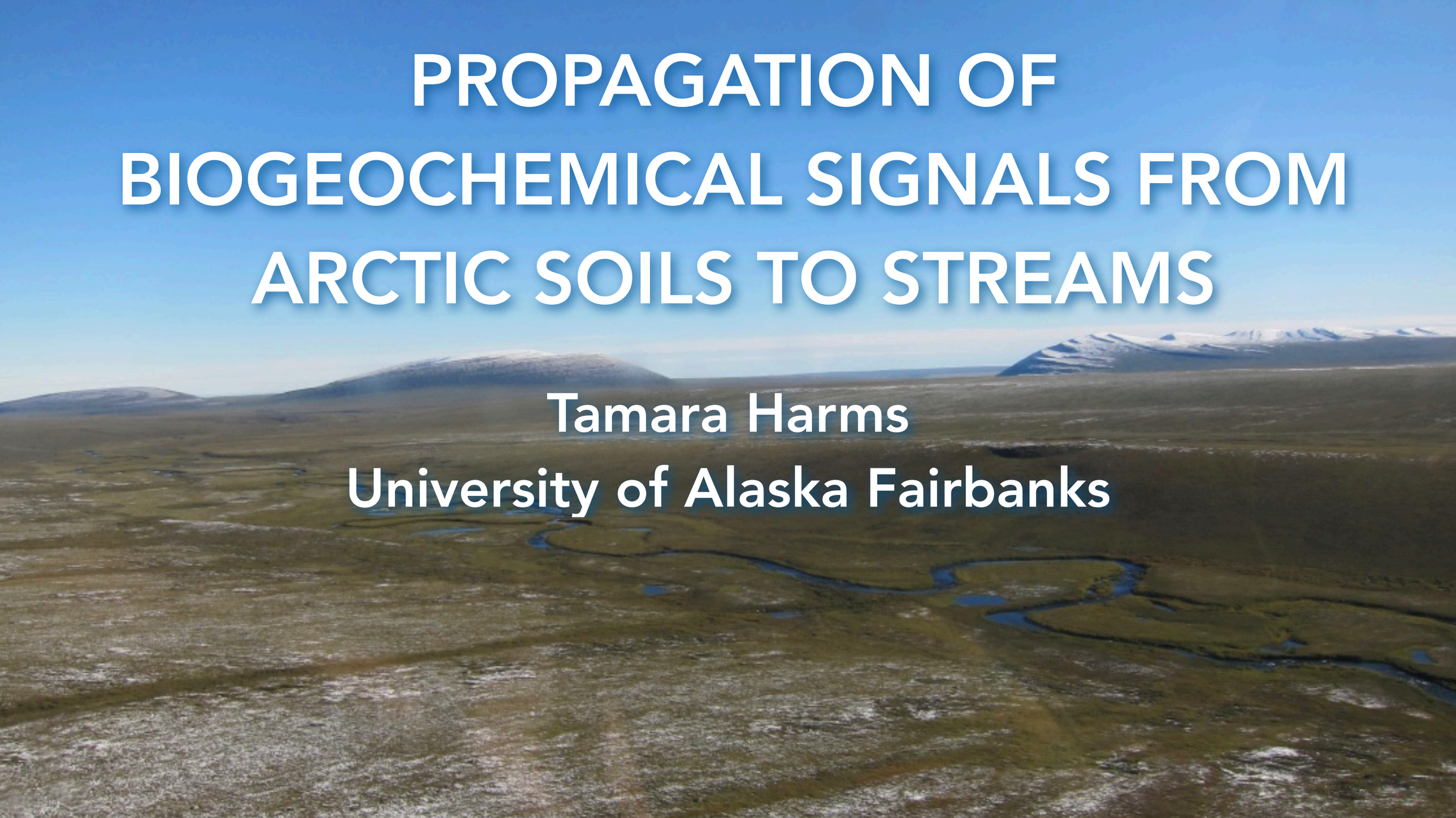


PROPAGATION OF BIOGEOCHEMICAL SIGNALS FROM ARCTIC SOILS TO STREAMS

Tamara Harms
University of Alaska Fairbanks

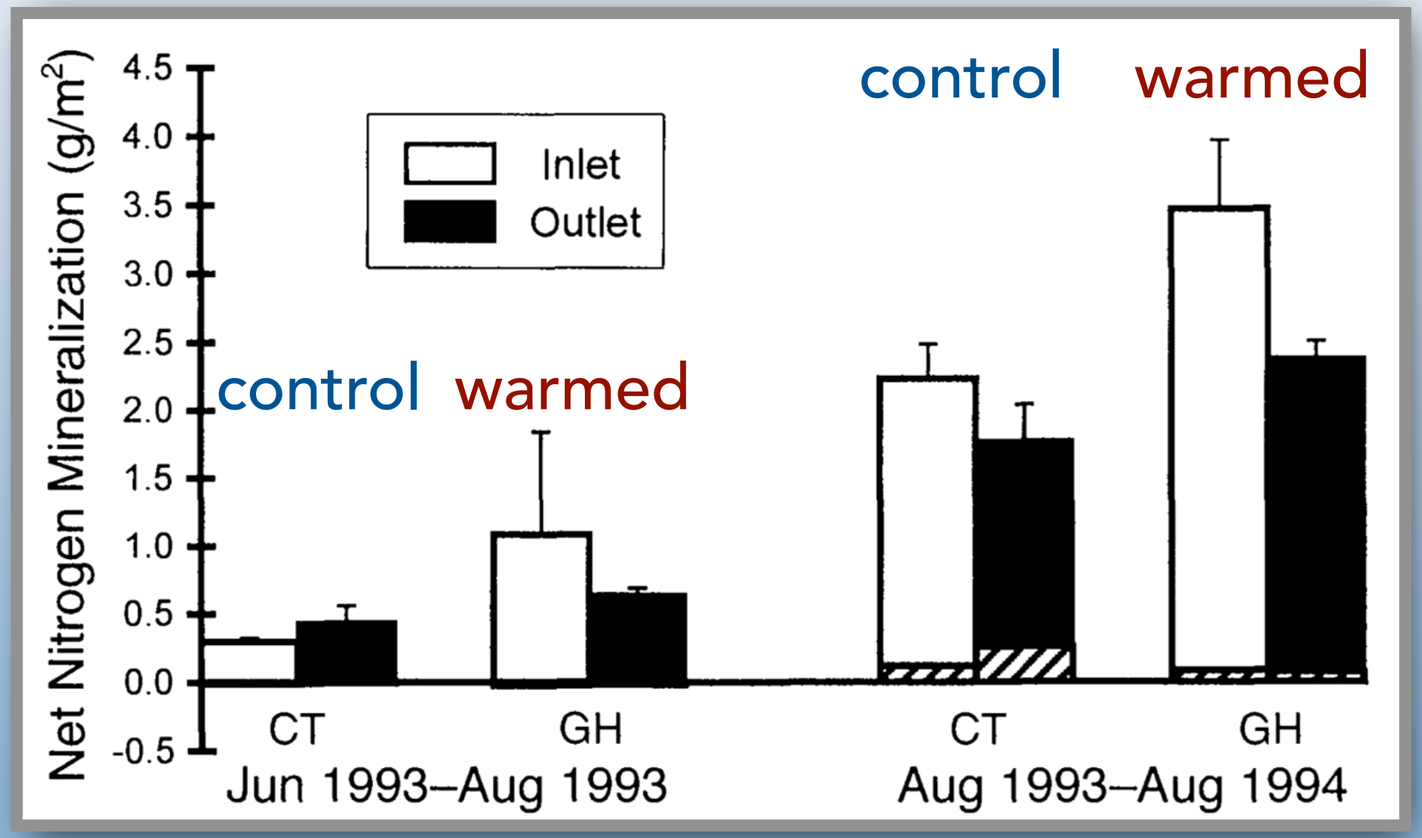
ACKNOWLEDGEMENTS

WEIR IMPORTANT

Sarah Godsey, Kelsey Blake, Chris Cook, Reiner Giesler, Mike Gooseff, Margit Jaeger, Jay Jones, Audrey Krehlik, Emily Longano, Ludda Ludwig, Becca Risser, Gerard Rocher-Ros, Caitlin Rushlow, Maria Väisänen, Adam Wlostowski

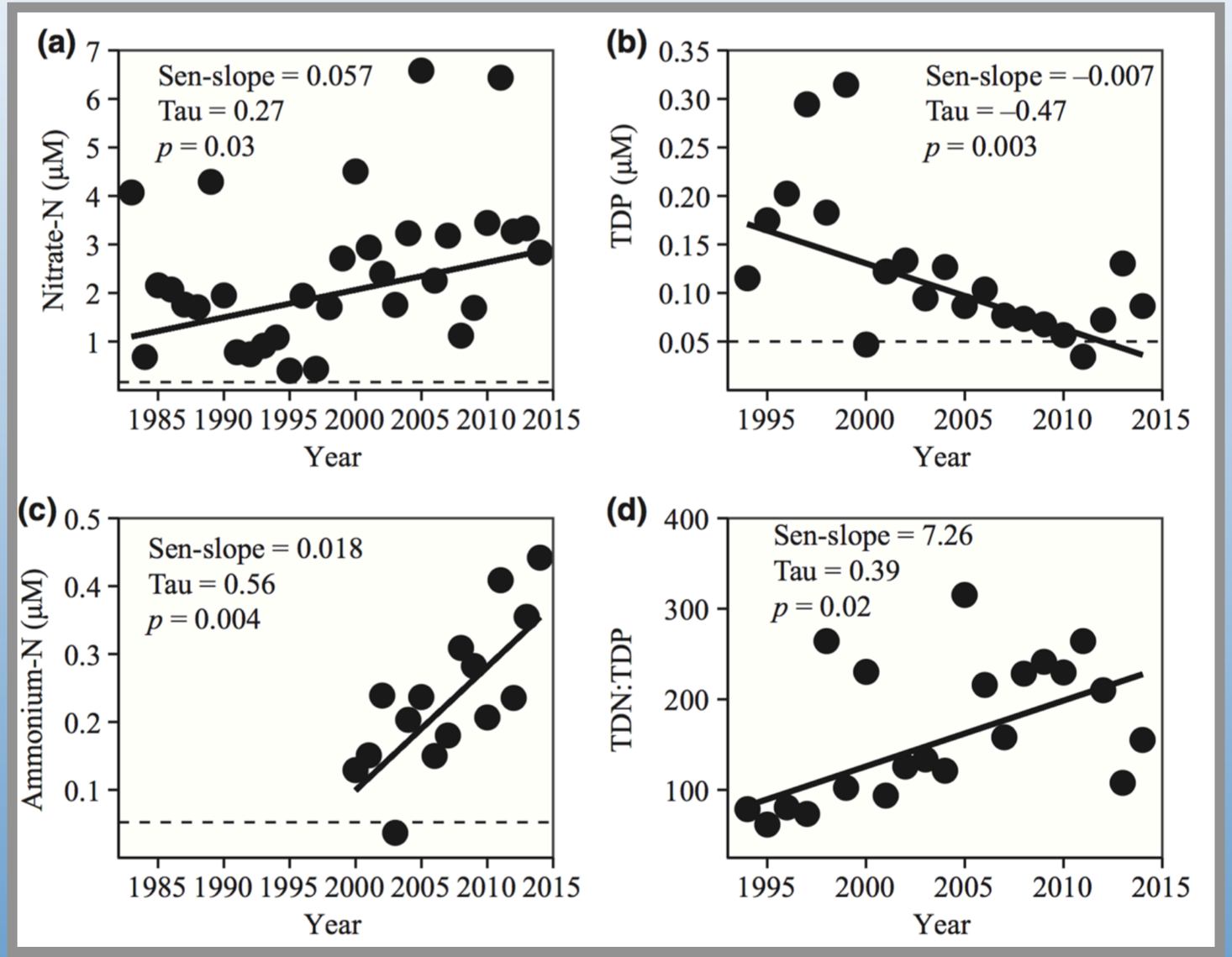
NSF Office of Polar Programs, INTERACT

NITROGEN RELEASE FROM WARMED TUNDRA



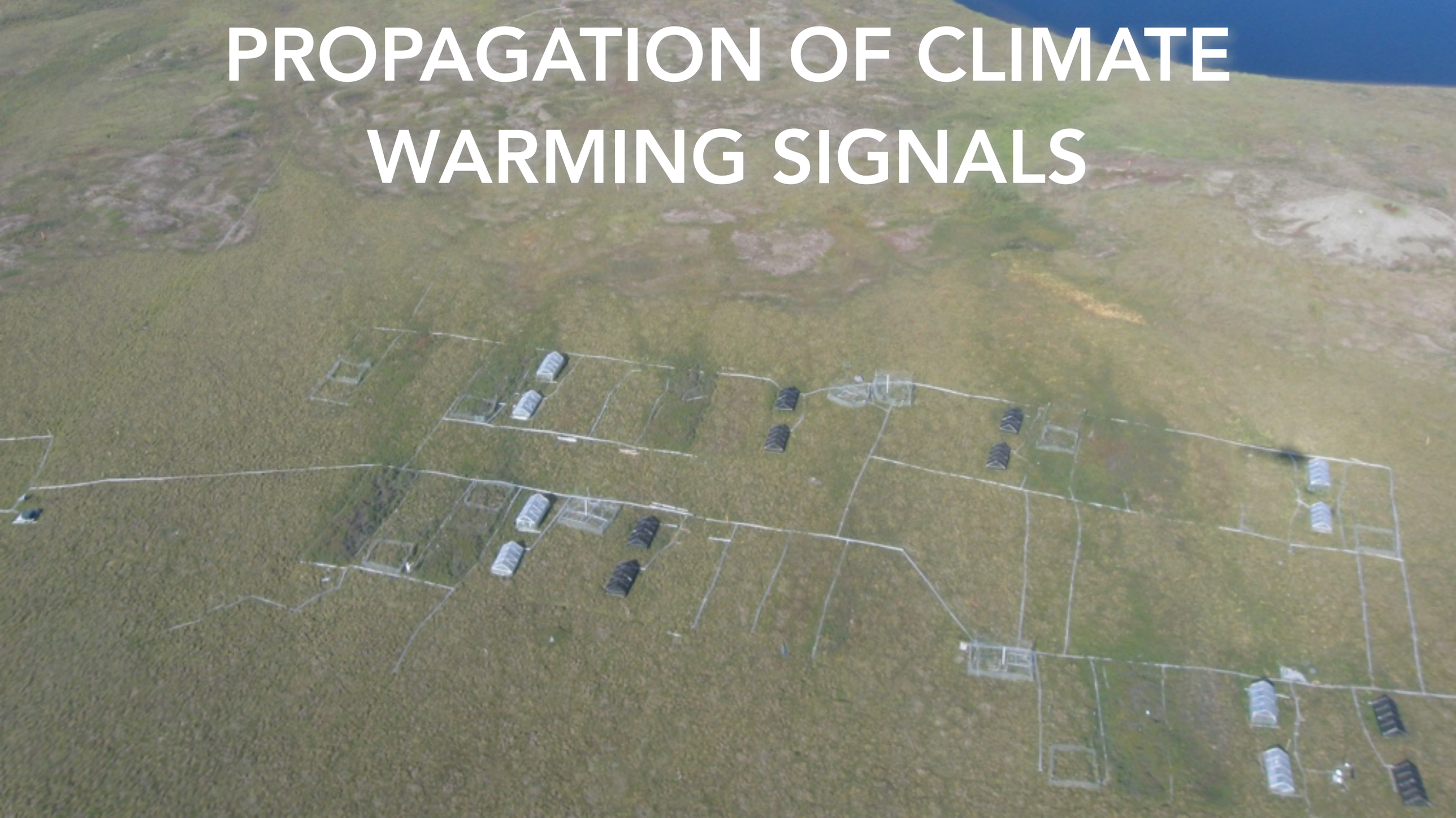
Shaver et al. 1998, Chapin et al. 1995, DeMarco et al. 2011, Lavoie et al. 2011, Nadelhoffer et al. 1991, Salmon et al. 2016, Schaeffer et al. 2015

INORGANIC NITROGEN FLUX INCREASING IN KUPARUK RIVER



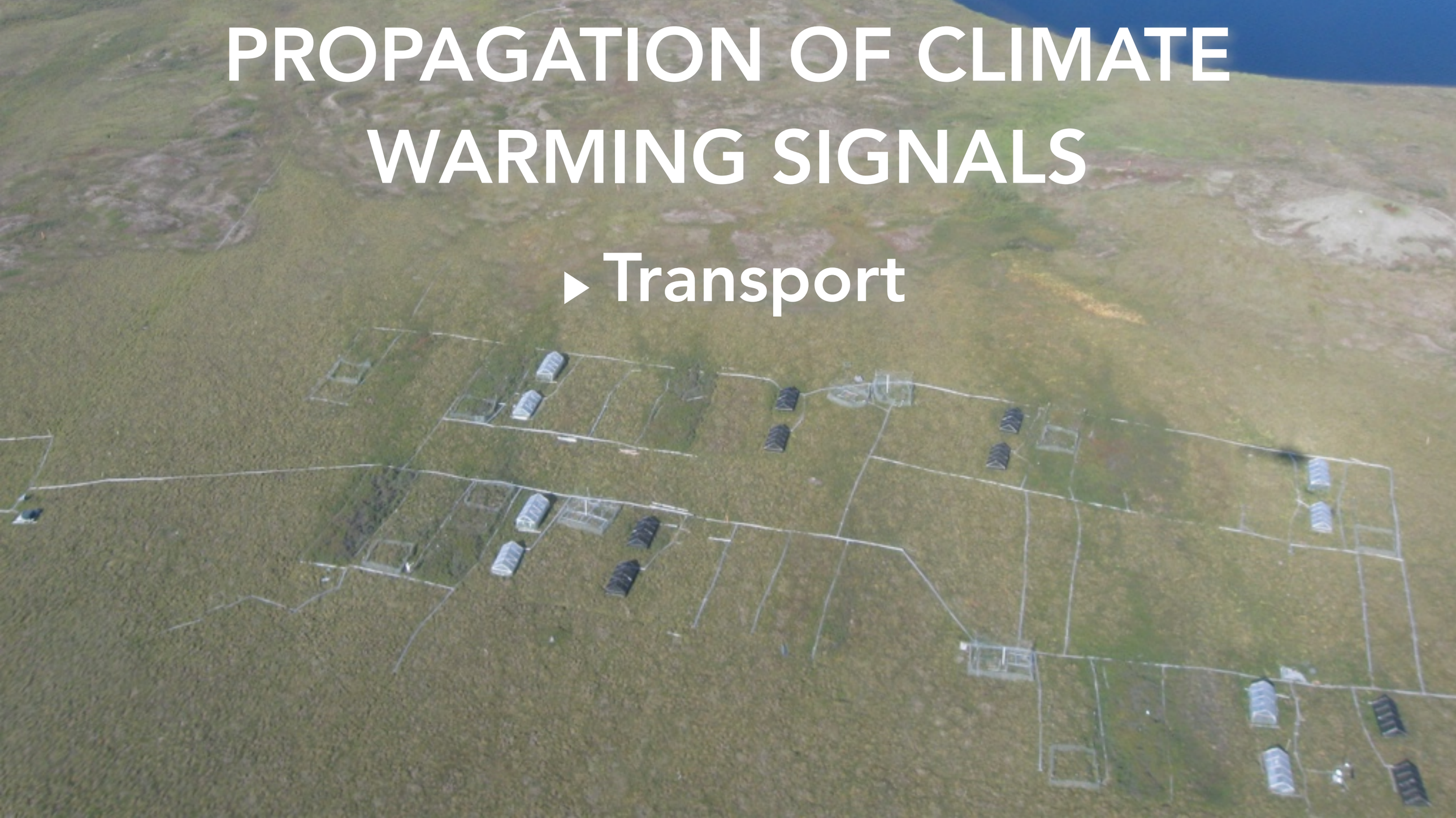
Kendrick et al. 2019

PROPAGATION OF CLIMATE WARMING SIGNALS



PROPAGATION OF CLIMATE WARMING SIGNALS

- Transport



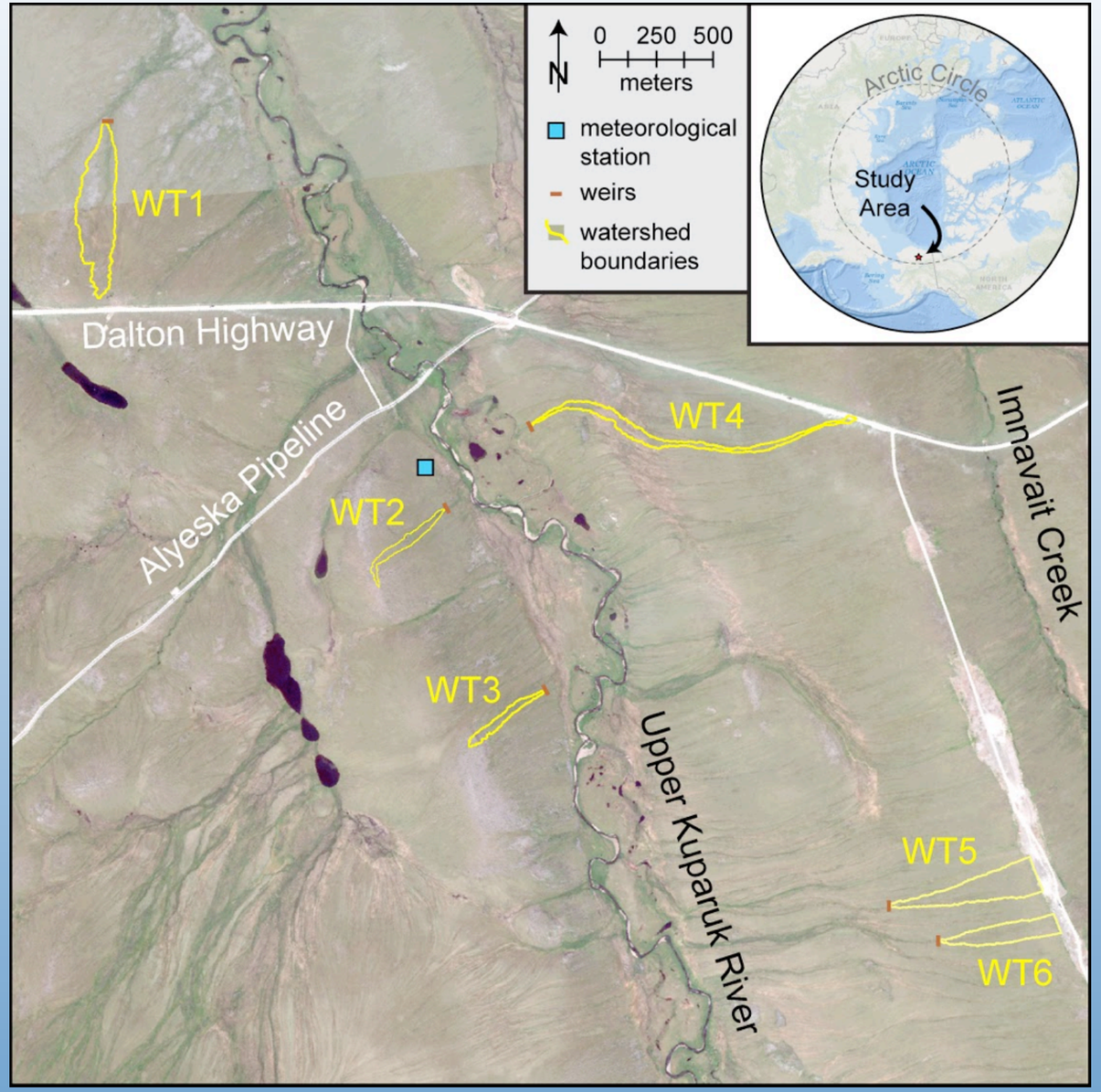
PROPAGATION OF CLIMATE WARMING SIGNALS

- Transport
- Reaction

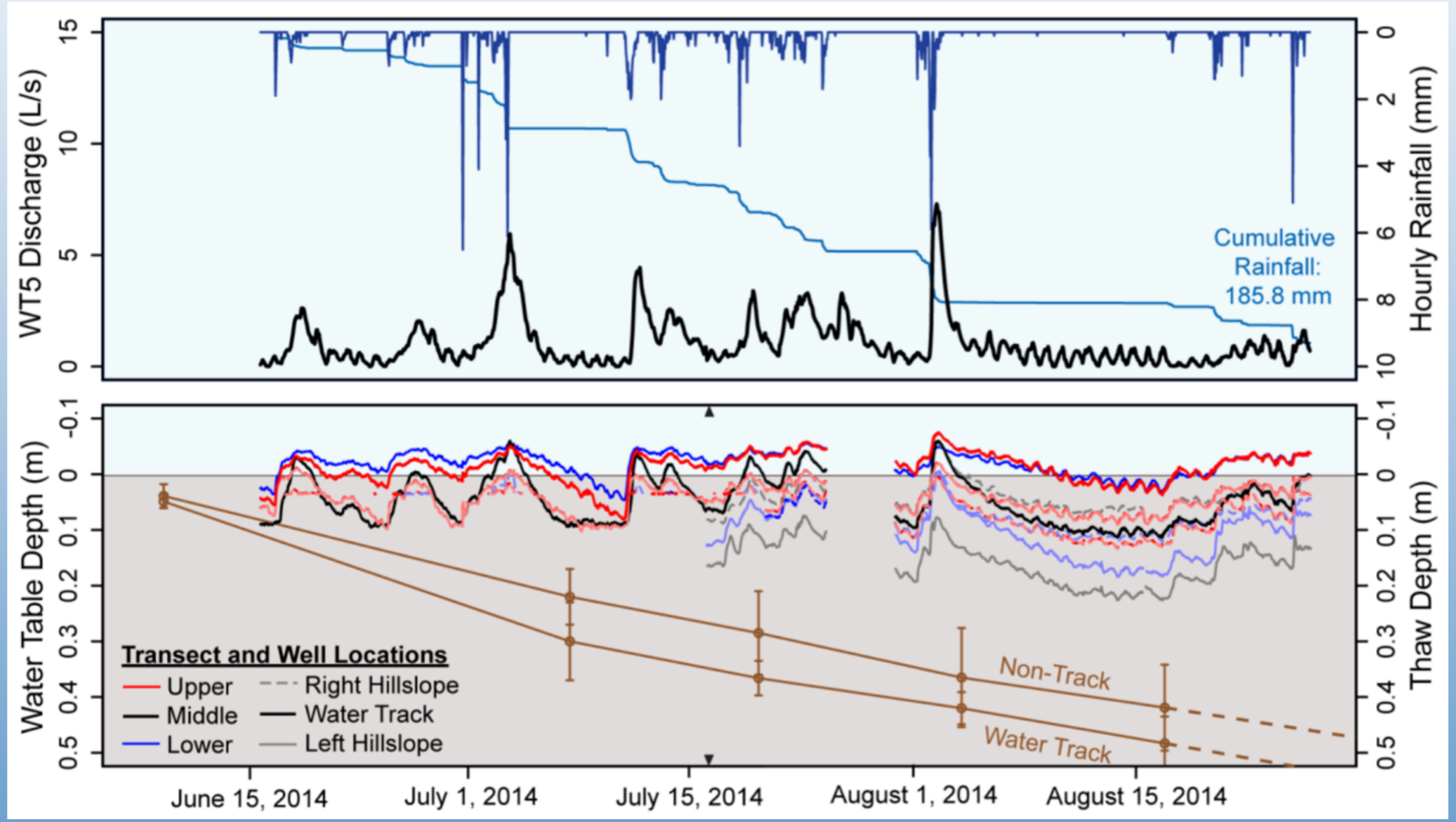
WATER TRACKS

WATER TRACKS

- 0.013-0.089 km^2
- Up to 1/3 catchment area (McNamara et al. 1997)

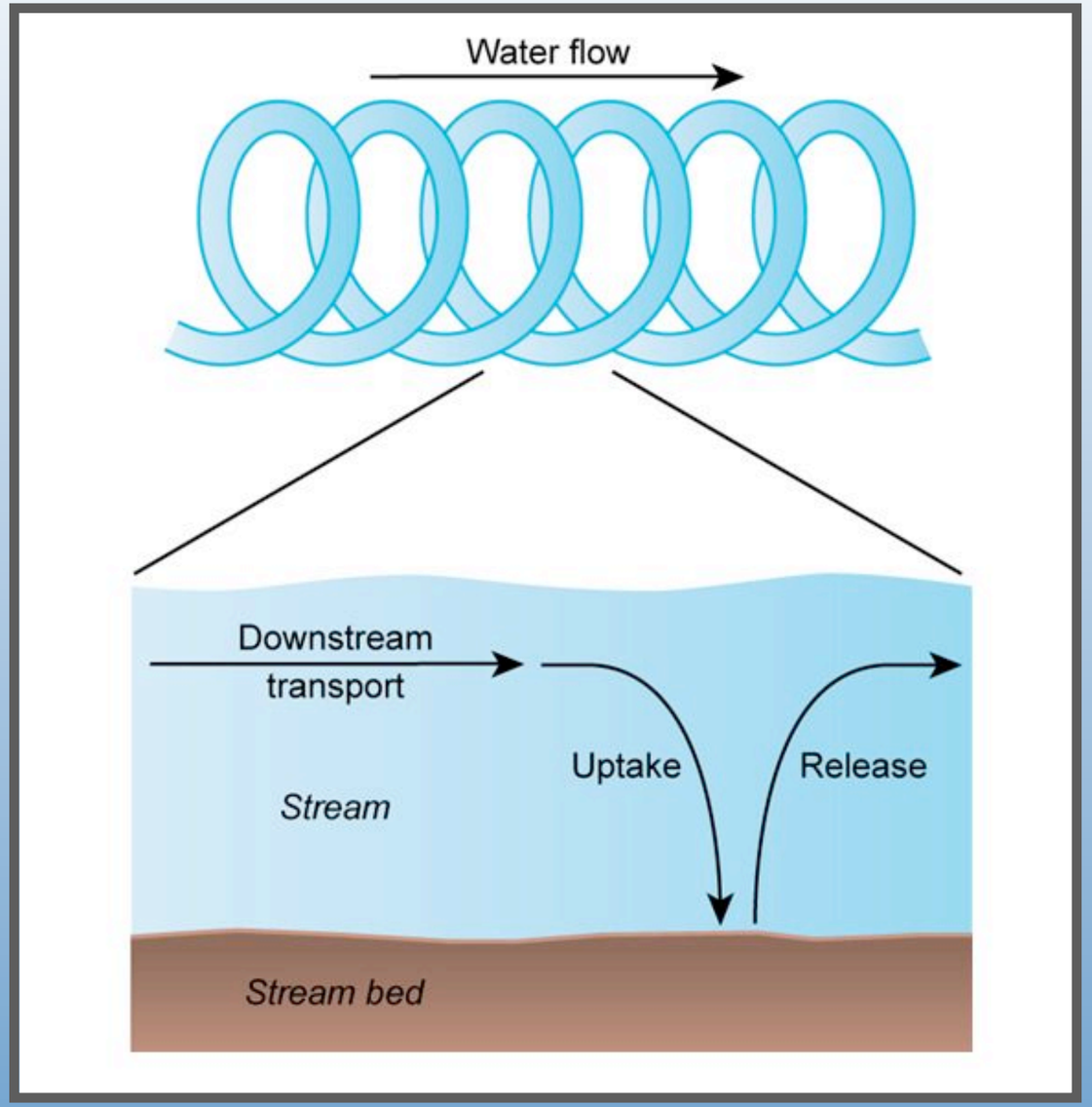


WATER TRACKS CONVEY THE MAJORITY OF STORMFLOW

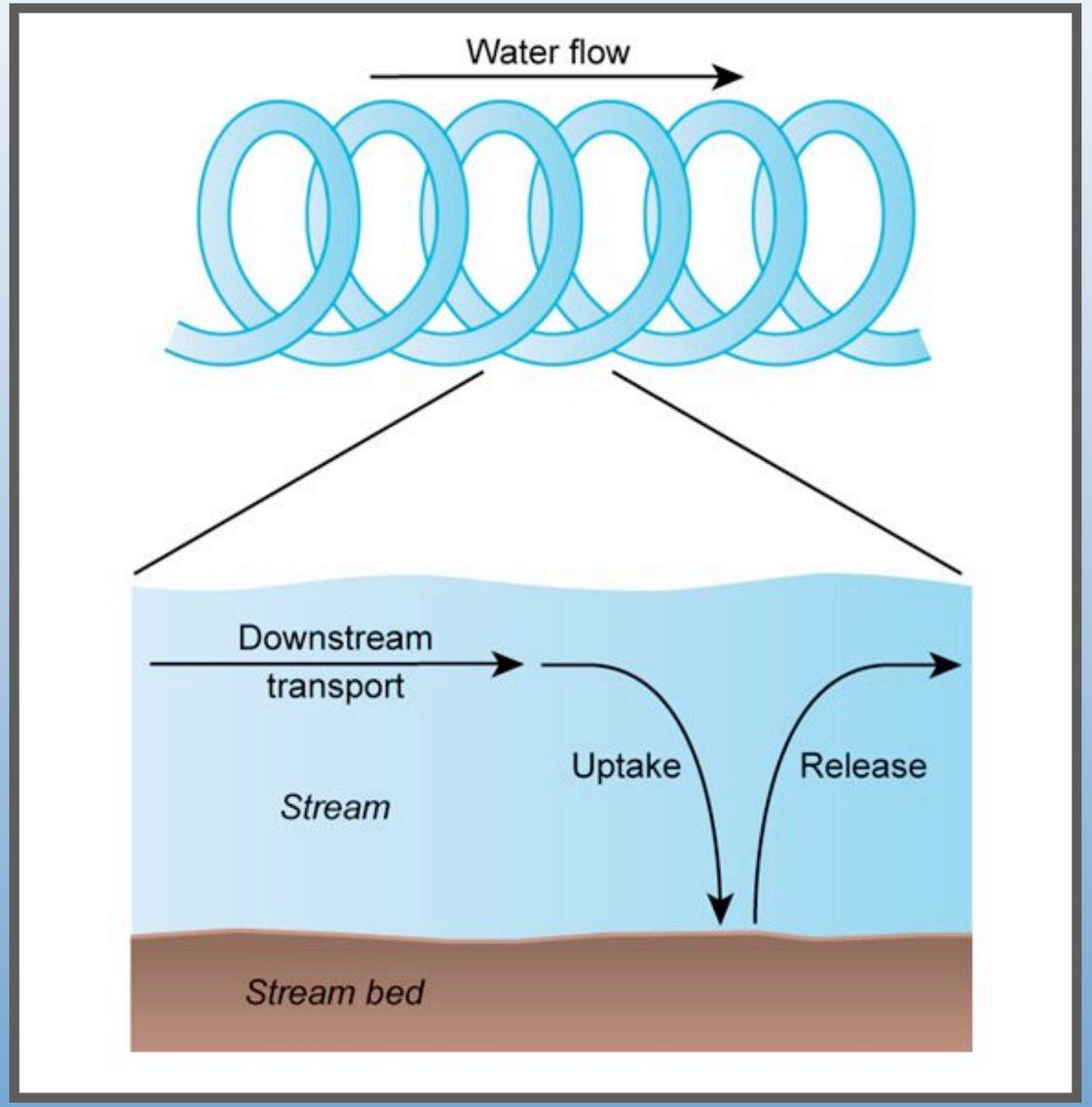


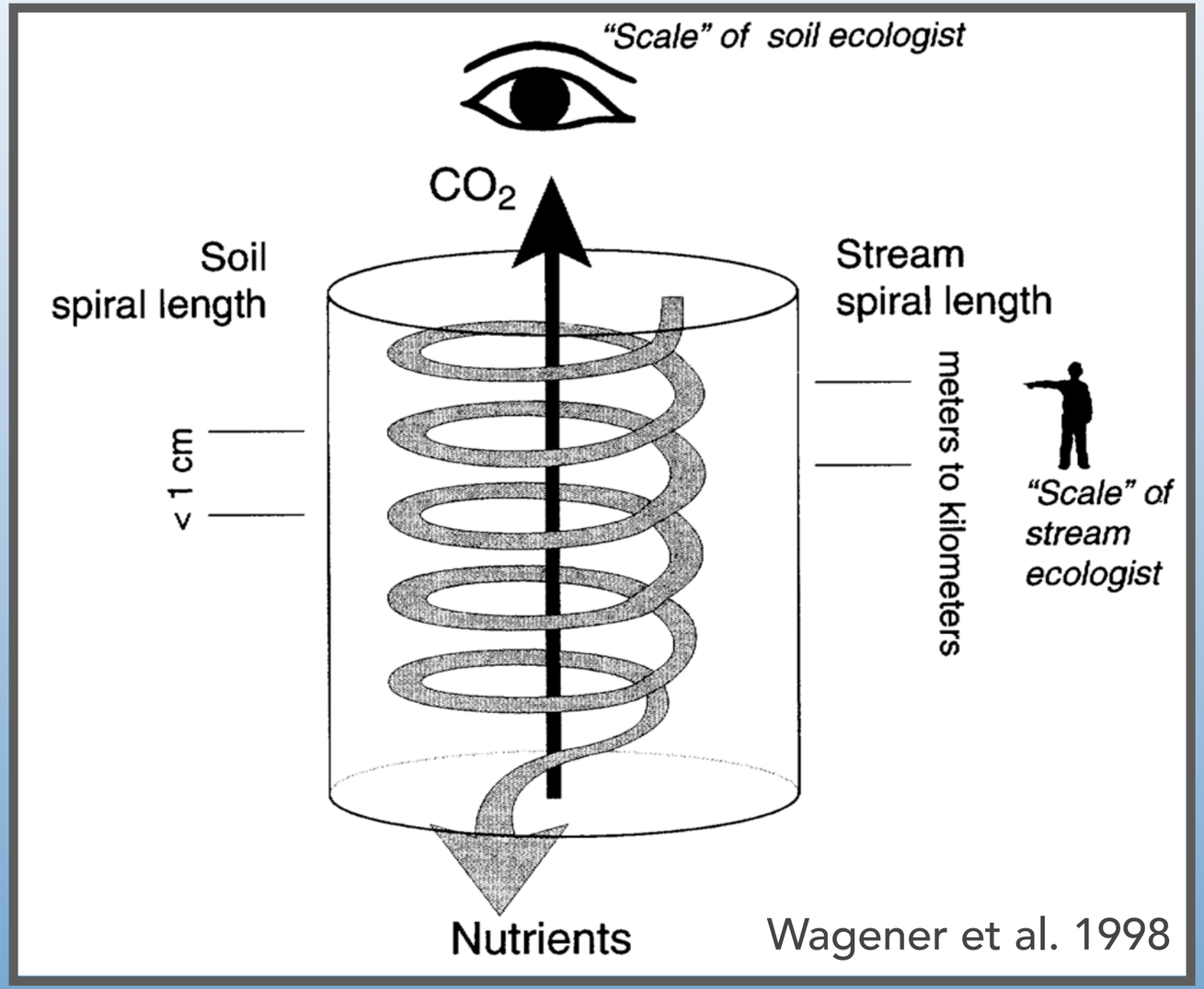
Rushlow & Godsey 2017

NUTRIENT SPIRALING



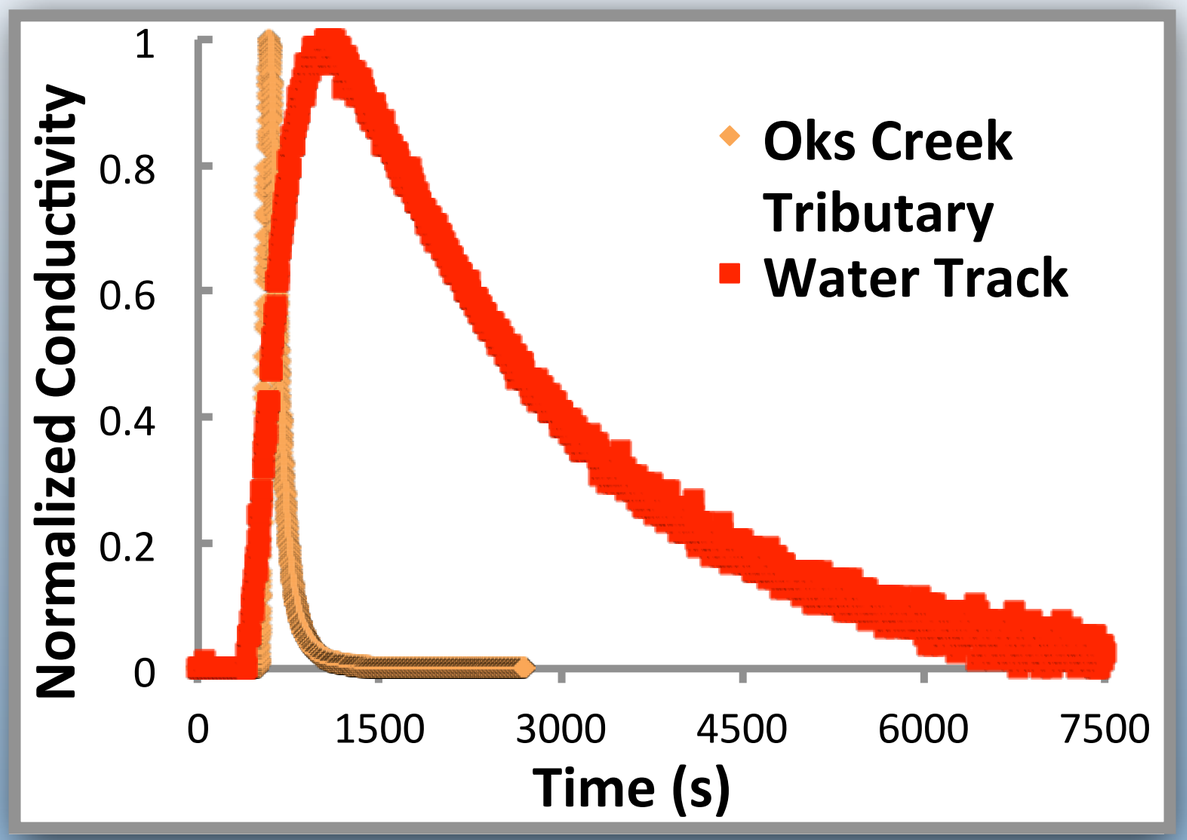
NUTRIENT SPIRALING





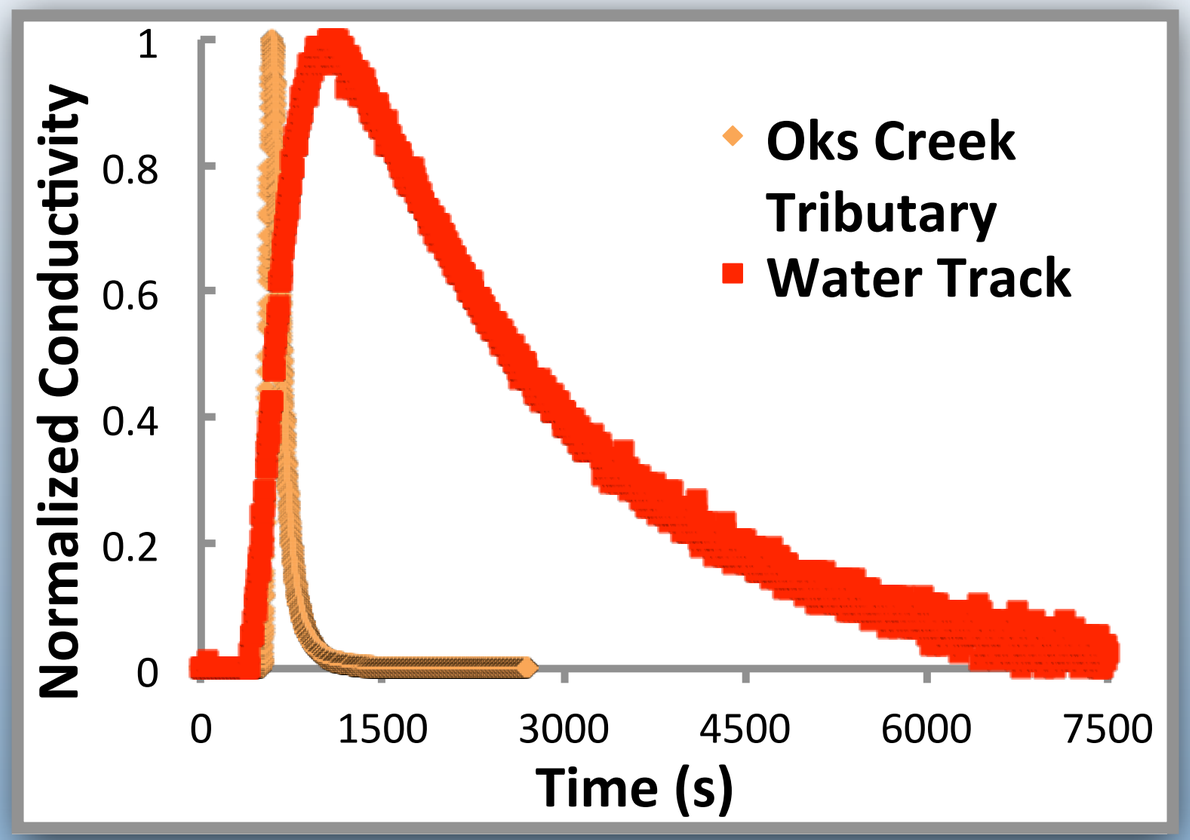
Wagener et al. 1998

NUTRIENT UPTAKE



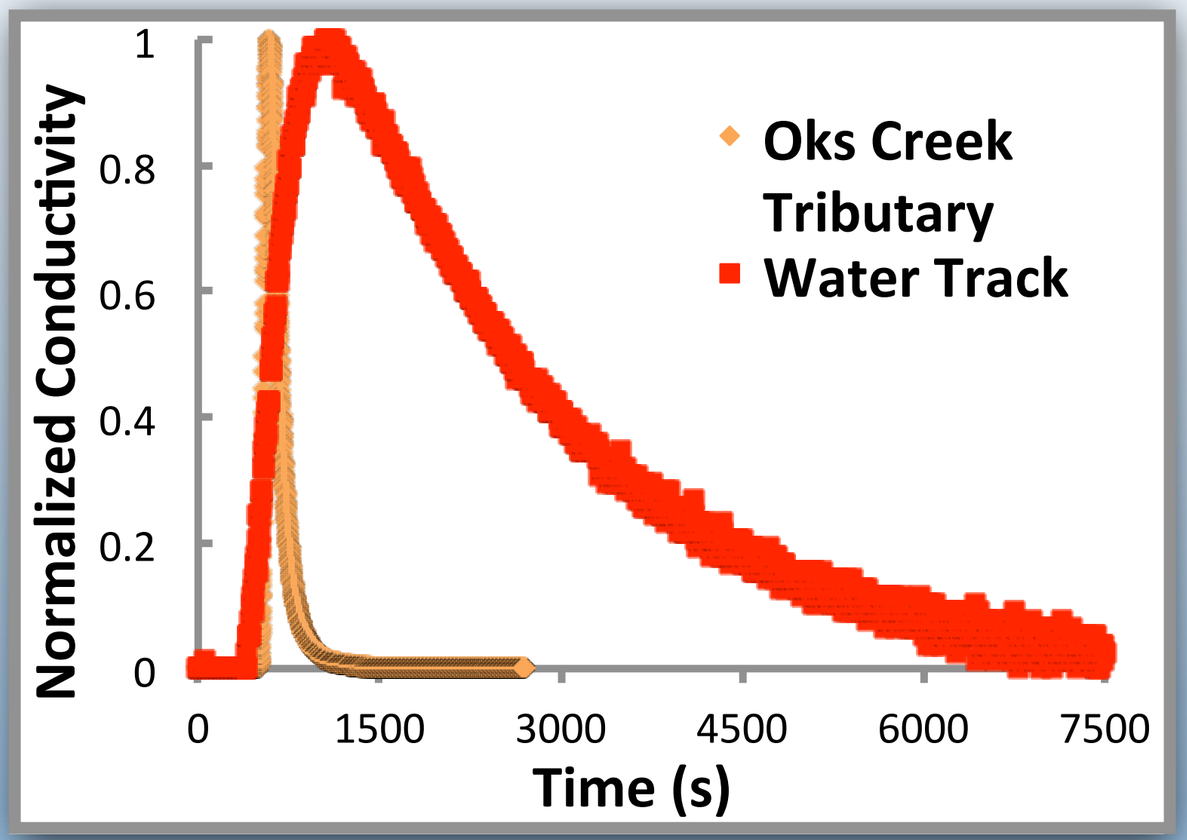
NUTRIENT UPTAKE

- NH_4^+ or PO_4^{3-} pulse addition



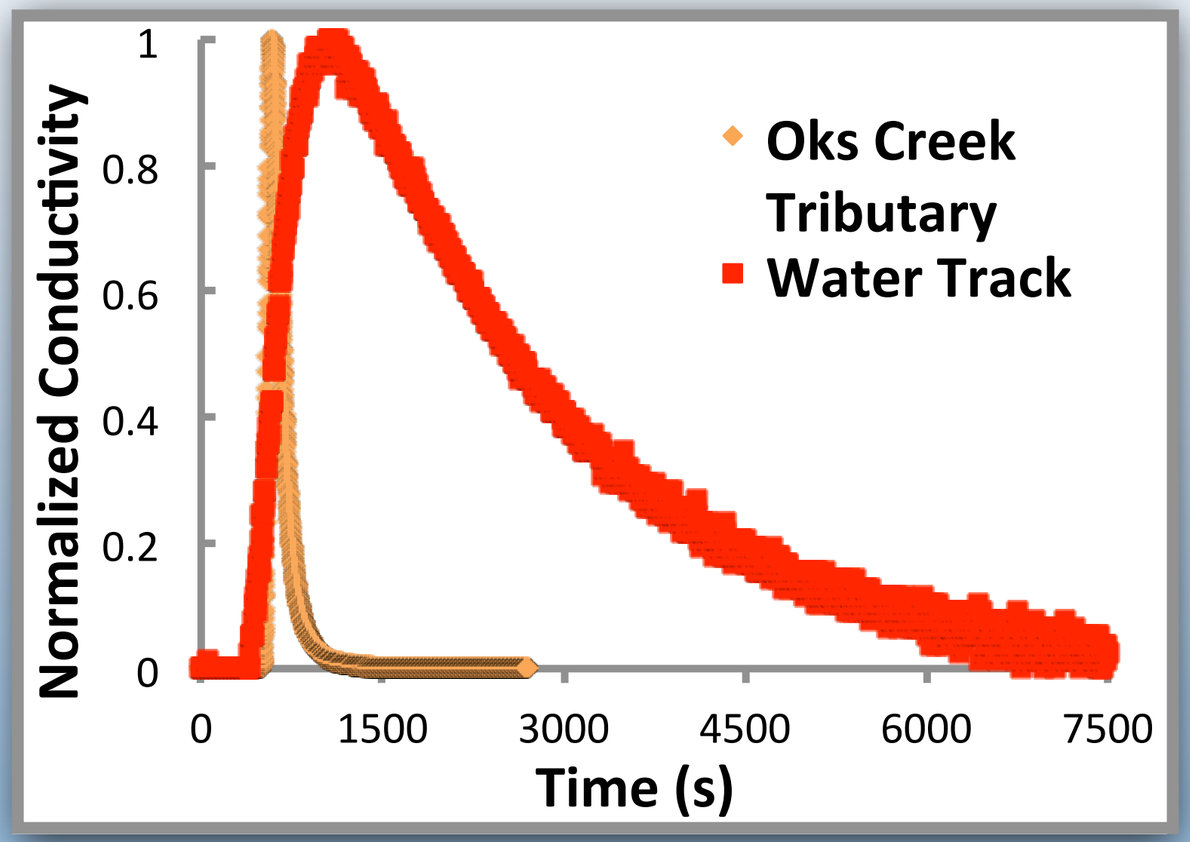
NUTRIENT UPTAKE

- NH_4^+ or PO_4^{3-} pulse addition
- Mass balance



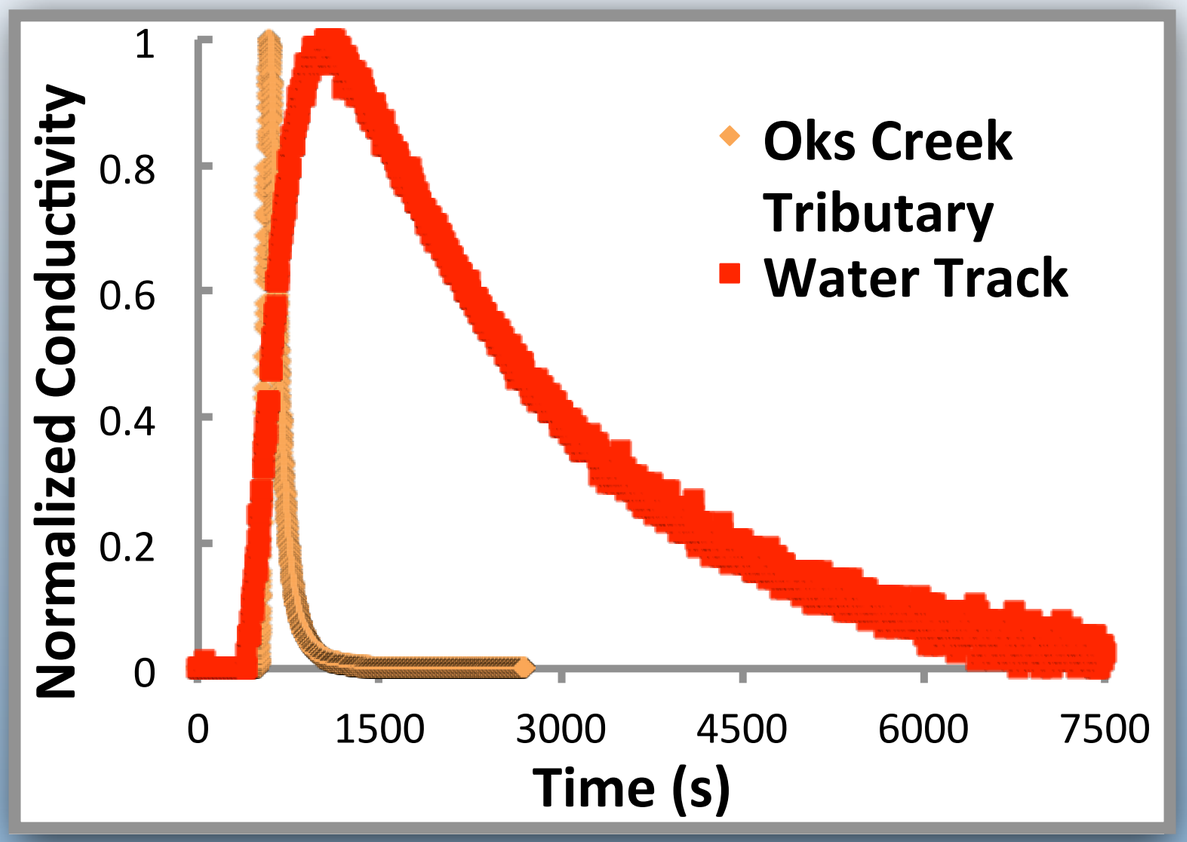
NUTRIENT UPTAKE

- NH_4^+ or PO_4^{3-} pulse addition
- Mass balance
- First-order kinetics

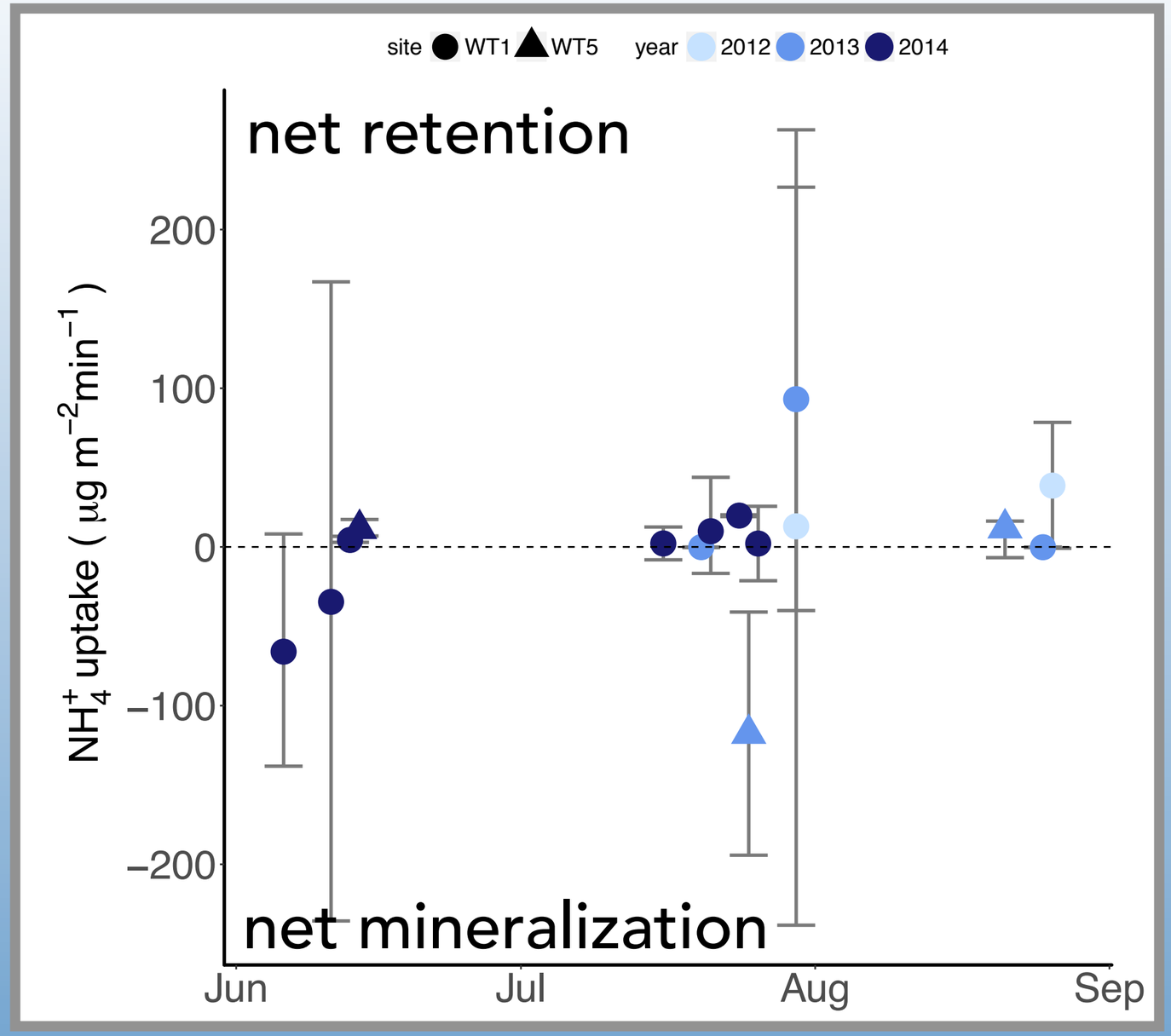


NUTRIENT UPTAKE

- NH_4^+ or PO_4^{3-} pulse addition
- Mass balance
- First-order kinetics
- Duration: 2-8 h

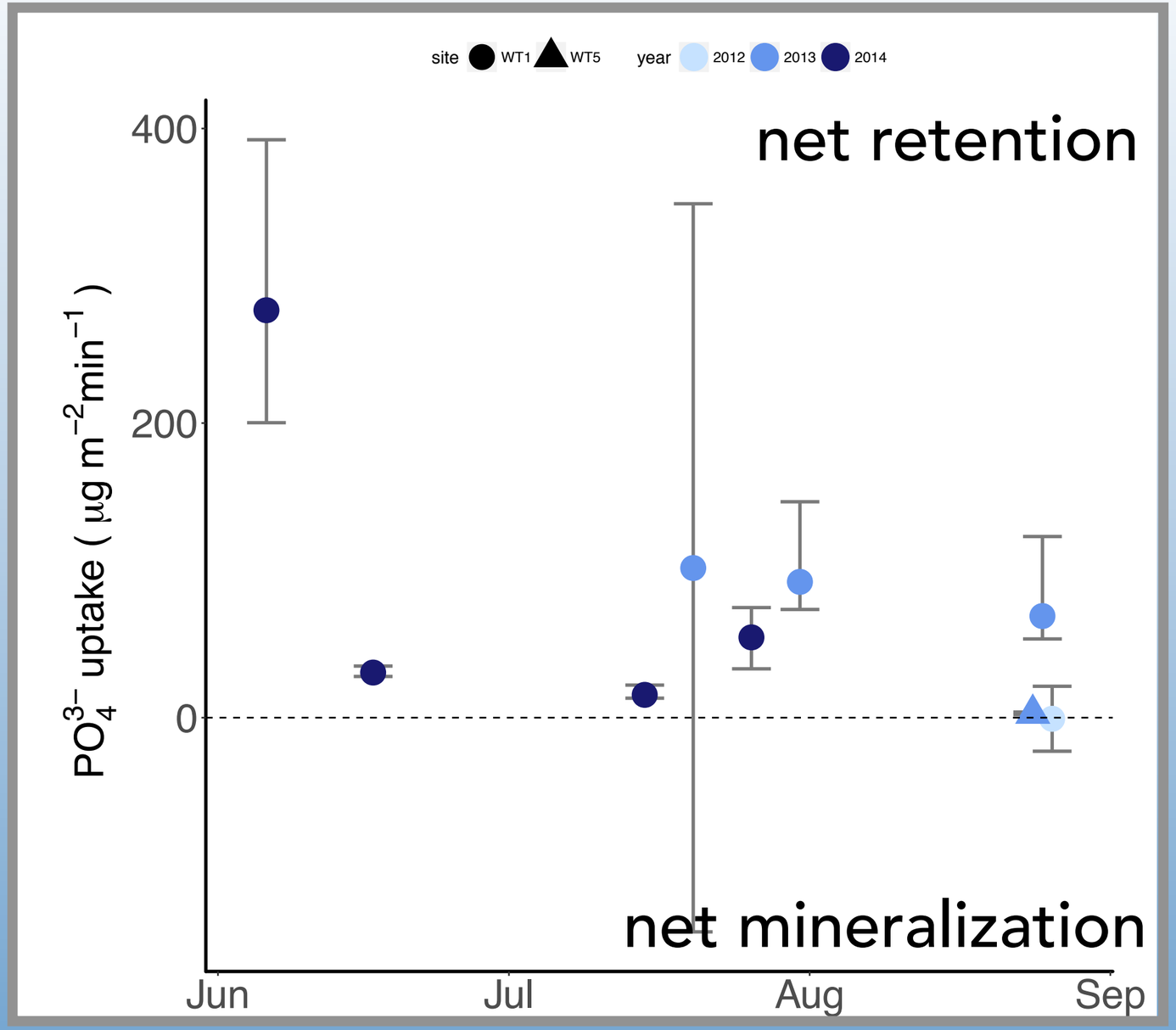


HILLSLOPES PROPAGATE NH_4^+



Harms, Cook, Wlostowski, Godsey, Gooseff, in press, *Ecosystems*

HILLSLOPES ATTENUATE PO_4^{3-}



Harms, Cook, Wlostowski, Godsey, Gooseff, in press, *Ecosystems*

DRIVERS OF NUTRIENT RETENTION

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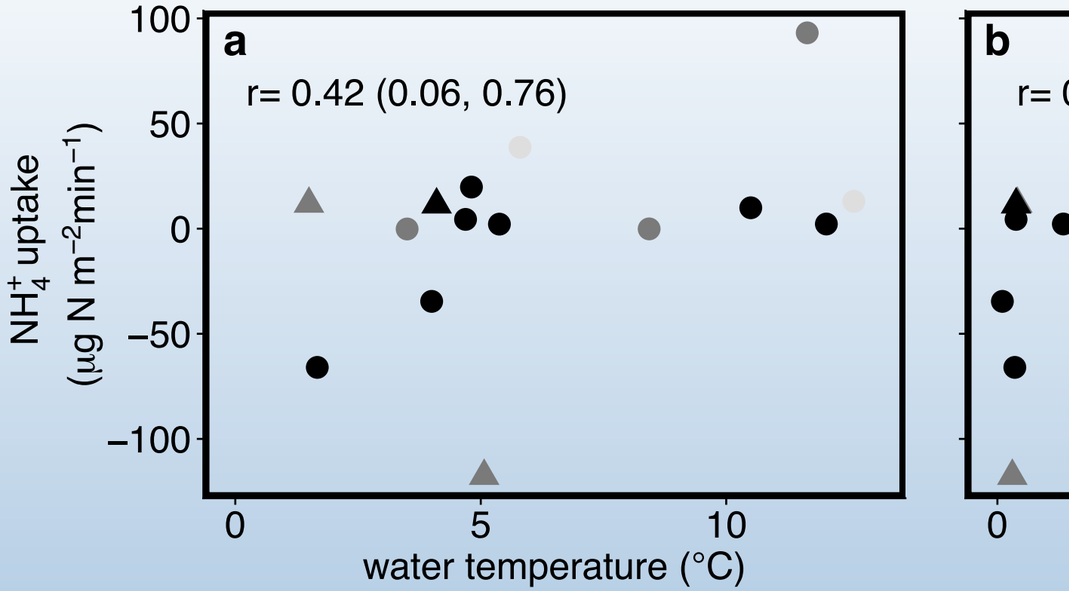

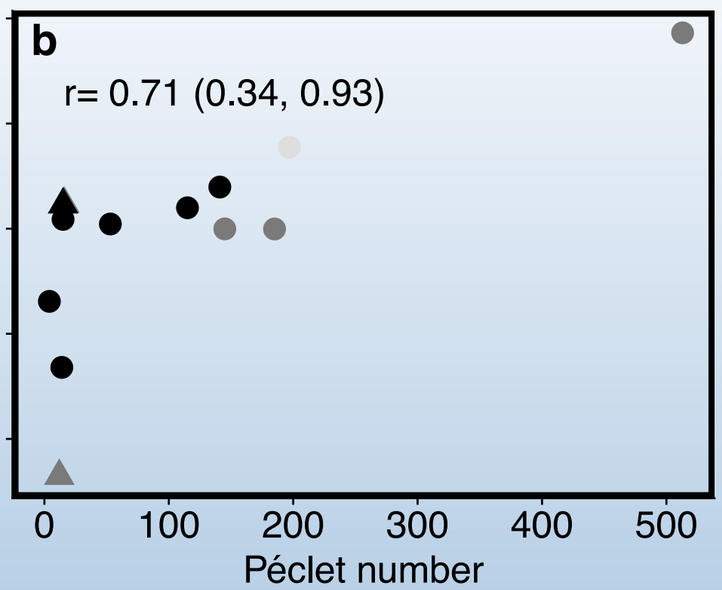

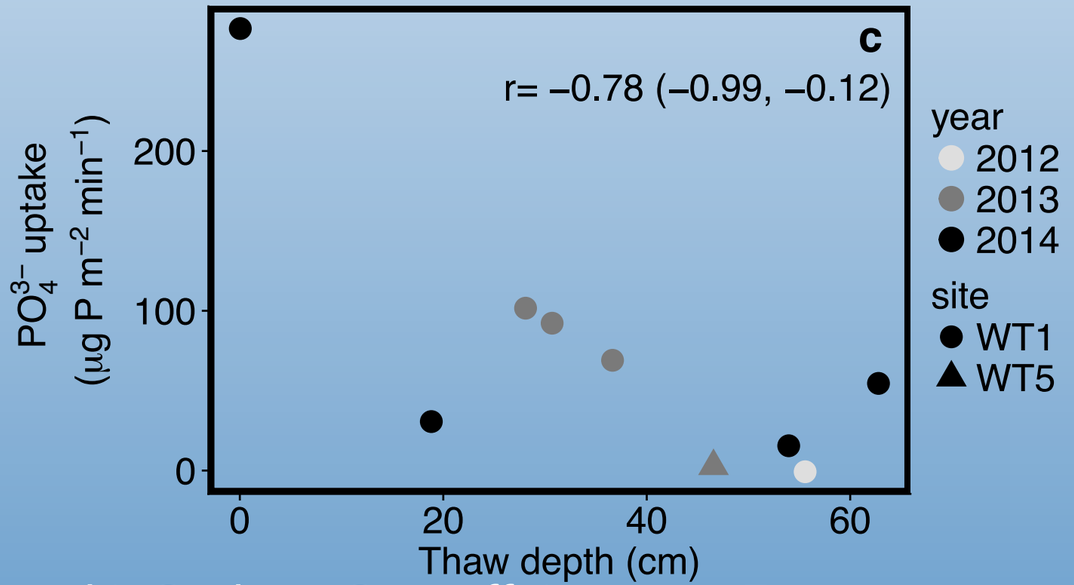

Harms, Cook, Wlostowski, Godsey, Gooseff, in press, *Ecosystems*

WATER TRACKS TRANSPORT NH_4^+ AND RETAIN PO_4^{3-}

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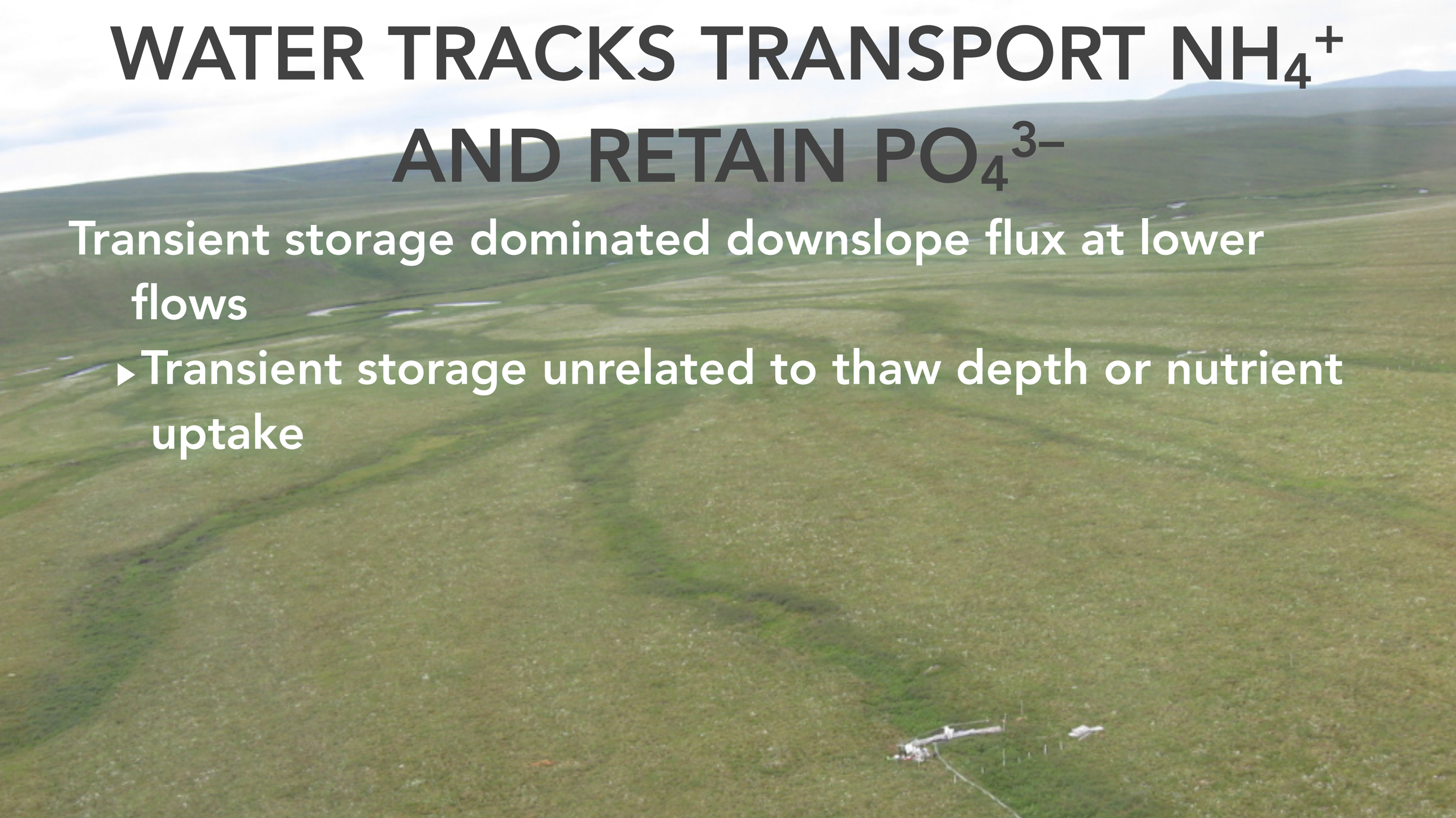

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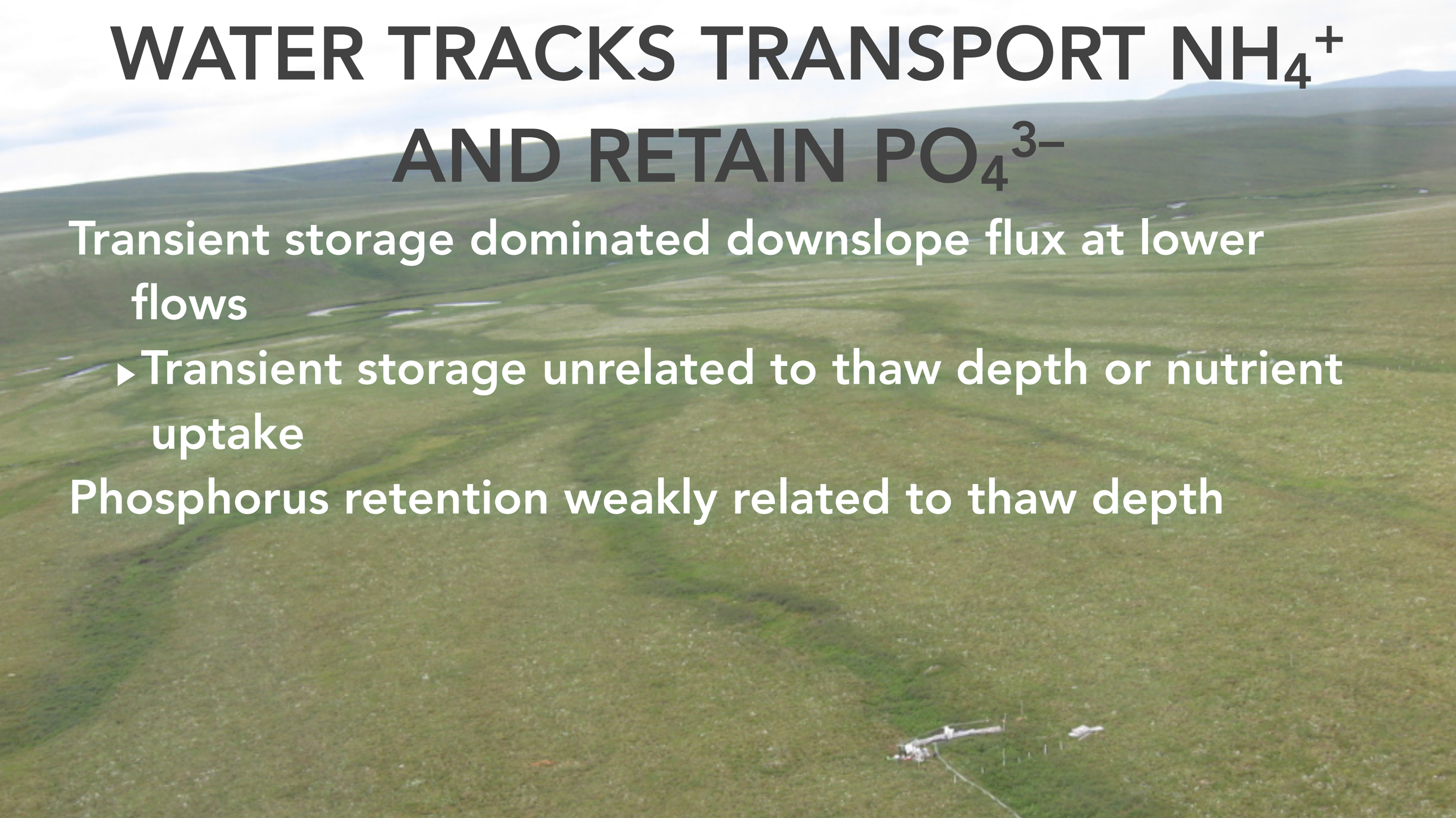
Phosphorus retention weakly related to thaw depth



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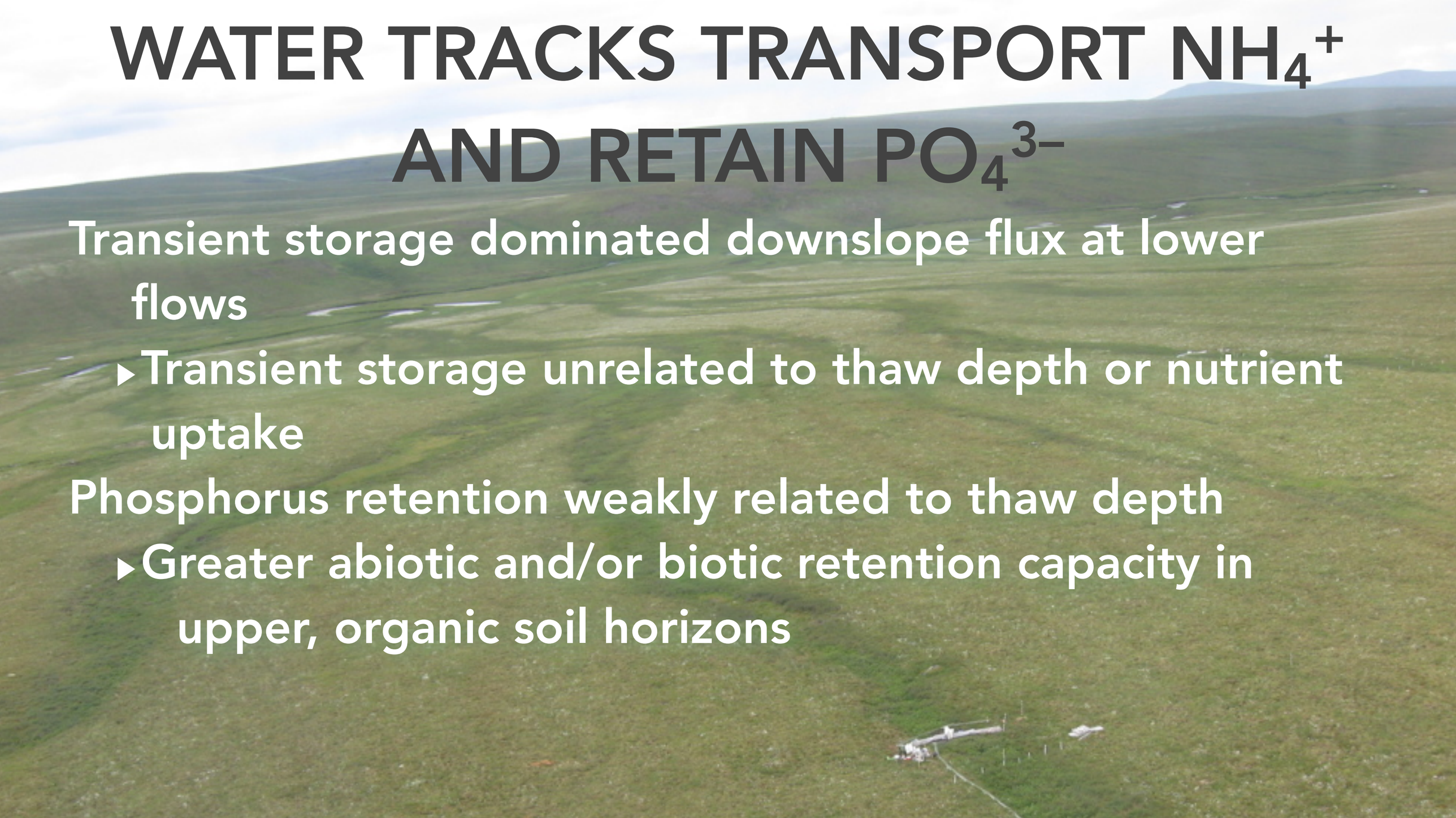


WATER TRACKS TRANSPORT NH_4^+ AND RETAIN PO_4^{3-}

Transient storage dominated downslope flux at lower flows

- Transient storage unrelated to thaw depth or nutrient uptake

Phosphorus retention weakly related to thaw depth

- Greater abiotic and/or biotic retention capacity in upper, organic soil horizons
- Deepening flows through thawed mineral soils might bypass zones of active retention


N release

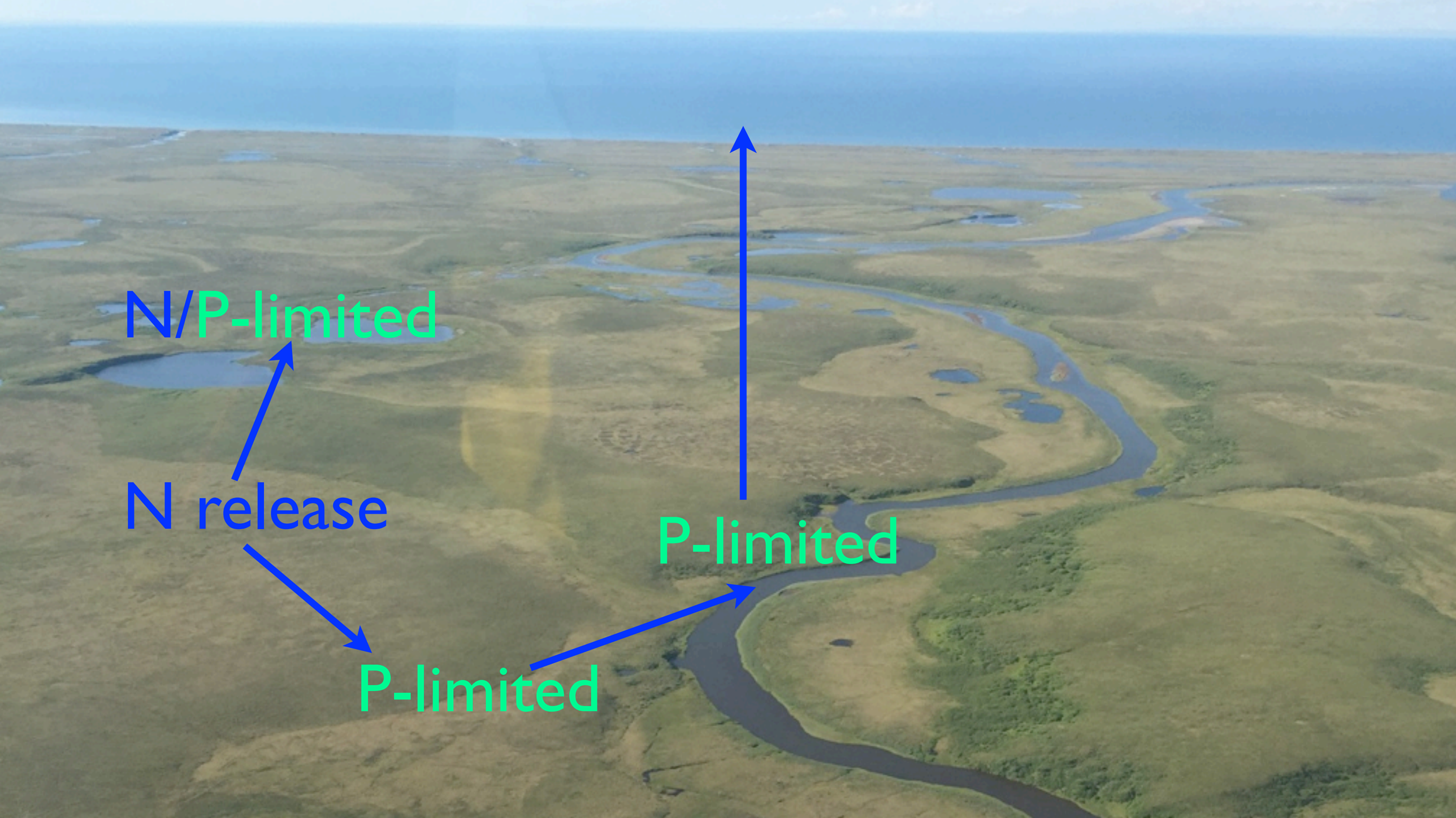

N/P-limited
N release

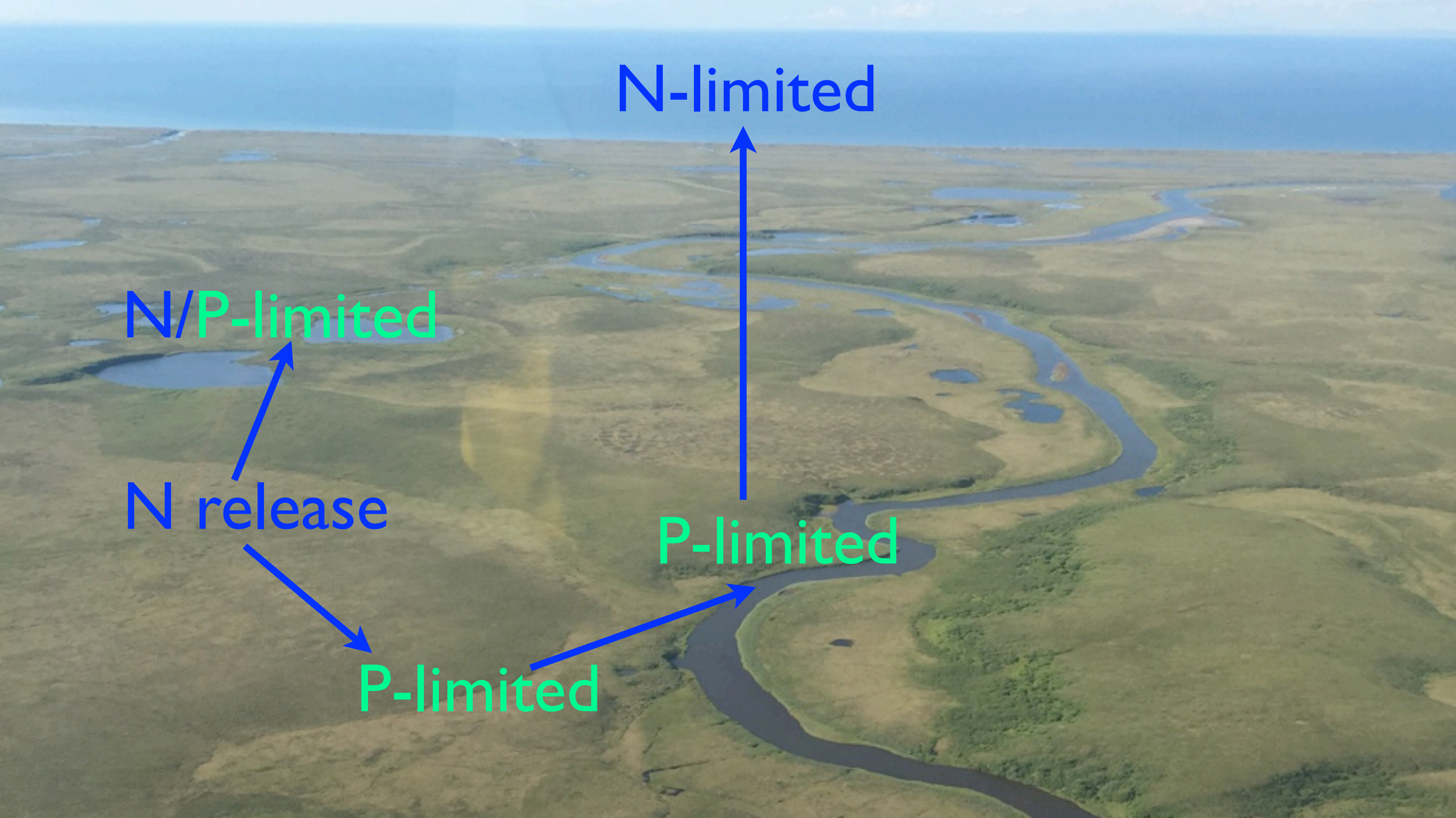

N/P-limited
N release


N/P-limited
N release
P-limited

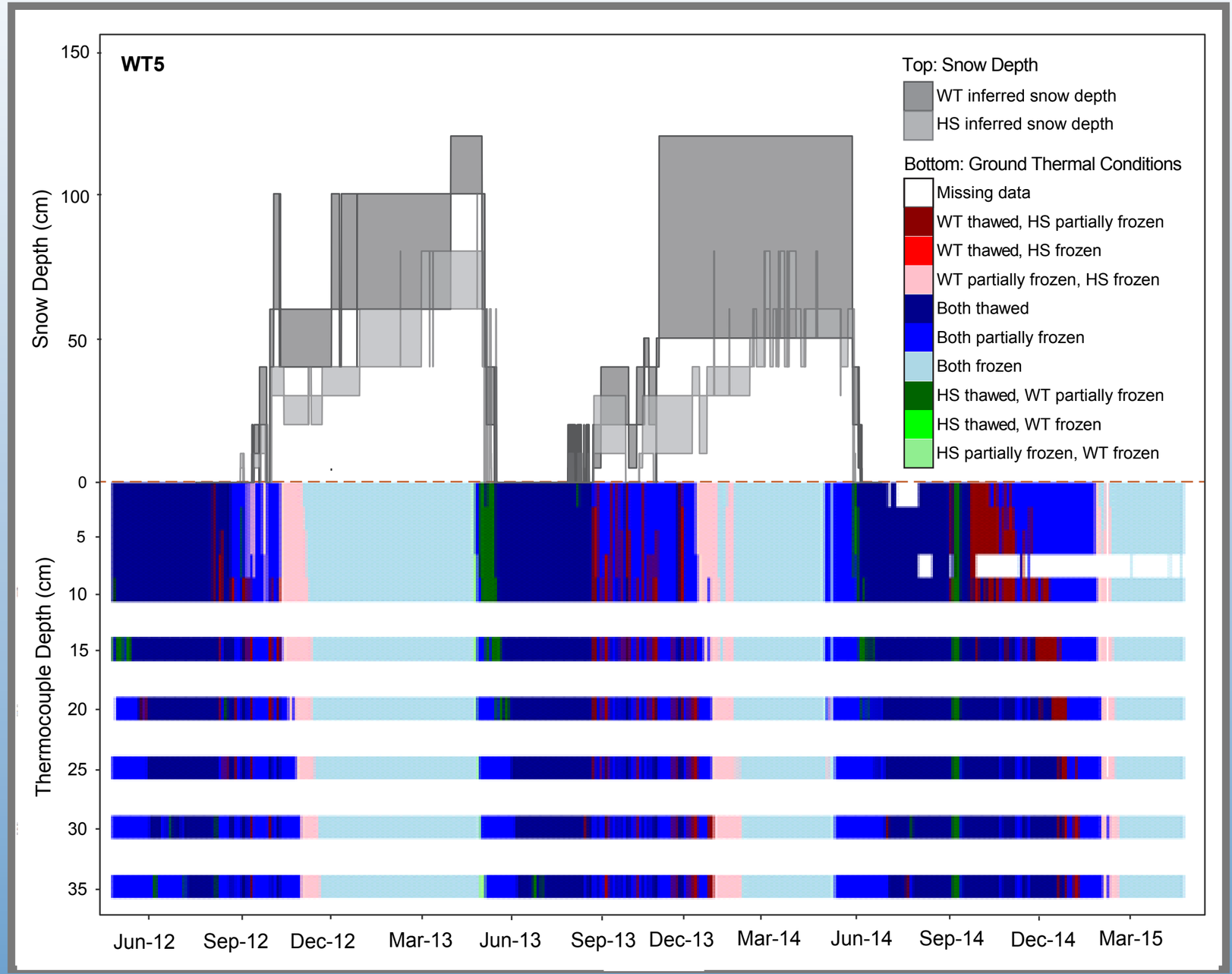

N/P-limited
N release
P-limited


N/P-limited
N release
P-limited
P-limited


N/P-limited
N release
P-limited
P-limited


N-limited
N/P-limited
N release
P-limited
P-limited

UNFROZEN SOILS IN WINTER



Rushlow, Godsey, & Harms, in prep

FUTURE PROSPECTS

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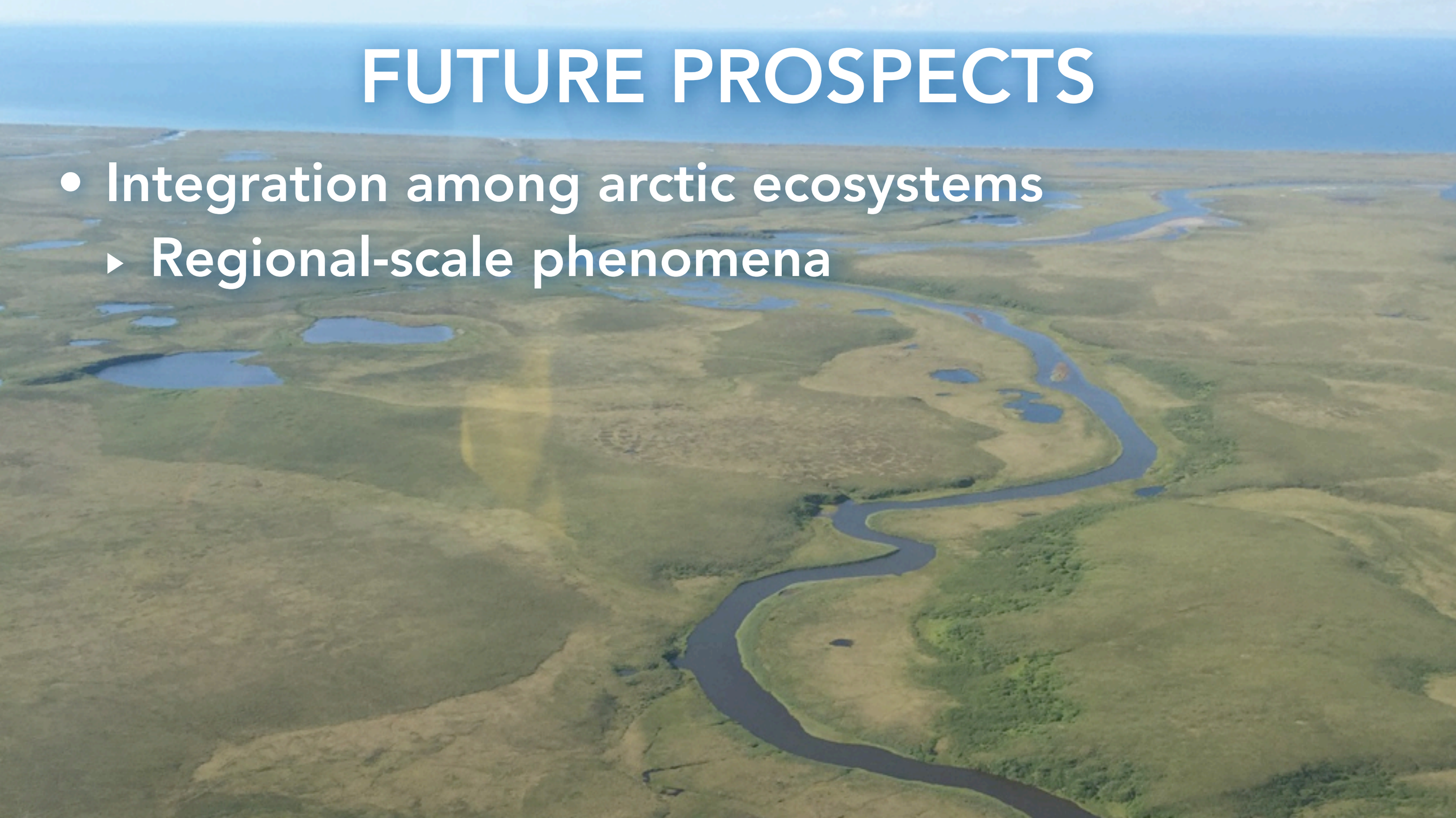
  - Regional-scale phenomena



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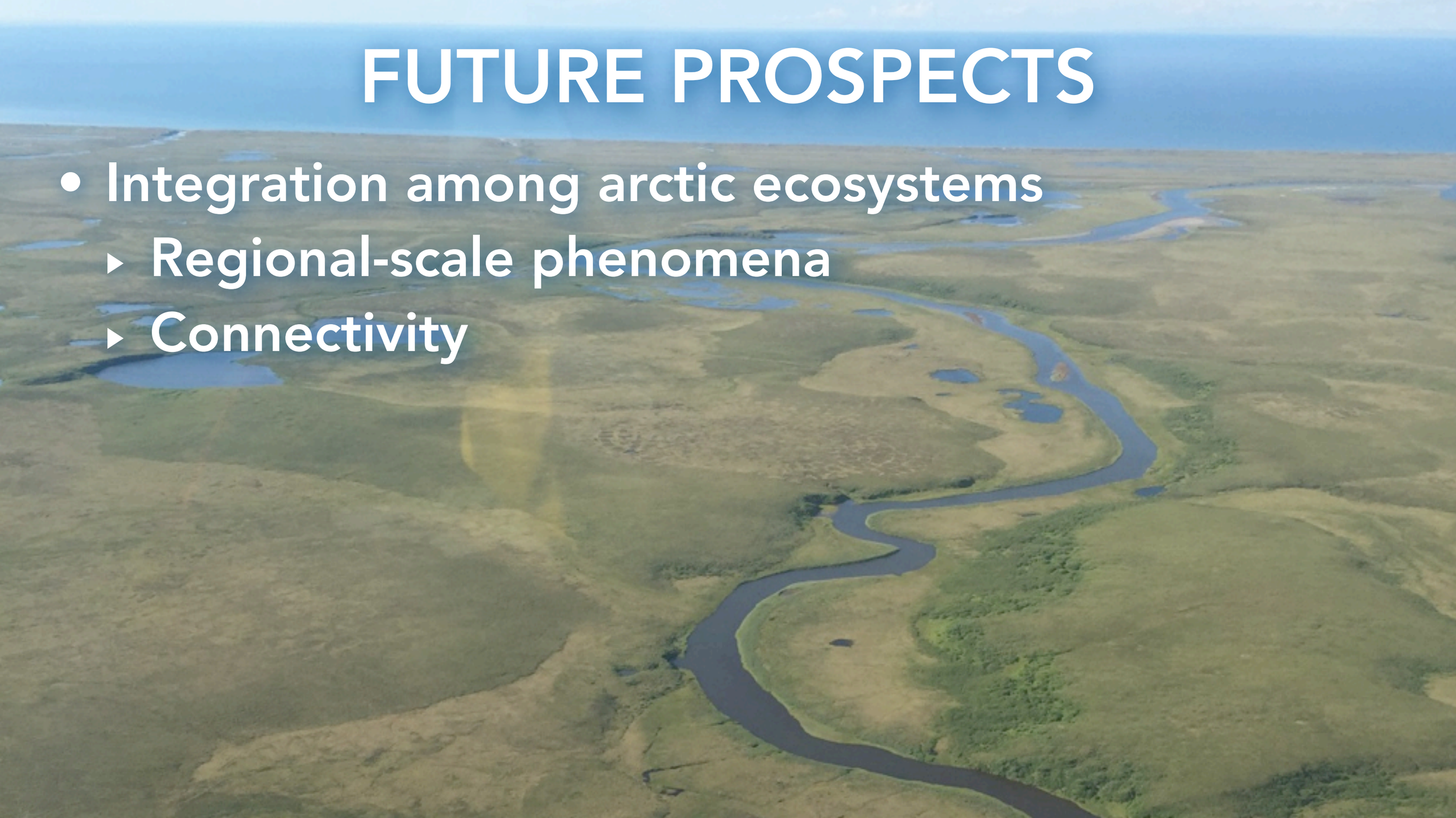
- Integration among arctic ecosystems
  - Regional-scale phenomena
  - Connectivity



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  - Logistics challenges