



## **Assessment of AnnAGNPS model capacity to simulate ephemeral gullies initiation and development**

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The relatively recent recognition of the importance of ephemeral gully erosion in agricultural fields in Europe explains that so far only a few mathematical models have included algorithms to simulate this type of concentrated flow erosion. Precisely, a conceptual and numerical framework was recently incorporated in the Annualized Agricultural Non-Point Source (AnnAGNPS) model to simulate gully initiation and development in order to assess the impact of gully erosion (sediment production) on management practices at watershed scale. More precisely, the Compound Topographic Index (CTI) approach was integrated within the existing AnnAGNPS GIS interface in order to identify the Potential Ephemeral Gully (PEG) mouth throughout a watershed. In addition, the Tillage-Induced Ephemeral Gully Erosion Model (TIEGEM) was also incorporated into AnnAGNPS to estimate ephemeral gully development.

The aim of this work was to assess the capability of AnnAGNPS for predicting (i) PEG location and (ii) gully erosion rate and gully geometry.

The study was carried out in the region of Pitillas (southern Navarre, Spain; under continental Mediterranean climate), in several field sites cultivated with wheat. First, thirty-one EGs observed in the fields and depicted in aerial photographs were taken as references. A DEM of the study area (5 x 5 m) was processed using AGNPS ArcView interface to determine the CTI values of each raster grid. Then, seven cumulative percentage values of CTI thresholds (94%, 95%, 96%, 97%, 98%, 99% and 99.5%) were used to create seven potential scenarios of PEG mouths locations in the study area. These scenarios were compared with the reference EGs. The CTI cumulative percentage thresholds of 95% presented the best performance in predicting EGs locations. However, the accuracy of the CTI approach notably decreased in low slope areas.

On the other hand, four EGs developed and surveyed in the same study area -in different years between 1996 and 2001- were used to evaluate the performance of the model to estimate gully erosion rate and channel geometry (length and width). After calibration and validation, AnnAGNPS overestimated EG erosion rate and dimensions. This due to an overestimation of the gully length.