Interaction and Reorganization of Loess Gully Network Evolution

Siming Chen\textsuperscript{1,2} and Liyang Xiong\textsuperscript{1,2}

\textsuperscript{1}Nanjing Normal University, School of Geography, Nanjing, China (chensiming_222@qq.com)
\textsuperscript{2}State Key Laboratory Cultivation Base of Geographical Environment Evolution (Jiangsu Province)

Loess gully is the most active and changeable landform unit in the Loess Plateau of China, whose morphology has been shaped under various formation processes. During the evolution process, gullies in the Loess Plateau interacted with each other and formed an intricate network system, which was the channel for material transportation and energy transmission in this area. From the perspective of the gully evolution process, the development of gully network is dynamic because such a network gradually tends to equilibrium through continuous reorganization. During the evolutionary process, stream capture occurs when a stream or watershed is diverted from its own bed, and flows instead down the bed of a neighboring stream. The stronger and more powerful streams (in terms of channel gradient, stream velocity, discharge and kinetic energy) capture the upstream of weak streams. In the process of dynamic reorganization, the loess gullies formed different shapes and gradually evolved into a stable network structure. In this paper, several gully areas in the Loess Plateau were selected. Based on the geological background, 5 m horizontal-resolution DEM data were used to analyze these areas. The $\chi$ index was used to describe the dynamic characteristics of the gully network, which could characterize the evolution trend of the gully. Finally, the author reveals the evolution and reorganization process of the loess gully networks by comparing the $\chi$ index diagrams of different areas in different developmental stages. The results show that the area with the stable geological background is closer to the equilibrium state than the area with the complicated geological structure. In other regions, networks composed of gullies in the middle development stage are more stable than networks in the early development stage. More importantly, for two adjacent mature gully networks, the developmental trends at different locations on their watershed boundaries may be different. The results provide for an understanding of gully network evolution and reorganization process in the Loess Plateau, which also contribute to the development of a process-based gully evolution model.

Key words: Loess Plateau ; Gully Network ; Geomorphologic Evolution ; Digital Terrain Analysis