**Current and historic stream channel response to changes in cattle and elk grazing pressure and beaver activity**

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Livestock grazing and beaver trapping alter streams hydrologically and geomorphically leading to declines in the quality and the extent of stream-riparian ecosystems. The influence of reductions in grazing pressures and fluctuating levels of beaver activity (treatments) on channel capacity was studies at 108 channel cross-sections, located on eight headwater streams in Montana and Arizona. Cross-sections were surveyed two or three times over a two-to-five year period to determine annual rates of change as a function of treatment. Most cross-sections in the cattle and elk exclosures and grazed areas showed minimal changes in area (< 10 percent). Large decreases in cross-section area were observed in reaches with intact beaver dams, especially near the dams. The beaver ponds reduced the channel capacity between 50 to 100% in most reaches, compared to <= 25% in reaches without beaver ponds. The ponds effectively restored the hydrologic connection between the stream and valley floor in less than one year. Upon dam failure, channel capacity increased within a year by 40 percent or more as ponds drained and sediment eroded.

A conceptual model describing geomorphic and hydrologic response of a drainage basin to the entry of beavers and then their removal or abandonment was developed, based on a literature review and field data. The model suggests that the simultaneous existence of discontinuous arroyos and wetlands, observed by Euro-American expeditions to the Southwest prior to settlement, may in fact reflect landscapes transforming due to recent beaver trapping rather than a recent climate shift. Beaver-dam failures would trigger channelization and thus greater flood magnitudes as water was more rapidly routed from upper to lower watersheds.

The study suggests that Euro-American trapping and grazing, though temporally and spatially separated, combined with two recent periods of above-average precipitation to transform drainage networks in the West and increase stream ecosystem sensitivity to climatic variability. The transformation pre-dates the installation of stream gages and the data collection that forms the current basis of our understanding hydraulic geometry and fluvial processes. Consequently, current hydraulic geometry relationships and our understanding of stream sensitivity to climatic variability reflect highly disturbed watersheds and ecosystems, not intact systems.