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Willow recruitment and channel patterns in beaver dominated stream systems

Rebekah Levine¹, Megan Tarmichael¹, and Grant Meyer²

¹University of Montana Western, Environmental Sciences Department, Dillon, Montana, United States of America

²University of New Mexico, Department of Earth and Planetary Sciences, Albuquerque, New Mexico, United States of America

Beaver activity can segment a stream corridor through dam building which locally affects channel slope and sediment transport. We have found, however, that long-term beaver presence within a river corridor has impacts beyond dam sites that affect system-wide stream morphodynamics and riparian willow recruitment. Along study streams (basin areas 20 – 125 km²) in southwestern Montana, USA, beaver-chewed willow stems (beaver cuttings) from dam construction, food caches and herbivory float downstream and commonly accumulate within 1 km of dam sites. At the 90 randomly selected sites surveyed, beaver cuttings accumulated on 81% of point bar sites and 51% of all surveyed sites. The accumulated beaver cuttings can sprout, adding roughness, thus enhancing sediment accumulation on point bars and at abandoned dam sites. Sprouting stems were present at 25% of all sites, indicating that beaver cuttings commonly provide a secondary pathway for willow recruitment and influence sediment dynamics.

As beaver cuttings and sediment accumulate on point bars, the channel migrates laterally, burying the cuttings. High resolution aerial imagery has been used to calculate migration rates for twenty-six 200 m reaches in the study streams. Migration rates range from 0.07 – 2.91 m/yr (mean 0.43 m/yr) over a 14 year period from 1995-2009. Thirty-four radiocarbon (¹⁴C) ages found in fluvial terraces 1.2 – 3 m above the bankfull channel, show that beaver cuttings range in age from ~6030 – 380 cal yr BP, demonstrating that deposition and burial of beaver cuttings on point bars has been a common process over millennia. The long-term preservation of beaver-chewed wood in point-bar sequences also attests to the importance of beaver activity for enhancing carbon storage in beaver-occupied stream systems.

The mosaic of sites created by beaver includes intact dams, recently breached or abandoned dams, and long-abandoned dams, interspersed with reaches unsuitable for beaver. The beaver produced habitat heterogeneity interacts with sediment and beaver cutting transport to enhance riparian plant colonization and meander development.