RISK MAPPING. APPLICATION OF A GIS TO EVALUATE THE POTENTIAL WATER EROSION IN LOS MONTES DE TOLEDO (SPAIN).

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Abstract

The risk mapping of water erosion provides information about the erosive potential of a territory. This information can be expressed qualitatively by setting up spatial units with different grades of soil protection regarding the erosion, by means of the combination of the physical variables which regulate the process. In this study, a risk mapping of water erosion is made in an area of Los Montes de Toledo by using a GIS and the methodology of the project LUCDEME in order to study the erosive landscapes.

1 Introduction

Risk maps are suitable to know the natural limits of certain activities and to evaluate the effects which are derived from the transformation of the territory. Their main advantadge is that everybody, even non-specialist people, can interprete them easily.

Risk maps of water erosion are used to locate geographically the areas with the biggest susceptibility. However its making is usually difficult because of the obtaining, manipulation and representation of the physical information. The GIS's are suitable for the spatial distribution of the variables and for representing the product of the combination of these variables. It is appropriate to emphasize that the reliability of the final map is never attributed to the GIS but to the quality of the physical information that has been obtained and to the methodology that has been used.

The aim of this study is to obtain a qualitative risk map of potential water erosion as first approaching to the diagnosis of the process. A GIS raster is used for the Cartographic Modelling. We have designed a data base whose information strata correspond to every physical variables which were chosen as decisive.

2 Materials and methods.

The area of study covers 322 km^2 and it corresponds to the River Bañuelo Basin in Los Montes de Toledo (Spain). The grade of soil protection is evaluated as contrated with water erosion, based on the methodology of the project LUCDEME (1982) in order to study the erosive landscapes. The main factors which were selected are: slope, vegetation and soil

The rain factor was not included because we thought that, because of the reduced size of the area, its weight is constant in the whole territory.

In order to generate the data base, the following thematic layers were digitized: contour lines, vegetation units and soil units. The final map was obtained by means of the cartographic modelling and starting from these layers.

2.1 Slopes layer.

The slope is one of the most important factors because of its direct relation with the erosion rate. This thematic layer was obtained in this way:

- Manual digitization with Arc/Info of the contour lines in vector model of the Mapa Topográfico Nacional (scale 1:50.000). We went on to error refinement and correction and to georeference.

- Modelling raster contour with a pixel size 50 x 50 metres and calculation of the Digital Elevation Model by means of the contour interpolation method of contour lines with Idrisi.

- Error evaluation of the Digital Elevation Model (DEM).

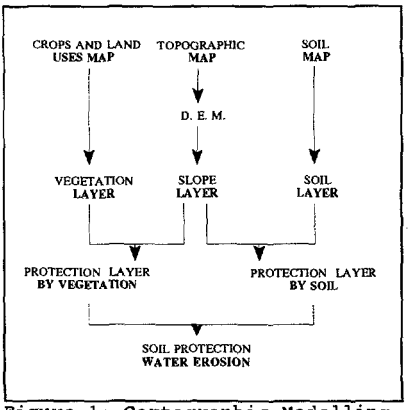

Figure 1: Cartographic Modelling

- Automatic generation of the slopes layer in IDRISI.

- Reclassification in 9 classes: 0-3; 3-7; 7-12; 12-15; 15-18; 18-20; 20-28; 28-35; >35.

Error Values(metres)

Maximum	Minimum	Standard deviation	Absolute Mean Error (AME)	Square Mean Error (SME)
30	0.1	8,1	5,9	9

Number of observations: 45

2.2 Soil layer

This thematic layer has been elaborated on the basis of the existing cartography: socioeconomic study of Los Montes de Toledo (scale 1:200.000) and Atlas Nacional de España (scale 1:2.000.000) with verification in the terrain for its adaptation to scale 1:50.000. In order to stablish the grades of protection related to water erosion we have considered the soil-relief relation, the deep soil profile and the textural characteristic of the surface horizon. Five physiographic units, which form the cartographic units, were determined:

- Fluvial bands: Fluvent ; Colluvial-alluvial lands : Dystrochrept and Xeroumbrept ; Footbase of mountain: Xerochrept and Xerorthent ; Hillsides: Xerorthent ; Ridges: Quartzite.

2.3 Vegetation layer

This thematic layer was obtained from the crops and land uses Map of Spain (1985). The legend to make the information homogeneous has been modified and ten categories have been determined:

- With no vegetation; Grass crop irrigation and of dry farming; Woody crops irrigation and of dry farming; Association of grass and woody crops; Meadows; Pastures; Scrubs and Tree-covered sparse.

2.4 Protection layer according to the vegetation

The vegetation factor is the one which influences the most in the stabilization of the soil faced with water erosion, determining sometimes the total elimination of the process.

In order to stablish the grade of protection by vegetation, the intersection of this layer with the slopes layer was made. The results of that combination were adjusted to a protection definite matrix which stablishes the different grades: 10 maximum - 1 minimum.

2.5 Protection layer according to the soil

It is the result of the layer intersection of soil units and slopes and with the adjust to a definite matrix of the grades of protection: 5 maximum - 1 minimum.

2.6 Grade of soil protection map as contrasted with water erosion

From the intersection of the protection layers according to vegetation and soil, together with the adjust to a definite matrix of grades, a final map with eight protection levels was elaborated: 1 minimum - 8 maximum. Figure 2 indicates the surface distribution (Ha) of the area of study, according to the grade of soil protection, to the water erosion.

3 Discussion and conclusions

The result of this study is a map which shows the grade of sensitivity to the potential water erosion on the River Bañuelo Basin. The distribution and surface of the units show a slightly eroded landscape with reduced surface in the extreme categories: grades 1; 2; 7 and 8. This coincided with the verification made in the terrain. Therefore, with the avalaible information and its manipulation in a GIS we have achieved to delimit and determine qualities to areas which are potentially erosed with acceptable credibility. However, in order to study in depth the characterization, we will have to update the information about vegetation and to study in depth the information about soils.

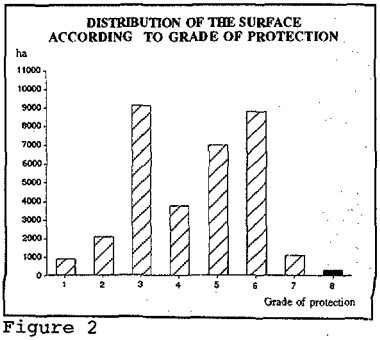

Figure 2

It is appropriate to emphasize that the reliability of the final map is never attributed to the GIS but to the quality of the physical

information that has been obtained and to the methodology that has been used. Finally we consider that we have achieved an operative, easy, reliable enough and rather fast methodology of study.

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