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Development and natural infilling of a gully under cropland in Sicily

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Gullies are relatively permanent, steep-sided water courses that experience ephemeral flows during rainstorms. Gully erosion causes great damage both in-site and off-site. Several studies discuss gully extension rates in different environments as well as under laboratory conditions, but there is limited information on medium-long term gully evolution. In this study, the medium-term evolution of a gully developed in a cultivated area on silty-clay-loam soil in central Sicily (Italy) from almost 20 years was studied over 11 years (from 2004 to 2014). During the examined period the gully evolved naturally as the farmer has not adopted any artificial measure, such as gully filling activities, to control gully erosion and continued the same agricultural management practice. The observations are based on high-altitude aerial photographs in combination with ground measurements.The channel size evolved over time. In particular, the gully length decreased of 31.7%, while the average width increased by 17.6% in the central and upstream part, and decreased in the valley segment. The reduction of the length occurred gradually during the observation period and was due to the natural infilling in the downstream area of the field where the gradient is less. The average infilling rate was of 3.43 m year-1.The gully width decreased between 2004 and 2005, increased slightly in 2006 and, therefore, showed a significant increase after 2010. The channel size evolution was mainly due to the rainfall characteristics of the different years. During the first years when the gully was highly active, no vegetation was observed in the channel floor. A dense vegetation, consisting mainly of herbaceous plants, was instead observed in recent years. The results, on the whole, show how the gully can be naturally filled if the soil management system and precipitation regime are invariant. According to field observations in the same area, in the future, the entire gully can be completely filled.