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UNDERSTANDING YELLOWSTONE STREAM MORPHOLOGY AND DYNAMICS THROUGH FLOODPLAIN INUNDATION MODELING

PHINNEY, April I.[1], FOKY, Trent[2], HINZMANN, Alice[3], IOSSO, Chantal[4], VAN WETTER, Eliza[5] and PERSICO, Lyman P.[2], (1)Department of Geology and Environmental Science, Wheaton College, 501 College Avenue, Wheaton, IL 60187, (2)Department of Geology, Whitman College, 345 Boyer Ave, Walla Walla, WA 99362, (3)Department of Geology, Carleton College, 300 North College Street, Northfield, MN 55057, (4)Department of Geology, Washington and Lee University, 204 W Washington Street, Lexington, VA 24450, (5)Department of Geology, Whitman College, 280 Boyer Ave, Walla Walla, WA 99362

Trophic cascade theory predicts cause and effect relationships between ecosystem elements that may impact river morphology. The removal of wolves from the Yellowstone ecosystem in the early 20th century could have altered stream dynamics in northern Yellowstone National Park. Without wolves, elk proliferated, and excessive foraging reduced riparian vegetation. Increased elk browsing of willow and aspen coincided with decreased beaver activity. The absence of beaver dams may have caused streams to incise and abandon their historic floodplains. The new channels have steep banks and small inset floodplains. To assess historic changes to streams, it is necessary to understand valley floor morphology and Holocene stream behavior. In this study, we surveyed the east and west forks of Blacktail Deer Creek, a small meandering stream confined in meltwater channels. Near the confluence of the two main tributaries, there is significant valley fill and an alluvial fan. We surveyed stream cross sections using RTK GPS and extended the cross sections across the valley using a LIDAR-derived DEM. Characteristic flood discharges were estimated based on regressions developed from gauged streams in Wyoming and three years of discharge data along the west fork. In HEC-RAS, we modeled the extent of bank flooding for 2, 5, 10, 50, 100, and 500-year floods. The east fork of the river is inset within a widespread terrace 2-3.5 m above the channel. Variable incision and lateral migration of the channel has produced surfaces of different elevations relative to the current channel. A small inset floodplain is inundated every 2-5 years. The west fork of Blacktail Deer Creek is more complex; repeated channel avulsions have developed varied paleochannel and floodplain surfaces inset and confined by kame terraces. The higher terrace surface on both tributaries is not inundated by a 500-year flood, and, based on soil development and ^{14}C ages, developed in the middle and early Holocene. Thus, this is not the historic floodplain but an older terrace deposit. The complexities of Blacktail Deer Creek call for nuanced consideration of geomorphic influences, such as gradual stream migration, channel avulsions, and bank collapse, on stream and floodplain behavior in addition to the theory of trophic cascades to adequately explain channel morphology.

Session No. 7--Booth# 54

T17. Undergraduate Research II (Posters)
Monday, 4 May 2020: 8:30 AM-4:30 PM

Ballroom A (Utah Valley Convention Center)

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