USING GIS TECHNOLOGYFOR THE STUDY OF DEGRADED LAND THROUGH EROSION

STUDIUL TERENURILOR DEGRADATE PRIN EROZIUNE CU AJUTORUL GIS

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Abstract. *The aim of this study was to present a map of erosion risk zone of the area Aldeni - Buzau. GIS tools provide the opportunity to achieve thematic maps that can model various processes. The methods are based on topographic characteristics of the land. For this study the maps were created using the ArcMap10.1 application.*
Key words: Aldeni, erosion, GIS, maps

Rezumat. *Scopul acestui studiu a fost acela de a prezenta o hartă a riscului de eroziune a zonei Aldeni – judeţul Buzău. Instrumentele GIS oferă posibilitatea pentru realizarea hărţilor tematice care pot modela diverse procese. Metodele se bazează pe caracteristicile topografice ale terenului. Pentru acest studiu hărţile au fost create cu ajutorul programului ArcMap10.1.*
Cuvinte cheie: Aldeni, eroziune, GIS, hărţi

INTRODUCTION

In 2009, the International Strategy for Disaster Reduction developed a dictionary of terms and definitions for environmental degradation as follows:

Environmental degradation is reducing its capacity to meet the social and environmental needs. Environmental degradation can alter the frequency and intensity of natural hazards increasing vulnerability of communities. Types of degradation caused by humans are varied and include misuse of land, erosion and loss of soil, desertification, fires, wild land, biodiversity loss, deforestation, destruction of mangrove land, water pollution and air and climate change, rising sea levels and ozone depletion. The most important factor which affects globally the agricultural production is farm land degradation through erosion. Soil erosion is the main threat and can be caused by natural geomorphologic processes, anthropological, but the most important factor of erosion is human activities. Population growth, massive deforestation, excessive land cultivation, uncontrolled grazing are also causes. Last but not least, human activities lead to soil and water loss resources all over the world.

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Erosion takes place when soil surface is exposed to rain or strong winds. Raindrops have a high kinetic energy and can easily dislodge soil particles. This form in which the rain particles are displacing a thin layer of soil erosion is called laminar erosion (sheet erosion). This type of erosion is the most dangerous. (Ghimire, 2013).

The impact of raindrops is intensified by slope if the slope is high when a significant amount of soil is carried by raindrops into the valleys or to the watercourses. Another important factor favouring soil erosion is the texture. Fine and medium soils texture, with contents of low organic matter and are structurally underdeveloped are most subject to erosion process (Bajracharya, 1992). This soil has a low capacity for water infiltration into the soil, and has a deep erosion due to water and the wind as it blows away the soil particle easily.

Romania has an agricultural area of 14.8 million hectares; 6 million ha of this area are located on agricultural land with slopes greater than 5%. On these surfaces occur annually geomorphologic slop processes such as erosion and landslide.

Annually, on the whole country surface are lost about 126 million tons of eroded solid material, therefore the average is 16.3 t/ha.

The distribution of soil erosion processes on the country surfaces is different; the most significant values are in the Sub-Carpathians Curvature, Moldova and Transylvania.

MATERIAL AND METHOD

The Surface erosion is a process that has a great spatial geomorphologic spread. The surface erosion is caused by triggering a process of removing the upper segment in the soil profile (Patriche, 2004).

Romania is among the first in Europe in terms of land degradation by erosion. For the Buzau County, the specific erosion has values of 41.5 t/ha of which 28 t/ha are ravines processes and landslides and values of 13.5 t/ha through surface erosion as compared to the admitted value of the specific erosion which reaches values between 3-6 t/ha.

For the study of erosion and the creation of thematic maps using ArcMap 10.1 Program, we chose the town Aldeni, located in the Buzau county.

In terms of geomorphology, the place is located inside the Sub-Carpathians Curvature (45 ° 19'30 "N latitude and 26 ° meridian 44'43" E longitude) and is a region characterized by increased soil erosion, mainly in the Eastern part. In terms of climate, it has a continental climate. In the Southern piedmont hills there is a Levantine Quaternary continental climate with a plain Fohn effect. The average annual temperature is 10.5 ^{O}C and moves towards the North to 8 ° C. The amplitude of the annual air temperature is 24^{o}C and in Buzau it reaches 24.9^{O}C.

The materials used in this study are the topographical map of Romania at 1: 25000 scales, processed through scanning and geo-referenced into the stereographic projection system 1970. The Soil Map of Romania at 1: 200,000, was presented in digital format with included analytical data and digital elevation model (DEM) with a resolution of 90 m; this model was interpolated and re-exported to obtain a resolution

of 30 m, with the ArcGIS 10.1 Program. The DEM was download free from (www://geo-spatial.org) and all the used vectors were download free from (http://www.opengis.org).

Based on this model, it was created for viewing a 3D relief hill shade which overlaps other shape- file format or file type with raster transparency of 35-45%. They also used vector data created by vectorization in ArcGIS 10.1 software represented by points, lines or polygons.

RESULTS AND DISCUSSIONS

The most important factor in field modelling is the gravity. Gravity has a decisive role in moving materials reached into imbalance.

For the study of erosion and risk mapping we conducted several maps of the studied area. The first map was achieved for the study area map hypsometrical, presenting terrestrial elevation, this map landforms play in ensembles hypsometric levels.

To establish the altitude steps we took into account genetic characteristics of relief and typology of geomorphologic processes. The area is divided into five altitude classes between 166-431 m. It is noted that most of the area is between 166-219 m, followed by a zone between 219-266 m. The area is part of the Buzau Sub-Carpathians, and the hills area is fragmented by deep valleys favouring erosion processes (Diaconu, 2016).

The role of this map is to identify areas which are prone to soil erosion (fig. 1)

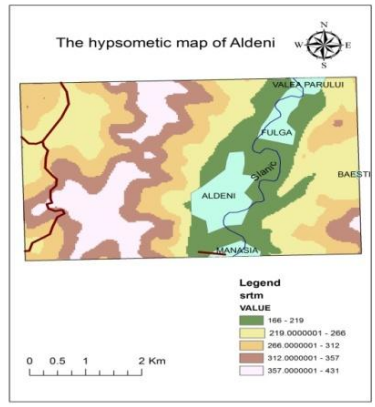

Fig. 1 The hypsometric map

The following achieved map is the slopes map or the geodeclivity map, made in ArcGIS 10.1 using calculation function of altitude slopes of the numerical model. The slope is an element that can accelerate or hinder morphometric processes of land degradation. As the area slopes are small increments this will manifest by specific phenomena as surface erosion, runoff or low landslides. The slopes of the area are between 0-24%. Near the localities, we

observed that the slopes are low between 0-10%. The highest values of the slopes are in the North and North - West (fig. 2).

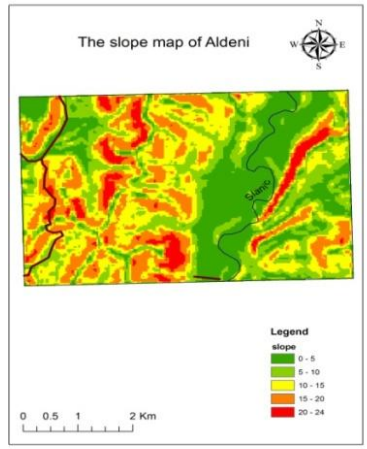

Fig. 2 The slope map

The slope exposure was made in ArcGIS 10.1 software using the tool Aspect which analyzes the slopes orientation (fig 3). The slopes are inter-connections between surfaces and valleys (Grecu, 2009). One of their important features refers to their position in relation to the cardinal points. Also, it has relevance to land use and to the observed current geomorphologic processes. There are four classes of slopes after exposition.

In the northern hemisphere, slopes with north orientation are more shade and are protected by vegetation, and their exposure to erosion is reduced, whereas slopes facing south are sunny and exposed to erosion due to the fact that aggregates are increasingly dry, therefore the cohesive forces between the particles are reduced and the dislocation is easier.

The land use map provides information about lands coverage and how they are used (land use). This data are useful for areas that have strong dynamics in social development and morphological dynamics. The land use map was download free from: http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2006-raster.

By analyzing the land use map one can observe that most of the surface is covered with trees and groves of trees followed by planting of vine. The crops are on the river Slănic.

The geological map of the study area provides information about how geodeclivity favours lithology, depth and drainage density. Most of the study area is on clays and sands. There are sand, boulders and loess on the Slănic riverbed The Northwest and South - West is made up of conglomerates and sandstones (fig. 4).

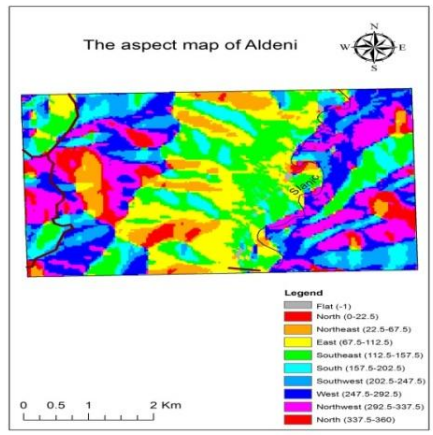

Fig. 3 The aspect map

Fig. 4 The geological map

The last map is the erosion risk map of the study area. It was created with the maps above, by reclassifying them, and then we multiplied together the maps above figure 5.

By analyzing the risk map one can notice that the area was divided into five risk classes. Near the Slanic riverbed area the risk is zero. North-Western and North-Eastern areas have high risk and very high risk for erosion.

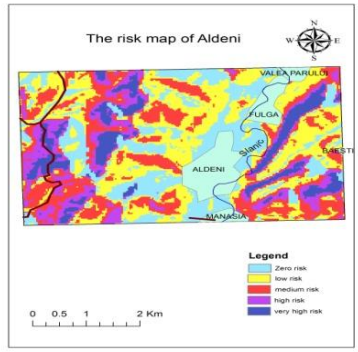

Fig. 5 The risk map

CONCLUSIONS

Erosion is a process which does not create geomorphologic landforms and destroys the potential of the productive land by having negative effects thus reducing the agricultural production;

The creation of risk maps to identify areas with potential risk for erosion of particular importance because these areas can be identified based on the created model;

Anti-erosion measures in areas with medium risk, high and very high by earthworks, through reforestation to protect the soil against erosion.

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