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Title: Techniques to Understand Arctic Hydrology

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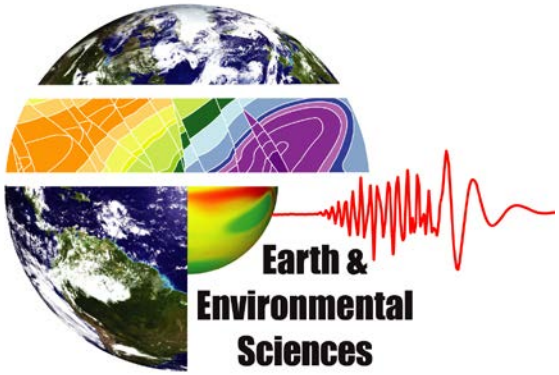
Techniques to Understand Arctic Hydrology

Strait Science Series



September 15th, 2016

Next-Generation Ecosystem Experiments (NGEE Arctic)

DOE Office of Science, Biological and Environmental Research Program

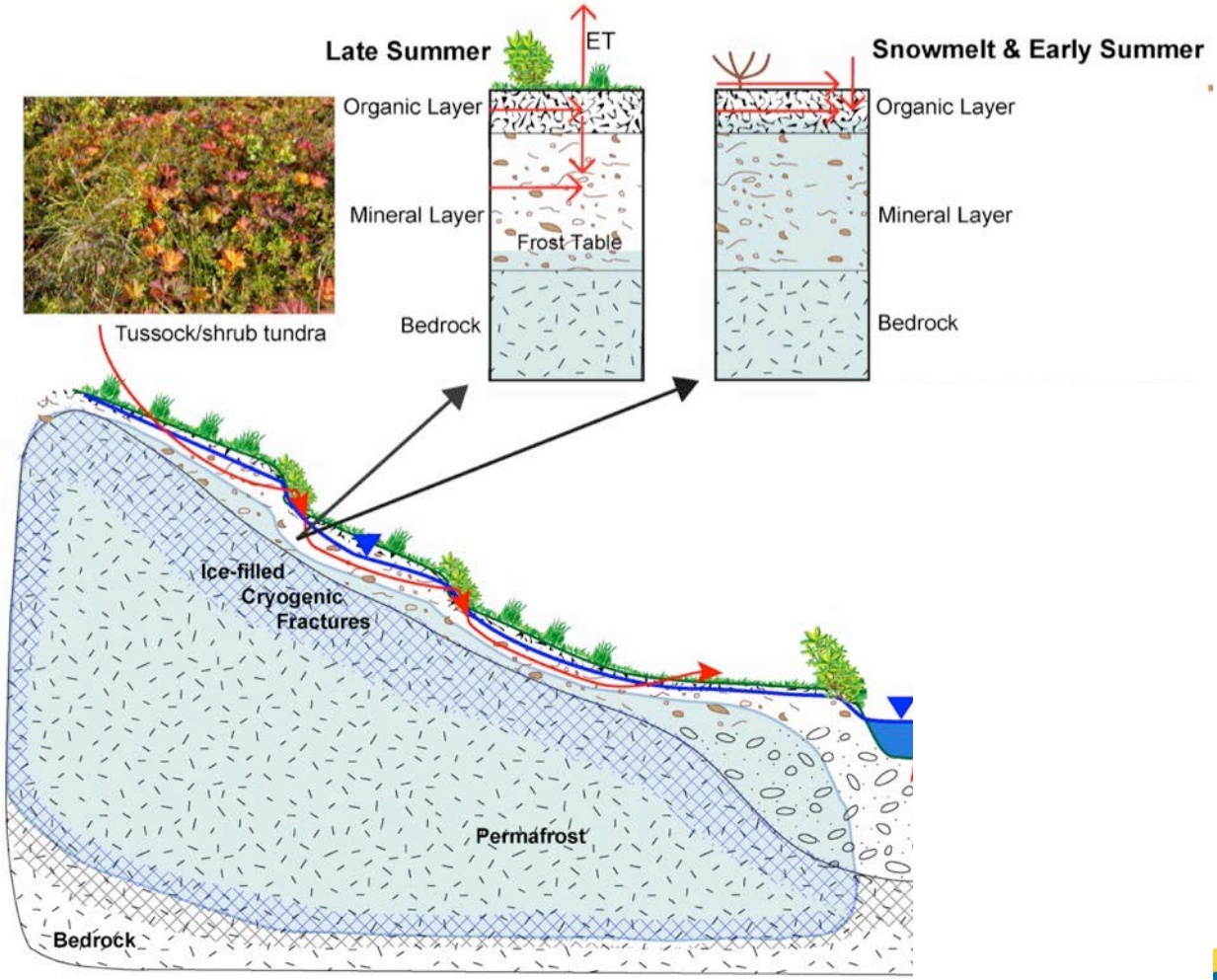
Project PI:
Stan Wullschleger, ORNL

LANL 2016 Field Team Members:
Cathy Wilson, Jeff Heikoop, Brent Newman, Lauren Charsley-Groffman, Christian Andresen, Nathan Wales

Overview

- Relationship between permafrost and hydrologic pathways
  - Shallow versus deep pathways
  - Drainage versus surface saturation
    - **Is the Arctic getting ‘wetter’ or ‘drier’?**
- Hydrogeochemical sampling techniques used
  - Surface Grab, ISCOs, Wicks, Rhizons
- Natural Chemical Tracers
  - Iron and nitrate
- What does this mean?

Interactions between geophysics, permafrost processes, hydrology, biogeochemistry and vegetation under changing climate



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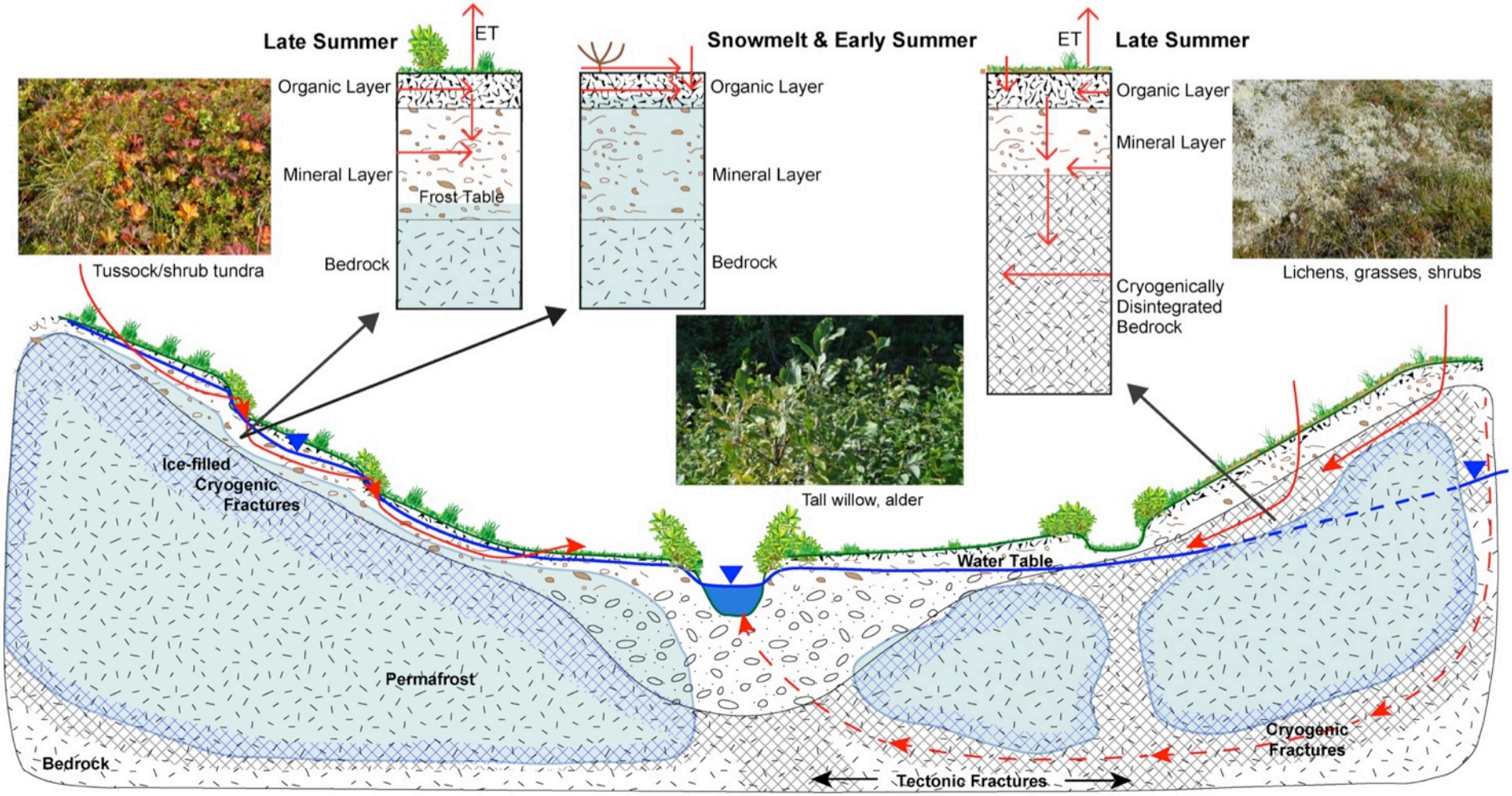
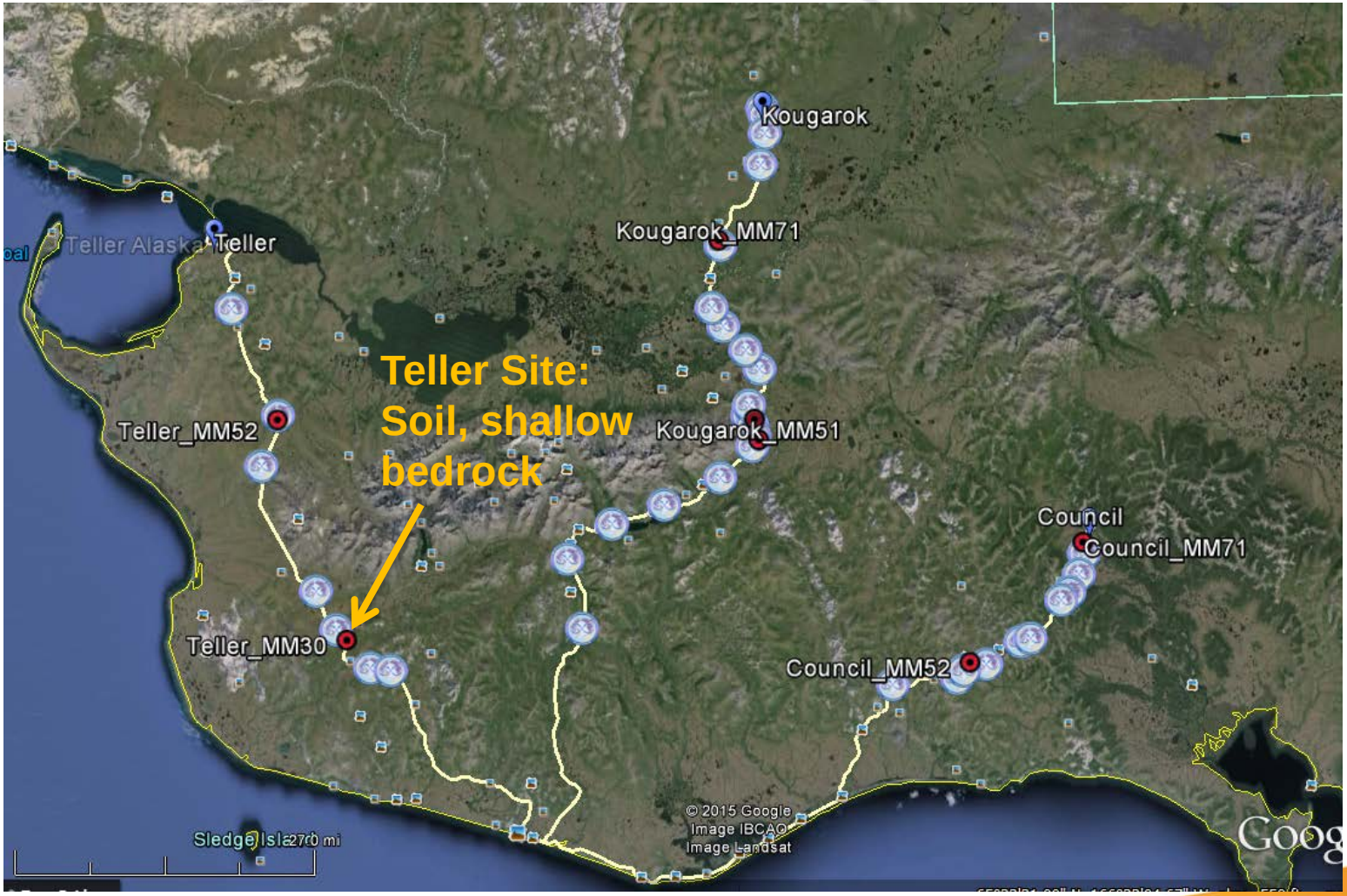
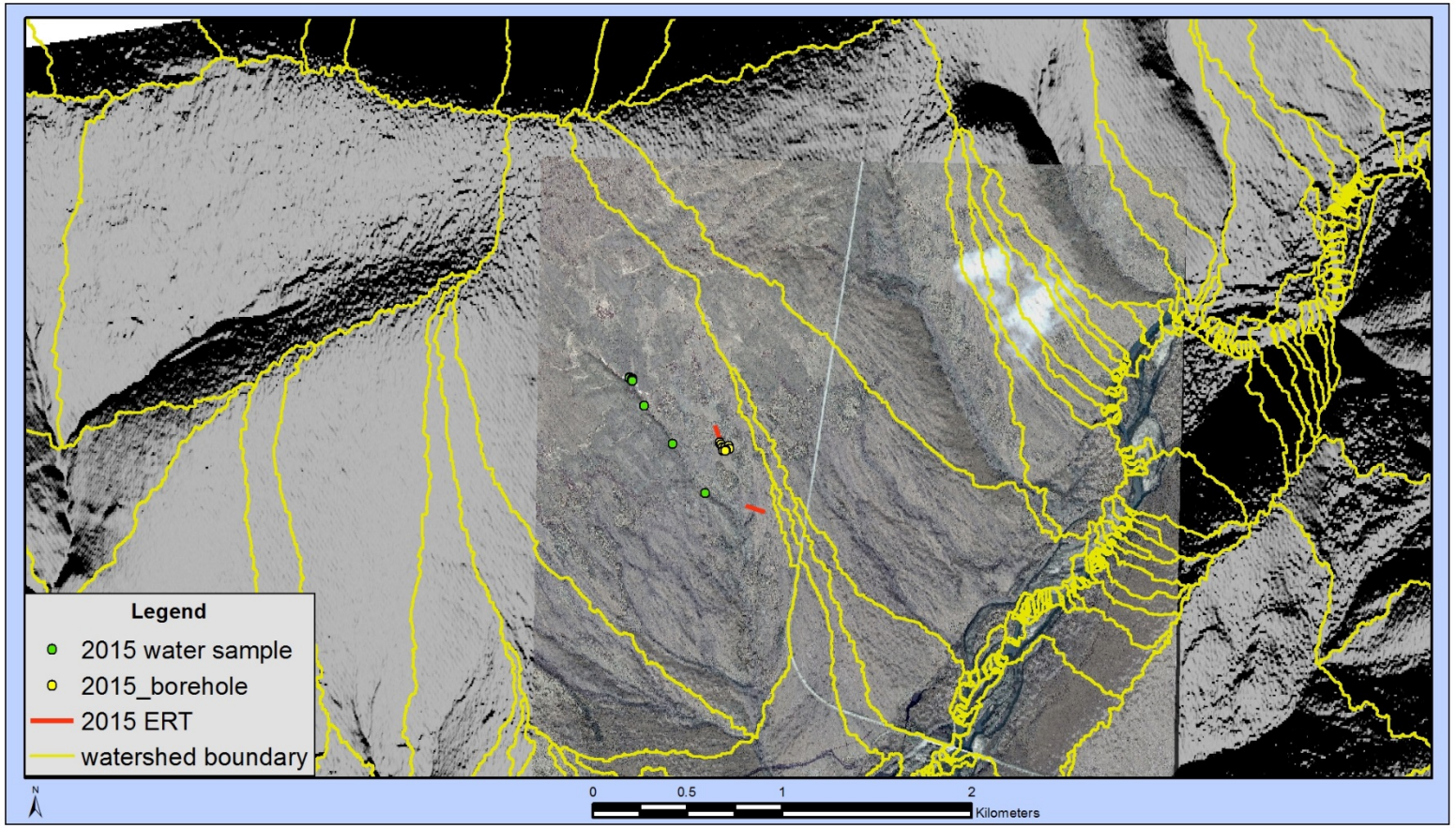
Interactions between geophysics, permafrost processes, hydrology, biogeochemistry and vegetation under changing climate



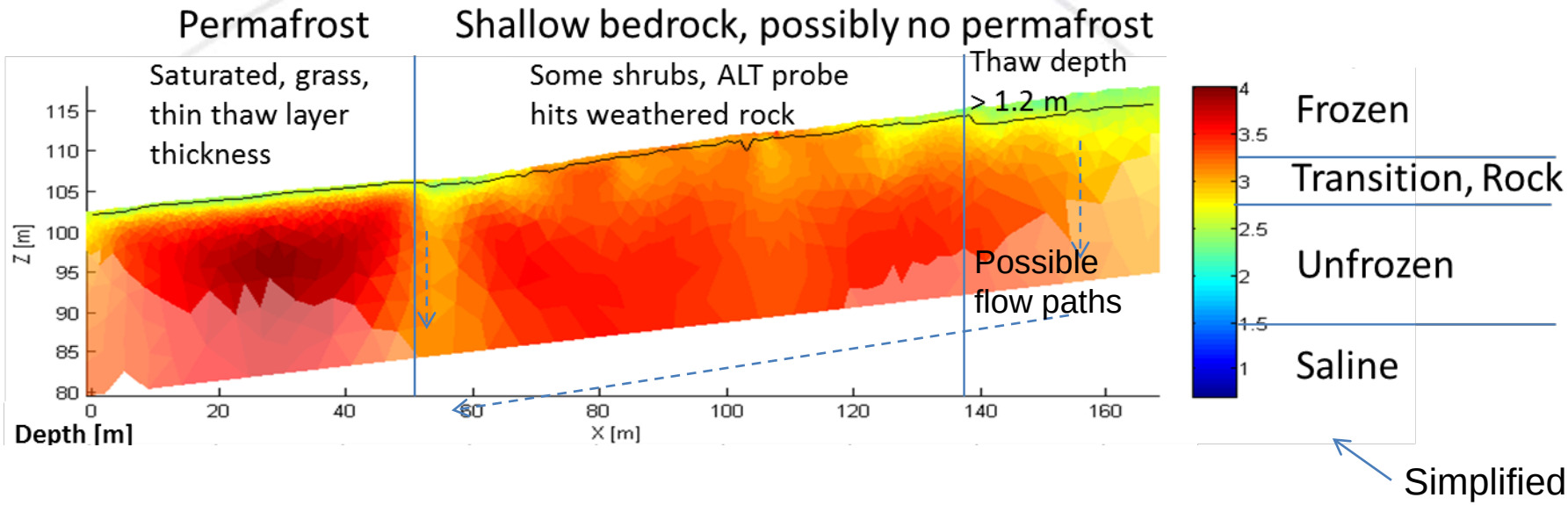
Sampling Location: Teller



Teller Rd mile 27 watersheds



Teller Uphill Transect



- Presence of fully saturated soil with thin thaw depth and of drained soil with deep thaw depth
- Links between subsurface, topography and vegetation
- Some locations without shallow permafrost likely imply flow paths in bedrock (incl., weathered, fractured)

Teller Site

- Presence of shallow bedrock (and rocky soil) in well drained areas
  - correlated with absence of shallow permafrost
- Subsurface flow paths in bedrock and under shallow permafrost is possible
  - seeps are present in many places)
- Strong spatial variability in soil properties and vegetation at the watershed scale

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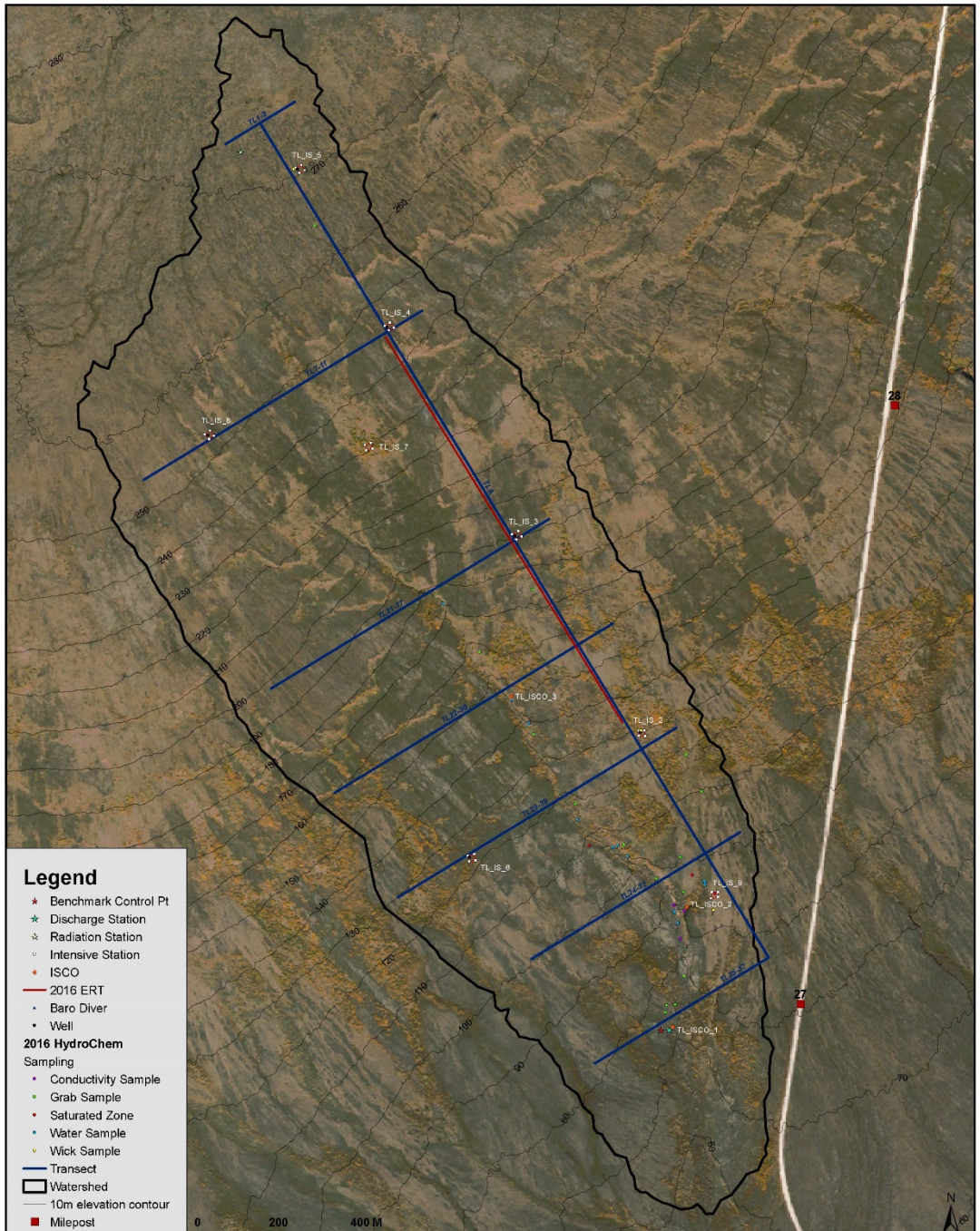
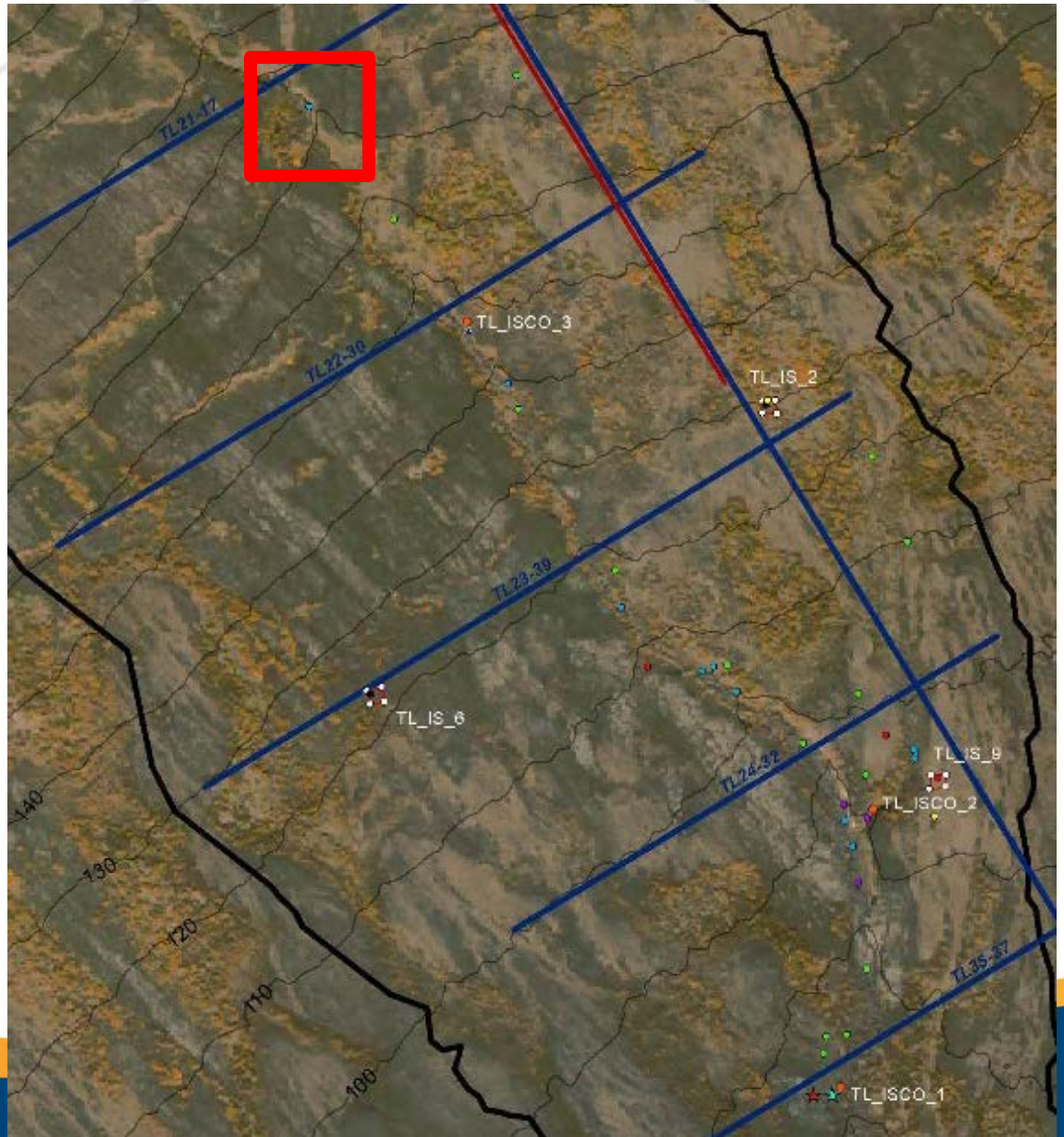
Teller Site (Mile 27)



Sampling Locations



Headwaters

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Previous Flow paths

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Seepage

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Trickle

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Saturation

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Shrub Channel

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‘Rusty Water’

Precipitation

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Rhizons

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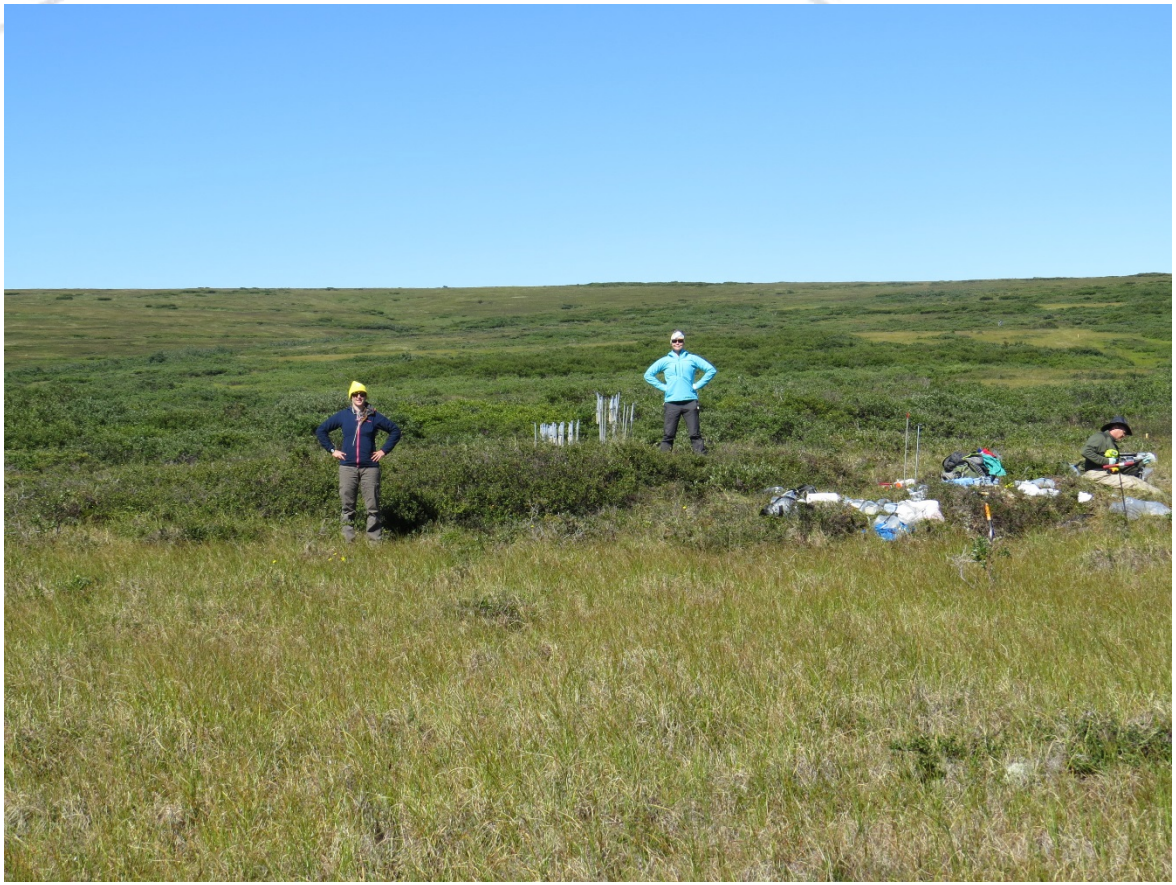
Plateau



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ISCOs

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Wick

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Iron as a Natural Tracer

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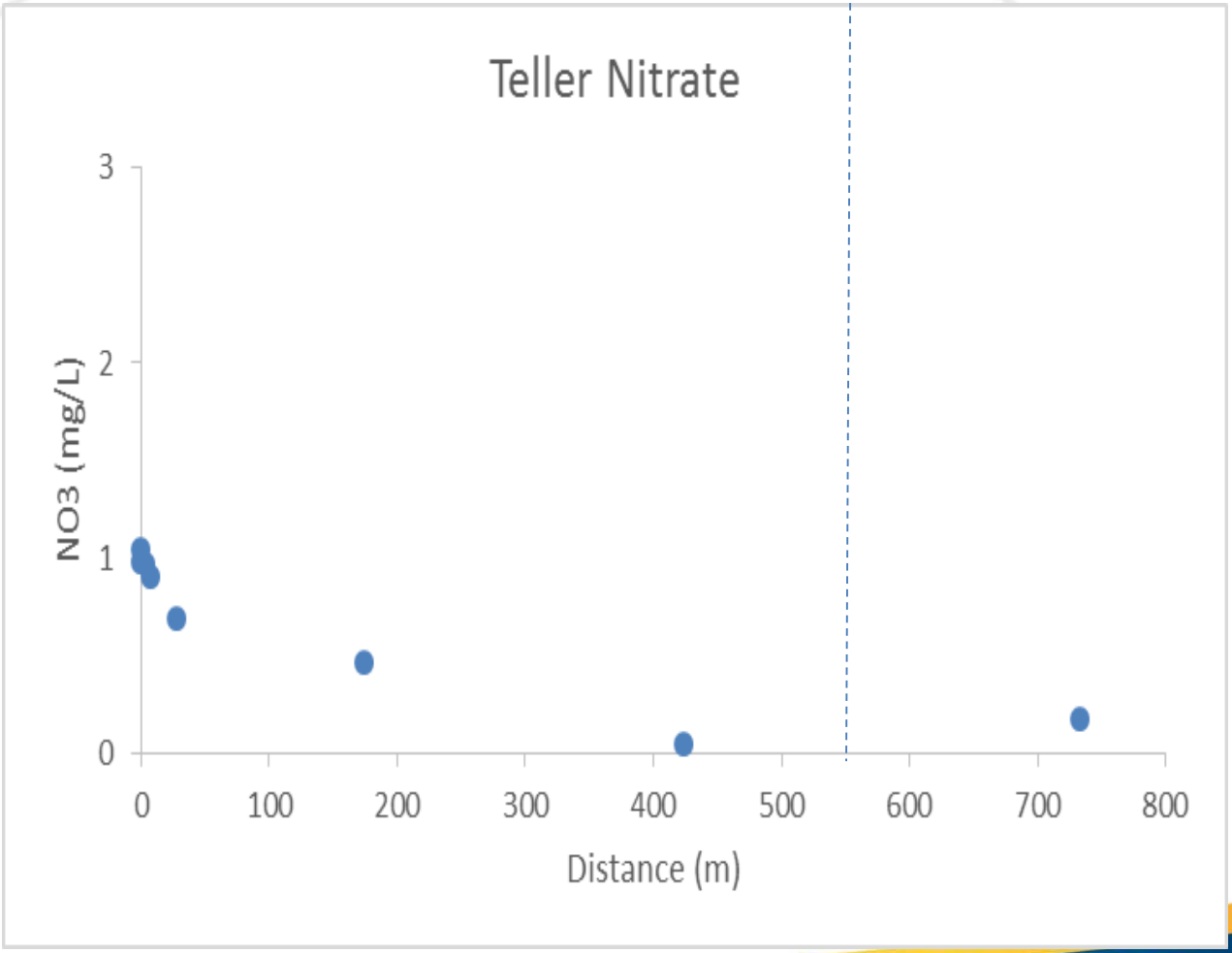
Nitrate as a Natural Tracer



Conclusions

Water availability influenced by state of permafrost

Natural tracers provide insight to hydrologic pathways

Teller site is divers in terms of permafrost extent, hydrologic connectivity, vegetation and chemical processes

More research to be conducted in the upcoming years

Thank You!

Questions?