



The Fate of Oxbow Lakes Determined by Mechanisms of Meander Cutoff

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Oxbow lakes are some of the most widespread and distinctive landforms along meandering rivers, but their persistence as aquatic habitat may depend on the mechanisms of their formation. Based on an archive of historical aerial photographs and maps of seven meandering rivers, we use changes in water-surface area as a proxy for alluviation to demonstrate that oxbows and abandoned channels created by neck cutoff can persist in the floodplain for centuries, whereas the oxbows and abandoned channels created by chute cutoff appear to undergo rapid alluviation following their formation. Differences in the persistence of the thirty-seven oxbows and abandoned channels under study are due to differences in the planform characteristics that are associated with each cutoff mechanism. Using theoretical and empirical relations that describe the conditions required for the conveyance of riverbed sediment, we show that neck cutoff results in the successful transition of persistent oxbows because they lack the planform characteristics required for sustaining the flows needed to prevent plug formation. The angle by which flow is diverted and the magnitude by which the river is locally steepened is significantly greater for channels created by neck cutoff than for those created by chute cutoff.