УДК 631. 4: [528.94:004] (478)
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SPECIAL CONSIDERATIONS ON SOIL-PROTECTIVE MAPPING USING COMPUTER TECHNOLOGIES IN MOLDOVA

Soil-protective mapping displays specific characteristics of collateral skills` interactions and improves soil protection measures` projects' analysis and informational backup in conditions of complex relief. Computer technology usage was proposed for complex planning of soil-protective measures.
Keywords: mapping, erosion, GIS-technologies.

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ОСОБЕННОСТИ ПОЧВОЗАЩИТНОГО КАРТОГРАФИРОВАНИЯ МОЛДОВЫ С ПРИМЕНЕНИЕМ КОМПЬЮТЕРНЫХ ТЕХНОЛОГИЙ
Почвозащитное картографирование показывает особенности взаимодействия смежных специальностей и дает возможность анализа и информационного обеспечения проектирования мероприятий по защите почв от эрозии в условиях осложненного рельефа. Предложено использование компьютерной технологии для комплексного планирования почвозащитных мероприятий.
Ключевые слова: картография, эрозия, ГИС-технологии.

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ОСОБЛИВОСТІ ҐРУНТОЗАХИСНОГО КАРТОГРАФУВАННЯ МОЛДОВИ ІЗ ЗАСТОСУВАННЯМ КОМП'ЮТЕРНИХ ТЕХНОЛОГІЙ
Ґрунтозахисне картографування відображає особливості взаємодії суміжних спеціальностей і дає можливість аналізу та інформаційного забезпечення проектування заходів із захисту ґрунтів від ерозії в умовах ускладненого рельєфу. Запропоновано використання комп'ютерної технології для комплексного планування ґрунтозахисних заходів.
Ключові слова: картографія, ерозія, ГІС-технології.

Introduction. A considerable experience in erosion control investigations is accumulated at present. The essential principle of anti-erosional measures projects is complexity which involves measures aimed at prevention of different types of erosions, such as caused by rain, snow melting, irrigation and soil blowing. It is imperative that soil erosion' prevention tasks should be considered in connection with other land management tasks. Among the special characteristics of erosion endangered land is, for instance, the necessity to select soil-cover complex with various classes of removal. There is a vast amount of publications dedicated to this topic [1–3]. Nevertheless, one lacks a concrete and developed soil-protective mapping of erosional processes using computer technologies. For this purpose, one should have a profound understanding of soil behavior, knowledge in erosion control, have an on-hand experience in mapping and GIS-technologies.

Computer mapping of soil erosion and its dynamic is practically a groundbreaker in Moldova. In this connection there exists a strong need in a development of the soil erosional monitoring concept on the basis of precise cartographic material.

Presuppositions. One cannot imagine that analysis of anthropogenic load on soil cover and investigation of erosional process dynamics would be done without computer technologies at present. The presupposition for the solution of the problem is cartographical material that generalizes a vast data of soil, geomorphologic and synthetic maps. They have their advantages, but it is also a challenge to estimate the dynamics of separate important and special landscape's components, such as soil's removal area and class, the expansion rate of ravines and other forms of linear erosion, active landslides development and forming. Meanwhile, these phenomena are fast developing in time, provide substantial damage to soil resources and require a stable monitoring for environment-oriented decision making.

The goal of this article is to demonstrate a new approach to mapping on the basis of geographical information systems and mathematical modeling. Using computer graphics for cartographic material of eroded soils can be a base

material for prognosticative changes in soil cover in nearest future. The innovative method in eroded soils mapping could be applied in a practical way in localities, but also could be used in geographical education.

Basic materials statement. Erosional investigation methodology has four main methods: comparative geographical method, comparative analytical method, stationary method and modeling method [4]. Eroded soils mapping has its particularities. The scale of soil erosion maps depends on mapping goal. Maps with the scale of 1:10000 are constructed for project development and anti-erosional measures placement on the territories of concrete farm units. The maps with lower scales of 1:50000, 1:200000 are composed for an erosion overview of the vast territories and for the aims of farm planning. The necessity of selecting soil-cover complex of various classes of removal of field conditions and afterwards physical-chemical analysis in lab conditions is the specific characteristic of eroded soils mapping. Topographical base is used in field investigations. Though there are some specifics in the soil erosion survey. For instance, one has to use slope inclination maps. They are composed on the basis of topographic maps with 1:10000 scale. Besides slope inclination maps, one can obtain cartograms of slope length and aspect. Relative altitude map (local erosion base depths) is also used in linear erosions investigations [5].

The above-mentioned materials usage has a great importance in soil erosion mapping regardless of scale. When using large scale, slope inclination maps and slope length maps give an opportunity for an investigator to have an idea of how dangerous the studied area's relief may be from erosional point of view and what soil removal classes to expect in different regions even before the actual field trip. This review does not replace the field trip itself, although it substantially assists in field research. Morphometric relief indexes are of even more importance in soil erosional mapping, the reason being that it uses a larger-scale soil maps as base material which do not always reflect erosional processes. That is why such maps are corrected based on connection between morphometric relief indexes and class of removal.

Airspace images substantially enhance soil erosional mapping, making it more detailed. Soil erosion map composition on the basis of airspace images is executed in three stages. Literature data and cartographic materials along with airspace images and space images for the investigated territory are aggregated and analyzed on the first pre-field trip stage, and key areas for field investigations are selected. The second, fieldtrip stage consists of composing detailed soil erosional maps of the key areas. The third stage consists in organizing tables and catalogues of decoding marks, thus forming a base for the extrapolation of a soil erosion map [6].

An additional decoding mark of soil removal is its association to reasonably large parts of the slopes that are easily selected during the stereoscopic study of the images. In some cases not only one can determine soil removal class, but also the volume of removed material according to aerial mapping images. This data combined with surface study can be used to reveal active erosion areas, which is especially valuable for tasks like protective forest ranges and anti-erosional hydrotechnical engineering structures. The obtained maps of the territories affected by sheet erosion in 1:50000 scale revealed spatial data of increase of removed soils as a whole and by classes (low, middle, high. Among the natural maps available now in Moldova, a large scale soil map (140 map-boards) is the most detailed and contains significant information. Large scale maps' cartographical analysis allows to specify the parameters of highly eroded soils' increase on account of low-eroded ones, to calculate coefficients of average annual increase of eroded soils' areas from agricultural lands which consisted 0.86% for the whole republic [7].

Coefficients of average annual increase of eroded soils' areas were also obtained for all classes of removal for different pedological geographical regions of the republic. This data do not only have a monitoring capacity, but also is used for prognosis of erosion process in the Republic of Moldova. Now, a digital map of republic's eroded soils is composed. Such map is estimative and prognosticative (1:200000 scale) and, as a rule, is created for production problems' resolution. The preparation of such digital electronic map of republic's eroded soils was based on corrected soil maps of 1:10000 scale and other cartographic materials intended for nature protection purposes. Computer graphic decreases design period and increases confidence level for decision making process in project works [8].

Informational digital map of eroded soils with corresponding database allows identifying not only degraded agricultural lands and class of removal, but also qualitative and quantitative pa-

rameters of degraded soils, which is necessary for anti-erosional measures planning and republic's soil cover monitoring. New methods were used while preparing this map: GIS Database, Orthophoto, ArcGIS.

Conclusion and follow-up studies perspectives. Digital map of eroded soils is the initial material for revealing of major areas endangered by erosion aiming to mitigate sheet erosion and linear erosion manifestation, and to control landslides and ravines on Moldova's territory. Seminars for farmers are very important in order to increase their knowledge for soil fertility conservation.

Digital cartographic material on the Republic of Moldova's eroded soils is indicative of vast areas of low-eroded soils and on their capability for further increase of erosion process on agricultural lands. Therefore a special attention should be paid to low-eroded soils in order to prevent their transition to a higher class of soil removal, which is prescribed by the Republic of Moldova's government degree in 2015–2020. The digital map of republic's eroded soils can be used on regional, republican, local levels and in agricultural areas of individual fields. The objective characteristic, complete and modern estimation of soil cover that resides in this cartographic material may be used by different organizations, ministries and higher educational establishments. Holding of seminars for farmer education in Moldova's rural area is carried out with the financial support of International Project "Transboundary degraded territories inventory" («Transfrontalier-CRING», code MIS ETC 1705).

The work was executed with the financial support of fundamental science project of Academy of Sciences, Republic of Moldova– ESDEGRASOL –14.05.213 A.

Reviewer: Doctor in Geology and Mineralogy, international expert of Global Water Partnership D.A. Drumea

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