



Groundwater

Grant Ferguson

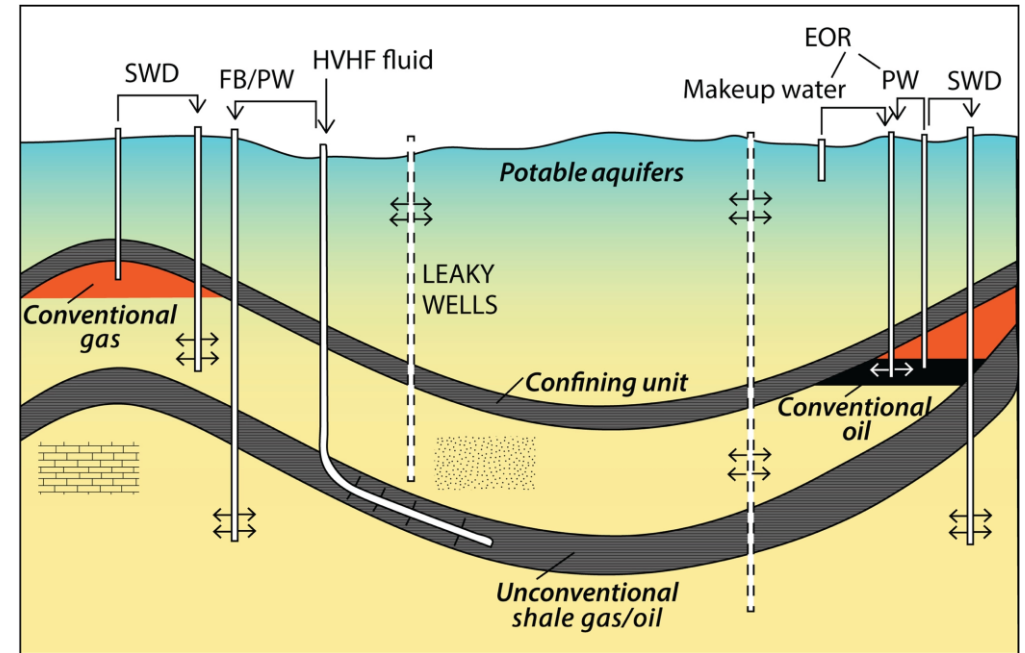


Questions and Challenges (User-informed)

- We don't understand to what extent our groundwater resources can be developed
- We have a poor understanding of the risks that the oil and gas industry poses to water supplies

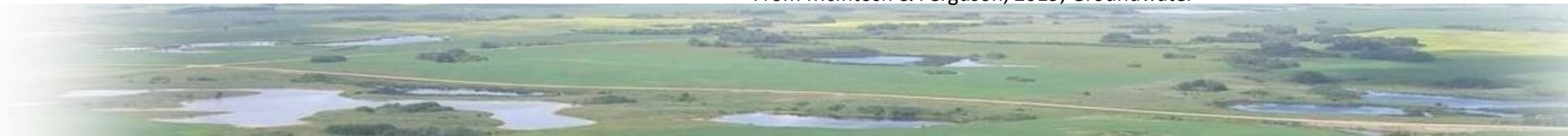


Water well near Regina, SK



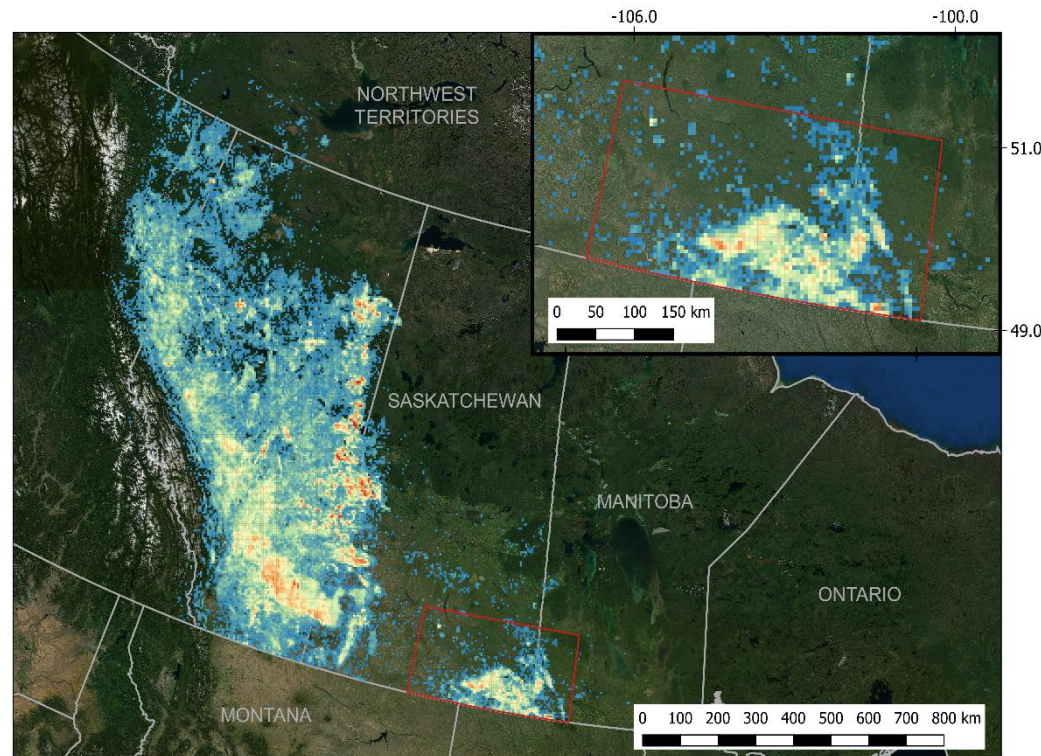
Subsurface pore space competition

From McIntosh & Ferguson, 2019, Groundwater



Theme Objectives

- Assess the capacity of aquifer systems in the Prairies to support current and future uses with a focus on connections between shallow and deep aquifers
- Understand the risks to water supplies associated with oil and gas development

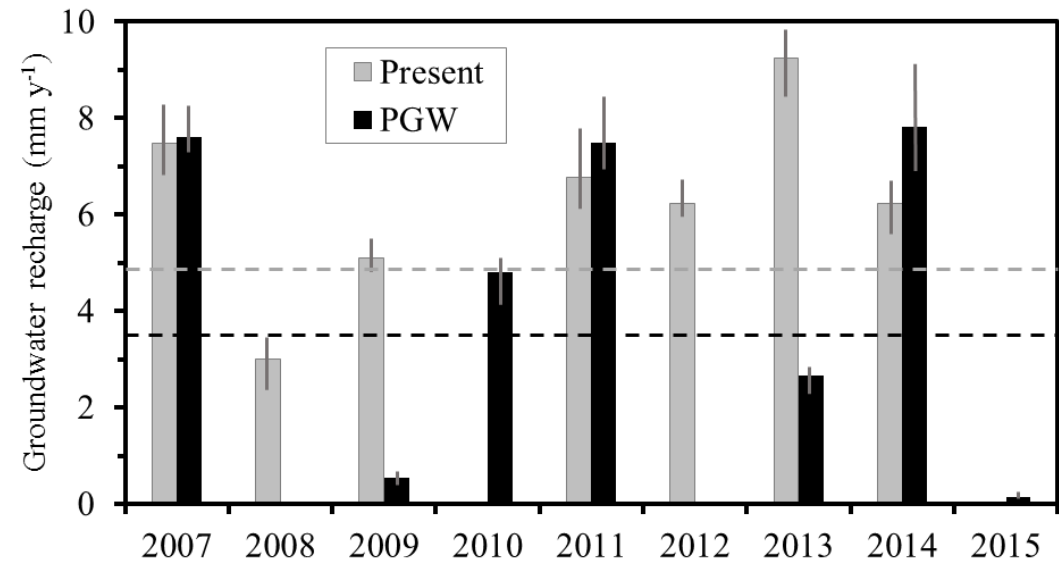
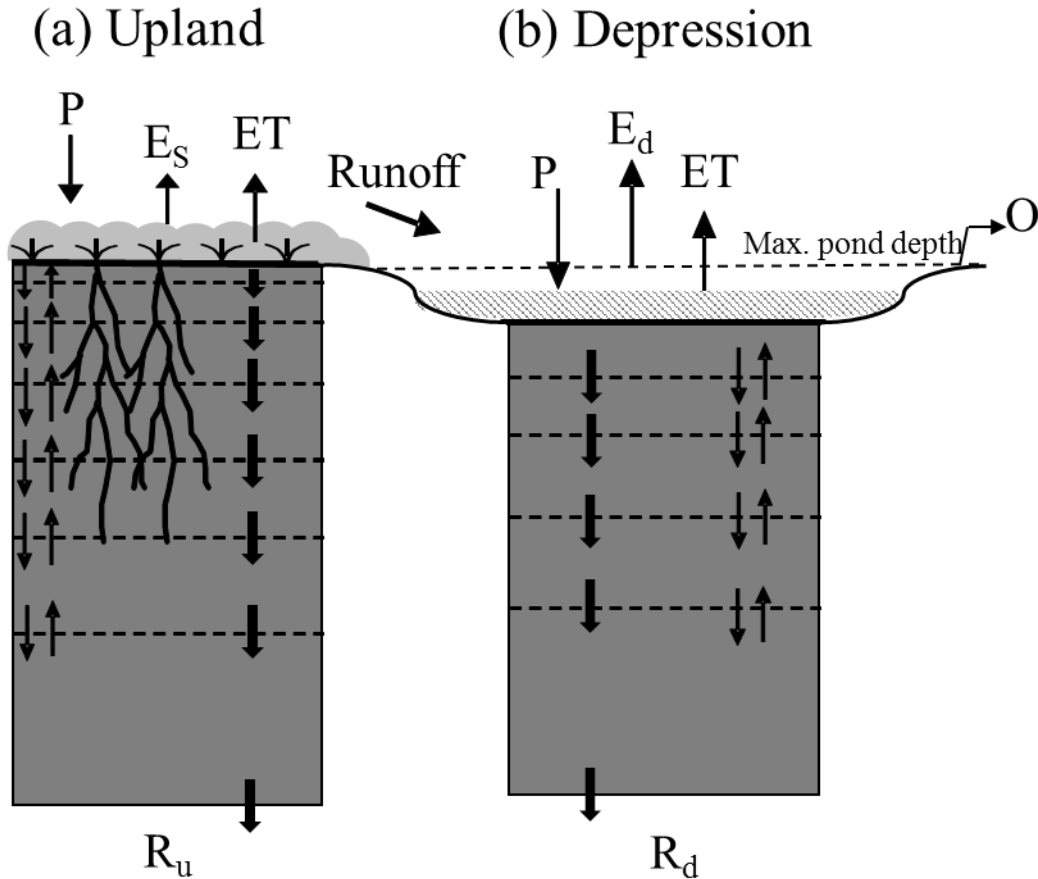


Injection wells in Western Canada
Figure by Keegan Jellicoe



Highlight of Findings

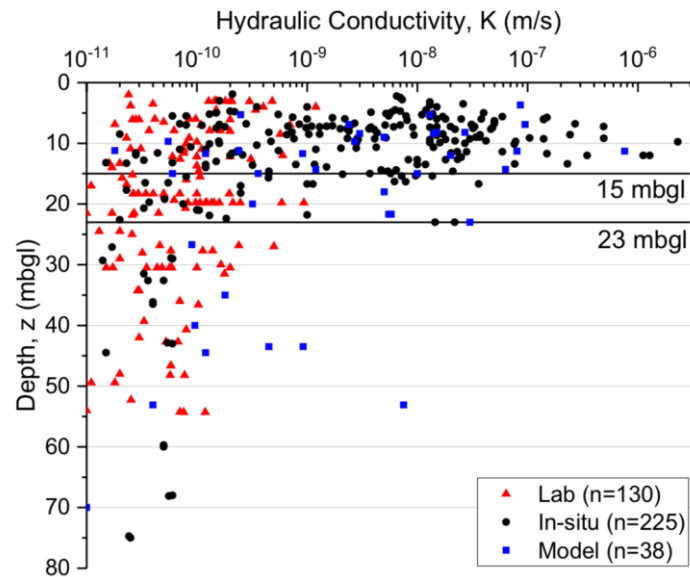
- Less groundwater recharge is predicted to with global warming based on results from VSMB



Predicted changes in recharge between present and pseudo-global warming scenario (2091-2100). See poster by Negm et al.

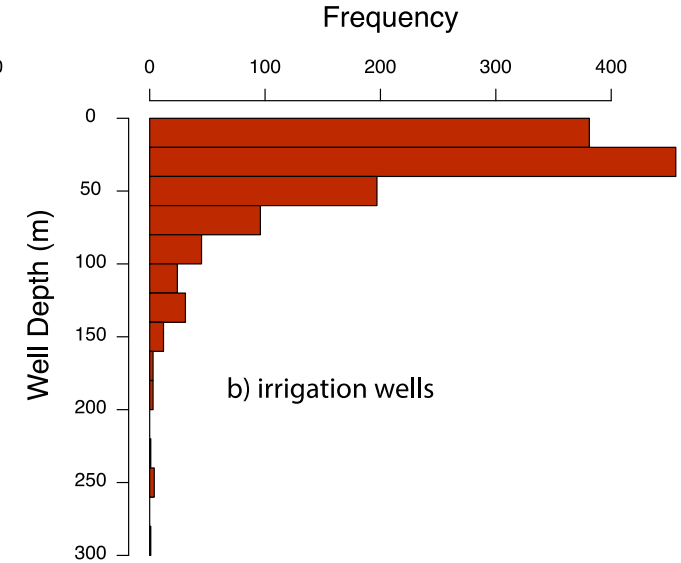
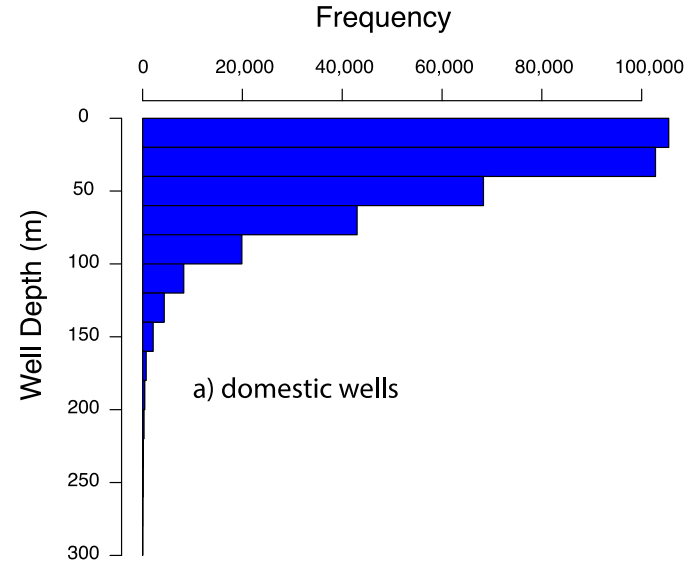
Highlight of Findings

- Most groundwater use occurs beneath the weathered portion of glacial tills
- Double edged sword:
 - Protects groundwater from contamination
 - Minimal recharge replenishing these groundwater stores



Hydraulic conductivities of till in Saskatchewan

From Ferris M.Sc. Thesis, 2019

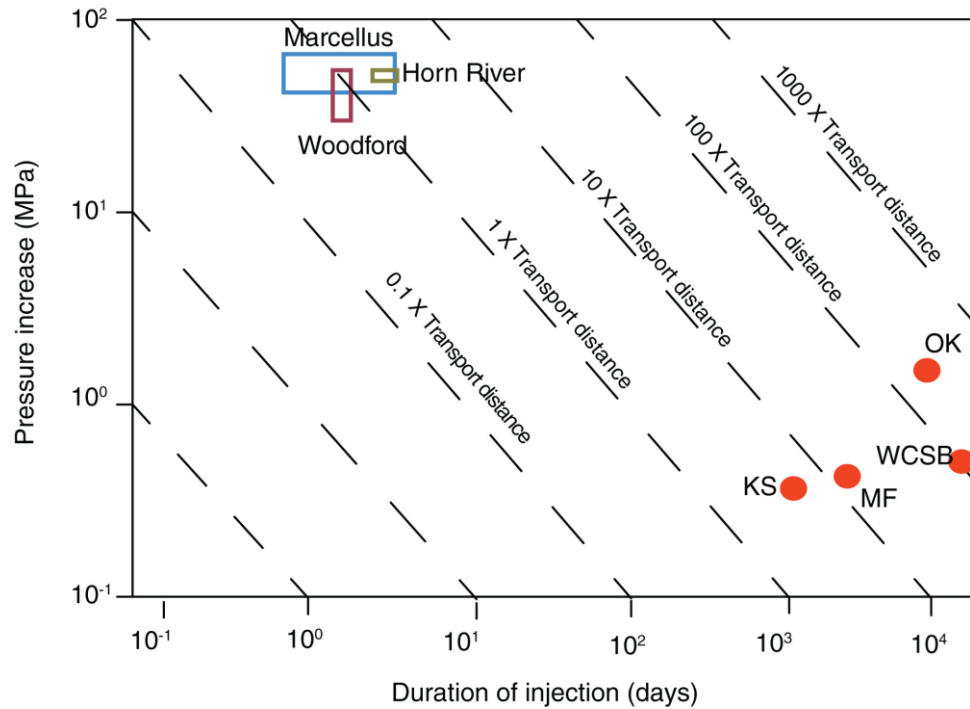


Depth of Water Wells in Alberta and Saskatchewan



Highlight of Findings

- The oil and gas industry has impacted the hydrologic cycle in the Prairies at a large scale
- Unconventional and conventional oil activities pose similar risks to groundwater supplies



Likely transport distance from hydraulic fracturing (boxes) versus injection wells (circles)

From McIntosh and Ferguson, 2019, Groundwater



Ongoing Work

- Integration of deep groundwater work with the rest of the hydrologic cycle
- Investigation of residence times in Prairie groundwater systems using novel isotopes
- More detailed work on impacts of the oil and gas industry with potential focus on heavy oil production in western Saskatchewan



Groundwater Crystallization

Data

- Records from the oil and gas industry
- Records from Water Security Agency
- Groundwater samples

Methods

- Compiled and synthesized data from Water Security Agency, oil and gas industry
- Calculated expected pressure changes
- Estimated transport times for various pathways between oil and gas production and groundwater supplies

Result

- Injection wells pose a threat to groundwater supplies
- Hydraulic fracturing is of lesser concern

Uncertainty

- Lack monitoring to determine presence/extent of contamination
- Limited understanding of geology and hydrogeologic properties