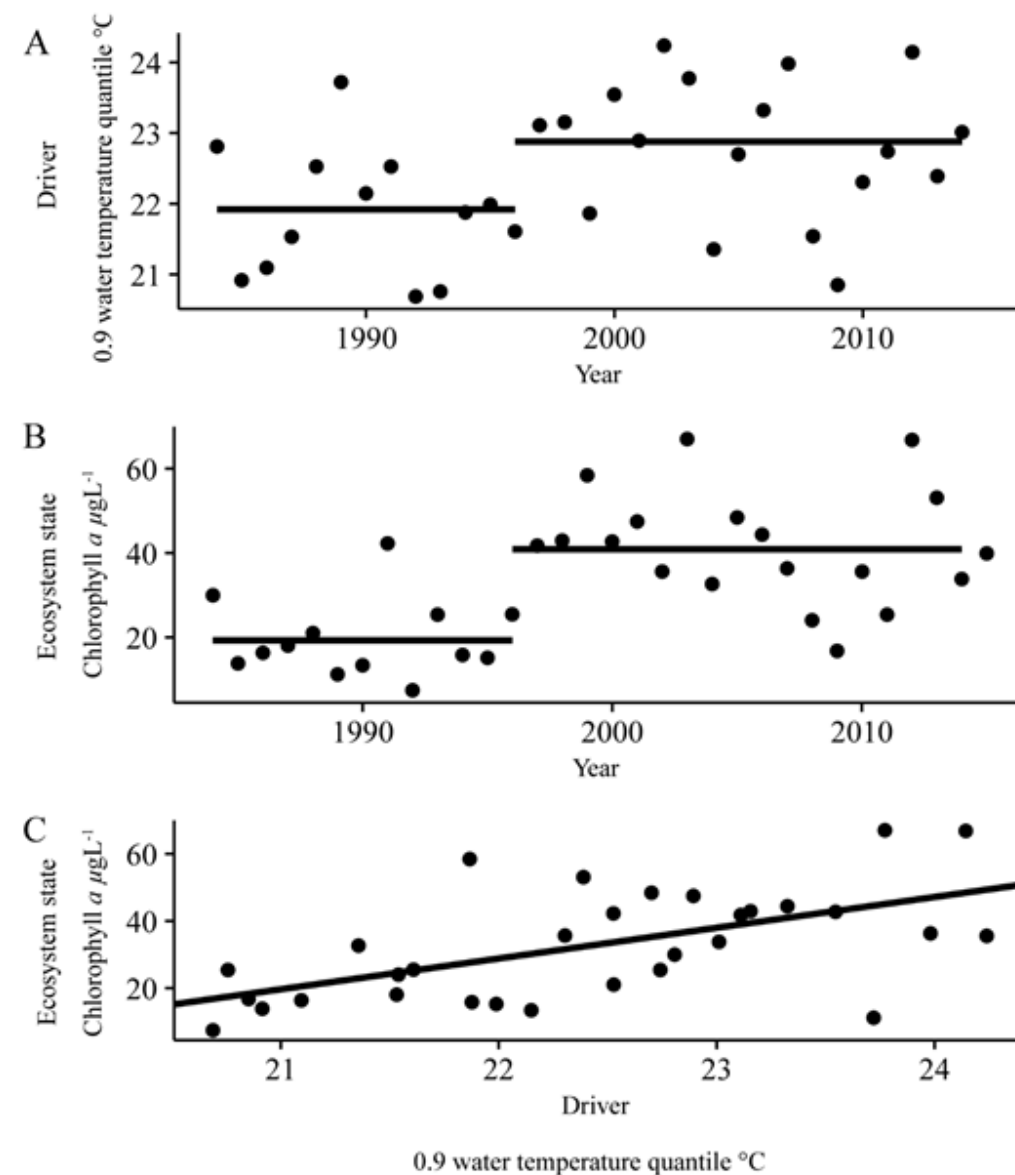
Weather and emergency situations around Saskatchewan have been changing rapidly in recent days amid heavy rainfall and flash floods.

Drought and flood + water quality



Buffalo Pound Lake

(drinking water for Regina + Moose Jaw)



Kehoe , Leavitt, Joehnk and Baulch, unpublished.



Province plans lake release to deal with city water woes

Release of Lake Diefenbaker a first in Saskatchewan, aimed at assisting Regina and Moose Jaw areas

CBC News · Posted: May 29, 2015 10:04 AM CT | Last Updated: May 29, 2015



CANADA

July 29, 2016 6:15 pm

Updated: July 29, 2016 6:59 pm

Toxic amounts of blue-green algae in Buffalo Pound Lake could be fatal for dogs

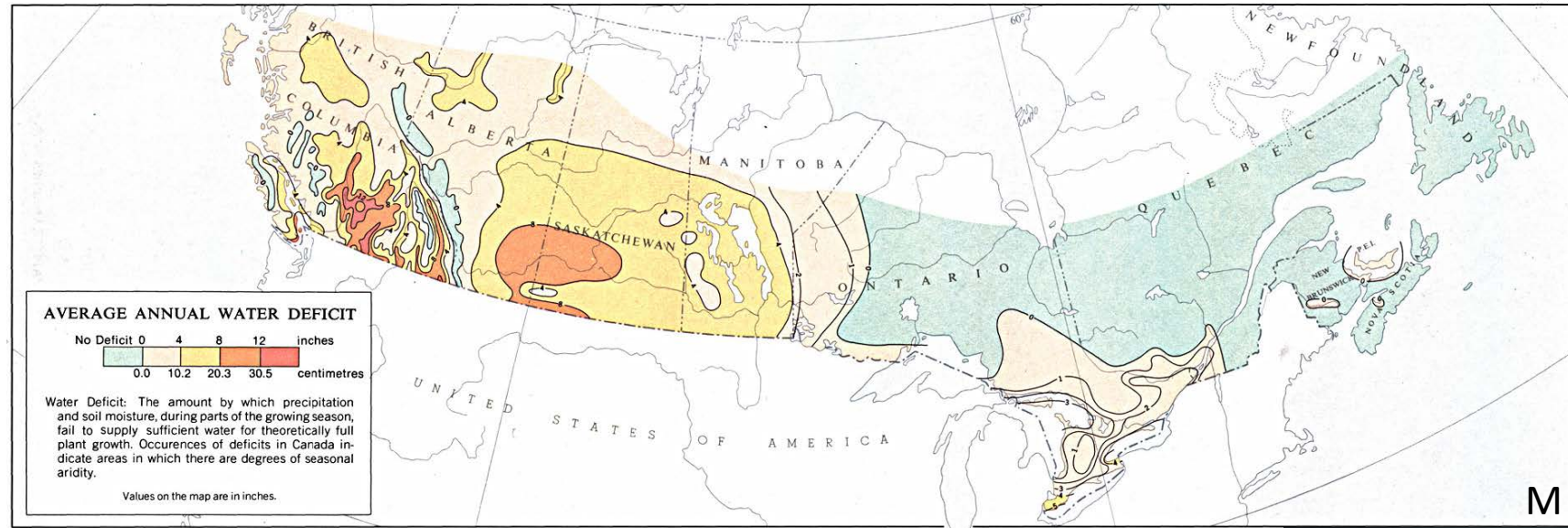


By Krista Sharpe

Reporter Global News

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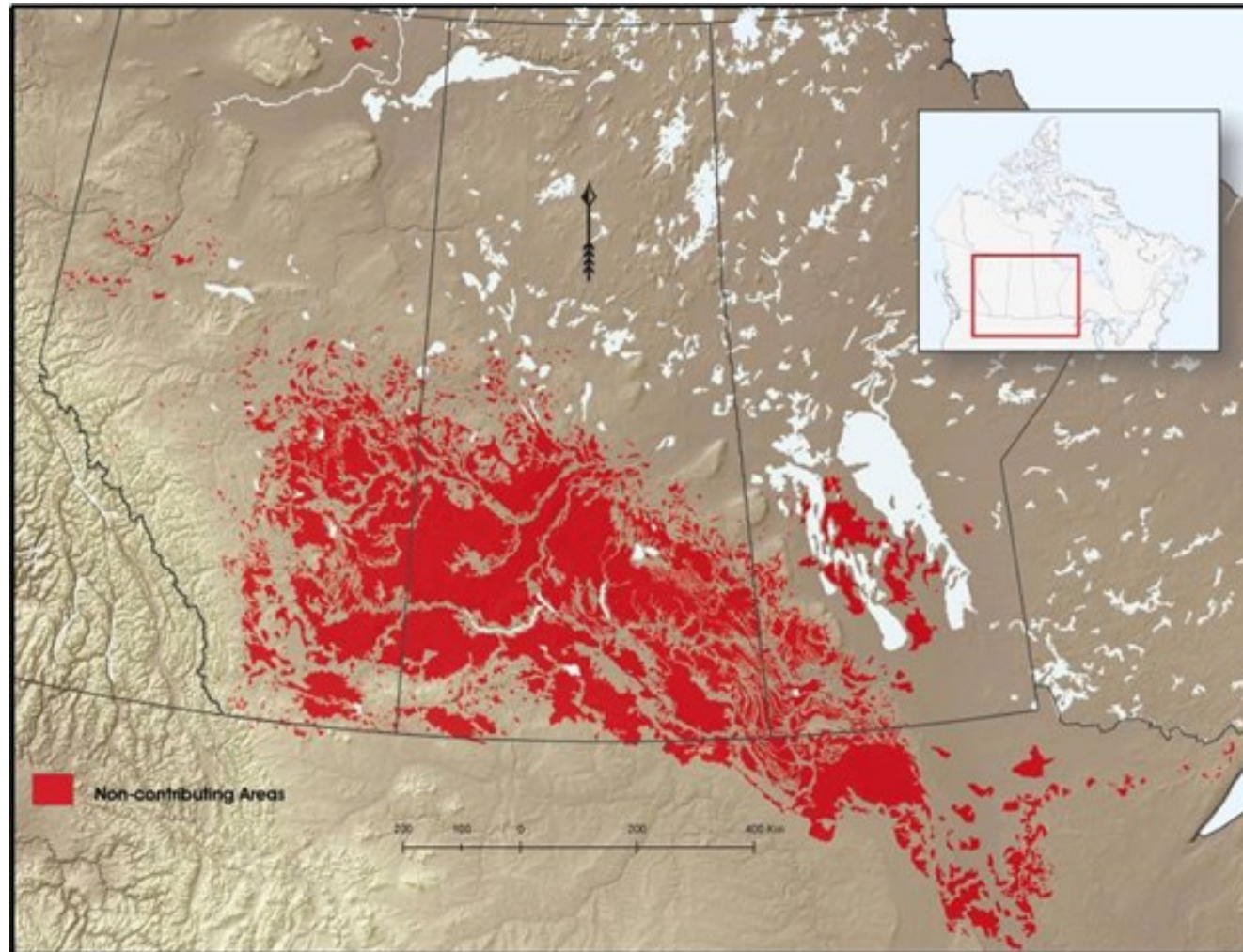
The Prairie context



- Water deficit. (Plant growth constrained by water availability.)
- 56% of Canada's agricultural production.
- Majority of Canada's wheat.

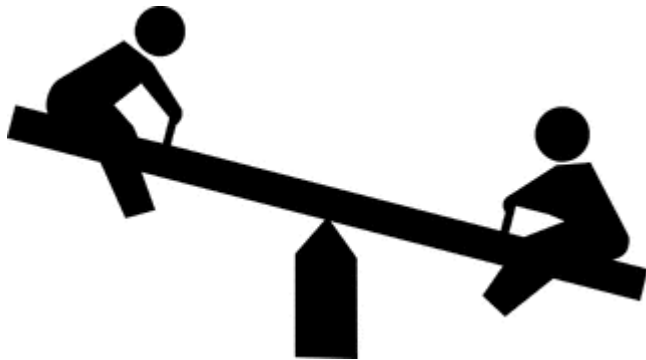


Non-contributing areas

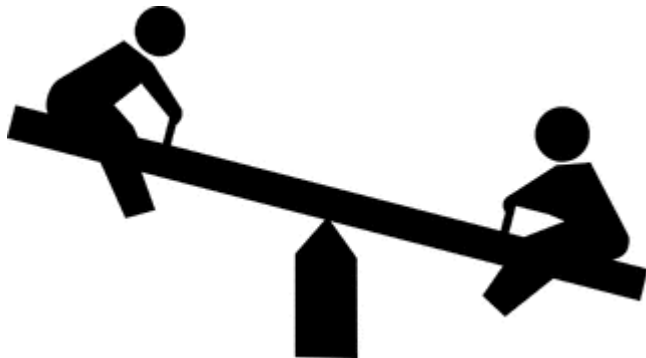


Pomeroy et al. 2005

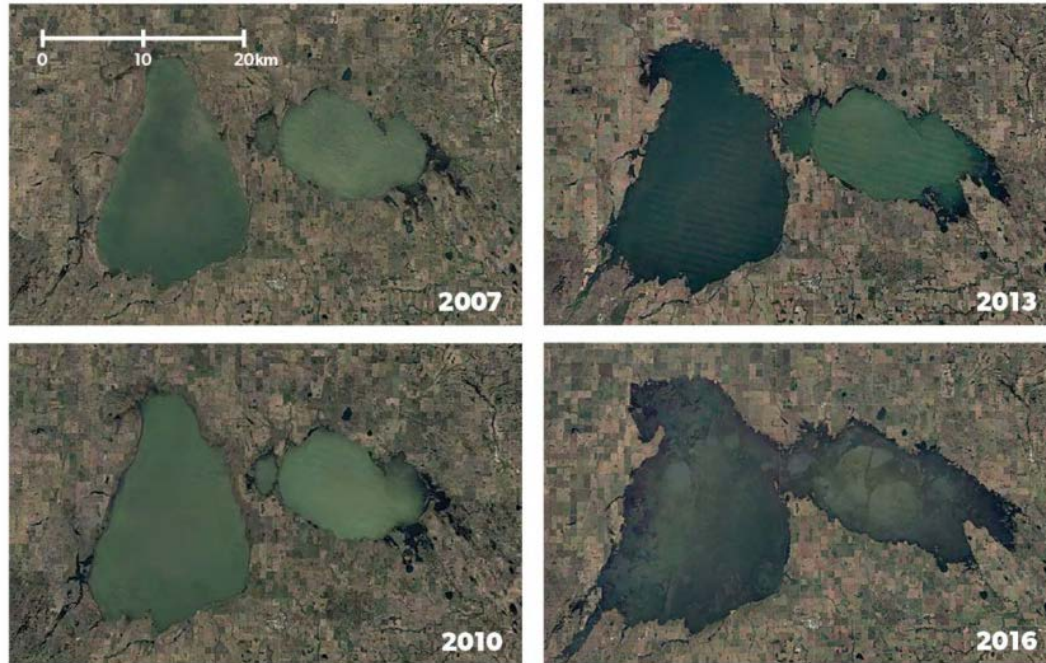
Fill and spill



Issues: wetland drainage



Issues: wetland drainage



Satellite images show the Quill Lakes' steady creep into neighbouring farmland. In 2010, the lakes merged to form a single body of water.

©DUC

- Estimated 200,000 unlicensed drainages in SK (PBO 2016).
- Drainage can increase flood peaks (Pomeroy et al. 2014)
- Unlicensed drainage is not (generally) managed (PBO 2016).

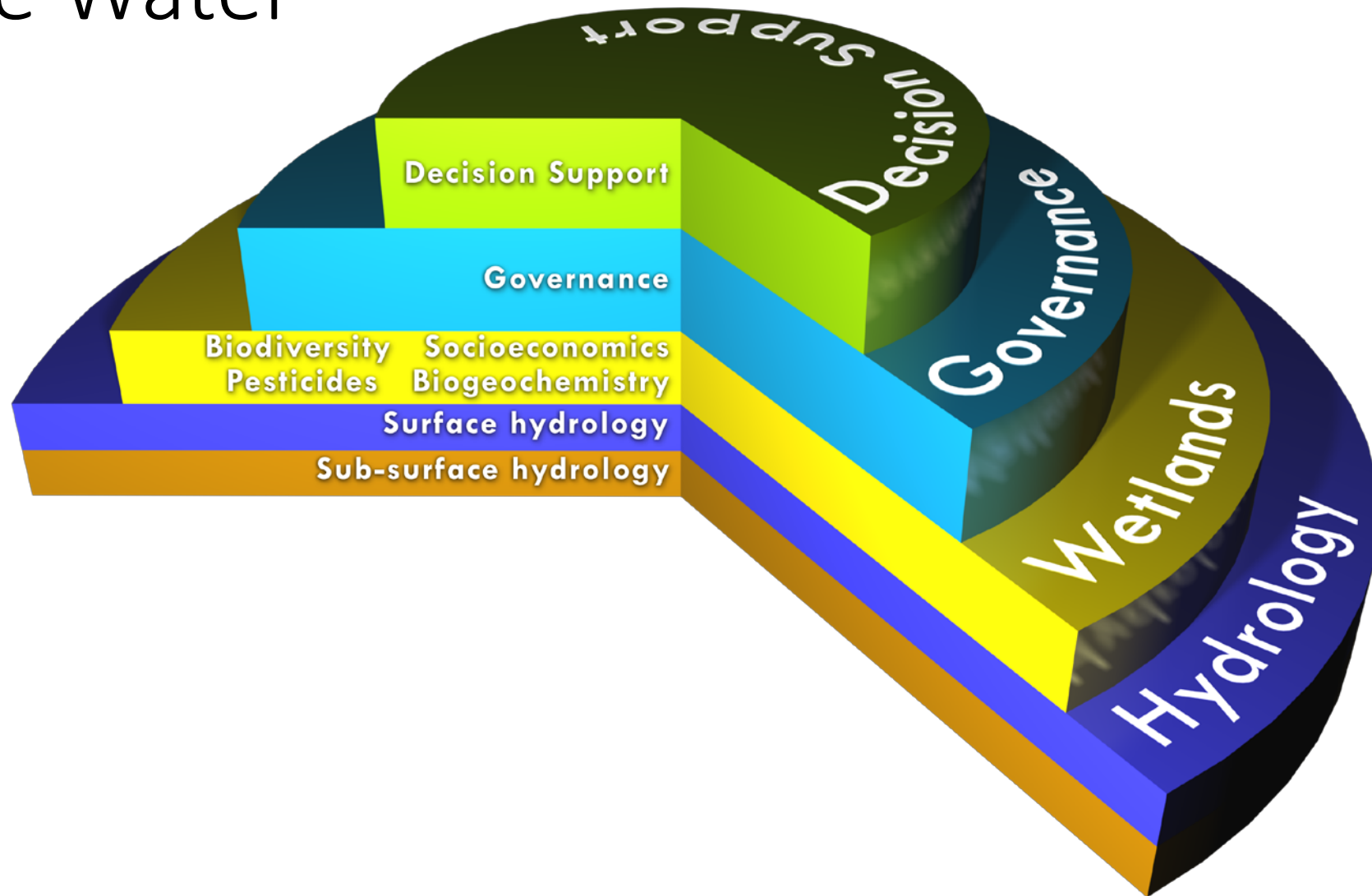
The prairies

- Extremes (hot/cold, wet/dry)
- Intensively managed and the management is not static
- Thresholds -- extremely sensitive to change – agricultural productivity, flood, drought, water quality.
- Many challenges



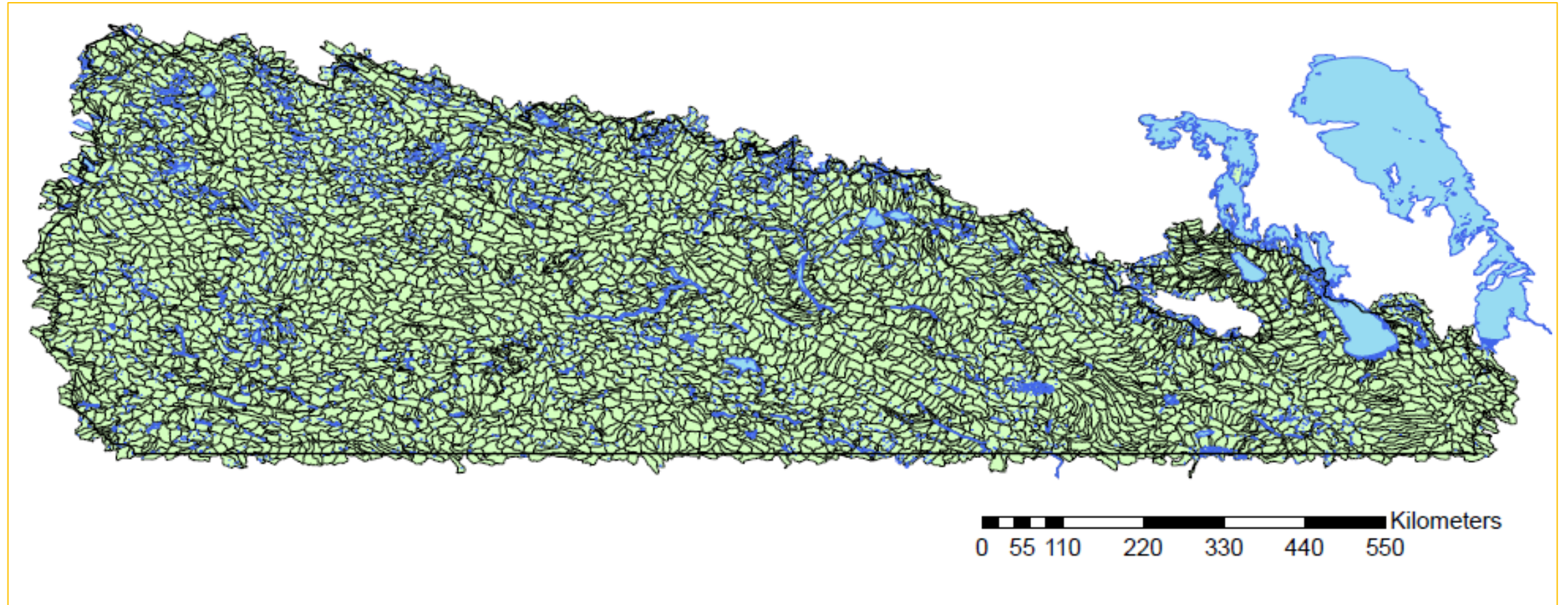


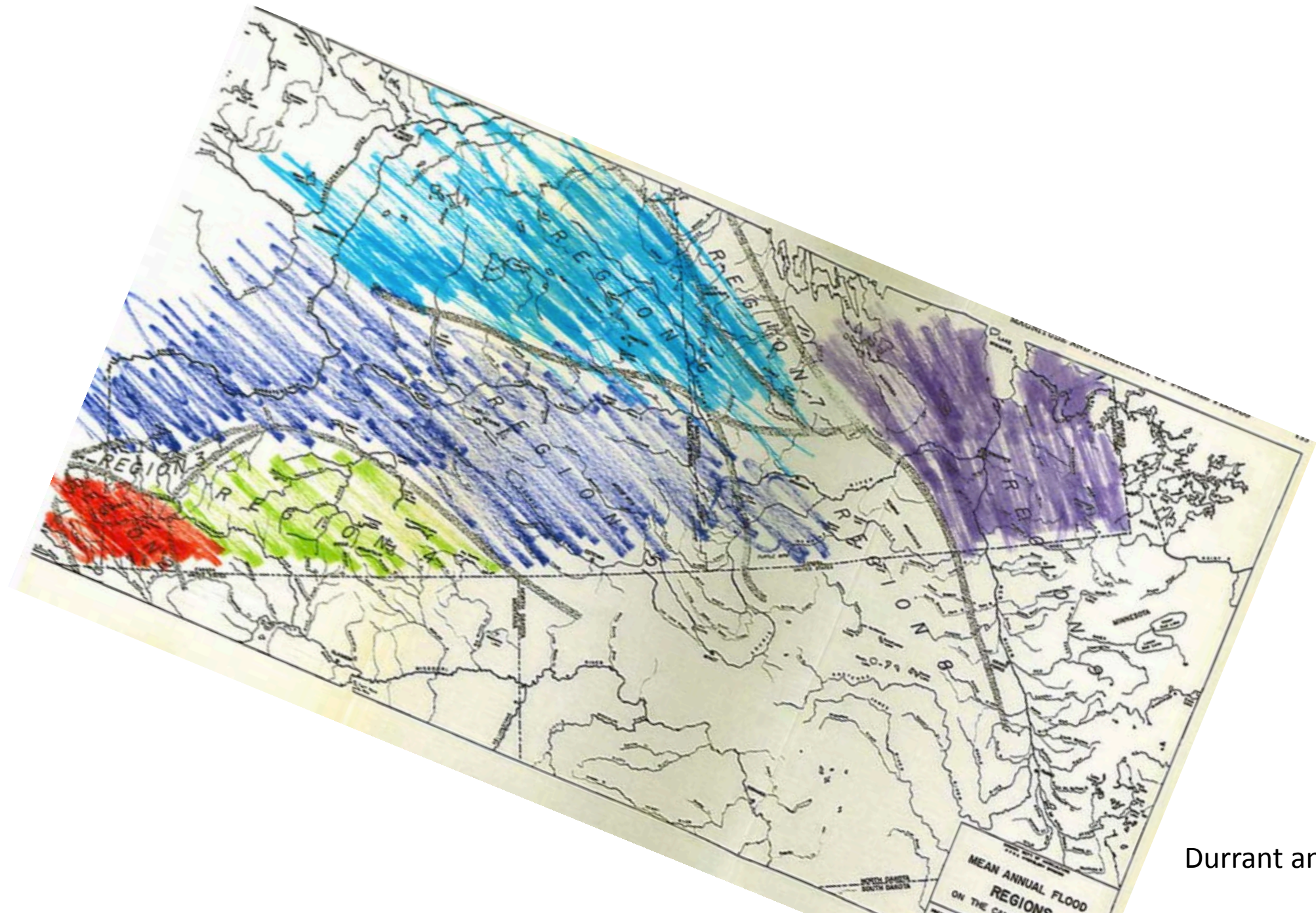
Prairie Water



Spence et al. submitted

Prairie watersheds

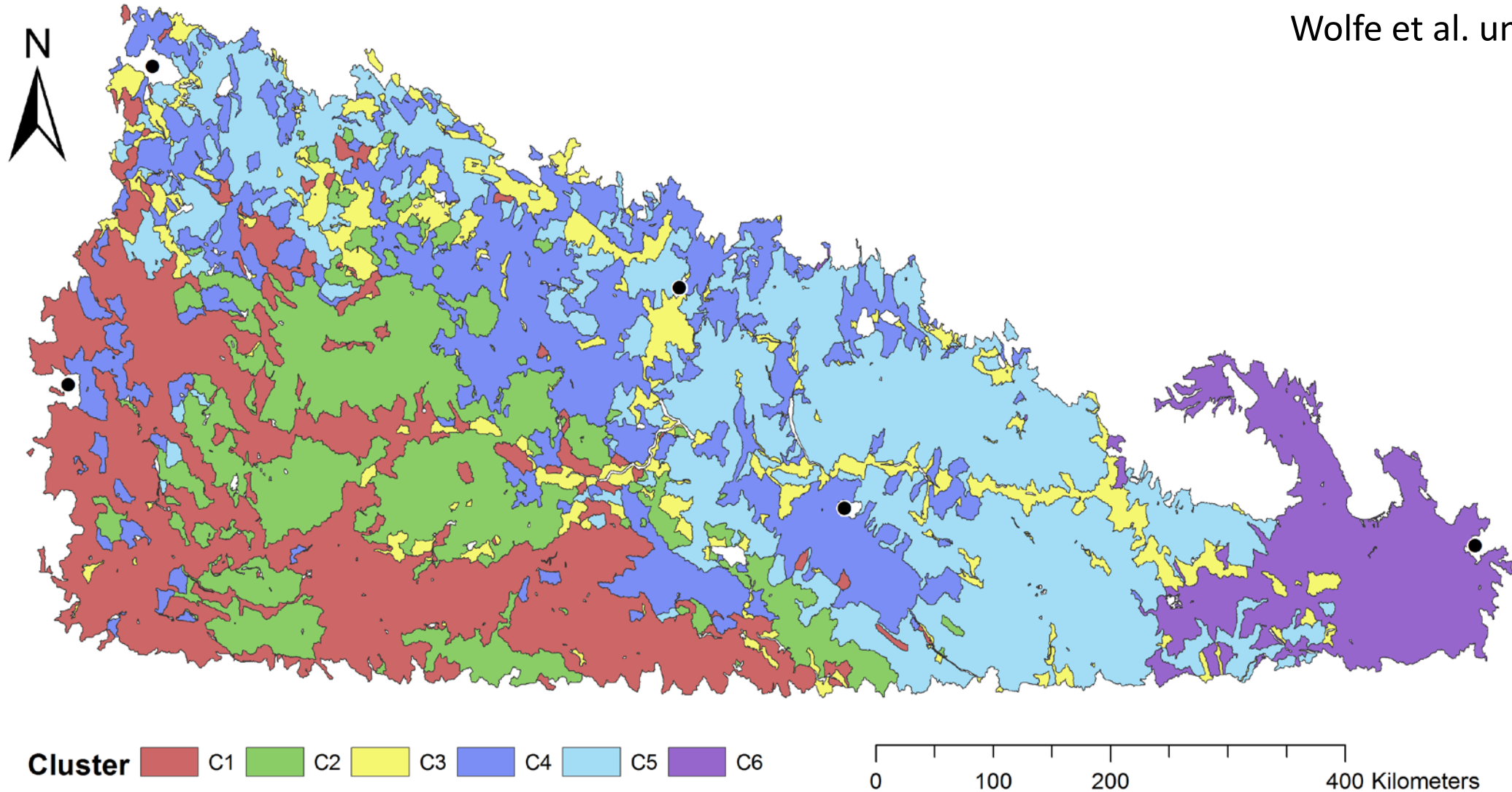




Durrant and Blackwell 1959

Watershed classification

Wolfe et al. unpublished



Issues: groundwater recharge and resources

Geophysical Research Letters








RESEARCH LETTER

10.1029/2018GL078409

Key Points:

- There is insufficient topography to

The Persistence of Brines in Sedimentary Basins

Grant Ferguson¹ , Jennifer C. McIntosh² , Stephen E. Grasby³ , M. Jim Hendry⁴ ,
Scott Jasechko⁵ , Matthew B. J. Lindsay⁴ , and Elco Luijendijk⁶ 



Issues: nutrient pollution

Winnipeg Free Press

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Lake fun suffers from invasion of green slime

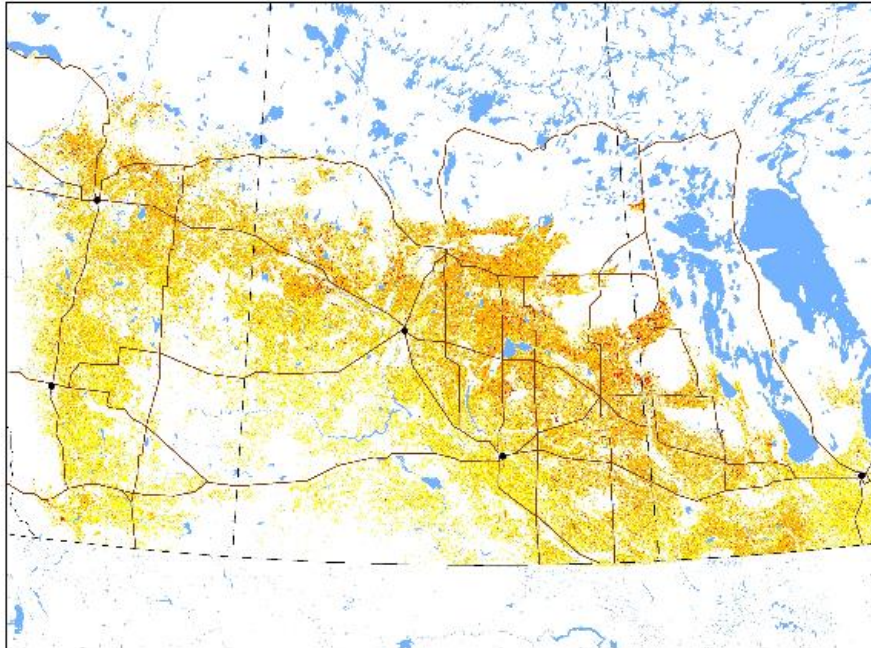
Cottagers worry algae blooms may eliminate swimming at Beaconia Beach

By: Dave Baxter

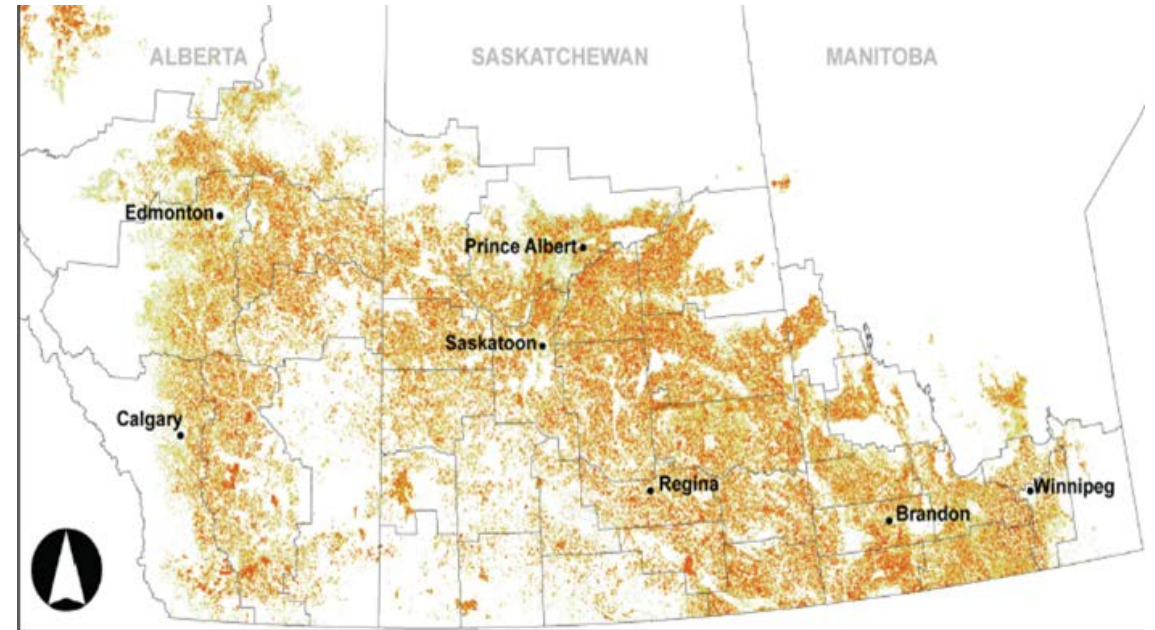
Posted: **05/19/2018 4:00 AM** | [Comments: 2](#)

Issues: pesticide mobility

Canola production (C. Morrissey)



Estimated neonicotinoid application (g/ha)



Two popular insecticides cause songbirds to lose their way: U of S research

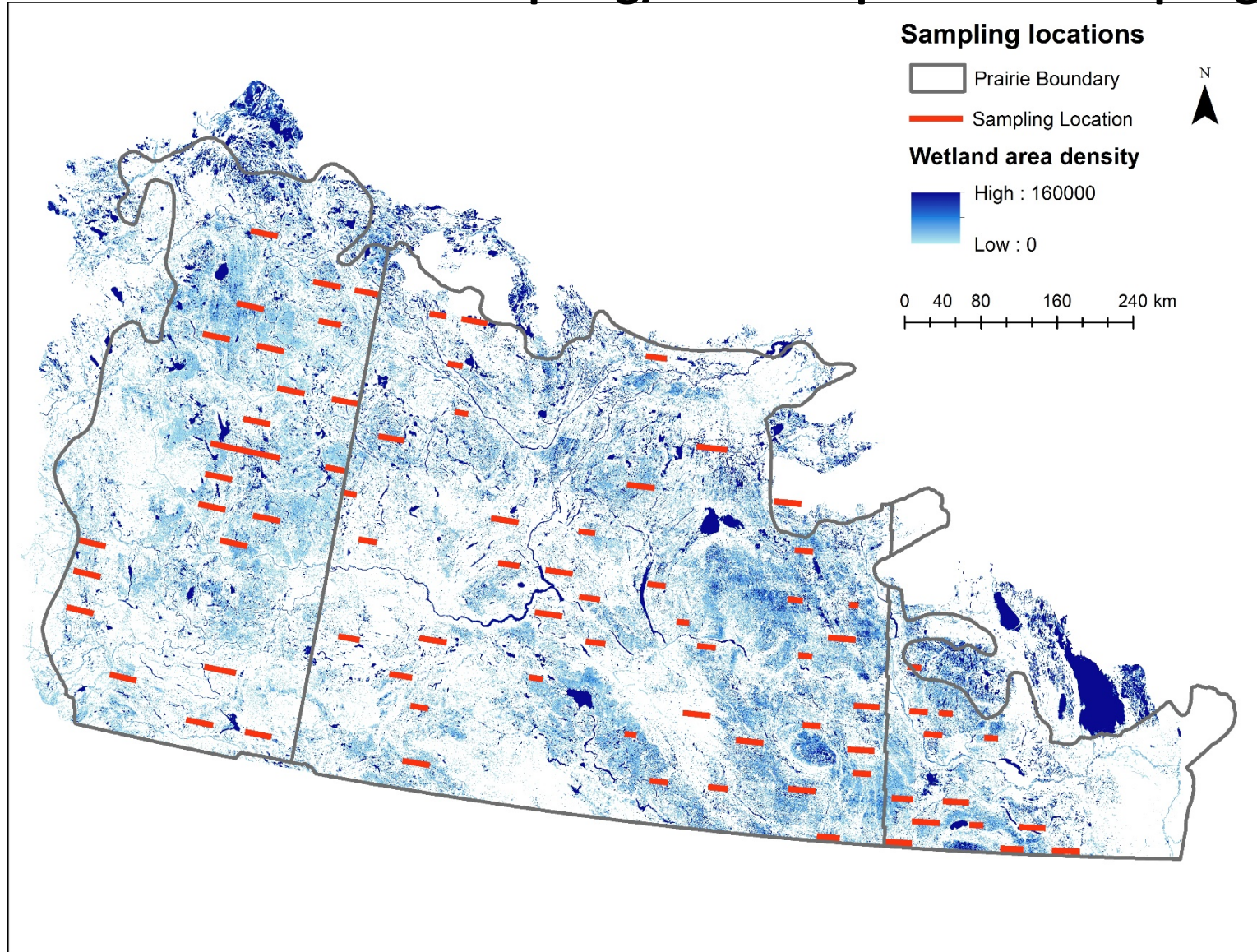


THIA JAMES, SASKATOON STARPHOENIX

Published on: November 9, 2017 | Last Updated: November 9, 2017 7:21 PM CST

Main et al (2014), *PloS One*

Locations for the 2018 spring/summer pesticide sampling campaigns



Sampling in 81 transects

In total, 200 wetlands
throughout the Prairies

$$Risk_i = \frac{C_i}{Benchmark_i}$$

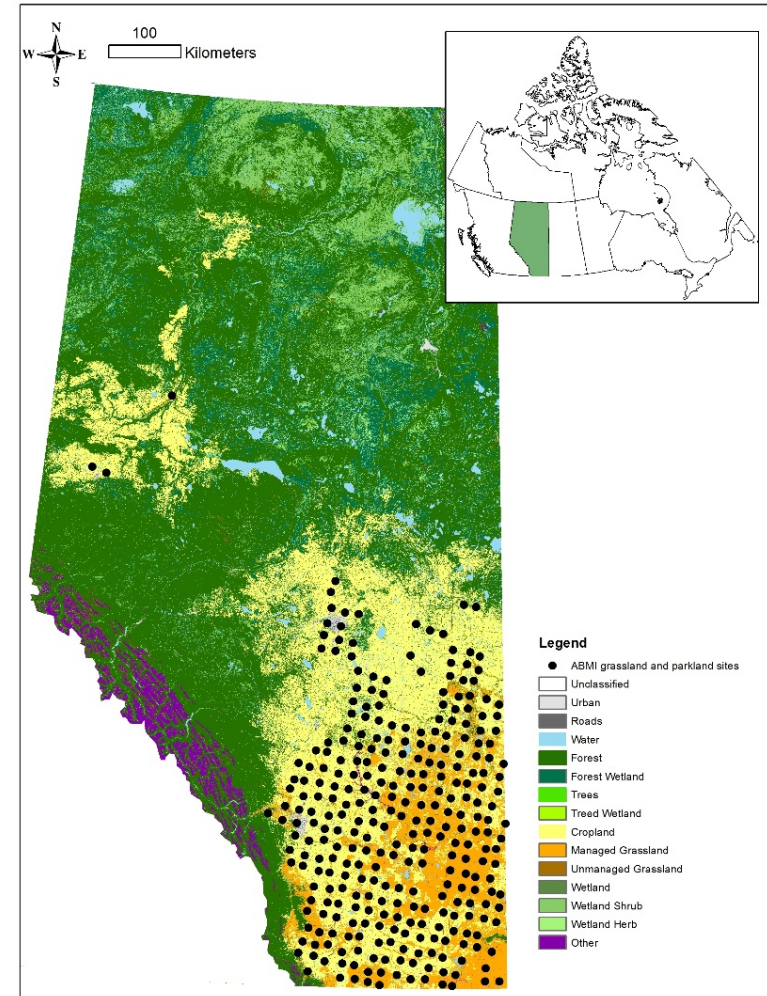
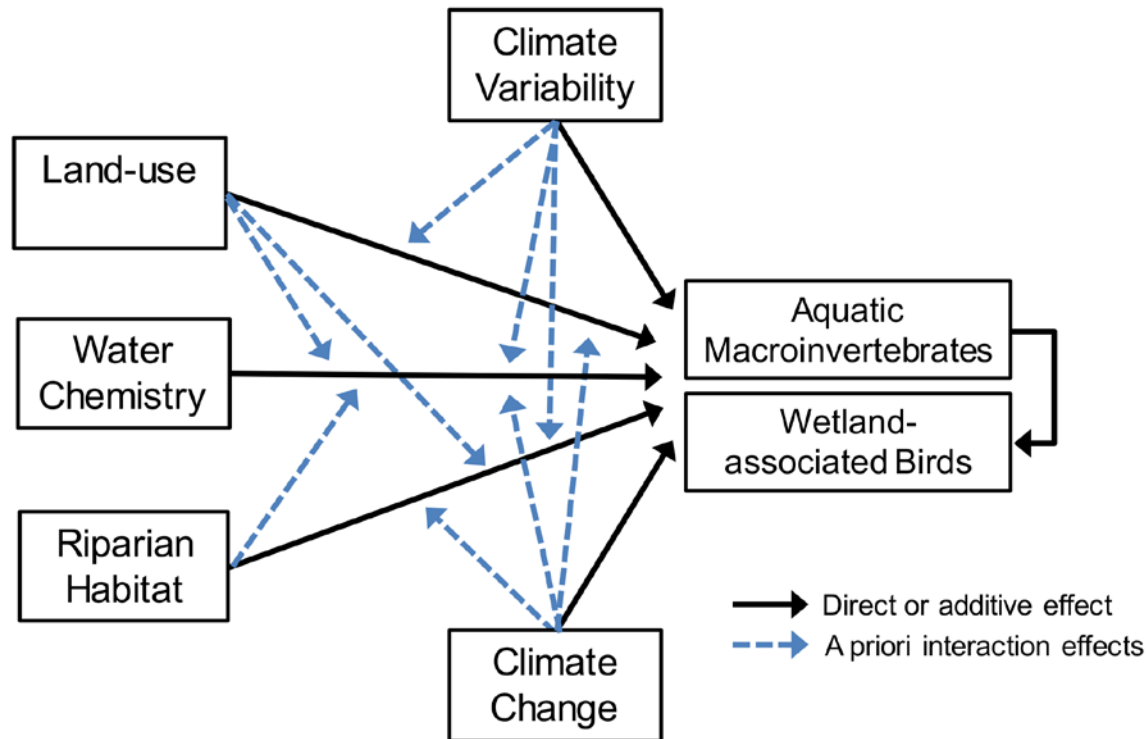
c_i - concentration of pesticide i
in wetlands

E. Malaj PDF research

Ducks Unlimited Canada (2017) Estimating Wetlands from CanVec Data: A Geoprocessing and Statistical Modeling Approach

Wartmough, M. D. and E. M. Beck (2017). Canadian prairie wetland and upland status and trends 2001-2011. Prairie Habitat Joint Venture. Edmonton, Alberta, Canada, Canadian Wildlife Service.

Issues: land-use & climate change impacts on prairie wetland biodiversity



Alberta Biodiversity Monitoring
Institute survey sites

- A negative Salinity, TP & DOC effect on aquatic macroinvertebrates
- A negative cropland effect on many wetland-associated birds
- A synergistic effect between temperature change over time and woody vegetation on birds

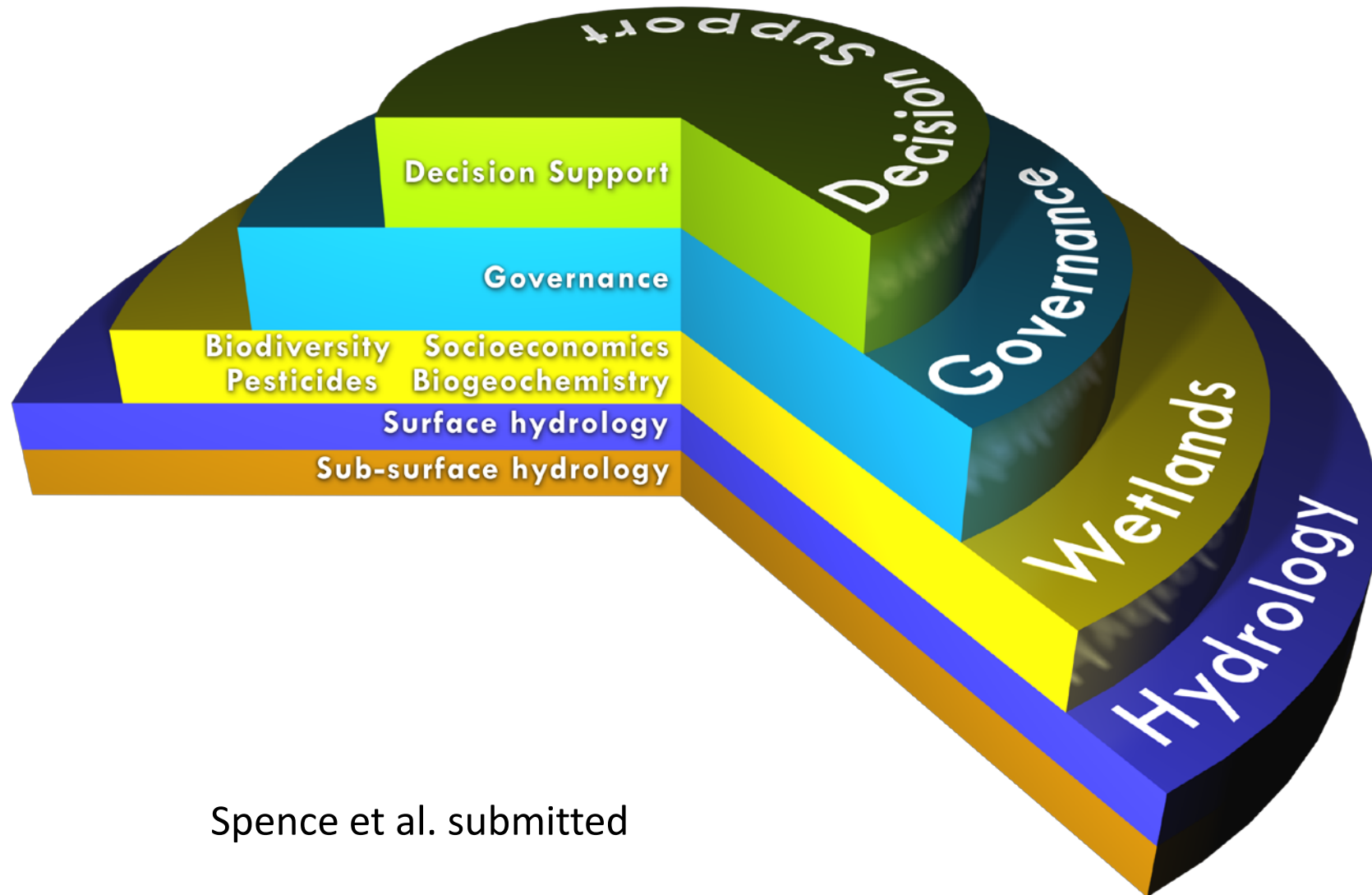


Photo credit –DUC library



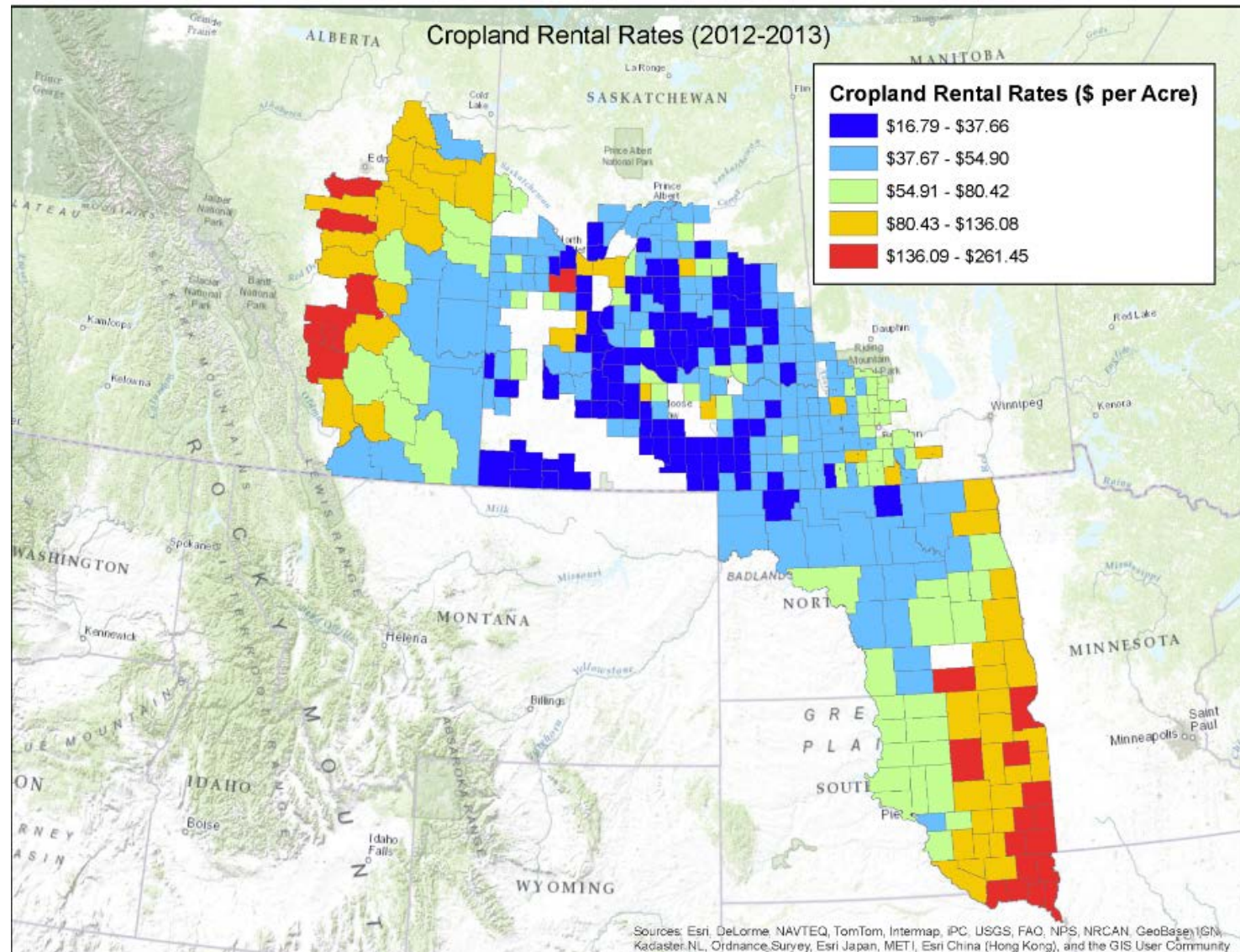
Photo credit - Lauren Bortolotti

Connecting people and science

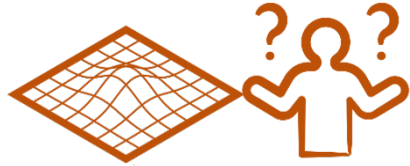


Spence et al. submitted

Economic dimensions



Governance and social science questions



What value does modeling add to governance and decision making?



How do we blend conventional & Indigenous water governance and management principles?



Which guiding documents and management plans are used, and are useful?



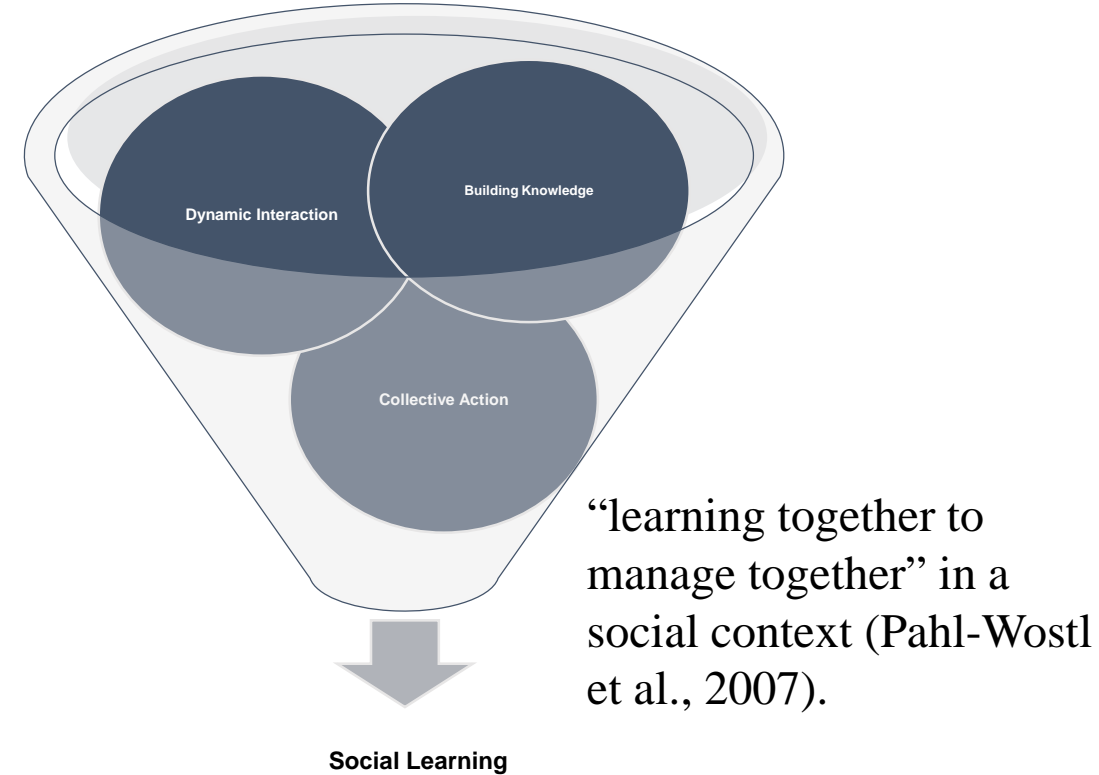
How can we enhance social learning for water governance?



What are some ways citizens can be engaged in water science?

Model utility

1. Evaluate utility of watershed model in promoting social learning and capacity building in the community, and,
2. Analyze factors influencing community members' acceptance of model-generated information



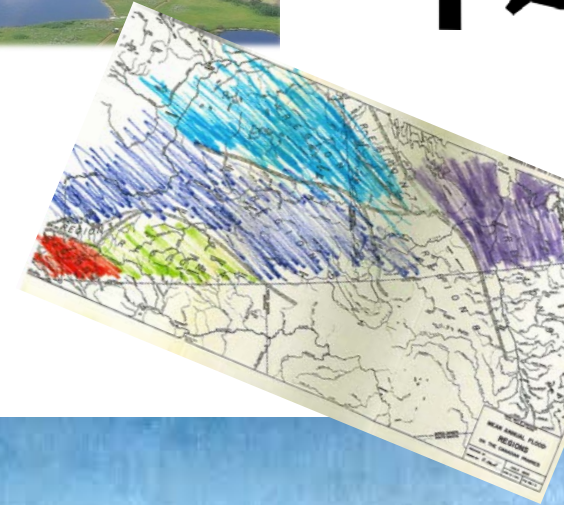
Key Outcomes

- 1) Watershed models to predict water availability and quality under different climatic and land use scenarios
- 2) Assessments of groundwater resources and management
- 3) Multi-stakeholder process to mobilize science with communities and governance
- 4) Decision-support tools for sustainable water management across user base



Conclusions

- On the Canadian Prairie, there exists two stable system states with very different predominant processes and rates of processes; “drought and deluge” à la *Shaw et al. (2012)*
- Two profoundly different behaviours
- Complex & layered challenges
- The prairies have always been a place where climate has been extreme. Adaptation is part of the culture. But we need to understand the extent of adaptation that will be required
- And, we need to better understand how actions of people today, and the governance of those actions impacts water related risks



Questions?



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LAURIER
Inspiring Lives.

<https://gwf.usask.ca/prairiewater/>

[https://twitter.com/Prairie Water](https://twitter.com/Prairie_Water)



Photos

- A <http://www.thecanadianencyclopedia.ca/en/article/great-depression/>
- B <https://www.agriculture.purdue.edu/agcomm/newscolumns/archives/OSL/2013/March/130314OSL.html>
- C <https://www.ctvnews.ca/canada/prairie-farmers-frustrated-as-flooding-drowns-crops-1.1911605>
- D <http://www.tourismsaskatoon.com/media/>
- E https://commons.wikimedia.org/wiki/File:Oil_Derrick,_near_Ponoka,_Alberta,_Canada.jpg
- F <http://www.canadianrailwayobservations.com/RESTRICTED/2015/November/shortlines.htm>
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- I <http://www.cbc.ca/news/canada/saskatchewan/blue-green-algae-blooms-shut-down-buffalo-pound-lake-1.3696278>
- J <http://lakepulse.ca/annual-report-2017-2018/>
- K <http://www.cbc.ca/news/canada/saskatchewan/province-plans-lake-release-to-deal-with-city-water-woes-1.3092778>
- L <https://globalnews.ca/news/2857033/toxic-amounts-of-blue-green-algae-in-buffalo-pound-lake-could-be-fatal-for-dogs/>
- M http://ftp.geogratis.gc.ca/pub/nrcan_rncan/raster/atlas_4_ed/eng/environment/climate/049_50.pdf
- N Ducks unlimited Canada
- O Ducks Unlimited Canada
- P <http://www.cwjefferys.ca/a-prairie-town?mid=0>
- Q http://www.livingskies2014.ca/wp-content/uploads/2014/01/IMG_3259.jpg

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https://www.usask.ca/hydrology/papers/Pomeroy_et_al_2014.pdf
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https://www.usask.ca/hydrology/reports/CHRp01_Hydrology-Water-Resources-Sask_Feb05.pdf
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Contributions from: Chris Spence, Jared Wolfe, John Pomeroy, Kevin Shook, Michael Kehoe, Grant Ferguson, Chrystal Mantyka-Pringle, Egina Malaj, Christy Morrissey, Anuja Thapa, Lori Bradford, Graham Strickert, Lalita Baradhwaj, Ken Belcher, Eric Asare