Sediment supply conditions and channel response to the 2017 and 2018 flood events in Guichon Creek

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Broad objectives

Primary objectives:

- Characterise the main sediment source hazards
- Evaluate ongoing and future changes to watershed hydrology, especially peak flows
- Estimate ongoing channel adjustment to watershed level land cover changes

Motivation for recent work

- **From our last meeting in September:**
  - Sediment sources in Guichon Creek suspected of contributing to channel change
  - But details unclear
  - How does sediment factor into the observed (and potentially ongoing) behavior of Guichon Creek?

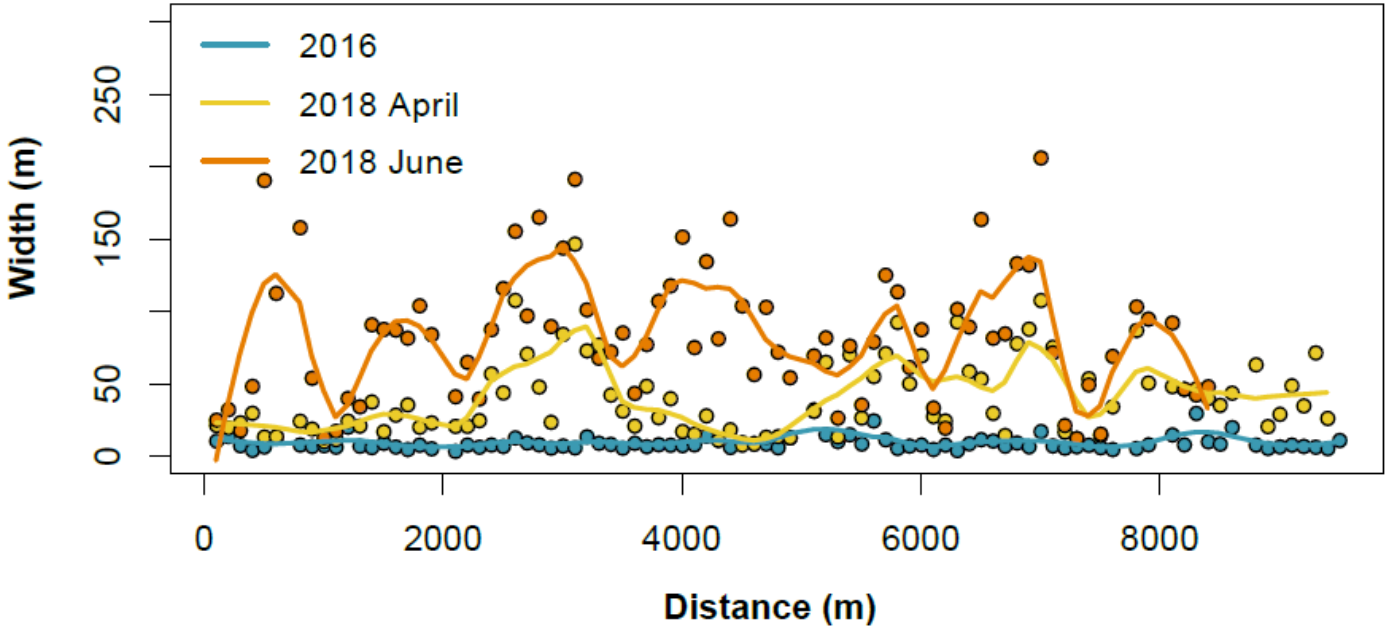
Specific research questions

1. Where, and how large, are the main sediment sources?
2. How does the volume of eroded sediment compare to the background transport rate?
3. Is this sediment depositing along the channel, or travelling out of the watershed?
4. Are any identified sediment sources at risk of supplying additional sediment?

Data and methods

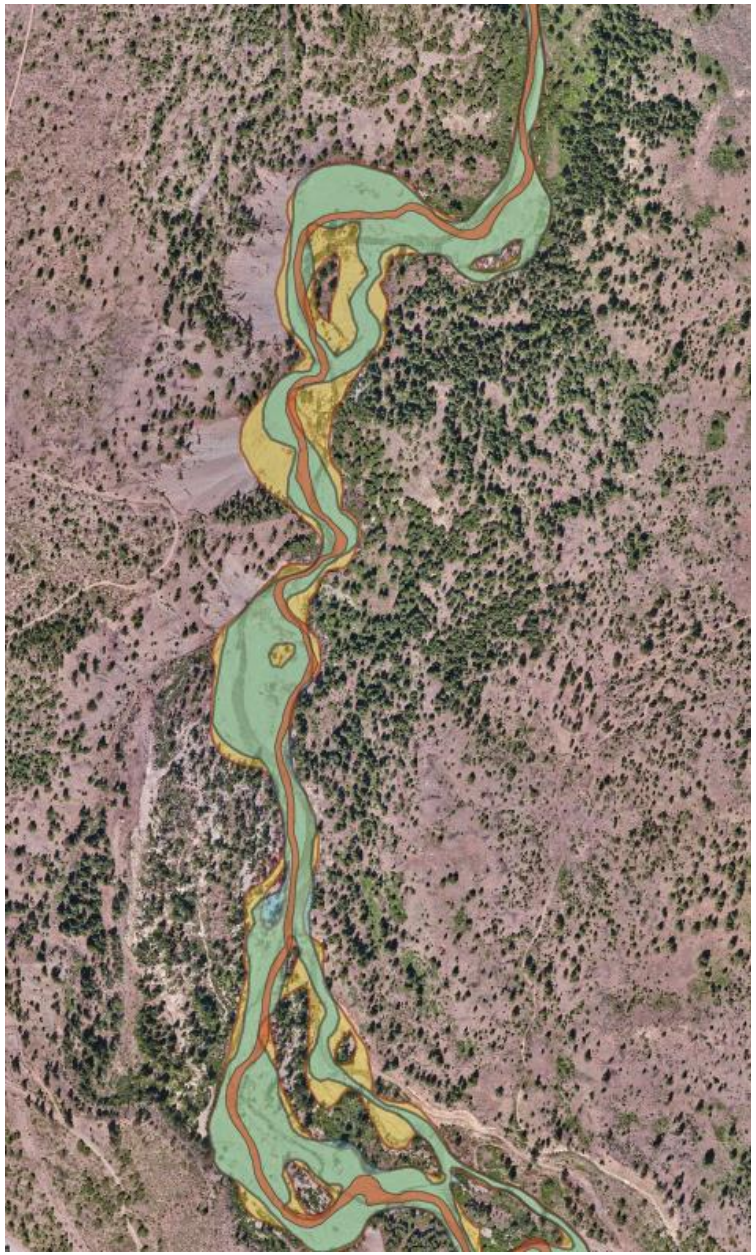
- **Sediment source volume**
  - Lidar data, airphotos, field inspection
- **Sediment texture**
  - Field sampling – pebble counts and bulk samples
- **Background transport capacity**
  - Calculated – 2 methods
- **Channel bed elevation change**
  - Lidar data, surface subtraction

Recap: observed channel change

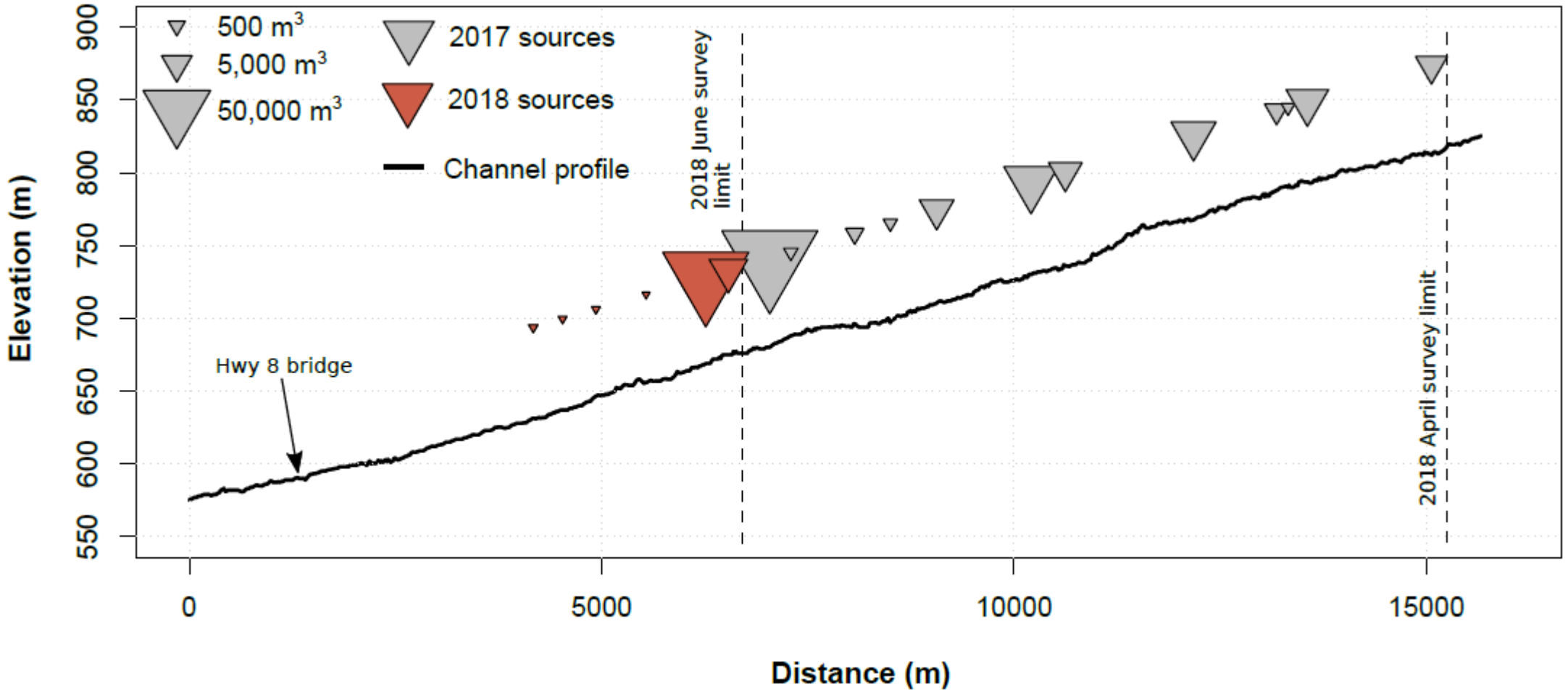


Average width (Nicola confluence to 8 km upstream)

- 2016: 10.1 m
- 2017: 41.1 m
- 2018: 84.6 m



1. Where and how large are the sediment sources?



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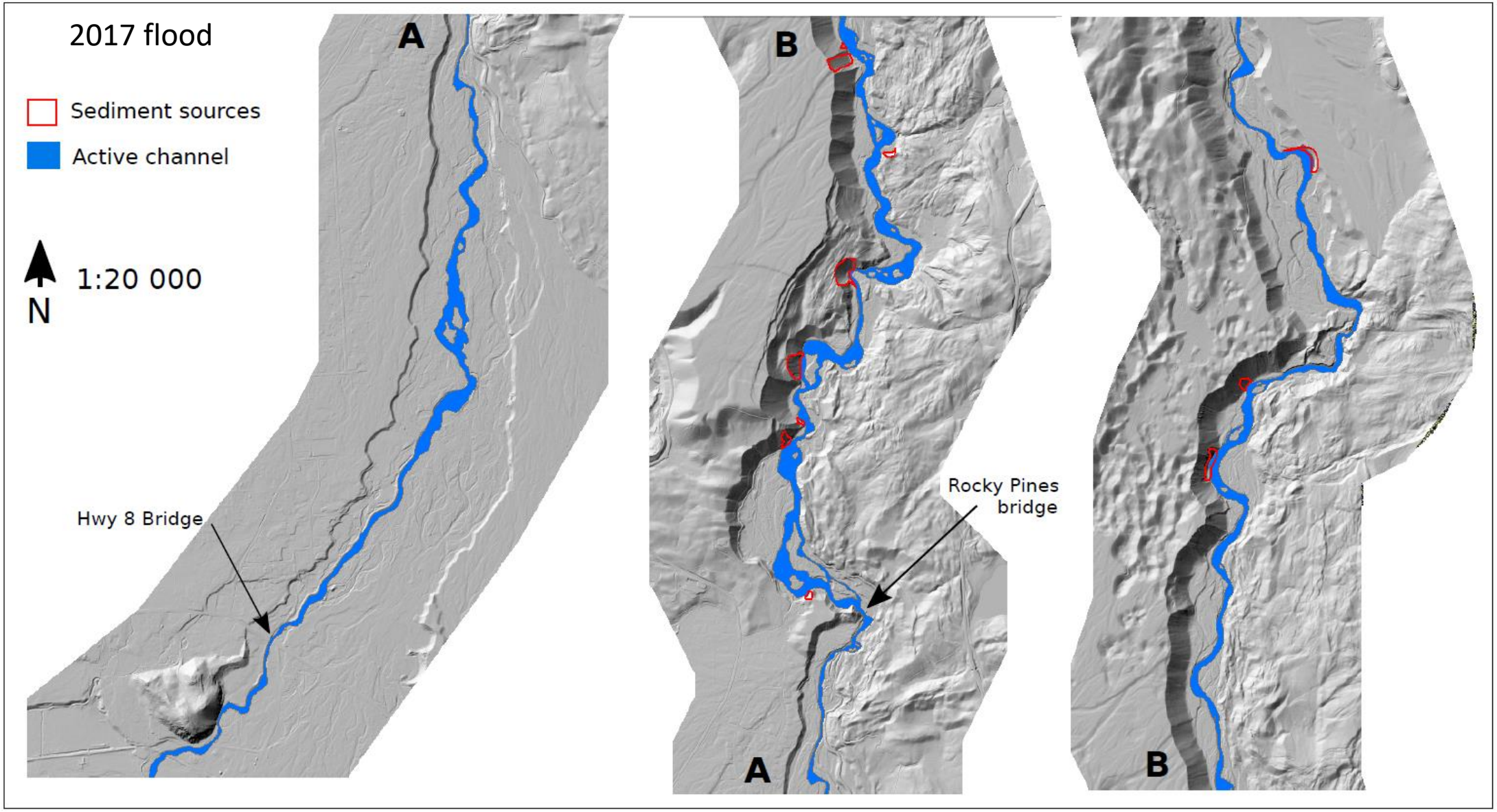

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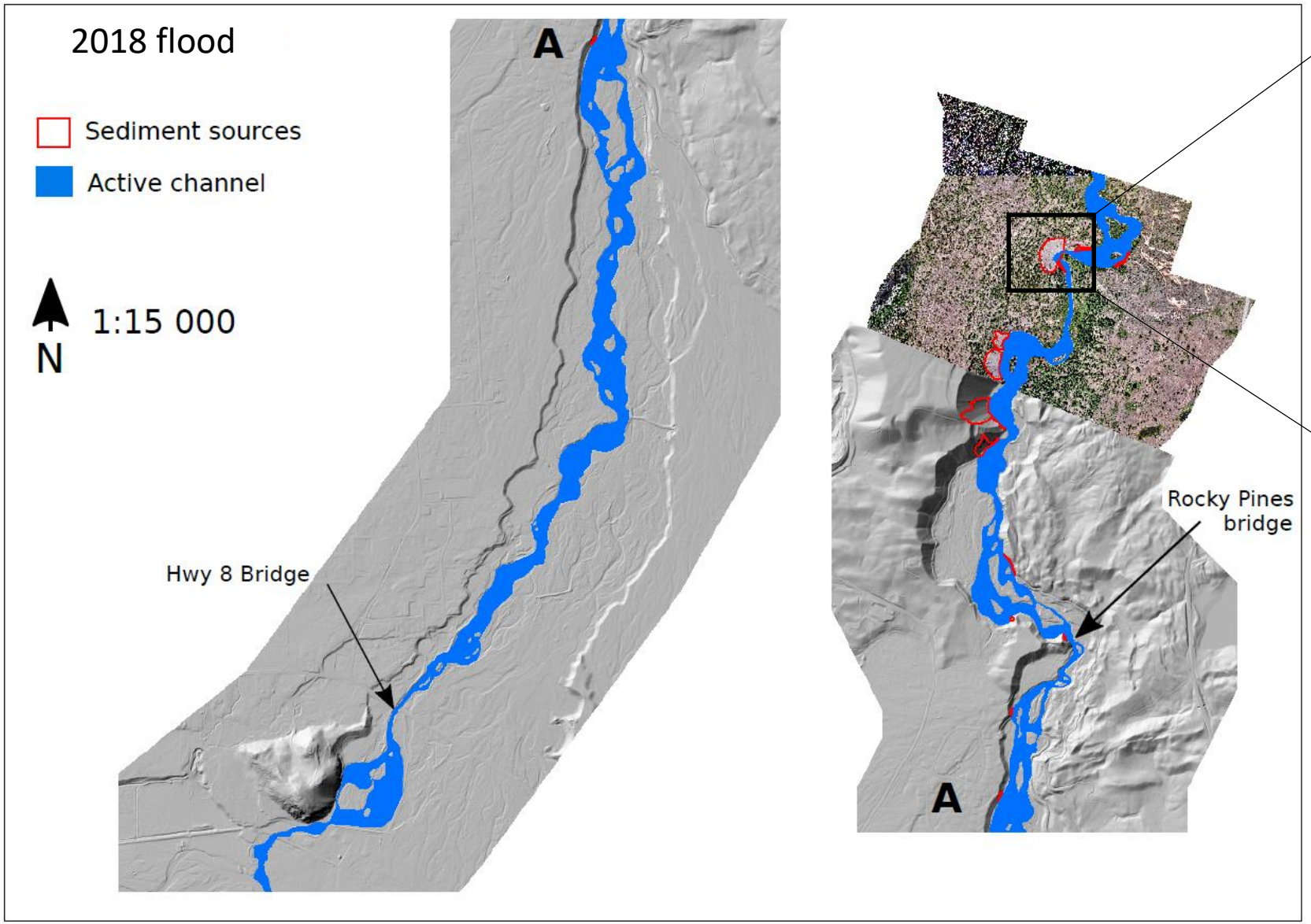


1. Where and how large are the sediment sources?

Sediment yield:

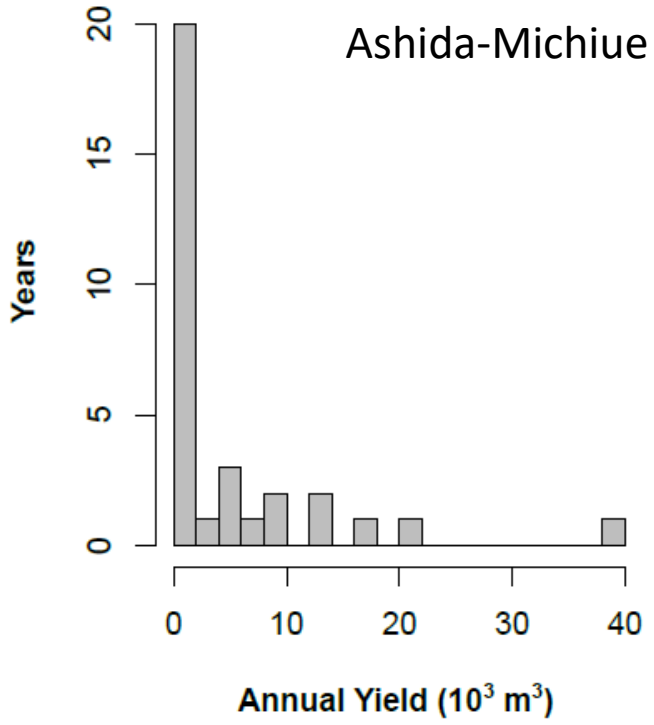
- **2016-2017:** 163,000 +/- 83,000 m^3
- **2017-2018**: 63,2000 +/- 6,300 m^3
- 22 major sources identified
- 40-60% sand/fine sediment

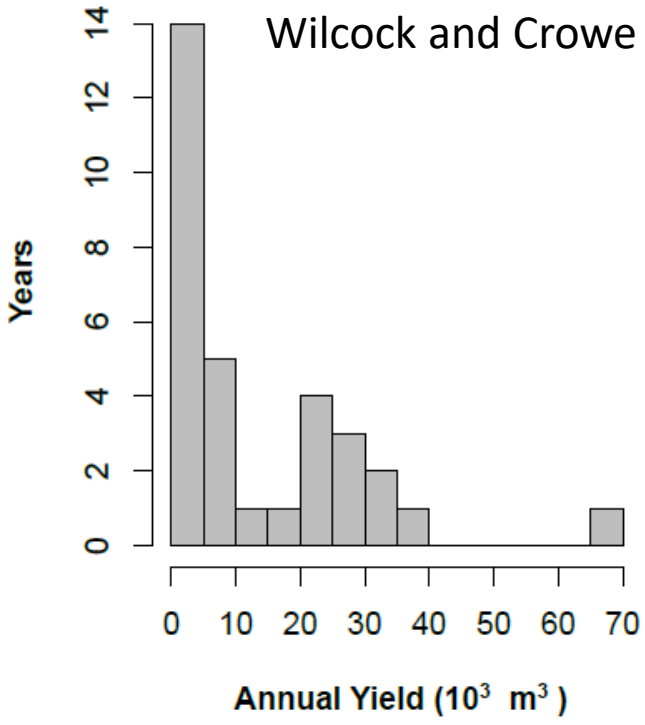
BUT: limited coverage for 2018 flood, difficulties with floodplain/channel bed erosion identification

These numbers are likely on the low side.

2. Eroded volume vs. background transport rate

Assuming the volume estimate is reasonable, how does the "normal" bedload transport rate of the channel compare?





Mean annual bedload transport:
4,600 – 13,000 m^3/yr

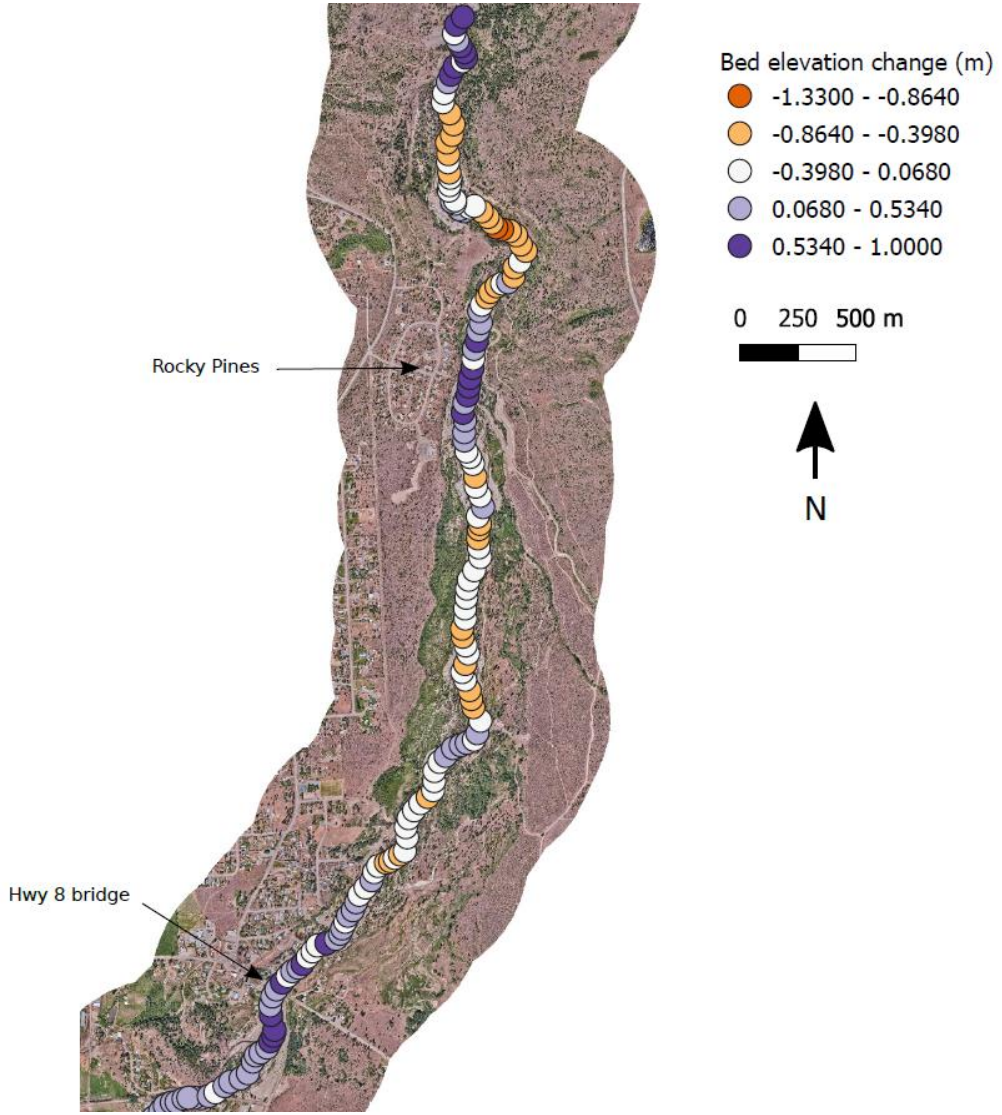
Median annual bedload transport:
92 – 6,500 m^3/yr

…But probably overestimating true yield

Eroded sediment:

7-500 x the median background rate
3.3-9.7 x the mean background rate

3. How much eroded sediment is depositing downstream?



- **44,500 m^3** gain in sediment over region of overlapping Lidar coverage
- during the 2018 flood
- Equivalent to approximately 70% of the total eroded volume in region of overlapping coverage
- Likely a much smaller fraction of true eroded volume
- Average of 10 cm increase in channel bed elevation
- Aggradation is not uniform

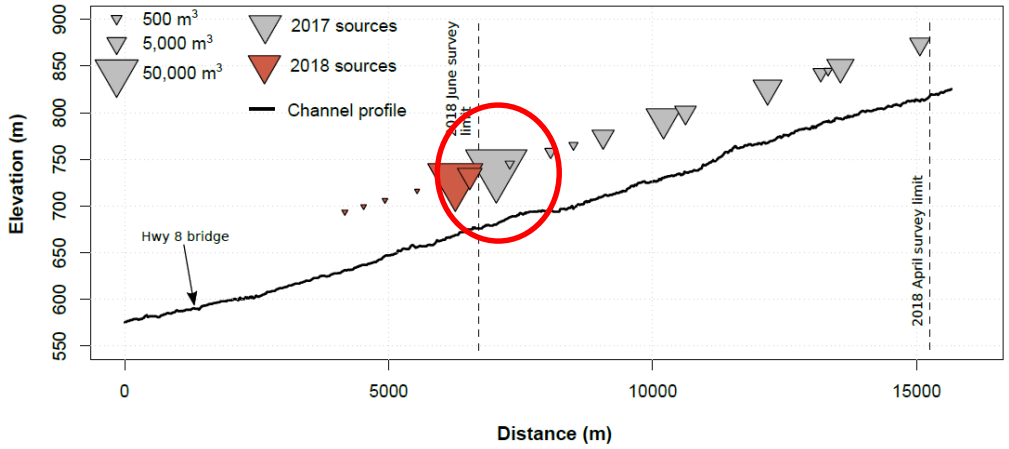
4. Is additional erosion/downstream change likely?

Short term (2-5 years): Several eroding slopes are still very much within reach of the active channel. But the channel has also moved away from some features.

One feature in particular should be watched: Major horseshoe bend a few km upstream of Rocky Pines.

Longer term (>5 years): Channel has an overall tendency towards incision, with the exception of areas within ~2 km of Nicola River.

Re-establishment of riparian vegetation will provide longer-term flood resilience



2016

2019

Implications

- Ongoing management of Guichon should consider sediment supply as a key contributor to channel (mis)behaviour
- Channel is presently in a state of adjustment; a few more years of “normal” freshets will allow for some stabilization of the floodplain with vegetation
- Certain channel locations more stable than others
- Implications for Nicola River

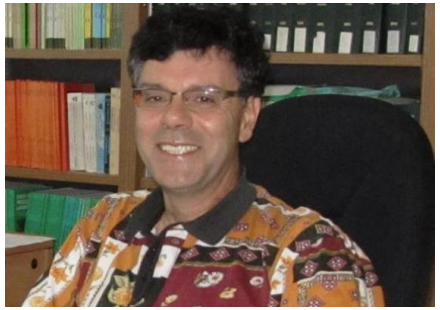
Summary – main points

- Substantial quantity of sediment entered the channel – likely many times the transport capacity
- More than 20 major sediment sources identified, more are likely
- A fairly large fraction of eroded sediment is redepositing downstream, but a lot is also going into the Nicola
- Several sediment sources at risk of ongoing erosion during moderate-large flood seasons

Physical modeling - experiments

Marwan Hassan (another UBC geomorphologist) wants to replicate Guichon Creek sediment impacts in an experimental setting

Marwan says: “you should all come and visit my lab”



CRF work – other watersheds

What is the risk of channel instability?

Starting with two sites