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The influence of reintroduced beavers on sediment processes in post-wildfire headwater streams, Methow River, WA

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The Influence of Reintroduced Beavers on Sediment Processes in Post-wildfire Headwater Streams, Methow River, WA

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Project Goals

We investigated how beavers **mitigate the effects of recent wildfires on sediment dynamics** in montane headwater streams in the North Cascades, Washington. **Salmonid populations and macroinvertebrate communities** are affected by changes in fine sediment transport and organic matter in streams. Further investigation into the way beavers can help improve the environment for these species contributes to existing research.

Questions we asked included:

- Do beavers improve habitat downstream, especially in burned areas?
- Is there less fine sediment downstream of beaver ponds?
- Is there more fine sediment in burned areas?
- Which settings have the highest organic content?

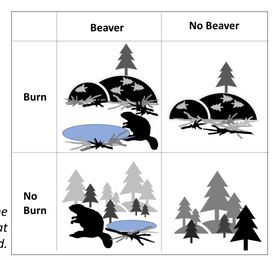

Fig. 1: A schematic showing the different kinds of settings that we sampled.

Setting and Background

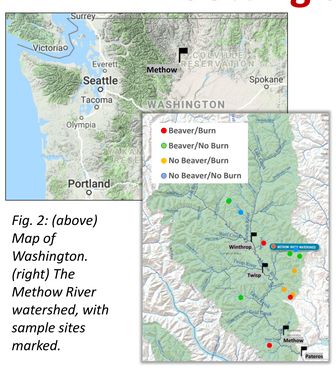

Fig. 2: (above) Map of Washington. (right) The Methow River watershed, with sample sites marked.

Located on the eastern side of the Cascades, the Methow River is a tributary of the Colombia River, and drains 4,900 square kilometers.

Fig. 4: A beaver in the process of being relocated.

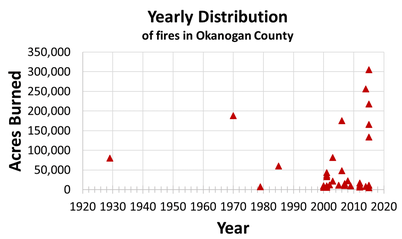

Fig. 3: Historical data showing the recent increase in bigger, more frequent wildfires near the Methow Valley.

The biggest and most destructive wildfires in the Methow Valley have occurred within the past five years. For example, the Okanogan Complex wildfires in 2015 burned over 304,782 acres and killed three firefighters.

The Methow Beaver Project works with 'problem beavers' that are building dams in the city and relocating them into their historical habitats in the mountains. In doing so, the beavers create wetlands, recharge groundwater systems, and change sediment transport

Methods

Field Methods

- In total, 57 stream samples were taken. For each sample, a baffle was set up to slow the stream velocity, and then a shovelful of the streambed was taken.
- Pond cores were taken along a transect, and at each sample site a depth reading was taken. We took 47 pond cores, with an average length of ten cm.

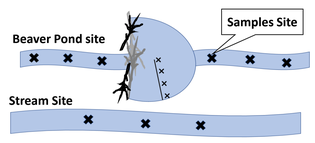

Fig. 6: Sampling schemes for different kinds of sites.

Fig. 7: (left to right) Stewart, Foster, and Rettig getting ready to hike out to a sampling site. Foster is holding the baffle.

Fig. 8: Putting samples out to dry back at camp with (left to right) Stewart, Foster, and Rettig.

Fig. 5: The beaver pond (and den) at Upper Cub Creek with (from left to right) Rettig, Stewart, and Wimberger.

Fig. 9: Taking a transect along a fallen log in the beaver pond at Mission Creek with (left to right) Wimberger, Stewart, and Foster.

Lab Analysis

- Each samples was divided into a manageable size using a splitter, and then was sieved in a mechanical shaker for about 15 minutes to separate the different size clasts (-4Φ to >+4Φ) from one another. Each size clast was then weighed out and used to determine a distribution curve.
- For elemental analysis, a subsample was taken, and the fine clasts were sieved out. The fines were homogenized using a mortar and pestle, and then were analyzed with a Cotech Elemental Analyzer (EA) for carbon content.

Fig. 10: 57 samples were sieved in order to be weighed.

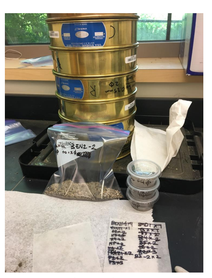

Fig. 11: Each size clast was weighed and recorded.

Fig. 12: A subsection of fines was run through the EA.

Do beavers and/or burns influence the size class distribution of streambed sediments?

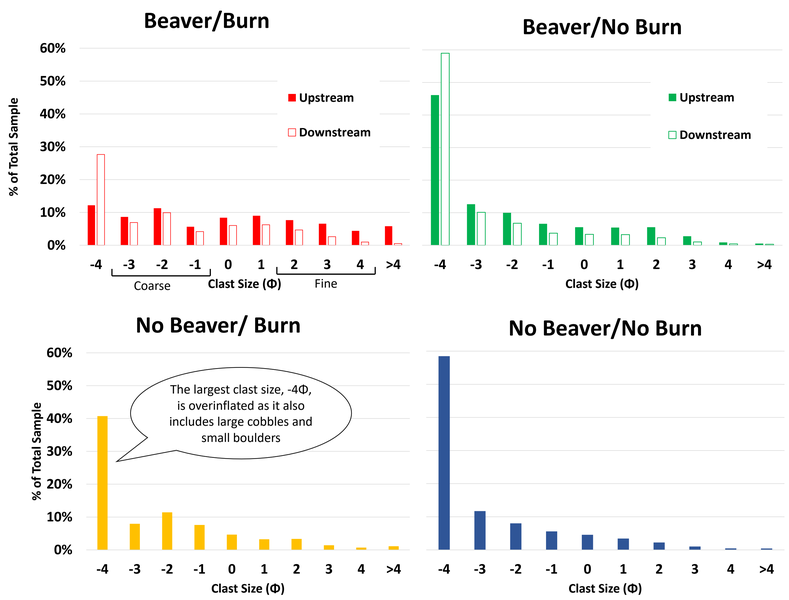

Fig. 13: Four graphs, each with a different setting. Beaver sites show an upstream versus downstream difference, whereas stream sites don't.

- High variance is shown, as a result of the high heterogeneity of the sample sites.
- Unburned areas have more sediment, both coarse and fine, than burned areas, which is likely a result of increased runoff, This occurs due to the lack of roots in the nearby landscape.
- Burned areas with a beaver presence show the largest difference between upstream and downstream, indicating that beaver ponds are acting as a sediment trap.
- There is a nearly statistically significant difference up vs downstream with fines (up to 33% difference).

How do beavers impact fine sediment transport in burned areas?

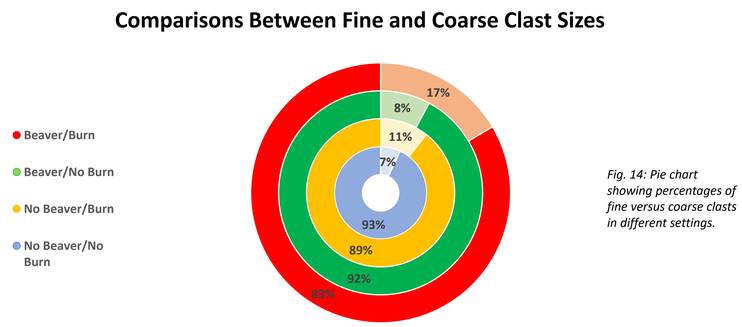

Fig. 14: Pie chart showing percentages of fine versus coarse clasts in different settings.

- Burned areas show the highest percentage of fine sediment, regardless of beaver status. This is likely due to higher runoff than in unburned areas.
- Burned areas with beaver ponds show the highest percentage of fines.
- Least amount of fines in no beaver/no burn areas, possibly because there is no mechanism in place to catch the fines.
- We would expect to see less fines in a beaver/burn setting than in a beaver/no burn setting, which this data doesn't represent. This is likely due to the high heterogeneity between sites.

What effect do beavers and/or burns have on organic content in streambed sediments?

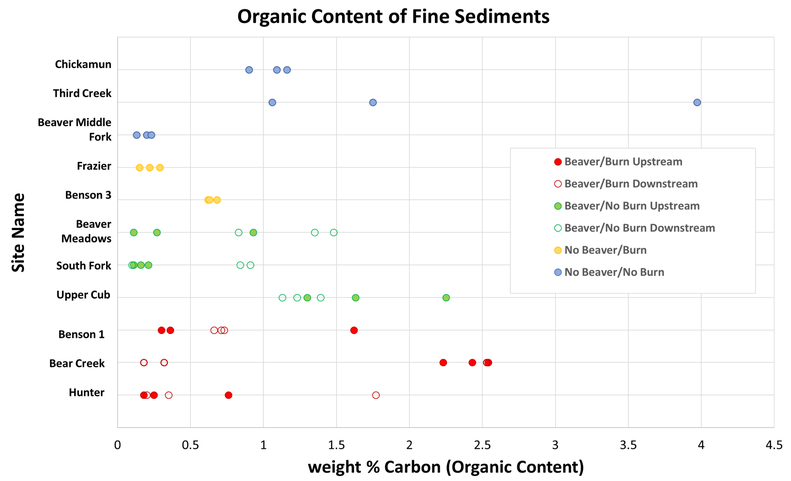

Fig. 15: Here the weight percentage of carbon in a sample is used as an indicator for organic content. Sediments show high heterogeneity.

- Downstream of ponds has a higher organic content than upstream, regardless of burned status.
- Streams with beaver presence have higher organic content, as beaver ponds allow algae, invertebrates, fish, and other forms of life to grow.
- Unburned areas have slightly higher organic content, because the organic matter was not already burned in a wildfire.
- In general, organic content is higher upstream of beaver ponds than below, showing the way beaver ponds can act as a filter.

Acknowledgements

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