How Climate Change Impacts Peatland Water Table Dynamics

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Rationale

Peatlands are powerhouse carbon warehouses but little is known about their response to climate warming. Carbon and water budgets are closely linked, with peatlands having a strong ability to moderate water table response outside external forcings (Waddington et al., 2015). Here, we **examine water table depth (WTD)–specific yield feedback** in response to a multi-year and increasing soil and atmospheric heating.

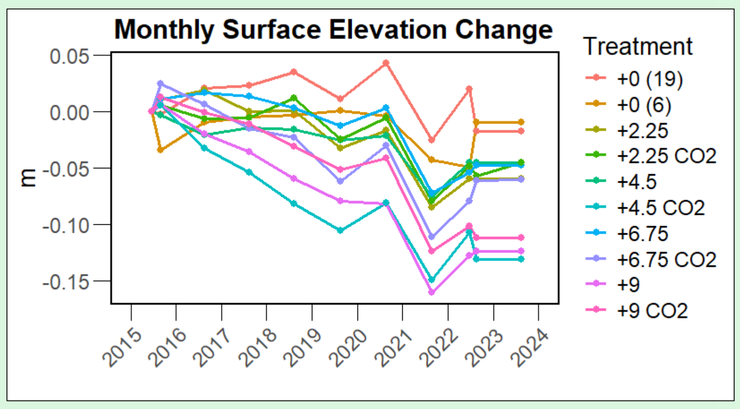
Methodology

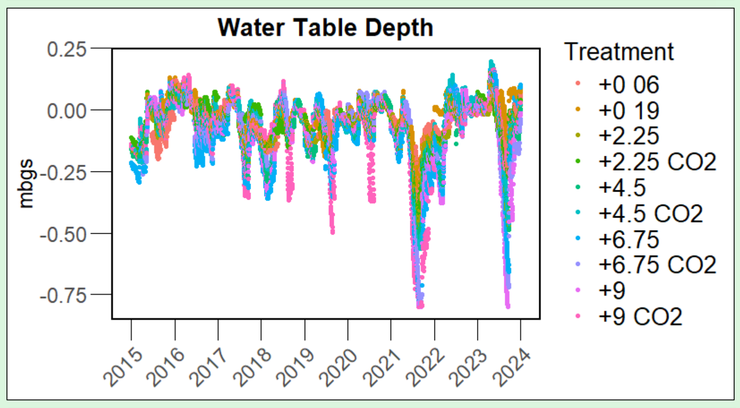
Specific Yield (S_y) – rate of water table change per unit volume addition of water to the saturated zone; quantified through water table fluctuation method (Bourgault et al., 2017)

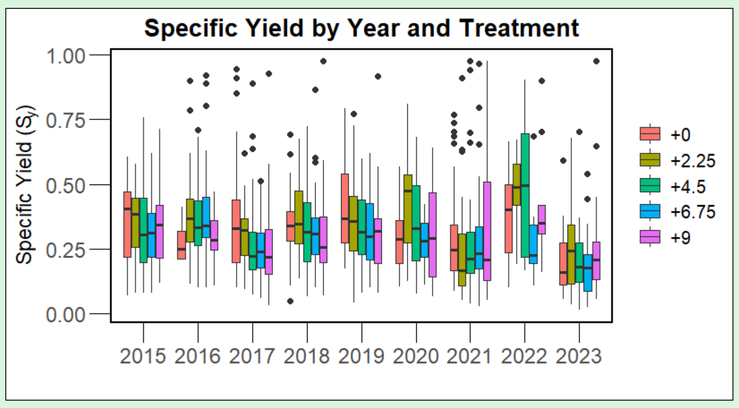
General Process:

Group precipitation (P) events → Determine peak water table (WT) 3 hrs after P event → Calculate S_y from total P/ WT change → Filter S_y values based on criteria set

Results & Discussion





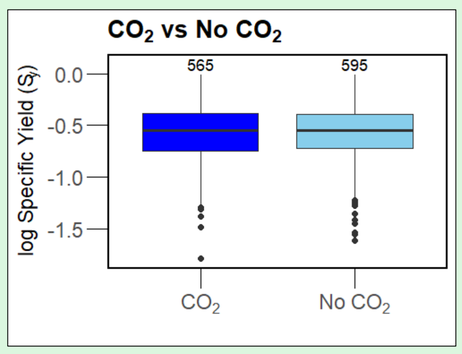


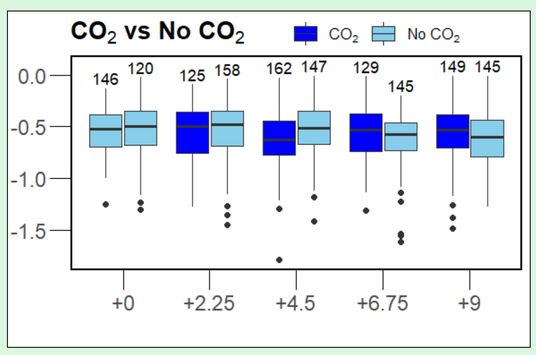
Ground Surface & WTD

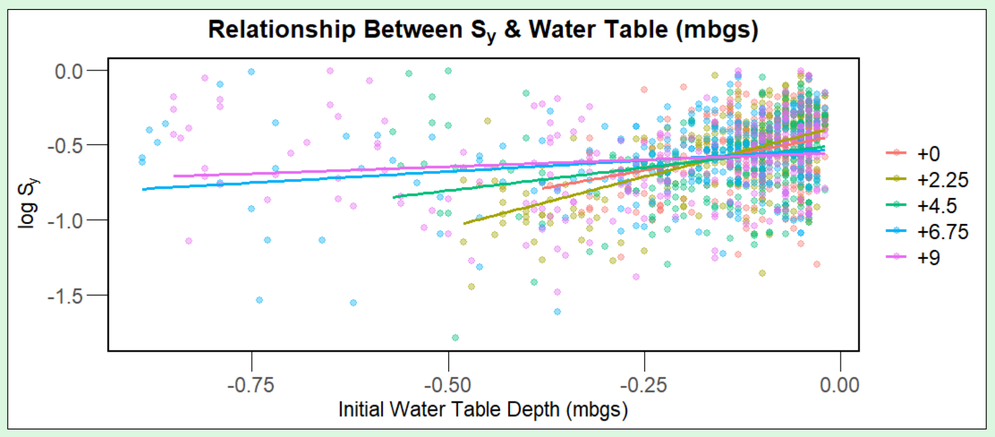
- Ground surface declined in higher temperatures (T)
- WT was near surface (mbgs) despite actual decrease in elevation (masl)
- Higher T recorded greater WTDs during droughts

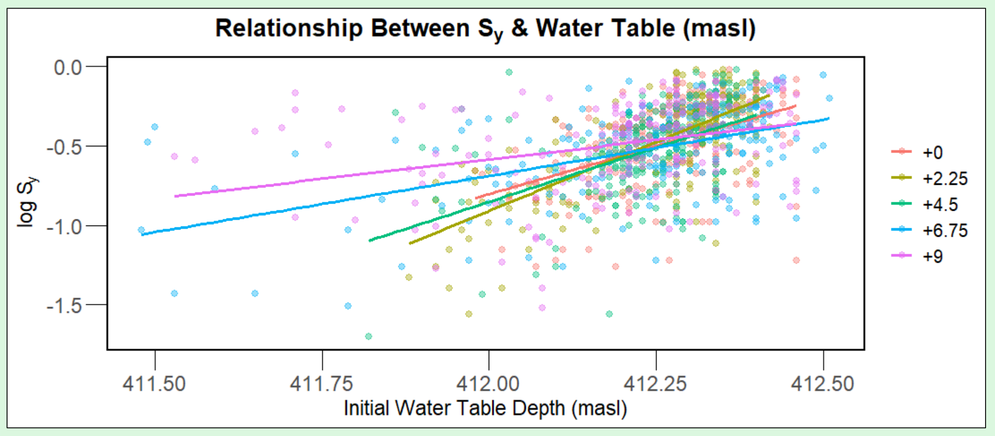
S_y & Relation to Water Table

- S_y in CO_2 and no CO_2 treatments were not different
- Decline in S_y with increasing temperature
- Shallower initial WTD in lower temperatures
- S_y variability increases in later years & with higher T
- Positive S_y-WTD relationship collapses with high T (mbgs), not as evident in masl plot



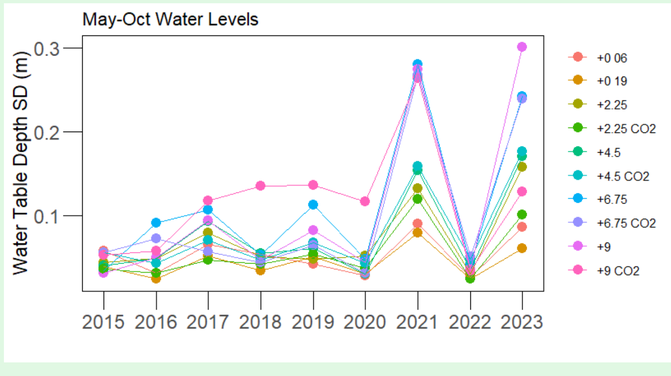






Conclusions & Further Research

- Lowering ground surface in higher temperature treatments helped maintain near surface water tables except during drought years
- High temperatures caused changes in hydrology, potentially resulting changes in peat pore size structure, creating a positive feedback loop between WTD and specific yield



- Next steps:
1. Seasonal WT variability
2. Peat porosity analysis

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Waddington et al., 2015: Hydrological feedbacks in northern peatlands. Ecohydrology, 8, 113-127. https://doi.org/10.1002/eco.1493
Bourgault et al., 2017: Quantification of peatland water storage capacity using the water table fluctuation method. Hydrological Processes, 31,1184-1195 . https://doi.org/10.1002/hyp.11116