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## **Assessing the rates of channel shifts, bend development and bank erosion hazard on the Sajó River (Hungary) by aerial and terrestrial photogrammetry**

László Bertalan (1), Gergely Szabó (1), and Saleh Yousefi (2)

(1) Department of Physical Geography and Geoinformatics, University of Debrecen, Debrecen, Hungary (bertalan@science.unideb.hu), (2) Department of Watershed Management, Tarbiat Modares University, Tehran, Iran (saleh.yousefi@modares.ac.ir)

The alluvial meandering Sajó River (or Slaná in Slovakian) is a transboundary river of Slovakia and Hungary with a total length of 229 km, of which 124 km is located in the Hungarian territory. Regarding the river regulation and management, Sajó River shows one of the highest rate of free forming sections in compare with other alluvial rivers in Hungary.

The recent morphodynamics of Sajó River had been investigated by GIS analysis of planform geometry parameters based on cartographic data and historical aerial imagery regarding the period between 1952 and 2011. According to the natural and anthropogenic effects the study reach of Sajó River had been classified into 12 sub-reaches. The horizontal dynamics of free-forming unconfined meandering reaches were analyzed regularly by DJI Phantom 2 UAV (Unmanned Aerial Vehicle) drone surveys. In selected bends terrestrial close-range photogrammetry and Structure-from-Motion methods were used in order to generate high resolution point clouds. This base data allowed us to estimate the rate and type of lateral bank erosion hazard.

The results show that the rate of lateral erosion exceeds the mean annual value of 4.5 meters/year in study reach; moreover, the results indicate a bank retreat of 2 meters/month at the most erosive reaches. Diverse bend evolution types from translation to rotation can be observed and these processes are followed by slump block failures and crevasse splay phenomena.

This approach provides a complex and detailed overview about the recent geomorphological state the Hungarian section of Sajó River. The process results could help to reveal the main driving factors of the extensive lateral erosion hazard in this area in the future.

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