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FORMATION OF THE MONITORING AND USE OF THE GIS LAND OBJECTS OF THE NATURAL RESERVEFUND OF REGIONS

In the current conditions the formation of tensions of land use, their protection and rational use is of particular importance. In recent years, the influence of anthropogenic factors on all natural processes, including land resources, has increased. In this context we should point out the irrational use of land, which leads to their degradation, the cause of which is the excessive land area, limited use of organic and mineral additives, lack of protection of land by agro-also-meliorative measures and low quality of technologies for the use of land. Rational use and protection of land is scientifically based process, whichtakes into account the natural properties of the land for their intended purpose while respecting the strains of their protection. To solve the presented problems,it is suggested to monitor the use of land on the basis of the formation and use ofinformation and analytical support.

Formation of the strains of land use at the regional level, their impact on the life of the population depends on the creation and use of objects of the natural-reserve fund, taking into account environmental factors. At the present stage is not resolved problems of development of land objects of the natural reserve fundof the regions, not established a system of information and analytical and spatialsupport of their identification, which reduces the level of efficiency of their use. Under such conditions, there is a need for monitoring the use of land objects of the natural reserve fund on the basis of information and analytical support, usingthe tools of geoinformation systems.

The importance of solving environmental issues in the last ten years has been growing due to their increasing intensity and impact on the living conditionsof the population. UN Secretary General A. Guterres at the Summit of the «GreatPackage» in the French city of Biarritz declared «an extraordinary climatic situation» and said: «According to the World Meteorological Organization, the level of concentration of carbon dioxide

in the atmosphere has reached the highest point in the entire history of mankind: This level of CO2 concentration existed 3– 5 million years ago, when temperatures were much higher and the level of the seas was 10 to 20 meters higher[1].

It should be noted that the experts of the Intergovernmental Panel on Climate Change note the deterioration of the climate in the world and point to the need to take measures to improve it:

The temperature increase in the range of 1.5 degrees Celsius to the end of the century;

- reaching the zero level of carbon dioxide emissions by 2050;
- to reduce greenhouse gas emissions by 45 % by 2030.
- The main problems in Ukraine that degrade its ecological situation are identified:
- the consequences of the war in Donbas;
- the creation and functioning of the Burshtino people's republic; virginization of forests;
- smitty chaos;
- the pollution of rivers and lakes.

In addition, a significant negative impact is made by the inefficient use of natural resources, land, wastes in the environment.

To ensure environmental safety at a low level, modern technology is used, which requires a rethinking of the approaches.

Thus, the development and implementation of information and analytical support for the formation and use of the monitoring of land objects of the naturalreserve fund of the regions is an urgent issue.

The purpose of the research is to develop and implement modern tools for the formation of information and analytical support for the formation and use of the monitoring of land objects of the natural reserve fund of the regions.

As a result of the generalization of theoretical and methodological approaches[2], the definition of «monitoring of land objects of the natural-reserve fund of regions», which includes the totality of legal, constructive, comprehensive, organizational, functional and instrumental tensions, was proposed, which allowed to form an information and analytical and comprehensive support on the status and level ofland use of objects of the natural reserve fund at the regional level based on the use of methods of mathematical modeling, which creates a quantitative basis for permanent monitoring and control over the use of objects of the natural-reservefund.

In the system of information and analytical support of monitoring of land use of objects of the natural reserve fund of the regions, it is important to developa diagnostic and analytical system of indicators. This system consists of three levels:

Visually, the diagnostic and analytical system of determinants of formation of monitoring of land use of objects of the natural reserve fund of the regions is shown in Fig. 1.1.

1 UN head declares environmental emergency on planet,Trump ignores climate panel. URL: https://texty.org.ua/fragments/96041/Golova_OON_ogoloshuje_nadzvychajnu_j ekologichnu_sytuaciju_na-96041/

2 Korniyets A. V, Mamonov K. A. The definition of geoecological monitoring of urban land use / Materials of IV International Scientific and Practical Conference "Geoinformation technology in territorial management and expert studies: legal, organizational, technical problems" (Odessa, 4-6 January 2017.); Korniyets A.V., Mamonov K.A. Geo-ecological state of lands of the city of Kharkov. Kharkov / Materials of the international scientific and practical conference "Steel development of cities (urban aspect)". Kharkiv, 2017; Assessment of environmental storages of bilateral cooperation between Ukraine and the EU / Ed. by Andrusevich N. Lviv. S. P. 121. URL: http://rac. org. ua/fi leadmin/user_upload/publications/EU_ Ukraine_ Monitoring_2013_FINAL. pdf.

– Local (*EL11*, *EL12*, *EL13*, *EL14*, *EL15*, *EL16*, *EL17*, *EL18*, *EL19*, *EL110*,*EL111*, *EL112*, *EL113*, *EL114*, *EL115*, *EL116*, *EL117*, *EL118*, *EL119*; *EL21*, *EL22*, *EL23*, *EL24*, *EL25*, *EL26*, *EL27*, *EL28*, *EL29*, *EL210*, *EL211*, *EL212*, *EL213*, *EL214*, *EL215*; *EL31*, *EL32*, *EL33*, *EL34*, *EL35*, *EL36*, *EL37*, *EL38*, *EL39*, *EL310*, *EL311 EL41*, *EL42*, *EL43*, *EL44*; *EL51*, *EL52*, *EL53*, *EL54*, *EL55*, *EL56*, *EL57*, *EL58*, *EL59*, *EL510*, *EL511*, *EL512*, *EL513*, *EL514*; *EL61*, *EL62*, *EL63*, *EL64*, *EL65*, *EL66*, *EL67*; *EL71*, *EL72*, *EL73*, *EL74*, *EL75*, *EL76*, *EL77*, *EL78*, *EL79*; *EL81*, *EL82*, *EL83*, *EL84*, *EL85*, *EL86*, *EL87*, *EL88*, *EL89*, *EL810*,*EL811*, *EL812*, *EL813*, *EL814*, *EL815*);
– system (*EL1*, *EL2*, *EL3*, *EL4*, *EL5*, *EL6*, *EL7*, *EL8*);
– integral (I_{EL}).

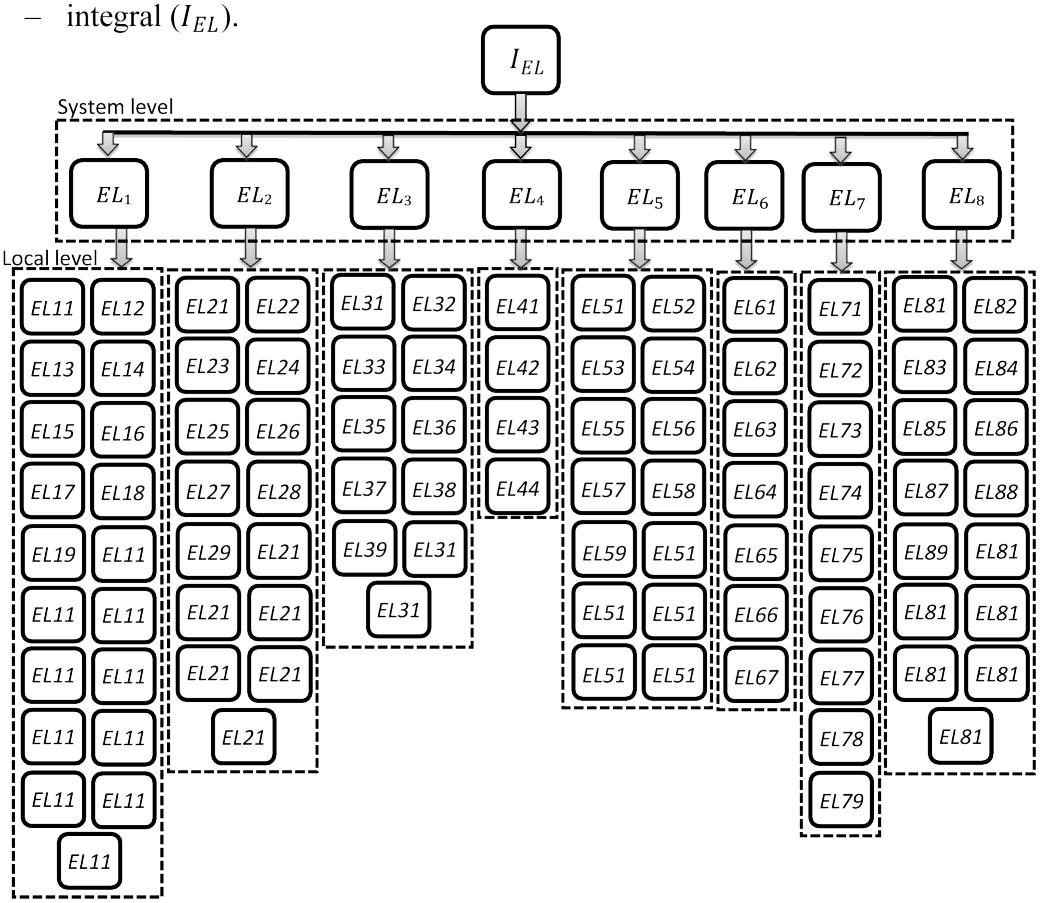


Fig. 1.1. Diagnostic and analytical system of factors of formation of monitoring of land use of objects of natural reserve fund of regions

It should be noted that local factors are determined either by using expert methods or using analytical methods (Table 1.1). In the research, expert methods are used and the determinants are determined by the average values of expert evaluations. Indicators that have absolute values are determined by analytical methods. Changes in these indicators or their net weight in the overall structure are used in the research. The presented values are used for unification of the obtained estimations.

Table 1.1

Determination of local factors by expert or analytical methods (developed bythe author)

Local factors	Evaluation method
1	2
Formation of the cadastre of territories and objects of the natural reserve fund (EL11)	Expert
Formation of environmental network monitoring (EL12)	Expert
Structural factors for determining the status and use of the environmental network (EL13)	Expert
Formation of a national environmental network (EL14)	Expert
organization of joint transcordonniary elements of thenational environmental network and the European environmental network (EL15)	Expert
Formation and Implementation of Mechanisms to Ensure Implementation of Programs for the Formation and Use of the Ecological Network (EL16)	Expert
Environmental protection (EL17)	Expert
Formation of the Natural Reserve Fund (EL18)	Expert
Formation and use of animal life (EL19)	Expert
Formation and use of plant life (EL110)	Expert
level of formation and use of ecological land (EL111)	Expert
level of use of wetlands of international importance, especially as a habitat for waterfowl (EL112)	Expert
Protection of Cultural and Natural Heritage (EL113)	Expert
Conservation of wild flora and fauna and natural environments (EL114)	Expert
level of implementation of conservation measures for migratory species of wild animals (EL115)	Expert
level of implementation of the Black Sea protection measures against pollution (EL116)	Expert
Biological diversity protection (EL117)	Expert

Table 1.1

1	2
level of implementation of the Pan-European Biological and Landscape Diversity ConservationStrategy (EL118)	Expert
Protection and maintenance of transboundary watercourses and international lakes (EL119)	Expert
The state of land of the natural reserve fund of the regions (EL21)	Expert
level of creation of state reserves of the regions (EL22)	Expert
level of formation and implementation of the regulatory framework for child welfare (EL23)	Expert
level of formation of information base on degraded lands (EL24)	Expert
level of inclusion of territories and objects to the list of ecological networks (EL25)	Expert
Plotting and mapping of areas and objects that require special environmental management (EL26)	Expert
level of creation and regime of use of territories and objects of natural reserve fund and other territoriessubject to special protection (EL27)	Expert
level of determination of perspective directions of preservation and non-dependent use of valuable landscapes and other natural complexes, objects and territories (EL28)	Expert
level of mapping of territories and objects that require protection (EL29)	Expert
level of application of the provisions of the State Cadastre of Territories of the Natural Reserve Fund (EL210)	Expert
The level of formation of databases of objects of the natural reserve fund for the monitoring of its territorialstructures (EL211)	Expert
The estimated area of land that forms the natural landscape (EL212)	Analytical
level of renewal of natural land landscapes (EL213)	Expert
level of establishment of water protection zones and protective bunds near water objects (EL214)	Expert
level of increase in the territory of forests, forested areas near agricultural land, industrial and residentialareas (EL215)	Expert
Total land area of protected areas and PPF objects of the regions (EL31)	Analytical
level of creation of protective forest plantations (EL32)	Expert
level of creation of field forest smogs (EL33)	Expert
level of cultivation of degraded lands (EL34)	Expert
Conservation level of degraded and contaminated land (EL35)	Expert

Table 1.1

1	2
Total area of land for plantations and pastures of the ecological network of regions (EL36)	Analytical
The estimated value of forests and forested areas of the ecological network of regions (EL37)	Analytical
Total area of open wetlands in the ecological networkof regions (EL38)	Analytical
Total area of open land without vegetative cover or with little vegetative cover of the ecological area of theregions (EL39)	Analytical
The estimated land area of the ecological network of regions (EL310)	Analytical
level of organization of work to identify degraded and unproductive land using space imagery (EL311)	Expert
level of application of remote sensing for ensuring monitoring of the formation of land objects of thenatural reserve fund of the regions (EL41)	Expert
level of implementation of land and land surveying during the formation of land objects of the natural reserve fund of the regions (EL42)	Expert
level of application of remote sensing methods in the formation of land objects of the natural reserve fund ofthe regions (EL43)	Expert
level of use of geographic information systems in the formation of land objects of the natural reserve fund ofthe regions (EL44)	Expert
level of dirt throwing (EL51)	Expert
level of change of land use (EL52)	Expert
Virus level (EL53)	Expert
level of uncontrolled and uncontrolled thinking (EL54)	Expert
level of performance of the natural processes (EL55)	Expert
level of impact of tourism and recreation (EL56)	Expert
Climate change level (EL57)	Expert
level of harvesting of forest products (EL58)	Expert
level of hydrological disturbances (EL59)	Expert
level of formation of transport and service territories in the system of ecological lands (EL510)	Expert
level of the execution of civil works (EL511)	Expert
level of livestock grazing in the ecological land system (EL512)	Expert
level of energy production from alternative sources (EL513)	Expert
level of transcodon influences (EL514)	Expert

	Table 1.1
1	2
Biological diversity level (EL61)	Expert
level of endemism and presence of rare species (EL62)	Expert
level of influence of landscape function on the land objects of the natural reserve fund (EL63)	Expert
level of the total volume of plant and animal diversity (EL64)	Expert
level of capacity for survival of the minimum number of resident populations of key species (EL65)	Expert
level of reduction of ecological land area (EL66)	Expert
level of influence of natural processes on the formation of land objects of the natural reserve fund (EL67)	Expert
Employment level in the system of formation of land objects of the natural reserve fund at the regional level (EL71)	Expert
level of performance of steel milling (EL72)	Expert
level of influence of society on the formation of land objects of the natural reserve fund at the regional level (EL73)	Expert
The level of natural heritage assets (EL74)	Expert
level of recreational activities (EL75)	Expert
level of environmental protection measures at theregional level (EL76)	Expert
level of ecosystem services (EL77)	Expert
level of educational and scientific value (EL78)	Expert
level of environmental research (EL79)	Expert
Efficiency level of conservation of diversity (EL81)	Expert
level of availability and use of the management plan (EL82)	Expert
level of support by state institutions for the formationand use of land objects of the natural reserve fund (EL83)	Expert
level of support by regional institutions for the formation and use of land objects of the natural reservefund (EL84)	Expert
level of support of local communities for the formation and use of land objects of the natural reserve fund(EL85)	Expert
level of protection of territories by normative and legalacts (EL86)	Expert
level of stakeholder cooperation in terms of regional land use of natural resource objects (EL87)	Expert
level of zoning of the territories of the objects of the natural reserve fund (EL88)	Expert
The level of implementation of measures on territoryplanning for the use of land objects of the natural reserve fund at the regional level (EL89)	Expert

Table 1.1

1	2
level of completeness and accessibility of decisions taken (EL810)	Expert
level of effectiveness of threat prevention (EL811)	Expert
level of efficiency of Dovkill management (EL812)	Expert
recreation management efficiency level (EL813)	Expert
level of infrastructure development (EL814)	Expert
level of management of personnel engaged in activities in the field of land use security of objects of naturalreserve fund at the regional level (EL815)	Expert

Each of the systemic and integral factors is evaluated by mathematical models, which have the following general view:

systemic level:

– the systemic factor of the level of regulatory and legal support that affects the formation and use of land objects of the natural reserve fund of territories (EL1):

$$\left\{\begin{array}{c} EL_{11}, EL_{12}, EL_{13}, EL_{14}, EL_{15}, EL_{16}, EL_{17}, EL_{18}, EL_{19}, \\ EL_{110}, EL_{111}, EL_{112}, EL_{113}, EL_{114}, EL_{115}, EL_{116}, \ EL_{117}, \\ EL_{118}, EL_{119} \end{array}\right\}, \quad (1.1)$$

the systemic factor in the development of information and analytical supportfor the formation and implementation of the monitoring of land objects of the natural reserve fund of regions (EL2):

$$\left\{\begin{array}{c} EL_{21}, EL_{22}, EL_{23}, EL_{24}, EL_{25}, EL_{26}, EL_{27}, EL_{28}, EL_{29}, \\ EL_{210}, EL_{211}, EL_{212}, EL_{213}, EL_{214}, EL_{215}, \end{array}\right\} \subset EL_2, \quad (1.2)$$

– the systemic factor of the level of rational use and protection of naturalresources identified the factors that affect the development of monitoring of the formation of land objects of the natural reserve fund of regions (EL3):

$$\left\{\begin{array}{c} EL_{31}, EL_{32}, EL_{33}, EL_{34}, EL_{35}, EL_{36}, EL_{37}, EL_{38}, EL_{39}, \\ EL_{310}, EL_{311} \end{array}\right\} \subset EL_3, \quad (1.3)$$

– the systemic factor of instrumental support for the monitoring of theformation of land objects of the natural reserve fund of regions (EL4):

$$\{EL_{41}, EL_{42}, EL_{43}, EL_{44}\} \subset EL_4, \quad (1.4)$$

the systemic factors of threats to the formation of land objects of the natural reserve fund of regions (EL5):

$$\left\{\begin{array}{c} EL_{51}, EL_{52}, EL_{53}, EL_{54}, EL_{55}, EL_{56}, EL_{57}, EL_{58}, EL_{59}, \\ EL_{510}, EL_{511}, EL_{512}, EL_{513}, EL_{514} \end{array}\right\} \subset EL_5, \quad (1.5)$$

the systemic factors of natural value of land objects of the natural reserve fund of regions (EL6):

$$\{EL_{61}, EL_{62}, EL_{63}, EL_{64}, EL_{65}, EL_{66}, EL_{67}\} \subset EL_6, \quad (1.6)$$

the systemic determinants of social and economic value of territories (EL7).

$$\{EL_{71}, EL_{72}, EL_{73}, EL_{74}, EL_{75}, EL_{76}, EL_{77}, EL_{78}, EL_{79}\} \subset EL_7, \quad (1.7)$$

the systemic indicator of the efficiency of management of the formation and use of land objects of the natural reserve fund at the regional level (EL8):

$$\left\{\begin{matrix} EL_{81}, EL_{82}, EL_{83}, EL_{84}, EL_{85}, EL_{86}, EL_{87}, EL_{88}, EL_{89}, \\ EL_{810}, EL_{811}, EL_{812}, EL_{813}, EL_{814}, EL_{815} \end{matrix}\right\} \subset EL_8, \quad (1.8)$$

Integral level:

$$\{EL_1, EL_2, EL_3, EL_4, EL_5, EL_6, EL_7, EL_8\} \subset I_{EL}. \quad (1.9)$$

Thus the diagnostic and analytical system of factors of forming the monitoring of land use of the natural reserve fund of the regions is developed, which allows to form the quantitative basis of the integral method of evaluation of land use of the natural reserve fund of the regions. This method forms the basis for the creation of a monitoring system and taking grounded decisions in the system of formation of land relations of the environment at the regional level. Diagnostic and analytical system provides the possibility to identify the factors at different levels, to get their assessment, to carry out diagnostics at local, system and integrative levels of the state and intensity of changes in the system of land relations of the objects of the natural-reserve fund of the regions.

The development of the method of integral assessment of the level of formation and use of land objects of the natural reserve fund of the regions includes a set of interconnected stages:

Establishment of a diagnostic and analytical system of indicators of the formation of monitoring the use of land objects of the natural reserve fund of theregions;

Determination of local factors of the level of formation and use of land objects of the natural reserve fund at the regional level;

– Description of systemic determinants of the level of formation and use of land objects of the natural reserve fund;

– Creation of models for determining systemic determinants of the level of formation and use of objects of the natural reserve fund of the regions;

– Modeling of the integral indicator of the level of formation and use of objects of the natural reserve fund;

– assessment of valuation coefficients by the hierarchy analysis method; The Integral Indicator;

– Interpretation of the obtained results.

Using the assessment method we determined the integral indicator of the level of land use of the natural reserve fund of the regions (Table 1.2).

Table 1.2

The results of the assessment of the integral indicator of the level of land use ofobjects of the natural-reserve fund, in.

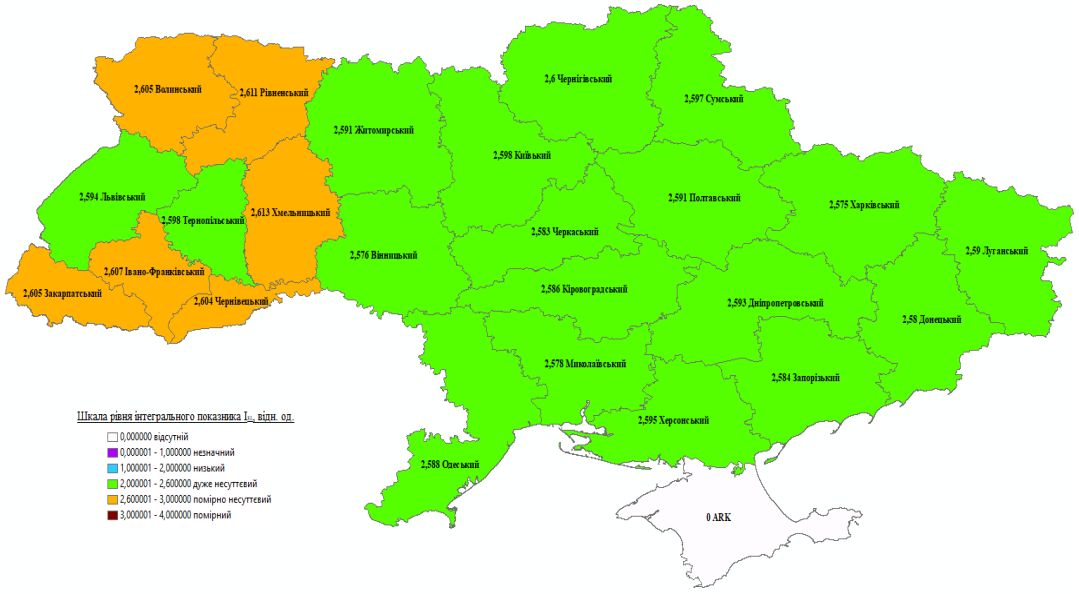
Regions	Value of the Integral Indicator I_{EL}
Vinnitsky	2,576
Wolinsky	2,605
Dnipropetrovsk	2,593
Donetskiy	2,580
Zhitomirsky	2,591
Transcarpathian	2,605
Zaporizky	2,584
Ivano-Frankivsk	2,607
Kievsky	2,598
Kirovogradsky	2,586
Lugansky	2,590
Lviv	2,594
Mykolayivsky	2,578
Odyesky	2,588
Poltavsky	2,591
Rivne	2,611
Sumskiy	2,597
Ternopil	2,598
Harkivsky	2,575
Kherson	2,595
Khmelnitsky	2,613
Cherkasky	2,583
Chernivetsky	2,604
Chernigov	2,6

The obtained values of the assessment of the integral indicator of the level of land use of the objects of the natural reserve fund are in the interval from 2 to 3 on the scale of the integral indicator, which indicates the unsatisfactory level of land use of the objects of the natural reserve fund of the regions, as well as neglect of the problems of formation and use of these territories, unsystematic creation of information and analytical support and lack of monitoring of lands of the natural reserve fund at the regional level. It should be noted that the development of regulatory support for monitoring of the use of land objects of the natural- reserve

fund, but its use is marked by low level of implementation at the regionallevel. There is a certain imbalance in the strains of ecomeregional land use, the interplay of state, regional and local institutions for their formation and use. Therefore, there is a need to develop scientific and methodological recommendations for the formation and use of information and analytical supportfor monitoring the use of land objects of the natural reserve fund of the regions.

Thus, as a result of the research the information and analytical support of monitoring of land use of the natural reserve fund of the regions was developed, which forms a quantitative basis for making informed management decisions in the system of land relations and developing geomonitoring maps, taking into accountthe peculiarities of the use of objects of the natural-reserve fund at the regional level.

As a result of the application of geoinformation systems, a geoinformation map of the integrated factor of the level of land use of the objects of the nature reserve fund by regions is proposed (Fig. 1.1). This allowed to visualize the level of land use of nature reserves by region, as well as to monitor the use of land of nature reserves of a particular region.



Puc. 1.1. Geoinformation map of the integrated factor of the level of land use of nature reserves by region, rel. from, rel. un.

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