INVESTIGATION OF THE EFFECT OF RELIEF ELEMENTS ON THE EROSION PROCESS BASED ON GIS TECHNOLOGIES

**Abstract.** Erosion has become widespread in the local climate of Azerbaijan. From this point of view, it is often possible to come across different types of erosion (washing, erosion, deflation, etc.) in many soil types formed in the territory of the republic. It should be taken into account that as a result of erosion, the top fertile layer of the soil is washed away and as a result, the soil is deprived of the humus layer. In the presented article, the impact of relief elements on the erosion processes occurring in the lands of Gadabay district was studied on the basis of GIS technologies. **Keywords:** exposition, slope inclination, electronic map, landscape, relief, rastr palette.

**Introduction.** The more eroded the soil, the more its non-eroded type depends on its granulometric, physical-chemical composition, water, air, thermal regime, bioecological properties, and so on. will differ sharply according to the indicators.
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To place the obtained information on electronic maps, it is enough to refer to the most modern and convenient tool "GIS" software, which will help us to process dynamic information of any shape and size [1,2,3]. Through this program, we have the opportunity to both analyze and visualize the mechanisms of interaction of complex complexes that are closely interrelated in nature. At the same time, the system itself allows us to make a comprehensive analysis of natural and anthropogenic processes occurring in nature and in various sectors of the economy, as well as to identify global factors that contribute to these processes. One of the basic functions of the Geographic Information System is the design and construction of the database. The first condition for the design of the database will be the first stage of identifying and clarifying the information we need. At this stage, the information is sorted so that it can be easily identified and entered into the database in the form of raster or vector layers. The quality of the analysis results depends on the quality of the data entered directly into the database. The main role here is played by the appropriate selection of the final information raw material. Information-carrying carriers that can be the final information raw material are mainly field measurements, GPS coordinate data of field support points, satellite images of the area (Landsat 2, 8) and cartographic data (land maps, topographic, geological, etc.). The final data can be of different projections and sizes. The low accuracy of the final data results in less information being obtained and the inability to create a high-precision layer. To avoid this, it is necessary to have information about the accuracy of the base data, especially their size. The next step is to enter the final data into the database and create layers on the data. The method of entering data into the system depends on the type of final data. Then comes the next step, which is the process of processing data in the database. During this process, the final information is gathered together into a single projection. In any case, it is possible to change one projection to another, as well as transform data from raster format to vector or vice versa [4].

**Research object and methodology.** Mountain-brown and mountain-black soils formed in different views of the northern slope of the northern part of the Lesser Caucasus were taken as the object of research. The degree of soil erosion in the research object was determined on the basis of comparative geographical
methodology proposed by K.A. Alakbarov, and the definition of morphogenetic features was proposed by Sh.G. Hasanov.

Analysis of results. The high altitude and slope of the slopes create favorable conditions for erosion processes. The creation of a DEM (Digital Elevation Model) model of the area using GIS technology involves the following procedures [5] (Figure 1).

Fig. 1. DEM model of Gadabay district

The first stage is to scan topographic maps and connect them geographically to the coordinate system, digitalization of the map, creation of height and isolation vector layers, electronic design of topographic maps at a scale of 1:100000. Creating a map of exposure and slope rates based on GIS technology with the help of the DEM model is very quick and easy.

Different characteristics of the slope of the relief of the area where the soil layer is formed are widely used in geographical research. One of the main morphometric indicators of Gadabay region is a map of slope rates. As shown in the figure, the red parts indicate steeper slopes; slopes with a slope of more than 27-34 ° belong to the category of very steep slopes. The green parts indicate relatively flat areas. As the
slope of the area decreases, the relief becomes flat, and as the slope increases, the stiffness of the slope increases. In mountainous areas, the slope of the slopes is 27 and more, which causes landslides. Inclination rate of the slopes and the direction of elongation affect the direction of runoff, the density of vegetation, soil moisture and temperature. Therefore, these factors are one of the main causes of landslides. Slope stiffness analysis using ArcGIS version 10.3 showed that the average slope stiffness in the mountainous areas of the research area is 27-34 degrees. The main component of landscape formation is the slope of the topographic layer (Fig. 2).

Many areas of the district are formed between 1000-2000 m altitudes. It is clear that this factor creates sufficient fertile conditions for the formation of moisture, as well as soil and vegetation. Spatial analysis of slope inclinations directly confirms their connection with the geo-lithological and morphostructural structure of the area. Active landslides are more pronounced on slopes at altitudes of 1000-2000 m (Fig. 3). This is due to the lithological composition of the rocks that make up these slopes and the high amount of atmospheric sediment [6,7]. One of the main
morphometric indicators of slopes is the exposure. It characterizes the degree of solar energy supply of the slopes. Exposure is measured clockwise, passing an entire circle from 0 degrees to 360 degrees.

Fig. 3. Horizontal plan of Gadabay district

Each color indicates the degree of illumination of the area on the map (Figure 4).

Fig. 4. Visibility map of Gadabay district
The southern slopes are represented by shades of green and blue in the raster palette, the northern slopes by red and pink, the western slopes by blue, and the eastern slopes by yellow. Gray indicates a relatively smooth surface. Depending on the total sustainability duration of sunlight, the exposure of the slopes is divided into the following types:

1. Cold in the range of 0° -22.5° to 337.5° -360°;
2. Moderate cold in the range of 22.5° -67.5° to 292.5° -337.5°;
3. Hot in the range of 67.5° -112.5° to 157.5° -202.5°;
4. Medium heat in the range of 112.5° -157.5° to 202.5° -247.5°.

From the digital version of the solar exposure of the slopes, a quantitative assessment of the different lighting of the slopes is given. The price of each cell in the exposition network indicates the direction of inclination. Since there is no direction of smooth descents, it takes the value -1. The exposition map of the slopes, compiled in electronic format, allows analyzing the spatial regularity of the lighting of the district. This makes it easier for us to assess the conditions under which the landscape is formed in terms of heat supply. The first approach reflected the proportional duration of direct exposure to the sun's rays. The processing of the obtained data allows comparing the fields and finding the regularity of spatial expansion on them. In the received digital map, each selected area is assigned a sequence number. The parts are then grouped according to the main types. According to the exposition, the slope is divided into two types - cold and hot.

The transitions are treated as moderately cold and moderately warm. Cold and moderately cold slopes predominate. While landslides and denudation processes predominate on the northern slopes, the southern slopes are dominated by surface and linear erosion processes. Due to the sparse vegetation of the southern slopes, which are well warmed by the sun's rays, the soil layer can partially preserve its structural composition without being completely washed away by atmospheric sediments.

The result. As a result of field and cameral researches conducted in 2014-2016, it was determined that brown mountain-forest soils were formed on slopes with an inclination of ≥ 11%, and other soils with an inclination of ≤ 11% (in a relatively
smooth part of the relief). A small part of the research area is soil that is resistant to washing (6.5% of I hazard grade the total area). Medium-grade II hazardous soils make up 11.6% of the total area, and low-grade III hazardous soils make up 9.0% of the total area.

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