The Use Of A Geographical Information Systems And Artificial Neural Network Methodology For Mapping Erosion Risk In The Almeria Region, Southeast Spain

Abstract for Poster Presentation

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Biography

First class honours degree in geography gained from Kingston University. Currently a second year postgraduate PhD student at Kingston University with a keen interest in the geomorphological processes operating in semi-arid regions.

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Introduction

Soil erosion caused by water is an increasing global problem (Vrieling *et al*., 2002), due largely to its inherent ability of creating severe on and off-site impacts. These impacts can, and do take many forms, either environmentally or economically. As a consequence, it is important to understand both the underlying processes that drive erosional activities, and the impacts that such processes have so as to more fully understand the issues, and thus be in a more suitable position to implement appropriate management strategies and policies at a range of scales.

Certain areas throughout the world possess an inherent vulnerability to the processes of erosion, particularly in warm, dry climates where vegetation is sparse, and thus the soil surface is exposed for long periods. This risk can, however, be further enhanced through the activities of humans, and the finely tuned balance of the natural environment can be drastically and detrimentally disturbed. One such area, which is at present experiencing rapid change and consequently the potentially increased risk of erosion, is the province of Almeriá located in southeast Spain. In recent years the interior regions of Almeriá have witnessed a change in agricultural regime, towards extensive plantation arboriculture, causing an extensive and rapid change in the appearance and stability of the cultural landscape (Faulkner *et al*., 2003). These areas could be said to be geomorphologically sensitive prior to any such agricultural changes, due to both the climatic characteristics and the sensitive lithologies found in

the province. However, with the added implications of agricultural clearances, the risk of erosional activity is therefore greatly increased.

The study area is located in the province of Almeriá, in and around the small municipality of Sorbas. The region has the lowest total annual precipitation of any part of Europe, with an average of 130mm of rainfall a year in the Cabo de Gata, and less than 200mm a year in the city of Almeriá (Tout, 1987). The average annual temperature also exceeds 18°C. Further to this, the region is located in the Betic Cordillera ranges, which is the result of the interaction between the African and European plates over the Jurassic to the Miocene (Weijermars, 1991). More locally however, a number of geological faults such as the Alhamilla-Carbrera fault, just north of the Sierra Alhamilla, have resulted in the uplift of the Sorbas and Tabernas basins, isolating them from one another. This has resulted in some unique geomorphological scenarios, and the infilling of such basins with detritus of differing ages. Further to this, two principal river capture events have taken place in the area (Mather, 2000), and have led to the vast oversteepening of slopes and rapid headward erosion. The region is therefore both geologically active and geomorphologically sensitive, and with the added implications of the current rapid land use changes make the ideal setting for a study investigating erosion risk.

It is important to have both detailed knowledge of the erosional activity in a region such as Almeriá so as to implement appropriate management strategies. In addition however, the methods by which this knowledge is obtained must be relatively easy to implement with data demands that are not beyond the grasp of local governments or organisations that would find such a data set invaluable. Therefore, this research will aim to identify a viable methodology using a set of tools, which can be put into practice easily and cheaply with which erosion risks can be identified.

Main Aims

This piece of research possesses three principal aims. The first of these three aims is to test the applicability of a given methodology for the application of an erosion risk classification with regards to the three operative erosional processes of surface and subsurface erosion, and mass movements. The study will take place at three different scales and therefore the second aim is to investigate scaling issues involved with this sort of research. Finally, the third research aim is to more fully understand the geomorphological processes operating in the region.

The methodology to be tested in this piece of research is largely concerned with the applicability and usefulness of Geographical Information Systems (GIS) in combination with Artificial Neural Networks (ANN's). Digital Elevation Models (DEM's) of varying accuracies have been developed though the process of digitising contours on a basic 1:25000 topographic map, to produce a ten metre contour DEM, and photogrammetric processes of aerial photography so as to produce a more accurate DEM. These models have been used at three varying scales to extract the independent variables to be used as the inputs for the ANN's. Further inputs that cannot be extracted from DEM's such as the underlying geology have been digitised separately. The use of such a methodology allows the extraction of large amounts of data, covering vast geographical areas to be achieved relatively easily and cheaply, with the added advantages of a non-linear classification technique used to produce an erosion risk output.

This methodology is to be tested at three varying scales, a macro-scale, a meso-scale and a micro-scale. This will therefore allow inferences to be made into the applicability of the methodology at different levels of enquiry, and will highlight the possible strengths and weaknesses of such an approach at these varying levels. The use of ANN's will also give an insight into the dominant independent variables and those that have little impact upon the risk of soil erosion, a highly topical and well discussed point in soil erosion literature.

Finally, the outcome of this research should give a much better insight into the operative erosional processes, and the variables controlling them. This will subsequently improve our ability to manage erosional process more successfully in this region and even beyond.

The above three aims are those set out as the guidelines for the final thesis, and therefore far too big a task for a poster presentation. The poster will thus focus upon the methodological issues relating to the research with regards to the use of GIS and ANN's for the mapping of erosion risks in the study area.

References

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