Recent carbon accumulation rates in peatlands along the North Shore of the Gulf of St Lawrence, Canada

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1. BACKGROUND

Peatlands are an important component of the global carbon cycle and have been a net C sink during the Holocene. Under current warming conditions, C emissions are projected to rise due to increased respiration. Longer growing seasons and higher rates of C uptake are also expected. Permafrost degradation has been accelerating during the last 50-100 years and is altering peatland hydrology, microbiotopography and C cycling. C stocks have been shown to increase as a result in Western Canada and in Arctic and Subarctic Canada; little is known about other northern regions. As peatlands cover 12% of the area of Canada, changes in climate-driven peat accumulation could represent an important future C source or sink.

2. OBJECTIVES

1. To compare regional changes in carbon accumulation rates (CAR) between peatlands located in three distinct ecotonal regions during the last millennium; 2. To evaluate within-site variability in CAR trends along a microtopography gradient for the 20th century.

3. SITE DESCRIPTION

Three peatlands were selected for this study (Fig 1): Located along the North Shore of the Gulf of St Lawrence, Formed between 7,400 and 4,200 cal. BP by paludification on deltaic sands, Ombrotrophic peatlands, i.e. only inputs from precipitation, Dominated by Sphagnum moss, ericaceous plants and shrubs; lichens become more dominant further North. Microform distribution and pool morphology vary

4. METHODOLOGY

Peat monoliths (N = 30, max. depth 1 m) were extracted from the central dome of each peatland using a box corer (Table 1, Fig. 2).

Table 1. Distribution of cores taken by microform (N = 30) A: hollow/pool edge; B: lawn; C: Sphagnum hummock D: lichen hummock

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<thead>
<tr>
<th>Region</th>
<th>A</th>
<th>B</th>
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<tr>
<td>Baie Comeau</td>
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<td>Blanc Sablon</td>
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To calculate carbon accumulation rates (CAR): Carbon content: calculated using bulk density and loss on ignition (3 cm2, 0.5 cm); C content assumed to be 50% organic matter. Chronology: established by lead-210 (210Pb) dating5 all cores using α-spectrometry (method modified from 6) and the CRS model5 assuming a constant rate of supply. Preliminary age models were constructed using 13C dates for 2 cores in CLAM version 2.21.

5. RESULTS AND DISCUSSION

Within-site variability (Objective 1, Fig. 3): Recent C accumulation rates calculated for the last 100 years. For all sites, CAR is highest for the last 5-10 years as acrotelm peat is not yet fully decomposed. BC has the highest rates overall. Within each site, Sphagnum hummocks have the highest CAR, and lichen hummocks the lowest. Note that CAR for BS are likely underestimated: lower resolution 210Pb profiles? While CAR for wet (and intermediate) (lawn) microforms are similar, C emissions are likely higher for hollows20.

Between-site (regional) variability (Objective 2, Fig. 4): CAR accumulation rates for the last millennium. Overall, CAR are higher at BC. At both sites, CAR lowest during and since the Little Ice Age (LIA). A slight increase in CAR at HP since the LIA may be due to the presence of more rapidly accumulating Sphagnum hummocks under changing hydrological: permafrost melt, climate warming, and/or other factors?

6. PRELIMINARY CONCLUSIONS

Carbon accumulation rates for the last millennium decreased during the transition between the warm MCA and the cool LIA. Within sites, microforms accumulate peat at different rates. This high degree of replication in this study allows for separation of allometric (climate) vs. autogenic (peatland-specific) signals, i.e. what role do local drainage, exposure and snow cover play? Further work is needed to investigate the drivers of these changes in carbon accumulation, and to work on up-scaling.

7. WHAT COMES NEXT?

• Completing Blanc Sablon profiles to improve understanding of carbon accumulation in permafrost • Improving age models: combination of tephra and additional 14C dates for longer-term sites for the last millennium (Medieval Climate Anomaly/Little Ice Age). • Water table depth reconstructions: multi-proxy analysis (testate amoebae and plant macrofossils) to investigate climate-C dynamics link between sites.

REFERENCES


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