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GIS SUPPORT FOR PROJECTS OF LAND USE PLANNING WITH ECOLOGICAL AND ECONOMIC JUSTIFICATION OF CROP ROTATIONS AND THE ORDERING OF LAND AT THE LOCAL LEVEL

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Statement of the problem

At present, GIS technology has become an integral part of modeling real-world objects in almost all spheres of life. The rapid development of GIS technology is uneven and not systematically due to the lack of uniform standards and norms for presenting information in a variety of GIS. By organizing and integrating great role played by the standards of ISO 19100 "Geographic Information and Geomatics", and the technical committee ISO / NC 211, whereby there called standards. The purpose of ISO 19100 – General requirements for technology for collecting, processing, storing, disseminating and improving the use of geospatial data.

In our state of this problem are actively working scientists, as Karpinski Y.O., Liashchenko A.A., Chernyaha P.G. and others [7, 9, 10].

Relation to important scientific and practical tasks

Extensive computerization of all the key areas of the state to effectively manage and improve the competitiveness to take place on the basis of the system. Legal framework of the problem is the law of Ukraine and their projects [1-4].

Remaining aspects of the overall problem

Most of the above-mentioned international standards regulate only the general requirements for geospatial data. Therefore, at the local level, a number of unresolved questions about a particular model of GIS for a single part of the subject-matter of which is land management at the local level.

Formulation of the task

This article aims to describe the conceptual model to automate GIS land use planning at the local level by the example projects that provide ecological and economic justification of crop rotation and ordering land and determine the relevant set of geospatial data.

The main material of research

Since the basic territorial formation outside of the place is the village council, the infrastructure of geospatial data advisable to develop it for the territory of the village council. Projects that provide ecological and economic justification of crop rotation and ordering land, usually covering a territory of only a single agricultural enterprise. Therefore, in the future we have in mind is a territorial identity.

Geospatial Data Infrastructure village council shall consist of a set of standardized and inter-sectoral information systems, based on geographic information technology use and produce standardized geographic information resources using a single digital information products topographic and geodetic base (base set of geospatial data) and a unified system of technical regulations, standards, classifications and codifiers data.

The infrastructure of geospatial data identifies the main components [9]:

1) legal and institutional framework;

2) basic sets of geospatial data;

3) specialized sets of geospatial data;

4) metadata catalogs and metadata for searching and accessing geospatial data;

5) technical regulations and standards for geospatial data , metadata, and GIS services;

6) software and telecommunications technology and means of forming and updating databases, and geospatial data banks, WEB-mapping and access, use, and dissemination of geospatial data in information networks.

Regulatory and institutional framework. The organizational structure of SDI at the village council should have the following basic components:

1) coordinating body - the formation and ongoing support SDI;

2) technical regulations, provisions, methodological and normative -technical documents for SDI;

3) technological support:

- a network of interacting servers BGDS and PGDS;
- automated bank system information resources SDI;
- a network of interacting metadata servers;
- local GIS portal to service a wide range of customers finished products;

4) staffing-training of qualified specialists in the field of GIS technology.

By basic set includes geospatial data corresponding to at least one of the following criteria: suitable for use in the integration of information resources, provide accurate (spatial and/or attributive) binding data subject or other spatial objects, have an increased resistance to changes in space and time, providing reduction of attribute data persistence and reduce costs for their input and updating.

Creating a basic geospatial data should be provided by the transition from the use of digital maps as basic information about the places to use a basic set of geospatial data in a standardized digital form.

Formation and maintenance of a basic set of geospatial data infrastructure for the village council is made a part of the land cadaster and relies on regional governance State agency of the land resources.

Profile geospatial data sets. By PGDS include all types of geographic data that are created using basic data set and meet standards for geographic information

and metadata available in the information environment infrastructures with the principles and rules of access and use of geographic information resources for special purposes.

These data sets include land register (registration number and quality of land resources, encumbrances, restrictions and easements, etc.), agrochemical certification fields, local utilities, engineering-geological conditions of the area (groundwater level, karst, landslides, etc.), the registry is potentially dangerous objects, areas of warehousing, storage or placement of industrial, household and other waste, and so on. Formation of core geospatial data relies on the district administration and departments and utility companies, the scope of which includes management, registration, monitoring and/or maintenance of appropriate facilities.

Metadata of geospatial data. Metadata contain ordered sets of special formal data ("data about data"), which describes the structure and properties of elements of geographical information stored and is offered in digital and non-digital form.

Metadata directory designated for geographic information resources at the local level and providing automated search process and assess the suitability of potential users of geospatial data and systems.

The availability of metadata is a prerequisite for creating a market of geospatial data and sustainable functioning of SDI.

Maintain databases and catalogs metadata placement to global information networks should be an administrator geospatial data infrastructure administrative district.

Standards and regulations. Interoperability infrastructure components based on the creation of and adherence to uniform standards system, including local and technical regulations based on harmonization of national and international standards in the production, storage, supply and use of geospatial data.

Conceptual model of GIS for land management automation projects show the example projects that provide ecological and economic justification of crop rotation and ordering land. These projects consist of chronological components [12]: 1) designing of production centers; 2) design of engineering infrastructure; 3) establish the types and kinds of crop rotation; 4) charting rotation of crops; 5) design margins rotations; 6) transition plan to Favorites rotation; 7) transfer to the nature of the project. In Fig. 1 shows a UML-diagram of this type of projects. This type of UML-chart – chart activities – shows the progress of the project in time. Also part of the project process, shown in Fig. 1 included surveying for land management as an integral part, which is a reliable source of updated source data for design. This design conventionally divided into two parts: a conceptual and detailed. This process implements the well-known principle of territorial design "from the general to the particular."

A functional model of automation of land management projects at the level of farms (for this type of projects) must include regulatory, and operational mapping database instrumental GIS to perform automated design process of the production area and output specifications (Fig. 2).

It contains the following components: 1) dialog window and data exchange program; 2) program input and processing of standard data; 3) creating cartograms module steepness of slopes and ecological suitability of land; 4) module design and reconstruction of production centers; 5) module organization of land area and placing of linear objects; 6) module ecological and economic justification of design decisions; 7) module creation marking drawing transfer project in nature; 8) program to generate documents; 9) GIS; 10) DB (database) regulatory documents and classifiers; 11) DB planning and cartographic documents; 12) DB of land management searches; 13) DB standards of text and graphic documents; 14) DB design solutions (documents); 15) DB planned high-rise framework; 16) DB areas with special conditions of land use.

Program data exchange needed for communication and the exchange of relevant information between the respective applications and modules.

By PGDS include the following classifications (by O. Melnychuk):

1) restrictions on land use, land or parts thereof;
2) servitudes;
3) agricultural lands;
4) agroproduction groups of soils;
5) economic activities;
6) resolve type of land use in the areas with special conditions of land use.

In addition, the need to belong PGDS data quality assessment for agricultural land: 1) slopes; 2) mechanical structure of the soil; 3) washing down; 4) deflationary risk; 5) salinity; 6) rockiness; 7) acidity (alkalinity); 8) bogging; 9) flooding.

In the database of regulations and classifiers besides the above should include the following detailed classifications [12]: ecological and technological groups of land (Table), location predecessors crops [5], the suitability of land for agricultural lands [8], the protective forest planting, types and species of crop rotation, farm roads, zone-based specialization, alternating scheme agricultural crops in rotation, hydraulic engineering constructions. In addition, to be presented State construction norms, rules and regulations applicable in the design of production centers [13] and the criteria for assigning lands to degraded and unproductive for their conservation [11].

In the knowledge base GIS project should be included in the design rules that would ensure the following requirements: tolerances of linear boundaries from contour lines; coordination of the location of elements (forest belts and roads relative to the prevailing winds and relief; parallelism of boundaries of fields, etc.); equal area and same quality fields in crop rotation; the optimal values and limits for the length of the working mating, configuration of fields and working sites; a detailed list of items of land (e.g. for natural forage crop: farm, field camp, paddocks regular grazing, roads for cattle, water supply, fencings).

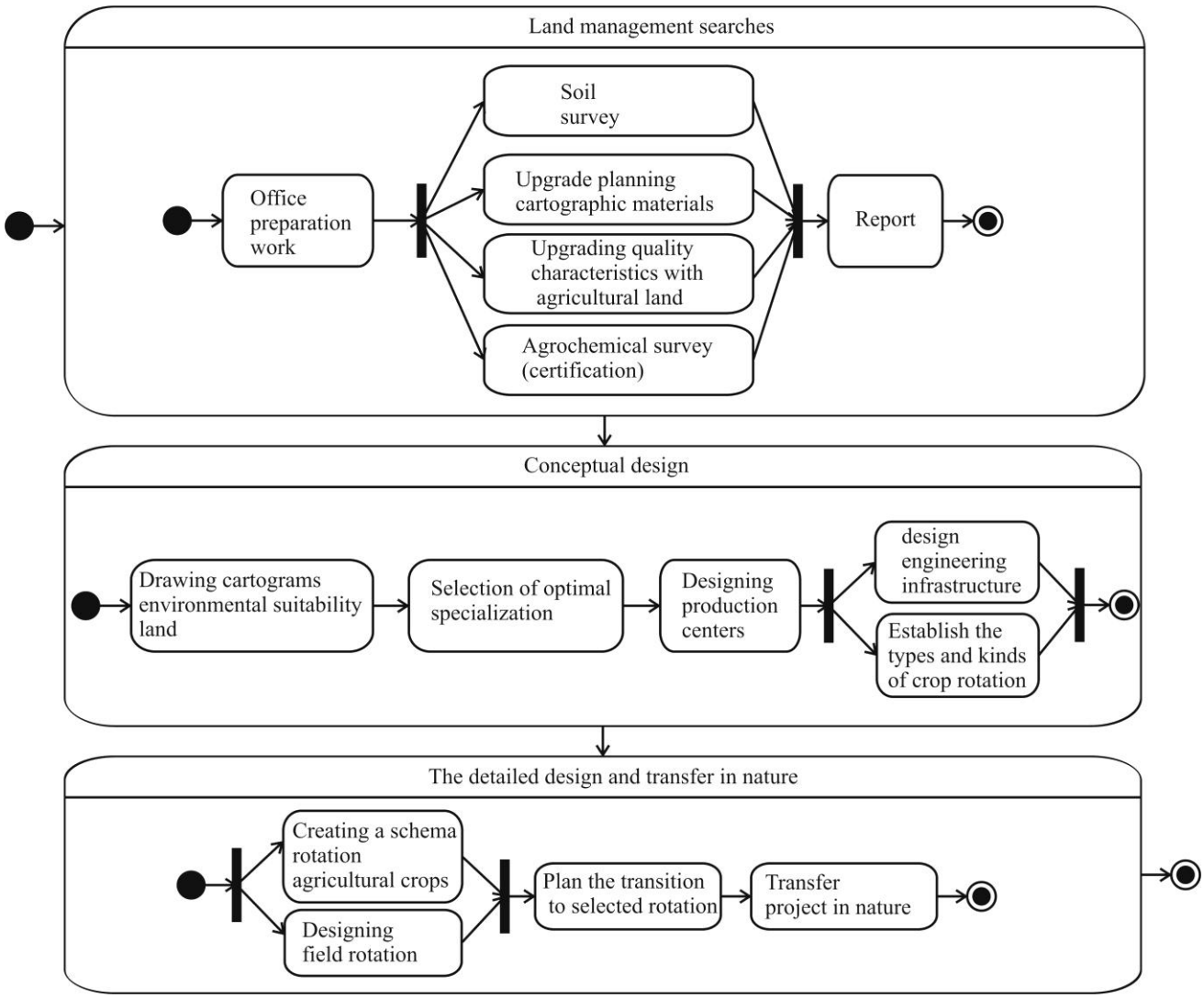

Fig. 1. UML-chart (activities) projects which provides ecological and economic justification crop rotation and ordering of land

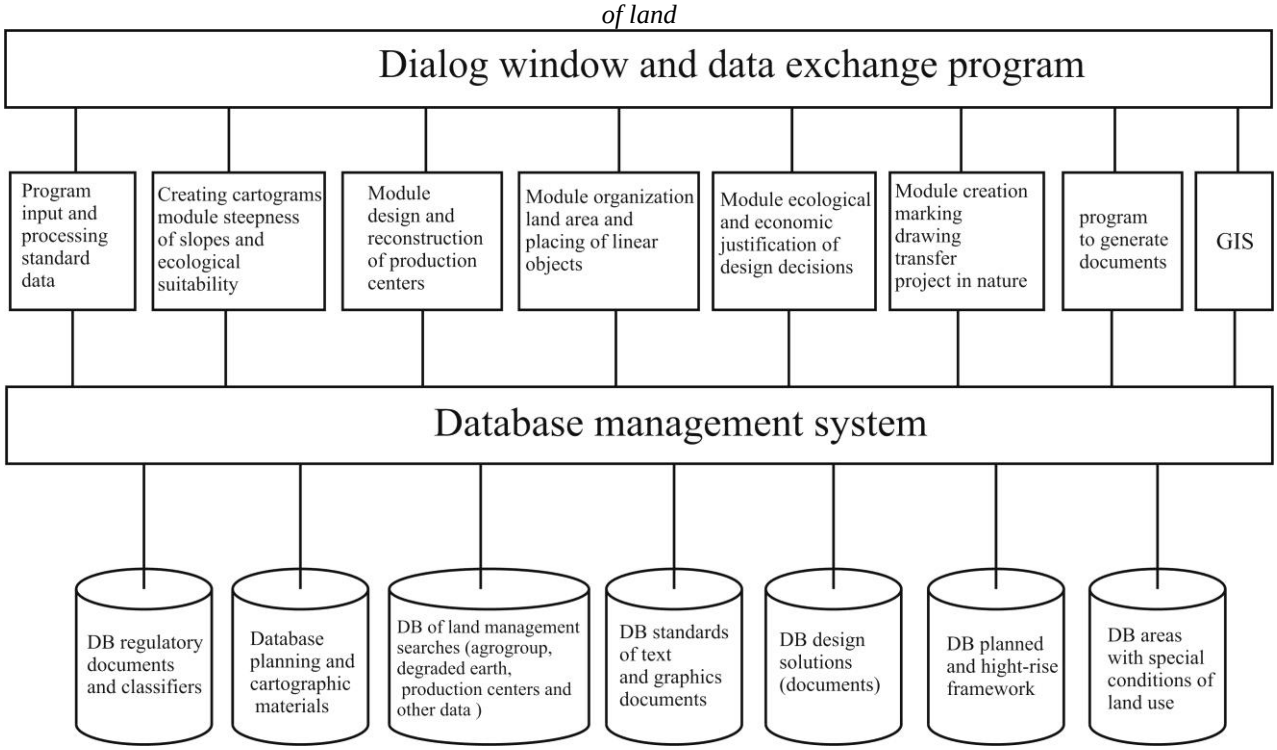

Fig. 2. A functional model of GIS project which providing ecological and economic justification of crop rotation and ordering of land

Table

Classification of ecological and technological groups of arable land [12, 14]

Code	Slope, degrees	Relief, soils	Recommendations about use
Ia	0-1	The fully profile and low erosion soils	There are no restrictions in choosing the direction of tillage and seeding for all zoned cultures.
Iб	1-3	The slopes with large water collect areas (Steppe, Forest-Steppe)	Tillage and seeding crops - or across the slope at an angle to the horizontal acceptable to all zoned cultures.
IIa	3-5	The slopes of fully profile low and medium washed down soils without basins	Temporary withdrawal from cultivation - long high extensive grasslands.
IIб	3-5; 5-7	Same with basins Without basins	Withdrawal from cultivation to constantly followed meadow or afforestation.
III	>7	Underdeveloped, with low production soils	Withdrawal from cultivation to constantly followed meadow or afforestation.

A list of graphic material for this type of project is set a [12]:

1) field survey area of land tenure;

2) cartogram agroproduction groups of soils with a relief area;

3) placing predecessors crops;

4) organization and regulation of agricultural land;

5) transfer project in nature.

In our opinion, during anti-erosion organization of the territory should have drawing erosion hazard of land. This drawing will serve as a basis for further design of complex anti-erosion measures: agro-technical, agroforestry, water engineering, organizational and economic.

When you place perennials need to know the depth of the underground water. This information may be include cartograms ecological suitability of land.

Moreover, in [6, 12] no such traditional graphics as cartogram steepness of slopes, cartogram ecological suitability of land and technological characteristics of the fields of crop rotation (the last missing in [12]). In a separate graphic material should provide a qualitative assessment of agricultural land where you want to allocate degraded and unproductive lands.

Regarding instrumental GIS is working with raster data for a given level can be recommended IDRISI; while working with vector data – ArcGIS.

Conclusions

The paper proposed a functional model of the GIS project for guarantee in land management projects that provide ecological and economic justification of crop rotation and ordering land at the local level. On the basis of the chart of activities it is shown conceptual model of implementation of such projects in time.

Subject of further research will improve the model by updating and clarifying all the databases that are included in the model, as well as trying to offer the technology realization of this model.

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GIS support for projects of land use planning with ecological and economic justification of crop rotations and the ordering of land at the local level

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The paper proposed a functional model of the GIS projects land use planning, which provide an ecological and economic justification of crop rotations and ordering agricultural lands at the local level. On the basis of the diagram activites is shown conceptual model of realization of such projects in time.