# Comments on the Future of Boreal Peatlands

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## Background

Globally, peatlands represent a large Carbon stock, estimated at 397-455 Pg carbon. Most of this carbon is in peatlands that occur in boreal, continental areas especially in Canada and Siberia. Over the past 20 years, we have studied the boreal peatlands that occur in western Canada. Peatlands in this region cover 21% of the land base and store about 48 Pg of C, or about 2.1% of the world's terrestrial carbon. Long-term C accumulation since the mid-Holocene has been estimated at 19.4 g C/m$^2$/yr (Vitt et al. 2000a); however, these radiocarbon-based estimates underestimate the long term net peatland C accumulation because they do not include carbon lost from the natural disturbance regime. When the natural fire regime is accounted for, we estimate the current accumulation rate at 24.5 gm/m$^2$/yr, or 26% higher than previous estimates.

## Findings

In 2002, M. Turetsky, K. Wieder, L. Halsey, and D. Vitt (Turetsky et al. 2002) published the first regional-scale assessment of peatland carbon storage from the western boreal under current disturbance regimes. We concluded that under the current disturbance regime, carbon uptake in continental peatlands is reduced by 85% when compared to a non-disturbance scenario. We estimated that across the western Canadian boreal forest, about 13% of the peatlands are affected by recent disturbance. We also concluded that a 17% increase in the area burned annually and in the intensity of organic matter combustion would convert these peatlands into a regional net source of carbon to the atmosphere.

Currently, carbon is lost to the atmosphere in these continental peatlands through a variety of disturbance parameters. First, carbon has been lost from historical fires where, based on long-term peat stratigraphies, about 0.25% of the peatland area has burned annually. Secondly, carbon losses from current fires have a combined direct and indirect effect of releasing 6,282 GgC/yr to the atmosphere. Thirdly, peat extraction, reservoir flooding, and oil sands mining all result in small C fluxes to the atmosphere (each less than 150 Gg C/yr). Currently, nitrogen deposition from Alberta's oil sands mining have increased *Sphagnum* production over three fold, but peat accumulation rates have not increased in the areas affected by high N emissions (Vitt et al. 2003). Fourth, permafrost melt (Vitt et al. 2000b) enhances the C sink (about 100 GgC/yr). Overall, C emissions from disturbed peatlands across western Canada total 6,462 GgC/yr and reduced the regional C accumulation by 85% when compared to the no-disturbance scenario.

## Conclusion

Natural and anthropogenic disturbances have a substantial influence on peatland carbon storage. The assessment presented in Turetsky et al. (2002) suggests that peatlands accumulate 24.5 gC/m$^2$/yr during periods of no disturbance. However, under contemporary levels of disturbance and development across this boreal region, average C accumulation rates are reduced to 3.6 gC m$^2$/yr. Changing disturbance regimes must be more carefully incorporated into carbon estimates if a true understanding of carbon balances is to be achieved. Fire and permafrost melt are both controlled by climate and will be important, interconnected processes in the future.

## References

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