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## Small permanent gullies: modelling and application to a semiarid region

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Gullies are key drivers of land degradation, are important sources of sediment and increase sediment and pollutant connectivity in the catchment. They also play an important role in desertification areas, changing the water-table height and in farmlands, reducing productive areas. In this study, we attempted to model small permanent gullies, common in the Brazilian Semiarid Region, where the shallow soils limit the size of gullies cross-sections to a depth of no more than one meter. To model this process, we coupled the models of Foster and Lane (1983) and Sidorchuk (1999), in order to consider the effect of permanent gullies not considered in the first. Both models need as input the discharge peak and its duration, however, these data are frequently not available. We tested four different rain intensities (average, 60-minute, 30-minute and 15-minute), finding that the most intense 30 minutes represent the best the effects of the storms over gully erosion. The coupling of the two models is defined by a threshold that indicates when the equations for sidewall erosion proposed by Sidorchuk should be applied. To validate the model, we measured three gullies in the Brazilian Semiarid Region. The gullies were initiated in 1958 after the construction of a country road and have drainage area below 1 ha. The model yielded a Nash-Sutcliffe coefficient of 0.85.