

## PROJECT OF THE ENVIRONMENTAL ATLAS OF RUSSIA

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### Abstract

The Atlas would represent the main subjects of environmental mapping, such as the natural factors guiding the ecological situation, the anthropogenic impact and transformation of natural environment, the ecological assessment of nature components, the medical ecological situation, the strategy of ecological safety. The Atlas provides the methodic and information basis on which the environmental databases add data banks and the bases of environmental knowledge could be created, and the environmental geoinformation systems (GIS) for Russia, its regions and individual areas could be developed.

### 1 Atlas as a core element of the system of complex environmental mapping

In recent years many departments, scientific and production organizations were engaged in compilation of geoecological maps and atlases of various purpose and territorial scope. They have accumulated a great body of information about the state of environment in Russia, which is being constantly updated and supplemented in the process of scientific research, mapping, environment monitoring, etc. They have gained experience on compilation of large cartographic works representing the interactions of nature and society; diverse geoinformation support for environmental mapping is being developed.

At the same time there is neither unified approach to environmental mapping nor coordination of research; basic concepts are lacking, top priority tasks of mapping are not well identified; no uniform methodological and organizational guidance of environmental mapping for Russia is available.

In 1993 the Ministry of Environment Protection and Natural Resources has adopted the extensive program "The Ecological Safety of Russia", in which much attention has been given to environmental mapping. The core element in this line of study is the project of the Environmental Atlas of Russia (hereafter referred to as "Atlas"), that could also be considered as one of the volumes of the National Atlas of Russia. Unlike most of the countries this one lacks the national atlas giving a comprehensive review of nature,

population, economy and culture in Russia. Thus, the compilation of such encyclopedic cartographic work is both an important scientific task and a matter of national prestige.

At present Russia disposes of large scientific cartographic teams capable of furnishing such task. These are the Moscow State University, the Institute of Geography of the Russian Academy of Sciences, as well as cartographers of St.-Petersburg University, Institute of Geography of Siberian Department of the Russian Academy of Sciences, other institutes of the Academy, ministries and departments. Federal Survey of Geodesy and Cartography of Russia and its research and production divisions would also play a great role in the compilation and publication of the Atlas, as well as in the development of its computerized version.

The Environmental Atlas of Russia is thought of as a fundamental scientific and reference cartographic work providing a comprehensive picture of the state of environment in Russia, its preconditions and the governing factors, the trends of its transformation in different regions and centres, the measures of attaining the ecological balance.

Compilation of the Atlas would organize the whole system of the environmental mapping in Russia. It should include maps of all levels of mapping:

- global and Eurasian - Russia in its relations to the global environmental issues
- all-Russian, or federal - the basic level of mapping the country at the scale of 1:10,000,000
- regional - individual regions of Russia at the scales of 1:2,500,000 and 1:5,000,000
- local - regions of Russia with the highest degree of environmental risk at the scales from 1:100,000 to 1:500,000
- municipal - individual industrial zones and centres at the scales of 1:100,000 and larger

The Atlas would represent the main subjects of environmental mapping, such as the natural factors guiding the ecological situation, the anthropogenic impact and transformation of natural environment, the ecological assessment of nature components, the medical ecological situation, the strategy of ecological safety. Environmental factors and preconditions, as well as the trends of their evolution would be characterised in the Atlas according to all major geospheres, namely lithosphere, atmosphere, hydrosphere, biosphere, pedosphere, technosphere, sociosphere.

Thus, the Atlas would generalize an extensive volume of diverse information and promote its integration into a single system. It would become the basic element of cartographic support for the studies in ecological safety of Russia.

Compilation of the Atlas would provide a significant basis for the implementation of the unified concept of environmental mapping aimed at the coordination of efforts of different organizations and departments, the identification of top priority tasks in mapping, the unification of requirements to the range of environmental maps and to their content, the single -type scientific, methodological and organizational guidance for the compilation of other complex cartographic works, such as environmental maps of Russia at the scales 1:2,500,000 and 1:4,000,000, environmental map series for the Moscow region, the Caspian sea basin, the Arctic region, etc.

## **2 Atlas as a basis for databases and the environmental GIS of Russia**

The computerized version of the Atlas includes a series of computer maps compiled on a single information and program basis which supports their automated visualization, co-ordination, comparison, input of additional data and prompt analysis.

The Atlas provides the methodic and information basis on which the environmental databases and data banks and the bases of environmental knowledge could be created, and the environmental geoinformation systems (GIS) for Russia, its regions and individual areas could be developed. Computerized version of the Atlas would ensure: 1) the uniform georeference system for data from all sources (cartographic, aerospace, ground surveys, statistic, etc.); 2) the automated database management (updating) using new information; 3) the constant "environmental watching" and updating of the Atlas; 4) the generation of new derivative information through the synthesis of available data; 5) the decision-making based on the application of geoinformation technologies.

The Atlas could serve as a basis for the development of EGIS of the following problem orientation: ecological geographical, hydro-ecological, medical-ecological, socio-ecological, etc.

By now the Faculty of Geography of the Moscow State University has developed the environmental computer maps for Russia at the scales of 1:8,000,000 and 1:4,000,000; the mode EGIS for the Volga basin has been created at the scale of 1:4,000,000; the system of prompt compilation of small-scale choropleth maps on environment statistical data for Russia (at the scale of 1:35,000,000) has been worked out. The development of computer maps also receives much attention at Rosgeoinform, the Institute of Geography of the Russian Academy of Sciences and other organizations.

## **3 International significance of the Environmental Atlas of Russia**

Environmental maps and atlases are being compiled in the countries of EEC and Eastern Europe, in China, Canada, the USA, etc. In several countries, such as Sweden, Norway, etc., there are special institutes of national atlases, as well as organizations co-ordinating the atlas mapping. The US National Centre for Geographical Data has compiled the Atlas of Environment that includes environmental maps.

The Environmental Atlas as a unique summary of studies on the state of environment in Russia would contribute significantly to the complex description of Eurasian environment as a whole. Work at the Atlas would provide the basis for cooperation with other CIS countries where similar atlases are being compiled, such as Ukraine, Uzbekistan, the Baltic states, etc. At the international level the Atlas could become an important part of global studies, as well as a Russian contribution to regional international projects, for example, the development of the Arctic GIS and others.

The Atlas being a specific national atlas of this country representing the present-day level of Russian science, the environmental policy of Russia and the state of cartographic production, its compilation could be regarded as a top-priority task at the state level.

#### 4 Requirements to the Atlas, its type and structure

The type of the Atlas determines the sphere of its application for scientific, practical, educational and other purposes, its scope of information, the possibility of its use for resolution of all-Russian and regional problems of ecological safety.

The Atlas should meet several requirements, providing: 1) the most complete and detailed representation of factual environmental information that is possible at the present level of knowledge and at the given scale; 2) the comprehensive and reliable description of environment for the whole territory and its separate regions; 3) the demonstration of complex environmental parameters, regionalization schemes, estimation indices, evolution trends, forecasts of ecological situations, recommendations on ecological safety; 4) the up-to-date information and the possibility of its renewal; 5) the most possible visibility of maps, their wide accessibility to users with different backgrounds.

National and foreign experience of complex mapping testifies that these requirements could be met only if a fundamental cartographic work of scientific and reference type is compiled. The Atlas should include the system of analytical, complex and synthesized maps. As to the purpose they should be inventory, estimative, forecast and recommendation ones.

The structure of the Atlas depends on its purpose, type and concept, natural features of Russia and their anthropogenic transformation, as well as on the available information support.

The Atlas would consist of 4 parts:

1. Introduction - 3 maps
2. Natural factors of environment - 50 maps
3. Anthropogenic impact and changes of environment - 109 maps
4. Strategy of ecological balance - 14 maps.

Besides, there would be the fifth part, that of reference.

Environmental situation and its factors are characterized at 5 spatial levels: global (4 subjects), all-Russian (129), regional (including shelf and coastal zones of adjacent seas - 22), local and municipal (industrial centres and cities - 21). The Atlas will include natural (91) and social-economic (51) maps, as well as complex ecogeographical maps at national (2) and regional (22) levels.

The Atlas would give models for the main features of ecosystems as follows:

- the elements of ecosystems of Russia and its regions are shown by series of analytical maps; they are grouped in sections and form independent subsystems with unified principles of representation, hierarchy and co-ordination;
- interactions of environment components with anthropogenic and technogenic factors are represented on complex and synthesized maps, mainly of estimative type;

- dynamics of ecosystems is shown on maps modeling the processes of environment degradation, deterioration of environment and its components, as well as on forecast maps;

- the functioning of ecosystems and the factors of their optimization are represented on maps showing the strategy of ecological balance;

- the hierarchy of ecosystems is shown on the maps of global environmental factors and the all-Russian, regional and local maps providing more detailed view of ecological situations.

## 5 Realization of the Atlas

Considering the requirements to the Atlas, its scientific and reference type and multipurpose character, the area of Russia and the degree of its environmental and cartographic exploration, the basic scale for the maps has been established at 1:10,000,000. At this scale the format of the Atlas (45x65cm) would make it easy to use it as a table one. Smaller scale of major maps (1:15,000,000 and smaller) would significantly reduce the scientific and informative value of the Atlas.

The basic scale is then used to form the scale series for maps of the Atlas: 1:15,000,000 (half of a sheet), 1:20,000,000 (1/4 of a sheet), 1:30,000,000 (1/8 of a sheet) are for the maps of Russia as a whole. Regional maps are compiled at the scales of 1:2,500,000 and 1:5,000,000, while the maps of industrial centres and cities - at the scales of 1:1,000,000 and 1:500,000. For the global maps the scales 1:60,000,000 and 1:150,000,000 are used.

It is reasonable to abandon the most common "book-type" form of publishing the Atlas as a stitched volume. This form is not operative at all, because it requires the whole Atlas to be completed at once. For the operative transmittance of the Atlas to users another approach to its publication is the most appropriate - in the form of separate blocks of sheets issued as they are ready. This allows to re-issue individual maps if new data or scientific concepts appear.

The Atlas will have extensive supplementary texts for particular sheets and blocks which will explain the content of maps and methods of their compilation and identify the sources of data. It will include reference materials and illustrations, particularly space images. This will make the Atlas more informative and attractive for general users and facilitates the application of maps for training and education.

## 6 Prospects of use of the Atlas

Compilation of the Environmental Atlas of Russia would have a pronounced effect on various environmental studies and the ecogeoinformation technologies. The Atlas will contribute to the development of system research, to the closer co-ordination of autonomous lines of environmental science and practice.

Within the frame of newly-developed strategy of ecological safety of Russia the Atlas would favour the selection of the most suitable, profitable and economically feasible ways of nature management, environment protection, improvement of living conditions and health of population. The Atlas would provide the uniform information and methodic support for environmental studies; it should become a basis for the improvement of environment monitoring, for the development of all-Russian environmental geoinformation system, supplemented and detailed with data of remote sensing, ground surveys, and with statistical and other information.

The extensive volume of information, the great diversity of maps' content, the objective nature of parameters used for map compilation offer new possibilities for application of different techniques of cartographic analysis, including visual analysis, graphic constructions, cartometry, statistic processing of data. Methods of mathematical and cartographic, as well as computer, modeling will allow to calculate the spatial correlations and mutual consistency, to estimate the uniformity, to identify the leading factors of development of phenomena and processes using the multidimensional statistical analysis. The analysis of maps of the Atlas provides for the compilation of other maps including the maps supporting the decision-making process.

Three groups of users of the Atlas can be distinguished, namely direct users (institutions and persons engaged in environmental issues, problems of ecological safety and environmental monitoring); indirect users (institutions and persons of adjacent spheres of knowledge and practical activities, referring to the Atlas non-systematically, in part and not for its direct purposes); potential users who would get the basic knowledge of the environment from the Atlas.

In order to provide the quickest possible dissemination of the Environmental Atlas of Russia and its effective introduction into scientific, practical and other activities it would be necessary to develop wide advertising in Russia and abroad for linking together the developers, the spreaders and the users of the Atlas. It is also necessary to popularize the Atlas, to develop the demand and marketing. The Atlas should be advertized and popularized through mass media, scientific and public organizations, special advertisements, etc.