Spatial Snow and Frost Patterns in Minnesota Peatland Watersheds

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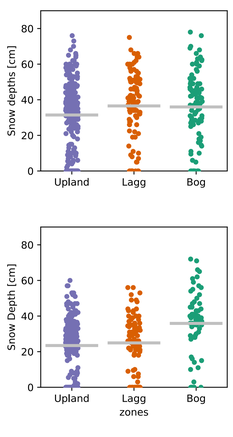
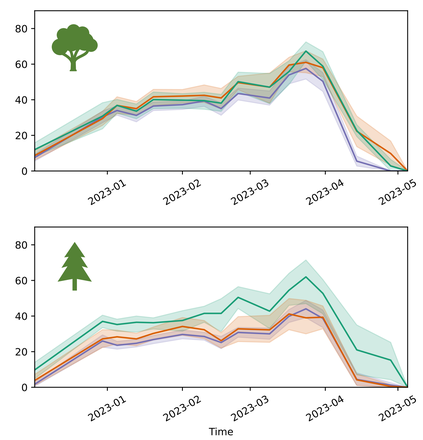
2022-2023 Winter Snow Field Season

Snow depth and Snow Water Equivalent (SWE) in two peatland dominated watersheds, one deciduous cover and one coniferous cover. In each watershed forested **uplands** surround a downslope **lagg** ecotone which regulates flow to and from the **bog**.

Summer and winter Leaf Area Index (LAI) photos were taken at each site to characterize the canopy cover





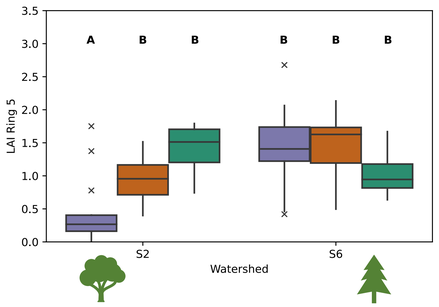
Overall snow accumulation was higher in the deciduous watershed. However, the coniferous watershed showed a larger difference in snow accumulation between the **bog** and the **uplands**

Research Questions

Q1: How does variability in the forest canopy and peatland watershed affect snow accumulation/melt?

Q2: Where does soil frost form within the watershed and where does it have the most impact on spring water dynamics?

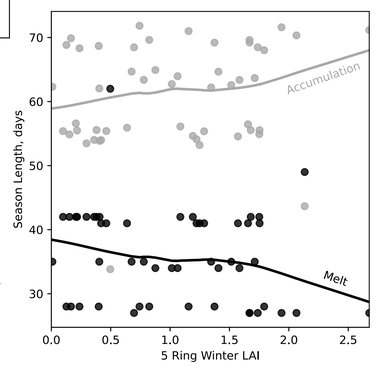
Q1: Canopy and Snow Controls



Winter LAI is only significantly lower in the **uplands** of the deciduous watershed – which would suggest that there should be higher snowfall accumulation there than the other zones.

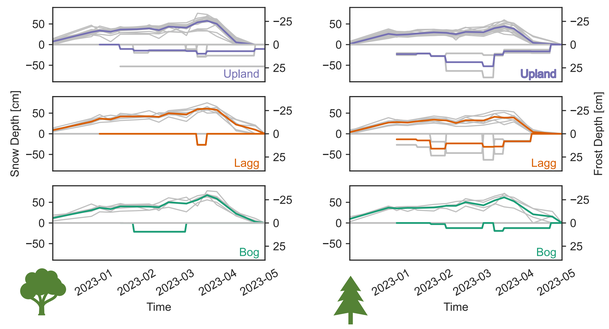
Typically, increased canopy cover leads to slower accumulation and melt rates.

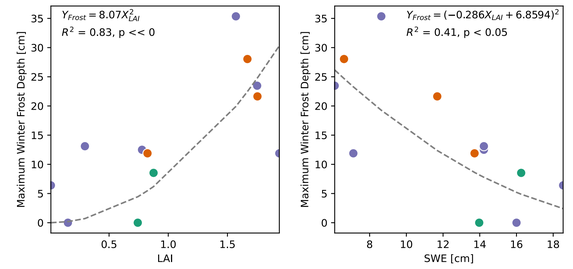
Based on the collected SWE data, higher LAI appears to lead to faster melt. This could be because there is a smaller initial snowpack to melt, or studies have also found that under warmer climates, the forest can become a heat source, accelerating melt (Lundquist, 2013)



Q2: Soil Frost

Soil frost forms deeper in the coniferous watershed than in the deciduous watershed. Models predicting soil frost from LAI are better than those using SWE or SWE and LAI. SWE, however, better predicts frost in the **uplands**.

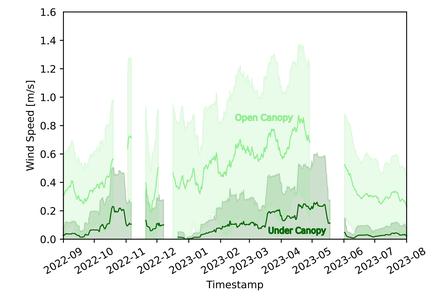


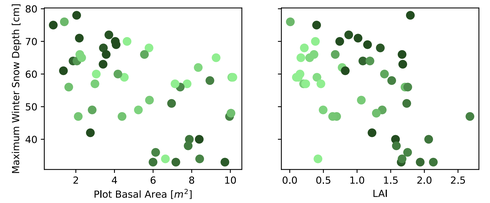


Conclusions

- Snow, frost, and forest data collection was done on grids in two peatland dominated watersheds during the 2022-2023 winter
- Overall snow accumulation is highest in the deciduous watershed , with similar accumulation occurring in both **bogs**
- LAI did not solely predict snow accumulation; we see contradicting relationships in the deciduous **uplands**, **lagg**, and **bog**.
- Soil frost forms deeper and is more persistent in the coniferous catchment. Frost that disappears earlier in the deciduous **bog** and **lagg** may lead to slower, more distributed runoff.
- LAI alone provides a better model for soil frost than SWE – potentially due to compounding factors of temperature (shading) and soil moisture (ET).

If LAI doesn't always explain snow distribution in small, densely forested catchments, then what might?





For more information on this project and others that we are currently working on scan the QR to the left or contact:

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Acknowledgments

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