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# Using peat property trajectories to assess the vulnerability of boreal peat to wildfire combustion

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Peat properties such as bulk density, moisture retention and specific yield (Sy) influence water table fluctuations, drying rates and peat combustion vulnerability, therefore determining peat susceptibility and response to wildfire. Smouldering peat fires are challenging to suppress and emit vast quantities of carbon and particulate matter into the atmosphere. A 120-year peatland fire return interval was used to constrain a landscape-wide space-for-time chronosequence in the boreal plains ecozone of Alberta, where peat properties were assessed along spatial gradients within 26 peatlands. Bulk density depth profiles are different between microforms where hummocks < hollows < margins, correspondingly Sy followed the opposite trend. Hummock moisture retention parameters, modelled using the Van Genuchten-Mualem model, are maintained over time whereas hollows and margins experience changes due to wildfire impacts and subsequent recovery, causing decreased Sy immediately following fire but increased moisture retention. This trend is exacerbated in coarse and moraine hydrogeological settings which is also where margin: peatland proper area tends to be greatest. We find that only minimal increases in the annual water deficit would be required to cause high combustion vulnerability in some hydrogeological settings. This study provides the first landscape-wide assessment of peat properties across a fire return interval and assessment of potential smouldering vulnerability given increased water deficits under future climate change. Such studies will be useful to inform wildfire management decision-making especially at the wildland society interface.