

**APPLICATION OF GIS TECHNOLOGIES IN GEOGRAPHICAL
RESEARCH**

(IN THE EXAMPLE OF THE ARCGISPRO PROGRAM)

Xamzayeva Lola Gayrat qizi

teacher at the Specialized School of Sardoba District

Abstract: This article analyzes the role of geographic information systems (GIS) technologies in modern scientific research, their scope and capabilities. In particular, achievements achieved through GIS technologies in areas such as geography, ecology, urban planning, agriculture, and natural resource management will be presented.

Keywords: digital map, geographic information, GIS technologies, Natural Earth, spatial analysis.

Introduction. Geographical sciences are widely used in the modern world to perform important tasks such as the study of natural and social processes, resource management, and environmental analysis. It is also of great importance to all of humanity as a science that studies changes in the natural and social aspects of the Earth and the consequences of these changes. It is no exaggeration to say that this system of sciences has further developed with the development of modern technologies. One of the innovative tools used in the field of geography today is GIS technology. GIS technologies allow for the collection, analysis, and visualization of a variety of geographic and social data, which enables deeper analysis and more accurate predictions in geographic sciences. With the help of GIS technologies, the process of collecting and analyzing geographic data can be significantly simplified

and studied. This plays a major role in the successful implementation of many scientific and practical projects, such as managing various territories and resources, monitoring ecological changes, and studying urbanization processes. Also, creating advanced projects using GIS technologies allows learners and researchers to try new methods and find solutions to global problems.

Main part. Geographic Information Systems (GIS) are a set of hardware and software tools used to input, store, process, analyze, and visualize geographic information systems. GIS is an English word that stands for Geographic Information System, that is, it is an information system designed to collect, store, process, display, distribute, and provide free access to electronic maps and related spatial data. GIS technologies are designed to work directly with databases, provide query languages and statistical analysis of data, and are aimed at visualizing information on maps and geographic analysis. GIS differs sharply from other information systems in these aspects and creates the following opportunities:

- analyzes and predicts phenomena related to the natural environment;
- making plans of strategic importance;
- planning the consequences of decisions made;
- demographic data analysis;
- environmental pollution;
- analyzing the negative consequences of natural disasters;
- can be a great help in finding solutions to issues such as determining the most optimal routes from maps.

To create designs using GIS technologies, we use the "Natural Earth" website, which is open and high-quality, and can provide data of any layer. You can download any data from the world from the "Natural Earth" website.

Natural Earth is a website that provides cartographic data and images. It includes datasets of geographic, physical, political and administrative boundaries, cities,

transportation networks and even natural geography elements. They can be used in a variety of mapping projects. This website allows users to download and use various data layers. The data on the site is available in a variety of formats, including those compatible with GIS software. The Natural Earth project is largely open source and is known for its high-quality data. It can be used for various maps, statistics, scientific research, and other visualization projects.

Below are some of the projects we have created through this site:

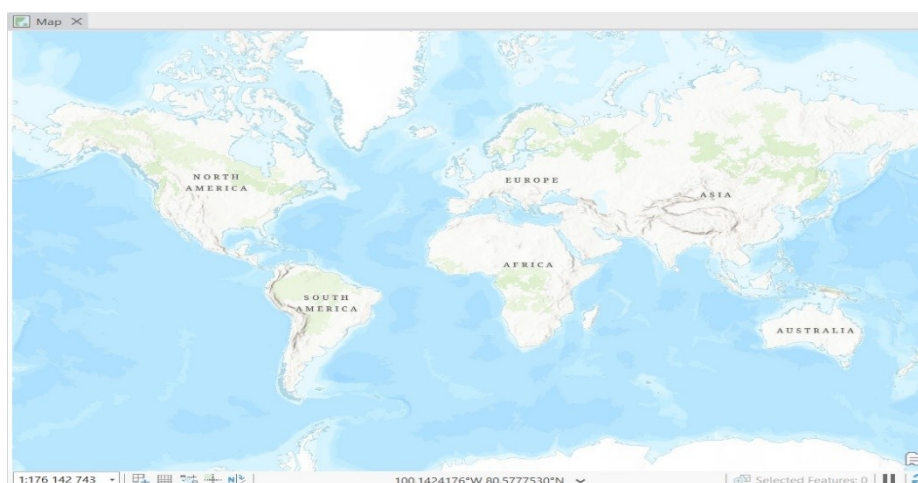


FIGURE 1.

This created layer can be easily loaded with existing layers on the website. For example: a world relief layer, borders of countries and their sub-administrative boundaries, transport routes, major cities, existing airports and ports, etc.

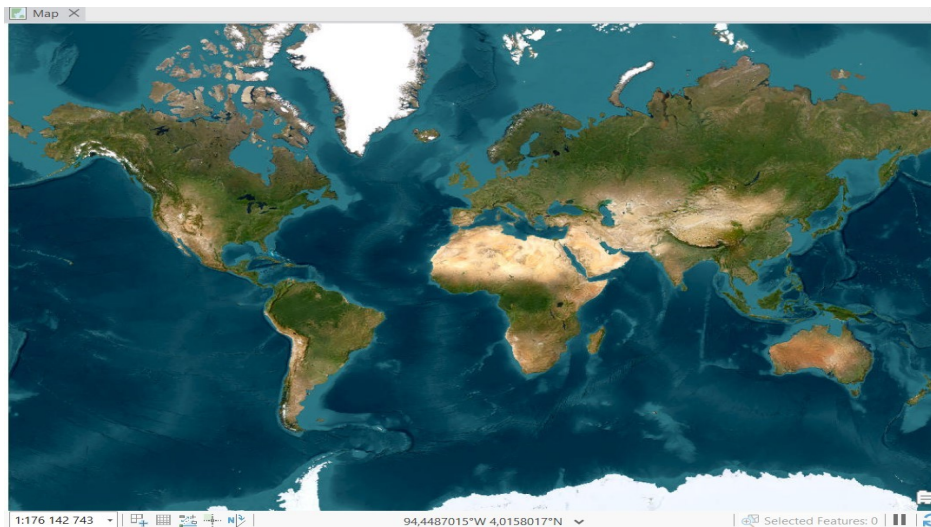


FIGURE 2.

It is also possible to create a natural map of the world in a more perfect way. This map will show the relief of the world more clearly.

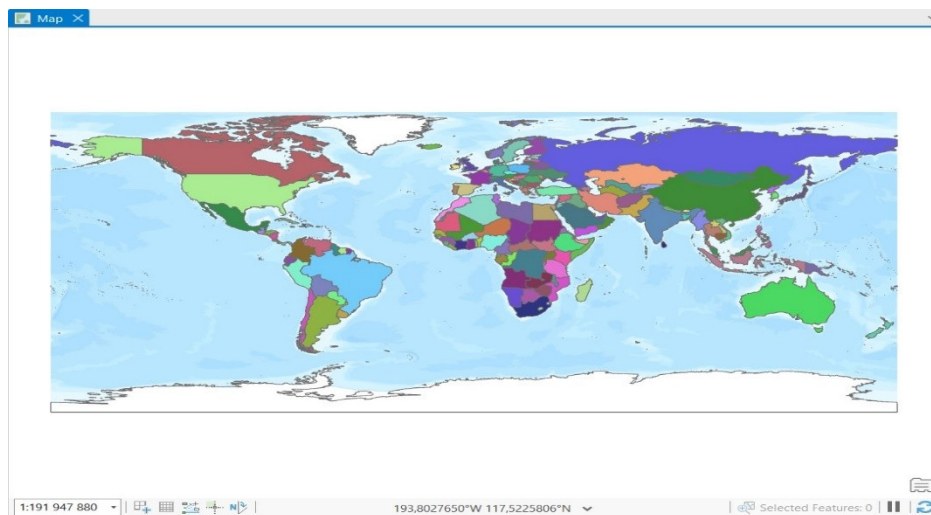


FIGURE 3. Countries of the world

As you can see from this generated image, the countries of the world are highlighted in different colors. In the table format, you can see which color represents which country:

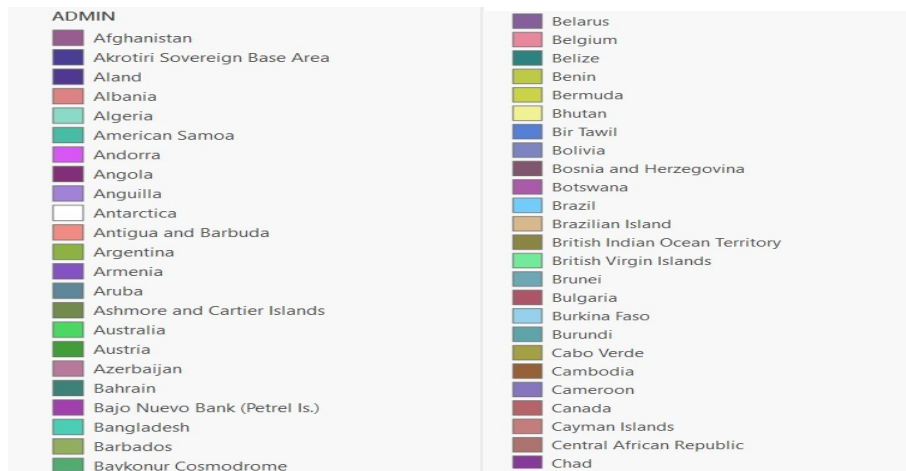


FIGURE 5.

In the current state of the program, when you click on the desired point, you can also get information about the name and coordinates of the place (Figure 4).

The following capabilities of GIS technologies:

- Representation of spatial data in the form of layers;
- Integration of natural and anthropogenic factors;
- Implementation of static and dynamic analyses;
- Forecasting and modeling based on maps.



FIGURE 5.

Areas of application of GIS technologies in research:

- Ecological research: Monitoring the atmosphere, water and soil, determining the level of pollution.
- Geography and landscape science: Analysis of landscape structure, dynamics of variability and spatial distribution.
- Urban and regional planning: Land resource management, population density analysis, transport infrastructure design.
- Agriculture: Monitoring cropland, analysis of land reclamation systems, yield forecasting.

Conclusion: The introduction of GIS technologies into research increases the accuracy of scientific results, allows for broader conclusions to be drawn through spatial analysis. Today, the use of GIS in any scientific or practical project is a competitive approach. Mapping any region of the world, the maps produced are distinguished by their accuracy and correctness of data. Advantages of GIS technologies: Helps integrate large amounts of data. Provides speed and accuracy in decision-making. Allows you to create a basis for scientific models and forecasts. It presents results in visual and graphical formats. Most importantly, researchers can easily map the area of their research object. They can do this independently.

Therefore, it is important for specialists and researchers to master these technologies and be able to use them in their research.

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