Waning Wetlands: Evaluating the loss of closed-basin ponds in British Columbia’s Semi-arid Rangelands

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Overview

• Background

• Evaluation of Water Loss
  • Related research
  • Methods
  • Preliminary data

• Lac du Bois Case Study
  • Related research
  • Methods
  • Expected results

• Conclusion
Background

Closed-basin pond inputs and outputs
**Background**

- These ponds are used as drinking water sources for cattle during grazing\(^1\)
- They also provide habitats for endangered wildlife and plant species\(^2,5\)

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1. Cattle Watering
2. Great Basin Spadefoot Toad
3. Water Parsnip
Evaluation of Water Loss

Related Research
Evaluation of Water Loss

Related Research

Smith et al. (2005) and Riordan et al. (2006) report a **decrease of 5 – 50%** of water body size and number over the last 50 years.
An analysis of weather instrument data from 2001 – 2009 in British Columbia reports a 0.71°C temperature increase accompanied by a 0.5 % decrease in precipitation.  

Vowell Glacier

Pink line – 1998
Green line – 2005
Yellow line – 2012
**Evaluation of Water Loss - Methods**

- Eight 100 km² sites representing BC’s semi-arid grasslands

- Eight randomly selected ponds per site

- Digitize pond boundaries in ArcMap using current and historic imagery (1995 – 2012)
Evaluation of Water Loss — Methods

- Obtain weather data from Environment Canada weather stations for each site
- Use the FAO Penman – Montieth equation to calculate evapotranspiration

\[
\text{ET}_0 = \frac{0.408 \Delta (R_n - G) + \gamma \frac{900}{T+273} u_2 (e_s - e_a)}{\Delta + \gamma (1 + 0.34 u_2)}
\]
Evaluation of Water Loss

Preliminary Data

Total surface area of randomly selected ponds in Lac du Bois upper grasslands

- **1997**: 15 ha
- **2004**: 10 ha
- **2011**: 5 ha
- **38 % Loss**

Total surface area of randomly selected ponds in Lac du Bois lower grasslands

- **1997**: 20 ha
- **2004**: 10 ha
- **2011**: 5 ha
- **78 % Loss**
Evaluation of Water Loss

Expected Results – Weather Data

- Mean ET = 0.92 mm day⁻¹
- Mean P = 0.86 mm day⁻¹
- ET/P = 1.07
Lac du Bois Case Study

Related Research

• Locations
  • Prairie wetlands in North Dakota\textsuperscript{13} and Saskatchewan\textsuperscript{6}
  • Boreal plains in northern Alberta\textsuperscript{4}
  • Sub-Arctic tundra in Canada\textsuperscript{17}
Lac du Bois Case Study
Related Research
Lac du Bois Case Study

Related Research
Lac du Bois Case Study - Methods

- Install groundwater wells and piezometers along a transect through each pond
- Collect data from research weather stations in Lac du Bois

Green Dots – Wells
Yellow Dots – Wells and Piezometers
Lac du Bois Case Study

Expected Results

• Describe water budget for each pond

• Compare results for each pond and look for factors that may explain differences in water retention
This study will fill the current knowledge gap of surface water loss and closed-basin pond hydrology in BC’s semi-arid grasslands.

It will reveal whether or not climate change is a contributing factor to the observed decrease in number and surface area of ponds.

The field study will show how surface water – groundwater interactions may differ between wet and dry ponds and thus, explain the observed difference in water retention.

These results will have range management implications with respect to the future effects of climate change on grassland ponds and the availability of water sources during grazing.
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Questions?
References