# Large wood as a driver and feedback of river corridor spatial heterogeneity

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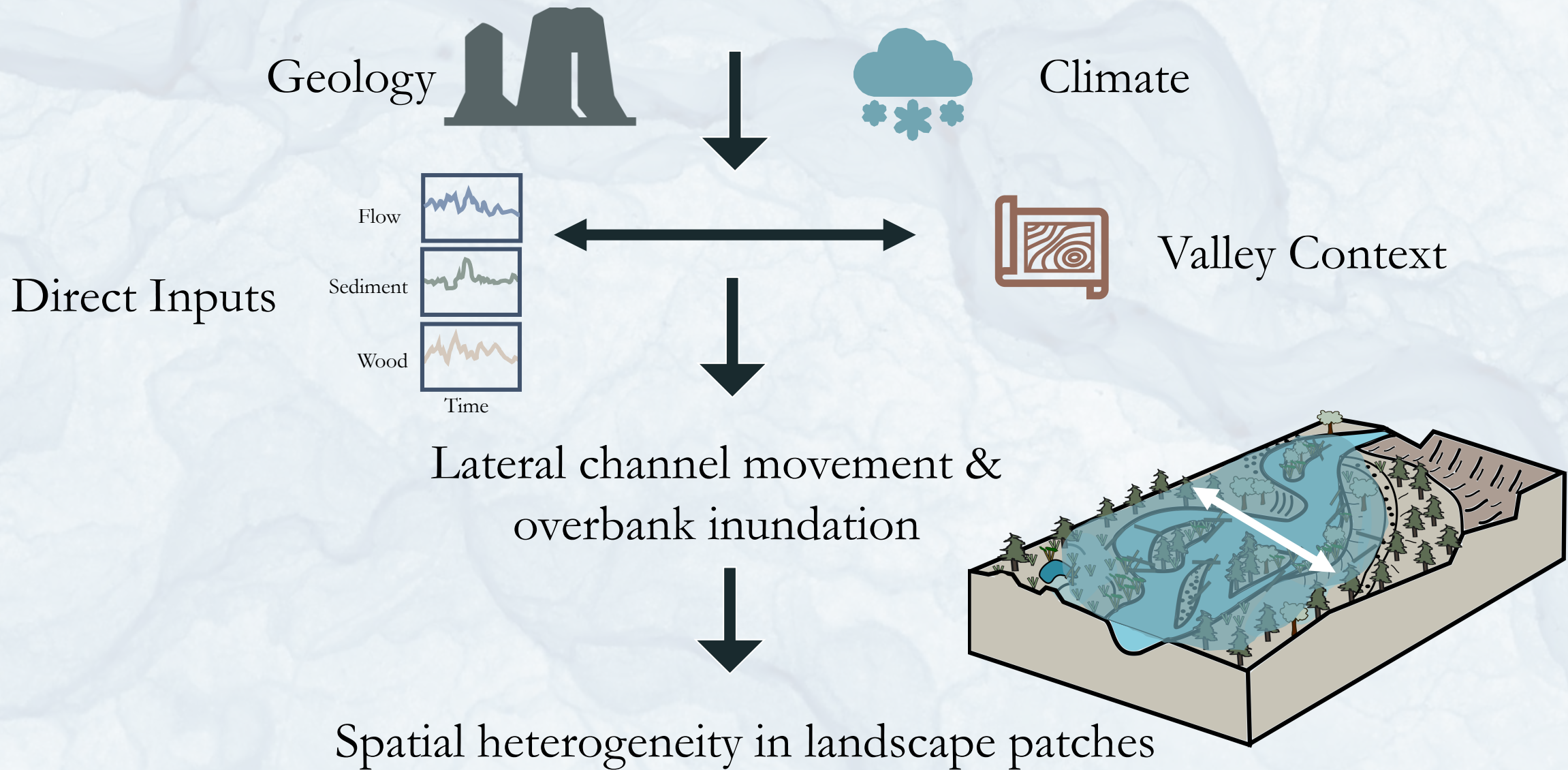
Large Wood Applications in River Restoration Workshop – February 13, 2025

What is a river corridor?

River corridor = active channel(s), the adjacent floodplain and riparian zone, and the underlying hyporheic zone (Harvey and Gooseff, 2015; Ward 1989)

Adapted from Marshall et al. (2024), *Water Resources Research*
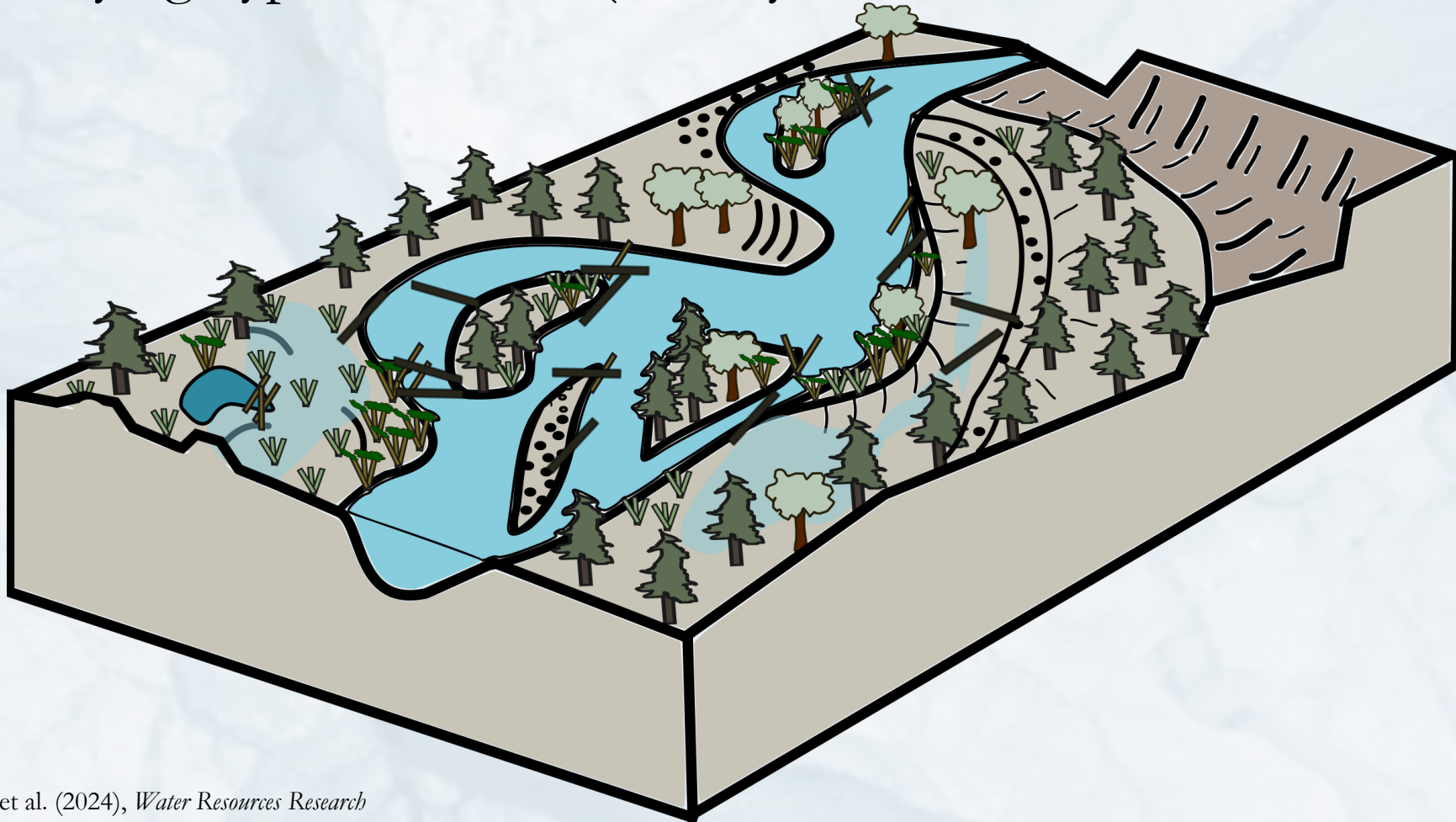
What is spatial heterogeneity?

The importance of river corridor spatial heterogeneity

Wide, low-gradient zones of the river corridor with wood-included spatial heterogeneity are important for:

Absorbing disturbance inputs

Enhancing hyporheic exchange

Creating & maintaining habitat diversity
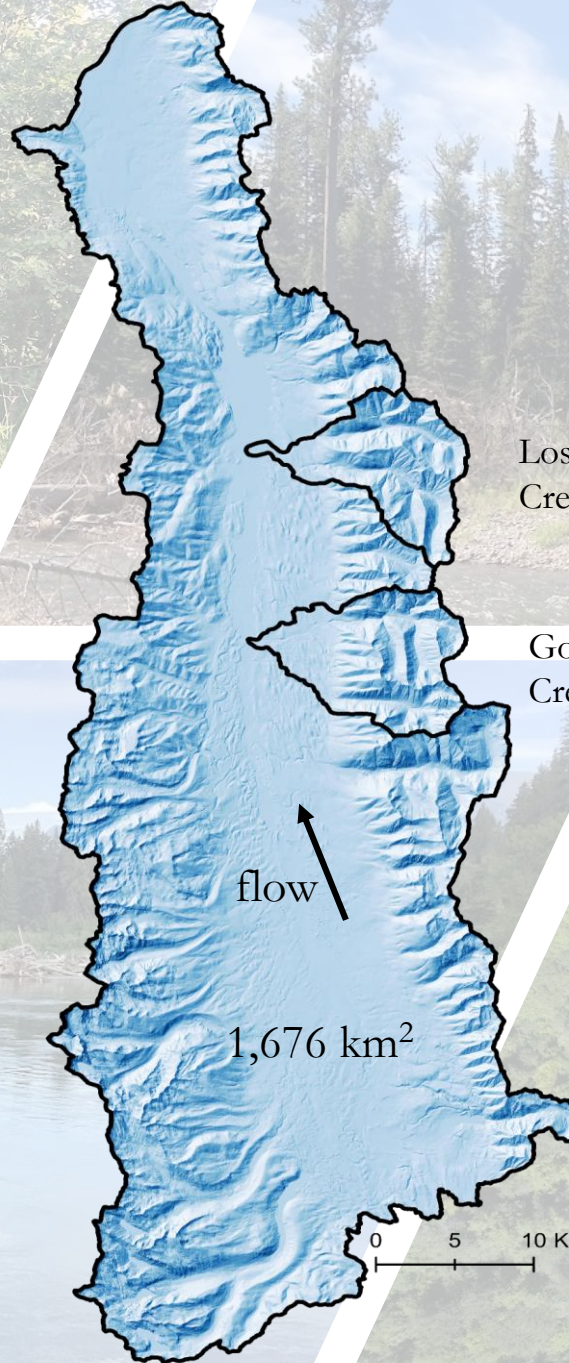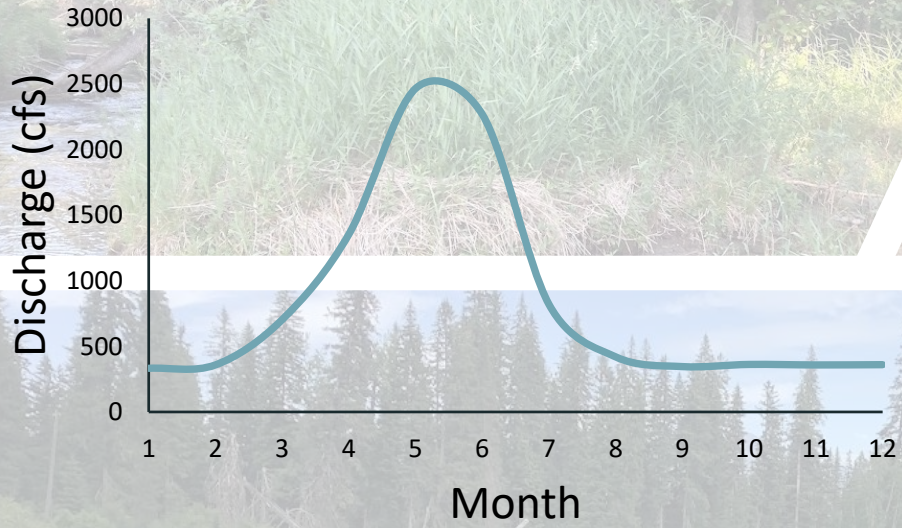
Societal expectations
Simple, stable
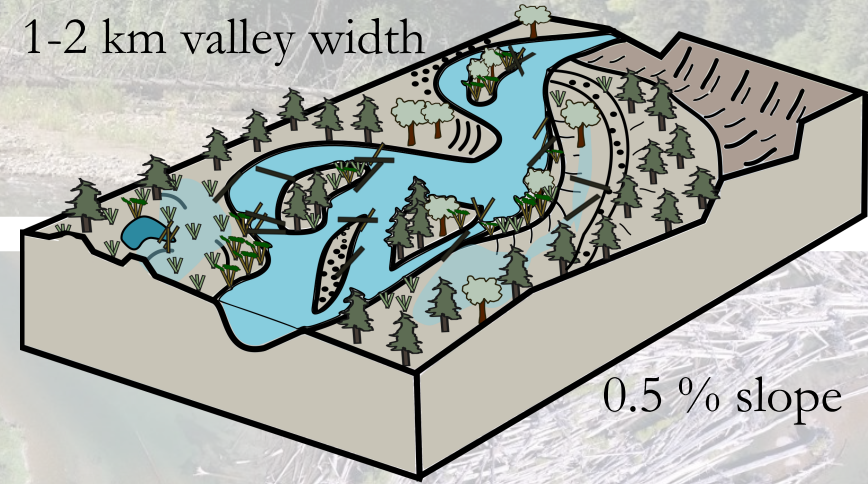
Scientific understanding
Dynamic, spatially heterogeneous

The role of wood in fostering river corridor spatial heterogeneity?
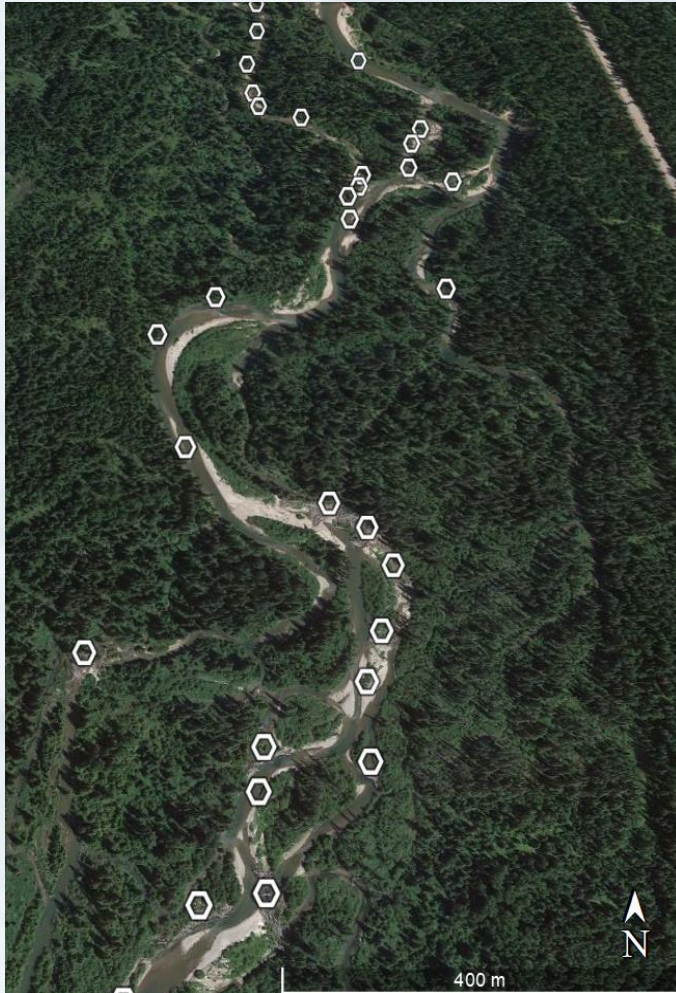
Swan River Catchment

Annual Hydrograph

Lost Creek

Goat Creek

flow

1,676 km²

0   5   10 Kilometers

River Corridor Geometry

1-2 km valley width

0.5 % slope

Evaluating interactions of channel dynamism, logjams, and spatial heterogeneity

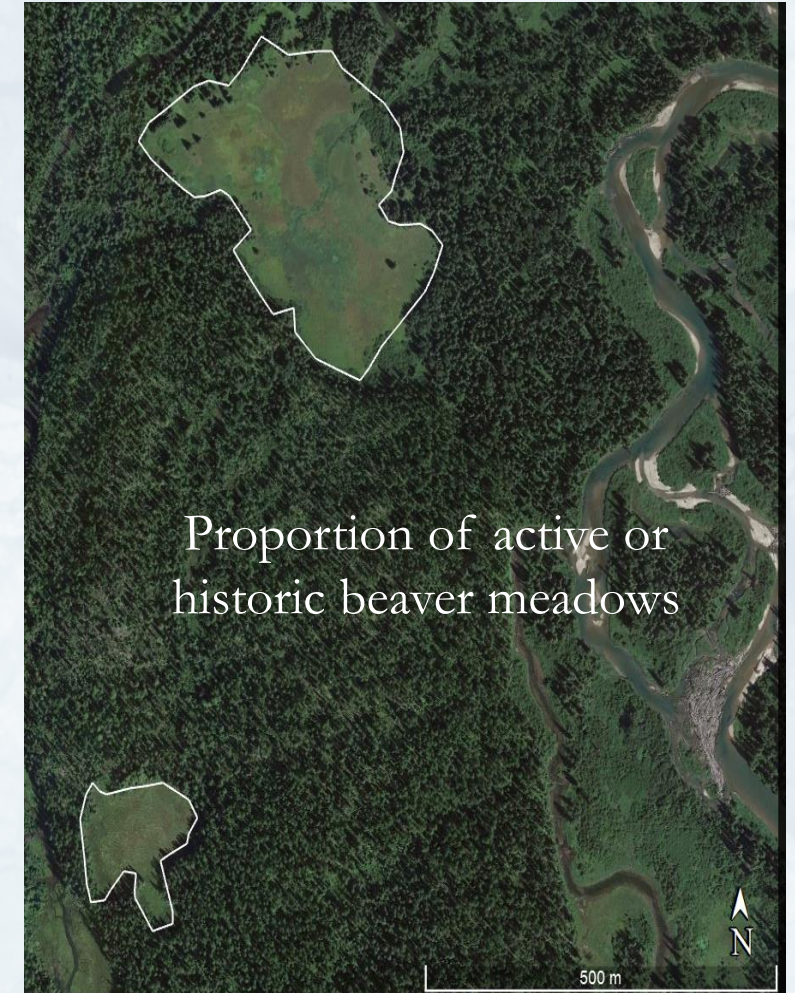**Logjams**: presence, persistence, distribution density of wood accumulations

2022

2016

2010

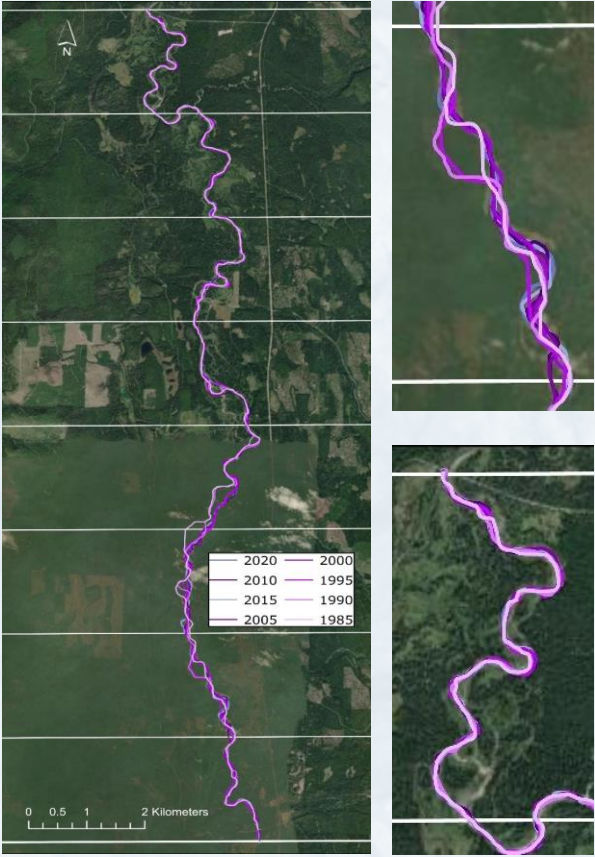Proportion of active or historic beaver meadows

Evaluating interactions of channel dynamism, logjams, and spatial heterogeneity

Channel dynamism: how much do the channels move
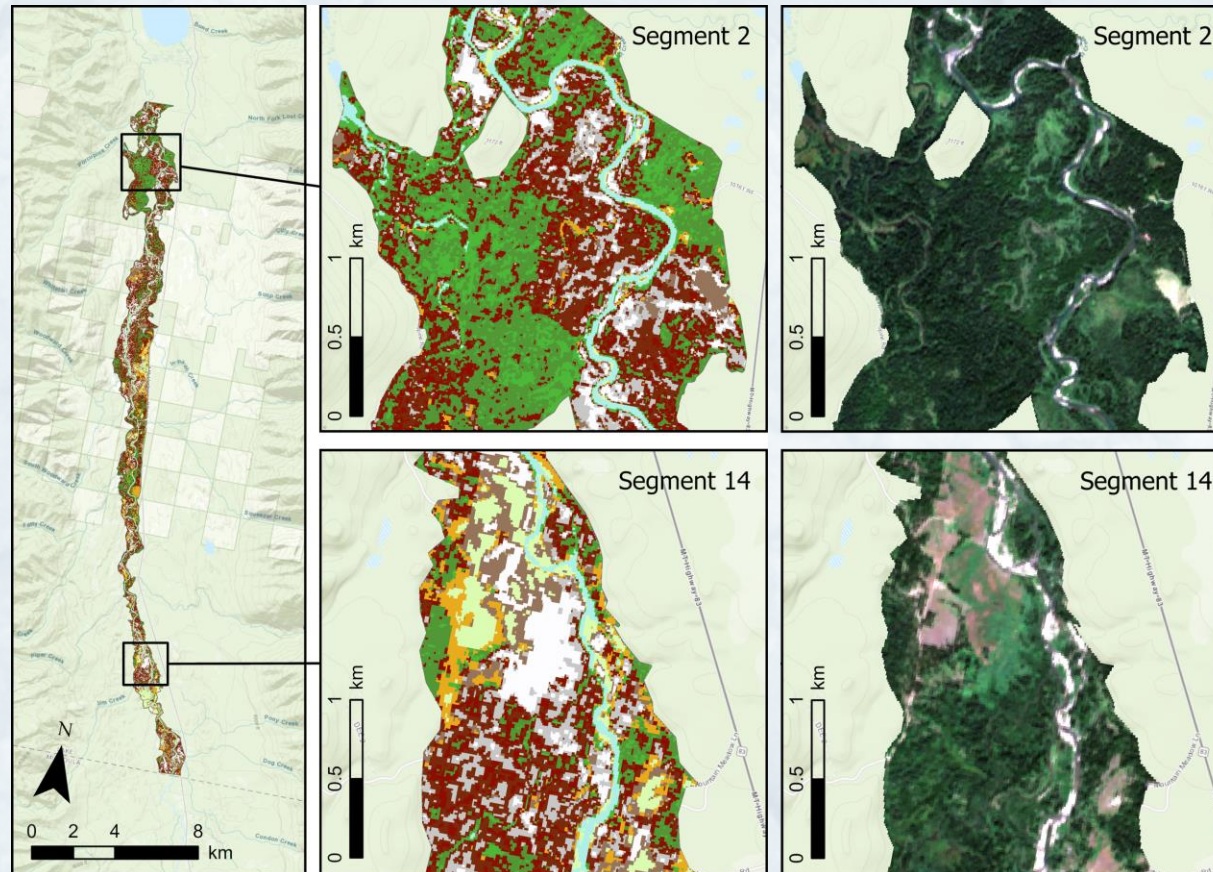
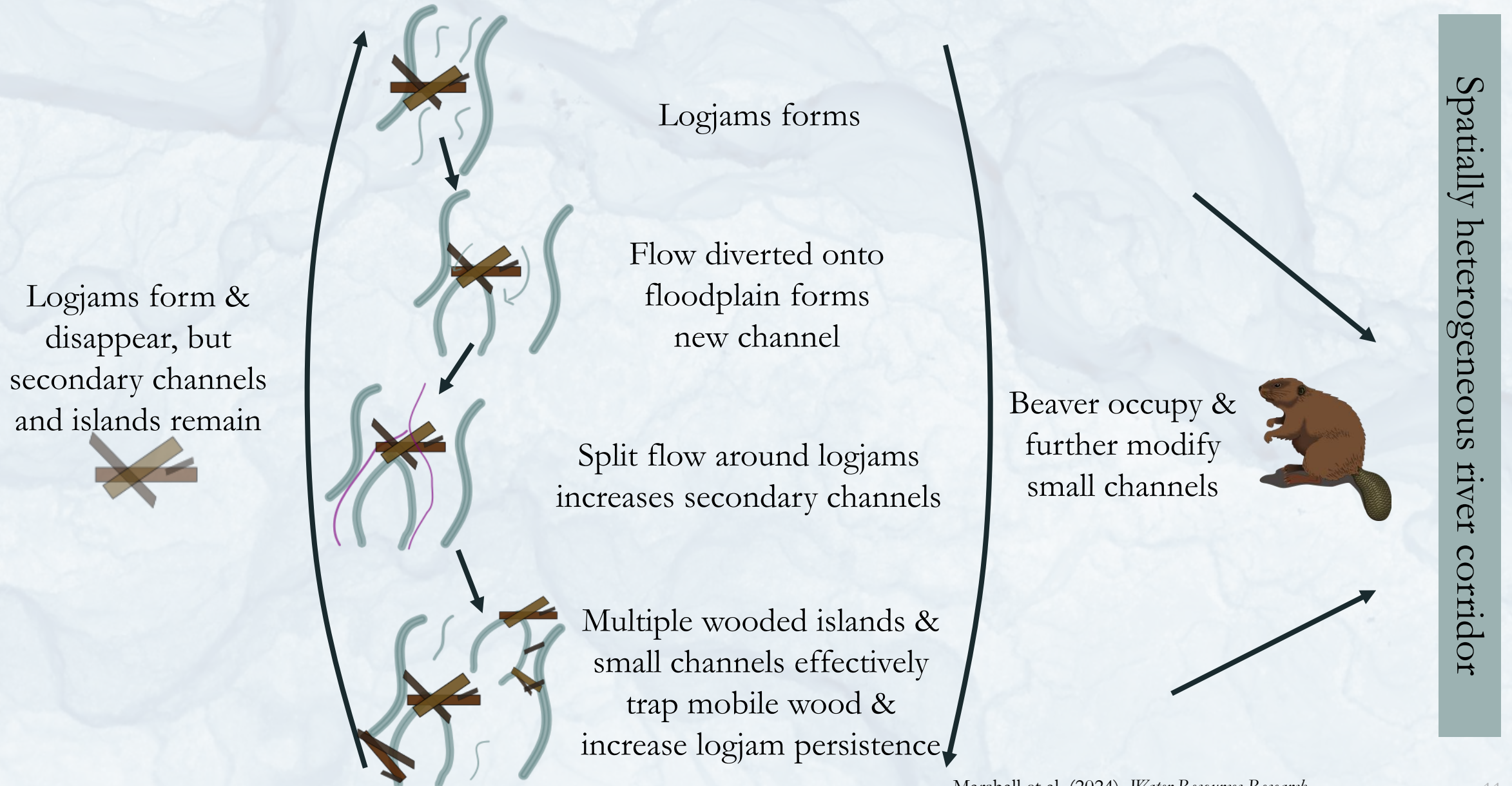Average channel migration

Total sinuosity

Evaluating interactions of channel dynamism, logjams, and spatial heterogeneity
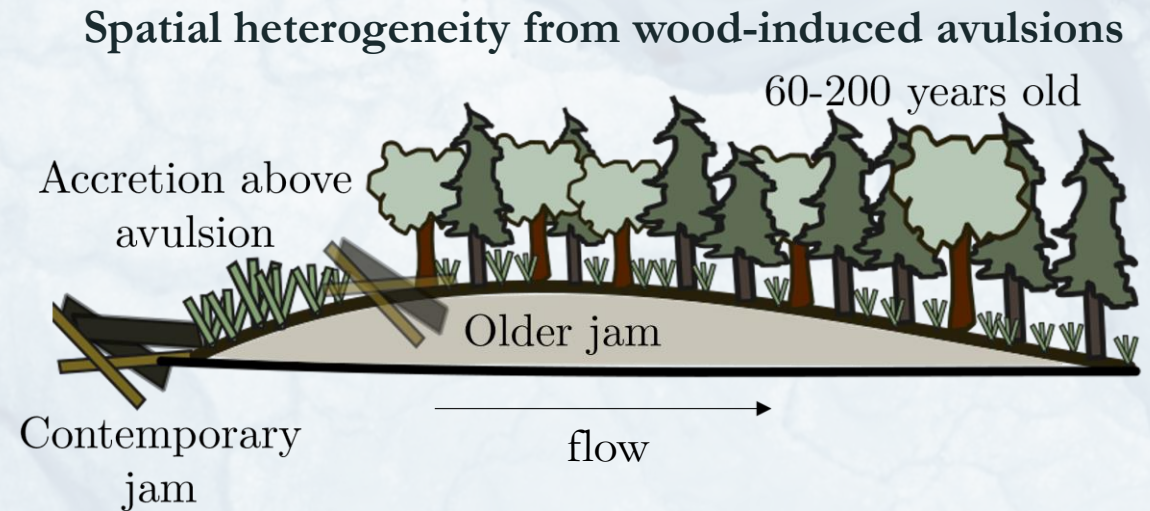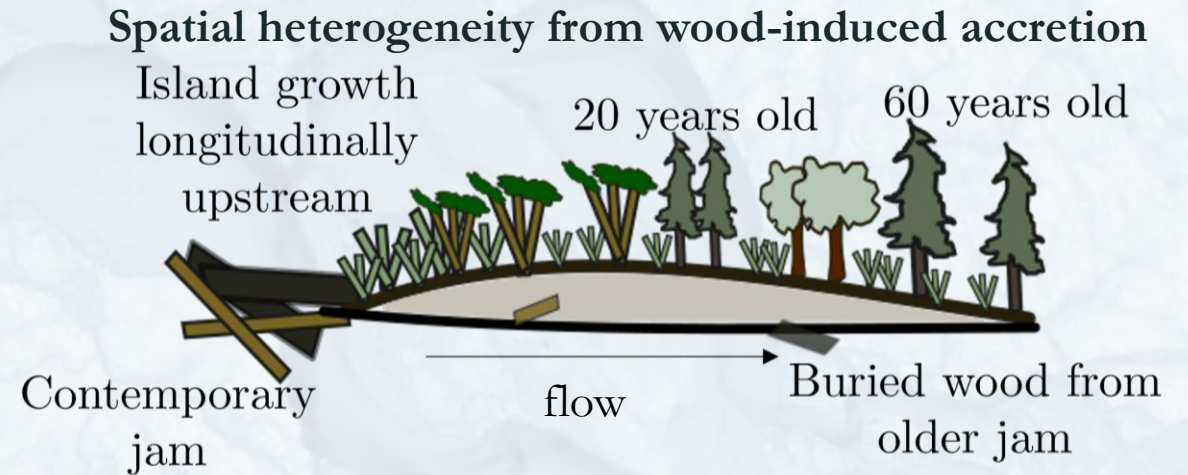
Spatial heterogeneity: similarities in topography, substrate, or vegetation as landscape patches

Reaches with more logjams and channel dynamism have higher spatial heterogeneity

Logjams forms

Flow diverted onto floodplain forms new channel

Split flow around logjams increases secondary channels

Multiple wooded islands & small channels effectively trap mobile wood & increase logjam persistence

Logjams form & disappear, but secondary channels and islands remain

Beaver occupy & further modify small channels

Spatially heterogeneous river corridor

Spatial heterogeneity persists after logjams are no longer present

Spatial heterogeneity from wood-induced accretion

Island growth longitudinally upstream

20 years old

60 years old

Contemporary jam

flow

Buried wood from older jam

Spatial heterogeneity from wood-induced avulsions

60-200 years old

Accretion above avulsion

Older jam

Contemporary jam

flow

Marshall and Wohl, (2024), *Earth Surface Processes & Landforms*

Using our understanding of wood-induced river processes in river restoration

- Sections of the river corridor with more logjams and more beaver meadows had higher spatial heterogeneity
  - Prioritizing wide, wood-rich retention zones within a river corridor is important for fostering spatial heterogeneity

Wohl, Marshall, et al. (2022), *Science of the Total Environment*

Using our understanding of wood-induced river processes in river restoration

Spatial heterogeneity persists after logjams are no longer present

- Wood reintroduced to the river corridor does not have to be anchored in place to facilitate heterogeneity

Wohl, Uno, Marshall et al., (2023), *River Research & Applications*

Considering the geomorphic context of a river

Process-based restoration, which focuses on restoring conditions under which river processes such as stream flow and sediment movement create and maintain a functioning river corridor is not a one-size-fits-all approach
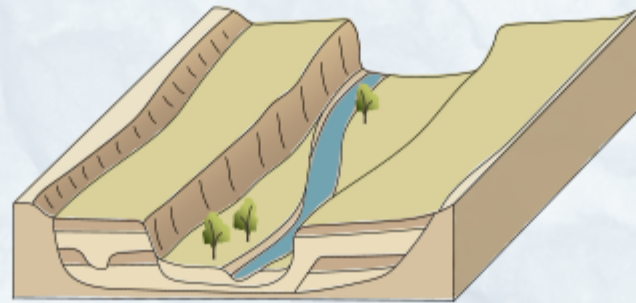

Unconfined beaver meadow
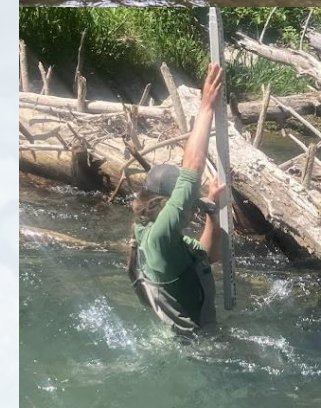
Unconfined multithread

Unconfined meandering
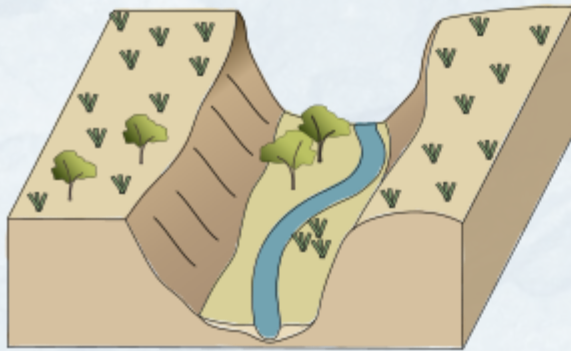
Confined meandering

Terraced meandering

Delta lowland

Wohl, Rathburn, Marshall et al. (2024) *River Research and Applications*

Acknowledgements

I acknowledge that the lands this field research was conducted on are the homelands of the Confederate Salish, Kootenai, and Flathead Tribal Nations and recognize, with respect, the Indigenous peoples as stewards of the land and waters that I worked on.

Thank you!
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