

APPLICATION OF TERRITORIAL GIS FOR STUDY AND INVENTORY OF NATURAL RESOURCES WITH THE SPECIAL REFERENCE TO THE DAGESTAN REPUBLIC

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ABSTRACT:

At the present time interest to GIS stipulated by economic and political reasons is widened in Russia. The most of territorial, administrative units aspire to create own territorial GIS for solution of wide spectrum of scientific, practical, economic and administrative tasks. An organized collection of computer hardware and software designed to efficiently create, manipulate, analyze and display all types of geographically or spatially referenced data. GIS allows complex spatial operations that are very difficult to do other wise. However, practical experience of these GIS application is absent in Russia. There are only special reference to GIS using for concrete tasks solution, for example, as compilation of land cadastr, forest and urban cadastrs, not infrequently with more experienced foreign partners.

The work under creation of GIS for Dagestan Republic was executed by VNIKAM with aim of information maintenance of management and prospective planning of republican economic development.

Composed maps will be used to planning and projecting of roads, gas and oil pipelines, exploitation of mineral resources, water supply and irrigation systems, agricultural areas (arable lands, vineyards, pastures etc.). Above mentioned maps are included into data bank, save there and forming electronic atlas of natural resources and environment on a whole.

1. INTRODUCTION.

Dagestan Republic occupies area 50.3 thousands sq. km with population more than 1.6 millions.

In accordance with relief peculiarities Dagestan is divided into two parts northern plain with absolute marks lower 0 meters at the larger part (Pricaspian lowland) and mountain southern (eastern slopes of Caucasus). The following branches of agriculture and industry are developed at republic such as chemical, manufactural, glass-work, machine-building, viticulture, gardening, poultry forming, cattle-breeding. Various mineral resources are prospected and exploited in Dagestan Earth's interior. Among them oil and gas deposits take the first place. Oil and gas industry becomes the most important in economy of Dagestan Republic.

Ore mineral resources such as ferrous, nonferrous, rare and generous metals, chemical raw material and building materials are prospected and exploited at the mountain part of republic. Water supply of population points, industrial and agricultural enterprises is provided by fresh underground water.

That is why a successful economic development of republic and creation of stable mineral raw mineral

base needs on intensive improvement of the whole natural resource into industrial usage. For this aim necessary to conduct prospective estimation of mineral resources exploitation and prospecting. This is one of the main task which may be solved on the basis of detailed investigations of geological structure, history of geological development and revelation of regularities of mineral resources location. Development of main agricultural branches such as cattle-breeding and viticulture also is important task.

Dagestan is seaside republic and last tens an actual problem became flooding of plain part, that is stipulated by lifting of the Caspian Sea level. This phenomena leads to shortening of agricultural areas intensification of sea shore abrasion and distraction of roads and economic objects at the coastal zone.

2. METHODOLOGY

In order to integrated solution above and other problems as well as for prospective planning of republic development versatile, objective and operative information on natural resources, environment and economy. For this purpose data banks and knowledge base are compiled.

One of the information sources is remotely sensed data including into bank as raster layers of airborne and

satellite images especially multispectral such as Landsat-TM, JERS-1 (OPS) and Resurs-F. Application of Russian high resolution (1-5 m) satellite images as KFA-1000, KVR-1000, TK-350, KFA-30 000 is more prospective.

Operative information particularly at the regional level is most fully represented on satellite images. On the basis of different scales remotely sensed data various thematic maps are compiled which provide investigation of area at the different generalization levels.

The second type of necessary information are cartographic materials including as vector layers such as geological, geomorphologic, mineral resources (ores, hydrocarbons, building materials), Quaternary deposits, soils, vegetation, topographic, landscape, economic, medical-biological and others maps.

The third type information is statistic data on environment, economy, natural resources, infrastructure etc.

These three types of data form bank which is a basis of Integrated GIS. An important problem is elaboration of data organizing structure which could provide their easy input, saving accuracy and informative content, as well as provide rapid and efficient spatial data processing.

Special data structure was created for GIS which permits to execute different operations providing both geographic representation and spatial analysis. Two types of this analysis may be realized under GIS:

- 1) Cartographic simulation based on coordinates and grid cells processing;
- 2) topologic simulation based on logistic interrelations of point, linear and area objects.

For creation of territorial (republican) GIS systems GeoDraw 2.0 and GeoGraph under Windows (version 1), elaborated by Center of Geoinformative Research of Russian Academy of Sciences were used. GeoDraw is vector editor and intend to compile base of digital maps and plans, accordingly to requirement of current GIS. Editor intend to work on IBM - compatible computers with graphic adapter VGA/SVGA and corresponding color monitor. GeoGraph allows to produce electronic atlases and composition maps on the basis of layers of digital maps and connected with them tables of attributes, to make electronic thematic mapping, to manipulate of the scale on the monitor as well as execute information/inquiry functions. Under preparation of vector digital maps system GeoDraw is used for input, editing, transformation and convertation to GeoGraph system format as well as to other GIS (ARCINFO, SPANS, INDRISI, ArcCad and others).

3. STAGES OF WORK

After determination of GIS project aims and tasks the work was realized at several stages.

I stage. Projecting and creation of data base consist of following operations:

- input of spatial cartographic and remotely sensed data;
- editing and creation of topology;
- input of attribute data;
- preliminary data processing including transformation to certain cartographic projection.

II stage. Interpretation of remotely sensed data and compilation of preliminary thematic maps.

III stage. Analysis and preparation of cartographic data and execution of spatial operations, estimation of acquired results.

IV stage. Presentation of results as graphic documents - maps; schemes, as well as text description including tables.

4. RESULTS

As the result of work the complete set of electronic maps was created based on Integrated GIS included the following thematic maps on environment and natural resources of the Dagestan: landscape, geological, mineral resources, forecasting of hydrocarbons, topographic, vegetation, soils, administrative regions, infrastructure, geomorphologic zonation, agricultural, landslide danger, hydronet, dynamics of the Caspian sea shore line at 1975-95.

The first experience on application of electronic maps complete set have allowed to evaluate environmental state and spy on landscape dynamics at the plain part of the Dagestan under influence of the Caspian sea level uplift.

Above complete set of maps allows to realize the following works on solution of economic and ecological tasks:

- land use inventory;
- compile the economic and geographic characteristics of separated administrative regions;
- conduct structural-tectonic zonation;
- reveal areas under mudrust danger at mountain regions;
- reveal areas of landslide processes development along the Caspian sea shores;
- forecast of flooding areas caused by uplift of the Caspian sea level up to 5 and more meters;
- execute of ecological examination at the regions

with mineral resources exploitation;

- compile recommendations on organization of aerial and space environmental monitoring; etc.

Remotely sensed data was especially wide applied under compilation of inventory, evaluating and forecasting maps with ecological content.