The influence of tropical cyclones in gully formation: A case study from Madagascar

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Soil erosion has been recognized as the main cause of land degradation worldwide and gully erosion is currently considered as one of the most striking erosion type. Madagascar is one of the most affected country with special gullies called lavakas. Despite of the several decade long research, the reasons and the mechanism of their formation are still unknown. Anthropogenic factors, specific combination of lithology, weathering profile and topography are most often stated but numerous publications mention climate as a main factor. We studied the role of climatic conditions and tropical cyclones since 2014.

This study aims to analyze lavaka distribution with GIS methods and to find relation between lavaka density, lavaka density change and climatic conditions. Lavakas have been identified in 17 selected study sites by visual recognition using satellite images from years 2000-2009 and 2003-2008. A total of 1330 km^2 has been processed at 1 km x 1 km grid cell scale.

The total number of recognized lavakas was 1592 in the 17 sites that corresponds to a varying lavaka density of 0 and 8.53 km^{-2}. Data show that the appearance of lavakas is related to the spatial distribution and the inter-annual variability of precipitation and this connection is further strengthened by the tropical cyclones. Furthermore, among our 17 study sites changes in lavaka density were observed between 2000-2009 and 2003-2008 only in areas frequently hit by cyclones in the last 20 years.