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Science BRIEFING

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CHANGES IN CHANNEL MORPHOLOGY OVER HUMAN TIME SCALES

BACKGROUND

Rivers are exposed to changing environmental conditions over multiple spatial and temporal scales, with the imposed environmental conditions and response potential of the river modulated to varying degrees by human activity and our exploitation of natural resources. Watershed features that control river morphology include topography (valley slope and channel confinement), discharge (magnitude, frequency, and duration of runoff events), sediment supply (volume, caliber and frequency of sediment delivery), and vegetation (riparian communities (bank strength, roughness) and in-channel wood debris). River stability and response to changing environmental conditions are highly dependent on local context (channel type and associated degrees of freedom; the nature of the imposed sediment, hydrologic, and vegetation regimes; imposed anthropogenic constraints; and the legacy of past natural and anthropogenic disturbances).

Steep, confined mountain streams, tumbling over large cobbles and boulders, may remain stable for decades.

RESEARCH

Research Activity: John Buffington (USFS Research Geomorphologist) recently contributed a book chapter (in Church *et al.* 2013) reviewing channel change over human time scales, which encompasses small-scale adjustments resulting from seasonal changes in watershed inputs to large-scale changes in reach morphology resulting from infrequent floods or decadal to centennial changes in climate (wet/dry cycles). The chapter begins with a review of scales of channel change and the spatial and temporal variability of channel response. This is followed by an examination of the available approaches for predicting channel change which, despite recent advances in the field, are still mainly limited to lowland rivers and assumptions of equilibrium conditions. Transient channel responses are explicitly accounted for in numerical models, but temporal variability of channel condition is typically absent in other quantitative models of channel response. Quantifying temporal variability is critical for assessing channel condition, planning restoration design, and predicting effects of climate change on riverine ecosystems.

Changes in the location of channels in this braided stretch of river can cut into or add to adjacent agricultural lands.

KEY POINTS

- Rivers are dynamic, and subject to rapid change in channel shape and flow pattern.
- The potential for channel change varies over space and time as a function of the imposed environmental conditions, the ability of the channel to respond to change, and the thresholds and time scales for a given response to occur.
- Unconfined alluvial channels have the greatest potential for channel response.
- Over human time scales, rivers exhibit responses ranging from small-scale adjustments resulting from seasonal changes in water and/or sediment discharge to large-scale changes resulting from infrequent floods or decadal to centennial changes in climate (wet/dry cycles).

MORE INFORMATION

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Keywords: *channel morphology, rivers, spatial and temporal scales*

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