Y. M. Kryzhanovsky, Sc. (Eng.); A. V. Vasylchuk

AUTOMATION OF ANTHROPOGENIC EFFECT TECHNIQUE AND CLASSIFICATION OF ECOLOGICAL STATE OF SMALL RIVERS BASINS OF VINNYTSIA REGION

Technique of anthropogenic effect computation and classification of ecological state of small and medium rivers basins was further developed as a result of application of GIS technologies for automation of classification results presentation. The developed theoretical principles were applied for computation of anthropogenic effect and classification of ecological sate of small and medium rivers basins of Vinnytsia region.

***Key words**: ecological state, anthropogenic effect, geographic information systems, visualization of information.*

1. Problem set-up

At present stage of development of engineering facilities it is not expedient to perform standard computations manually, that is why the task aimed at automation of computations is very actual. Automation of computation procedure will considerably accelerate the process of analysis of rivers basins state and will make the process of decisions taking more efficient. Due to technique automation, the information is presented in tabular and graphic forms, that enables to visualize the evaluation of rivers basins state.

To automate the algorithms of anthropogenic effect on small river basin it is necessary:

- to provide data input;
- formalize algorithms for automatic calculations;
- provide the output of the results of computations;
- develop geoinformation pattern to visualize the results of computations, applying the given technique;
- use the developed program tools for evaluation of anthropogenic effect on the basins of small and medium rivers of Vinnytsia Region.

2. Automation of computation technique of anthropogenic effect and classification of ecological state of small and medium rivers basins

Computation model of anthropogenic effect and classification the ecological state of the river basin is constructed on the hierarchical logic-mathematical principle [1].

At the low hierarchical level four independent models of basis river basin subsystem are considered:

I – “Radioactive contamination of the territory”,
II – “Land usage”
III – “River run-off usage”
IV – “Water quality”.

Each subsystem is characterized by the set of criteria and indexes, comparison of which provides classification of river basin state with relatively each index, and, proceeding from evaluation of these indices we classify the state of each subsystem [1].

By the evaluations of low level the value of anthropogenic effect level on river basin is calculated and total ecological state of river basin is evaluated. Calculations of basic subsystems start with determination of natural - agricultural or province, where the investigated river basin is located. Anthropological state in river basin is evaluated qualitatively and quantitatively, i.e., by the results of calculations each quantitative assessment also has qualitative characteristic and vice versa

[1].

For the analysis small (water catchment area from 2 to 50 km^2) and medium (up to 2 km^2) rivers of Vinnytsia region, where quality control monitoring stations are located. These are such rivers as the Dokhna, Zgar, Liadova, Markivka, Riv, Rusava and Sob.

The sources of information for the subsystem "Radioactive contamination of the territory" are maps of radioactive contamination of the territory of Ukraine, materials of Weather Center observations, Ministry of Natural Environment.

The sources of information for determination of initial data in the subsystem “Land usage” serve data of land registration on the level of districts and regions, project of land-use system, materials of soil study and results of investigation of institutions of State Committee of Land Resources, Forestry Ministry of Agricultural Policy, Ministry of Ecology.

The sources of information for determination of initial data in subsystem “Usage of river run-off” are materials of Meteorological agency, certain publications, the results of research, performed by the experts of institutions, rivers certificates, materials of State Committee of water resources and its institutions, namely, the data of state statistical reports according to form 2 - water resources management and their generalizations.

The sources of information for determination of initial data in the subsystem “Water quality” are hydrochemical yearbooks, materials of hydrochemical laboratories, regional sate departments of environmental protection basin departments of sate water resources management, sanitary and epidemiological departmens of Ministry of Health of Ukraine, annual reports of Central Geophysical Observatory of Sate Meteorological Agency of Ukraine.

Sources of input data for assessment of anthropogenic effect and classification the ecological state of small and medium rivers basins of Vinnytsia Region are:

- GIS map of Vinnytsia region;
- software of ecological classification of water resources by classes and categories developed by scientists of VNTU [2];
- database of monitoring of surface waters Vinnytsia Region;
- annual report of Basin Water Resources Management Administration of the South Bug.

The necessary information is taken from the given sources, then it is entered in Excel sheet. Data base is formed, the information from this data base is connected to already prepared GIS template (Fig 1).

Calculations of anthropogenic effect and classification of ecological state of rivers basins are carried out automatically on a separate sheet of Excel using scales and logic functions indicated in the technique. The calculation results are displayed on a separate sheet in tabular form.

In GIS-package "Panorama", in classificatory of Vinnytsia Region map (scale 1:200000) series of objects for classification of general ecological state of rivers basins and a series for ecological assessment of their main subsystems are created (Fig. 2) [3].

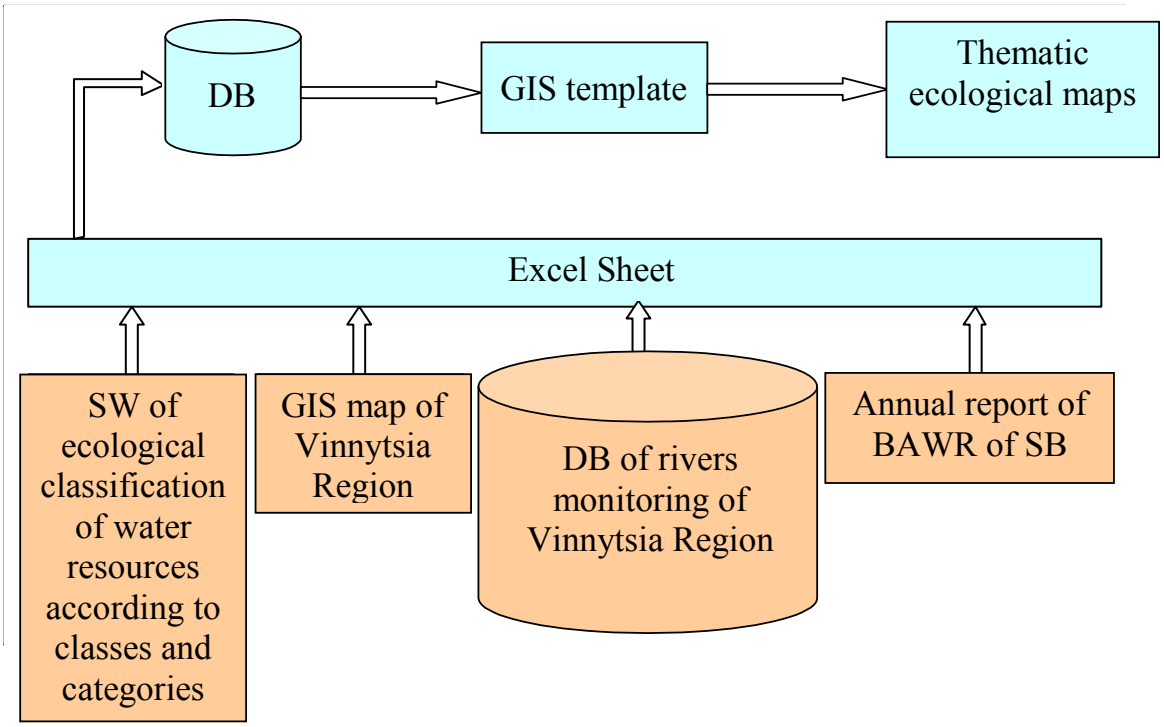

Fig. 1. Computer- based realization of the technique

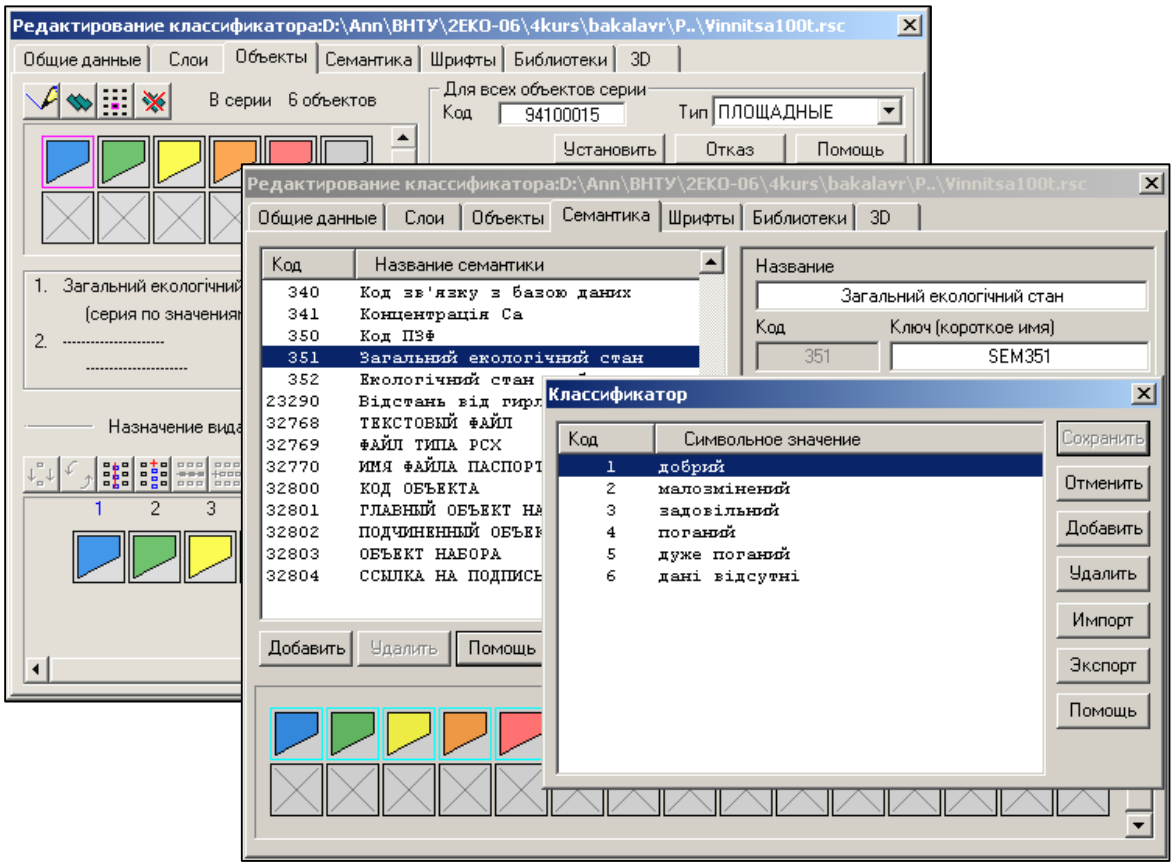

Fig. 2 – Improvement of map classifier

As a result of computation results visualization thematic map “Ecological sate of small and medium rivers basins of Vinnytsia region” is created (Fig 3).

3. Conclusions

Thus, technique of calculation of anthropogenic effect and classification of the ecological state of small and medium rivers basins has been developed as a result of application of GIS technologies for automation of presentation of classification results. The developed theoretical fundamentals were applied for computation of anthropogenic effect and classification of ecological state of small and medium rivers of Vinnytsia region.

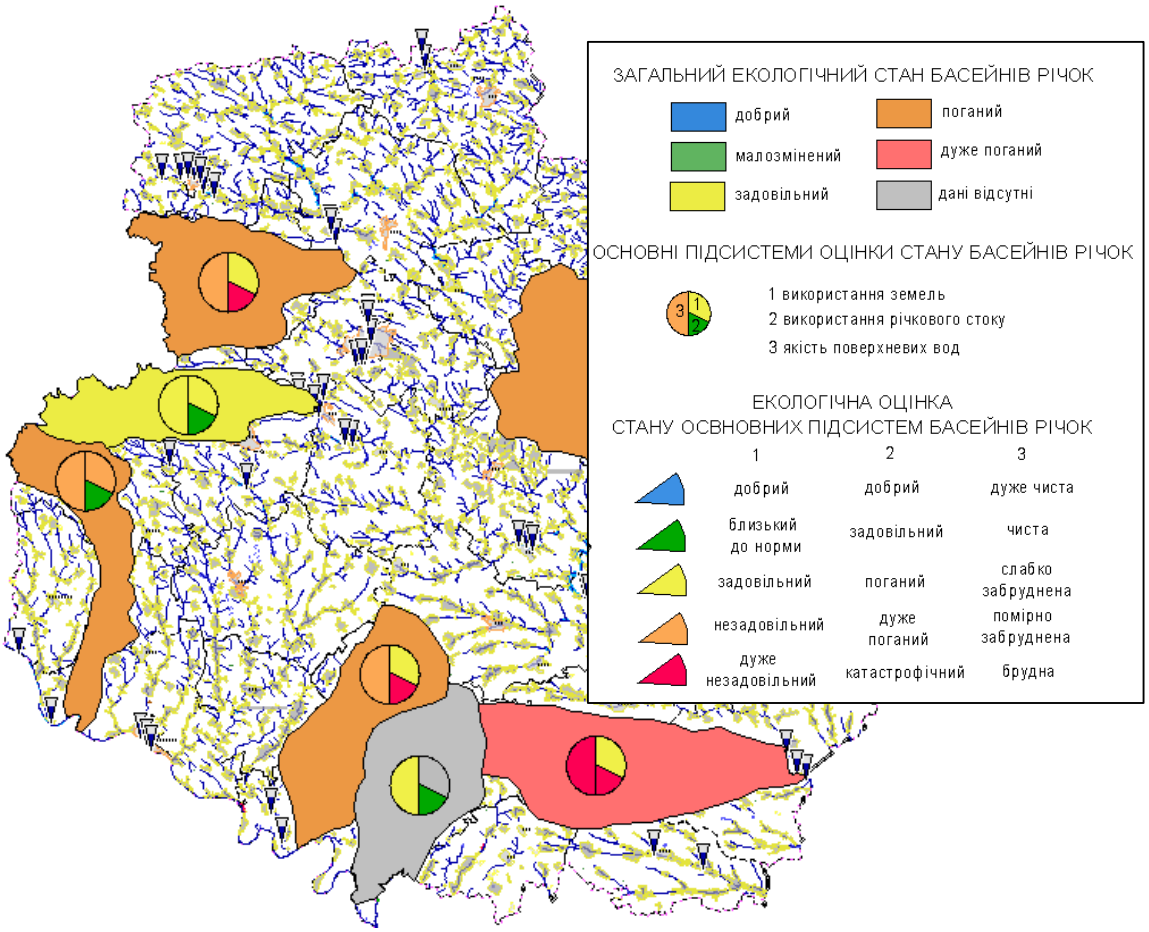

Fig. 3 - Thematic map

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Kryzhanivskiy Evgen – Cand. Sc.(Eng.), Senior Lecturer, Chair of Modeling and Monitoring of Complex Systems.

Vasylchuk Anna – Master of Science(Eng.)
Vinnytsia National Technical University.