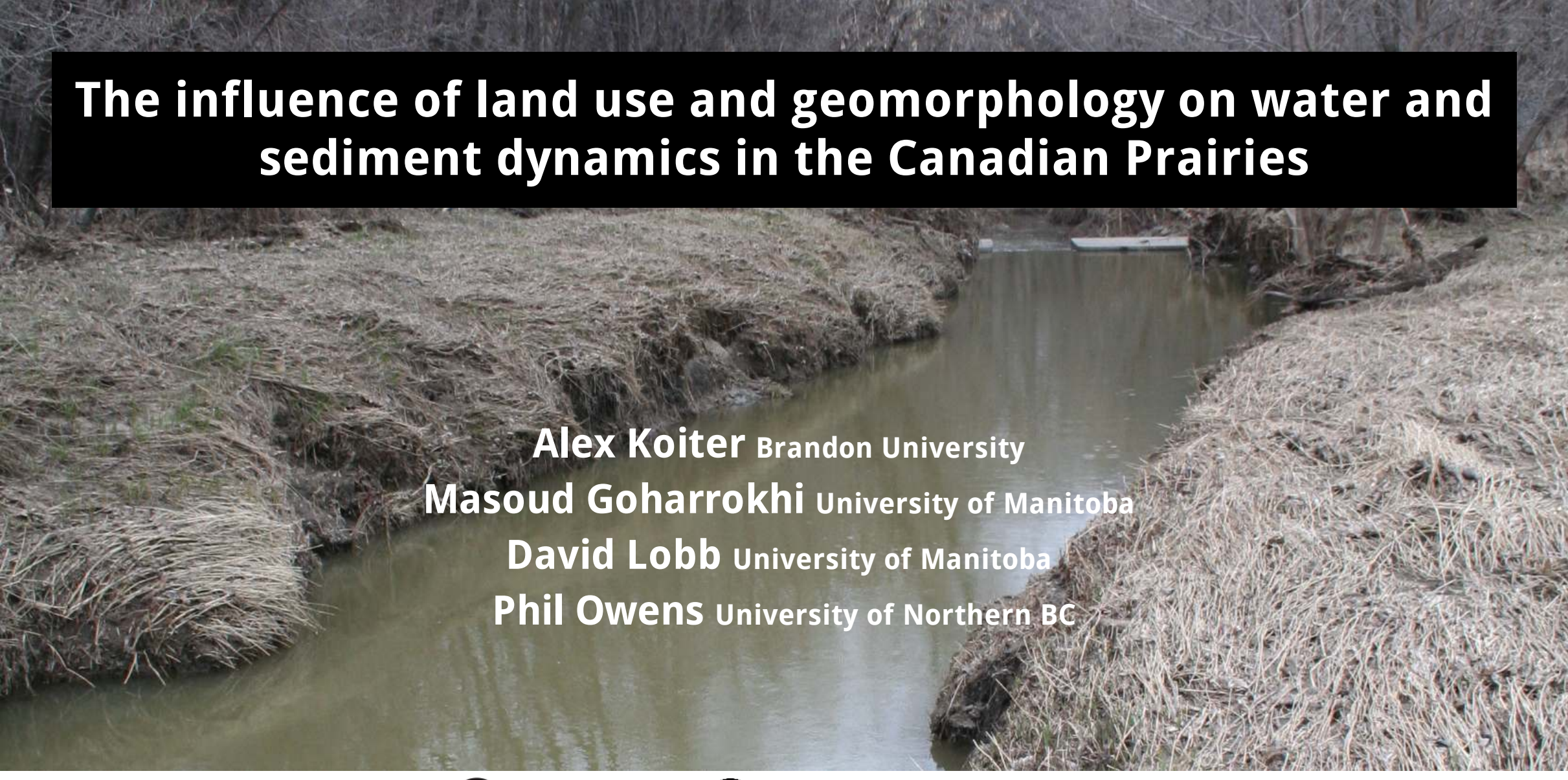
The influence of land use and geomorphology on water and sediment dynamics in the Canadian Prairies



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Canadian Prairies

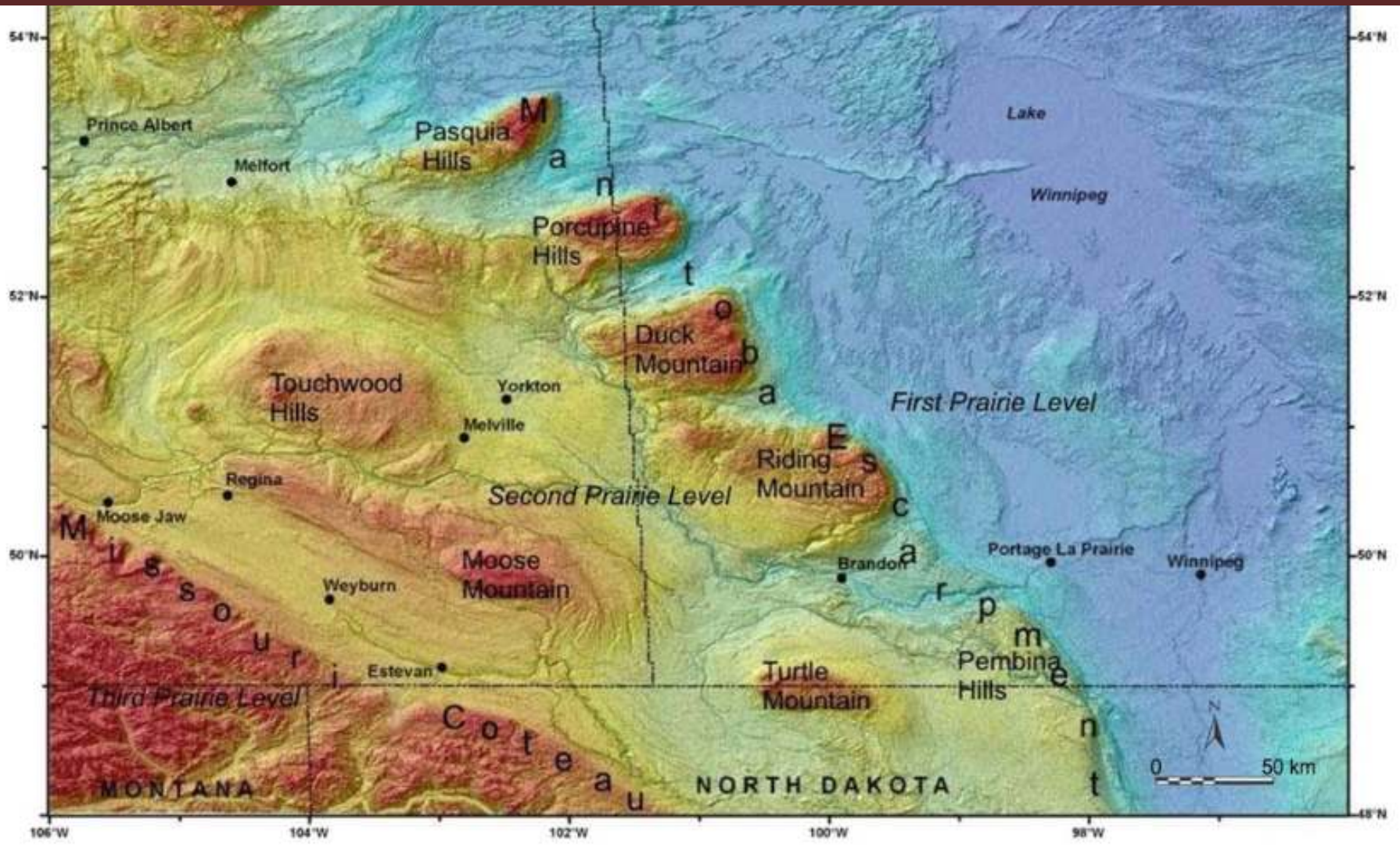
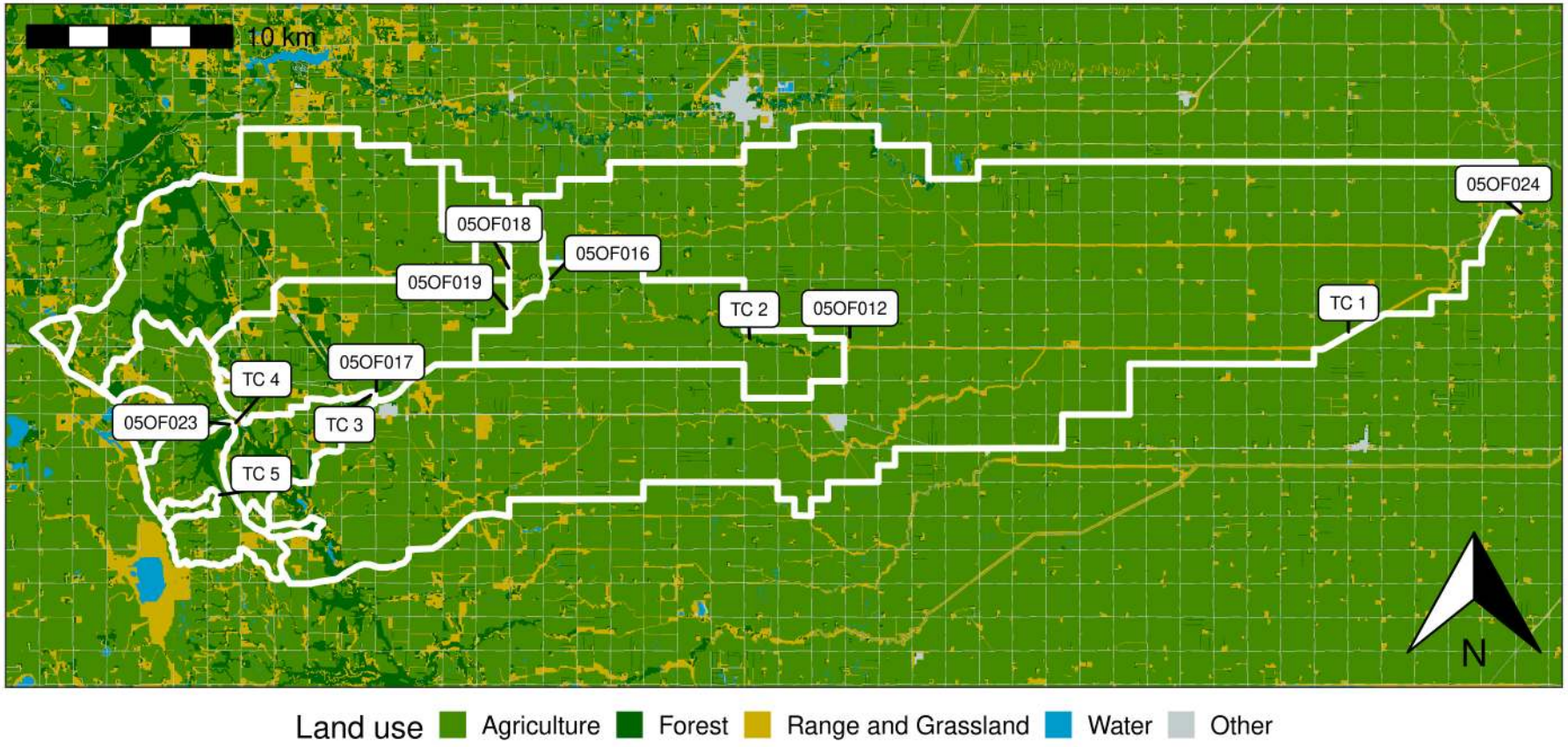


Fig. 9.2 The First, Second, and Third Prairie Levels, Manitoba Escarpment, and Missouri Coteau (after Bamburak and Nicolas 2010)

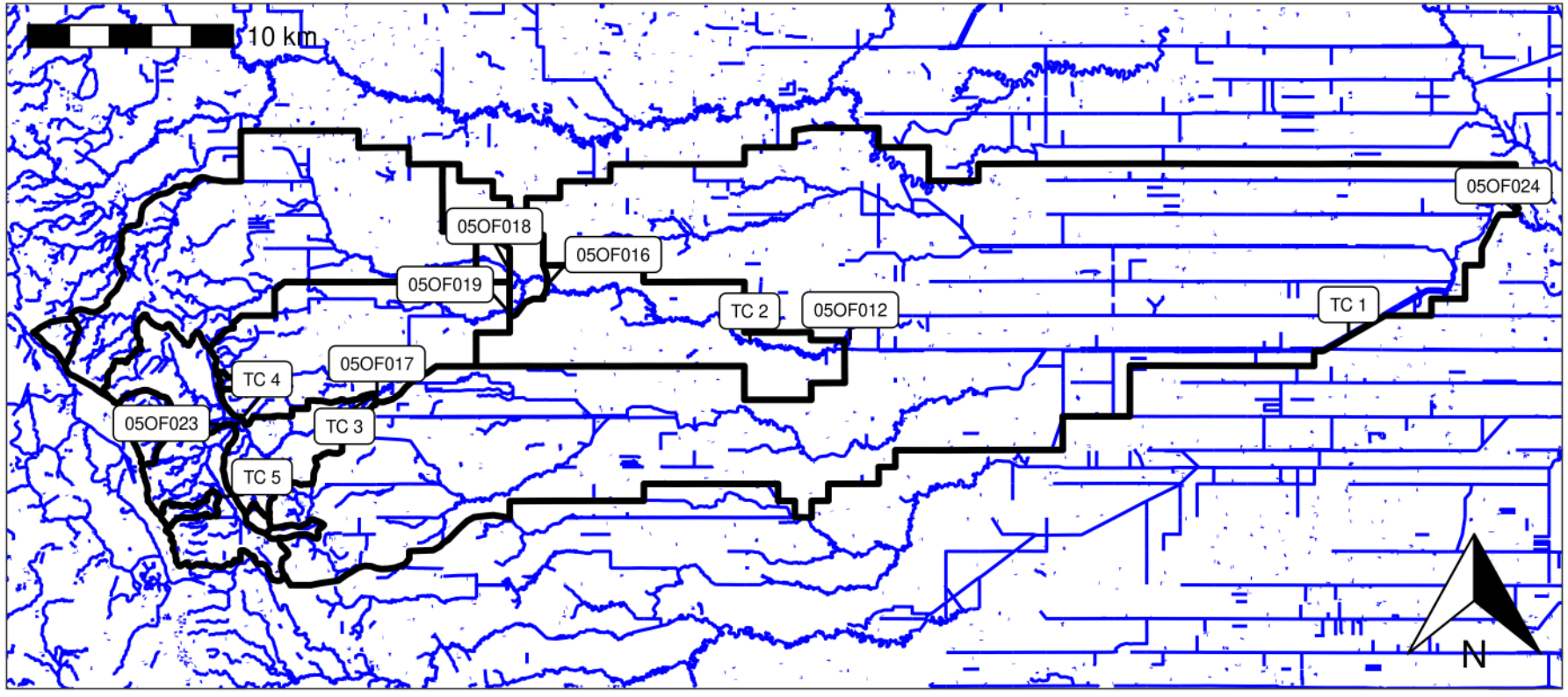
Tobacco Creek Model Watershed

- Nested watersheds: ~2km^2 to ~1000km^2
- Predominantly agricultural land use



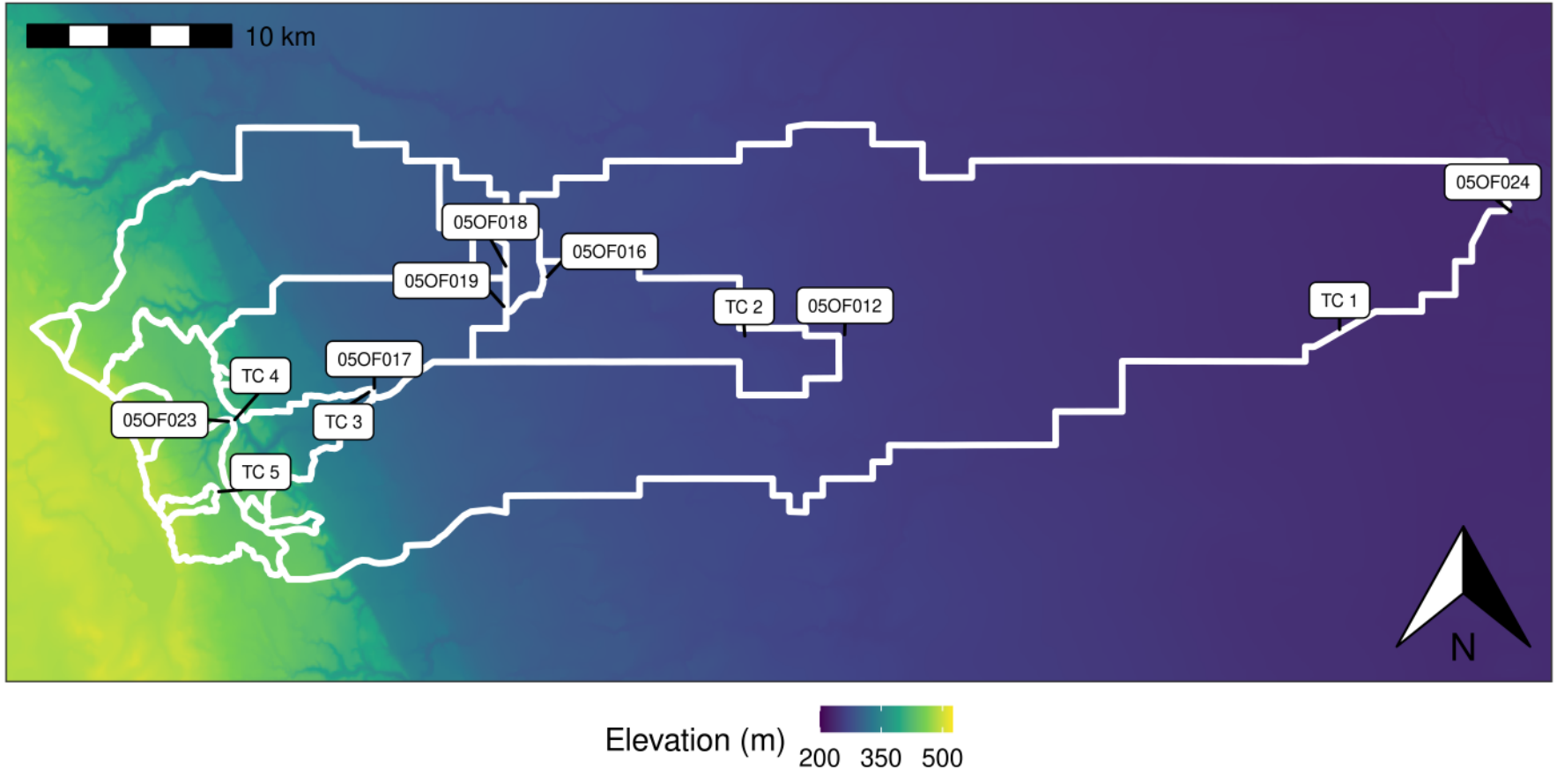
Tobacco Creek Model Watershed

- Nested watersheds: ~2km^2 to ~1000km^2
- Predominantly agricultural land use
- Highly modified drainage network



Tobacco Creek Model Watershed

- Nested watersheds: ~2km^2 to ~1000km^2
- Predominantly agricultural land use
- Highly modified drainage network
- Three distinct physiographic regions



Above the MB Escarpment

- Undulating hills
  - Glacial till
  - Headwater storage dams
  - Low-order streams

MB Escarpment

- Incised streams
  - Rapid change in elevation
  - Steep valley walls
  - Low-strength shales
  - Beaver dams

Lowlands

Glacial Lake Agassiz

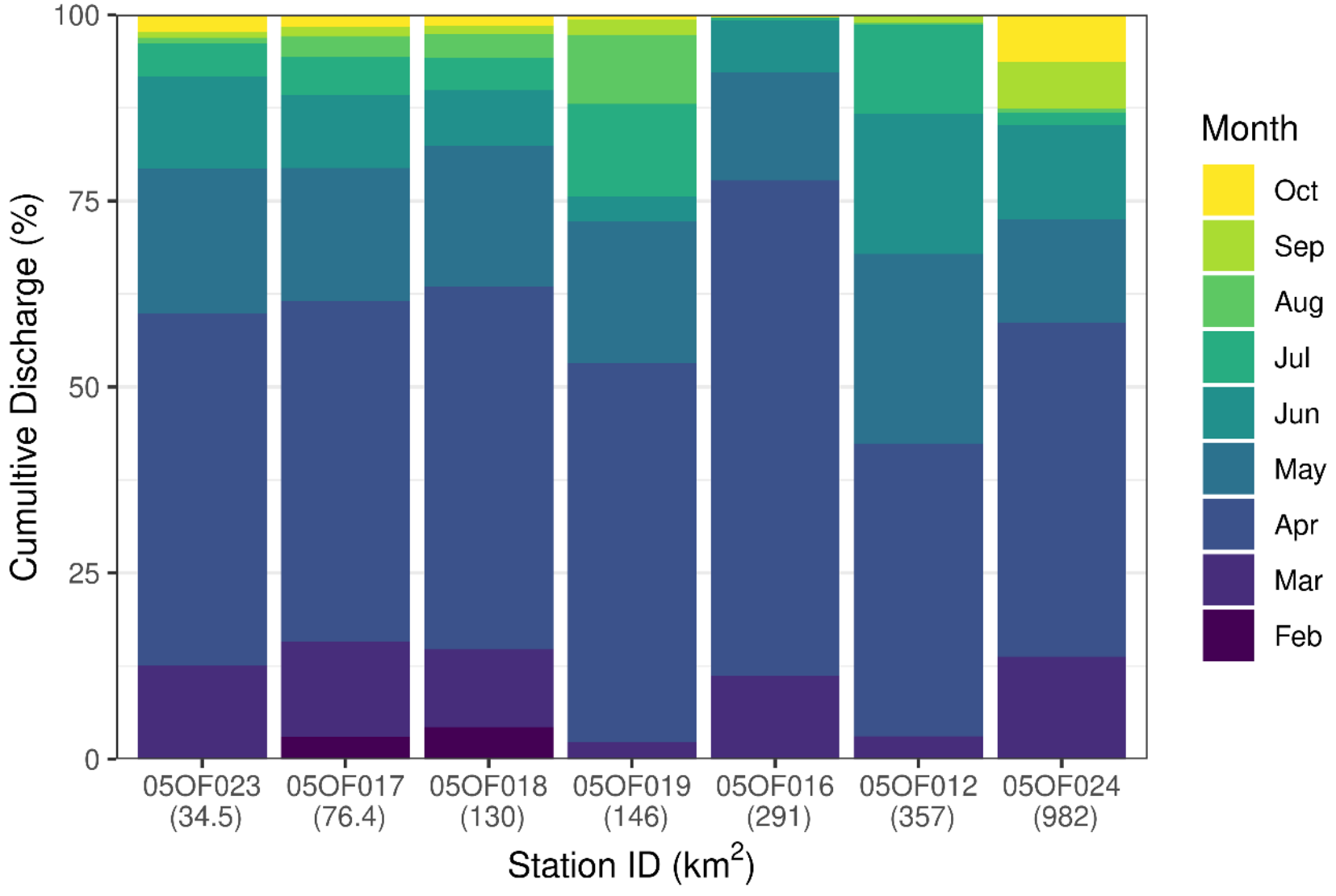
- Low relief
  - Meandering rivers and streams
  - Provincial drains
  - Municipal drains
  - Lots of in-field surface drains

Complicates the normally simple concept of drainage area

Discharge

Annual

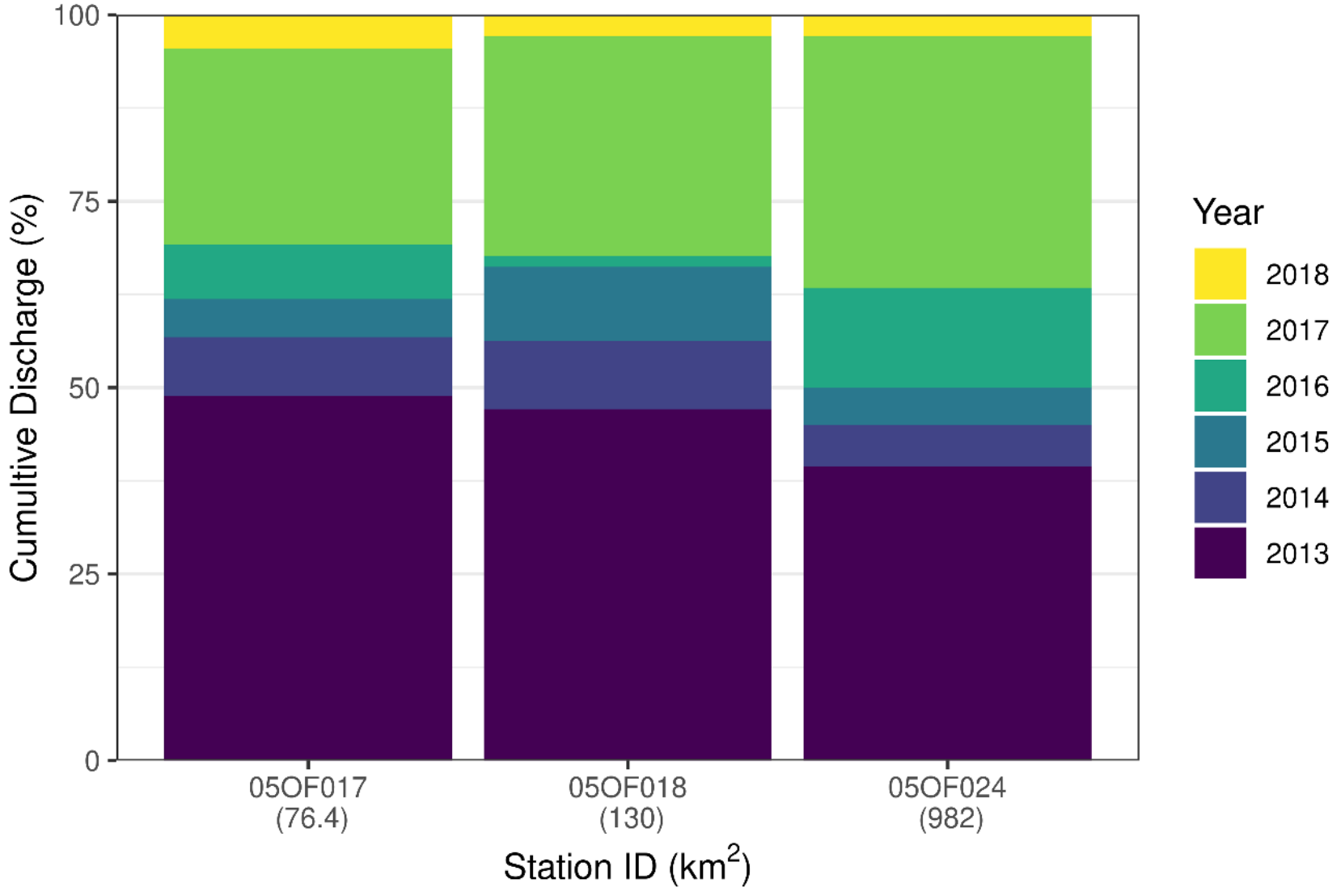
- Spring snowmelt dominated hydrology



Discharge

Inter-Annual

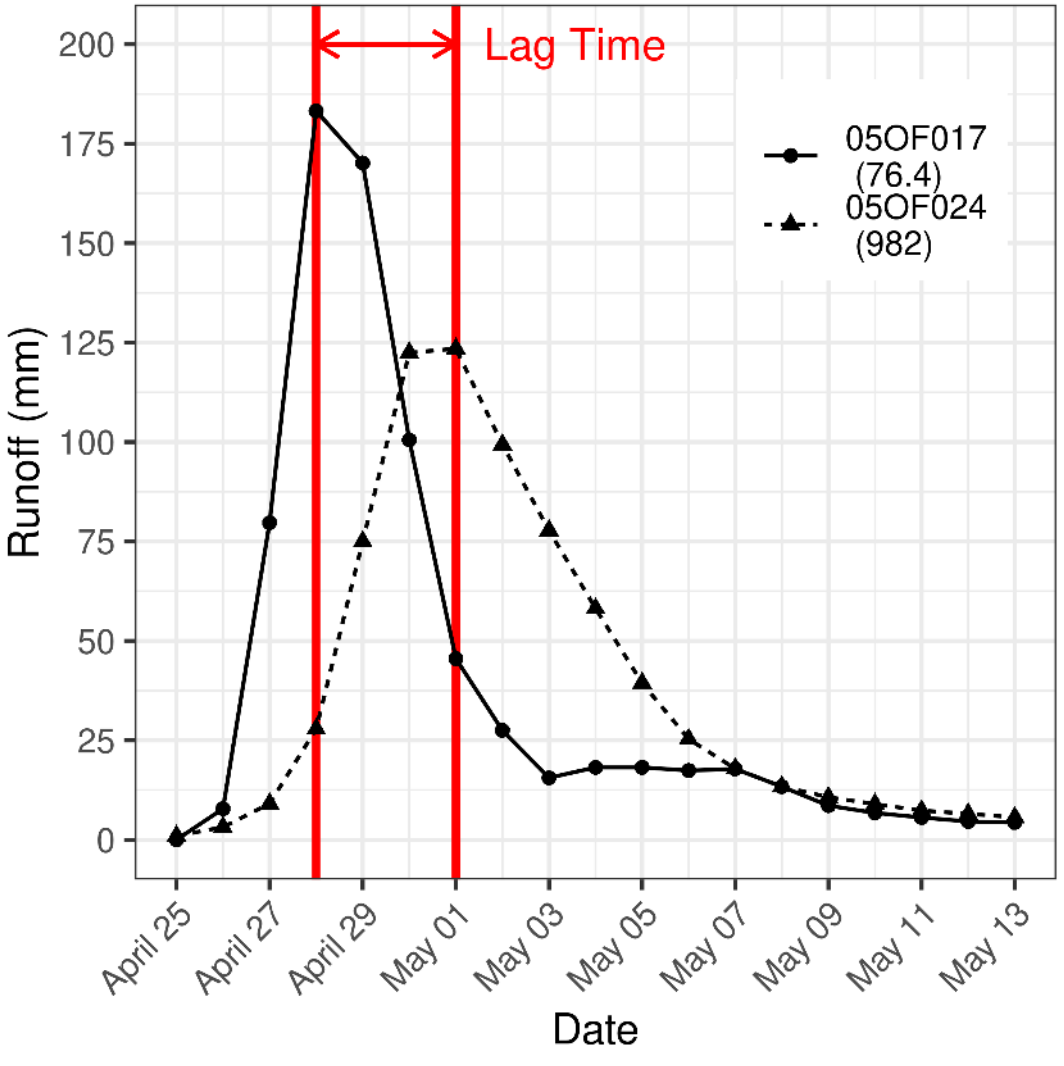
- 2/6 years account for more than >75% of water



Runoff

Lag Time

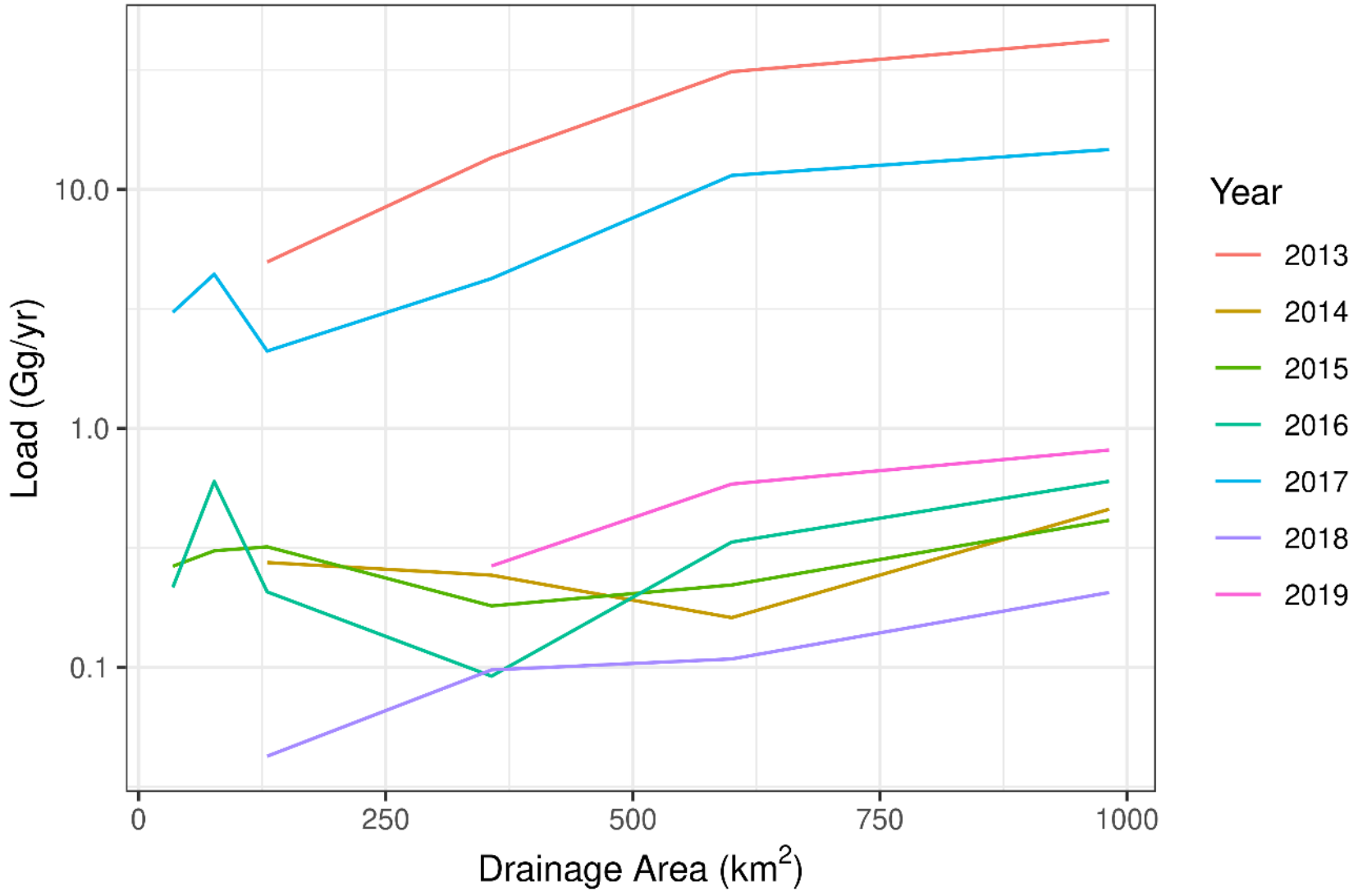
- Gaining streams above and within MB escarpment
- Losing streams below MB escarpment



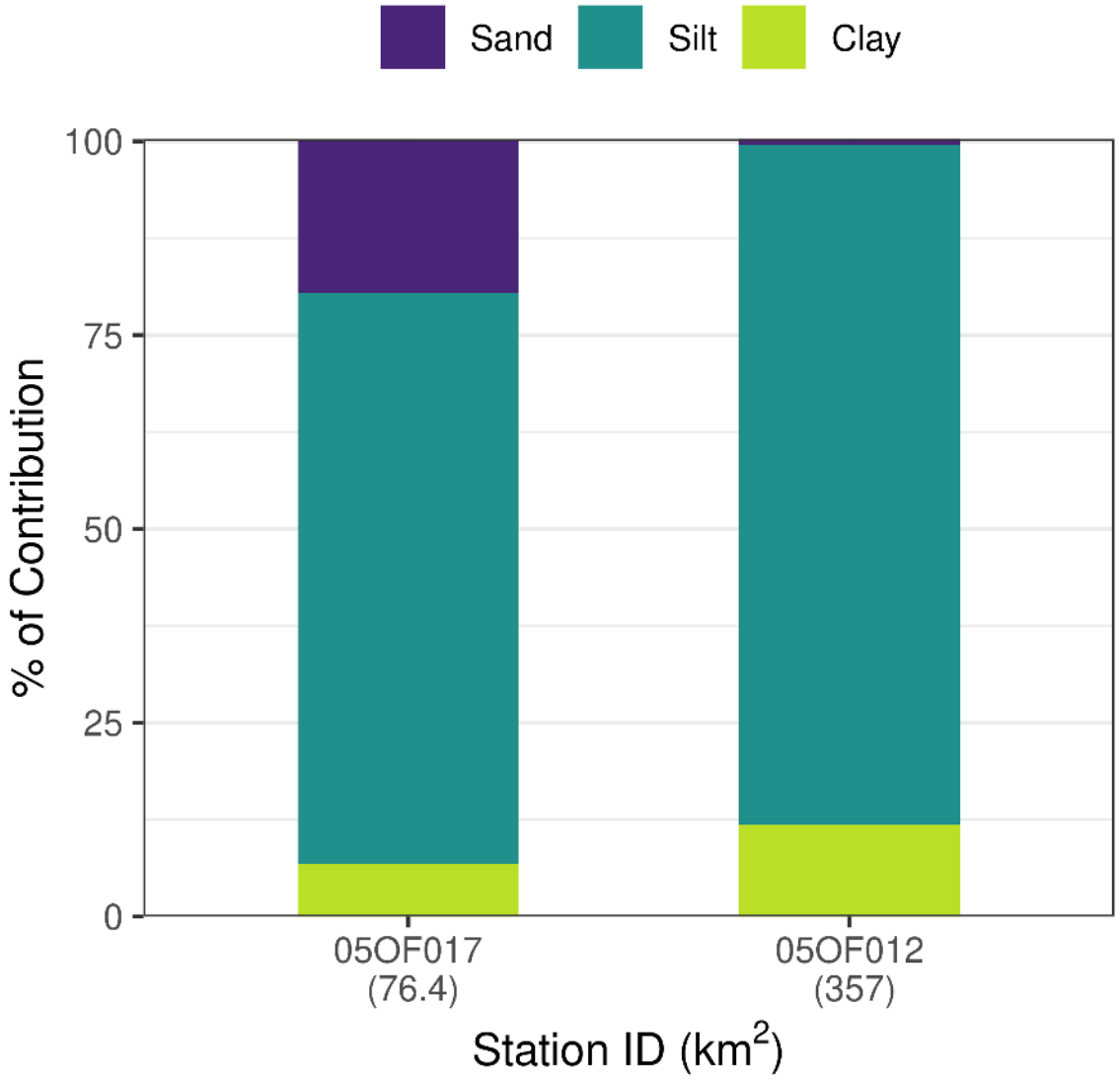
Sediment Load

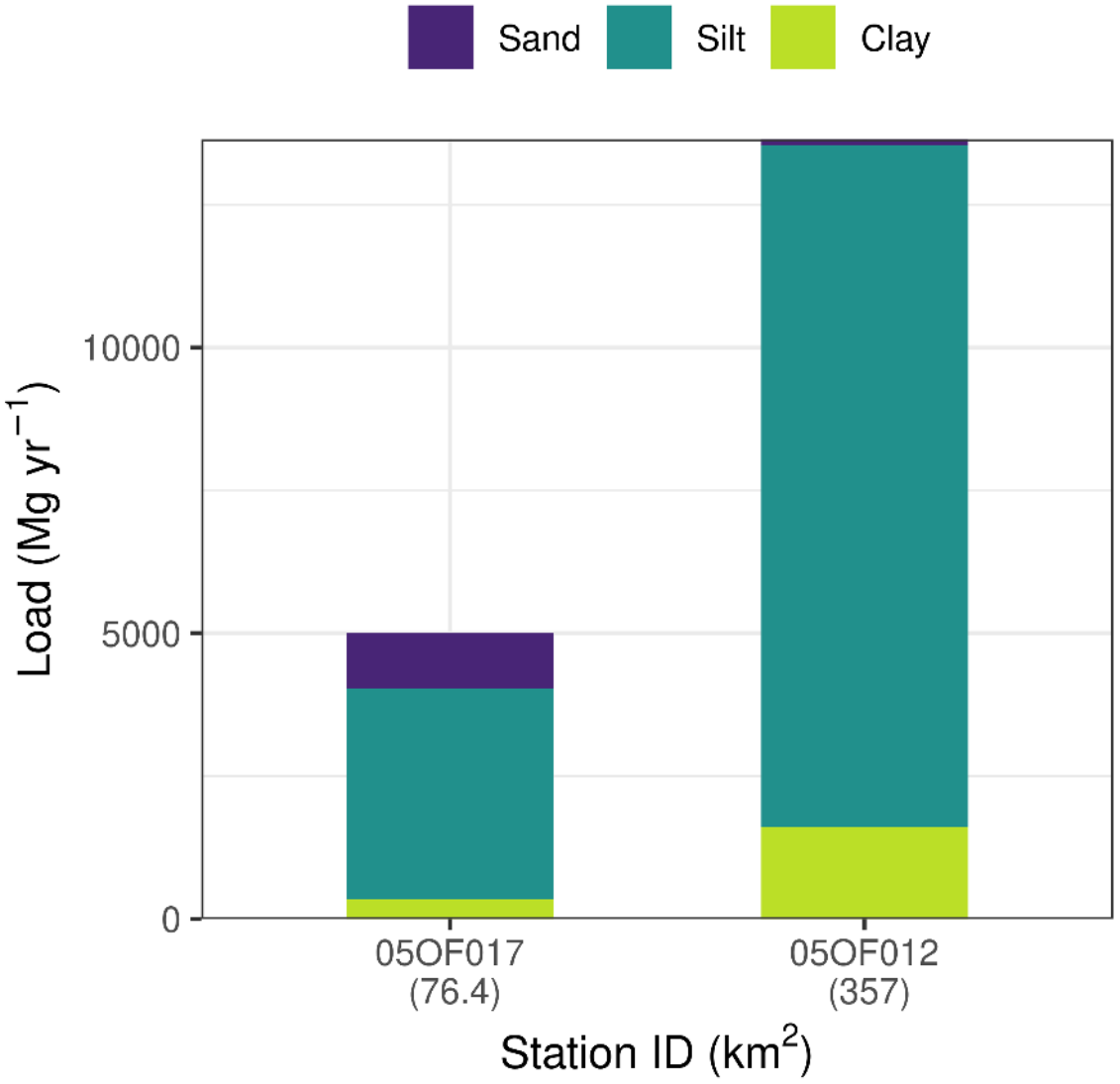
Inter-Annual

- 2/6 years account for more than >80% of sediment moved



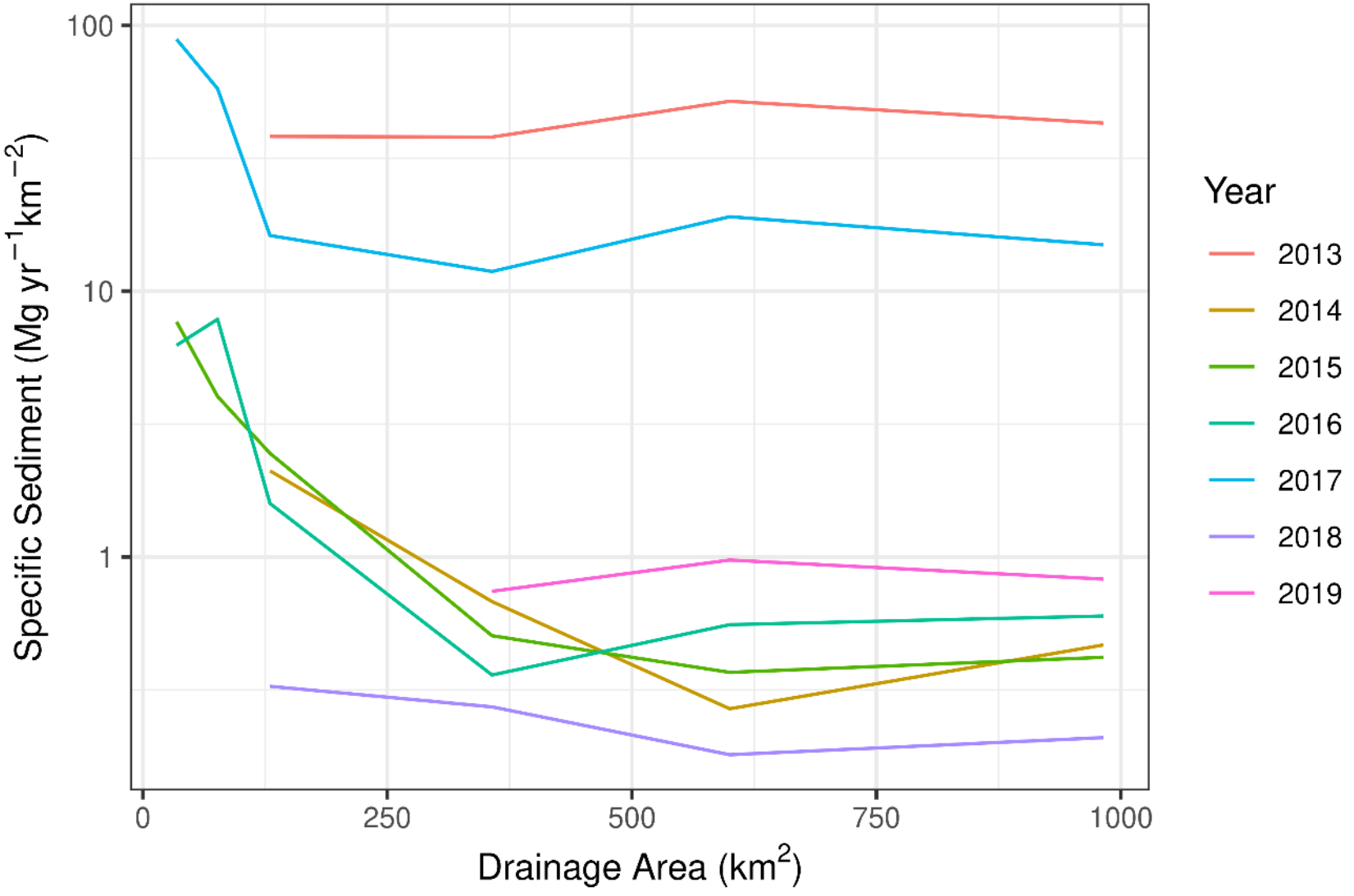
Grain-size


Sand
Silt
Clay
100
75
50
25
0
% of Contribution
05OF017
(76.4)
05OF012
(357)
Station ID (km^2)


Sand
Silt
Clay
10000
5000
0
Load (Mg yr^{-1})
05OF017
(76.4)
05OF012
(357)
Station ID (km^2)

Specific Suspended Sediment Load

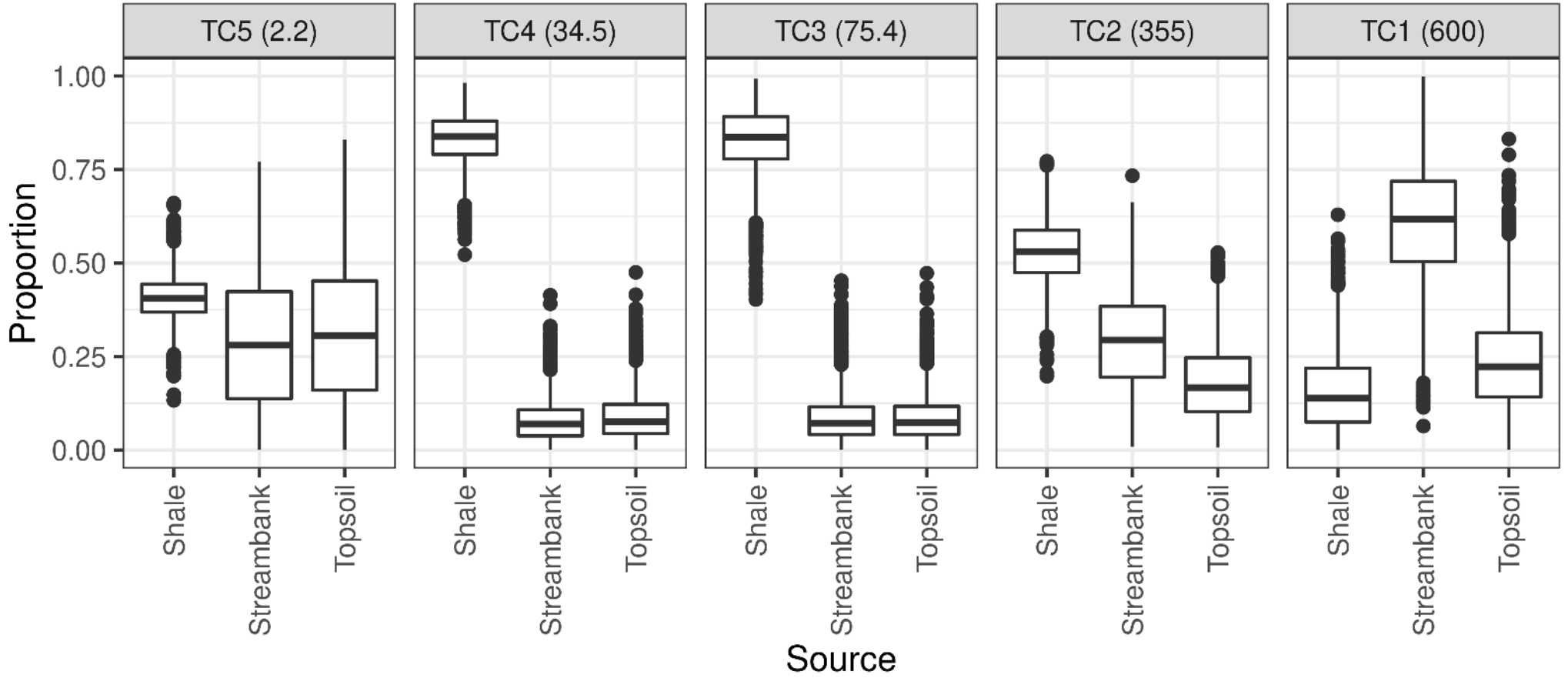
Decreases with increasing drainage area



Sources of Sediment

Shift in sources of sediment

- Colour fingerprints



Thank You

Changes in

- Physiographic regions, drainage, scale of observation

Impact

- Water yield, sediment yield, sources of sediment

Thank you!

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Slides: https://github.com/alex-koiter/presentations (PDF)
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