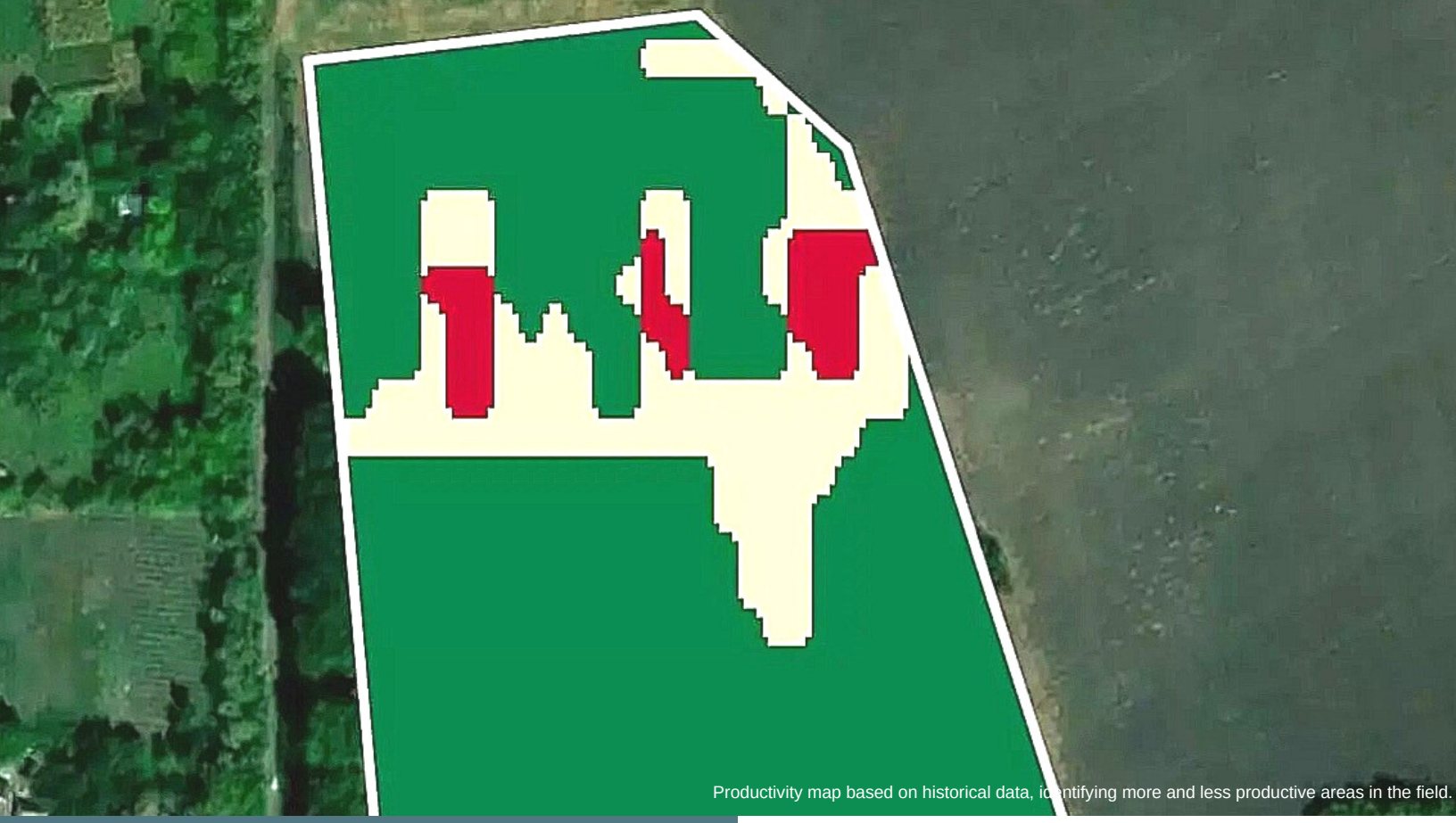

Productivity map based on historical data, identifying more and less productive areas in the field.

Geospatial Technologies For Progress: Empowering National Development

By Elena Ivanova
EOS Data Analytics

A geographic information system (GIS) is a huge database of digital data converted into a digital format. It consists of detailed layers united by geography and tied to a certain coordinate system. Any events taking place can be successfully tracked using such a database. In addition, it can be used to find almost any point on the globe and track the movement of almost any object.

GIS databases can perform different tasks. You can enter up-to-date data into the database, and in most cases this is done automatically with a scanner. You can manipulate the data, scale it as you see fit, and collect the information you need to solve a particular problem. Like conventional databases, a GIS system can be managed. This is done through a range of integrated applications.

The large amount of data contained in the database provides a wide range of opportunities for analysis of various parameters. You can find vacant lots for building a house, optimally form traffic flows, analyze the proximity of various objects (for example, to determine the number of people who live within walking distance of your store), overlay various indicators and analyze the resulting picture. More so, farming businesses can even perform crop yield forecasting using satellite-derived data through GIS.

The last task that GIS allows you to perform is the visualization of data. You can get maps, graphs, tables, and even pictures of the area of interest. This data is very

important for scientific research as well as for the work of individual companies and organizations.

GIS And National Development

Land, and more precisely its area and associated resources, is the basis for the well-being of nations. The effective management of territory and space is largely responsible for the present and future prosperity of countries, individual regions, or particular areas of large cities.

Information is the very first thing needed for management. In fact, most of the information that people encounter in their daily activities has a territorial connection. Information itself, while potentially existing, needs to be retrieved. For this purpose, methods and technologies are constantly being improved, thanks to which humankind draws the necessary information from space.

Just a few decades ago images of Earth from space were used only by a small circle of specialists. Modern technical means make it possible to receive images from artificial satellites to a personal computer, and the latest software allows quick processing of this data.

Application of space imagery in terms of getting up-to-date information about terrestrial space knows no limits — geology, geography, ecology, economy, nature management, production management, logistics, agriculture, forestry, land management, industry, energy, construction, tourism and transport, as well as many other branches and areas of human activity. In addition to space imagery and geographic information systems, so-called satellite positioning systems (GPS) are very closely involved in the collection of information about the Earth surface.

The need to manage land according to the level of modern technology arises when the state develops, when authorities at all levels feel the need, understand the possibilities of technology, and realize its value with their daily routine.

GIS In Urbanization And Infrastructure Development Monitoring

Urbanization and infrastructure growth are two of the most important aspects of development in the world today. As cities continue to expand, it is becoming increasingly important for governments and businesses to track these changes. Satellite technology is an invaluable tool for achieving this goal, offering a wide range of benefits that can help improve urban planning, economic development and environmental protection.

Satellite technology provides a comprehensive overview of urbanization and infrastructure growth. Its high-resolution images can be used to track changes in land use, population density, transportation networks and the environment. By combining this data with more traditional methods of analysis, such as ground surveys, a deeper understanding of urban development and its effects can be gained.

Using satellite technology can also help identify potential problems before they become serious. For example, it can be used to detect signs of rapid urbanization, such as deforestation, soil erosion, and air pollution. This information can then be used to inform decision-makers, allowing policymakers and planners to develop strategies to address these problems before they have serious environmental or public health impacts.

Satellite technology can also be used to improve urban planning and economic development. Detailed images can be used to identify opportunities for new developments, such as residential areas or commercial projects. This information can then be used to create more efficient urban planning, leading to increased productivity and economic growth.

Finally, satellite technology can be used to monitor infrastructure growth, allowing for better management of essential services such as electricity, water, and telecommunications. This can help ensure the efficient and cost-effective delivery of these services, contributing to an improved quality of life for citizens and boosting local economies.

In conclusion, satellite technology provides a number of benefits for monitoring urbanization and infrastructure growth. By providing a comprehensive overview of urban development, it can help decision-making and improve urban planning, economic development and environmental protection.

Using Geospatial Tech To Drive Agriculture

The sphere of agriculture in developed countries is characterized by the use of powerful agricultural machinery, a variety of chemicals and innovative agronomic technologies. Nowadays, GIS services have also become relevant for agriculture, due to which its efficiency is increased and the quality of agricultural products is improved.

The main purpose of using GIS-technologies by farmers is to manage the production, storage, marketing and transportation of agricultural products. In addition, in this area it is critically important to take into account numerous and diverse data about the land being exploited. These include:

- climatic, hydrologic, and weather conditions of the area;
- characteristics of soils;
- historical yield data for crop yield prediction;

- distribution of pests and diseases;
- types of environmental pollution and their causes;
- types and timing of previously conducted or planned soil treatments;
- digital terrain modeling.

As advanced computer technologies in agriculture are becoming more and more popular, they simplify the work with information for agrarians, which enables them to efficiently use agricultural land and optimize processes. Examples include the use of specialized programs that help to map how many fertilizers and pesticides to use and where based on remotely collected data.

EOSDA Crop Monitoring As An Example Of Agriculture GIS Software

The modern market offers a huge variety of GIS software depending on the purpose of its use across industries. The same applies to agricultural GIS tools. One such solution out there is the EOSDA Crop Monitoring — a digital precision agriculture platform that offers a comprehensive set of features for full-circle plant development management.

Precision Farming

Precision agriculture GIS software provides detailed maps of vegetation and productivity, helping farmers make informed decisions. They can adjust the application of seeds, nutrients, herbicides, and fertilizers based on varying levels of vegetation. EOSDA Crop Monitoring enables the creation of productivity maps using the previous year's data, identifying and fertilizing unproductive areas to increase productivity.

Mapping

Satellite sensors can analyze soil and crops to create valuable maps for agriculture GIS monitoring. By comparing vegetation in fields on different dates or using various indices, farmers can determine how different factors impact yield. EOSDA Crop Monitoring's Split View feature enables viewing current and historical field data and comparing the performance of various indices.

Monitoring of Plant Health

Remote sensing and GIS technology can help farmers monitor crop health more efficiently. Satellites and aircraft equipped with image sensors can identify crops that need additional care and detect diseases, pest infestations, or dehydration, enabling growers to take timely measures.

Insect And Pest Control

With the help of deep learning algorithms and satellite data, EOSDA Crop Monitoring can efficiently identify pest infestations in large fields. Vegetation indices calculations can help to recognize potential risks. Then, the Scouting feature is used to pinpoint specific areas. Scouts can inspect and report threats via the mobile app.

Irrigation Management

Agriculture GIS technology helps farmers regulate irrigation by using visual patterns to determine each crop's water supply status. The NDMI index in EOSDA Crop Monitoring, ranging from -1 to 1, is commonly used to identify water stress. Negative values near -1 indicate water scarcity, while positive values near 1 suggest waterlogging.

Predicting Yields

Thanks to remote sensing, big data, and AI, predicting crop yield accurately is now possible. EOSDA has developed a method that utilizes historical and current satellite crop data, achieving an impressive accuracy rate of over 90%. Reliable yield estimates are necessary for governments and enterprises to ensure food supply security and accurately predict profits and budgets.

Technology To Boost Farming in Georgia

The economy of Georgia heavily relies on agriculture. For the last few years, this industry has accounted for up to 8% of the country’s GDP and provided jobs for almost 40% of its workforce. Thanks to the country’s farming-friendly climate

Figure 1: Fertilizer application assessment based on data from field equipment, processed with EOSDA Crop Monitoring.

conditions and fertile soils, local agri producers are able to grow different types of agricultural crops from annual plants like wheat, maze, and barley to subtropical fruits and nuts.

However, despite the sector's growth, it's still dominated by traditional farming approaches, including manual field monitoring, which is very time and labor-consuming, especially when it comes to large territories. To ensure reliable, accurate, and relevant farm data collection, modern agricultural producers need to implement technology. Not only it improves farm productivity and increases profit, but also ensures sustainable business development thanks to precision and data-based decision-making.

Having knowledge of the market specifics, the Georgian Farmers' Association (GFA) works on identifying the challenges farmers encounter and suggests possible solutions. Therefore, the organization has a clear understanding of the most frequent issues that prevent farmers from achieving high yields and profits. These include wrong irrigation management, the use of environmentally unfriendly farming practices, fertilizer overapplication, lack of weather forecasts on a field level and historical farm data for analysis.

Therefore, the GFA needed a way to access current and historical agri data and develop different packages of services and agronomic consultancies. For that, they have adopted the EOSDA Crop Monitoring platform and became its reseller. This means the possibility of creating client subscriptions with specific pricing and the number of hectares available for monitoring. More so, the partner also offers consultancy services and productivity field mapping for an extra price.

Among the most used data for the organization is weather information: daily, historical, and 14-day weather forecasts. Another popular feature is plant condition monitoring based on vegetation indices values throughout all growth stages. This helps to identify any deviations in crop health timely and easily. Some of the most used indices were NDVI (for vegetation's greenness and density measurement), and NDMI (for water stress identification and irrigation management). Historical data is also of great importance since it helps to detect patterns occurring during several years and perform yield prediction, necessary preparations, or crop rotation planning if necessary.

The GFA has noted that adopting the platform and access to such full farm data had a positive impact on its cooperation with organizations and businesses. With EOSDA Crop Monitoring the organization can better coordinate with the private sector, governmental and donor bodies. They also continue promoting the adoption of technologies in farming to achieve sustainability.

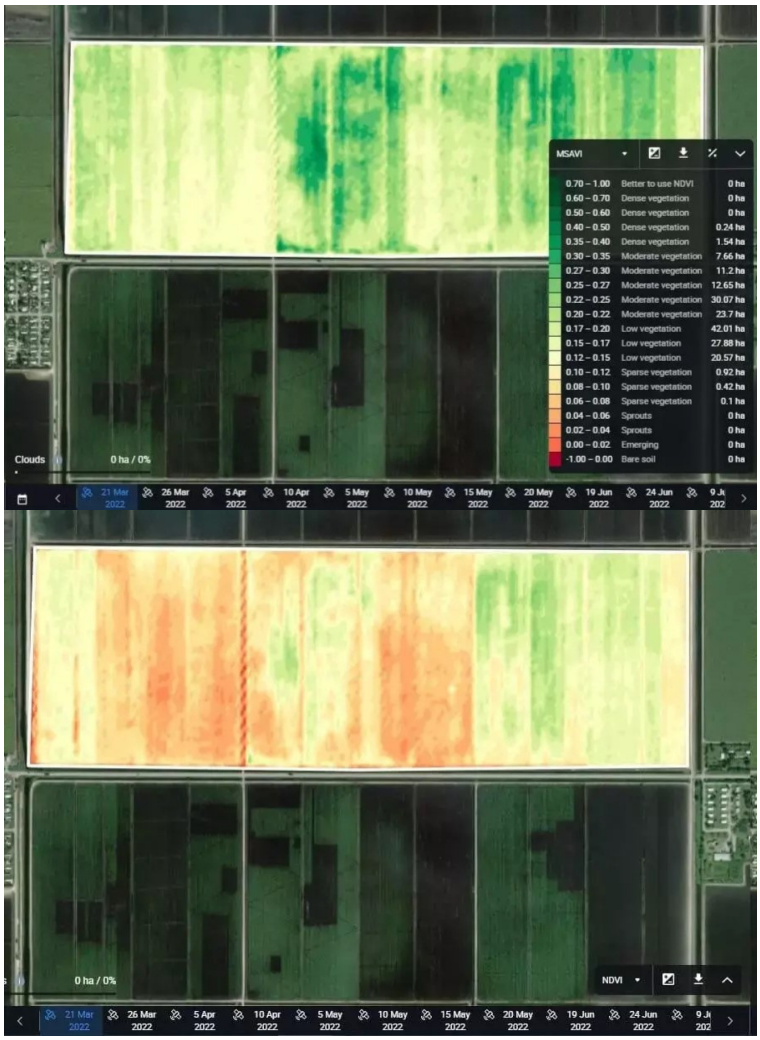

Figure 2: Comparing the NDVI and MSAVI indices to assess vegetation at an early stage of crop development.

For example, the GFA has also altered its way of providing services for mobile laboratories. They perform field productivity mapping to define problem areas for taking test samples right there. That is possible thanks to the precision satellite monitoring provides in terms of field state assessment while also allowing for saving time and costs on field inspection.

GIS In Forestry

Forest mapping was one of the first applications of geographic information systems. Currently, there are studies regarding development of mapping methodology in several areas of forest cover research, such as: forest mapping, mapping of current changes in forests, research of information content of satellite images to solve problems, monitor forest conditions and dynamics, identify forest fires, assess damage to forest plantations from various factors.

One of the main conditions is constant updating of forestry operations, including the data created during forest inventory. Improvement of operability and accuracy of information is practically impossible without modern GIS tools, which allow

to automate methods of constructing maps using stereophotogrammetric interpretation of aerospace images and geodetic measurements, combining them with any cartographic materials.

Application of remote sensing is a condition for adequate assessment of forest fund use efficiency. At the same time the condition of the areas is studied; violations of the requirements under which timber may be harvested are determined; the volumes, areas, and places of illegal logging are determined.

GIS In Healthcare

Health care as a field of human activity is currently undergoing a period of active informatization, which affects a variety of aspects of the industry. This includes the development of electronic medical records (EMR) for patients, the creation of information systems in the area of computerized disease diagnosis, electronic document management and analysis systems for medical statistics, etc.

One important aspect of this process is the analysis of organization of the healthcare system, identifying its shortcomings and advantages, and evaluating the geographical factors of public health.

Therefore, one of the components of the medical state information system should be a medical geographic information system (GIS).

The application of geoinformation technologies and spatial analysis in healthcare relies on different knowledge: medical and socio-economic geography, transport geography and geostatistics, raster image processing and many others. At the same time it is logically conditioned to allocate several main structural and functional subsystems: analysis of public health; analysis and management of medical infrastructure; dispatching of emergency medical aid; space monitoring and analysis of natural factors of diseases; multidimensional data analysis and decision support.

GIS In Telecommunications

Telecommunications service providers use GIS systems as they expand their networks or implement innovative infrastructure. In solving these tasks, the market situation is analyzed based on spatial and demographic data. Decisions are made taking into account the location of network planning services, return on investment, and competition.

The most favorable location of the telecommunications network is selected based on the combined information from planning tools, infrastructure, addresses, GPS coordinates and other data. Accurate coordinates of network components are necessary to identify the relationship between service deficiencies and the constituent network elements. Location information reflects the localization of stations, the presence of multi-storey buildings, and the type of terrain on the site. New facilities, commissioning dates and other network planning data are displayed on accurate maps. Geographic information systems are integrated into corporate databases and provide a functional extension of services.

So what does it have to do with farming? Telecom companies can act as a third party between precision agriculture technologies and farmers, while generating more revenue and improving livelihoods. Since agriculture is the largest employer in the world, giving farmers access to such platforms as EOSDA Crop Monitoring will add value to the telecom company's services, expand its client base and enable building connectivity in the most remote areas of the world. Therefore, for telecom companies it's a way to cover new territories, play a part in ensuring global food security, and tackle climate change.

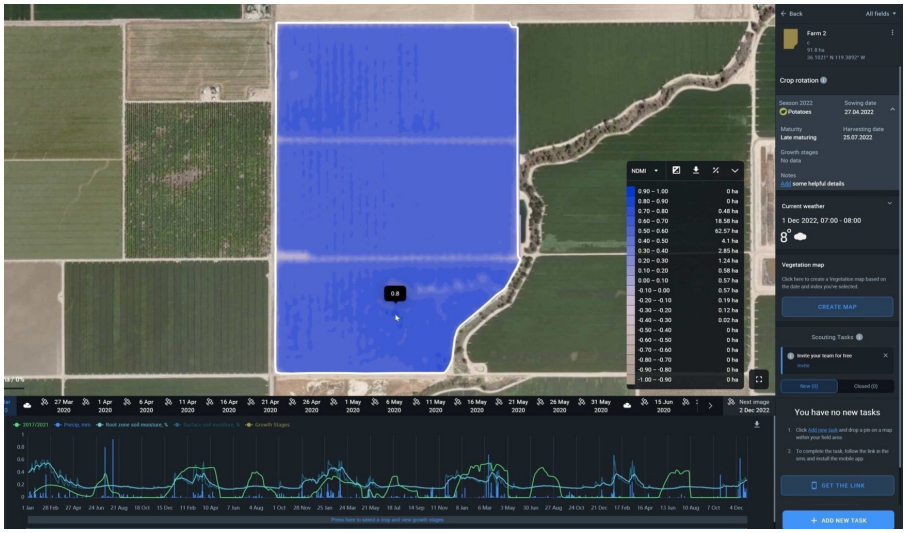

Figure 3: Water deficiency identification with NDMI index on EOSDA Crop Monitoring.

Figure 4: Field NDVI values before (June 30, 2021) and after (June 30, 2022) improved irrigation management. Image Credit: The Georgian Farmers' Association