Understanding the Impacts of Post-Wildfire Process-Based Restoration on Sediment Fluxes and Transient Groundwater Storage in a Colorado Headwater Stream

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Background Information

- In 2020, the Cameron Peak Fire severely burned the majority of the Cache la Poudre Watershed.
- Caused increased sediment transport rate
- Water quality concerns downstream.
- Post-fire restoration efforts aimed at retaining sediment in the headwater systems began in 2021.
    - Structures included Post-Assisted Log Structures (PALS).

Research Objectives

Objective 1:
- Characterize the impact of PALS on sediment retention and groundwater transient storage

Objective 2:
- Evaluate the relationships between groundwater transient storage and restoration implementation scenarios through numerical modeling

Project Area – Elkhorn Creek

- Perennial
- 2-4 m channel width
- Seven channel-spanning PALS were constructed
- Five PALS were constructed in the floodplain/secondary channels

Methods

Sediment Probing

- Depth to Refusal
- Cross sections were taken beginning directly US of each PALS at an interval of 1m until the next PALS or end of study reach.
- Only in-channel sediment was probed.

Groundwater Wells

- 20 groundwater monitoring wells
    - 12 in the study reach
    - 8 in the reference reach
- Instrumented with a HOBO Water Level Logger measuring pressure and temperature every 15 minutes.

Additional methods included pebble counts, stream flow measurements, hand-held lidar, and slug tests

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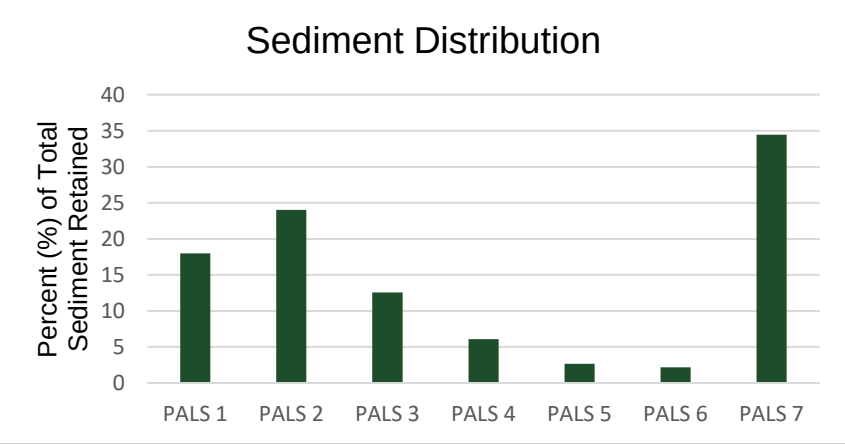
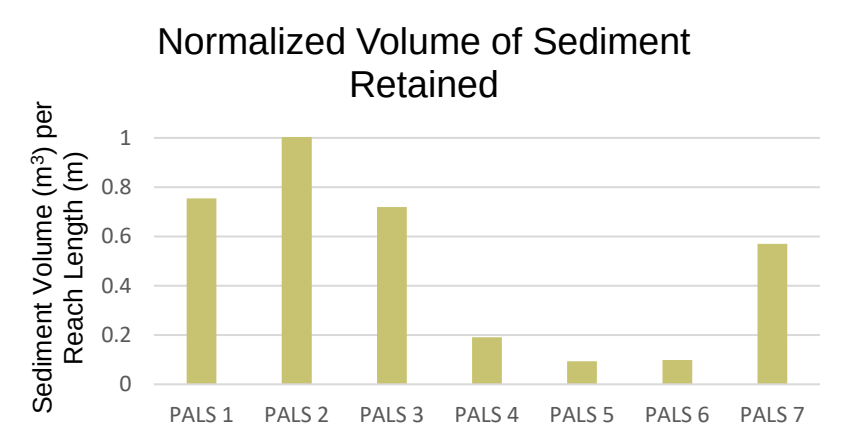
Results

Total Estimated Volume of Sediment Retained In-Channel:

~63 m^3 or ~2,224 ft^3

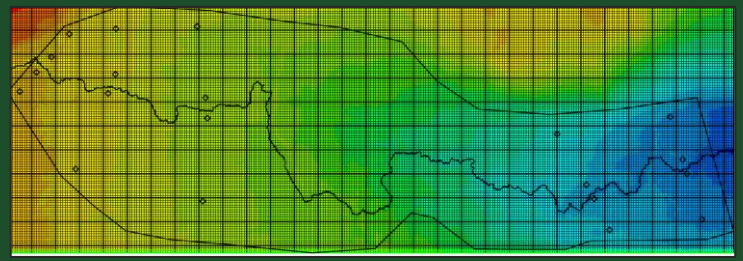




Upstream → Downstream

Current/Future Work

- Estimate volume of sediment deposited on the floodplain
- Further Groundwater Data Analysis
    - Focusing on the groundwater response during the receding limb of the hydrograph.
- Numerical Modeling
    - MODFLOW-NWT and a hydraulic model
    - Implement various restoration scenarios
    - Determine which scenario creates the greatest groundwater response



Thank You!

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Acknowledgments

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