GRASS GIS as Technical and Scientific Support for Research Activities in NIMRD *(Nedelcu Marius, Gabriel Ganea)*	"Cercetari Marine" Issue no. 37 Pages 143-147	2007

GRASS GIS AS TECHNICAL AND SCIENTIFIC SUPPORT FOR RESEARCH ACTIVITIES IN NIMRD

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ABSTRACT

This paper discusses about GIS opportunities, GRASS GIS capabilities and results in the frame of the project "The assessment of anthropogenic impacts on Tasaul Lake, Romania, and ecosystem rehabilitation" financed by the Swiss National Science Foundation, the Swiss Agency for Development and Cooperation and the Romanian Ministry for Education and Research within the framework of the Swiss-Romanian cooperation program on "Environmental Science and Technology in Romania - ESTROM".

KEY-WORDS: GRASS GIS, open source, maps

AIMS AND BACKGROUND

A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyse, manage, and present all types of spatial or geographical data. At the simplest level, GIS can be thought of as a high-tech equivalent of a map. However, GIS is more than making a map. The real power in GIS is through using spatial and statistical methods to analyse attribute and geographic information.

Both GIS and traditional maps represent the real world. One way of thinking about it is that the GIS is the data while the map is the picture. The end result of GIS analysis is often a map, or cartographic output, but it is only one of many output types. Once created, a traditional map cannot be changed. However, as an integrated system, a GIS allows users to ask new questions of a database and visualize answers.

There are many types of GIS software products to choose from, but the analysis considered the most widespread GIS software: Arc Info (from ESRI), TNTmips (from Microimages), GRASS (Geographic Resources Analysis Support System) GIS (Open Source Software, GNU GPL License), AutoCADMap (from Autodesk). We have considered the following features: geospatial data management and analysis capabilities, image processing, graphics and maps production, spatial modeling, and visualization, the

price/performance ratio, further updates price. Considering all this, GRASS GIS was choosen as a final solution. An drawback of this software was his relatively complicated interface, but the next version (which was in beta testing at the moment of this analysis) came with a more freiendly interface.

MATERIAL AND METHODS

GRASS GIS is a suite of open source applications designed for geospatial data management and analysis, image processing, graphics and maps production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world, as well as many governmental agencies and many environmental consulting companies. GRASS GIS contains over 350 modules to render maps and images on monitor and paper; manipulate raster, and vector data including vector networks; process multispectral image data; and create, manage, and store spatial data. GRASS GIS offers both an intuitive graphical user interface as well as command line syntax for ease of operations. Also has support for many SQL RDBMS: PostgreSQL, MySQL, SQLite, dBASE. GRASS GIS requires a workstation running Linux, Mac OS X, Solaris, IRIX, or BSD or MS-Windows.

RESULTS AND DISCUSSION

At the begining of the GIS solution implementing project, the Institute had only hard copy maps. As a result, it was necessary to digitize these maps for a starting mapset (Fig. 1). Other digital maps and orthophotoplans were acquired during other projects.

GRASS GIS was used in different projects as a tool for viewing expedition ship routes, query and view data applications, GIS maps.

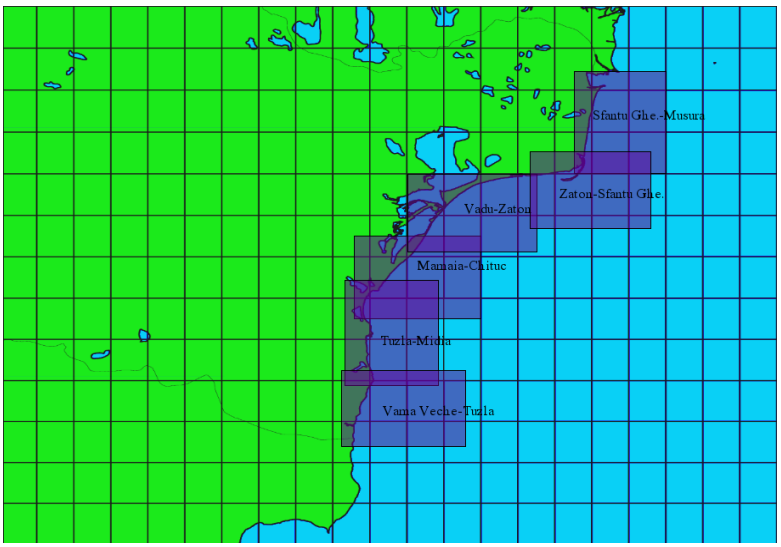


Fig. 1. Initial cover of starting map set

GRASS GIS in the ESTROM project

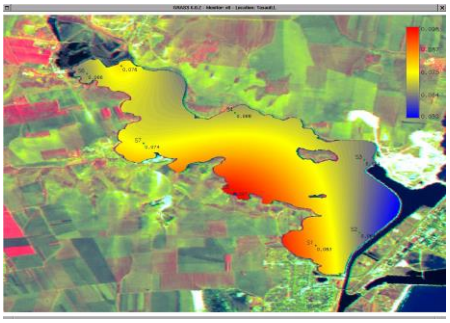
ESTROM project's purpose was the assessment of anthropogenic impacts on Tasaul Lake, and ecosystem rehabilitation. Within the project, a set of GIS maps was made, used for visual analysis of the impact of monitored chemicals.

Software packages used to make maps:

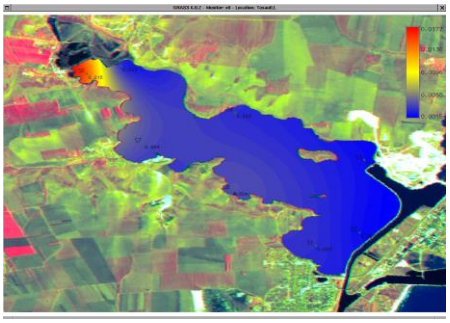
- GRASS GIS, which was briefly described;
- Generic Mapping Tools (GMT) - an open source collection of command-line tools for manipulating geographic and data sets

The data obtained from sampling at 8 monitoring stations was used to make the GIS map sets. For each chemical (NH_4, NO_2, NO_3, SiO_4, Cd, Ni, Cu, PAHs etc.) and for each month when sampling was obtained, using the GMT (Generic Mapping Tools) package, the data was interpolated, resulting a set of georeferenced raster maps (netCDF format). Each map shows the concentration variation as different colors and color levels. In the next step, these maps were overlapped with a satellite map of Tasaul Lake. GRASS GIS was used for all the operations necessary to obtain the final maps (importing, image processing, legend).

Next are presented several maps made within ESTROM project.

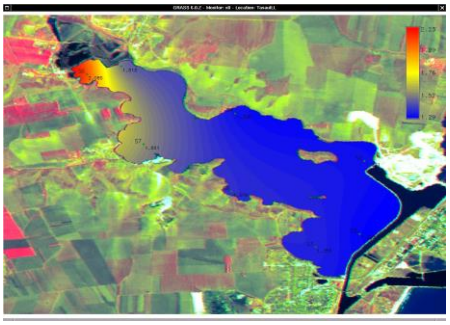


Tasaul Lake
NH_4 October 2005



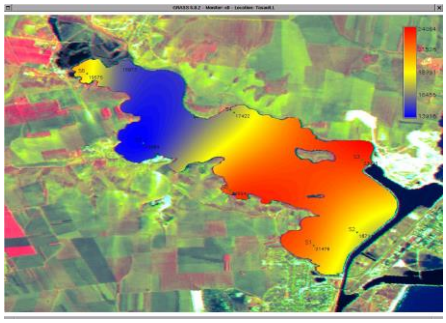
Tasaul Lake
NO_2 October 2005

Tasaul Lake
NO_3 October 2005

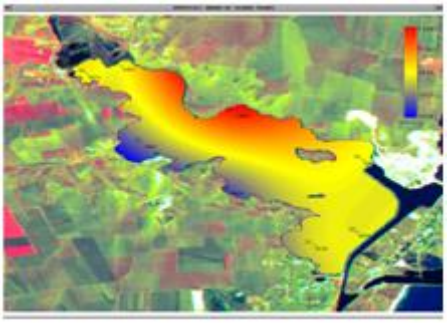


Tasaul Lake
SiO_4 October 2005

Fig. 2. Evolution of various parameters in same month



Tasaul Lake
Biomass August 2005



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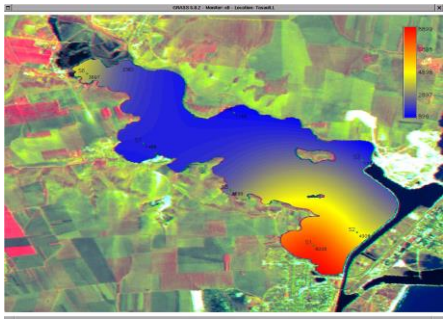
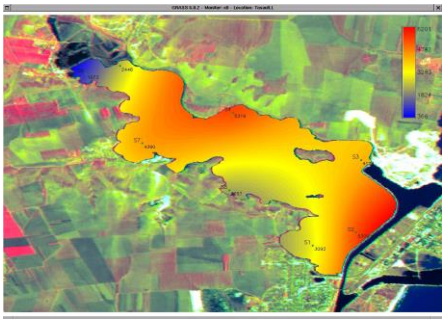
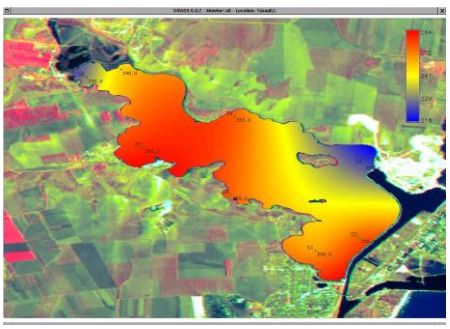


Tasaul Lake
Biomass November 2005

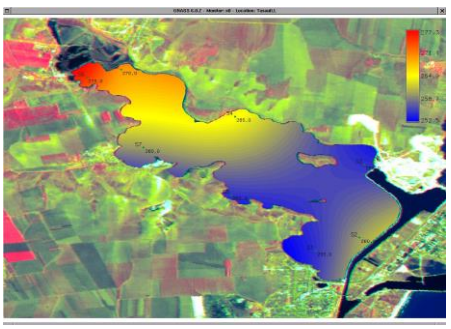


Tasaul Lake
Biomass December 2005

Fig. 3. Evolution of same parameter across several months

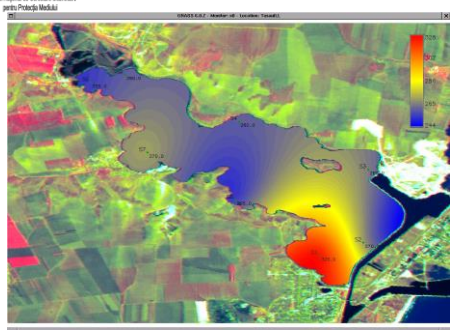


Tasaul Lake
Alcalinity August 2005



Tasaul Lake
Alcalinity October 2005

Fig. 4 a. Evolution of same parameter across several months



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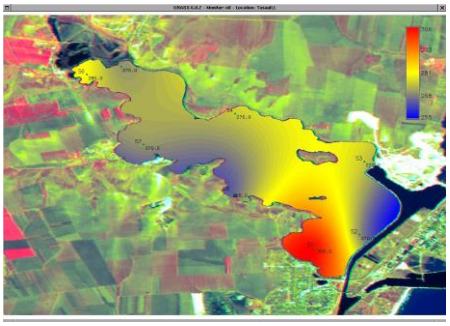

Tasaul Lake
Alcalinity December 2005

Fig. 4 b. Evolution of same parameter across several months

CONCLUSION

- The representation by themathic maps of the distribution and extent of the main risk parameters and potential contamination of Tasaul Lake was made for the first time. It allowed a more clear picture of the impact caused by human activities on environmental conditions, as well as of the main risks and threats on this significant coastal lake.
- Using GRASS GIS showed the utility of this imaging tool, aiming at deepening the detailed knowledge of the issues dealt with by data updating and using GIS applications and facilities.

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2. Official GMT (Generic Mapping Tools) site: http://gmt.soest.hawaii.edu/
3. Documentations and discution lists for GRASS GIS and GMT, available in Internet