

COMPLEX STUDYING AND MAPPING OF NATURAL
RESOURCES AND DYNAMICS OF ENVIRONMENT
ON THE BASE OF THE REMOTE SENSING

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Our century differs from the entire preceding history of mankind by radical acceleration of the social development and, first of all, productive forces. During a very short period, the mankind has reached the space and is now mastering it. But, this break-through coincides with such global problems facing the world economy as food, raw materials, energy, ecology, etc. Limited natural resources now used (oil, non-ferrous metals, phosphorite, etc.) have resulted, in some countries, in noticeable difficulties. The problems mentioned are also connected with inadequate knowledge of the potential of natural resources.

Two last decades have shown that space engineering substantially promotes investigation of the natural resources and environment and revolutionizes the progress of the sciences about the Earth.

In the 70s, the universal methodology for using space facilities and remote sensing data for the purpose of overall (multitarget) studying of the natural resources and dynamics

of natural and socio-economical events gave rise to space-based natural studies that is a radically new way making it possible to describe the large regions of the Earth on the basis of one data base (satellite-based sensing) and one methodological-technological method so as to obtain multiaspect (multifunction) products.

Emergence and development of space natural studies provide for real solution of global problems of the day and give rise to success in searching of new (unused) natural wealth.

The greater importance of territorial-spatial, resource, and ecological problems of the economical development of particular regions gives birth to the necessity of searching new and efficient ways of their comprehensive study.

Further progress of the USSR economy greatly depends on intensive use of large territories in Siberia and Far East abounding in the natural resources. Information support of solution of problems of further economical development in these regions using traditional branch-oriented methods of studies is not efficient.

As the experience accumulated during the recent years shows the complex studying and mapping of the natural resources with the use of space data promote operative implementation of planned information support for intensifying economical development of particular regions of our country.

To start the complex studying and mapping of the natural resources all over the territory of the USSR, adequate technical facilities are created and the problems of methodology and technology are studied.

The methodology of overall studying and mapping of the natural resources is based on the interdependent investigations of the natural resources of a particular region by means of thematically-oriented interpretation of space data depending on the analysis of this information alongside traditional studies.

Accepted as a method of presentation of the results of studying the natural resources is a thematic mapping with the wide use of space data that makes it possible to compile a system of interrelated maps to present, as full as possible,

information about spatial location of the natural resources in the region under study. It should be remembered that maps themselves are not a single target but are an optimum, for the time being, means of recording of information to insure its practical use and storage.

The most important stages in studying and mapping of the regional natural resources include:

preparation of a scientific-technical detail design involving detailed elaboration of target orientation of regional investigations in the field of the complex studying and mapping of the natural resources and defining of rational composition of map series;

obtaining of space data required;
inter-branch processing of remote sensing materials;
elaboration of map series programs;
office interpretation of space photos;
carrying out of field check investigations;
making of compilation manuscripts;
editing, preparation for reproduction, reproduction of maps.

Investigations concerning the complex studying and mapping of the natural resources with the use of space data promote simultaneous investigation of the most important natural resources of the region under study. Such approach makes it possible to use all experience accumulated and materials collected by traditional methods in order to obtain information about the present state and dynamics of the natural resources. Experience shows that new information about the natural resources during the complex studying and mapping are obtained and utilized long before completion of the entire cycle of cartographic work. Therefore, scope, sequence of execution, and planning of work on the complex studying and mapping of the natural resources meet, first of all, the requirements for obtaining new information about the natural resource potential of the region concerned.

The composition of cartographic records advisable for making during the complex studying and mapping of the natural resources, the scope of investigations are dictated by the

specifics of the natural conditions and problems of economic development of the region with due regard for the natural-economical zoning of the territory. The number of maps in a series may be from several to tens of maps.

Studying and mapping of mineral, land, forest, fodder, and water resources are the main goals of the complex studying and mapping of the natural resources. To attain each goal, a group of maps are compiled as a rule. For instance, for studying and mapping of mineral resources worked out are geological, tectonic (geological structural) maps as well as fracturing tectonic, ring structure, quaternary sediment, oil-gas zoning, and other maps, land use (agricultural use), soil, soil-amelioration, agricultural production state maps as well as of territorial maps of agro-industrial complex, etc., are made for land resources. As for forest, these maps include geobotanica, forestry, forest dynamic, and other maps.

Fodder studying requires compilation of hydrological, hydrogeological (surface and ground waters), and other maps.

Besides, the complex studying and mapping of the natural resources dictate compilation of natural conditions maps including maps of recommendation and assessment nature such as:

geomorphological map;

landscape map;

engineering geological map;

engineering assessment map;

exogenic process map;

nature protection map, etc. as well as a group of maps on socio-economic topics.

Worked performed for complex studying and mapping of the natural resources of particular regions of the USSR testifies to that utilization of space data substantially reduced the time of compilation of thematic maps alongside better vitality and scientific and practical value.

Very important are the complex studying and mapping of the natural resources of poorly investigated and undeveloped territories since these territories are just the place for full implementation of advantages of space data resulting from their high information yield due to large field of view,

optical generalization, and high resolution, multiaspect interpretation, comprehensiveness and immediateness of compilation of informational cartographic products.

The complex studying and mapping of the natural resources present a unique possibility to accelerate revealing and usage of the natural wealth and provide reliable support for efficient performance of prospecting and design studies and for solution of the problem of nature protection.

During the stage space natural studies of becoming a reality, the mankind became in a position to see object of the natural very complex in their genesis and which the mankind has tried to "reconstruct" on maps by means of traditional and sometimes inadequate methods. Cartographic modelling of natural objects has been justified at that level of knowledge when no information has been available about the properties of the objects as expressed by their appearance. The analysis of images of the natural objects on space photos has reveal a certain discrepancy between the previous gnosiological constructions (models) and the reality observed. From the other hand, such analysis has given an impetus to a new understanding of structural specifics of the Earth surface. The necessity has arisen to revise the available methods of obtaining information from remote sensing data traditionally used for interpretation of aerial photos and to work out a different modelling basis for using space photos in inter-branch investigations.

The new possibility of observation and studying of complex natural and socio-economical objects on space photos in different scales and in their dynamics makes it possible to examine the essence of objects by their optical images. These images are explicit on the photos and changing from one scale to the other (during enlargement) performed by means of image differentiation results in showing the structure of objects under study proceeding from the general to the particular, from the entity to the part. Such approach to studying and mapping of the natural objects is not common for the geological-geographical sciences and, as result, the complex studying and mapping of the natural resources judging from space data leads to making new kinds of thematic maps or to elaboration of new type legends

of traditional maps depending on nontraditional or improved classifications of objects.

To better practical value of maps, elaborated during the complex studying and mapping of the natural resources of a particular region, assessment and forecasting aspects acquire greater importance, the specifics of the present state of the natural resources are presented with due regard for existing and probable human actions, the steps recommended are represented to facilitate rational use and protection of the natural resources.

The complex studying and mapping of the natural resources greatly improve the existing methods of map appearance elaboration of unified systems of symbols meeting the requirements of joint use of conjugated map, and rational techniques are worked out for map reproduction.

To reduce the amount of computations arising from inter-branch processing of space data during the complex studying and mapping of the natural resources, it is advisable to utilize computing and dedicated digital hardware. Use of digital methods makes it possible to fully implement the capabilities of the complex studying and mapping of the natural resources and substantially increase the number of applications of this method. In future, the materials resulting from the complex studying and mapping of the natural resources will create the basis for elaboration and implementation of computerized data systems for land management aimed at operative storage, regular refreshment, and out-put of information about the natural resources of the region to the users concerned both in digital and graphical form.

Work performed in various regions of the USSR in the field of complex studying and mapping of the natural resources has made it possible to standardize systematization of a great amount of branch-oriented scientific information about the natural resources of several regions.

Wide testing and analysis of the results of scientific and experimental work make it possible to underline their great practical value. The results of the complex studying and mapping of the natural resources are used for improving

the methods of mineral prospecting, bettering the use of land water, and fodder resources and are also utilized in working out the designs of large hydrotechnical projects and location of localities.

So, the use of space data for complex studying and mapping of the natural resources and the dynamics of the regional environment is aimed at solving the problems of regional economic development and presents the example of utilization of the space and space technology in peaceful purposes. The methodological-technological basis of the complex studying and mapping of the natural resources worked out in the USSR depending on the use of space data can find many applications in information support of solution of resources and ecological problems and planning of rational nature management both in the develop and developing countries.