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CREATION OF DIGITAL MAPS FOR AGROPHYSICAL PROPERTIES OF IRRIGATED MEADOW-ALLUVIAL SOILS BASED ON GEOINFORMATION TECHNOLOGIES

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Abstract. This article presents the results of the research on the creation of various thematic maps using modern geoinformation technologies based on the research results on the agrophysical properties of irrigated meadow-alluvial soils.

Key words: *meadow-alluvial, salinity, geoinformation technologies, digital map, mechanical composition, bulk density, solid phase density, porosity*

Introduction. The development of digital methods and technologies for information analysis has marked the beginning of a qualitatively new stage in the development of soil cartography. Its distinctive features are the high level of formalization of all stages of cartographic model development, making the mapping cheaper and increasing its speed through objective control of the reliability of the results, and expanding the possibilities of meaningful analysis of soil-landscape relations [4].

Soil research has always been one of the most informative and targeted methods of describing the soil cover, the properties of its components, its composition and prospects for use. In the practice of soil-cartographic studies, there are several methods of soil study, each of them has its own goals and research methods [2].

Generally, field studies and developing soil mapping include general introduction to the object of study, the study of soils in field conditions, soil-cutting for sampling and description of soil, taking soil samples for further studies, determining soil contours, and gathering information on soil use and the field soil map layout.

Thus, the main method of soil diagnosis in field conditions is the soil profile method. By digging a soil to a certain depth to get soil cut, we get an idea of a certain soil type or subtype.

The transition to digital methods and electronic maps has led to the development of third-generation soil information systems, development of network systems, GIS methods and global Internet capabilities related to the automation of the next stages of soil mapping and the use of a number of relational databases, creating opportunities for development of regional digital soil models [3, 5, 6].

So far, international SOTER, European Soil Database, Australian ASRIS and Canadian CANSYS digital soil models have been developed, they enable rapid decision-making on modelling soil processes and improving land use systems and monitoring and prediction of anthropogenic impact on the environment in response to climate change [7, 8].

The problem of modernization of large-scale soil cartography in our country was put before the scientists much earlier, and the experimental researches of recent years are mainly focused on the production of methods of using the possibilities of geoinformation technologies, as well as on the basis of adaptive-landscape soil-cartography, also focused on agrogenic transformation of soil cover study [1, 9, 10].

Nowadays, one of the most important problems of agriculture is to increase the productivity capabilities of soil by preventing salinization of irrigated soils, maintaining and restoring their fertility. However, there are still problems regarding the appraisal and mapping of the condition of irrigated soils in our republic. Over the years, thematic maps in the form of paper have been compiled as a result of soil research.

Today, the only way to use these maps that store this valuable archival information is to create a digital representation of them using geoinformation technologies.

It is expedient to develop measures to obtain reliable information about agricultural land, to use it effectively and rationally to prevent negative anthropogenic effects. For this purpose, the application of modern technologies to soil cartography, especially the use of new GAT technologies in limited conditions of gross soil surveys, will bring the field to a higher level and allow to achieve the expected efficiency. Also, due to the use of these technologies, the initial (preparation) and final (cameral) stage processes in the correction of soil maps will be reduced, the speed of work, database, its updating and processing will increase.

As the automated geoinformation system is used in all fields, the use of this system in the management of land resources, preservation and restoration of soil fertility is the most urgent issue today. The application of the geoinformation system in this field creates opportunities for the proper analysis of complete information about a specific object or area and solving problems in a specific direction, as well as predicting adverse conditions in the soil in advance, and due to this sustainable management for soil fertility.

Object and methods of research. Research was carried out in irrigated meadow-alluvial soils in Kogon district of Bukhara region. Field and laboratory studies were carried out according to generally accepted standard methods. Profile-genetic, comparative-geographic and chemical-analytical methods were used in the research. The IDW interpolation method of the Arc GIS program was used to create different thematic maps of the agrophysical properties of soils.

Results of research. Determining the cartographic representation of different soil cover at different scales using modern geoinformation programs is one of the most important areas of modern soil cartography. The application of these methods plays an important role in the study of soil cartography diversity and structure of soil cover and also in the study of the factors that determine it, as well as in solving practical tasks such as agro-ecological appraisal of the territory.

Digital soil cartography is considered a new direction in soil science which uses the possibilities of GPS geodetic measuring devices, GAT, digital models of the place, remote sensing of the earth, geostatistical models and other modern technologies in the quantitative analysis of soil cover and various stages of research, and positive results are being obtained in this regard.

Based on the above, ArcGIS 10.8.1 Geostatistical Analyst (GA) and Erdas Imagine 9.1 programs were selected to create a cartographic framework based on the experience of advanced foreign countries in the use of modern geoinformation systems.

Through this program model, it is possible to clearly express the relationship between its properties when determining soil fertility, and select indicators that accurately characterize productivity.

Several indicators of agrophysical properties (mechanical composition, volume and specific gravity, porosity) were selected to analyze the soil condition using the above programs. Based on these selected indicators, digital soil maps were created in the ArcGIS 10.8.1 program for the researched areas in the Kogon district of the Bukhara region.

These indicators were selected taking into account that they are the main agrophysical properties of soils, and geoinformation analysis was carried out through the Geostatistical Analyst (GA) module of ArcGIS10.8.1. For this, the coordinates of the geographical location of the main soil sections were determined, and the values of the corresponding properties of the obtained soil samples were entered. Based on these, the spatial distribution of soil properties in the experimental area was determined. For this, one of the interpolation methods available in the Geostatistical Analyst (GA) module of the ArcGIS10.8.1 program was used.

The agrophysical properties of soils are the most important criterion for evaluating the level of their productivity, while expressing the essence of the processes taking place in the soil. Important agrophysical properties of soils include mechanical composition, volume and specific gravity, and soil porosity. These properties are among the factors that have a great influence on the free growth and development of agricultural crops. They are closely related to the chemical composition of soils, including the amount of humus, structure, pH and other factors. Deterioration of these factors slows down the growth and development of crops, worsens the water-physical properties of the soil.

The mechanical structure of the soil is one of the main parameters in the description of soil fertility, and it is of great importance in the processes of soil development and the use of soil in agriculture.

Therefore, the importance of mechanical composition is important when characterizing varieties of any genetic type or determining their production (productivity) ability (Fig. 1).

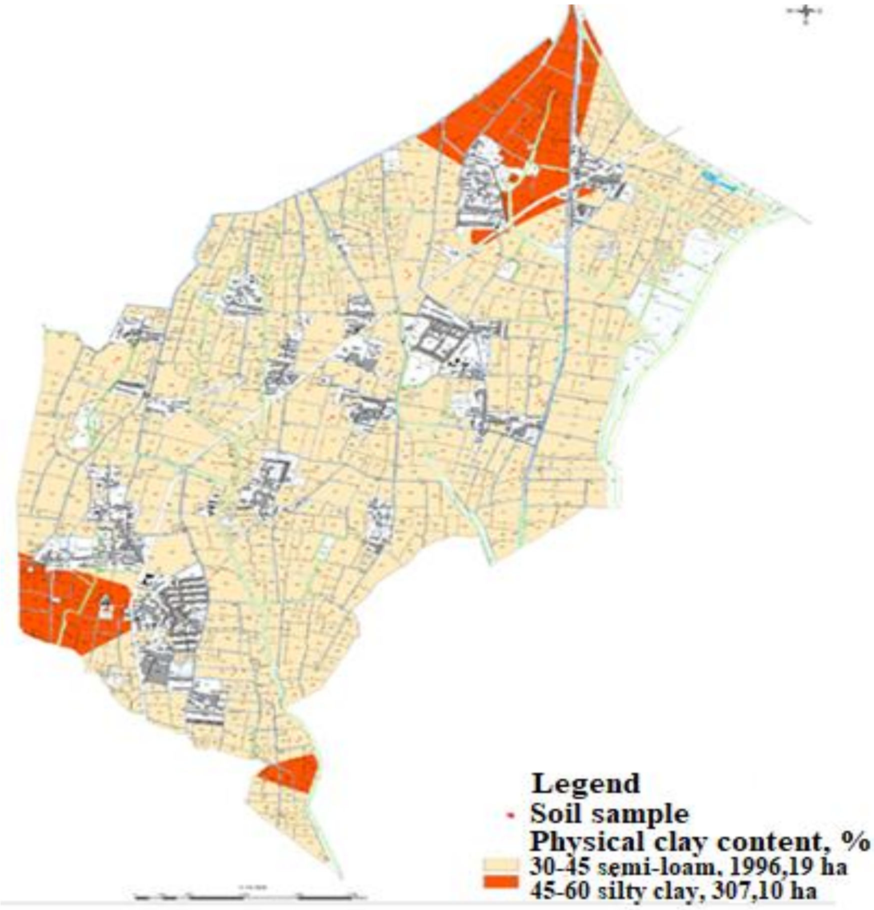

Figure 1. Digital map describing the distribution of mechanical content in the upper (0-30 cm) layer of meadow-alluvial soil formations

It is known that the study of the general physical properties of the species is of great importance in the development of the scientific basis of highly efficient and rational farming, because the physical properties of the species affect the productivity of the species, the degradation processes, the progress of biological activities and also hava a big impact obtaining a high yield from agricultural crops.

According to the methods described above, maps of the general physical properties of the soil were created, and a digital map describing the distribution of volume, compaction and porosity of the soil in the upper (0-30 cm) layer was created (Figures 2, 3 and 4).

One of the most important agrophysical properties of soil is its **bulk density.** The volume weight of the soil is highly variable and mainly depends on its mechanical composition, structure, humus reserve, the amount of carbonates, the content of absorbed bases, the pH of the soil environment, etc.

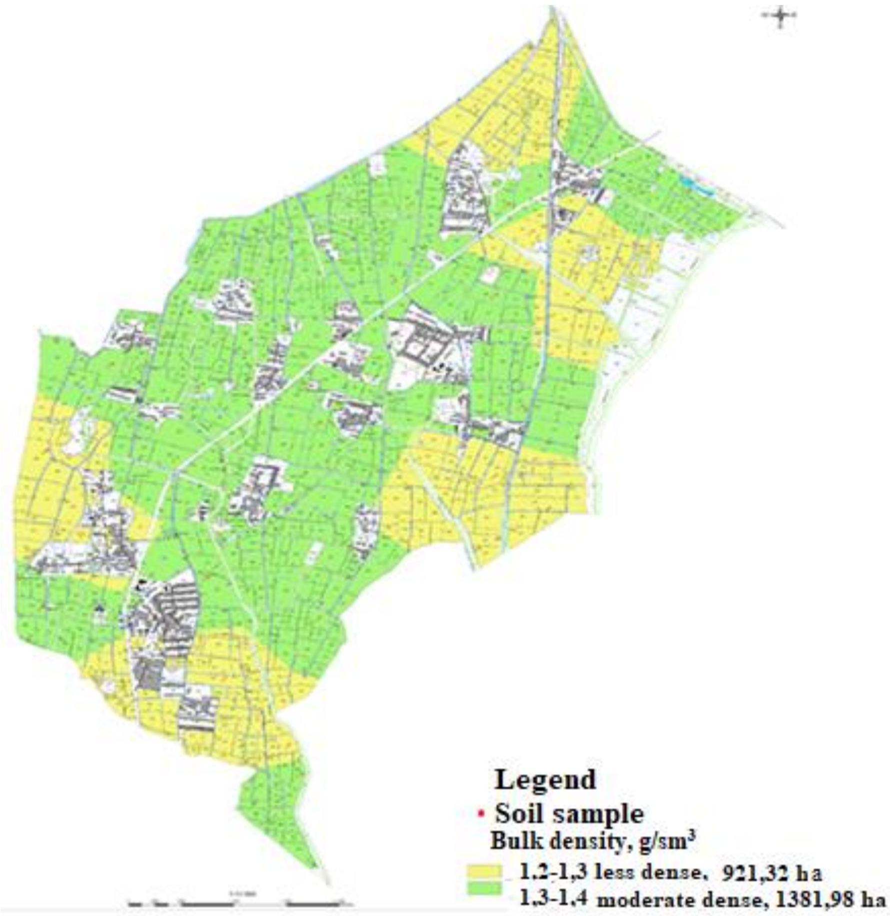

Figure 2. Digital map describing the bulk density distribution in the upper (0-30 cm) layer of meadow-alluvial soils

One common physical property of soil is **solid phase density**. Since the solid phase of the mixture of soil consists of primary and secondary minerals and organic, organo-mineral substances, its specific gravity can only change depending on the type and amount of minerals in it.

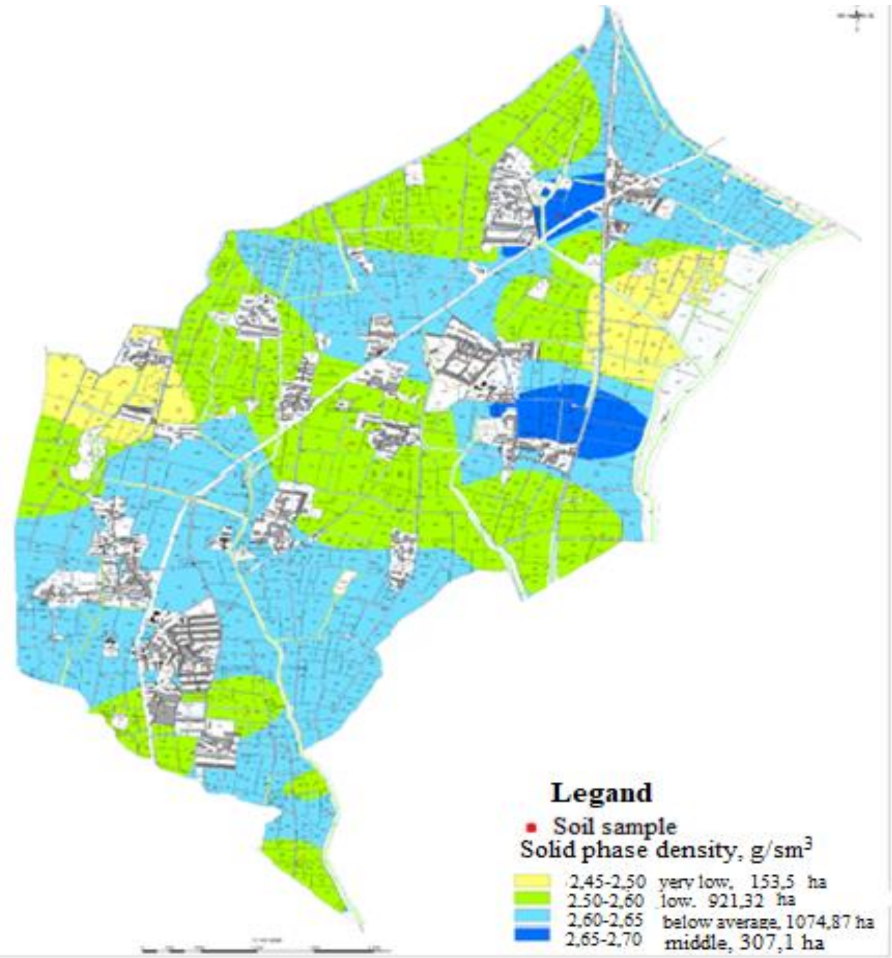

Figure 3. Digital map describing the distribution of the amount of specific gravity in the upper (0-30 cm) layer of meadow-alluvial soils

It is known that the higher **porosity** of soil is one of its important physical properties. The presence of porosity has a positive effect on the aeration process (air exchange) and other properties of the soil species.

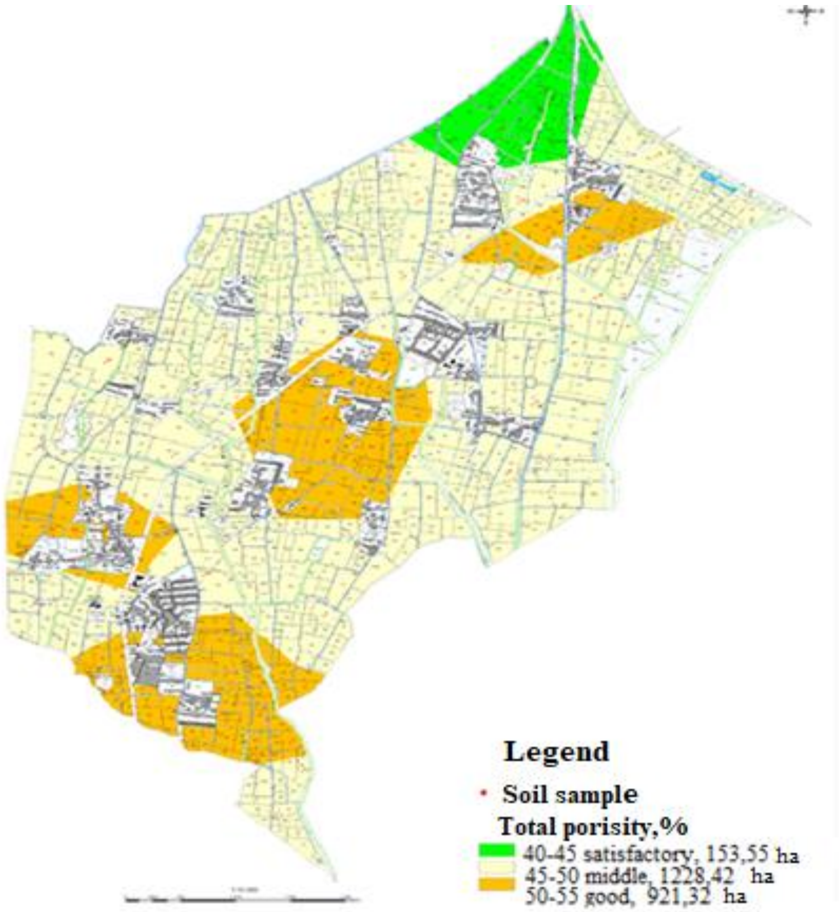

Figure 4. Digital map describing the distribution of porosity in the upper (0-30 cm) layer of meadow-alluvial soils

In conclusion, a series of thematic electronic maps have been created on the basis of the results of the research conducted in order to determine the cartographic representation of the research area using modern geoinformation programs, which is one of the most important directions of modern soil cartography. The application of this technology creates opportunities such as high accuracy and speed, high possibilities of data comparison, economic advantage and time saving in the determination soil status, its appraisal and in conducting annual monitoring of it.

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