UDC 34

Forming a legal strategy for the conservation of the ecological environment in the context of the effective development of agricultural industry

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Abstract

To solve the problems of complex analysis in agriculture, electronic maps with the results of satellite geodetic measurements are used. The use of such methods allows obtaining detailed information about vast territories (agricultural enterprise, administrative region, etc.). The ability to determine the configuration of fields, their orientation, area, direction of plowing, the state of the fields at the time of shooting and contributes to the rapid assessment of agricultural land. Thus, the creation of a system of information support for decision-making processes based on GIS technologies allows to increase the overall efficiency of agricultural production by providing relevant analytical information on the entire range of necessary parameters for making optimal and timely management decisions. Geographic information systems allow employees of the economic Department to conduct a comparative analysis of planned and actual data, automate the accounting of working time and the formation of reports and references. The author concludes that GIS technologies are especially important in managing agricultural production in regions with risky agriculture. For these areas, it is necessary to constantly monitor the conditions for the development of crops and the conduct of agrotechnical and agrochemical activities. Supervision can be carried out both on separate fields, and within the area, area or more extensive territory.

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Keywords

Remote sensing, formation, system, agricultural sector, law, regulation.

Introduction

The information system of ensuring town-planning activity (ISOGD) – the systematized set of the documented data on development of the territory, on their building, on the land plots, on objects of capital construction and other data necessary for implementation of town-planning activity (the town-Planning code of the Russian Federation, Art. 6). In the modern sense, ISOGD includes municipal GIS, archive documents storage, information collection and presentation system, document automation system, territory development planning tools, territory use monitoring system [Chumakova, 2017].

In the process of implementation of the geoinformation project, the following stages of work can be distinguished.

1. The stage of task occurrence at which the task is formed. The IP user has one of the following problems [Антонян et al., 2011]:

a) it is necessary to collect and place in the information system a large amount of data on spatial objects, processes, phenomena;

b) it is necessary to take into account, systematize and accumulate various spatial and non-spatial data;

c) with existing data of spatial character it is necessary to perform certain manipulations [Chelysheva, Verenich, 2010].

2. Stage of analysis of existing methods and developments for solving problems. At this stage, the information consumer independently comes to the conclusion that in order to solve such problems, which he faced, it is necessary to use geoinformation technologies [Wu, Qiao, Lan, 2005].

3. The stage of consultations is to seek advice from an organization specializing in the use of geoinformation technologies. Specialists of the organization conduct technical seminars, consultations, preparation of technical specifications [Rostokinskii, Tolpekin, 2014]. The initial task acquires a number of explanations and clarifications, the mechanism of implementation and achievement of the result becomes more transparent. At this stage, a work schedule is formed [Krishnakumar, Pulugurtha, Nambisan, 2005].

4. The step of selecting a final technology of performance of works. At this stage, if necessary, it is possible to conduct additional training and retraining of performers. Often, organizations that have programmers in their staff develop specialized programs.

5. Production work.
6. Presentation of the intermediate version of works to the customer.
7. Correction of remarks.
8. Delivery of finished products.
9. Start the project and debug.
10. Elimination of remarks.

However, with the most thorough study and implementation of the project by the contractor, a situation is possible when the customer, after receiving the intermediate version of the work or, worse, after the final delivery, gives a number of significant comments. As a rule, such remarks can be divided into three groups [Rostokinskii, 2011]:

1. Comments related to the quality of work. These remarks are explained either by unprofessionalism of the contractor, or by shortcomings of the applied technology or deviations from the requirements of the terms of reference;

2. Remarks connected with unreliability of the production received by the customer of works, loss of its relevance. Large industrial enterprises and organizations engaged in mining and transportation of

minerals, often ordering geodetic works to update cartographic materials are faced with a situation where the contractor, having performed a set of measurements, needs additional time for registration, approval and delivery of products [Li, Pan, Shangguan, Yang, 2005]. As a rule, coordination of results of topographic and geodetic works in territorial inspections of bodies of the state geodetic supervision or at cadastral works-coordination with adjacent land users, can take more than one month [Antonyan, et al., 2014]. Taking into account the object of observations, for example, the territory of the oil and gas field, where the constant construction of new facilities, the laying of engineering communications, it is difficult to talk about the relevance of topographic plans in 3-6 months after the work [Hirose et al., 2005]. From the practice of land inventory of a large oil company, we can say that in order to maintain an operational and up-to-date topographic plan of the territory of the mineral Deposit, the survey must be performed constantly, as new objects appear. At the same time deformation and geodynamic monitoring should be organized on the territory.

3. The Third group of comments are those related to the increased "appetite" of the customer. Many customers, just getting to use the GIS product, begin to understand all the possibilities of these modern technologies and often try to introduce additional requirements to the products, not previously specified in the terms of reference, within the framework of one contract. For example, it is not surprising, when in the framework of the agreement on compilation of GIS fundamentals of works on territorial planning of the subject, the administration or the Department of architecture may request to create a three-dimensional model of the territory, to make a presentation or submit a video with a sightseeing flight over the area [Chelysheva, Verenich, 2009]. As a rule, the contractor agrees to this kind of additional costs, because the competition is currently on the market of geographic information services is high enough, and if the customer is satisfied with the quality of work, next time he will turn to you. There is a belief that the best work of the same plan on the same site to run specialists a single organization: first, it is explained by specificity of work – the study of spatial objects, processes and phenomena, as well as the approach close to the monitor [Gong, Lin, 2006].

When using cadastre data, the following problems arise: many local cadastral coordinate systems make it impossible to combine cadastral units in a single geographical space. In some cases, the boundaries of adjacent objects of cadastral registration, presented in different coordinate systems, are superimposed on each other [Rostokinskii, 2014]. Only at computer transformation of object it is possible to establish discrepancy of adjacent borders of objects of the cadastre. It should be borne in mind that the transformation of cadastre objects should be only affine, with other transformations there is a compression or stretching of the object and, as a consequence, a change in its area [Kondo et al., 2005]. Of course, there is no doubt that it is necessary to present cadastral data in a flat coordinate system. However, most projects for the preparation of General planning schemes of the territory of subjects or administrative units require the application of cadastre data. In this case, the scheme itself, as a rule, is composed in a spherical coordinate system [Verenich, 2015]. Thus, it is often simply impossible to accurately combine cadastral data with a digital model, such as a 1:100,000 scale map. The solution is as follows:

a) a single cadastral coordinate system, clearly linked to the SC-95 and WGS-84 coordinate systems, Should be used;

b) as a raster substrate for existing digital maps to use space images. At the same time, each region of the Russian Federation should create an information resource with the mandatory presence of a hybrid model, including: the low − resolution space image; a digital map of scale 1:100 000; data from the cadastre of real estate; the cartogram showing cartographic study of the territory, the contractor and the place of storage of materials, date of performance of works;

c) to implement, along with a raster digital technology and map updates;

d) to enable any interested user to receive data, as well as to share their suggestions and ask questions about the mapped territory. There should be a dynamic dialogue between the population of the region and the governing structures [Steward, Le Grand, Bernard, 2005].

Cadastral map (plan) is a map (plan), which in graphical and textual forms reproduced information contained in the state real estate cadastre. The main data that are displayed on the cadastral map are cadastral number and boundaries of the land plot in the cadastral quarter; the boundary and cadastral number of the building, structure or object of unfinished construction on the land; the address of the property; information on the presence of restrictions (encumbrances) of real rights to the real estate object; category of lands to which the land plot is referred; permitted use of land; the purpose of the building (non-residential building, residential building or apartment building), if the property is a building; description of the state border of the Russian Federation; borders and the name of subjects of the Russian Federation; borders and name of municipalities; borders and name of settlements; boundaries of territorial zones; numbers and boundaries of cadastral division units; location and name of points of reference boundary networks.

Main part

The inventory is maps and other descriptions of land parcels with the identification of all entities having the right to own land. Currently, the Committee of the Russian Federation on land resources and land management (Roskomzem) has formed a unified system of state land cadastre and land monitoring (Askk).

ASIC includes all three levels: accumulation, modeling and storage of information, data presentation. The following subsystems are a part of GIS ask: photogrammetric (contactless) data collection; field data collection; conversion of three-dimensional images in the planned, which retains all the details of objects; digitalization of cards; processing of cartographic information; - publication of maps.

GIS inputs are aerial photographs (black and white and color) of 1:8000 and 1:40000 scales; results of total station surveys on the ground-contours of objects; cartographic materials (paper maps, atlases); - catalogs of coordinates and elevation of reference points.

The output data (main) are 1:2,000 scale maps with coverage area of 1 sq km; card of scale 1:40 000 with an area coverage of 20 sq km.

The main cartographic layers of ASCC: land cadastre objects; territories of political and administrative division; land plots with indication of their owners or tenants; borders of lands of various categories (reserves, forest Fund, recreational purpose, etc.); real estate related to land plots; transport networks; engineering structure; waterworks; streets and driveways in settlements; fences; objects of hydrography; objects of vegetation.

The main requirements for ASIC – increased accuracy of coordinate data and the ability to generate specific queries to this GIS.

Agriculture is one of the most important branches of material production.

According to Rosstat, 38 million people, or 26% of the Russian population, live in rural areas. About 8 million people are permanently employed in agricultural production [DeMotto, Davies, 2006]. There are 27 thousand agricultural enterprises and 260 thousand farms in the industry. Every year, the industry demanded 18.5% of diesel fuel (5 million tons) supplied to the domestic market, bought 1.5 million tons of gasoline.

These volumes were used in agriculture by a fleet of tractors totaling 572.5 thousand units, grain and fodder harvesters in the amount of 197 thousand units.

A huge area of fields, a large number of vehicles, a large number of people employed in agriculture determined the need to develop qualitatively new methods of land management and agricultural production.

One of the most perspective directions of increase of efficiency of management of agricultural production is use of information systems on the basis of geoinformation technologies. Such systems allow to solve the following tasks:

– information support for decision-making;

– planning of agricultural operations;

– monitoring of agrotechnical operations and condition of crops − - crop yield forecasting and loss assessment;

– planning, monitoring and analysis of the use of technology. Consider each of them in more detail.

To provide managers with a complex of information necessary for management decision-making on the GIS platform, a database containing:

– digital model of the area on which agricultural operations are carried out;

– information on remote sensing;

– information about the properties and characteristics of soils; - maps of crops by year;

– field processing history, etc.

For more efficient use, agronomic GIS should contain a multi-layer electronic map of the economy and an attribute database of field history with information about all agricultural activities. Be sure to include mesorelief layers, information about the steepness of the slopes, and their exposure, microclimate, groundwater level, humus content in the soil, etc.

The attribute database, which contains data of different nature, is associated with the layers of the electronic map [Liu, Luo, 2006].

Binding begins with the hydrographic network, gully-beam complex, in most cases, complement the road network and other objects. User databases are also linked to specific objects of the digital map, including information about the acreage, data on the state of soils, etc.

Planning of agricultural operations

Information management systems based on geoinformation technologies play an important role in the planning of agricultural operations.

Agrotechnical planning includes the following types of work:

– calculation of potential and efficiency of personnel and land resources;

– measurement of fields (for example, by detouring along the contour with high-precision GPS Equipment with a maximum accuracy of 1-3 cm);

– preparation of the structure of acreage and crop rotations in the format of a vector electronic map;

– analysis of the need for machinery and equipment;

– calculation of the required amount of fertilizer;

– formation of the sequence of operations of soil cultivation, fertilization and protection.

On the basis of the above data daily for drivers and machine operators are planned tasks for the next working day and, if necessary, in the morning they are amended [De Paz, Sánchez, & Visconti, 2006].

Planning based on GIS data can reduce (or completely eliminate) downtime in case of shortage of personnel or equipment, reduce the cost of agricultural operations per unit of cultivated area and improve productivity [Hu, Li, Gan, 2006]. Monitoring of agricultural operations and condition of crops

In the course of solving this task is the registration of all agricultural operations, costs of holding, fixing of a condition of crops through ground-based measurements, estimates of agronomists and data of remote sensing (aerial and satellite images).

For monitoring, the data of agrochemical soil analysis for each working area of the field are important. They can be obtained in two ways:

– as a result of own researches with application of samplers and laboratories on the analysis of samples;

– as a result of agrochemical surveys carried out by a specialized organization.

End result analysis and reporting

With the help of GIS it is convenient to analyze all conducted agricultural operations and display this information in the form of maps, tables, graphs. It takes into account the receipt of products from the fields, the sale of grain from the field and from the market. In this case, data can be collected both from the control center and removed from electronic scales installed in warehouses or currents. The use of pesticides and fertilizers is taken into account. The volume of seed consumption during sowing is studied.

It is possible to reduce the consumption of seeds and fertilizers, for example, by minimizing the overlap of sowing strips, using a parallel driving system.

The yield forecasting system is based on the methods of monitoring the condition of crops, taking into account the influence of climatic conditions. This technology allows you to monitor the dynamics of crop development, vegetation conditions, determine the timing of their maturation and the optimal timing of the beginning of harvesting, to conduct economic analysis at the minimum and maximum levels of yield consistently possible for specific conditions.

Taking into account the received forecast of productivity on various sites of the field (including expenses and possible extracted profit) the decision on the differentiated processing of fields is made. On the other hand, it is possible to analyze possible losses in accordance with the potential of the crop on poor land. To more accurately determine the level of yield in the fields of the farm, a computer monitoring system is used.

The effective functioning of the cartographic system of agricultural enterprises is possible only when combining heterogeneous information into a single spatial database. This integration is carried out by building an object data model, which includes map layers; tables with information on objects (acreage, livestock, production, sales and consumption of agricultural products and food, etc.);-aerial and space images.

Data analysis in this system is carried out by means of cartographic analysis, which makes it possible to obtain spatially defined data of increase or decrease in productivity.

As a result of crop yield forecasting and loss assessment, management can calculate the optimal price for equipment and materials that the company will need in the future and determine the purchase prices for agricultural products.

Conclusion

The technical subsystem of agricultural enterprises also does not remain aloof from the use of geoinformation technologies. It includes:

– scheduling the use of equipment and its repair;

– analysis of the use of equipment and fuels and lubricants (all movements of equipment, calculation of mileage and treated areas);

– determination of optimal routes of movement and transportation of equipment from the base to the cultivated fields;

– determination of optimal routes of delivery of the harvest to the reception points;

– control over the speed of movement of equipment when performing field work;

– determination of the length of the rut or the optimal distance between fields and points of delivery of agricultural products on a digital map; - formation of accounting sheets of tractor drivers.

– formation of road sheets of motor transport.

GIS will also help to improve the processes taking place in the livestock sector, for example, effectively and at low cost to solve the following tasks mapping areas:

− with scarce natural vegetation;

− desertification due to overloading of the pastures;

– degradation of natural vegetation on pastures;

– with knocking out of vegetation and erosion of soil cover around watering holes, on the routes of crossings, etc.;

– contaminated effluents of livestock complexes and poultry farms, etc.

It should be noted that less than 70% of the resulting waste is used as fertilizer on average, the rest overflows storage ponds, is dumped into adjacent territories, getting into reservoirs and groundwater.

The use of GIS technologies will help the management to carry out remote control over the work of the economy (manage processes in real time), as well as on the basis of the reports to analyze the effectiveness of investments in production.

For the dispatching service, the use of these technologies allows you to quickly track the location of equipment, coordinate the work of machine operators and drivers, including through the establishment of voice communication, as well as control the consumption of fuel and the state of equipment.

Workstation of agronomist, GIS-technologies:

– provides maintenance of history of fields on productivity, crops, applied fertilizers and means of protection;

– allows you to plan the application of fertilizers, taking into account the individual characteristics of the fields;

– provides information support in assessing the quality of work and development of proposals for their planning.

Geographic information systems allow employees of the economic Department to conduct a comparative analysis of planned and actual data, automate the accounting of working time and the formation of reports and references.

GIS technologies are especially important in managing agricultural production in regions with risky agriculture. For these areas, it is necessary to constantly monitor the conditions for the development of crops and the conduct of agrotechnical and agrochemical activities. Supervision can be carried out both on separate fields, and within the area, area or more extensive territory.

In European countries, the use of GIS applications in agriculture has long been an important component in the management of the economy. In our country, the cartographic materials available to agricultural producers are often not suitable for work, there is no reliable information about both the terrain and the nature of land use, and the level of information training of farm workers, as a rule, does not meet modern requirements.

The lack of systematization and mapping of all agro-industrial activity data and the results of their analysis negatively affects the efficiency of agricultural production. For the management of the enterprises it is first of all unproductive expenses, decrease in productivity and quality of production.

The introduction of applied GIS and training of employees helps in a relatively short time to improve the efficiency of the agricultural enterprise.

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Формирование правовой стратегии сохранения окружающей среды в условиях эффективного развития сельскохозяйственного производства

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Аннотация

Для решения задач комплексного анализа в сельском хозяйстве используются электронные карты с результатами спутниковых геодезических измерений. Использование таких методов позволяет получить подробную информацию об обширных территориях (сельскохозяйственное предприятие, административный район и т.д.). Возможность определения конфигурации полей, их ориентации, площади, направления вспашки, состояния полей на момент съемки способствует быстрой оценке сельскохозяйственных угодий. Таким образом, создание системы информационной поддержки процессов принятия решений на основе ГИС-технологий позволяет повысить общую эффективность сельскохозяйственного производства путем предоставления актуальной аналитической информации по всему спектру необходимых параметров для принятия оптимальных и своевременных управленческих решений. Геоинформационные системы позволяют сотрудникам экономического подразделения проводить сравнительный анализ плановых и фактических данных, автоматизировать учет рабочего времени и формирование отчетов и справок. Автор приходит к выводу, что ГИС-технологии особенно важны для управления сельскохозяйственным производством в регионах с рискованным земледелием. Для этих районов необходимо постоянно следить за условиями развития посевов и проведения агротехнических и агрохимических мероприятий.

Для цитирования в научных исследованиях

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Ключевые слова

Дистанционное зондирование, образование, система, аграрный сектор, право, регулирование.

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