

## **Effects of gully erosion on sediment connectivity in a small agrarian catchment: basis of an experimental proposal**

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Connectivity aims to explain the transit of substances in a certain (natural) area. Thereby, the connectivity of sediments from soil erosion involves complex factors determining the subsequent movement of detached matter across the land (for instance, a hydrographic catchment). Agricultural soil erosion in Navarre has been studied mainly by recording sediments at the outlets of experimental catchments. These studies have revealed a complex dynamics in the sediments. For example, a clear seasonality was noticed, with the highest records in winter and the beginning of spring, coinciding, however, with rainfall events of a relatively low erosion capacity. In fact, this dynamics was not only conditioned by the intensity and duration of precipitations, but also, for instance, by the soil's previous humidity, use and management, and by plant cover. Further, it was suspected that a key factor in sediment connectivity would be erosion due to concentrated flows (i.e. ephemeral gullies), which would act as a source and transport of sediments. The aim of this research is to monitor, long-term, the movement of sediments generated by erosion from ephemeral gullies within a typical agrarian catchment in Navarra, in order to clarify the role played by those gullies in sediment connectivity.

The experiments will be performed in the experimental catchment of "La Tejería" (169 ha) located in the Central Area of Navarre, and which is frequently affected by concentrated flow erosion and with long-term records of sediments at its outlet. The climate is humid submediterranean, with an average annual precipitation of approximately 725 mm. The prevailing soil class is Vertic Haploxerept and cereal crops usually cover over 90% of the total area.

Our previous experience in the study area would permit the prediction, with a high degree of certainty, of the appearance of ephemeral gullies at least in 4-5 watercourses selected. A specific tracer (a rare-earth oxide) will be sprinkled over each watercourse following the methodology proposed by Masselink et al.(under review). This will also be done throughout the principal channel of the catchment in an area next to its outlet. These tracers do not affect either the soil properties – or therefore their erodibility – or the natural process of sediment transport by runoff either.

With the formation of each gully, after the occurrence of rain events, significant for their intensity or duration, the surface layer of the soil will be sampled. This will be carried out throughout the natural drainage network of the catchment (determined from a high resolution DEM), starting from the gully upper limit to the main channel of the catchment. The soil samples will be analysed in our laboratory. A very much higher rare-earth oxide concentration than those found naturally in the soil would indicate that this element comes from the experimentation and, therefore, from a certain gully.

The spatial-temporal monitoring of the sediments from different gullies associated with rainfall records, soil conditions, degree of plant cover, and sediment records at the catchment outlet, would contribute to a better understanding of sediment movement and the factors conditioning its dynamics.

### References

Masselink, R. J.H., A. Temme, R. Giménez, J. Casalí, S. Keesstra. Determining hillslope-channel connectivity in an agricultural catchment using rare-earth oxide tracers and random forests. Cuadernos de Investigación Geográfica. (Under review).