Geophysical Research Abstracts
Vol. 21, EGU2019-13653, 2019
EGU General Assembly 2019

Resilience of peatland-forest landscapes in the Canadian Boreal Plains

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The peatlands of the Canadian Boreal Plains are one of the world's large carbon stores. Climate warming and human disturbances may change the spatial extent and configuration of peatlands, lakes, and forests, potentially releasing large amounts of carbon currently stored as peat. Despite having extensive wetland coverage, the Boreal Plains receive relatively low precipitation; at the landscape-scale (>100 km2) precipitation almost equals evapotranspiration with on average only 50 mm/yr runoff by rivers. Interestingly, peatlands have been found to use appreciably less (up to 40%) water than forests and lakes and therefore function as a water source for neighboring forests and lakes. Given these intricate water-controlled dependencies between ecotypes, the Boreal Plains ecosystem (i.e. peatlands, forest and lakes together) is potentially sensitive to changes in climate and water availability.

Typically, resilience is evaluated for either peatlands, forests or lakes. In this study we extend the definition of resilience to the landscape scale. Thus, we define resilience as the capacity of the Boreal Plains landscape to absorb climate, natural, and artificial disturbances by slightly reorganizing spatial distributions of peatlands, forests and lakes while maintaining current functions for storing carbon. We present dedicated model results combined with observations to evaluate resilience from both ecotype and landscape perspectives. We demonstrate the dominant role that spatial variability in topography and soil types may play in landscape resilience and the potential for large-scale shifts in the Boreal Plains landscape.