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Is there a pattern to oxbow lake geomorphic evolution?

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Oxbow lakes are located along the floodplain corridor and created after meander cutoff. They are of high ecological value as they provide relatively calm wetlands which are regularly supplied with nutrients during floods. The persistence of oxbow lakes has been observed to vary from decades to several hundreds of years but little is known about the controls on their longevity. This study aims to ascertain if there is a common pattern in the water decrease of oxbow lakes and to define the controls on the lakes' longevity. The longevity of 37 oxbow lakes from 7 rivers from different parts of the world has been studied. The Towy River (Wales), the Ain River (France) and the Sacramento River (CA, USA) are largely dominated by oxbow lakes created after chute cutoff which is the incision of a chute across the floodplain; whereas the Mississippi River (MS, USA), the Kansas River (KS, USA), the Red River (MN, USA) and the Otter Tail River (MN, USA) show a large number of neck cutoffs which occur when two meanders migrate into one another. The water surface area decrease has been measured for all the sites using aerial photographs. Results revealed that the longevity of oxbow lakes is significantly affected by the type of cutoff. The lakes formed by chute cutoff lose very rapidly most of the water surface area of the initial channel as it is reduce by >80% within the first 10 to 30 years following cutoff for most sites. The water surface area of chute cutoff shows a logarithmic decrease with a fast decrease rate following cutoff, followed by a much slower loss of water surface area. The change in water decrease rate appears to be related to the moment of obstruction of the former channel entrance by sediment aggradation. In contrast, lakes formed by neck cutoff persist for much longer in the landscape and lose 40 to 60% within the first decades but then they maintain this water surface area for longer than a century. The cutoff process is therefore the main control on the persistence of oxbow lakes and has important impact on the habitats on the floodplain corridor.