Sibbald Research Wetland: Mountain peatland form and ecohydrologic function as influenced by beaver

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ABSTRACT

Sibbald Research Wetland is a 1.3 km² peatland in the foothills of the Rocky Mountains. The primary research foci are 1) the influence of beaver ponds on mountain peatland hydrology and 2) the potential influence of climate change on these beaver-impacted peatlands. This paper summarizes initial results and implications of the research.

RÉSUMÉ

Le site de recherche de Sibbald sur les milieux humides est une tourbière de 1,3 km² située au pied des Rocheuses. Les principaux axes de recherche portent sont 1) l'influence des étangs de castor sur l'hydrologie des tourbières en montagne et 2) l'influence que pourraient avoir les changements climatiques sur ces tourbières affectées par le castor. Cet article donne un aperçu des résultats préliminaires et de leur implication sur les travaux de recherche.

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Introduction

The Sibbald Research Wetland (Table 1; Fig. 1) was established in 2006 with the overarching goal of understanding the influence of beaver on mountain peatland form and ecohydrological functioning. An improved understanding of how both present and historical beaver ponds are affecting modern-day peat characteristics and hydrology are essential to determine and model how different climate futures will affect these important source areas (Table 2). Key questions that need to be answered, for example, include:

- How important are beaver ponds in peatlands to sustaining the low flow regime of mountain streams?
- How will the different climate futures influence beaver populations and how will such fluctuations impact resilience of the hydrological and soil-forming processes of mountain peatlands?
- Will changes release massive amounts of greenhouse gases and/or nutrients into streamflow?

Important Scientific Advancement

Beaver dams, even very small ones that are wholly contained in the stream channel, greatly enhance the amount of stream water flowing into the stream bed and banks - this water is typically discharged back to the stream somewhere downstream (Janzen and Westbrook 2011). These beaver-influenced flowpaths bring nitrogen-rich water back to the often low productivity streams (Shaw 2009).

The amount of water stored in beaver ponds can be accurately approximated using the algorithm Hayashi and van der Kamp (2000) developed for prairie pothole wetlands, which was simplified by Minke *et al.* (2010).

Our recent work (Morrison *et al.* 2015) shows that, within the greater Kananaskis region, nearly all peatlands in the mountains and 63 % of peatlands in the foothills are impacted by beaver. The frequency impact in the region varies by management zone. Further, wetlands (peat- or mineral-based) with beaver impacts have much more open water than those without beaver impacts (3.9 km² vs. 0.4 km²).

Management/Operational Results

Beaver have a large control on peatland form and hydrological functioning in this region, affecting processes such as the delivery of water and nutrients to downstream environments under both peak and low flow conditions. Additionally, different beaver management practices drive the degree to which beaver modify the wetlands. As a result, beaver management requires recognition of the critical hydrologic roles played by beaver in the region.

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Table 1: Description of the study area

Watershed location data	
Location (descriptive)	The foothills of the Rocky Mountains, approximately 70 km west of Calgary
Location (geographic)	51°03'29.38"N, 114°52'11.66"W
Watershed area	Not yet available (peatland is ~1.3 km ²)
Elevation range (a.s.l.)	1475-1653 m
Precipitation (mean annual)	661 mm (from University of Calgary BGS Institute, 1975–2008) New year-round weather station as of fall 2012
Runoff (mean annual)	Not yet available
Temperature (mean annual)	3.5°C (BGS Institute; 1975–2008)

Table 2: Data collected in the Sibbald Research Wetland

Research design	
Study type	A variety of ecohydrological and soil science studies ongoing
Treatments	Varies by individual project
Controls	Varies by individual project
Study duration	2006 – present
Variables measured	Hyporheic flow, groundwater level and flows, year-round water balance, beaver pond stage, stream flows, ground penetrating radar, soil type, soil chemistry, water chemistry (ions, N, P, conductivity)

Fig. 1. Study area with locations of tipping buckets to measure precipitation inputs, stream gauging sites to measure discharge, and wells to measure depth to subsurface water.

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