



Analysis of initial drainage network evolution from aerial photography and a DEM time series

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The evolution of erosion rill or gully networks is a formative process in initial landscape development. Digital representations of drainage networks are often derived from Digital Elevation Models (DEMs) based on morphometric parameters, or mapped in field surveys or from aerial photographs.

This study attempted to reconstruct and analyze the first five years of erosion rill network evolution in the 6 ha artificial catchment 'Hühnerwasser', which serves as a real world-laboratory to study patterns and processes of initial ecosystem development.

The drainage network was characterized in a twofold approach, based on the analysis of remotely-sensed data. We used high-resolution drone-based aerial photographs to map the actively eroding rill network for four states of development, and a time series of ten Digital Elevation Models to characterize the morphology of the surface. Rill network maps and morphometric parameters were combined to allow for region-specific analyses of morphometry for different parts of the rill network.

After a rapid growth of the erosion rill network during the first two years of development, a reduction of the area of actively eroding rills was observed. Region-specific analysis of morphometry indicates an increase in flow accumulation in the central parts of the rill network, which suggests that locally evolving feedback cycles between flow accumulation and erosion affected rill network development, in addition to the effects of precipitation characteristics and the growth of vegetation cover.

The combination of drainage network characterization from aerial photography and DEMs could improve analyses of initial drainage network development in experimental studies, as it allows for critical comparisons of flow accumulation patterns and the actual patterns of erosion rills or gullies.