Lateral channel migration on beaver dominated streams: California Creek, southwest Montana, USA

Margaret Anderson
margaret.anderson@umwestern.edu

MontanaView Remote Sensing Fellowship, April 2021
The University of Montana Western
Environmental Sciences Department

Introduction

Beavers and their dams can be considered a nuisance, especially to those that work or live adjacent to their habitats. Their dams can cause flooding, infrastructure obstructions in places like culverts and floodgates, and can damage or destroy mature streambank trees. Despite these problems, beavers are incredibly important for floodplain connectivity, helping maintain a high water table. In addition, their dams help store sediment and provide refuge for fish during low flows (Montana DNRC, n.d.).

In order to avoid beaver mitigation practices—including lethal extermination—a better understanding of beavers' effects on riparian ecosystems must be met. *How does beaver activity, such as dam building, affect lateral channel migration rates of small creeks in Southwest Montana?* The results of this question may improve understanding of how small-scale sinuous streams could migrate in the future in order to avoid mitigation practices while reaping the positive ecosystem services provided by beavers.

This project focuses on the lateral channel migration of California Creek (Figure 1) in southwest Montana. It is located in Deer Lodge county, west of Butte and south of Anaconda. After joining other small streams in the area, it flows into the Big Hole River.

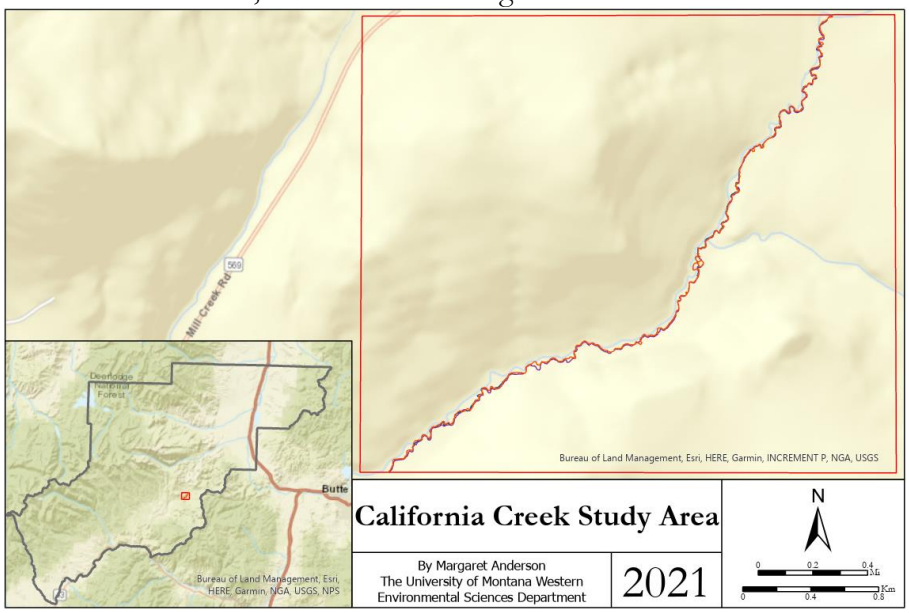

Figure 1: California Creek is located in Deer Lodge county of southwest Montana, west of Butte and south of Anaconda.

Previous Research

This study is based on a previous UMW graduate's work, Megan Tarmichael, who looked at lateral channel migration on Blacktail Deer Creek near Dillon, Montana. The study looks at both dammed and undammed reaches. Dammed reaches included a beaver dam that was present in 2009 imagery but was not present in 1995 or 2018 in order to see what the migration looked like pre-dam and post-dam. The reaches included 200 meters above and 200 meters below the dam, for a total of 400 meters. Undammed reaches were chosen based on the absence of dams during all time periods, and not within 250 meters of any dam.

Data

The data used in this project included satellite imagery from 1995, 2009, and 2018, to replicate Tarmichael's study. The 1995 imagery is Panchromatic 1-meter resolution in black and white, 2009 is a 50-centimeter resolution image from GEO1, and the 2018 imagery is a 1.5-meter resolution image from SPOT7. All images were purchased from Land Info Worldwide Mapping's archive.

Methods

All data was processed using ArcGis Pro. This process included manually drawing channel center lines, identifying dams, identifying reaches, separating reaches, and using the channel migration toolbox to calculate the area of migration.

- Channel center lines were drawn by adding and editing vertices of a line shapefile.
- Reaches were chosen based on the presence or absence of beaver dams—dams were identified by observing imagery (i.e. creek obstructions that pool the flow) and undammed reaches were located based on the absence of dams during all time periods.
- Reaches were separated by duplicating channel center lines, using the "Measure" tool to measure the appropriate reach length, then deleting unnecessary vertices outside of the reach length.
- Both dammed reaches and undammed reaches were put through the channel migration toolbox (dammed reaches were calculated as a whole, as were the undammed reaches), which is available at this site.
- I observed three dammed reaches, each 400 meters in length, and two undammed reaches, each 200 meters in length.

Results

In dammed reaches from 1995 to 2009 (Figure 2), the total migration over fourteen years was 2.54 meters or 0.182 meters per year. From 2009 to 2018, the total migration was 3.303 meters over nine years or 0.367 meters per year.

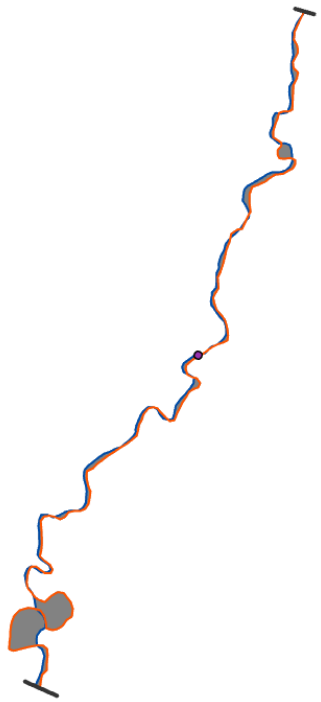

Figure 2: This figure shows the migration of the second dammed reach, from 1995 (orange) to 2009 (blue). The purple dot marks the location of the beaver dam.

In undammed reaches from 1995 to 2009, the total migration was 1.721 meters over fourteen years or 0.123 meters per year. From 2009 to 2018, it was 4.056 meters over nine years or 0.451 meters per year, the highest of all.

Considerations

Some considerations to these results include: 1) Imagery resolution, especially in 2018, was poor. It can be difficult to distinguish the difference between a dam and an unrelated obstruction. In addition, poor resolution and bank vegetation makes it difficult to see the channel and to define where the channel centerline is. 2) The study area was limited (due to the extent of the 2018 imagery), resulting in a small sample size. 3) Other factors may contribute to channel migration, such as calving banks from livestock grazing.

Summary

In conclusion, the highest channel migration rate occurred from 2009 to 2018, both in dammed and undammed reaches. The highest migration rate was on undammed reaches from 2009 to 2018.

Looking forward, this study can be replicated in order to get an understanding of the potential lateral migration of small, beaver-dominated, sinuous streams in southwest Montana and similar environments. To conduct this study more accurately, higher resolution imagery (at least 50-centimeter resolution) and more information about the study site (i.e. is this area affected by livestock or other factors?) is required. Repeated studies may improve planning in beaver-dominated riparian environments, thus lessening the need for beaver mitigation practices.

References

Montana DNRC. (n.d.). *Beaver Dams.* Montana Stream Permitting: A Guide for Conservation District Supervisors and Others. Retrieved on April 23, 2021 from http://dnrc.mt.gov/licenses-and-permits/stream-permitting-book/chap2.pdf

Tarmichael, Megan. (2019). *Investigations of lateral channel migration on beaver dominated streams in southwestern Montana, USA.* The University of Montana Western.