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ANALYSIS OF FUNCTIONALITY OF STATISTICAL DATA IN GEOVISUALIZATION OF POPULATION DYNAMICS

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Abstract: *The article deals with the analysis of population density with the help of geo information programs, the process of visualization of the integration of statistical and geographical data, the structure of the technological sequence. One of the methods for describing the relative productivity of land data is considered. Geo information systems can support the decision-making process in the design and selection phase with limited capabilities, and these systems provide a very static modeling environment. This limits their scope as a decision support tool, especially at stages where collaborative problem solving decisions are required.*
Keywords: *Geo visualization, geographical, GIS programs, geographical mapping.*

INTRODUCTION. R-was created as a system of statistical analysis and graphs and is currently one of the most powerful tools for data analysis. R is a free, open source translator. Among other things, R is a programming language with high potential for creating and visualizing graphics. In addition, R offers an interface to other programming languages and GIS programs. R is very popular for data analysis in various fields: statistics, Geo informatics, geography, agriculture, ecology, bioinformatics and others [1-4].

Geo visualization involves the depiction of spatial data to facilitate observation and interpretation of simulated data sets, through which processes on the surface and on solid ground can be understood. Many methods can be applied to geographic information system images, digital relief models, and other data layers to find patterns and descriptions of landscape features. Given the rapid proliferation of remote sensing data and high-precision digital relief models, satellite imagery and relief morphology are used to describe human-induced manual interpretation in the study of geomorphic processes and mapping of landforms. plays an important role. In the context of geomorphological mapping, a description of some of the methods that can be used to improve satellite imagery and visualize topography to improve landform identification is given. Visual interaction with spatial data is an important part of the study and understanding of geomorphological data sets, and there are many methods ranging from simple coating, pan and scaling, 2.5 D, 3D and time analysis. Precise imaging results for static and interactive distribution methods will also be considered. Legends of geomorphological mapping and cartographic principles of mapping design are discussed, as well as details of dynamic web mapping systems that ensure full immersion of end users and efficient dissemination of data [5-11].

Geo visualization involves the depiction of spatial data in an attempt to facilitate the interpretation of observational and simulated datasets through which Earth's surface and solid Earth processes may be understood. Numerous techniques can be applied to imagery, digital elevation models, and other geographic information system data layers to explore for patterns and depict landscape characteristics. Given the rapid proliferation of remotely sensed data and high-resolution digital elevation models, the focus is on the visualization of satellite imagery and terrain morphology, where manual human interpretation plays a fundamental role in the study of geomorphic processes and the mapping of landforms. A treatment of some techniques is provided that can be used to enhance satellite imagery and the visualization of the topography to improve landform identification as part of geomorphological mapping. Visual interaction with spatial data is an important part of exploring and understanding geomorphological datasets, and a variety of methods exist ranging across simple overlay, panning and zooming, 2.5D, 3D, and temporal analyses. Specific visualization outputs are also covered that focus on static and interactive methods of dissemination. Geomorphological mapping legends and the cartographic principles for map design are discussed, followed by details of dynamic web-based mapping systems that allow for greater immersive use by end users and the effective dissemination of data [18].

Geo visualization has garnered considerable interest, as a term covering a wide swath of activities ranging from exploration, through to analysis, synthesis, and presentation. An intuitive, useful definition is 'the visual depiction of spatial data,' and this chapter has focused more on the use of geo visualization in geomorphology under this definition. There is considerable overlap between some of the techniques outlined here with analysis techniques covered in other chapters in this volume, and this demonstrates the important role that visualization plays in the analysis of spatial data for geomorphological applications. It also clearly demonstrates the very important role that visualization plays in the exploration of patterns, as we seek to formalize concepts and theories, and better understand landscape evolution. Advances in geospatial technologies have led to the widespread availability of high-resolution terrain data that have facilitated advances in geo morphometry and geo visualization, collectively revolutionizing geomorphology. The generation of new observational geospatial data sets, through the use of geo visualization and mapping, may be functionally termed visual processing. In geomorphology, researchers are specifically interested in attempting to visualize the topography in new ways through quantitative characterization and qualitative visualization. Numerous techniques can be used to describe various characteristics of the topography that can be visualized, including location, extent, variation, height, volume, and many other parameters. This is still predominantly performed by manual mapping efforts using image interpretation, although new automated approaches also exist for the generation of land-surface parameters and mapping, although they must be carefully evaluated and ultimately formalized [18-20].

MATERIAL AND METHODS. The study mainly mapped population growth using statistical methods and GIS software, and determined the functionality of the statistics. A geographic information system (GIS) is a computer system designed to collect, manage and describe geospatial data, in which these data can be displayed through images, tables, along with the details of events, events, activities, or where they are located. Geoinformatics, which is a different form of geoinformation system, means a complex of scientific, technical and applied sciences related to the development of geoinformation system. This complex arises from the connection between geography, informatics and information technology theory, cartography and new approaches to computing.

Geo visualization is widely utilized in geomorphology for the exploration and analysis of spatio-temporal data. Although a spatial framework is not a requirement for geomorphological study, it is natural in many studies to use 'space' as the organizing paradigm. A better understanding of many geomorphic phenomena can therefore be gained through the recording (i.e., 'mapping') and analysis of their spatial distribution. In the past, the observed distribution and form (i.e., morphology) would typically have been communicated using a geomorphological map [19-21].

RESULTS AND DISCUSSION. Under ideal conditions, populations of most species, including Homo sapiens, have the potential for exponential growth. The larger the population, the faster it grows.

Almost no population lives in ideal conditions. Therefore, most, at least, do not grow indefinitely. They can grow exponentially, but sooner or later something will limit their growth. Many factors can limit population growth, so it slows down or even stops. Often factors depend on density. Density factors are factors that slow population growth and overcrowding. For example, a population may run out of food or overcrowding may lead to epidemics of infectious diseases. There may be more deaths or more people may migrate, causing slower population growth and a lower population size.

How does the population stop growing in logistics growth? It depends on the carrying capacity of the population.

For most of our species, the world population has grown very slowly. Then, a few centuries ago, the human population began to grow exponentially. It took thousands of years for the human population to reach 1 billion people, which happened around 1800 BC. After that, it took just over a century for their number to reach 2 billion. In less than another century, we added another 5 billion people, reaching a total of 7 billion by 2012. Today, the human population is approaching 8 billion. At a global growth rate of 1.03 percent in 2021, we will add more than 80 million people annually. If this rate of growth continues, the total population will double in just 58 years.

Can the population grow by 1.2 percent? As the late 18th-century economist Thomas Malthus predicted, rapid population growth would soon outstrip food production, leading to increased starvation and death. This indicates that the population has reached its carrying capacity and can no longer continue to grow. Malthus argued that if population growth did not occur before carrying capacity was reached, depopulation would result from increased warfare, malnutrition, and disease.

Since Malthus issued his dire warning, the human population has grown from one billion to more than 7 billion people. Has the human population reached or exceeded its carrying capacity? Is the planet overpopulated? Do we have a person? Is population growth a problem?

Attempts to calculate the carrying capacity of the world's population have produced wildly different estimates. However, a meta-analysis of 69 such studies found that the best estimate of human carrying capacity is 7.7 billion people. By the year 2100, the population is estimated to reach 10.88 billion people. If these calculations are correct, then the human population is at its peak and must stop growing. Some people are already suffering from shortages of food, water and other resources; and our use and purchase of resources have already harmed the environment. Such evidence suggests that we have reached our carrying capacity and indeed have an overpopulation problem.

Although many environmental problems are exacerbated by population growth, some experts believe that overconsumption and waste by people in rich countries is worse than population. People in developed countries use resources 30 times more than in less developed countries where most people live today. If everyone used resources at the level of people in developed countries, the total human population would need more than one planet Earth to meet their needs. In order to solve the problem of overpopulation, it is necessary to reduce the excessive consumption of resources and our ecological footprint.

Environmental problems are not only caused by overpopulation. However, the fact that there are too many people on the planet will undoubtedly exacerbate the problem, so it is important to reduce the rate of human population growth. The accepted goal is an overall zero population growth rate. Zero population growth (ZPG) occurs when the birth rate equals the death rate (in general, there is no net migration for the population). ZPG can be achieved if women, on average, replace their children and their partners. This is called the replacement birth rate. Depending on the mortality rate, there are 2 to almost 3 children per woman. When the death rate is high, the birth replacement rate is high because fewer children in the population reach adulthood to replace their parents. Even if the birth rate falls to replacement level, there will be a period of time before the rate of population growth slows down. This is because populations with recent high birth rates have an age distribution with a large proportion of women of reproductive age. With too many young women, the population's birth rate will remain high for at least another generation.

Having a child is an important and personal decision that is influenced by many socio-economic and cultural factors. Obviously, trying to influence how many children women have is a complex problem. The top-down approach was introduced in China in 1979 when it adopted the one child per woman policy. The Chinese government has estimated the policy of reducing China's population by 400 million people. However, when the policy was enacted, China's birth rate was already declining, so the impact of the policy is debatable. A small dip in the curve beginning in 1979 indicates that the policy's impact on population growth was minimal.

Unlike China, most countries do not have direct policies to limit the birth rate. However, data from many populations show that when there is more education and economic opportunity for women, gender equality, more knowledge about family planning, and improved access to contraception, women are less likely to they start having children. Needless to say, achieving these kinds of societal-wide changes is often very difficult and requires multiple approaches, but the future of our species may depend on them.

Due to the radical change in the mechanisms of development of the demographic situation in the Asian region, there is a need for research to restore the dynamics of the population at the local and regional levels. Cartography, which has become relevant in the last decade due to the systematic view of the dynamics of mapped objects and events, the transition to geo information methods and digital technologies, the acquisition of new knowledge about the spatial development of regions, prevails.

If we look at the population figures of the countries in Central Asia, we can see progressive numbers. The fact that it is reflected in the numbers makes almost no change in the imagination of the student. In addition, today the geographical location of any information has become relevant metadata.

The age structure of the population is closely related to all demographic processes. One of the important consequences of such interactions is that the age composition is characterized by demographic inertia. For example, there is such a thing as population growth potential, which, due to its inertia, continues for a long time after previously existing population movement trends cease to be movement factors or change their movements in another direction. Therefore, the degree of influence of age structure on the dynamics of demographic processes is always taken into account using special methods that eliminate this effect.

For analytical purposes, the age structure is presented in the form of groups and relative indicators. Typically, age composition is considered in conjunction with sexual structure rather than spontaneous, so often we talk about the gender and age (or age-sex) structure of the population. In the analysis, as a rule, annual or five-year age groups are separated. However, other methods of grouping are also possible depending on the objectives of the analytical activity (e.g., the study of centuries-old trends in population growth).

Gender and age pyramids are widely used to visually represent the gender and age composition of the population. The gender and age pyramid is a double-sided tape diagram constructed in a rectangular coordinate system. The vertical axis (ordinate) shows the scale of the accepted age range, the horizontal axis (abscissa) shows the scale of the number of relevant age groups.

The existing combination of demographic indicators (processes, structures) in a certain area is called geodemographic situation (situation). The concept of geodemographic situation is one of the components of the methodology of internal geography of the population.

We can visualize phenomena and events of different scales through the tools that work with geographic data. A simple example for a large scale is to find the most optimal way to get from one settlement to another, while a small-scale visualization includes the population density, per capita land area and its annual cross-section of the constituent parts of a republic or region. it can be said to show trends of change [12].

Based on the analysis of the existing population statistics in Uzbekistan and a number of mathematical processes, we can create new and important data. Currently, if we look at the population statistics, it shows only certain values (Figure 1):

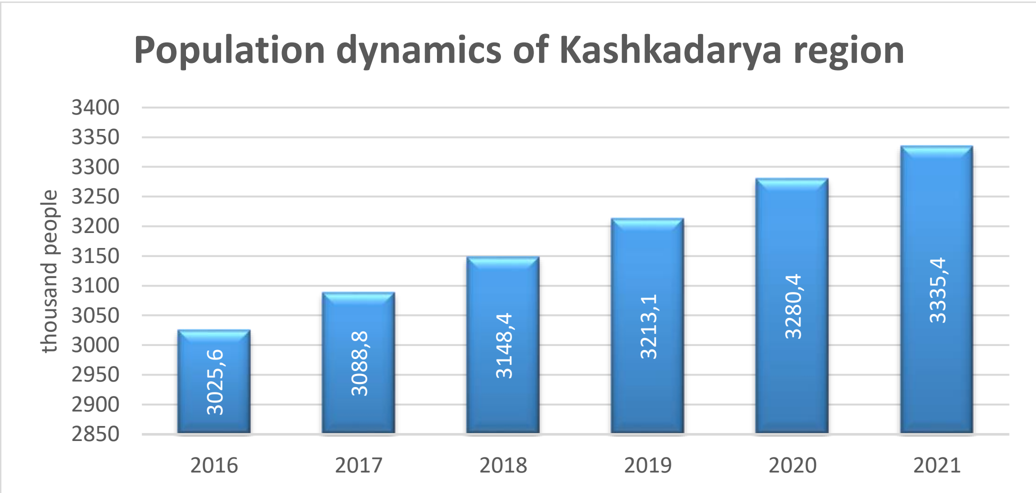

Fig. 1 Population growth dynamics

We will develop a new type of data by linking these indicators directly to geodata. To do this, we can divide the land of the region into its inhabitants. As a result, we see how many people per 1 km2 (Figure 2).

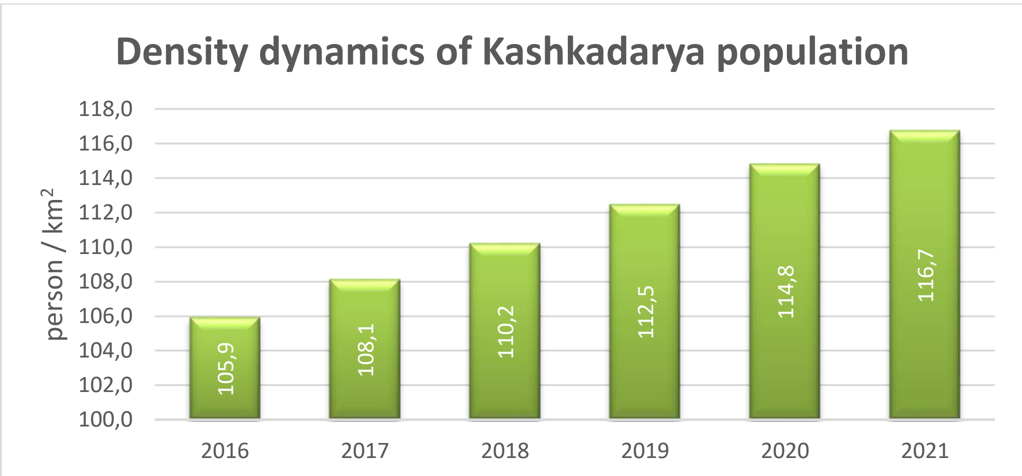

Fig. 2 Dynamics of population growth

Based on the population density, the area of land per capita was determined (Figure 3). According to him, in 2016 it was 94.43 hectares per person. At present, the figure is about 85.66 hectares. or 9.69%. Statistical issues can be used to determine how much has changed over a given period, as well as what trends can be prepared for the near and long term.

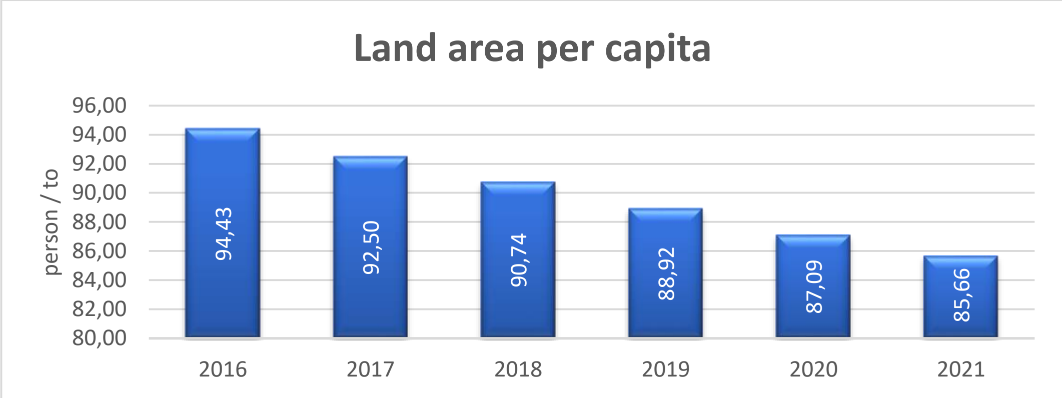

Fig. 3 Dynamics of reduction of the area per capita

Nowadays, it is noted that the users of electronic networks use communication tools more as a new source of information. The excessive amount of maps and other types of geovisuals in the Internet, the quantitative increase of documents significantly reduces the process of their effective use. Another problem is the rapid change of information searched by users directly on the Internet.

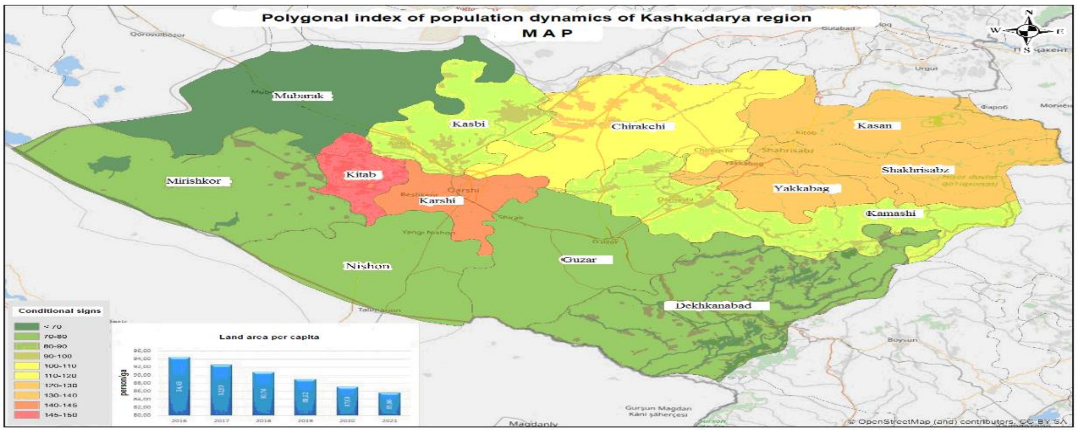

Fig. 4 Thematic map of population statistics of geostatic visualization

However, without a doubt, the main problem is that the efficiency of using the Internet is relatively low. Due to the large area of vector format visual images, it takes a lot of time to transfer them over the Internet. It is observed that the possibilities of full use of available information sources from the Internet through receiving channels by users are still insufficient.

Based on the data discussed above, we use the functions of geographical analysis when compiling district statistics. After all analyzes are performed in the district, the results are summarized. Statistics are linked to geographic features [13] and are performed on the basis of tabular data. The use of information in the form of geographically linked data to increase the accuracy of analytical data and provide a number of additional data can now be a clear solution to finding solutions to current problems and selecting the most appropriate [14].

Today, the search for alternative solutions to complex problems in various fields using geographic information systems is improving day by day. In turn, the improvement of decision support systems has a positive effect on this. During the 70s and 80s of the last century, the concept of a decision support system began to be researched by many experts, many developments were created and a number of works were carried out on their practical application. To this day, this direction of research, without losing its relevance, is used not only by GAT specialists, but also in all aspects of our life, for example, in nature, society, science and technology, and other areas.

Information in the form of a map leads a person to be aware of the strategic and general situation, to form an opinion about it and to increase the effectiveness of solutions. Dynamic and or static visualization of data from the world, continent, region, republic, region or other scale is the most effective way to convey to the user that it changes its state in the context of natural and man-made factors [15-17]. A clear example is the visualization of the map, which is the result of viewing statistical analysis and converting it into geostatistics (Figure 4).

CONCLUSION. The issue of geo statistics and its visualization is seen as the biggest issue of today and a simple solution to big problems. It is the same fact that objects with a geographical location can bring solutions to the most optimal version in terms of position and location. Its use in agriculture, industry, transport, communication, and defense purposes is unprecedentedly simple and can serve as a basis for extracting the most accurate information. It is necessary to popularize geo statistics in order to scientifically base all the information and to expand the scope of use of the basis, to turn it into a ground-creating mechanism. It is reasonable to say that geo statistics is the best location-related solution library of our time.

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