

Perspectives on Connectivity in Canadian Watersheds

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How it all started

CAG 2021

- Workshop on watershed connectivity
- Short presentations on recent and ongoing projects across Canada
- Lots of Q and A and discussion following

Participants

- Genevieve Ali, Faran Ali, Stephen Dery, Masoud Goharrokhi, Sirja Islam, Kristen Kieta, David Lobb, Merrin Macrae, Issac Noyes, Phil Owens, Ellen Petticrew, Kokulan Vivekananthan

How its going

Draft paper being written

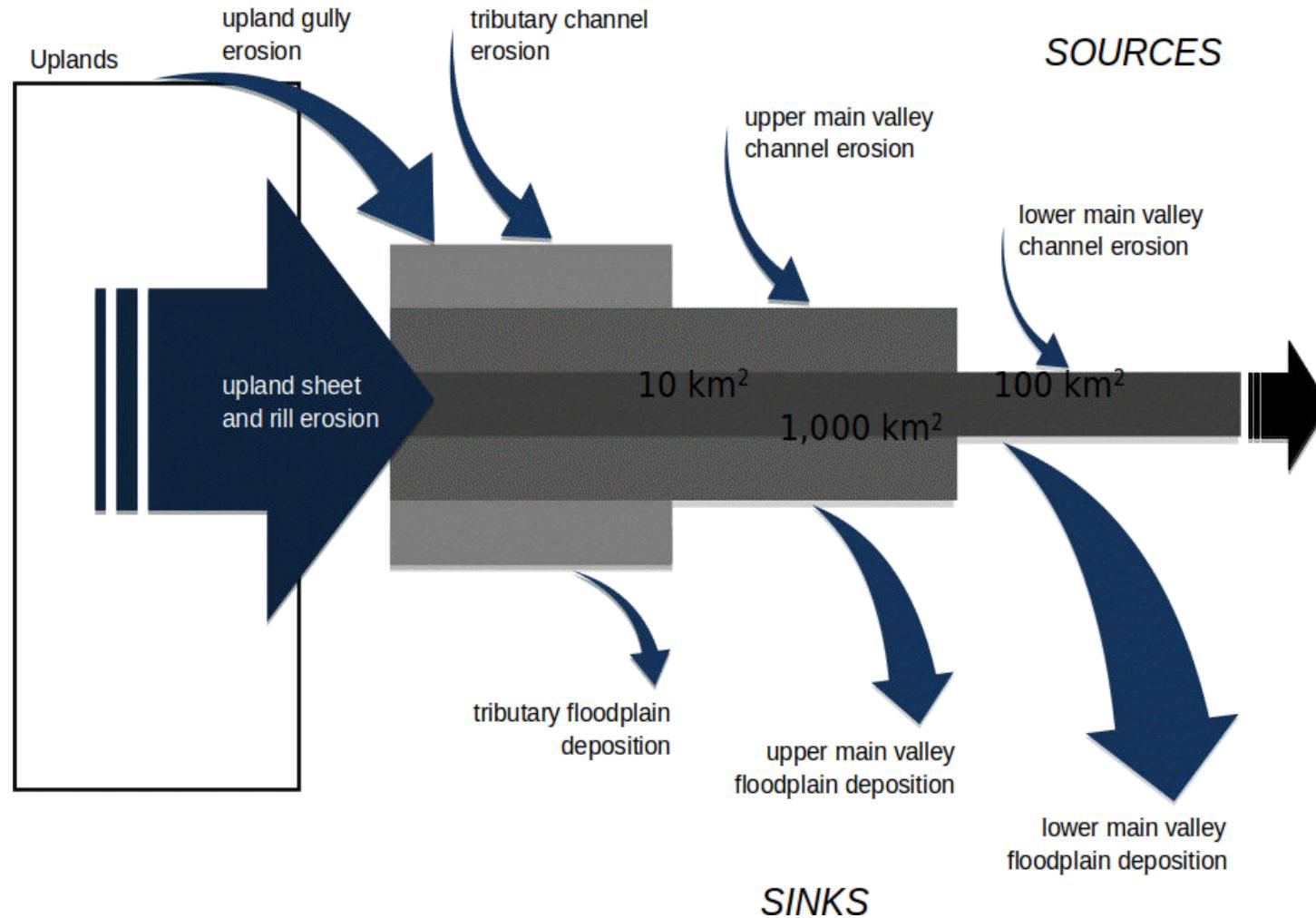
- State of knowledge
- Major themes
- Implications

Consider this presentation an early test drive of a forthcoming publication



What goes in must ...

The path from source to sink is rarely straightforward



Types of connectivity

Structural

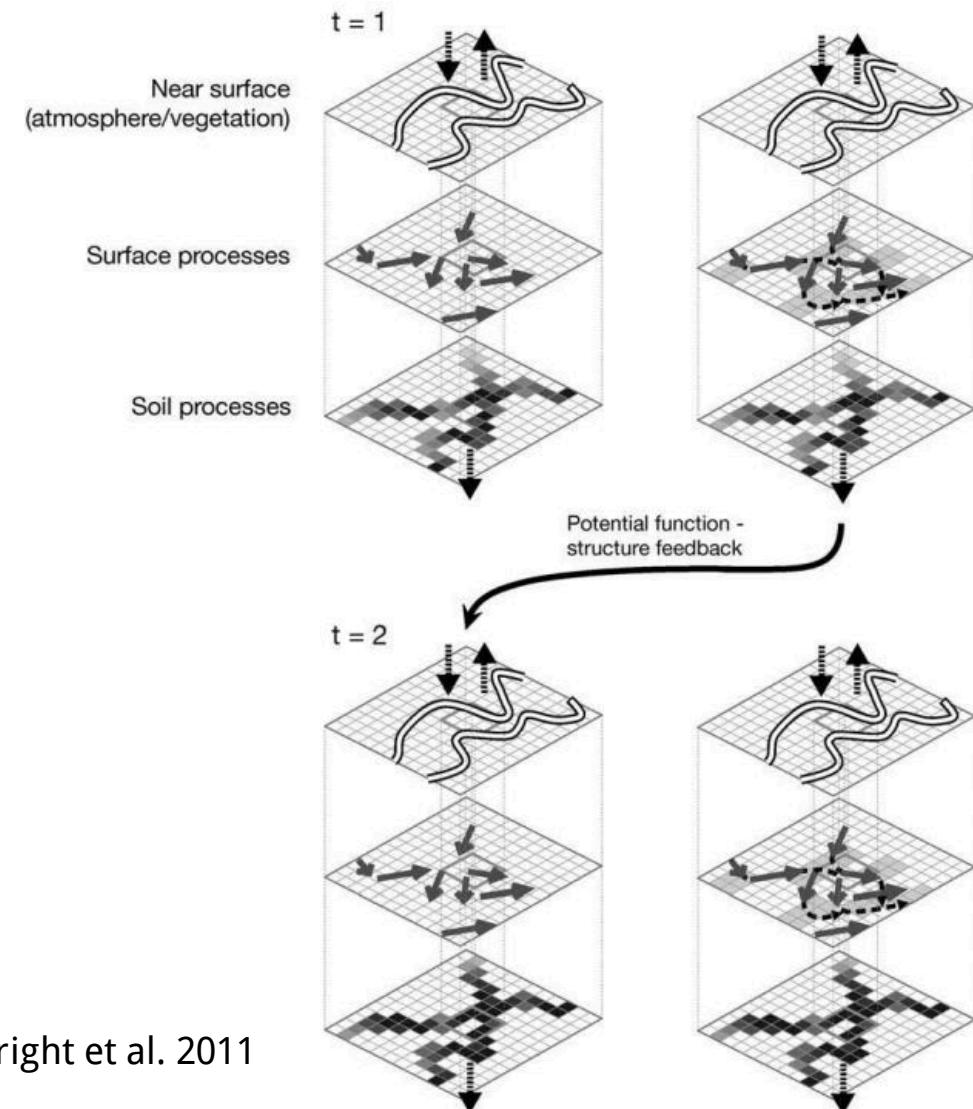
- Configuration of landscape elements
 - Location, size, shape, number

Functional

- Linkage of landscape elements by a process(es)
 - Flows of energy and materials

Changes

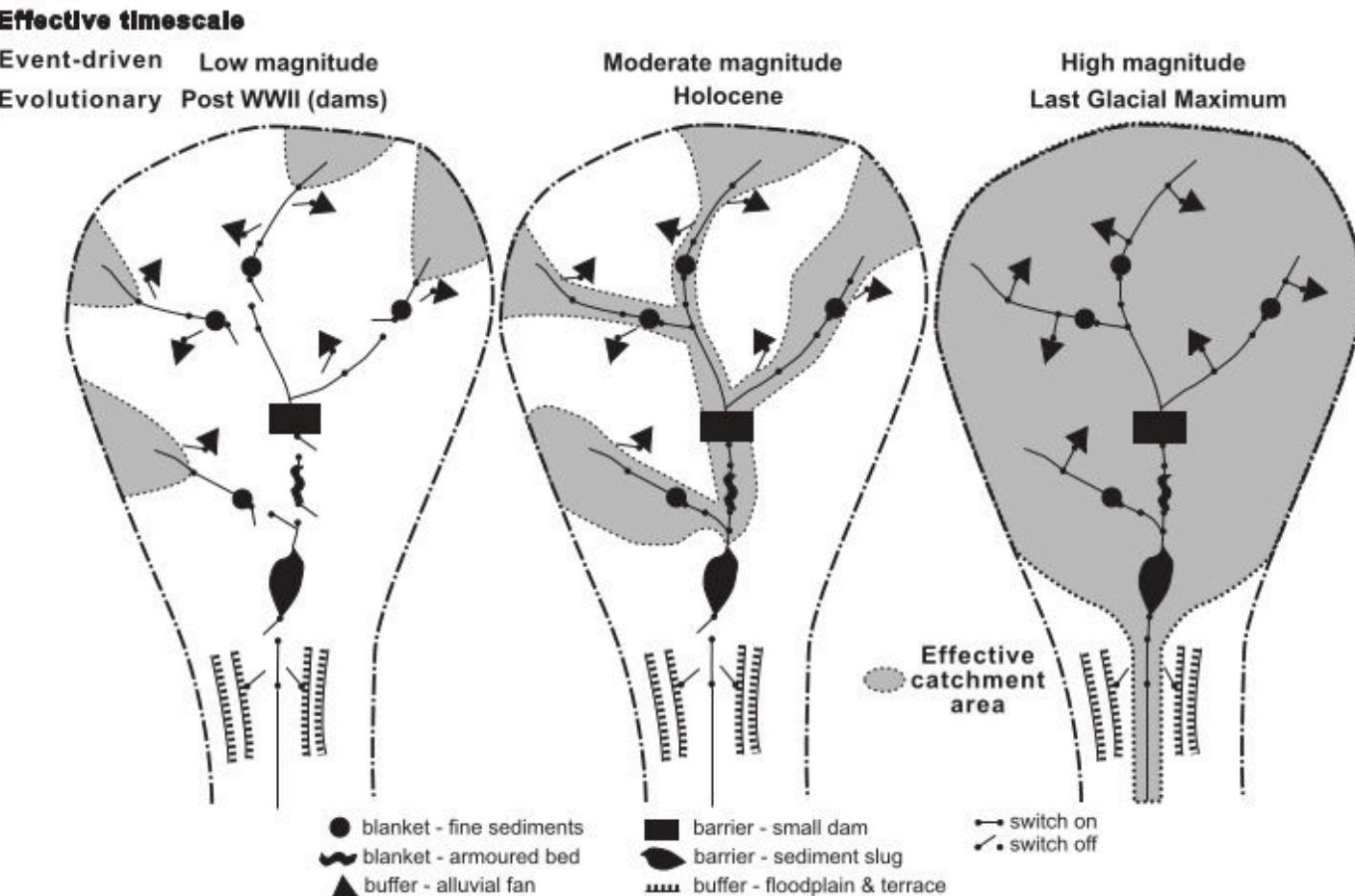
- Alteration of the structure and function over time
 - Function-structure feedback



Wainwright et al. 2011

Scale

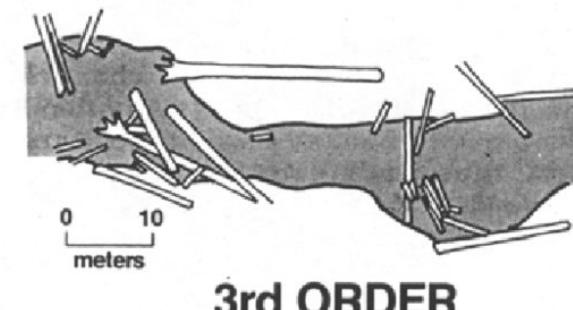
Degree of connectivity depends on the temporal and spatial scale of observation/interest



Land use change

Forestry

- Reduced evapotranspiration → Increased connectivity
- Increased LWD → Decreased connectivity
- Increased landslides → ??



Booth et al. 1997

Land use change

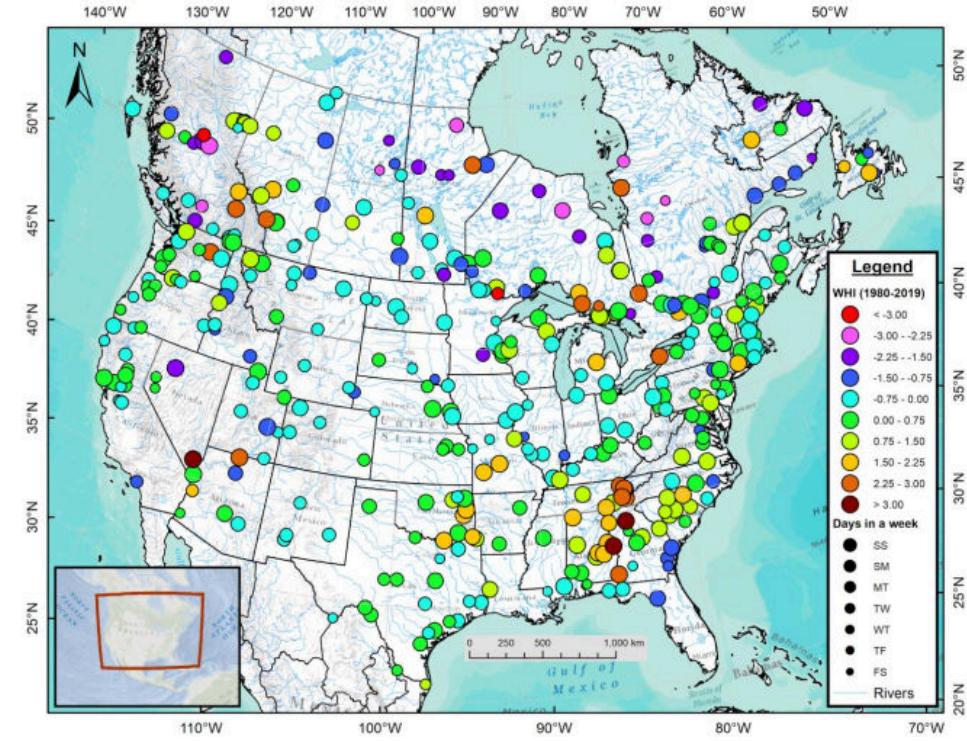
Agriculture

- Creation of surface and subsurface drains → Increased connectivity
- Drainage of wetlands → Increased connectivity
- Tillage ridges → Decreased connectivity



River channel changes

- Dams and reservoirs → Decreased connectivity
- Channelization in urban areas → Increased connectivity
- Culverts → Depends on design and purpose

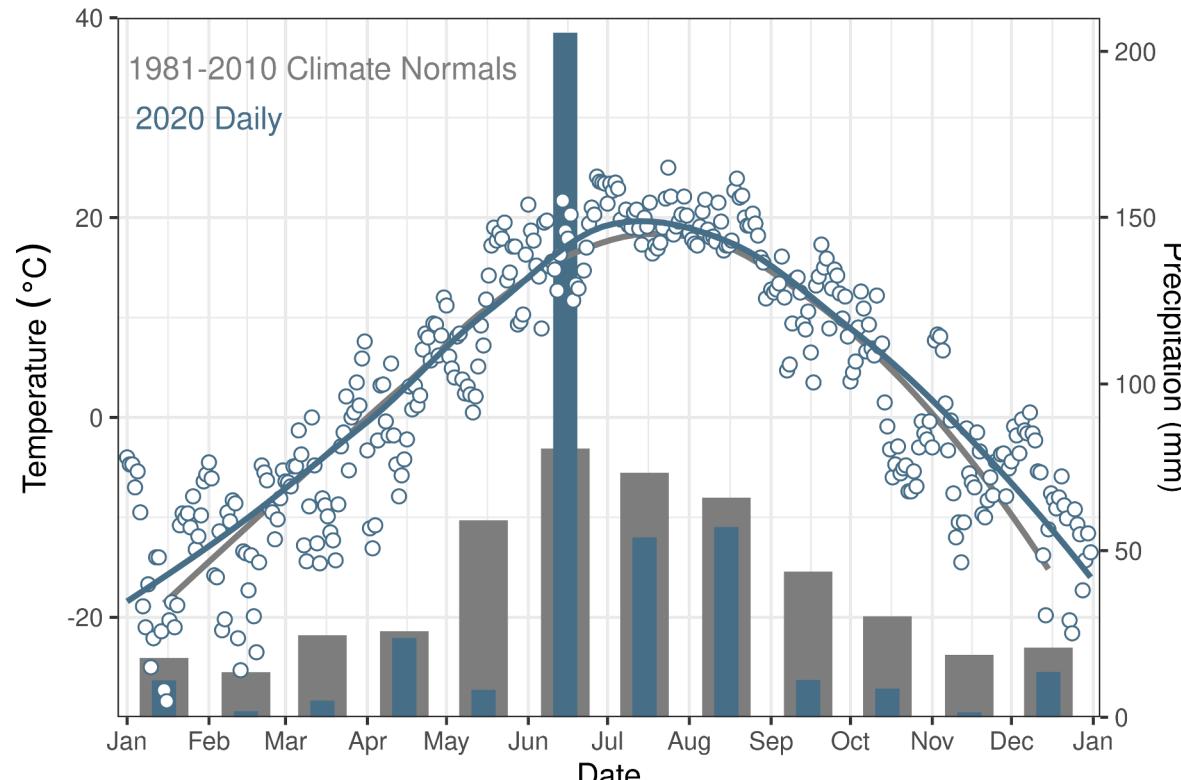


Dery et al. 2021

Climate change

Changes in precipitation and temperature

- Change in precipitation types, frequency & intensities (magnitude and duration) → Complicated
- Increased droughts resulting in the loss of the "fill and spill" of potholes → Decreased connectivity



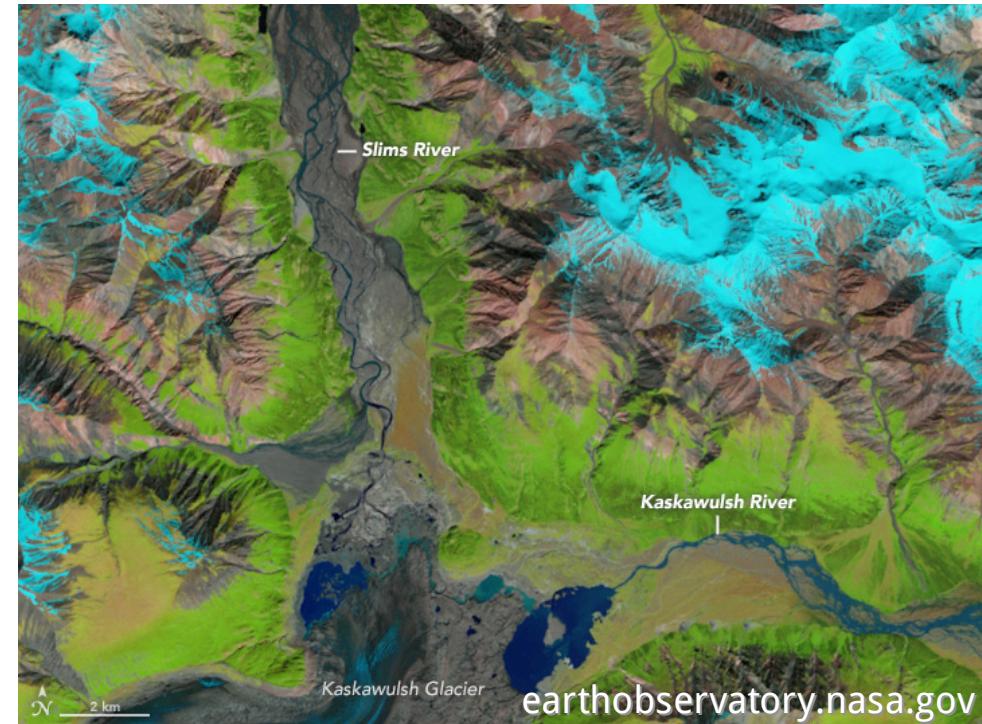
Climate change

Wildfire

- Decreases in evapotranspiration and infiltration, and increase in soil hydrophobicity → Changes in the amount and timing of runoff and sediment and chemical fluxes

Cryosphere

- Receding glaciers → Complicated
 - River piracy → Reconfiguration in connectivity
 - Faster rates of melting → Increased connectivity
 - Smaller/disappearing glaciers → Decreased connectivity
- Permafrost degradation → Shift from overland to subsurface flows



Regional challenges

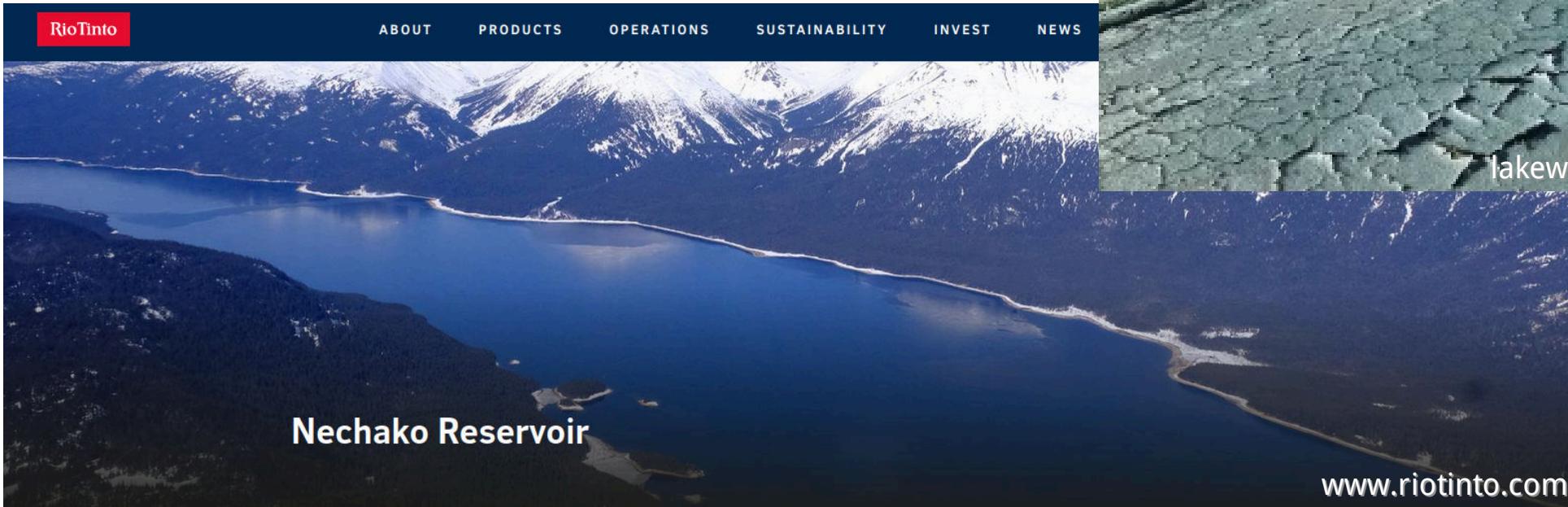
Geography matters

- Urban vs rural
- Forested vs prairies
- North vs south
- Resource development
- Climate change



Impacts on water resources

- Water security (access, quantity, quality)
- Indigenous traditional territories
- Power production and industrial development
- Aquatic ecosystems



RioTinto

ABOUT PRODUCTS OPERATIONS SUSTAINABILITY INVEST NEWS

Nechako Reservoir

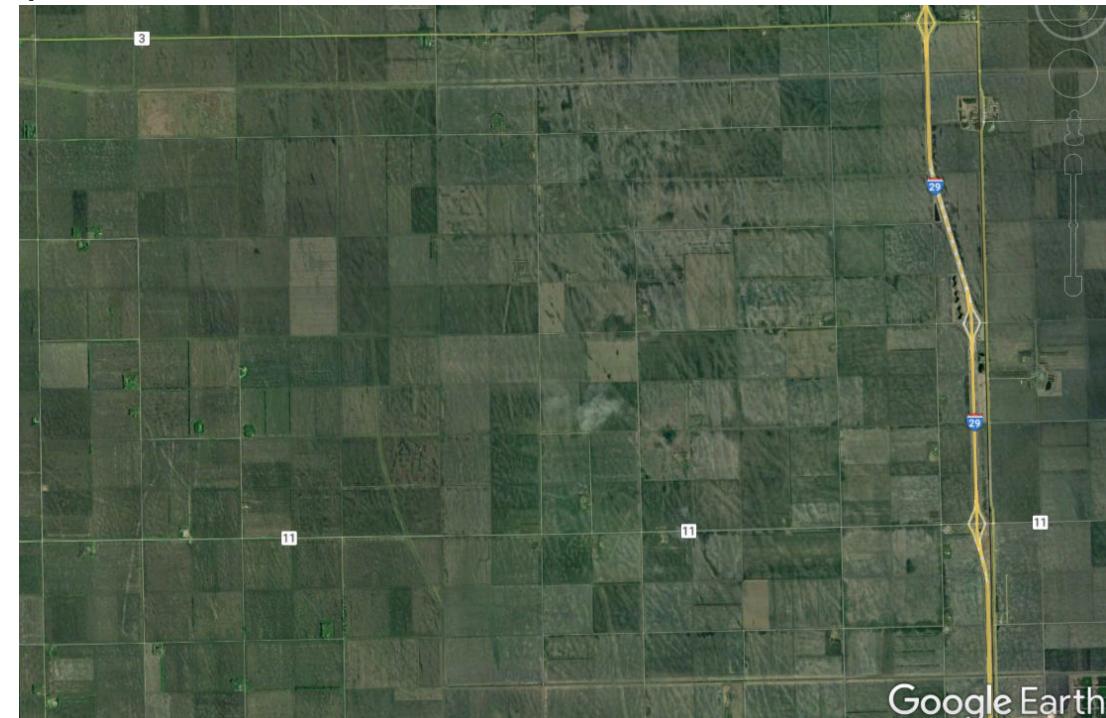
www.riotinto.com

This block contains a large aerial photograph of the Nechako Reservoir, a deep blue body of water nestled in a valley between towering, snow-capped mountain peaks. The reservoir's shoreline is rugged and rocky. In the upper left corner of the image, the Rio Tinto logo is visible. Above the main menu, there are six navigation links: ABOUT, PRODUCTS, OPERATIONS, SUSTAINABILITY, INVEST, and NEWS. At the bottom of the image, the text "Nechako Reservoir" is overlaid. The website address "www.riotinto.com" is located at the very bottom right.

Addressing issues of connectivity

Mitigation

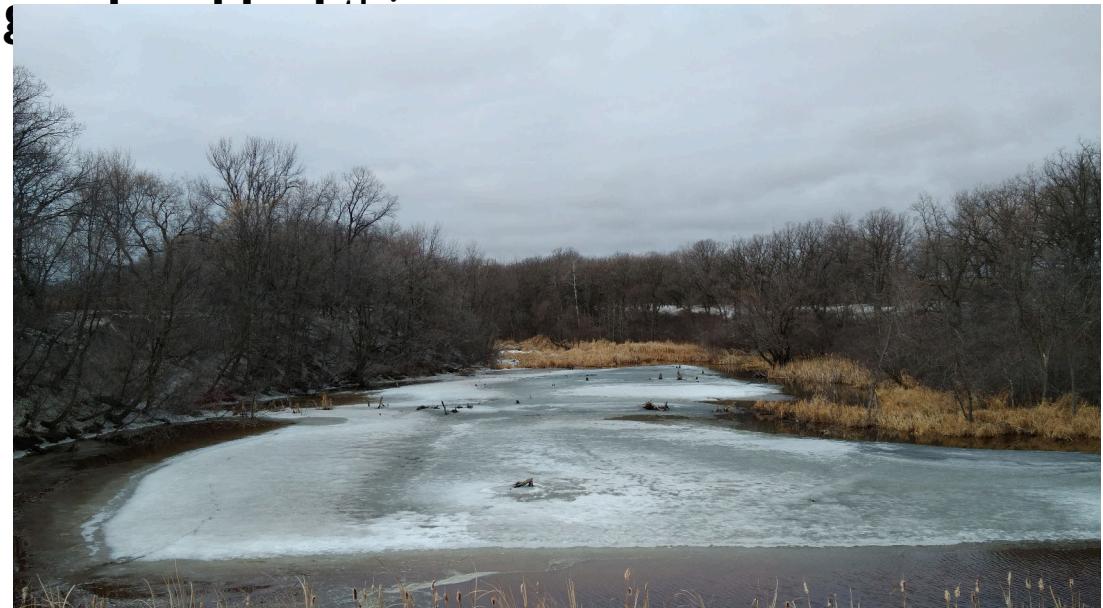
- Limit fragmentation of landscapes and watersheds (roads, pipelines)
- Limit the number of dams and structures and/or better design
- Land management (cover cropping, riparian buffers)
- Multiple stressors → cumulative impacts



Addressing issues of connectivity

Need to consider measures that are relevant to the specific landscape/region

- Sometimes **increasing** connectivity is a good thing
- Sometimes **decreasing** connectivity is a good thing
- Sometimes increasing connectivity in some areas **and** decreasing it in others is a good thing
- Sometimes **decreasing** connectivity is both a good and bad thing



Thank You

Need to consider measures that are relevant to the specific landscape/region

- Sometimes **increasing** connectivity is a good thing
- Sometimes **decreasing** connectivity is a good thing
- Sometimes increasing connectivity in some areas **and** decreasing it in others is a good thing
- Sometimes changing connectivity is both a **good and bad** thing

Thank You!