

Gully erosion in Northeast China – a case study on history, erosion rates and causes

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Abstract

Mollisols are of major importance for food security worldwide but are increasingly degraded by soil erosion. Mollisols in Northeast China have been converted into agricultural use only recently, but gullies are widely distributed and gully erosion history, rates and causes remained unclear. We chose a study typical village to estimate initiation years and development rates of the gully systems from 1968 to 2018 by using aerial and satellite imagery. The outlet fan deposits of a large gully system were dated by Caesium-137 (137Cs) and artefacts. To verify the results, we collected information from local farmers. Gully volumes were measured by structure-from-motion technique using photos taken from an unmanned aerial vehicle. Our results showed that gully systems had already appeared on the steep slopes and along unpaved roads in 1968 and had become more complex by 2018 despite terracing and afforestation. Based on gully morphology and 137Cs, gully erosion was estimated to have started in the 1950s to 1960s when the original grassland and forest were completely converted into arable land. From 1968 to 2018, the gully density increased from 1.2 to 2.3 km km⁻². The gully heads retreated at speeds from 1.5 to 2.5 m yr⁻¹, and the soil loss from gully erosion ranged from 25.7 to 44.7 Mg yr⁻¹ ha⁻¹. These data demonstrate the severity of gully erosion in study region and underline the importance of appropriate countermeasures, such as maintenance of abandoned terraces under reforested land and better design and construction of roads within the arable land.

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