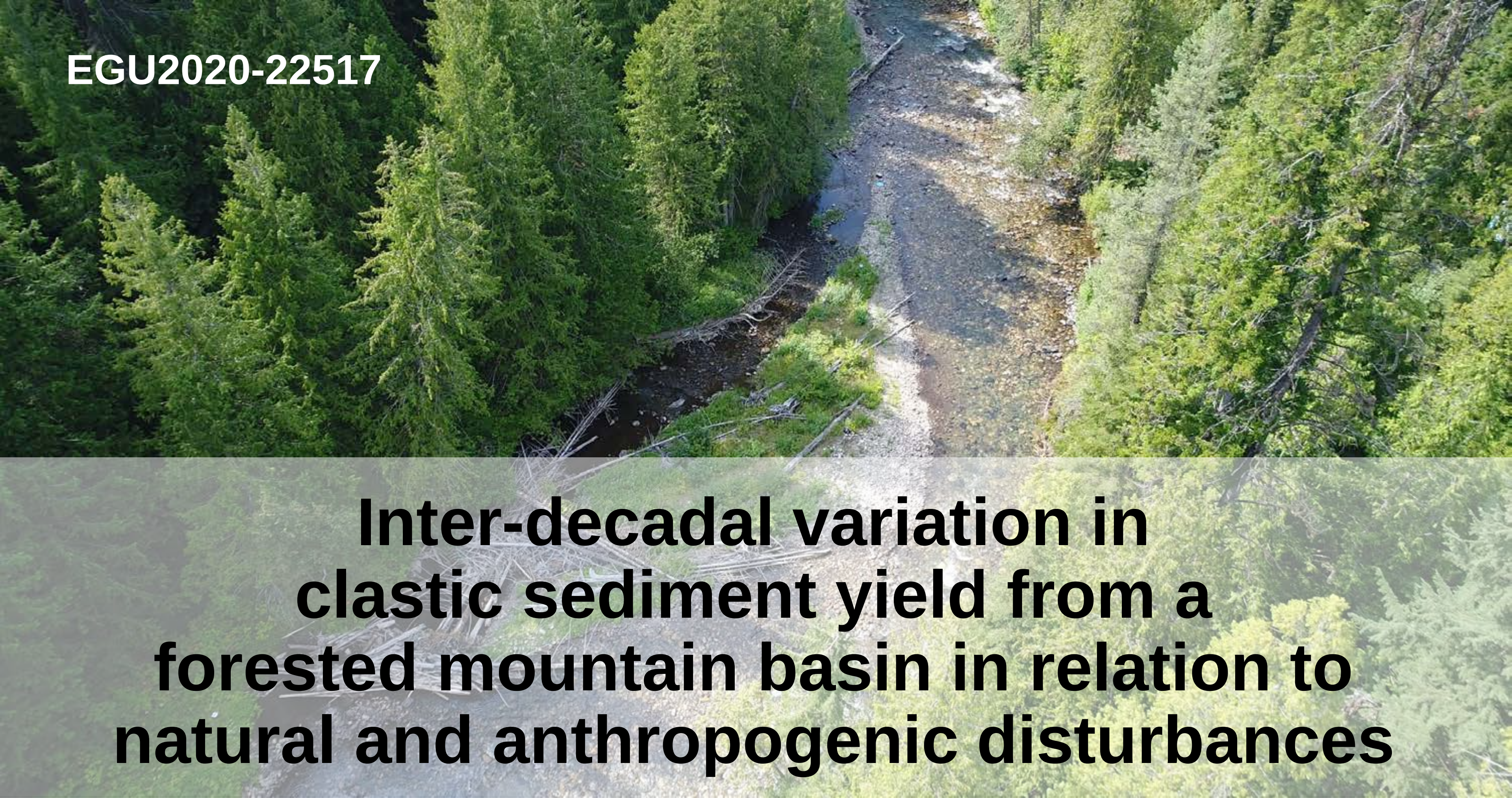

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Inter-decadal variation in clastic sediment yield from a forested mountain basin in relation to natural and anthropogenic disturbances

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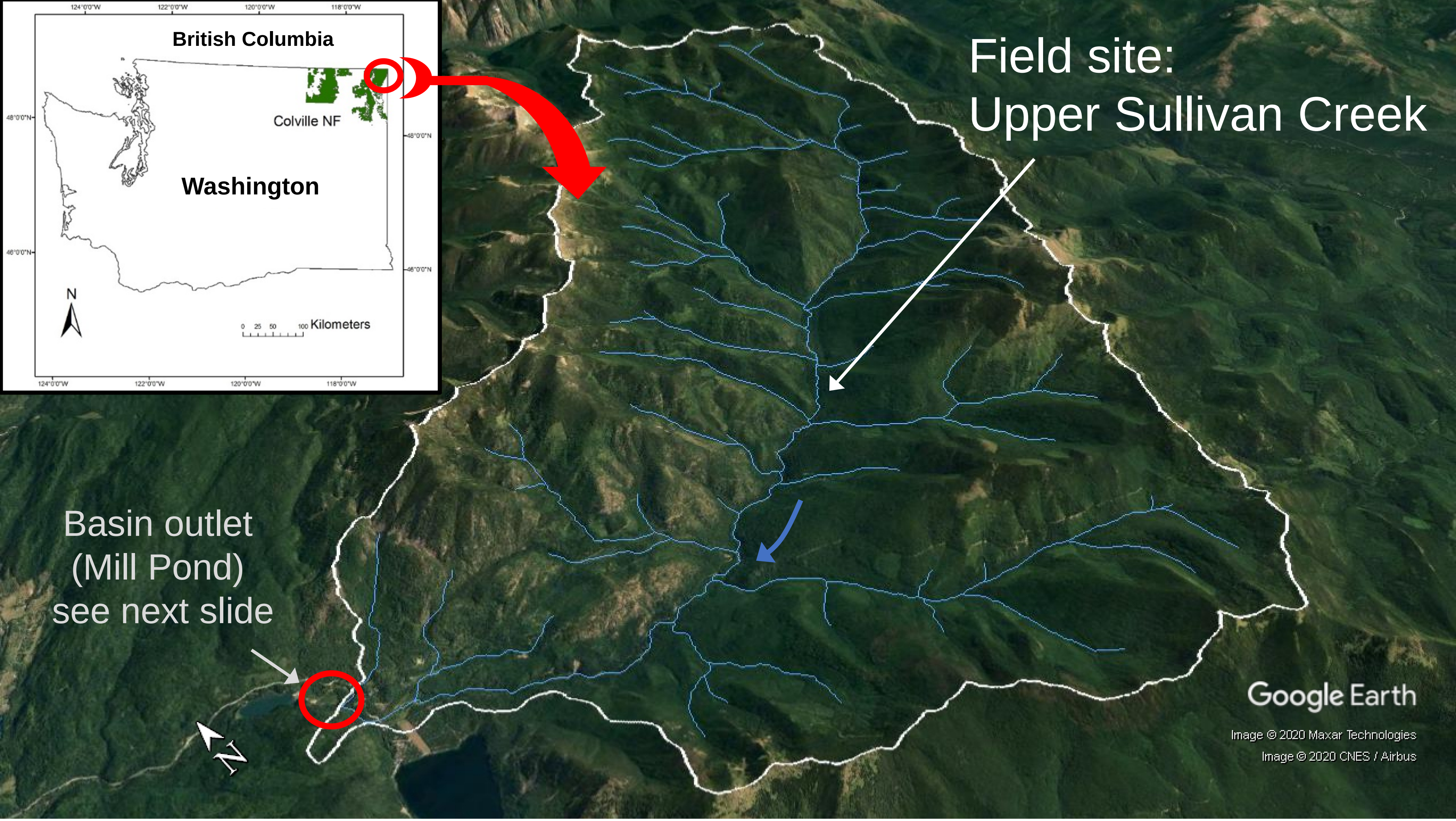
Importance of sediment yield

- **Understanding of sediment dynamics/regime; long-term: erosion/denudation rates**
- **Signal of disturbances/environmental change “filtered” by the routing system**
- **Ecosystem dynamics: aquatic biota sensitive to sediment**
- **Natural hazards/river management downstream e.g. channel conveyance, erosion, water quality.**

Study objectives

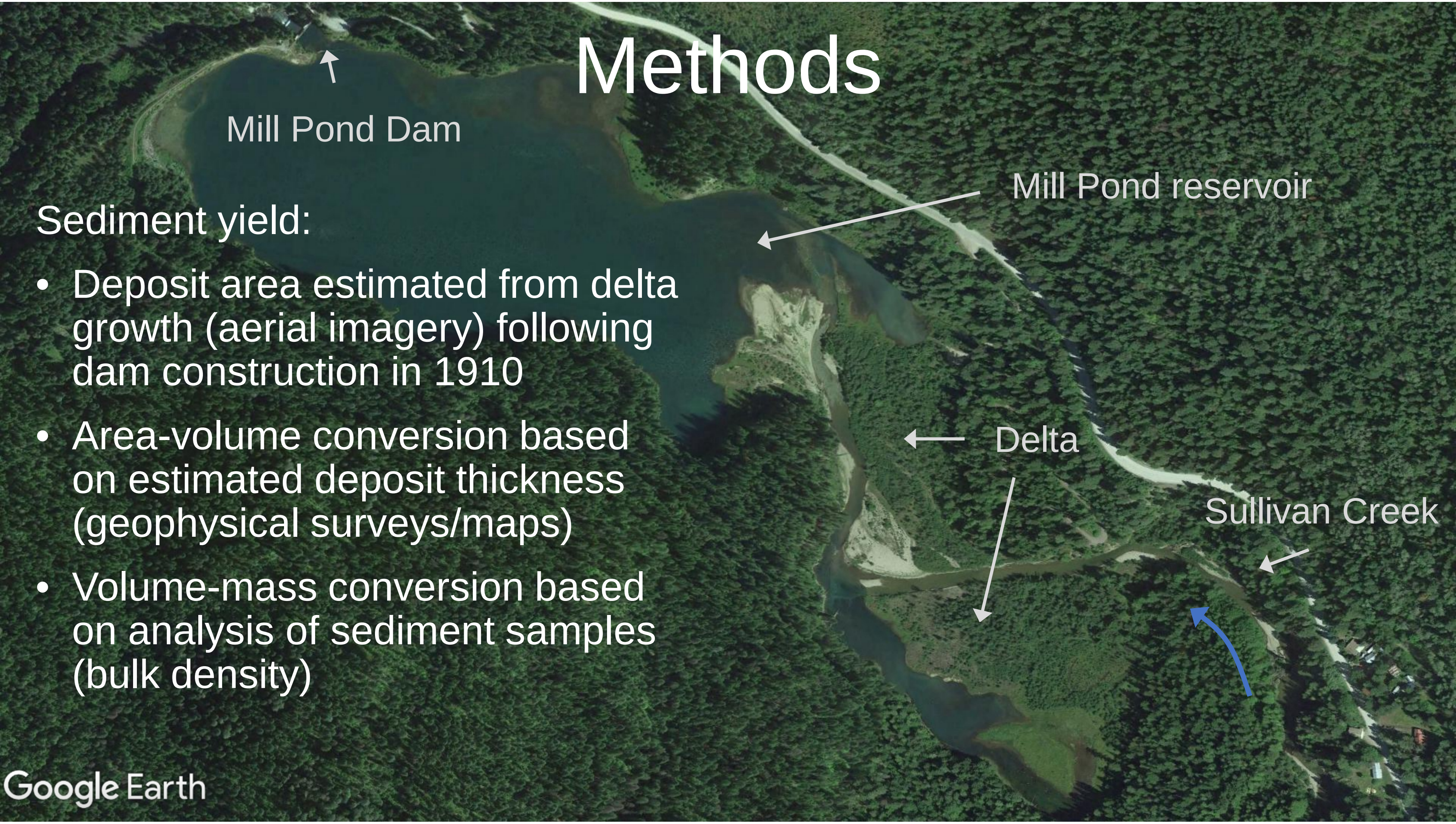
- **Understand clastic sediment yield regime/variability in a medium size mountain basin ($\times 10^2$ km^2) at timescale of 10^2 years**
- **Understand drivers of this variability in relation to disturbances/environmental change (hydroclimate, land use)**



- **Location: NE Washington, USA (Colville National Forest)**
- **Drainage area ~320 km² (~44% geomorphically disconnected)**

- **Forested (inland temperate rainforest)**
- **Climate: temperate, peak flows mostly snowmelt-driven**
- **Geology: complex incl. metsedimentary, metavolcanic bedrock & Quaternary drift**
- **Dominant land use: timber harvest**

Methods



Sediment yield:

- Deposit area estimated from delta growth (aerial imagery) following dam construction in 1910
- Area-volume conversion based on estimated deposit thickness (geophysical surveys/maps)
- Volume-mass conversion based on analysis of sediment samples (bulk density)

Disturbances:

- Discharge (floods): combined historical record (USGS gage) and flow modeled based on empirical relationship with nearby long-term gages
- Timber harvest incl. fuel reduction treatments: USDA data base

Preliminary results

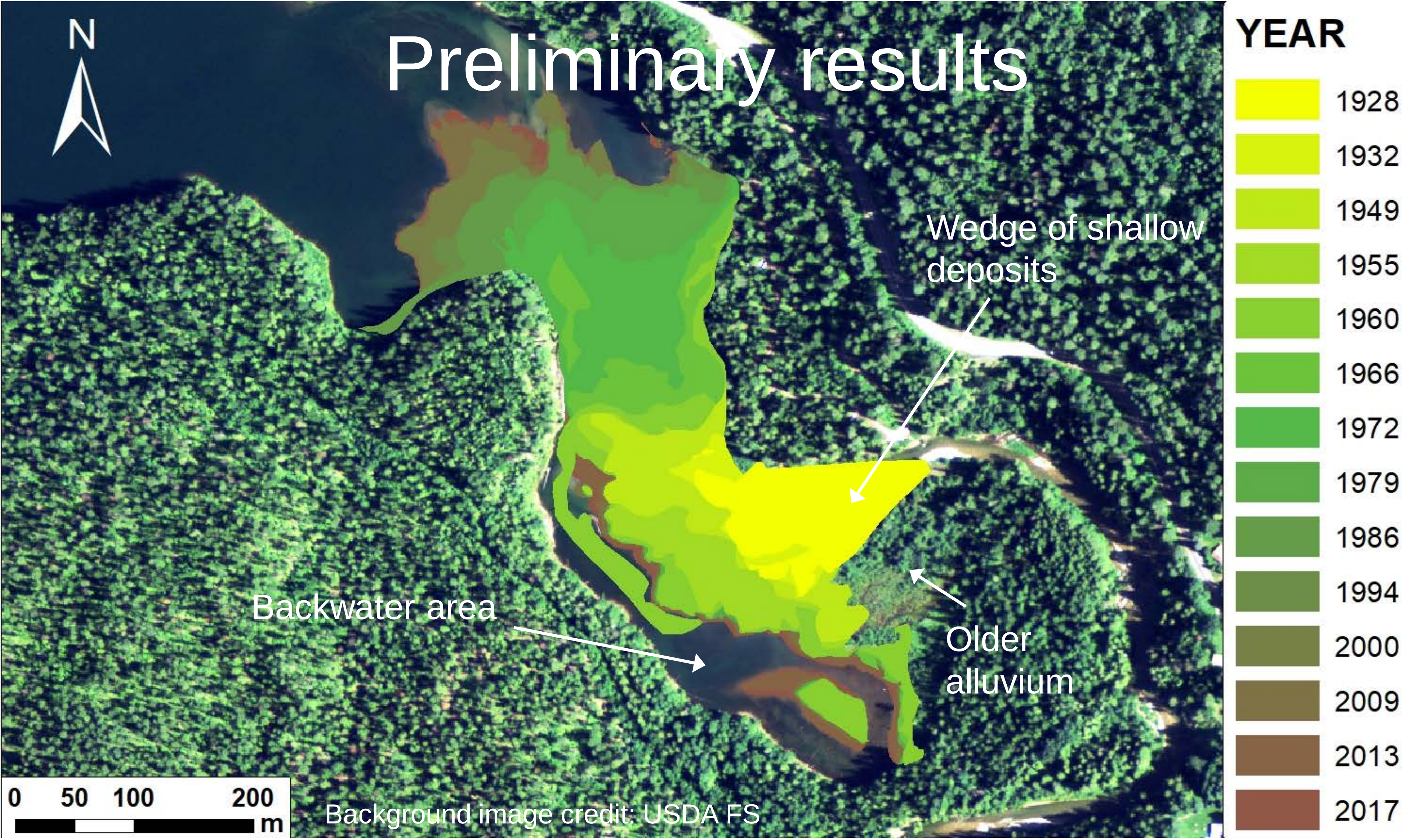
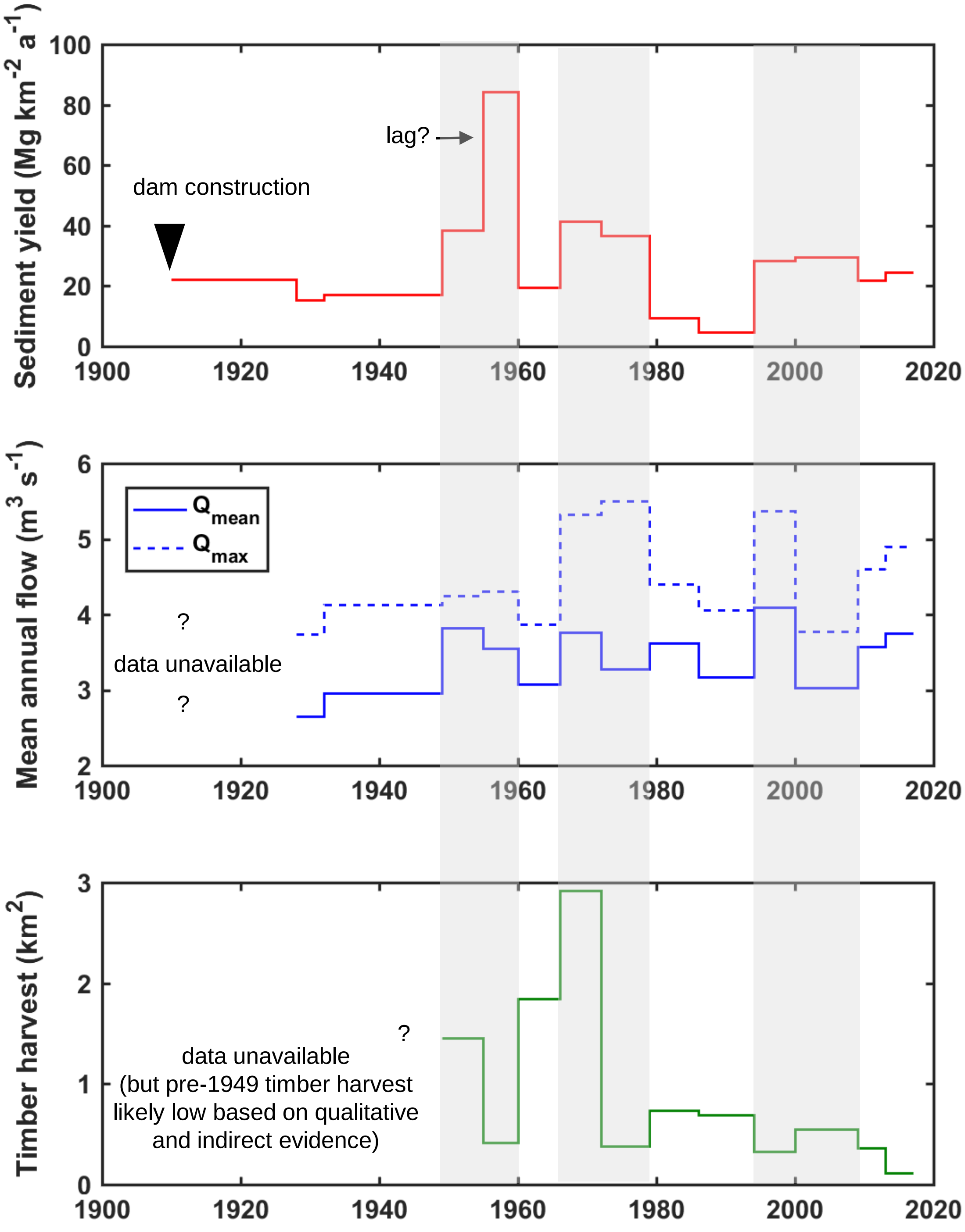


Figure above shows growth of the delta beginning in 1910 through 2017.

- 1910-1928 increment includes a shallow wedge of sediment at delta apex
- Deltaic deposits dominated by gravel and sand, overlying finer material

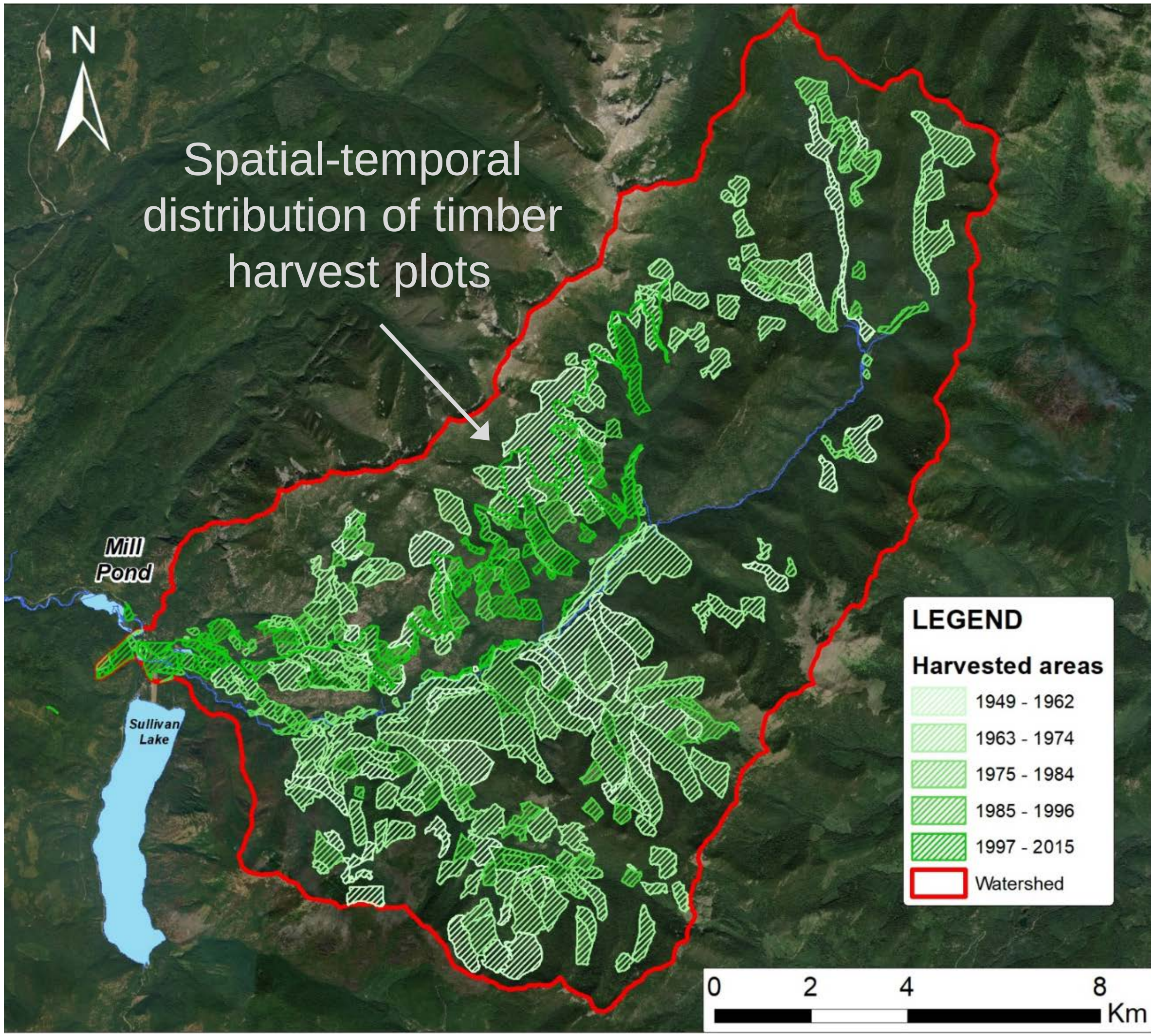
Preliminary results

- > 10-fold variation in specific sediment yield
- Higher sediment yield broadly coincides with higher flows and timber harvest (hydrology vs. sediment supply)
- However, note apparent lags in the response (routing system)
- Variable sensitivity to harvest: routing vs. change in forest practices



Preliminary results

- Differences in discharge associated with modes of climatic variability
- In-channel storage, valley floor, and timber harvest-related road erosion likely the key sediment sources along the surveyed channels network (at least during the last few decades)
- Further analysis is underway incl. sediment sources, uncertainty, etc.



Implications

Preliminary findings indicate that sediment yield in the basin:

- Falls within a range of values observed in other basins of similar size in the same region; overall, suggestive of relatively low sediment supply & geomorphic stability, in line with prior work[1]
- Varies over a wide range (>10-fold differences)
- Sensitive to hydro-climatic and anthropogenic disturbances: large floods and timber harvest (sediment production from forest roads?)

Sediment routing seems to play important role in “filtering” signal of disturbance in the study basin

Multiple (often correlated) factors regulate sediment yield: difficult to disentangle their unique influence

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References:

1. Cienciala, P., Nelson, A.D., Haas, A.D. and Xu, Z., 2020. Lateral geomorphic connectivity in a fluvial landscape system: Unraveling the role of confinement, biogeomorphic interactions, and glacial legacies. *Geomorphology*, p.107036.

THANK YOU

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