

***Development of practical recommendations on the formation of the environmental framework and ecological networks at local, national and regional levels. Environmental policy in Ukraine the field of preserving the biodiversity and the formation of ecological networks***

Таврический национальный университет  
им. В.И. Вернадского

Almost universally natural landscapes are replaced by the anthropogenically transformed which are characterized by the presence of man-made elements, specific territorial structure and function. The process of human transformation of natural landscapes is inevitable, since a person can not normally exist in a purely natural landscapes. The key is to plan territorial structure on the basis of the balance between natural and anthropogenic component. This will allow, on the one hand, to ensure conditions for the reproduction of biota and preserve biological diversity, and, on the other – the person to receive the necessary social and economic effects from the operation of the natural reserve of the landscape.

One of the tools of environmental management areas is a landscape and territorial planning, in particular, the formation of ecological framework by organizing **a network biocentral-territorial structure of the landscape (or ecological network)**.

Conceptual Foundations of a network biocentral-territorial structure of the landscape have been developed in the late 70s – early 80s German, Czech and American landscape ecology Naveh Z., Lieberman AS (Z. Naveh and A. Lieberman) (1984) [1], Low J. (I. Left) (1985) [2], Forman RT, Godron M. (RT Forman and M. Gordon) (1986) [3] and based on the theory of island biogeography. The aim of these scientific developments was the formation of the territorial structure of ecologically sustainable landscape. However, the direct transfer of the laws of the theory of island biogeography to terrestrial landscapes has led to quite contradictory conclusions and has not found a proper practice.

New developments of recent decades in the formation of a network structure– biocentral antropogenezed landscape belong to the Western European landscape ecologists – F. Zemeku (Czech Republic), M. and M. Ruzhechke Miklos (Slovakia), T. and D. Brossardu Joly (France) Solon J. and A. Rihlingu (Poland) [4] VM Yatsuhno and JE Mandera (1995) [5] and based on comprehensive analysis of the structure of natural landscape, features of its operation and managing the migration of species, biotic linkages between populations, ability of species to adapt, etc.

The problem of optimization and territorial formation biocentral -territorial structure of the network is to address issues of balance between the use, improvement and environmental protection. **The methodological basis** for this are well-known **geo-ecological principles and rules** set forth in the works JWForrester, 1971 [6], Meadows et al. , 1972 [7] Odum, 1975 [8], and Reimers, 1992 [9] and Gorshkov, 1995 [10] and others

1. **The rule of «soft» control of nature**, according to which all efforts should be aimed at enhancing the useful natural chain reactions, including the processes of restoration and renewal of resources. Under this rule, «work» biological farming systems, the idea lies in the basis of creating shelter belt, gully forest belt, ravine forest belt. A typical example of soft control rules may be called the withdrawal from active agricultural use of marginal and

erosive-dangerous sloping lands followed with their grasslanding and afforestation of the most degraded of them.

2. *The principle of territorial differentiation*, resulting from differences in landscape structure of the territory lies in the different behavior of the intensity of Environmental work and, therefore, different densities and configurations of systems of environmental infrastructure. The higher the potential sustainability of the landscape and its natural diversity, the less it needs to be protected. This principle must be supplemented by the law of requisite variety UR Ashby: «only systems with sufficient diversity can successfully counter the effects of various external impact.»

3. *Preventive principle of providing a primary form of environmental Geosystems in the territories*, is actively involved in economic turnover, but have not lost their full potential. According to this principle, initially, a system of environmental infrastructure is formed, and after the economic activity is planned. Areas, degraded completely (ravines, pits) shall be full reclaimed through irrigation and afforestation. Protection of such sites in the early stages will ensure the maintenance and restoration in the future ecological potential.

4. The principle of command and control is based on the different levels of human activity in creating and maintaining the required level of environmental protection measures. There are three levels of activity: non-intervention, support and active management. Within the highly transformed areas most applicable of the second and third level, though active management should be implemented in most areas. Small quantity of natural areas limits the first level of activity – non-interference.

5. *Rule of functional «polarization» of the landscape*, informed by BB Rodoman (1974). It is based on the principles of delimitation, demarcation of zones of different operations, in which the most far-flung territories are actively used and protected (protected). The transitional zone between them consist of areas with varying degrees of familiarity and economic use. Areas with increasing anthropogenic stress will be placed in the direction of preservation. In this case the principle of subsidiarity must be respected, in which different but interrelated systems complement each other in their unity and opposition. In the absence of dynamic equilibrium under the principle of interaction is short and the system collapses.

6. *The principle of ubiquity* is important in the sense that based on the concept of close horizontal relationships between the different landscapes and within each of them. Therefore, the existence and effective operation of environmental systems is supported through the links of its elements which breach and termination through the flows' system leads to the degradation and destruction. Thus, environmental objects and systems should be included in all territories, but with different intensity.

7. *The rule of completeness components*, whereby the number of functional components of the system must be efficient – without deficiency or excess. It should be determined by the type of system and environmental conditions.

8. *Multifunctional principle* consists in the possibility of the same object fulfill simultaneously multiple functions with a given efficiency.

The main elements of biocentric-network structure of the landscape are the Biocentre and biological corridors. **Biocenter** is a combination of natural geosystems with a natural or quasi-natural vegetation and is a key element of biocentric-territorial structure of the network, whose primary function – is the preservation of the natural genofond and biodiversity areas. In connection with this Biocentre area should be such as to ensure plant communities and animal populations an opportunity for a normal existence and self-perpetuation. However, Biocentre also serve for the reproduction of environment, resources, generation or accumulation of real power and information flows, an aesthetic function.

Biocenter can vary significantly by function, by type, by edaphic conditions and habitat characteristics and spatial scales. Classification of biocenters shown in Fig. 1, reflects a fundamental approach to differentiation and is somewhat arbitrary.

In conditions of practically ubiquitous anthropogenic transformation of the landscape of the territorial structure, the areas of preserved natural Geosystems are rather small. Often the size of Geosystems corresponds the complex tract or group of tracts – from 1 km<sup>2</sup> to several tens of km<sup>2</sup>, and the distance between them ten times more than their size. Isolated Biocentres are inefficient, unstable and doomed to extinction.

To maintain the viability and normal functioning, biocenters need close connection with other biocentres, similar to edaphic conditions and genesis. Biological corridors are connecting channels, which provide a free exchange of genetic information between biocentres.

Biological corridors may be of natural origin (river valleys, forested slopes or bottoms of gullies and ravines), and man-made (shelterbelts, planting trees and bushes, not concreted canals, special technical ekoelements – tunnels, chutes, etc.). The main function of biological corridors is to provide conditions for moving of biological flows, ie migration of species between the biocentres. However biological corridors are also channels for moving real-energy and information flows. In some cases, biological corridors act as barriers. For example, shelterbelts reduce wind power and prevent deflation of the soil, detain flows of snowdrift and accumulate snow mass, artificial planting on slopes of varying steepness decrease the rate of runoff flows and prevent erosion.

They distinguish the biological corridors by different scales, levels and types. Thus, at the regional level biological corridors reach a length of a few hundred kilometers and the width – of tens of kilometers.

By type of location there could be valleys and rivers, coastal, watershed, slope, lake biological corridors.

Coast of the oceans and seas is the type of biological corridors, which is dated the maximum biodiversity.

The river valleys and large valley beams, hollows – are the main types of biological corridors in natural landscapes. They bind Biocentre with different edaphic conditions, and also are the channels of transient movement of matter and energy. However, today, as a rule, the river valleys are the most anthropogenically transformed because of the widespread uptake. The existence of settlements in the valleys of riveras interrupts their continuity as channel coupling and reduces the biological and ecological role in biocentric-network structure in the region.

This process is also typical for the Crimea. However, it is not spread all over the peninsula. For example, the river valleys of the South-Eastern Crimea are mastered (agricultural land, selitba), but they have not completely lost their function of the biocorridors [11]. This is explained by the fact that valleys are not wide and settlement system is represented by the fine focal character, while river and beam terraces are occupied by vineyards and gardens, close to the adjacent natural shrubland communities having the vertical structure. In addition, the area of terraced vineyards is small, so they are not an absolute barrier for the movement of animals and anemochorous (air flow) transportation of seeds and woody vegetation, grass. There are shrub communities preserved in many valleys along waterflow. The main role of bio-corridors perform valleys and slopes dissected by gullies and ravines. Ravines and gullies are narrow and deeply incised, and are forested and shrubbed on the bottom. This creates favorable habitats, a shelter for many species of plants and animals displaced from the mastered valley. The existing slope runoff contributes to the displacement of seeds of oak, pistachio, juniper, which are coming from the forest biocenters. The presence of gullies and ravines with more favorable edaphic conditions (primarily by moistening) creates the conditions for their germination. Thus, they are also bio-corridors, but of lower rank.

Formation of optimal biocentric – network structure must contribute to the following **general priorities**:

1. all major natural landscapes and ecosystems should be included in the network;
2. protection of sites of the greatest biological diversity;
3. ensuring unity and connectedness of network elements;
4. providing conditions for the reproduction of protected species

Depending on the spatial scale of the territory, its main functional load (recreational, agricultural, industrial, residential, etc.), landscape and environmental priorities in the formation of biocentric-network, the structure and establishing role (function) of biocenters is changed.

**At the regional level** (*this is the direct impact level of economic and environmental interests and the emergence of the most bitter conflicts of land use*) the planning of economic activities, develops and implements specific type of natural management and environmental standards are determined. The main priorities of landscape spatial planning at the regional level should be **the environmental and bio-ecological**.

**The conservation priority** involves actions, aimed at preserving the existing natural systems and facilities, endemic and rare species, as well as preventing the development of degradation processes (*salinization, waterlogging, pollution, erosion, slumping, deflation, etc.*) in a man-made landscapes.

**Bioecological priority** when forming biocentric-territorial structure of the network at the regional level, involves the creation of conditions for the preservation and maintenance of biodiversity, the effective reproduction of plants and animals populations for a long-term period, maintaining their stability.

To form a biocentric- network territorial structure of the landscape at the regional level, according to these priorities, we should: 1) determine the minimum possible area of the biocenters, that would ensure the fulfillment of its primary function – the maintenance and reproduction of natural gene pool. 2) determine the optimal ratio of the natural and anthropogenic landscape systems areas. 3) identify the opportunities (regional, biological, social) for the spatial organization of the ecological network elements.

Thus, for example, it is established, that the minimum area of biocentre, which ensures the existence and reproduction of deer and roe deer populations, should be not less than  $10^5 \text{ km}^2$ , at the same time, hundreds of  $\text{km}^2$  are required for the normal existence of the forest population of woody vegetation (such as oak and beech).

However, for areas characterized by high granularity of landscape painting and a variety of locations and habitats (areas with a significant degree of dissection of the surface), as well as for agricultural landscapes, particular attention should be paid to protection, maintaining and building of the local (small  $1 - 3 \text{ km}^2$  and an average of  $3 - 10 \text{ km}^2$ ) biocenters.

The main functions of biocenters in agricultural landscapes are agroecological and aesthetical. They provide biological protection, and pollination of agrocenosis. It's established, that even biocentres, which have small areas ( $0.5 - 1 \text{ km}^2$ ) have an optimizing impact on the functioning of adjacent agricultural lands within a radius of  $2 - 2.5 \text{ km}$ , as well as they significantly increase the level of aesthetic perception of monotonous agricultural land.

Thus the main task of creating effective bio-networks, is to provide connectivity between biocentres. Usually, reserves for this high degree anthropogenic transformation of the landscape, are very hard to find. For example, it can be done through the withdrawal of use lands, uneconomic for agricultural use areas, planting of forest belts, as well as special artificial corridors – tunnels (for construction of main roads, high-speed railways, etc.).

For example, reserves in bionetworksi in plain part of Crimea are represented by: 1) areas of preserved natural steppe vegetation (eg, Samarchik, Taukskaya steppe Tarkhankut, Klepininskaya steppe). Giving them the conservation status, will allow to preserve them and protect from degradation, 2) underproductive agricultural lands are to be phased out of use 3) the creation of new objects of natural reserve fund (the National Park «Sivash», regional landscape park «Kalinowski», «Karalarsky», etc.) 4) the inclusion of environmental conservation projects of local significance in the socio-economic development plans of districts [12].

With regard to the priorities of biocentric-network structure on the regional level, the basis of its formation must be an existing network of protected areas of different status, as well as the projected conservation areas.

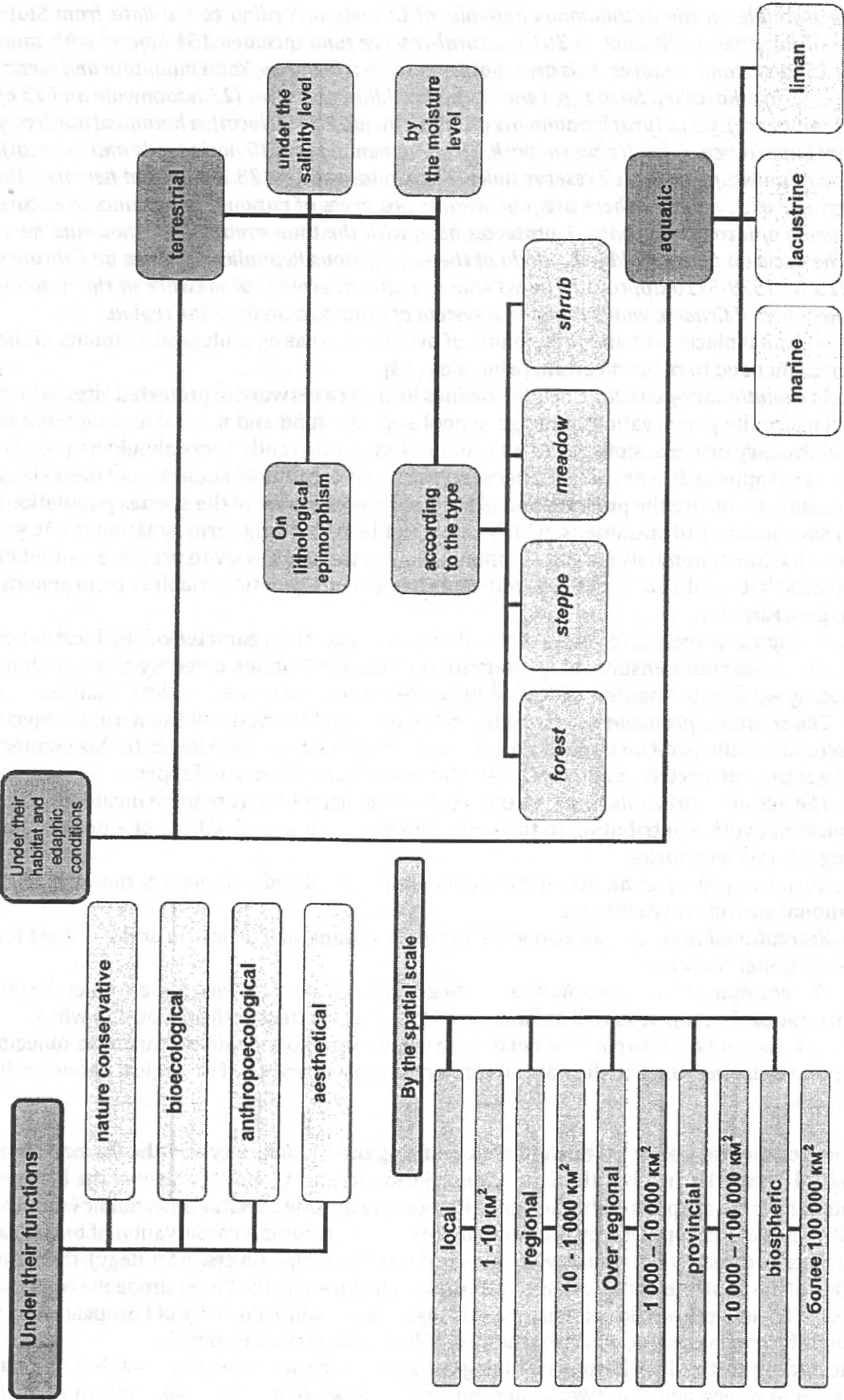


Fig. 1. Classification biocenters

*For example, in the Autonomous Republic of Crimea, according to the data from State Service of Reserves of Ukraine, in 2010 natural-reserve fund included 154 objects with total area of 154 thousand hectares. This are 6 nature reserves (Crimean, Yalta mountain and forest, Capes – Marian, Karadag, Kazantip, Opuksky), 26 wildlife preserves (13 nationwide and 13 of local significance), 68 natural monuments (13 nationwide and 55 local), a botanical garden of national importance, 1 dendrological park, 29 monument – parks (9 nationwide and 20 local), 2 regional landscape parks, 10 reserve holes. Their total area is 128.1 thousand hectares. On the territory of Sevastopol, there are four wildlife preserves of national importance, 6 nature monuments of local importance, 1 protectes hole, with the total area of 26.1 thousand hectares. The decision of the Verkhovna Rada of the Autonomous Republic of Crimea on February 17, 2010 № 1579-5/10 approved The scheme of regional ecological network in the Autonomous Republic of Crimea, which relies on a system of protected areas in the region.*

For optimal placement and functioning of protected areas as ecological elements of the network, you need to respect certain principles [13].

1. *An evolutionary-genetic principle* provides forming a network of protected sites, which would ensure the preservation of the gene pool and cost-fund and normal development of the evolutionary processes of species and communities. Inherently, there should be populational-based approach, from which a necessary amount of protected objects and their sizes, i.e. necessary to ensure the preservation of the necessary number of the species populations and in such number of specimens, which would not lead to a long-term isolation in the genetic unification of populations and communities. It is also necessary to preserve a number of a species that would not lead to a significant change in its genetic variability from generation to generation.

2. *Ecological principle* requires that the number, size and character of the location of protected areas, could ensure the preservation of the ecosystems diversity in the region, historically established natural relationship between them and the ecological balance.

3. *The scientific principle*: an ecological network should include all the natural objects with scientific value, and be the basis for getting/achieving new knowledge. In this connection, we should protect, first and foremost, typical and rare objects and types.

4. *The aesthetic principle* requires the most scenic parts of nature to be included in the ecological network, contributing to the development of emotional sphere of a person, improving his aesthetic ideas.

5. *Cognitive principle*: an ecological network should include all objects that are of an educational and informative value.

6. *Recreational principle*: an ecological network should include all the areas, richest for the recreational resources.

7. *The principle of representativeness*: the need for the highest possible reflection of the objects in ecological network, as well as landscape-ecological specifics of the region as a whole.

8. *The economic principle*: the need to preserve the most common business objects, which are complementary to the natural elements in the structure of ecological networks in the region.

**Environmental policy in the field of preserving the biodiversity and the formation of ecological networks.** In 1995, the Sofia Ministerial Conference on Environment of the European states under the auspices of the Council of Europe and the United Nations Economic Commission for Europe was approved by the Pan-European strategy for the conservation of biological and landscape diversity (Pan-European Biological and Landscape Diversity Strategy), the basic direction of the implementation of which was the establishment of the Pan-European ecological network. The network would combine the existing focus of natural diversity of European values in a single territorial system, which extends from Ural to the Iberian Peninsula.

According to the Pan-European Biological and Landscape Diversity Strategy, the basic elements of ecological networks are: natural habitats (core) for conservation of vari-

ous types of ecosystems and habitats (ecotopes), plants and animals species, landscapes which have the European importance, ecological corridors (transition zone) for providing the links between natural habitats, restoration of areas damaged ecosystems, buffer zones to protect the natural foci from harmful external influences. And to the natural foci of the Pan-European ecological network, we include, above all, environmental or natural protected areas, that meet the criteria of international (global, European and regional) conventions and agreements and are recognized by them. Integrity is ensured through the establishment of ecological networks, where necessary, continuous ekocorridors or so-called persistent «transitional zones», which contribute to the resettlement or migration of species between natural foci. In many cases, the binding functions of eco-corridors, are to be linked to some forms of economic activity in the territory.

Legal basis for an ecological network in Ukraine was laid in the Law of Ukraine «On Environmental Protection» (1991), which states that natural areas and sites subject to special protection, constitute a single territorial system and include areas and sites of natural and reserve fund, resort and recreational, recreational, waterproof, field and other types of sites and facilities, which are determined by the laws of Ukraine.

Relations associated with the formation, conservation and use of ecological network governed by the laws of Ukraine «On the nature reserve fund of Ukraine», «On the vegetable world», «On the Fauna», «The Red Book of Ukraine», «On the Protection of Cultural Heritage, the Land, Water, Forest Code, the Code «On Subsoil» and the Law «On General scheme of planning of the territory of Ukraine» (2000) and the Law «On the design and construction of the territories» (2002).

In September 2000, Ukraine adopted a special law **«On the formation of a national program of the National Ecological Network in Ukraine for 2000-2015.»** And in 2004 **the Verkhovna Rada approved the Law «On Ecological Network in Ukraine»**, which consists of sections, articles and items disclosing a program of conservation, protection and development of national ecological network. National Econet Ukraine is a complex multifunctional natural system, the main functions of which are conservation, stabilization of the ecological balance, increasing the productivity of landscapes, environmental improvement, and ensuring balanced and sustainable development of the state.

Natural foci of high-level are natural reserves, protected areas of national parks and biosphere reserves, buffer zones around nature reserves, recreational areas in national parks and natural buffer zones in biosphere reserves (reserves) which are essentially the buffer zones.

The main natural foci of the national ecological network, due to their conservation and recovery ability, include: the Carpathian mountain country, Precarpathians including the Opole, the Crimean mountain country, the Western Polesie, the Dnieper Polesie, the Eastern Polesie, the Podolsk Upland, the Donetsk ridge and the Azov Upland. Significant role in the national ecological network play branched river network of the Dnieper, Dniester, Southern Bug, Western Bug and the Seversky Donets, the Ukrainian coast of the Azov and Black Seas.

According to the **«National Program of formation of the National Ecological Network in Ukraine for 2000-2015 years.»**, there should be established 29 national parks, 7 biosphere reserves, expanded the borders of three natural and three biosphere reserves, five national parks. Total area of the natural reserve fund of Ukraine should increase more than doubled to reach 10% of the area of the state.

Formation of an ecological network involves changes in the structure of Ukraine's land fund by referring to the categories of land, subject to special protection to ensure the integrity of the ecological network.

The program provides for the implementation of a series of events:

- expansion and optimization of network objects of natural reserve fund;
- formation of cross-border conservation areas;
- the creation of protective forest plantations, shelter belts, etc.;
- reclamation of disturbed lands and renaturalization;



- ensuring the protection of wetlands;
- providing conditions for the preservation and reproduction of the variety of plant and animal species;
- special measures to ensure that migration animals;
- implementation of measures to prevent negative impact on natural ecological network core.

The program provides an inventory of special and scientific research, establishment of centers for artificial breeding of rare and endangered plant and animal species, public awareness, the implementation of the activities arising from international obligations.

The nationwide program provides for the formation of a national ecological network preparation of applications for recognition of the values of natural areas of Ukraine, primarily within its nature reserve, at the international level, a national inventory of natural heritage. Submission will be prepared for the international recognition of new biosphere reserves, made proposals to the List of Wetlands of International Importance and the World Network of Biosphere Reserves, the Emerald Network for Europe and for awarding the European Diploma for protected areas.

Following the adoption of the Law «On the formation of a national program of the National Ecological Network in Ukraine for 2000-2015 years.» began to adopt programs to promote regional ecological networks. So, in September 2008 Resolution of the Verkhovna Rada of the Autonomous Republic of Crimea on 17.09.2008 № 968-5/08 approved the ***Development Program of a regional ecological network in the Autonomous Republic of Crimea in 2015, under which a scheme of regional ecological networks in Autonomous Republic of Crimea*** (the Scheme), recognized by the Ministry of Environment and Natural Resources as the best in Ukraine, was developed and adopted (see Fig. 2) [14]. According to the approved scheme 36 objects of local significance, are reserved for further commandments, in the area of 51 324 ha. After the implementation of relevant activities provided by scheme, the percent of nature reserves will be 17.4% in the Autonomous Republic of Crimea.

**Key elements of a regional ecological network** as a part of the National Ecological Network of Ukraine in the **Crimea**, are:

- Regional ecocentres (core areas, or Biocentres) – formed on the natural areas that have high biological and landscape diversity (here are included the Crimean, the Yalta mountain and forest and Karadag nature reserves, wetlands of international values generated by the territory of the National Natural Park «Tarkhankut» etc.);
- natural core – Biocentres – are the most valuable areas, mostly represented by large (more than 500 hectares in the steppes and over 1,000 hectares of forest ecosystems) objects of natural reserve fund and other areas requiring special protection (East Sivash, Karalarsky, Karkinitzky, Sasyksky « etc.);
- ecological corridors – connecting the territories that formed the natural landscape areas of various shapes and sizes, providing appropriate conditions for the migration of flora and fauna;
- buffer areas – provide the protection of key and connecting areas from the human influence. They are transitional strips between natural areas and areas of economic use;
- the restored areas – provide a spatial integrity of the Econet. The priority measures of the primary reconstruction of the state of nature must be taken for their formation.

Under the proposed scheme, as a result of the formation of a regional ecological network of the Autonomous Republic of Crimea, which includes 21 environmental center and 20 ecological corridors, the area of regional ecological network objects will be more than 38% of the total land area of the country. The share of the objects of natural reserve fund will be about 10%. The remaining 28% of the area, are occupied by the objects of the ecological network, will be regulated and controlled, depending on the functionality, environmental and biological value, the nature of economic activities, etc. [15].



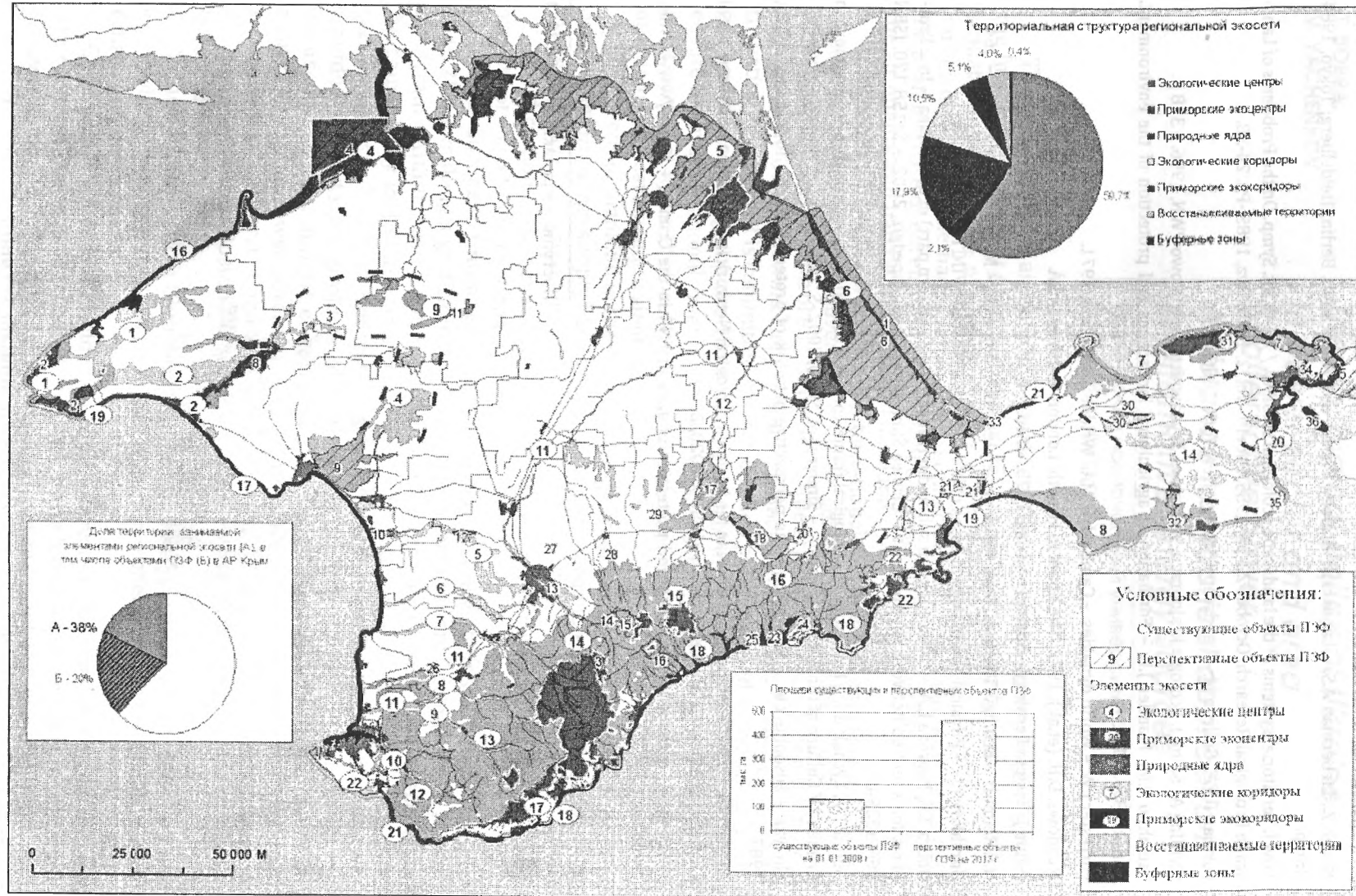


Fig. 2. The Draft of an Environmental Network in the Autonomous Republic of Crimea, 2009 [14]

**LITERATURE**

1. Naveh Z., Lieberman A.S. – Landscape Ecology. Theory and Application. Berlin; Heidelberg; Tokyo, 1984. 356 p.
2. Low J. Territorial systems of the landscape ecological stability. // 7-th Int. Symp. On the Problems of Landscape Ecological Research. October 22-25, 1985, Panel 1. Vol. 2.-Bratislava, 1985.-Pp. 24-38.
3. Forman R.T.T., Godron M. – Landscape Ecology. New York, 1986. 619 p.
4. Richling A., Solon I. Ecologia krajobrazu. Warszawa, Wydawnictwo Naukowe PWN, 1996. – 318 p.
5. Yatsuhno V.M., Mander J.E. – Formation of agricultural landscapes and protection of the environment. Minsk, 1995. – 121.
6. Forrester J.W. – World dynamics. – Cambridge, MA.: Wridht-Allen Press, 1971.
7. Meadows. D.H. (et.al.). 1972: The limits to growth. London: Earth Island.Â.
8. Odum J. Basics of ecology – Springer-Verlag, 1975. – 740.
9. N.F. Reimers – Ecology. Theories, laws, rules, principles and hypotheses. – M. Young Russia, 1992. – 364.
10. Gorshkov V.G. – Physical and biological bases of life stability. – Moscow: VINITI, 1995. – 470.
11. Bobra T.V., Bagrova L.A. – Crimean South submediterranean coast (eastern part) of the Crimea. – In ...: Prospects for a unified network environment .- Crimea Simferopol Krymuchpedgiz, 2002 .- S. 158-170. ISBN 966-8025-03-2.
12. Bobra T.V., Lychak A.I. – Formation of ecological framework as a condition for sustainable development in Crimea // Culture of the Black Sea nation. – Simferopol, № 30, 2002.-S. 155-159.
13. Shelyag – Sosonko Y.R., S.M. Stojko. – The perspective network of protected objects in Ukraine. – Kiev, 1987.
14. NIT № 688 \ 08 «Development of the Plan for Regional Ecological Network in the Autonomous Republic of Crimea». Number of state. Registration 0108U010020, 2009
15. Problems of organization, content, and protection of sites of FNR in the Crimea. – [Http://www.arhus.crimea.ua](http://www.arhus.crimea.ua)

---

Поступила в редакцию 26.06.2011