

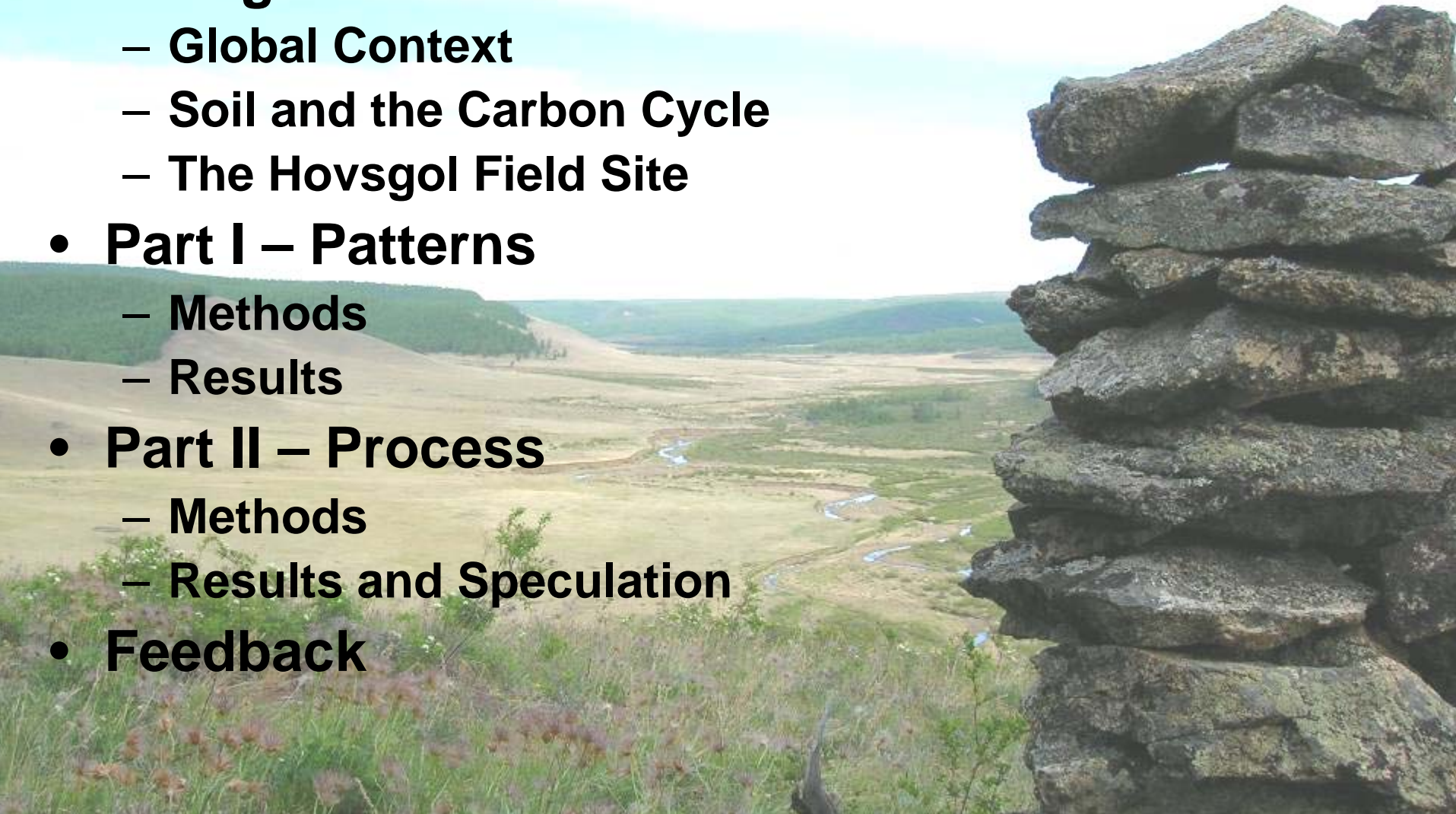


Soil Organic Matter in a Permafrost System: Climate and Land Use Interactions

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CES Thesis Seminar
March 9, 2006

A Road Map

- **Background**
 - Global Context
 - Soil and the Carbon Cycle
 - The Hovsgol Field Site
- **Part I – Patterns**
 - Methods
 - Results
- **Part II – Process**
 - Methods
 - Results and Speculation
- **Feedback**



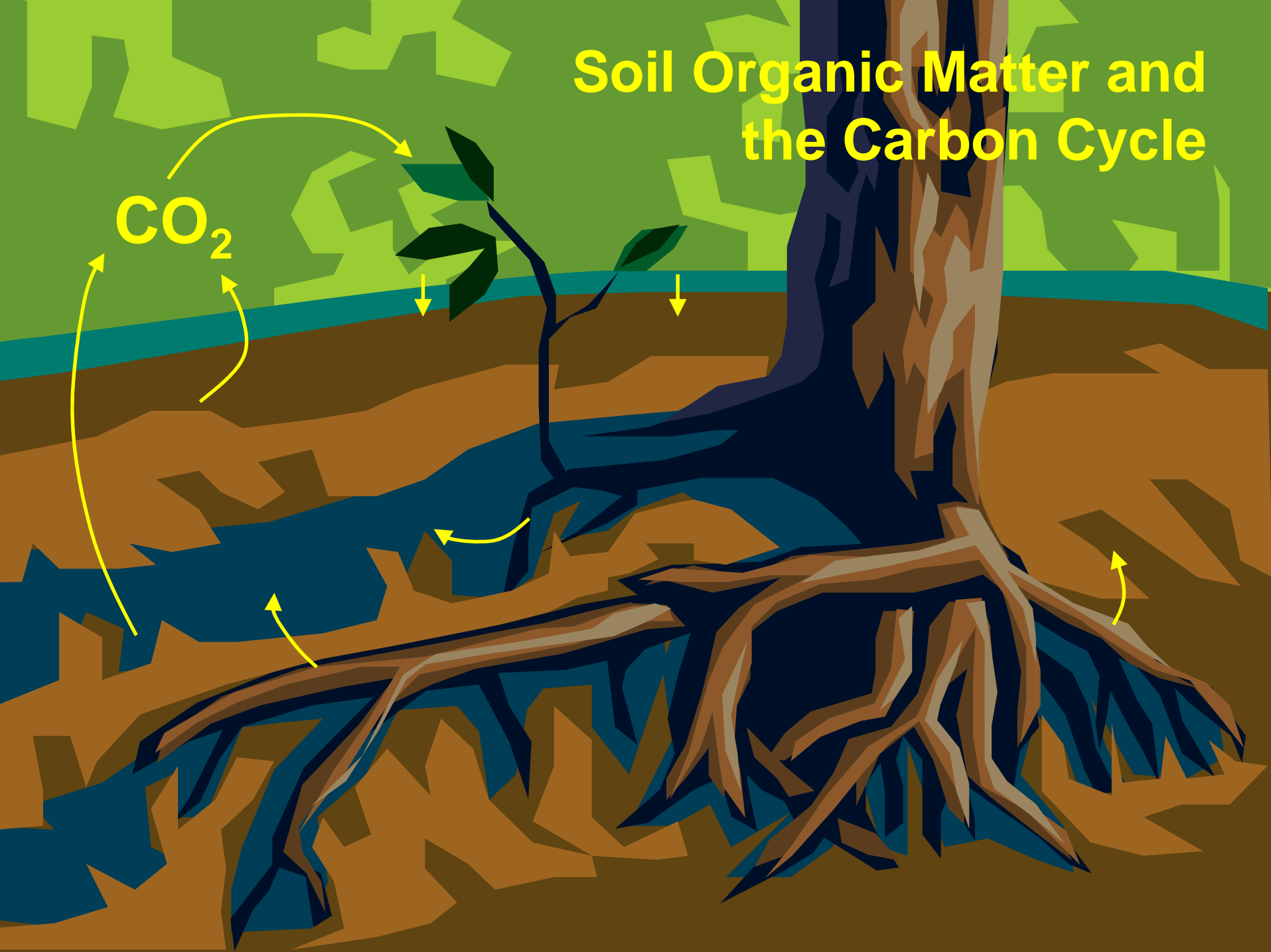
Global Context

Land Use Change

Global Warming



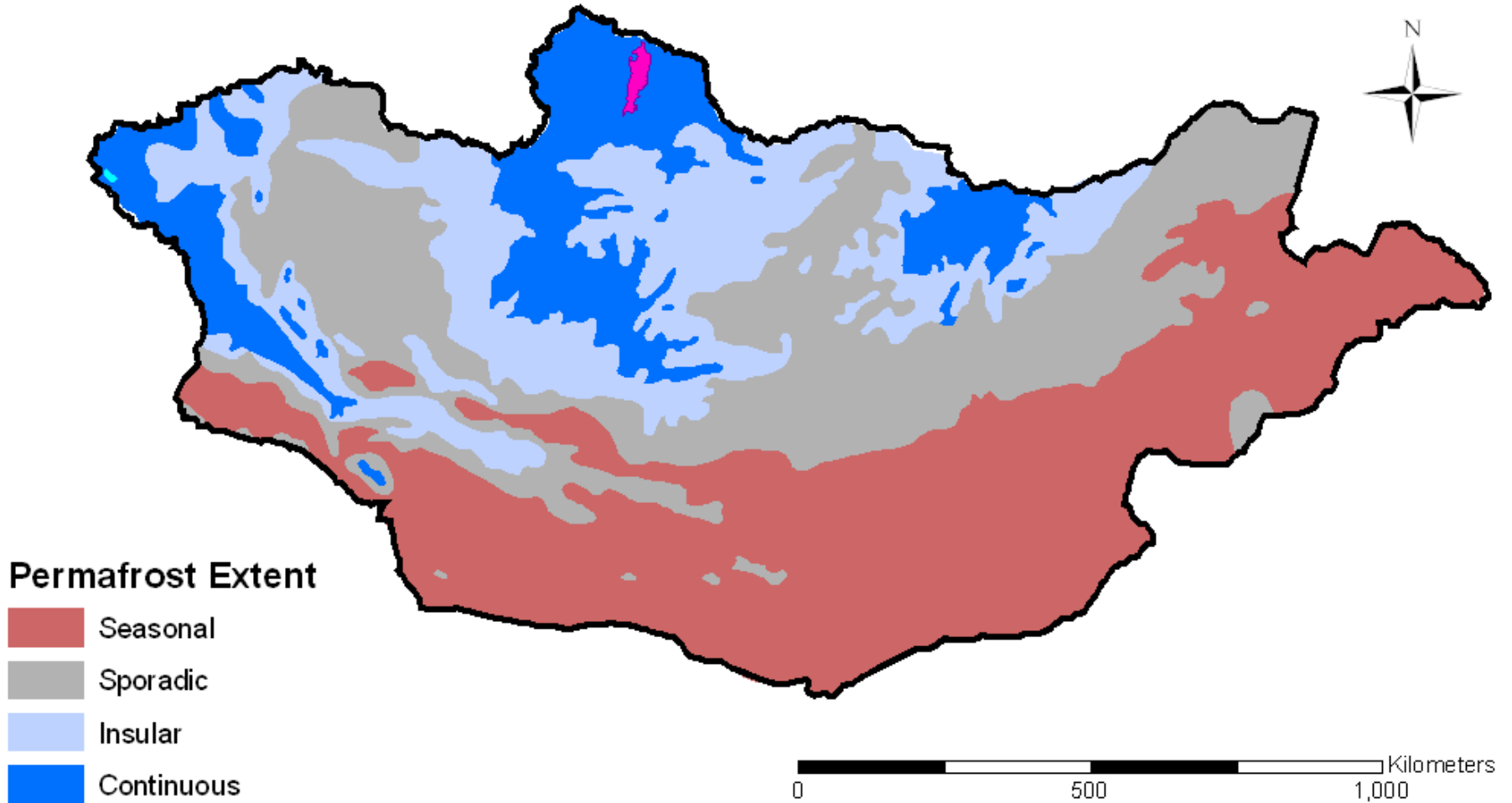
Soil Organic Matter and the Carbon Cycle





Mongolia

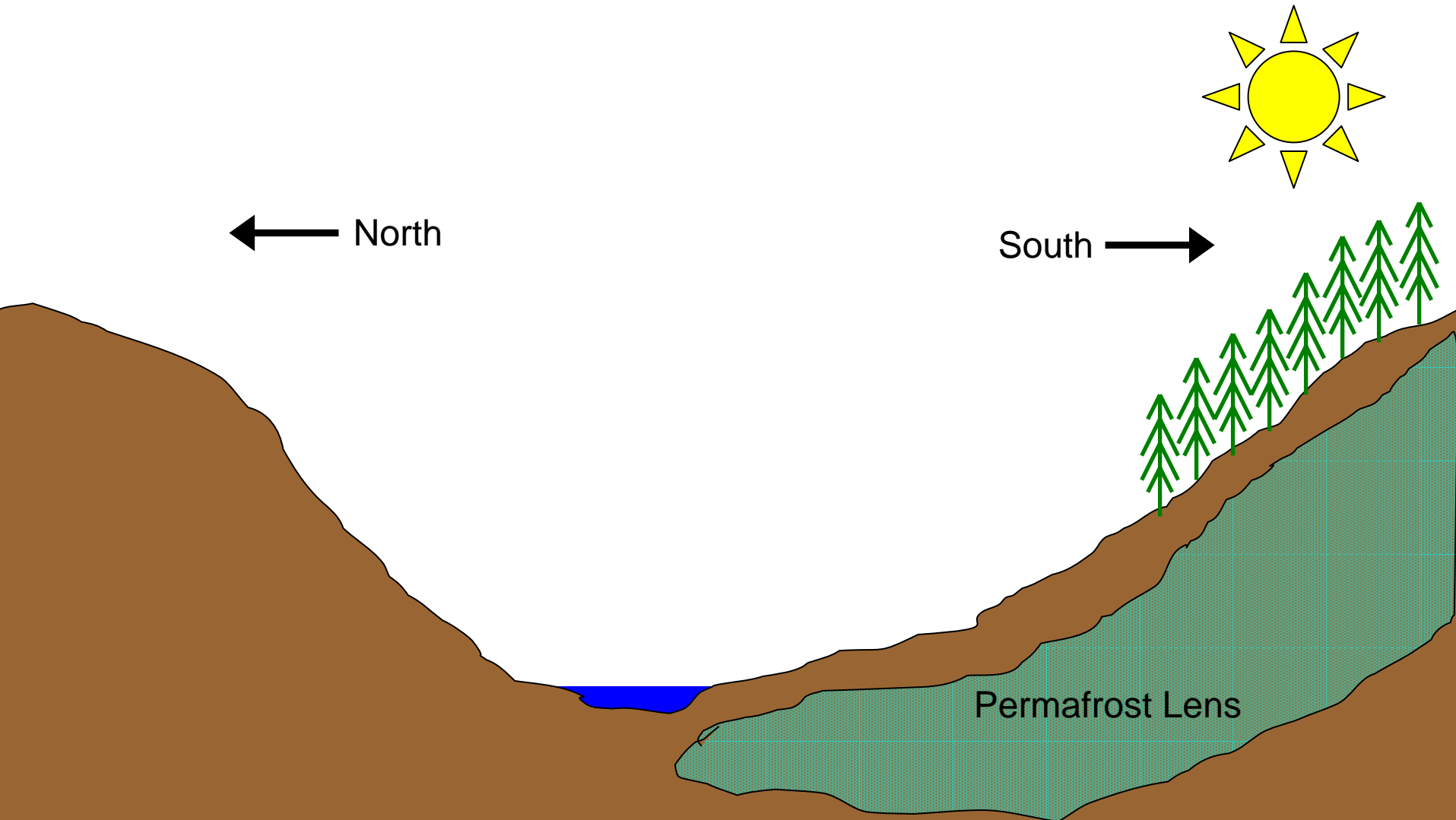
Permafrost Soils in Mongolia



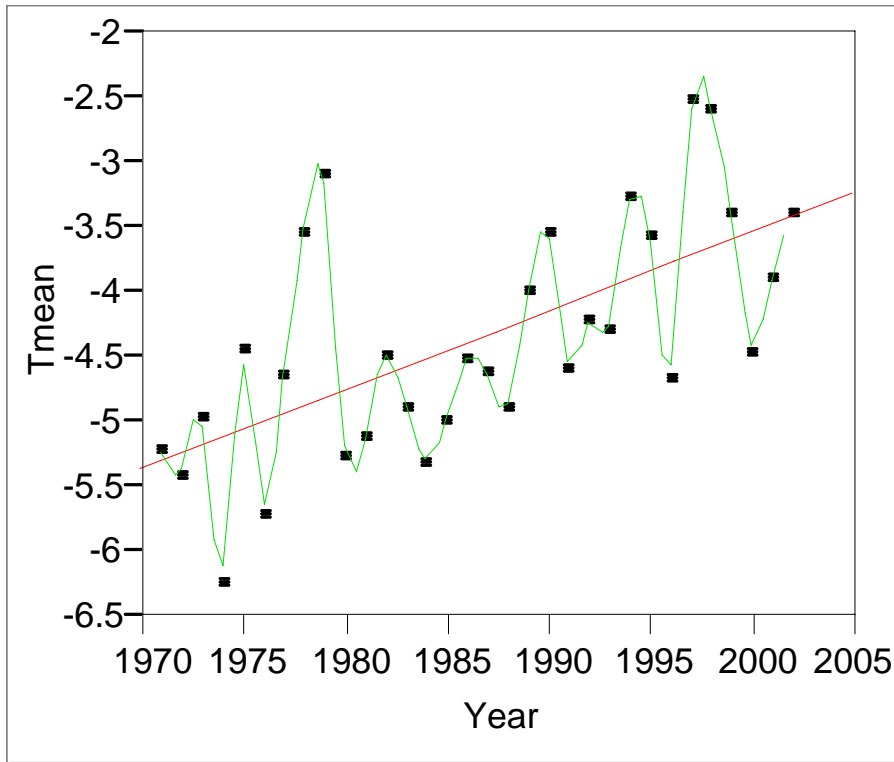




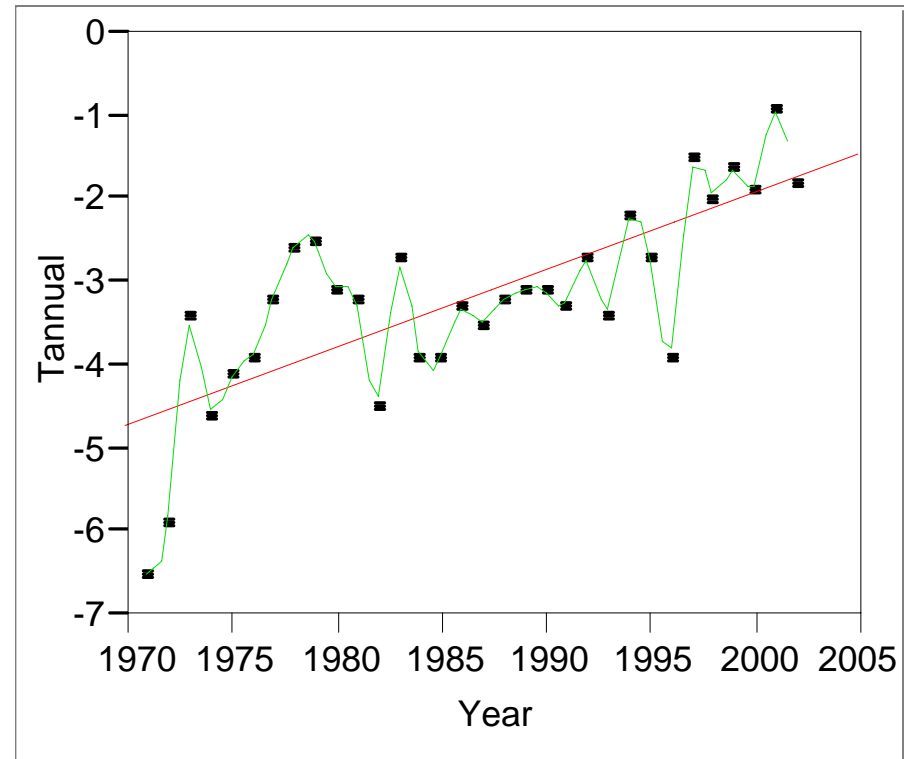
Valley Profile



32-Year Temperature Trends, Hovsgol Lake



Hatgal Station, South End of Lake



Hankh Station, North End of Lake

Part I: Pattern

How do the presence of permafrost and the intensity of grazing affect patterns of soil organic carbon storage?

Hypothesis:

Permafrost will be associated with greater carbon stores.

Grazing will be associated with smaller carbon stores.



Turag Valley

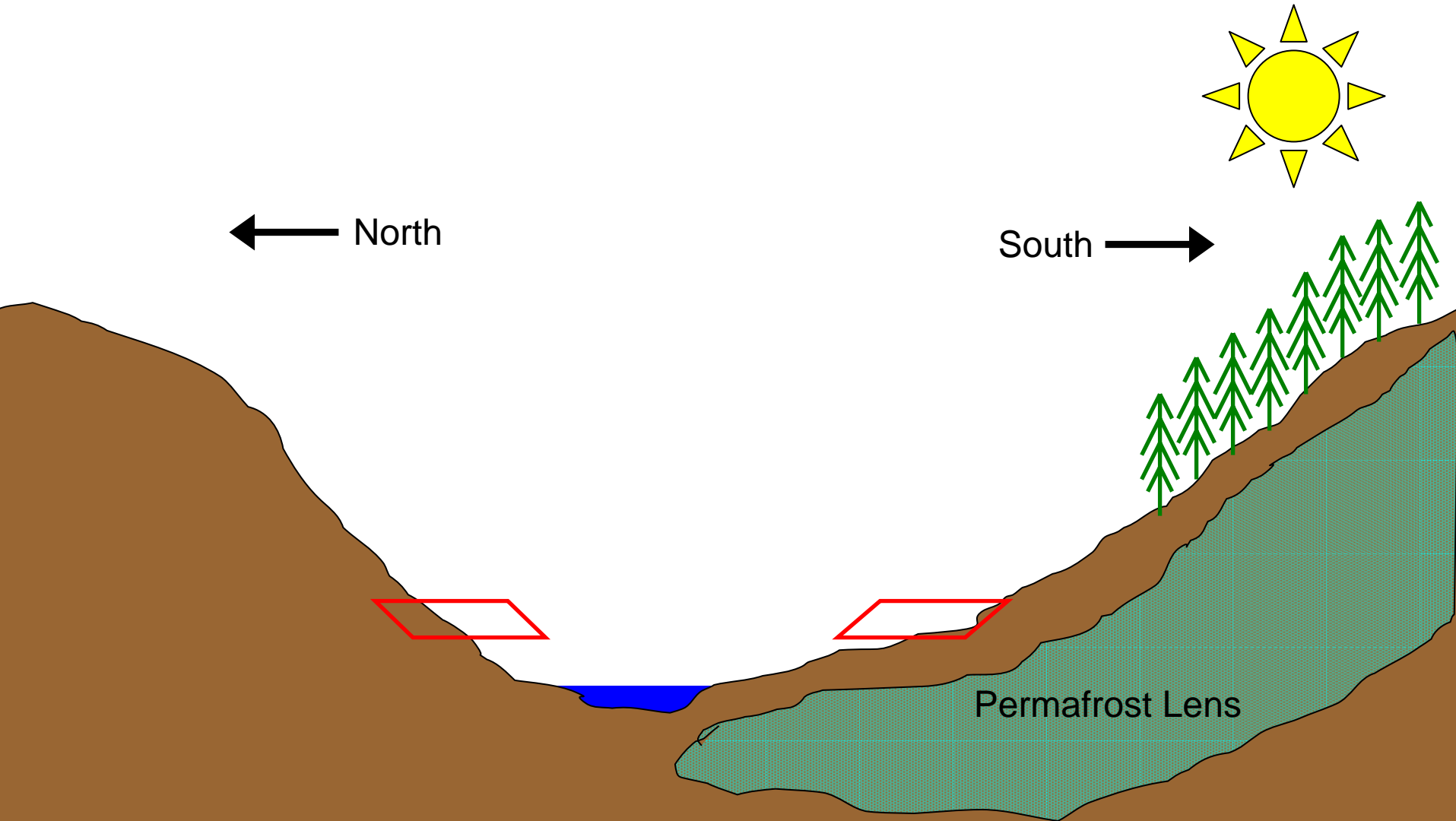
0.21 livestock/ha

Dalbay Valley

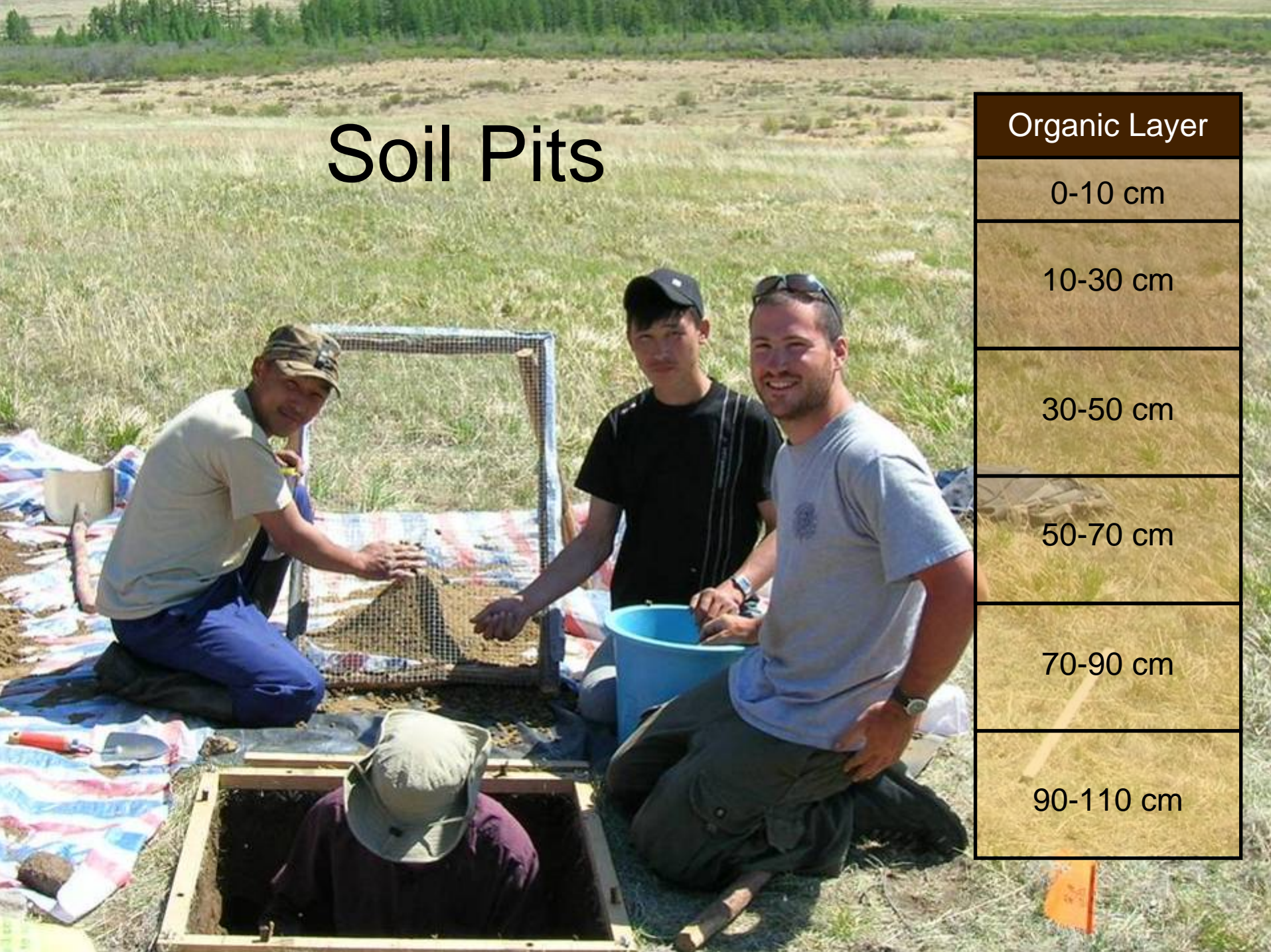
0.068 livestock/ha



Valley Profile



Soil Pits



Organic Layer

0-10 cm

10-30 cm

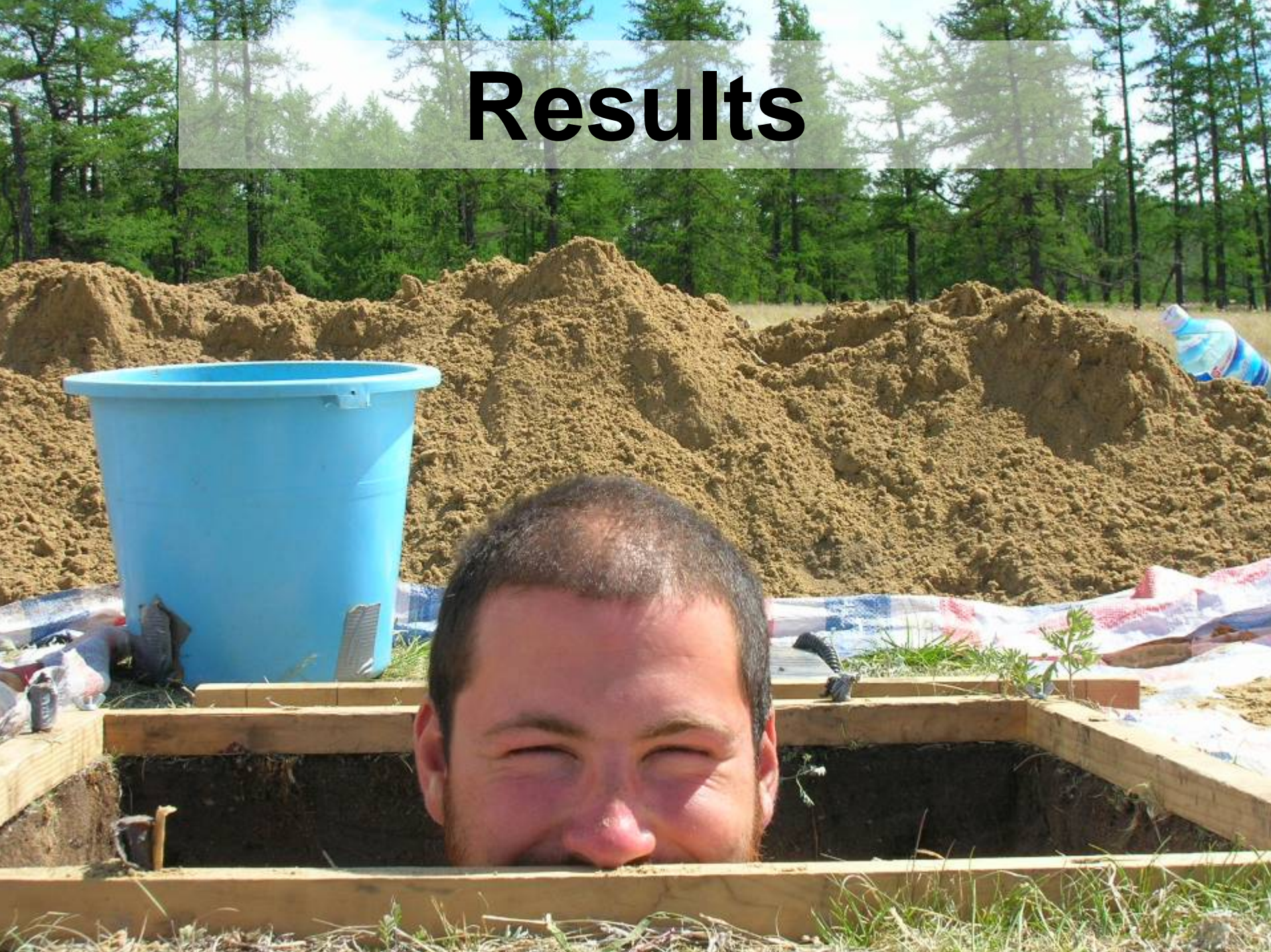
30-50 cm

50-70 cm

70-90 cm

90-110 cm

Results



Permafrost-free Soil Profiles



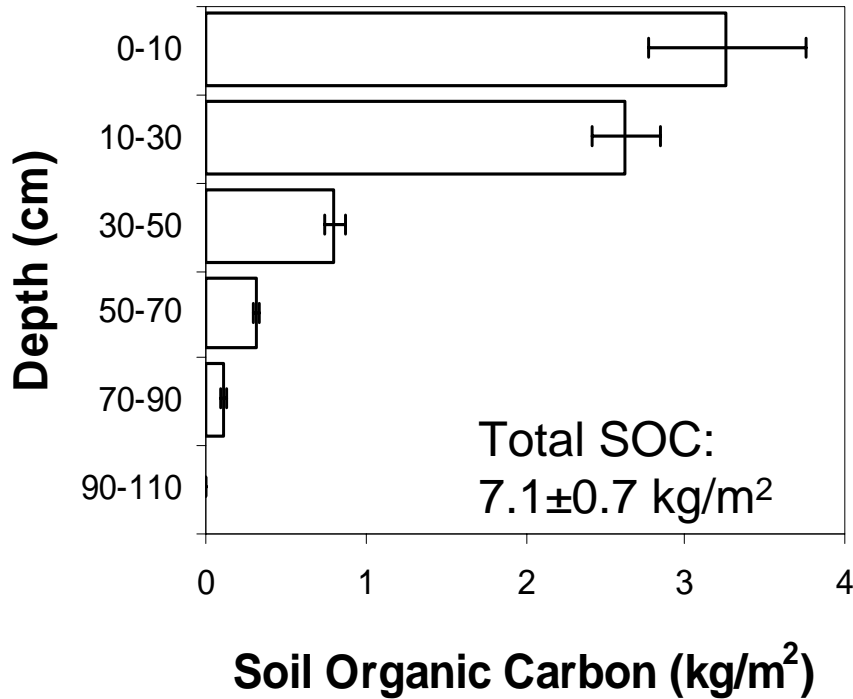
Dalbay Valley - Light Grazing



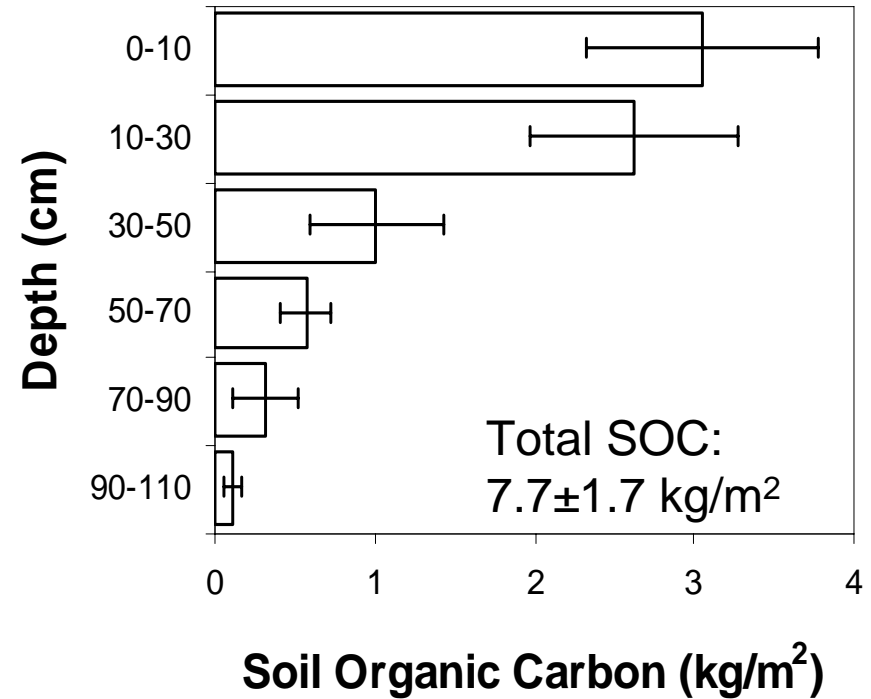
Turag Valley - Heavy Grazing

Permafrost-free Sites

Light Grazing



Heavy Grazing



On south facing, permafrost-free slopes, grazing intensity appears to have little effect on the amount or distribution of soil carbon.

($P > 0.65$)

Soil Profiles – Light Grazing



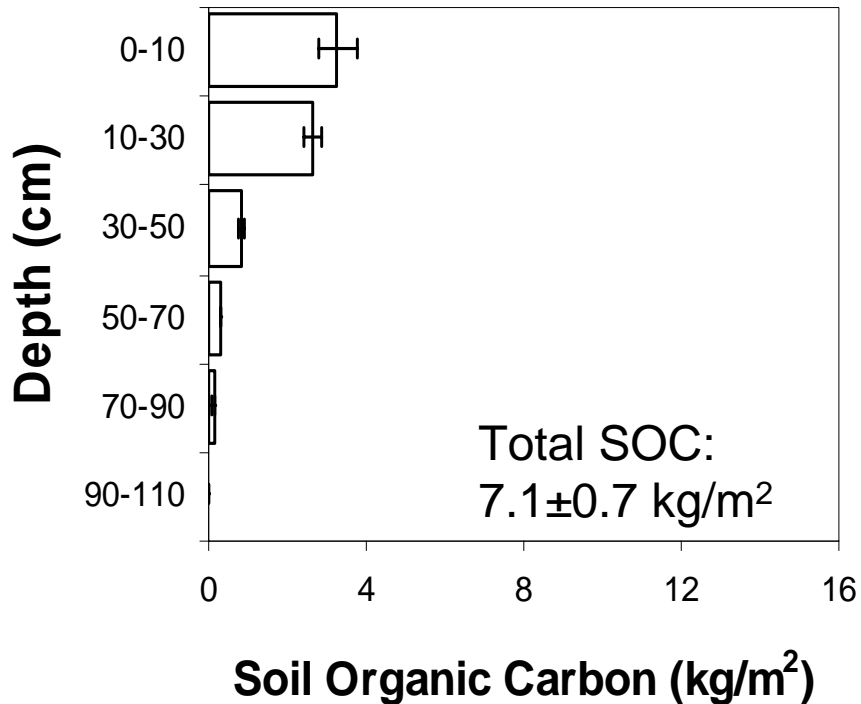
North Slope – No Permafrost



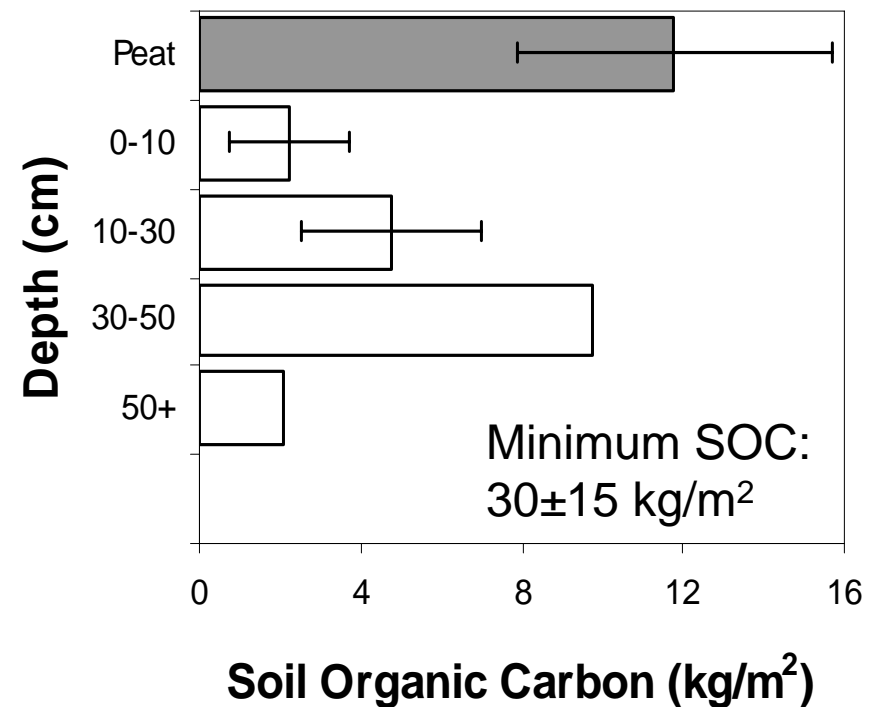
South Slope - Permafrost

Lightly Grazed Sites

No Permafrost



Permafrost



In little-grazed areas, the presence of permafrost is associated with much greater soil carbon.

($P < 0.01$)

Soil Profiles – Heavy Grazing



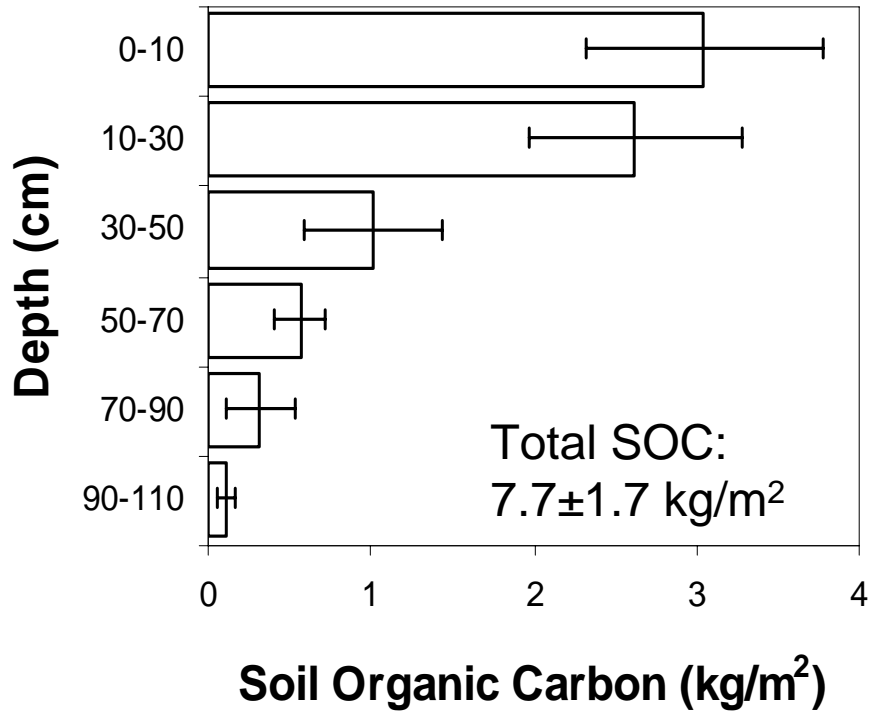
North Slope – No Permafrost



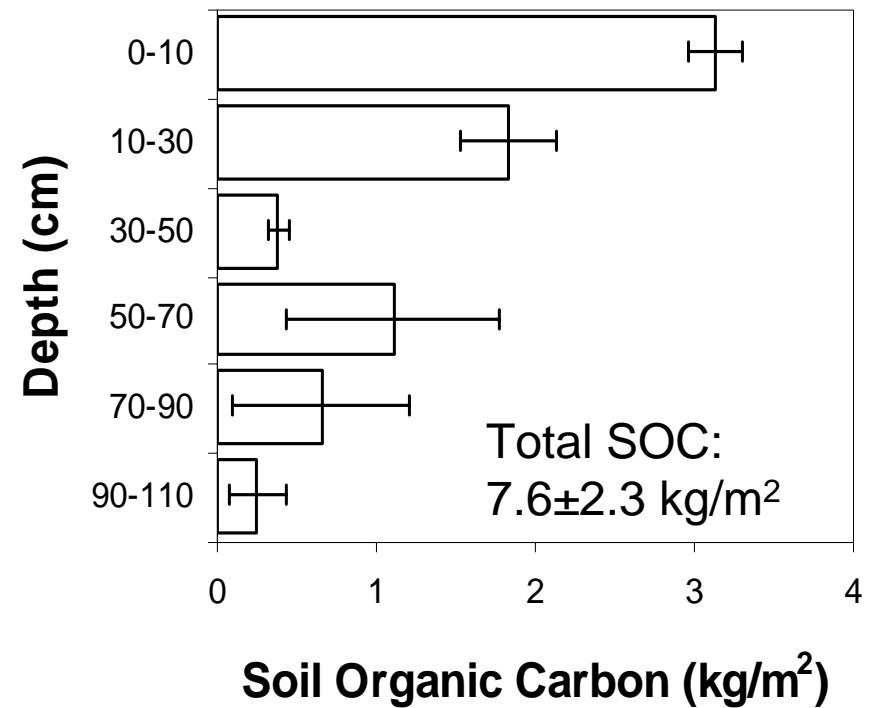
South Slope - Permafrost

Heavily Grazed Sites

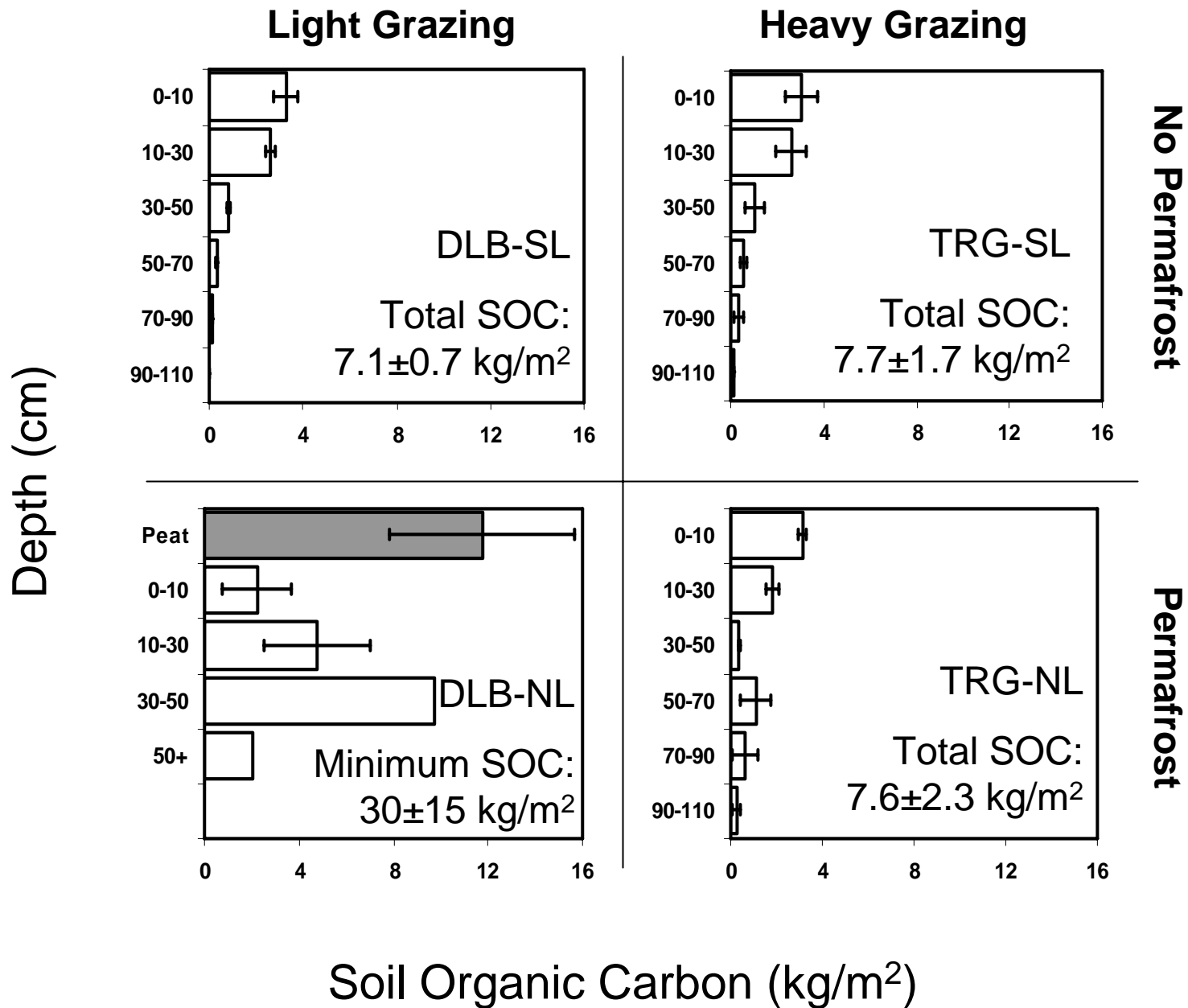
No Permafrost



Permafrost



In heavily grazed areas, underlying permafrost is not associated with greater soil carbon ($P > 0.8$), though there is a different distribution ($P < 0.05$)



Part II: Process





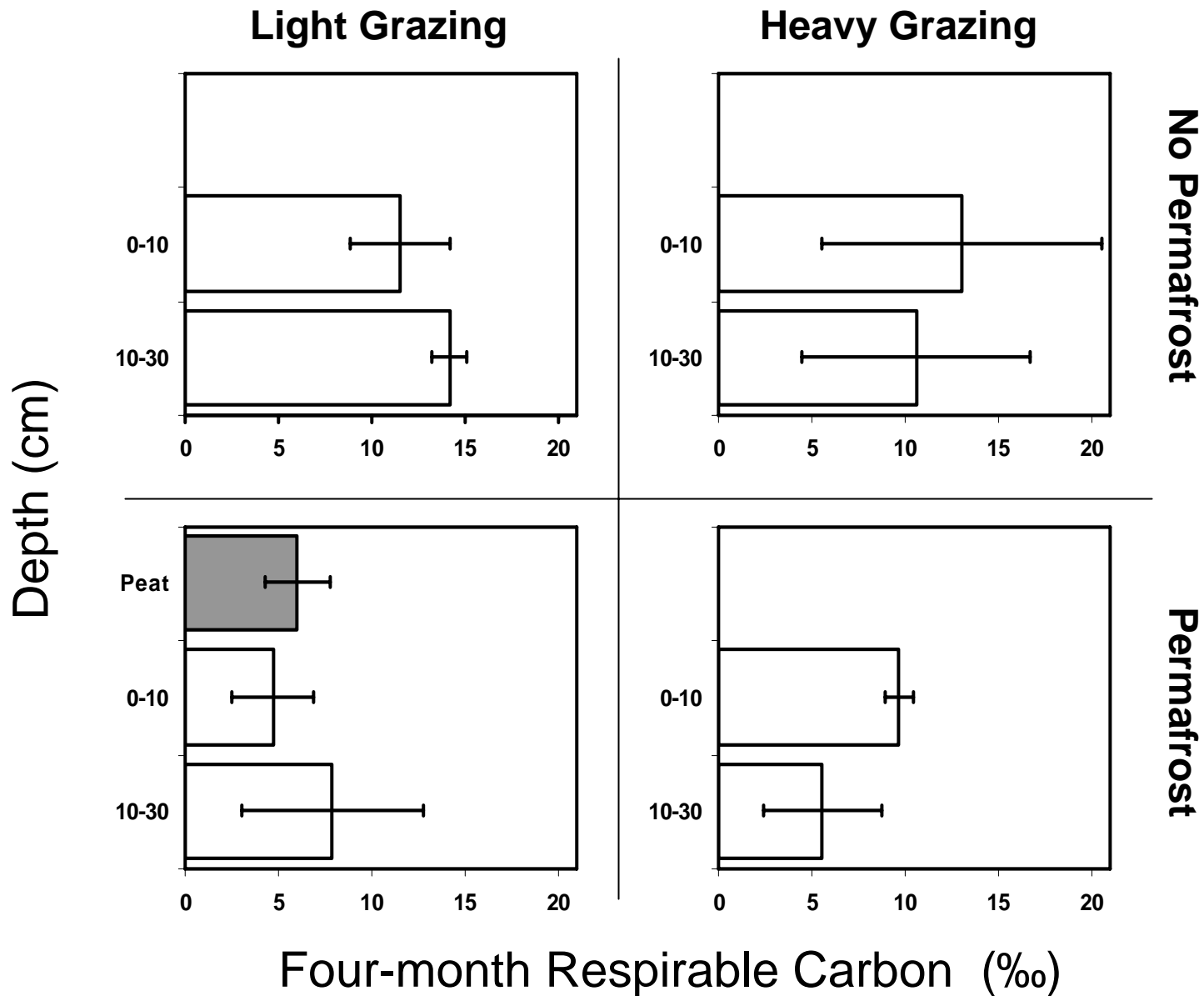
Hypothesis:

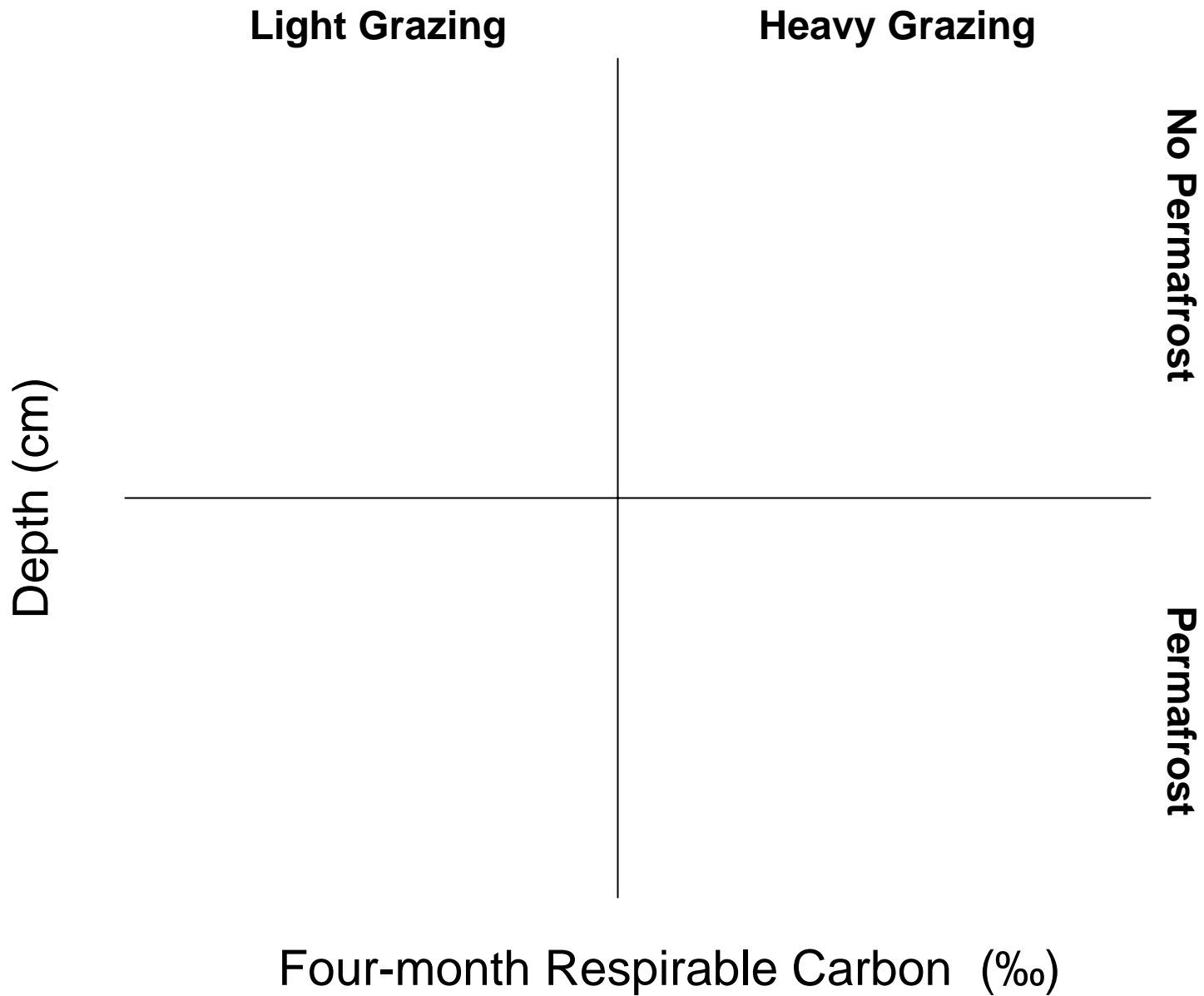
If patterns of soil organic matter distribution are due to differing rates of decomposition, greater soil organic matter will be associated with greater lability.

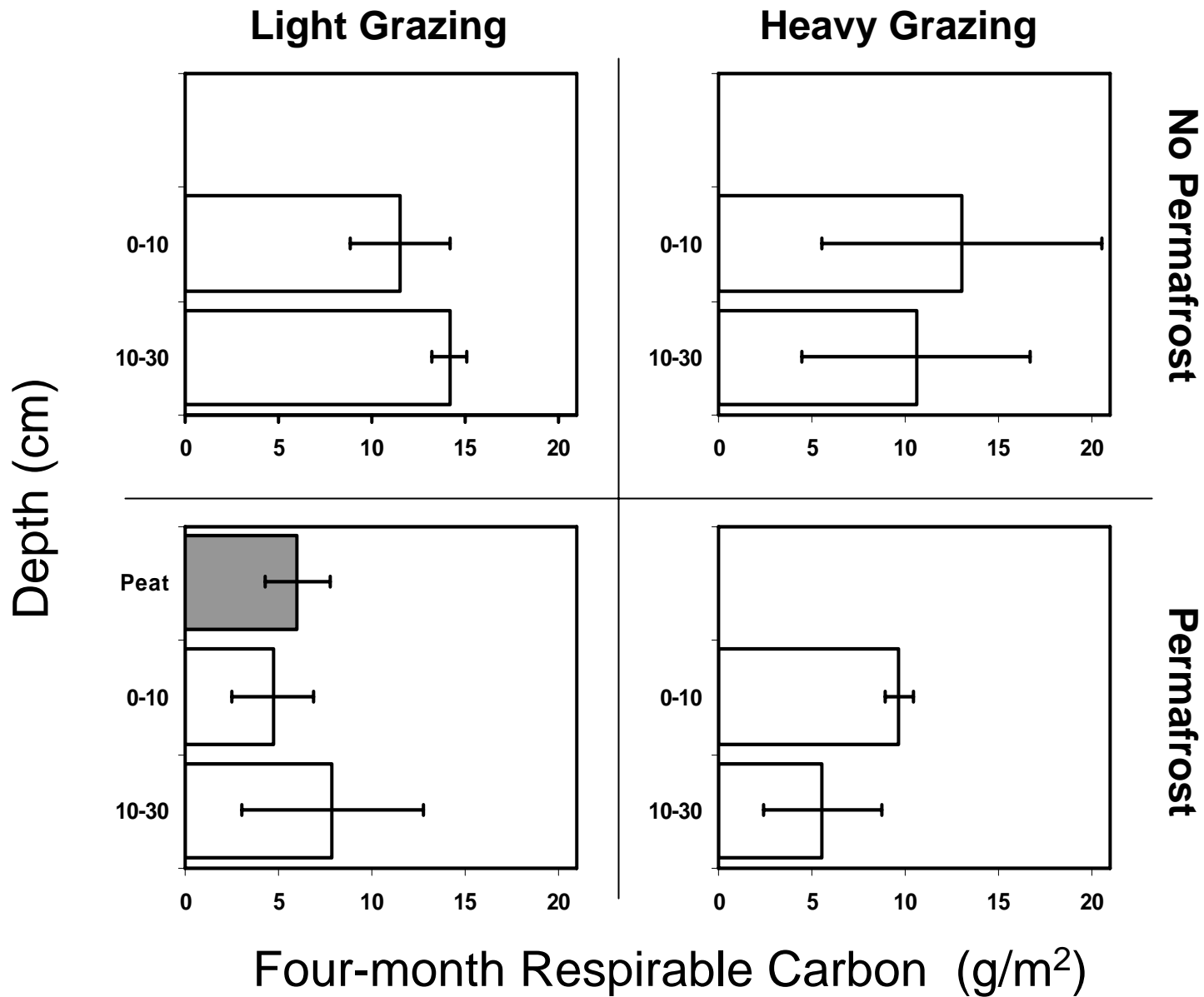
Methods – Soil Lability

- Soil samples were incubated at 25°C, 100% humidity with 60% pore water
- Rates of CO₂ respiration were measured monthly.
- Rates were integrated to calculate total carbon respired.

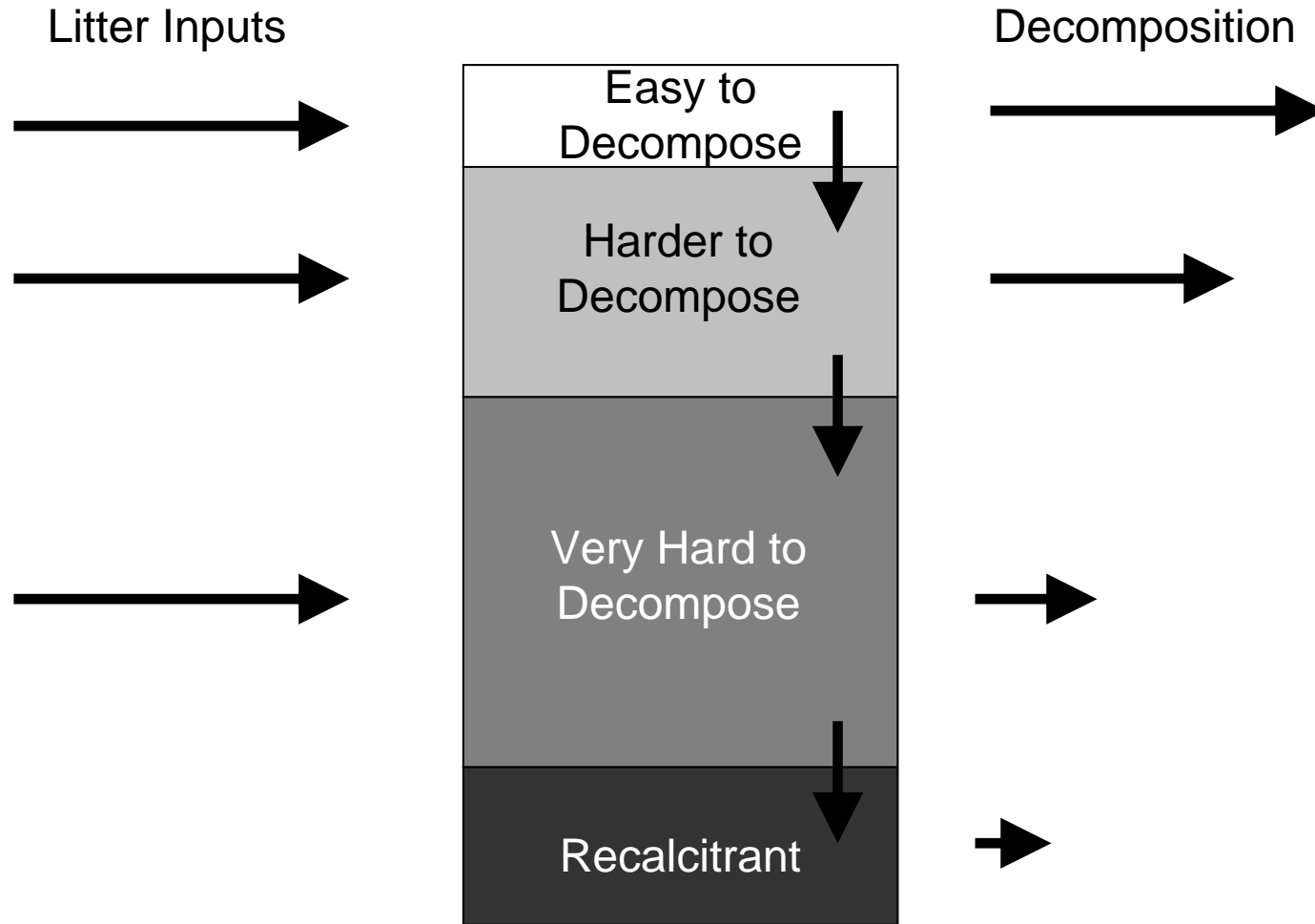
TR6-NL-1, TR6-NL-2



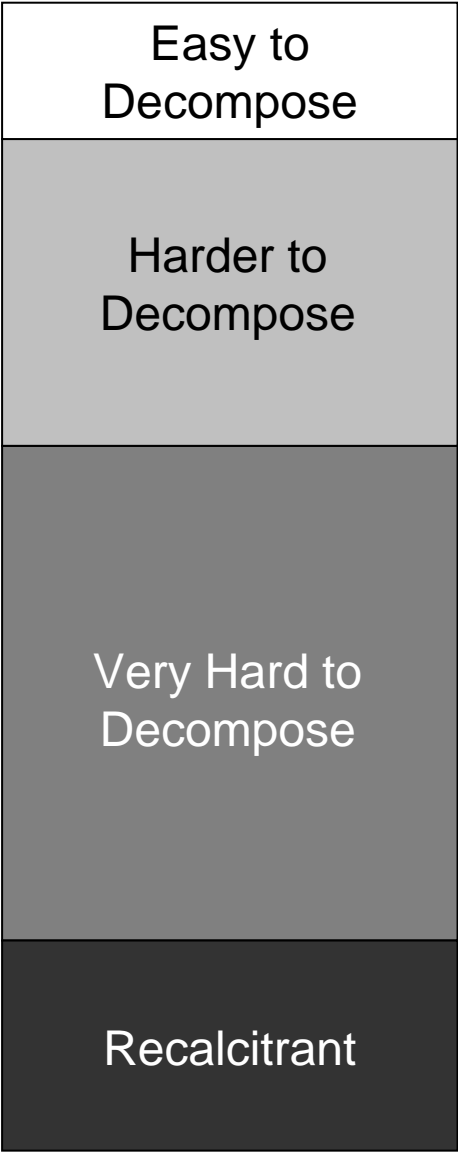
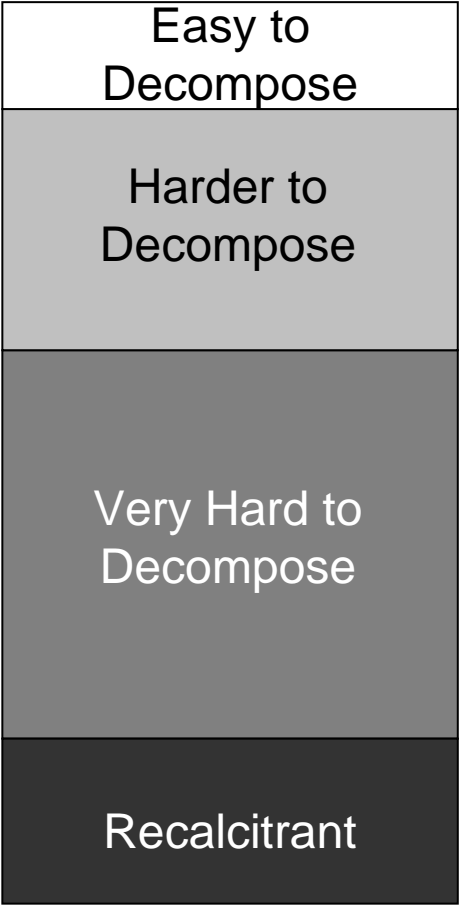




Organic Matter Decomposition: Multiple Pools

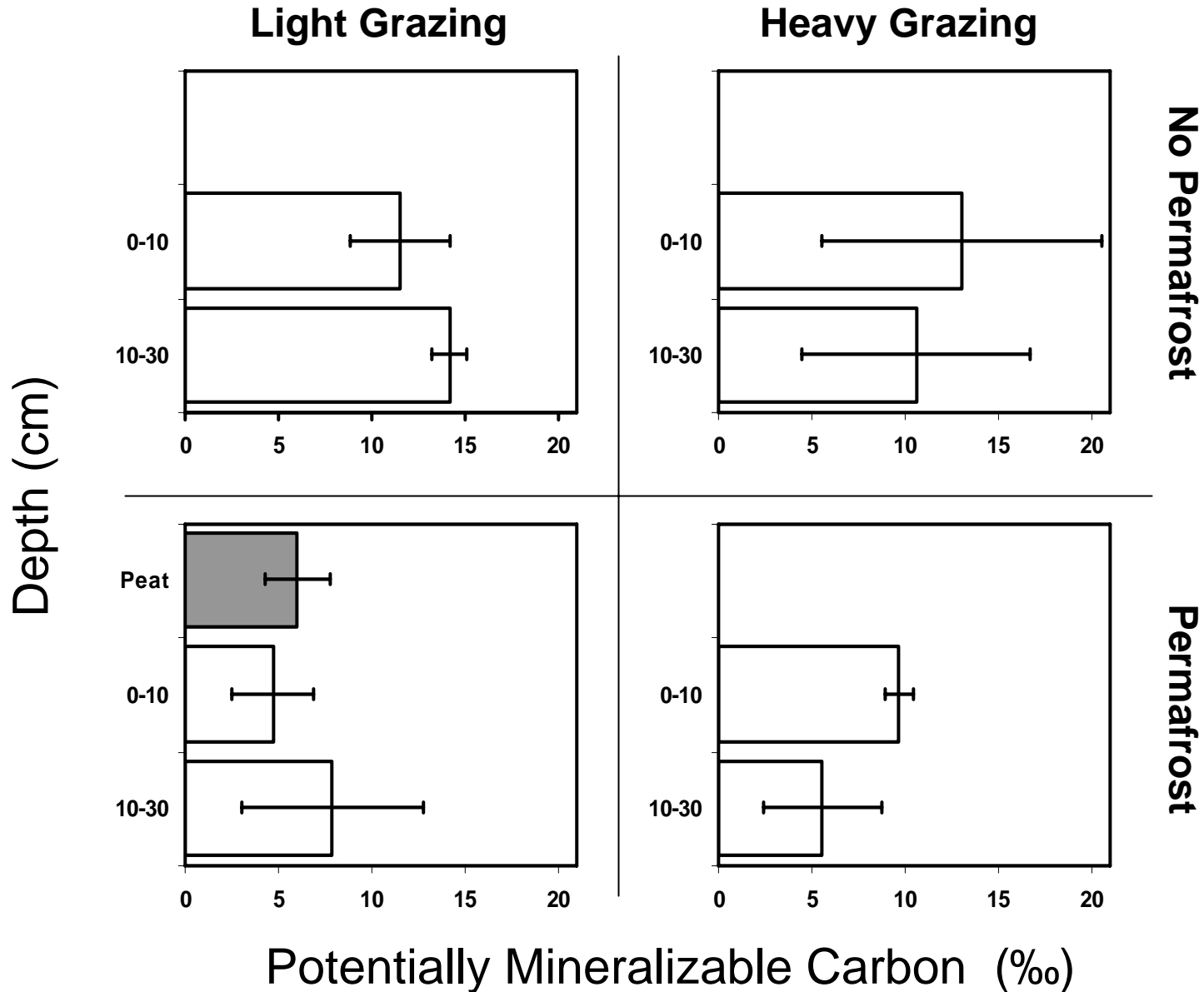


Organic matter buildup in a poor decomposition environment



Time 

Labile Fraction of Soil Organic Matter



Conclusion:

Grazing and permafrost interactions generate patterns in soil organic matter storage.

Organic matter lability patterns are consistent with a model of grazing causing greater decomposition rates.



Too Many Thanks

- **Steven Hamburg – For teaching and guiding me for four years**
- **Indy Burke, CSU – For tearing up my first thesis proposal**
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 - **Idree and Bulgan – For digging, wrestling, and yak-slaughtering**
- **Mother Earth – Duh**
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- **The Clan**
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Questions?

