BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iaşi
Tomul LIX (LXIII), Fasc. 3-4, 2013
Secţia
HIDROTEHNICĂ

INTEGRATION OF THE INFORMATIONAL LAYER ON THE USE OF LANDS IN GĂICEANA HYDROGRAPHIC BASIN, WITH GIS TYPE SOFTWARE

BY

GABRIELA BIALI*

“Gheorghe Asachi” Technical University of Iaşi,
Faculty of Hydrotechnics, Geodesy and
Environmental Engineering

Received: September 12, 2013
Accepted for publication: October 22, 2013

Abstract. This paper sets out a segment of a GIS project which focused on agricultural land degradation by erosion processes, in the hydrographic basin of Găiceana, Bacau County. Is presented a methodology integration to layer information on the use/land cover in a spatial database of GIS.

The information layer on the use/coverage of the lands has a special importance in the assessment of erosion-related degradation in the reviewed basin due to two issues: presence of vegetation and monitoring of existing agricultural crops (structure of crops).

Keywords: land degradation; water erosion; layer; agricultural crops; GIS.

1. Introduction

The monitoring and management operations related to a territory imply a significant volume of data and processing and analysis means thereof.

In this context, the determination of the soil quality and in particular of

*Corresponding author: *e-mail*: gbiali@yahoo.com

those impaired by erosional degradation processes gain a special importance both for the farmers and for the decision makers in the agricultural management field.

For large areas, these actions are possible by means of the GIS techniques; through the special evolution of acquisition techniques of data characterizing a certain territory (including remote sensing) and information technology. The association of the acquisition system with a simulation model provides the possibility to set out scenarios for the selection of the most appropriate actions for the protection and preservation of soil, mitigation of the alluvial effluence, mitigation of torrentiality etc.

The data acquisition and storage in numerical (digital) form, computerized processing, analysis and afterwards the display of obtained information in various forms (maps, charts, tables, text etc.) provide certain special advantages, among which:

a) the possibility to handle large, multi-layer, heterogeneous databases, with spatial reference;

b) the possibility to interrogate these databases on the existence, location and characteristics of a large number of objects on the land surface;

c) high flexibility for the interrogation or actions on the system, in an interactive manner;

d) large flexibility in the configuration of the IT system in order to adjust itself to a wide variety of applications and users;

e) the possibility to integrate knowledge on various objects;

f) analysis of the information acquired through the computerized processing of the initial data;

g) diversified presentation (display) or edit of information.

2. Research Grounds

Vegetation has a direct and importance impact on the erosion process, representing a factor that mitigates this process at all times, by: dissipation of the impact force of raindrops, mitigating the discharge speed, increasing the soil roughness, increasing the soil porosity and cohesion, improving the soil structure, ensuring a protective bed for the surface discharges.

In order to calculate the "umbrella" effect (rain interception), Horton R.E. (USA) proposes a formula depending on the crops type:

$$F = \frac{a}{2.54} + \frac{b}{6.45} m \times h, \quad (1)$$

where: h is the height of the rain layer, [cm]; a and b – coefficients experimentally determined depending on the crop specifics; m – height of plants, [cm].

3. Development Stages of the Informational Layer in Order to be Integrated within GIS

3.1. Geographic Location of the Reviewed Hydrographic Basin

The reviewed area consists of the catchment area of Gaiceana agricultural – fishing accumulation, located in the hydrographic basin of Berheci river, (right) arm of Bârlad river, Bacău County, in the vicinity of Târgu Găiceana locality.

A first stage consisted of framing the reviewed hydrographic basin in plan sheets (trapeze) at 1:5,000 scale, with the limits thereof in geographic coordinates (Fig. 1).

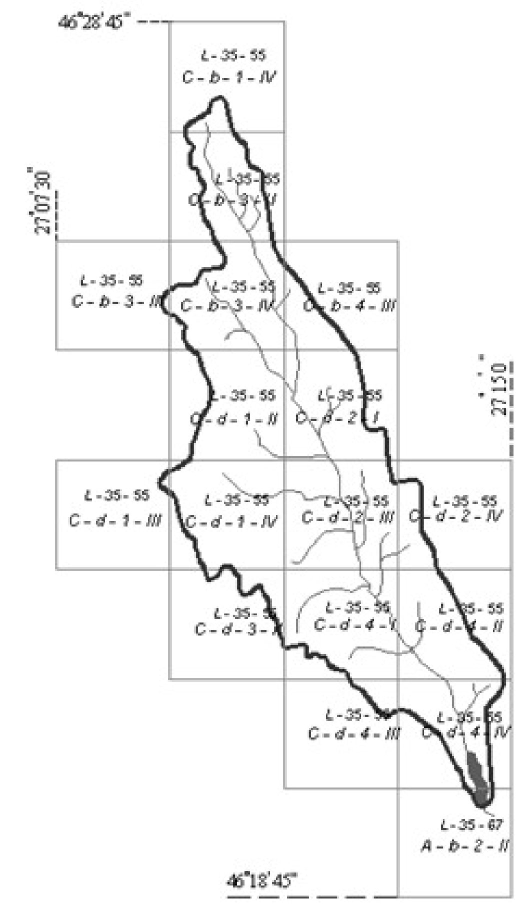

Fig. 1 – Framing of the reviewed basin in the plan sheets at 1:5,000 scale.

In the GIS system (namely Geo – Graph software) used herein, the geo-referential data is displayed in the form of layers, fact that facilitates the analysis of spatial variables and of the distribution of entities on the reviewed surfaces, and the overall analysis of the acquired information, which implies the concomitant approach of several layers, was performed through the so-called "***overlay***" technique.

The "overlay" technique is based on overlaying or combination operations of several layers (based on specific algorithms – determined within the project), which generate new layers and, consequently, new data and attributes. ***The "overlay" technique*** enabled the performance of certain multiple spatial analyses because it referred to the spatial entities and databases belonging to an unlimited number of layers.

With a computation module of the Geo – Graph software we changed the geographic coordinates into flat Cartesian coordinates (by applying the method of constant coefficients)

The finality of this stage pursued at framing the perimeter of the hydrographic basin, reported to a system of axes (either in STEREO 70 system, or in a local system – Fig. 5).

3.2. Raster – Vector Transformation of the Plan

The layout with the land coverage (mapping of uses) at 1:10,000 scale was scanned with a Mutoh scanner (extended A_0 width, unlimited length) with a 300 dpi resolution. Almost all CAD (**C**omputer **A**id **D**esign) systems enable us to digitize „on – screen" a raster image.

This procedure is more convenient in case of small sized surfaces or perimeter lines as line segments; but in case of a large volume of graphic elements (as in this case) the "*on – screen"* digitations is no longer benefic: the execution time is extremely long and the vectorization accuracy is not always the envisaged one, depending on the attention and skills of the operator (the human factor).

In this case, the raster → vector conversion took place automatically by means of the Corel Draw 10 software, OCR Trace module.

Corel OCR Trace has the special vectorization option for maps, but own vectorization coefficients can also be imposed. In this case such parameters were selected based on the result acquired following the process.

This module vectorises the raster lines by setting out the X and Y coordinates for each scanned pixel. Following the vectorization, the file is saved in vector format (standard CAD) ***.dxf*** (**D**ata **E**xchange **F**ormat).

The obtained vector format file is imported under Geo – Graph software.

Fig. 2 – Mapping the uses in b.h. Găiceana – vectorial plan.

3.3. Setting out the Cartographic Limits of the Vectorial Drawing

The new system of axes the plan reports to can be fixed by means of a function accessed from the main menu of the Geo – Graph software: *„Update”*; by means of the “*Coordinates transcalculation*” button one can perform the automatic translation of the axes system origin (Fig. 3). The same button will also be used in the further applications when the vectorial plan needs to be rotated.

The window commands enable us to select the transcalculation points (between the vectorial plans), one point for each (the „select” button). The

"Scale" button enables us to apply a correction coefficient and is used in particular for bringing the vectorized images from scanned raster images at scale.

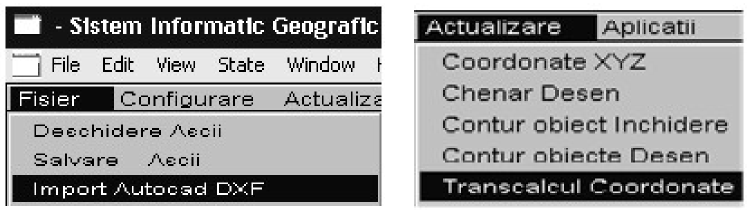

Fig. 3 – Import vector plan and transcalculation menu of the plan.

The commands enable:
⇨ translation for each axis or for both axes („*transl*" button);
⇨ translation and rotation („*tr_rot*" button);
⇨ image inversion in X axis („*Invert*" button).

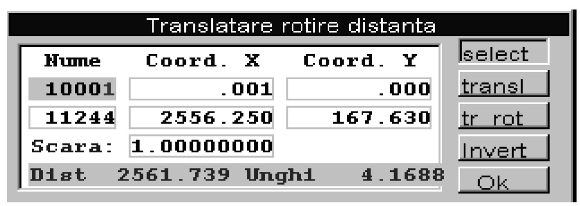

Fig. 4 – Sequence of the „*Coordinates transcalculation*" menu.

The displayed distance is useful in order to see the size of displacement to be applied. The gradient is useful in case of applying the rotation command.

The figures represent the minimum and maximum framing limits of the vectorial drawing in the active working window of the system, but also represent the lengths and widths along the axes of the reviewed hydrographic basin (in meters).

The coordinates of these four corner points will be automatically saved in the ASCII file. Of course, the plan can be reported to a standard projection plan at all times (for instance STEREO '70).

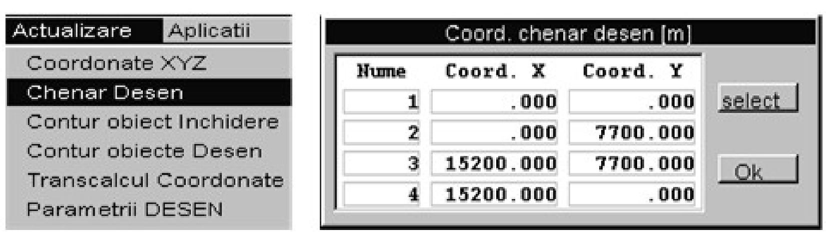

Fig. 5 – Automatic computation menu of the vectorial drawing border.

At the end of the operation, through ***ASCII saving***, in the "*xyz*" file (Fig. 6.) all points of the perimeter of vectorized polygons will have *XY* values.

In order to avoid the re-reading of the three file types *(.xyz, .con, .icx*) for the next uploads of the graphic drawing, and consequently to significantly reduce the required time, we recommend the use of the ***binary saving*** („*.cof*") as well.

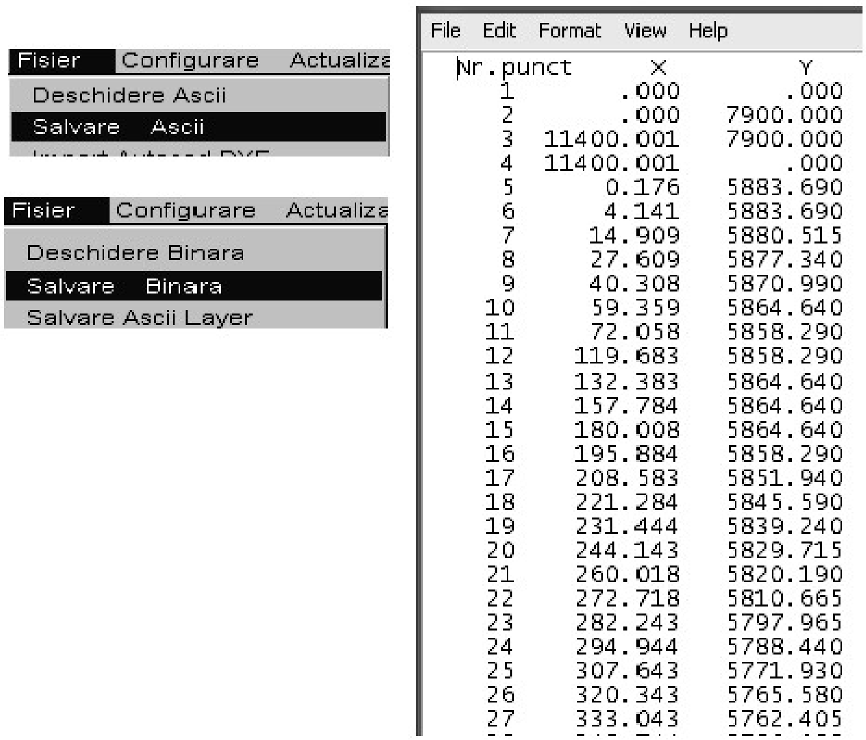

Fig. 6 – Sequence fin ASCII file.

If required, the binary format can also be exported to other GIS-type softwares: Arc/View (ESRI), Microstation or Geographics (Bentley), AutoCad MAP (Autodesk), GeoMedia (Intergraph), provided that, under certain circumstances, the color configuration by layers may not be complied with.

The importance of the set out operations consists of the fact that all coordinates of the file points have positive values, but in particular of the fact that this border is a control method for the correct overlay of plans in the IT system (the other plans will have the same reporting system).

The integration of the IT layer on the use of lands at b.h. Găiceana, through the Geo-Graph software, pursued:

a) the inventory of the current categories of use (Table 1);

b) the possibility to forecast the erosion-related soil losses by means of various scenarios (different crops);

c) the selection of the most appropriate soil protective and preservation actions.

Table 1

Use Categories of Lands at b.h. Găiceana

Use	Catchment area of Găiceana accumulation	
	Area, [ha]	%
Ploughable	1,227.8	26.31
Pasture	886.2	18.89
Meadow	52.5	1.12
Orchard	19.8	0.42
Vineyards	33.7	0.72
Forest	2,195.2	47.05
Constructions	196.7	4.21
Non-productive	19.8	0.42
Land under water	4.1	0.08
Various	29.1	0.62
TOTAL	**4,665**	100

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INTEGRAREA STRATULUI INFORMAŢIONAL PRIVIND FOLOSIREA TERENURILOR ÎN BAZINUL HIDROGRAFIC GĂICEANA, CU SOFTWARE DE TIP GIS

(Rezumat)

În cadrul acestei lucrări este prezentat un segment dintr-un proiect GIS care s-a axat pe evaluarea degradării terenurilor agricole prin procese de eroziune, în bazinul hidrografic al acumulării Găiceana din judeţul Bacău.

Este prezentată metodologia de integrare a stratului informațional privind folosirea/acoperirea terenurilor într-o bază de date spațială de tip GIS.

Stratul informațional privind folosirea/acoperirea terenurilor prezintă o deosebită importanță în cadrul evaluării degradării prin eroziune în bazinul studiat prin prisma a două aspecte: prezența vegetației şi monitoringul culturilor agricole existente prin structura culturilor.