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Viktoria Yavorska

TERRITORIAL ANALYSIS OF COMPONENTS OF STRUCTURAL ELEMENTS OF THE UKRAINIAN BLACK SEA REGION ECOLOGICAL NETWORK

In provided article the distribution on the territory of the Ukrainian Black Sea region one of the most important elements of the ecological network – objects of Nature Conservation Fund was analyzed. The problems arising from the formation of the ecological network associated with excessive development of the territory were reviewed. It was described the main components of the structural elements of the regional ecological network. Schematic map with different marked areas of territories that may be included in the regional ecological network was developed. The ways of increasing the area of ecological network in the region was proposed.

***Key words**: regional environmental network, structural elements of ecological network, objects of Nature Conservation Fund, land usage.*

***Вікторія Яворська. ТЕРИТОРІАЛЬНИЙ АНАЛІЗ СКЛАДОВИХ СТРУКТУРНИХ ЕЛЕМЕНТІВ ЕКОМЕРЕЖІ РЕГІОНУ УКРАЇНСЬКОГО ПРИЧОРНОМОР'Я.** Проаналізовано розподіл по території регіону Українського Причорномор'я одного з найважливіших елементів екомережі – об'єктів природно-заповідного фонду. Розглянуто проблеми, що виникають при формуванні екологічної мережі, пов'язані з надмірним освоєнням території. Охарактеризовано основні складові структурних елементів регіональної екомережі. Розроблено картосхему, на якій позначено райони з різною часткою територій, які можуть бути включені в регіональну екомережу. Запропоновано шляхи збільшення площі екомережі регіону.*

***Ключові слова:** регіональна екологічна мережа, структурні елементи екомережі, об'єкти природно-заповідного фонду, землекористування.*

***Виктория Яворская. ТЕРРИТОРИАЛЬНЫЙ АНАЛИЗ СОСТАВЛЯЮЩИХ СТРУКТУРНЫХ ЕЛЕМЕНТОВ ЭКОСЕТИ РЕГИОНА УКРАИНСКОГО ПРИЧЕРНОМОРЬЯ.** Проанализировано распределение по территории региона Украинского Причерноморья одного из важнейших элементов экосети – объектов природно-заповедного фонда. Рассмотрены проблемы, возникающие при формировании экологической сети, связанные с чрезмерной освоенностью территории. Охарактеризованы основные составляющие структурных элементов региональной экосети. Разработана картосхема, на которой обозначены районы с различной долей территорий, которые могут быть включены в региональную экосеть. Предложены пути увеличения площади экосети региона.*

***Ключевые слова**: региональная экологическая сеть, структурные элементы экосети, объекты природно-заповедного фонда, землепользование.*

Introduction. Currently, the absolute priority of the new strategy of planning of Ukrainian territory is to establish the national ecological network, development of which is based on a set of laws. One of them [8] provides to increase an area of ecological network to the level of 40% of the area of the country, and therefore still continues inventory of spatial resources that can potentially be used to build an ecological network.

It should be noted that the large natural-economic regions have their own regional peculiarities in formation of ecological network elements, depending on the level of safety and availability of natural ecosystems, economic and industrial development of the territory, and the level of urbanization. At the same time, existing today "Regional ecological network" in many publications is used relatively to the administrative subjects (oblast), not to the region. Such situation exists due to missing of approved official regionalization scheme of the country, which is a prerequisite for membership in the EU. In provided research the concept of "regional ecological network" was taken directly to characterize the holistic Ukrainian Black Sea natural-economic region, which consists of three administrative subjects (oblasts) – Odesa, Mykolayiv and Kherson, which in turn are forming oblasts and local ecological networks with a certain set of structural elements.

The purpose of provided research is to analyze the components of the structural elements of the ecological network of the Ukrainian Black Sea region, and to identify key measures to increase the area of ecological network in the region.

Analysis of previous researches and publications. The fundamental aspects of the formation of ecological networks written by Yu. Shelyag-Sosonko, P. Shyschenko, M. Hrodzynskiy; various aspects of the formation and development of ecological networks in the steppe zone written by I. Movchan, L. Protsenko, D. Dubina. The issues of econetwork development within the Odessa oblast were analyzed by O. Topchiev, A. Shashero, L. Platonova; within Kherson oblast – M. Boiko, D. Malchykova, V. Kolomiychuk; within Mykolaiv oblast – O. Derkach, G. Kolomiets.

Main material. The law "State Program of national ecological network of Ukraine for 2000-2015" lists territory to be used for the development of an ecological network [8]. It should be noted that not all categories of land are referred to in this Law, as for today. As it was mentioned repeatedly [3,15] in the official nomenclature of the land resources management there is no category for the lands of Nature Conservation Fund, therefore they are part of the lands of Water Fund, Forest Fund and lands of Agricultural purpose. Next informa-

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tion were taken into account according to study provided by the State Land Agencies of Mykolaiv, Odesa and Kherson oblasts, and also [5, 11, 12, 13, 15]. Current research was focused on potential regional ecological network components including sustainable land types (such as forests, pastures, meadows, wetlands, lands under wooded areas of common use) and inland waters, spa and therapeutic areas, unproductive and degraded lands, recreational areas, open lands without vegetation or with little vegetation.

The key areas of ecological network in the Ukrainian Black Sea region are 343 *natural protected areas* with a total area of 485.896 thousand hectares, which constitutes 5.62% of the entire region. But they locate uneven. For example, the highest reserve percentage, i.e. the ratio of the area of Nature Conservation Fund to total area of specific territory [7], have Berezanka, Ochakiv, Kiliya, Ovidiopol', Savran', Tatarbunary, Henichesk, Gola Prystan', Novotroitske, Skadovsk and Chaplinka districts – from 6.88% to 31.96% of the total area. Almost all of these districts, except Savran', relate to the Coastal zone, i.e. have exit to the Black and Azov Seas. The high level of wildness protection is achieved primarily due to presence of 3 biosphere reserves and 5 national parks.

Within such areas as Artsyz, Razdel'na, Snigirevka, Beryslav, Novovorontsivka, Vysokopillya, Ivanovo (Kherson oblast) are located natural protected areas of local importance, but they have very small areas, so the reserve percentage is 0,02-0,04%. Some areas have a 0% of natural protected areas, such as Krasni Okny, Lyubashivka, Reni, Sarata, Lepetykha, Verkhniy Rogachyk. Most of the districts of Ukrainian Black Sea region have a small part of natural protected areas, which ranged from 0.04 to 5.23%.

It should be noted that, according to scientifically based recommendations, in the steppe zone, which includes almost the entire territory of the Ukrainian Black Sea region, level of reservation should be at least 10%. So, the minimum required area of natural protected lands should be 863 thousand hectares. In fact, now it is 485.8 thousand hectares, although in the steppe zone is very difficult to raise an area of Nature Conservation Fund to the above mentioned level.

An important question still opened how to reserve areas for further giving them protected status. Thus, according to [10] in the Kherson oblast the area of natural lands that could be protected for natural reserves are 129 thousand hectares, in Odesa oblast – 80 thousand hectares [9]. This includes as a large land massives, such as marshes of Lower Dnieper River, lakes Yalpuh, Kitay, Kugurluy, as a small areas – slopes of river valleys, ravines, gullies, which remained the steppe vegetation. Again, without regulated usage of these areas today, tomorrow we could lose them.

The mandatory structural elements of national and Pan-European Ecological Network is international wetlands. Ukrainian Black Sea region has 14 such territories with total area of 601.5 thousand hectares [1]. Wetlands play the role of ecological corridor between the Danube and the Don rivers along the northwestern border of the Black Sea.

An important part of the ecological network is the *lands of Water Fund*, their categories regulated by the Land Code of Ukraine. In the Ukrainian Black Sea region inland waters occupy 770,580 thousand hectares or 27.68% of the land area potentially suitable for formation an ecological network. Category of open wetlands includes firth and estuary occupy a small part of territory – 124.4 thousand hectares. As for such categories of lands of Water Fund as coastal protection stripes, it is currently only started picking them out on the ground. In the Kherson oblast water protection zones compose 11.717 thousand hectares and coastal protection strips – 9.253 thousand hectares [13]; in Mykolaiv oblast – coastal protection strips 8.3 thousand hectares and water protection zones - 0.925 thousand hectares [11]; in Odesa area – water protection zones include 0.91 thousand hectares and coastal protection strips – 3.7 thousand hectares [12]. Overall allocated coastal protection strip and water protection zones include 34.8 thousand hectares. This is a small percentage - only 0.4% of the total area of the region, especially if we take into account the coastline of the Black and Azov seas and all rivers, firth and lakes in the Ukrainian Black Sea region.

Region, due to its coastal location, has large areas of *recreation and resort lands* that could potentially enter to the ecological network. Today being developed project documentation of these lands, and according to [11, 12, 13] this area are increased in 1.5 times in the last year and now stands 8 thousand hectares. But even this figure is a tiny part of the regional potential ecological network.

The problem in forming of regional ecological network is an extremely high degree of economic development of the area. Steppe is almost entirely under cultivation. According to national expert's studies, today the area of natural steppe in Ukraine is insignificant - about 1%. [6]. These are disappointing figures confirmed by data from State Land Agencies. According to Mikolaiv, Odesa and Kherson Regional Departments of Land Resources in 2013 farmlands occupied 78.13% of the region and directly arable land – 64.25% (Table 1). The maximum acceptable level of arable land is 38.2% [4]. So it should be reduced percentage of arable lands when forming ecological network in the region.

Despite the fact that in the Odesa oblast ecological network formation program adopted in 2005, unfortunately arable land does not decrease, but rather increased from 2068 thousand hectares in 2008 year to 2074.4 thousand hectares in 2012 year, while the area of hayfields and pastures decreased from 404.4 thousand hectares to 403.3 thousand hectares [12].

One of the constituent elements of the ecological network should be *recovery lands*. This category includes areas of disturbed lands, degraded and unproductive lands and lands affected by the negative processes and natural disasters such as drained swamps, degraded forests, eroded and salinated lands, meadow and steppe natural pastures, farmlands of intensive using [2]. By withdrawing these lands out from agricultural usage, it is possible to restore the natural vegetation, make renaturalization measures and then include them in the key areas of ecological network. Amount of degraded and unproductive lands in the region, can be used to reduce the percentage of arable land, currently they are consti-

tute up to 366 thousand hectares or 13.14% of the regional potential of econetwork (Table 2), open lands without vegetation – 192 thousand hectares (or 6 9%). In Odesa oblast from 84.38 thousand hectares of land that require conservation measures, at present time such measures carried out only for 0.5 thousand hectares of land. The same situation relevant for the Kherson oblast, where today conservation measures required more than 71.4 thousand hectares, but no action never organized till now [10, 12].

Table 1

Land Fund of the Ukrainian Black Sea region (thousand hectares)

Land Fund	Mykolaiv oblast	Odesa oblast	Kherson oblast	Ukrainian Black Sea region	Percentage of the total area
Total lands	2458,5	3331,4	2846,1	8636,0	100
Agricultural lands	2055,0	2660,4	2031,8	6747,2	78,13
including arable lands	1698,9	2074,4	1776,6	5549,9	64,25
including pastures and hayfields	269,3	403,3	165,5	838,1	9,7
Underwater lands	128,8	211,2	430,8	770,8	8,9
Forests and wooded area	124,2	223,9	152,0	500,1	5,79
Wetlands	21,1	72,5	29,8	123,4	1,43
Other lands	129,4	163,4	201,7	494,5	5,75

Sources: [11, 12, 13]

Table 2

Regional potential of ecological network

Administrative units (oblast)	Total area of land, thous. hectares	Area of land of Nature Conservation Fund, thous. hectares (actual)	Regional potential of ecological network: the area of land that can be used as elements of the ecological network, thous. hectares	The structure of potentially suitable lands for regional ecological network, thous. hectares (%)								Proportion of territories that could potentially be covered by ecological network, %	Proportion of Nature Conservation Fund areas (actual), % of total area
				hayfields pastures	Degraded and unproductive lands that are intended for conservation	Lands of green plantings of general use	Lands for camping, holiday homes, resort and recreational area	Open swamps and saturated land	Open lands without vegetation or with little vegetation	Inland waters	Forests and wooded area		
Odesa	3332,9	159,9	1000,2	403,3 (40,2)	67,5 (6,57)		2,70 (0,26)	72,52 (7,17)	33,14 (3,31)	211,9 (21,1)	223,9 (22,2)	**30,29**	4,8
Mykolaiv	2458,5	101,7	819,1	268,9 (32,8)	246,4 (30,0)	2,48 (0,3)	0,77 (0,09)	21,05 (2,57)	30,88 (3,77)	128,7 (15,2)	124,2 (15,1)	**33,31**	4,14
Kherson	2846,1	224,1	963,9	166,7 (17,3)	52,0 (5,4)	1,83 (0,19)	1,73 (0,18)	30,84 (3,2)	128,2 (13,3)	429,9 (44,6)	151,3 (15,7)	**33,9**	7,18
Total of Ukrainian Black Sea region	**8635,9**	**485,8**	**2783,3**	**839,0 (30,1)**	**366,0 (13,1)**	**4,31 (0,15)**	**5,21 (0,18)**	**124,4 (4,47)**	**192,2 (6,9)**	**770,5 (27,6)**	**499,5 (17,9)**	**32,22**	**5,62**

Sources: [11, 12, 13, 15]

The structure of the ecological network, which including its natural corridors and buffer zones may also include *farmland of extensive using (hayfields, pastures), open lands* and so on. Hayfields and pastures in the structure of regional ecological network potential occupy 839 thousand hectares (or 30.14%). In the region this category of lands could become a major reserve for ecological network, therefore an area of hayfields and pastures should be increased. In comparing such an indicator as the ratio of arable land to grassland areas, in EU countries, varies in fairly narrow diapason and in average equal to one, so arable lands and pastures have the same areas, but in the Ukrainian Black Sea region this indicator is equal to 0.15 (Table 1) .

Forests also are an important part of the ecological network. The total area of forest land in the region – 499,504 thousand hectares (17.94% of the area potentially suitable lands for ecological network). The largest

area of forests and wooded areas is situated in region, related to forest-steppe zone, on the north of Odessa oblast – in Anan'ev, Balta, Kodyma, Kotovsk, Savran districts, and in Tsyurupinsk and Gola Pristan districts in Kherson oblast. Nowadays, the actual woodiness of forest-steppe zone of the region is 11.8%, which is significantly less than the standard rate of 18% [14]. Therefore, for districts located in the forest-steppe zone is proposed to initiate afforestation process of degraded and unproductive lands.

Territorial analysis of the structural elements of the regional ecological network shows that the area of ecological network in the whole district can fluctuate from 5.8% (Ivanivka district of Kherson oblast) to 67.6% (Gola Pristan district of Kherson oblast). Schematic map has been developed to indicate administrative districts with low (0-25%), optimal (26-35%) and high (36-70%) proportion of areas that could be included in the regional ecological network (Fig. 1).

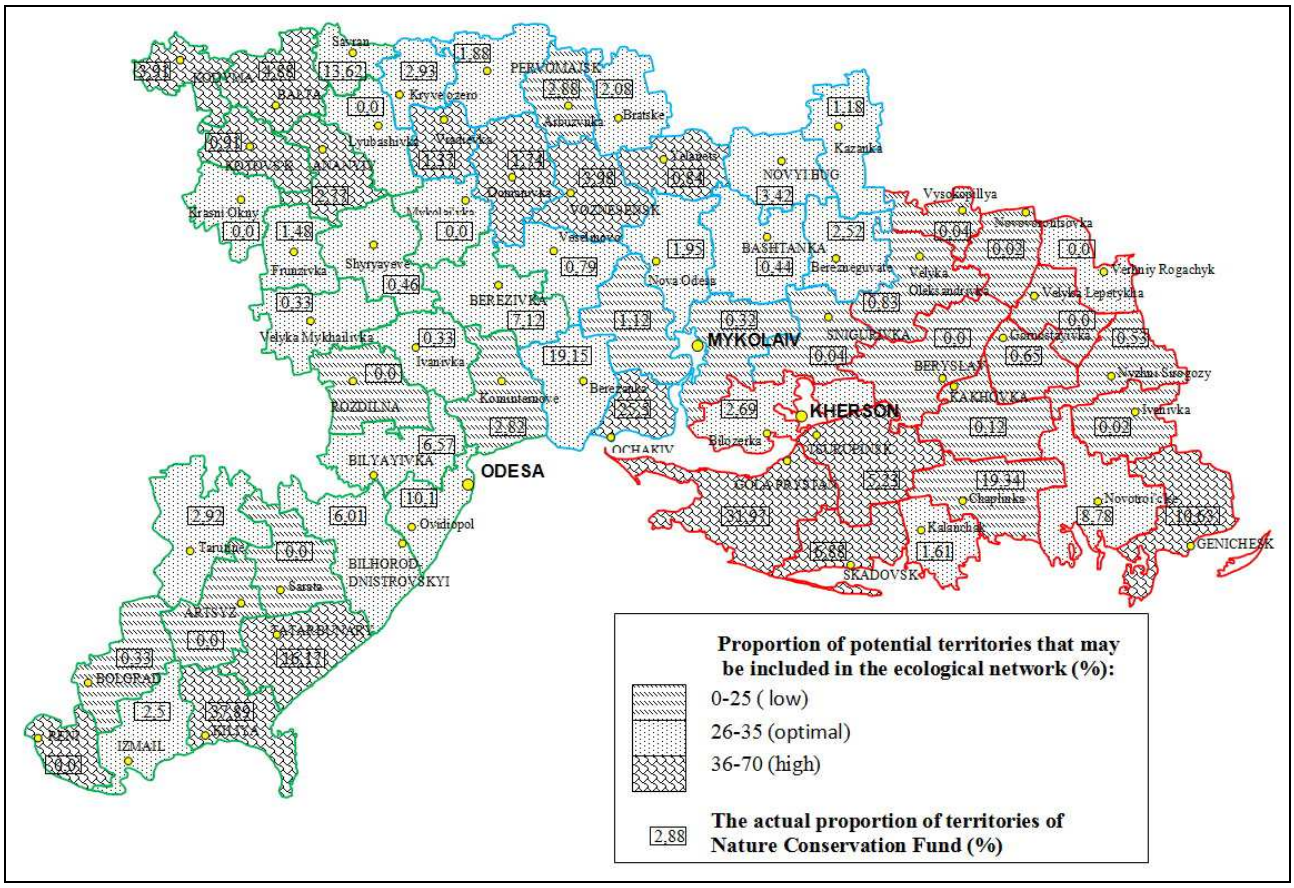

Fig. 1. Regional potential of ecological network of the Ukrainian Black Sea region

The first group of districts where potential ecological network area does not exceed 25.9% and includes 19 of the 63 administrative districts, more than half of them (10) is located within the Kherson oblast – on the central and northern part. It should be noted, that the same districts (except Chaplinka district where actual proportion of Nature Conservation Fund areas is 19.34% due to the biosphere reserve national park "Ascania Nova") has the lowest reserve percentage from 0.0 to 0.83%. This is the most arable territories within the region in which agricultural land reaches up to 93%. The basis territories for forming an ecological network in the districts are located near the Dnieper River, they are lands of Water Fund, and for the other districts of Kherson they are pastures and degraded and unproductive land that should be withdrawn for conservation.

Other 5 districts of the group are situated within the Odessa oblast – Bolgrad, Artsyz, Sarata, Razdel'na where the main component of the ecological network is pasture, and for Kominternove district, with the most anthropogenic overloaded lands – are lands of Water Fund can be significant reserve to form an ecological network. In Mykolaiv oblast, to the category of insufficient ecological network area can constitute only 4 districts: Arbuzinka – the main components of the ecological network here may be degraded lands, pasture and lands of Water Fund; Mykolaiv and Zhovtneve districts can form econetwork primarily due to pasture and lands of Water Fund, and at last, the structure of regional ecological network for Snigurivka district are pastures and degraded lands. Should be noted that in this category Arbuzinka district due to National park "Bugskiy Gard" and several local reserves as Kominternovo district due regional landscape park "Tylyguls'kiy" have the highest percentage of protected lands – 2.88% (after Chaplinka district). Unfortunately, in all other districts completely undeveloped objects of Nature Conservation Fund not succeeded at all, but potentially they can be the key areas for the development of an ecological network.

The second group being with optimal ecological

network area includes the most districts of the region - 28 of 63. Geographically they are belonging to the central part of the Ukrainian Black Sea region and 8 districts are also located within the Coastal zone. In the structure of regional ecological network potential of the central districts dominate such categories, as hayfield, pastures, forests and other wooded areas. In districts of the Coastal zone, to the ecological network, first of all, next areas could be included: lands of Water Fund, open swamps and saturated land, pastures.

The smallest *group of districts has the highest percentage* (above 36%) of the lands suitable for ecological network. Half of this districts are located within the Coastal zone - there are Reni, Kiliya, Tatarbunary, Ochakiv, Gola Prystan', Skadovsk, Henichesk and Tsyurupinsk. All these districts, except Reni, are characterized by very high rates of reserve percentage. In Reni district econetwork will be based on lands of Water Fund, which occupy almost 40% of the total area of the district. At the present time, there are proposals to expand the areas of Nature Conservation Fund, for example, include lakes Kugurluy and Kartal to the Danube Biosphere Reserve or even to create new protected area such as national park or regional landscape park.

Conclusions. Territorial analysis of the structural elements of the regional ecological network showes, that the proportion of areas that could potentially be covered by ecological network are 32.22% of the area of the Ukrainian Black Sea region. Thus there is clear visible disproportion – from very low indicators of the ecological network area in the central part of Kherson oblast to significant indicators in the forest-steppe zone and the coastal zone.

Being determined that pastures and hayfields are the main potential reserve for forming a regional ecological network. Therefore, to increase the area of ecological network it is important to implement the following actions: to increase the area of steppe, pastures and hayfields by reducing arable lands, especially within degraded and contaminated lands.

Due to specific territory of the Ukrainian Black Sea region, the lands of Water Fund are being significant reserve for the formation of regional ecological network, to speed up process for allocation of the ground water protection zones and coastal strips in order to establish corresponding rules for land usage. In addition to that such water objects like rivers, estuaries, coast lines are important acting natural corridors and at the same time they being a pass migratory routes, which fact should be to be taken into account too.

Almost all the key areas that are situated on the Coastal zone of the region are under severe anthropogenic pressure, so it is necessary to allocate of large areas for ecosystem restoration. These areas are estuary ecosystems and wetlands, and in many cases they need to recovery hydrological regime, which was disturbed as a result of drainage and building dams for the purpose of construction or agriculture.

Lands of Nature Conservation Fund currently occupy 5.62% of the region; this rate can be increased up to 7.10%, both by expanding existing protected areas and by creating new natural reserves. Authorities should pay particular attention to the districts with low indicators of potential ecological network areas. These districts usually are characterized by the absence or very small indicators of reserve percentage.

To prevent future negative impacts on ecosystems, should be given more attention to environmental management throughout the administrative and legal decisions-making process aimed at achieving environmental purposes in cooperation with ecological management of a particular company or industry that could be a source of environmental hazards.

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Summary

Viktoria Yavorska. TERRITORIAL ANALYSIS OF COMPONENTS OF STRUCTURAL ELEMENTS OF THE UKRAINIAN BLACK SEA REGION ECOLOGICAL NETWORK.

According to the new Strategy of planning of Ukrainian territory, the main priority is to develop the natural environmental safety carcass – ecological network at national, regional and local levels; identification of specific areas that are part of it, and implementation of the appropriate mode of use. In provided research the concept of "regional ecological network" was taken directly to characterize the holistic Ukrainian Black Sea natural-economic region which in turn is forming oblasts and local ecological networks with a certain set of structural elements. Regional specificity of developing an ecological network depends directly on natural factors – the presence of unmodified landscapes, biodiversity and from man-made – features of economic use of the territory and the possibilities of her environmental management. Territorial analysis of the structural elements of the regional ecological network shows, that the proportion of areas that could potentially be covered by ecological network are 32.22% of the area of the Ukrainian Black Sea region. The key areas of ecological network in the Ukrainian Black Sea region occupy only 5.62% of the total area and they locate uneven. Being determined that pastures and hayfields are the main potential reserve for forming a regional ecological network, on the second place are the lands of Water Fund. Territorial analysis of the structural elements of the regional ecological network shows that the districts have clear visible disproportion on the area of ecological network.

Key words: regional environmental network, structural elements of ecological network, objects of Nature Conservation Fund, land usage.