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Approaches to organize the econetwork of the Transnistria region in the conditions of urban landscape

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Abstract. The article focuses on the relevant topic of the development of the ecosystem consisting integral landscape formations of biocentric-network type, which has been done in many countries of Europe since the 1990s. The article emphasizes certain achievements of independent Ukraine regarding the methodological developments of the concept of ecosystem, first of all at

the national and regional levels and also the low level of its introduction at the local level. In the process of performing (based on studying foreign and domestic experiences) the scientific study of development and perspectives of the development of local ecosystem of a residential area as a basis for the regional ecosystem in the conditions of Yampil city of Vinnitsia Oblast, we determined its extremely high biotic and landscape diversities, and also the threats of its significant transformation. As an important step to prevent negative influence of agrarian activity of inhabitants of Yampil on the environment with restoration of diversity it is characteristic of, we considered the development of the city's ecosystem. The scientific substantiations made by applications of tools became the basis for the development of local ecosystem. In the developed scheme "Local ecosystem of Yampil city", we indicated the structural elements of the ecosystem, their localization, toponyms, made corresponding indications on the map and provided all its elements with descriptions. The key and connective territories of the local ecosystem of Yampil city are compartmentalized based on the adopted criteria of the selection. Their internal structures that we characterized in details allowed us to assess the special roles of the key and connective territories in the preservation of biodiversity, landscape basics of the formation and further development of Yampil city. The territories of the city which were not included in the local elements of the ecosystem are considered restorative and buffer territories within the local and regional ecological networks. The suggested scheme of the local econetwork is basic concerning the implementation of the following stages of the development of the ecosystem by composing schemes at the regional and general national levels and is the main condition for the balanced development of the Transnistria region. We obtained the results so as to preserve and effectively use the biotic and landscape diversities combined with non exhaustive use of natural resources, which is the main goal of contemporary nature use, ecological safety and nature protection. The recommendations were developed for the use of nature-protection and administrative bodies in decision making and any kind (land use, nature protection, ecological, etc) of studies.

Keywords: ecosystem, urban environment, territorial organization, nature use, biodiversity, local level, Transnistria.

Підходи до організації екомережі Придністер'я в умовах міського ландшафту

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Анотація. У статті, на основі, еколого-ландшафтного наукового підходу зроблена оцінка специфіки природокористування та умов функціонування (в тому числі відносно ступеня антропогенного впливу) на прикладі специфічного міського середовища Придністер'я – м. Ямпіль Вінницької області. Встановлено, що природні комплекси м. Ямпіль, як і Придністер'я загалом, зазнали значних змін, пов'язаних з тривалим у часі антропогенним впливом (будівництво промислових об'єктів і житла, забруднення повітря, води, ґрунтів, рослинності). Це призвело до загострення протиріч між мешканцями і навколишнім середовищем, що виражаються у виснаженні і деградації природної складової міських ландшафтів, погіршення умов проживання та зниження відтворювальної здатності середовища. Негативні зміни навколишнього міського середовища потребують розробки шляхів збалансованого розвитку території. Одним із шляхів узгодження виробничо-господарської діяльності з екологічними вимогами і обмеженнями є оптимізація співвідношення природних й антропогенних ландшафтів, яка забезпечується формуванням екомережі. У формуванні локальної екомережі м. Ямпіль вбачається найдієвіший на сьогодні механізм, який здатний забезпечити збереження і відтворення біотичного і ландшафтного різноманіття та сприятиме: дотриманню екологічної рівноваги; створенню

більш сприятливих умов для життя і розвитку місцевого населення, запобіганню безповоротній втраті частини гено-, ценофонду, екосистем і ландшафтів міста й околиць як частини Придністерської України; забезпеченню раціонального природокористування; розвитку ресурсної й рекреаційної бази для екотуризму, відпочинку та оздоровлення населення; ренатуралізації земельних угідь, що вилучаються із використання; посиленню узгодженості діяльності органів виконавчої влади, місцевого самоврядування, громадських екологічних і природоохоронних організацій у вирішенні проблем природокористування. Обраний масштаб локального рівня забезпечує достатню детальність досліджень міського середовища й оптимальну генералізацію результатів комплексної оцінки території. Логічне визначення місця локальної екомережі в екомережах вищого рівня, дає нам можливість стверджувати, що визначені нами її структурні елементи є однією з ключових їх територій, передусім, Дністровського екологічного коридору в Національній екомережі України. Тому збереження їх є завданням не лише для Ямполья, але й для усієї країни загалом.

Ключові слова: локальна екомережа, міський ландшафт, територіальна організація, природокористування, біорізноманіття, Придністер'я.

Introduction.

At the current stage of interaction between the nature and the community, especially acute is the problem of preservation of its dynamic balance. The importance of solving it is indicated by the general Assembly of the UN, the First Summit on issues of biodiversity with support of the global system of biodiversity for the period after 2020 (United Nations Summit on Biodiversity 30 September, 2020) and the report of a number of international organizations with the support of the UN (State of Climate Services 2020 Report, 2020). Having not decrying the threats of the global scale, we should note that the most intense and multi-faceted consensus of “co-working” between human and the environment is in large cities. No exception, but rather typical for the entire Ukraine, is the situation in cities of Vinnytsia Oblast (Hudzevych, 2004). In the urbanized landscape structure, which is developed on the basis of the interaction between the natural and anthropogenic subsystems, represented by structures, transportation-communication complexes, garden and park, ornamental and green and other components, the pattern of interrelations between human community and the environment is seen more notably and informatively than in any other place. Technogenic transformations of urban systems provide comfort and amenities to the inhabitants and at the same time serve hallmarks as shockingly disturbed environments. Excessively altered technogenic environment needs timely attention and action aimed at its rational organization (Hudzevych, 2012).

Researchers and practitioners (Voropaj, 1982; Tyutyunnik, 1991; Klieshch, Maksymenko, 2020) focusing on different aspects (economic, social, ethnic, nature-protection) of anthropogenic-technogenic environment point out imperfect pattern of urban development, which, in their opinion, directly affects the ecology and takes negatively impacts on the health of the population. Among other things, it comprises the use of physical-geographic and bioecologic approaches to define the territorial parameters of optimum condition of green zone of large cities, peculiarities of their functioning (Savytska, 2003), etc. One of the promising measures aimed at providing balanced development of urban territories is the ecological network (hereinafter – econetwork), which, unlike the already created and successful ongoing programs in Europe (EECONET, EMERALD (Emerald network),

NATURA-2000, networks of biosphere and biogenic reserves) is legally supported in Ukraine (Vashchyshyn, 2014). Conceptually, this idea is related to the notions of stability, resistibility and capacity.

With the adoption of Law of Ukraine “On the General Scheme of Planning of the Territories of Ukraine” (07.02.02. № 3059-III) and Resolution of the Cabinet of Ministers of Ukraine “On Provision of Implementation of Law of Ukraine “On the General Scheme of Planning of the Territories of Ukraine” (29.08.02. № 1291), the development of ecosystem was included in the General Scheme of Planning Territories in Ukraine, which according to Article 1 of Law of Ukraine “On Planning and Development in Territories” (20.04.2000 № 1699-III) determines conceptual solutions of planning and use of the territories in the country. In turn, it was reflected in Law “On Protection of Lands” (19.06.03 № 962-IV). Development of ecosystem is included in the system of measures in the sphere of land protection (Article 22) and recognized as a measure of protecting lands of various categories (Article 50 and others).

Theoretical and practical provisions of the future ecosystem of Ukraine, taking into account the experience of development of national ecosystems in the European countries, are described in numerous publications (Hrynevetskyi, 2002; Rozbudova ekomerezhi Ukrainy, 1999; Shelyag-Sosonko Yu. R., Grodzinskij D. M., Romanenko, 2004 et al.). According to planners, basic elements of econetwork should be natural centers, buffer zones, ecological corridors, territories that are being restored, and territories of natural development. According to them also, the objects are defined as territories that are rich in biodiversity, or appropriate for combining centers of biodiversity in case of favorable development of environment-restoring functions of quasi-natural condition. This indicates that the strategic direction of implementation of the concept is solving two important tasks within the framework of protection of the natural wildlife (natural centers, buffer zones, ecocorridors) and taking care of the environment (restorative territories and territories of natural development) as the habitat for human life, focusing on high-quality condition of the environment to improve the health of the population. In their continuous integrity, they make up an eco-

network that functionally unites centers of diversity into an integral continental and water area system of various hierarchical levels: biosphere, all-European, National, Regional and Local.

It has to be noted that the opportunities of integrating urban systems into econetworks (locals, regional or other levels) are usually not taken into account, or considered at the level that is far from satisfactory, because the modern tendencies of the development of ecosystem use “green circles” of cities to travel around them. Therefore, to justify them, it is important to create local ecosystems within settlements at the lowest, i. e. local, level (Hudzevych, 2008). The implementation of this approach is relevant for the territory of Transnistria, particularly residential area of Yampil city, due to its location within the international Ukrainian-Moldovian Dniester (Dnistersky) ecocorridor.

The objectives of the study were Yampil city of Vinnytsia Oblast and its suburbs. The subject of the study was natural specifics of urban and suburban environment (object of nature-reserve fund; aquatic objects, wetlands, protected wet areas, protective bank belts; forests of various groups; recreational territories; other nature territories, including hayfields, meadows, pastures; areas with species of animals and plants of the Red Book of Ukraine; groups from the Green Book of Ukraine), as the main structural elements in the local ecosystem of Yampil.

The goal and purpose of the study were the geographic analysis of the constituents, development and prospects of development of the local ecosystem of the residential area as the basis for development of the regional ecosystem.

To achieve these goals we solved the following tasks:

1. Characterizing the peculiarities of natural geographic, biotic and landscape components of the territory of the study;
2. Determining the directions of nature use and the most notable anthropogenic changes and determining potentially appropriate lands to develop the local ecosystem of local residential area;
3. Proposing the scheme of ecosystem in Yampil based on geographical analysis of residential territory;
4. Identifying the significance of local ecosystem of Yampil in the regional and national models of ecosystem and modeling it on the example of territory of Yampil district and trans-border territory.

Materials and methods of study.

Study of the opportunity of creating the local network of Yampil was consistent with the Laws of Ukraine “On Ecological Network of Ukraine” (N 1864-IV of 24 June 2004) and “On National Programm of development of National Ecological Network of Ukraine for 2000–

2015” (N 1989 of 21 September of 2000) and carried out taking into account the positions of Laws of Ukraine “On Protection of the Environment”, “On Nature-Reserve Fund of Ukraine”, “On Fauna”, “On Flora”, Land, Forest and Aquatic Codes of Ukraine, Decree of President of Ukraine of 23.05.2005 № 838/2005 “On measures for the further development of nature-protection in Ukraine”, Decree of the Ministry of the Environment in Ukraine of 13.11.2009 № 604 “On approval of Methodic Recommendations for Development of Regional and Local Schemes of Econetwork”. We took into account the other normative legal acts that are also related to creation, management and monitoring of the National Ecosystem of Ukraine: “On the basics of Urban Development”; “On land management”; “On local government in Ukraine”; Water and Land Codes of Ukraine, etc, and also strategic and program documents mentioned above.

To solve the complex issue of protection of landscape and biotic variety, Vinnytsia Oblast has enough experience of planning the use of land in its territory (Yatsentiuk, 2011; Hudzevych A., Liubchenko, Bronnikova, Hudzevich L., 2020; Hudzevich, Nikitchenko, Baiurko et al., 2020; Hudzevych A., Hudzevich L.,

Nikitchenko et al., 2021). Study of development of ecological network in Yampil is determined by a number of strategic and program regional documents, particularly “Regional Program Econetwork in Vinnytsia Oblast in 2004–2015”, “Regional Program of Protection of the Environment and Rational Use of Nature Resources for 2013–2018”, “Strategy of Balanced Regional Development in Vinnytsia Oblast for the period of 2020”, “Complex program of creation and development of geoinformational system of management and urban development of the cadastre of Vinnytsia Oblast for 2016–2020”, “Oblast Program of the Development of Forest and Hunting grounds in forests provided for regular use to Vinnytsia Oblast Specialized Forestry Vinoblalagrolis, increase in forest coverage and greening of settlements in the Oblast and use of objects of global fauna in cultural-educational and pedagogical goals for the period of 2017–2021”, “Regional Ecological Budget Program for 2019–2023”, “Oblast Program of achieving optimum level of forest coverage in Vinnytsia Oblast for 2012–2025”, “Program of development of tourism in Vinnytsia Oblast for 2021–2027”.

Methodological basis of the conducted study was the International strategy of sustainable development, basic principles of which are defined in the Declaration of the International Conference of the UN on the environment and development in Rio Declaration in 1992. Furthermore, the work used methodologic approaches that were approved by the Resolutions of the European Union on preservation of wild birds (Council Directive 79/409/EEC on the conservation of wild birds) and preservation of

natural environments of wild fauna and flora (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora); described in the articles (Pashchenko, 2004; Samoilenko, Korohoda, 2013); recommendations (Formuvannia rehionalnykh skhem ekomerezhi, 2004), including the ones approved by the Ministry of Nature of Ukraine (Tymchasovi metodychni rekomendatsii shchodo rozroblennia skhem rehionalnoi ekomerezhi, 2006 p.; Pro zatverdzhennia metodychnykh rekomendatsii shchodo rozroblennia rehionalnykh ta mistsevykh skhem ekomerezhi, 2009 p.). The indicated methodological recommendations were suggested for the development of regional and local schemes of econetwork, they are recommendations prepared to provide help to territorial bodies of Ministry of Nature during projecting regional and local schemes of econetwork. Their fulfillment included combination of the following methods and approaches to the organization: analysis of archival and normative legal sources, materials of hydro-meteorological observation, transport organizations, forest- and land development, department of architecture; laboratory work focusing on herbarium and collected material; route field expedition surveys of residential areas and their surroundings (substantiated biogeographic study, landscape survey, ecopathological survey, monitoring transportation, etc); collection of corresponding field and material for the study, cartographic analysis, analysis of the obtained practical data with the purpose of theoretic generalization and development of the scheme of local econetwork.

Collection and analysis of the initial data on opportunity of developing a scheme of local econetwork of the residential area of Yampil were used in the 2017 survey (Vyhotovlennia proektu ekomerezhi m. Yampil, 2017).

Results and their analysis.

The surveyed territory was an interesting nature-territorial complex composed of urban settlement of a district significance – Yampil city and its suburbs, the administrative center of Yampil district of Vinnytsia Oblast since 1932. Since the new administrative territorial organization in Ukraine has been adopted and the Resolution of the Parliament of Ukraine “On creation and liquidation of districts” of July 19 2020 implemented, Yampil is subordinated to Mohyliv-Podillia district of Vinnytsia Oblast. The city founded in the second half of the XVI century borders with Moldova on the left bank of the Dniester river and lower current of its tributary – the Rusava river.

According to geobotanical zoning, the surveyed territory belongs to the European broad-leaved region, the Podillia Besarabian Province, Vinnytsia (Central Podillia) county, Right Bank-Dnipro forest-steppe province (Didukh, Sheliah-Sosonko, 2003). The preserved natural forest-steppe vegetation has been altered in the

conditions of high anthropogenic activity and is now represented by modified forest, meadow and aquatic-wetland groups.

The results of field surveys indicate specificity of the vegetation in the local residential area, mainly composed of near-river and near-road alley greenings in the streets. In the areas around the stream, there grow thickets of willow-oak and willow-acacia (grey willow *Salix cinerea* L., goat willow *S. caprea* L., sharp-leaf willow *S. acutifolia* Willd.; common oak *Quercus robur* L.; acacia yellow *Caragana arborescens* Lam. and acacia white *Robinia pseudoacacia* L.). In the floodplain part – true and waterlogged valley meadows and fragments of lowland herbaceous wetland. On the banks of the Dniester and its shallows, there are thickets of green algae (Entheromorpha and others), and also plots with higher vegetation developed by formations of rdest or water cabbage (rdest shiny *Potamogeton lucens* L. and rdest curly *P. Cricpus* L.), hornwort (*Ceratophyllum demersum* L.) and arrow head ordinary (*Sagittaria sagittifolia* L.).

Vegetation in the city and the suburbs is distinct by its complexity due to uneven moisture in the territory, microrelief and pattern of development, first of all residential and agricultural, by contrast to the Rusava right bank in the outskirts with hilly terrain. Not to mention other factors, just artisanal crafting from “stone” and private constructions in the XX – early XXI century were enough to significantly alter its nature. This led to emergence of depressions in the natural tree and herbaceous-shrub landscape of the Rusava hills, accompanied by disturbance of vegetation by irrational grazing (excessive). Capacity of the pastures was small, suitable for 0.2–0.3 individuals of cattle per one hectare according to optimum assessments. Small pastures within the slopes and floodplain and above-floodplain terraces of the Rusava and Dniester are too small for the population of goats (*Capra hircus* L.) that are grazed there.

A distinct trait of the vegetation in the city is that it is distributed in “islands” of tree-shrub vegetation which now occupy small areas and are often isolated one from another by structures and agricultural lands. They may be used as basis for developing park and aqua park recreational territories. The area of greenings of general use in the city equals 52.7 ha, which is around 9m² per one inhabitant, the norm being about 17m². The greenings include the local park, park squares, alleys, green zones, zones around the stream beds of the Rusava and Dniester, etc. Their development has begun in the late 1950s. In the village streets back then, dozens of thousands ornamental and fruit-bearing plants have been planted, which became the basis of the current green “dress” of Yampil.

We have to note the special significance of the green zone of the municipal institution of the central dis-

trict hospital (Yampil district medical center of emergency treatment – Pirohova st, 1). Among the typical leaved plants (common oak *Quercus robur* L., small-leaved linden *Tilia cordata* Mill., European ash *Fraxinus excelsior* L., sharp-leaved maple *Acer platanoides* L. and ash-leaved A. *negundo* L.) and coniferous species (European spruce *Picea abies* L. and silver spruce *P. pungens* Engelm., Scots pine *Pinus sylvestris* L.), there grow ornamental plants (white fir *Abies alba* Mill., juniper – Cossack juniper *Juniperus sabina* L., common juniper *J. Communis* L. and Irish juniper *J. Hibernica* L.) that serve as a shelter for representatives of fauna. Currently it is an example of optimization of species diversity, first of all, tree and shrub vegetation in the conditions of technogenic environment.

Recreational zone of the city was formed on the basis of the existing green plantations adjacent to the city from the side of Rusavy village, towards Halzhbiivka and the city park along the Dniester. The largest areas are located in the north (area around the railway station, streets Vynohradna, Nova Lisova, Horihovala, Cheresheva, Lomonosova, Haidamatska) and north-west district (streets Kovpaka and Zhukova). Currently these territories are not used for their purpose and are considered potentially appropriate for constructing private homes. Only over the recent ten years, massive private construction and complexes of garden landlords have emerged in the territory of former vine gar-

dens and fruit garden, in the district of streets Nova Yablunova, Zhukova, Haidamatska. Furthermore, individual constructions, massively and chaotically in many cases, have recently been made in territories in different parts of the city.

Over the recent decades, the condition of greenings in Yampil has deteriorated, and the amount of green zones reduces. First of all, this is the result of construction of private homes and the infrastructure of the city and irrational measures for support and monitoring of greenings, which does not provide sufficient conditions for growth and development of plants. On the other hand, there is the climate change and therefore intensification of extreme weather phenomena (storms, droughts, glaciations, etc), as well as a nature-protection culture of the population. At the same time, negative tendencies are most notable in green zones around houses and roads, alleys and small garden squares.

According to the zoogeographical division (Shherbak, 1988), the territory of Yampil and its suburbs is within the Boreal European Siberian subregion, European West Siberian province, East European county, area of mixed, leaved forest and forest-steppe, Dniester-Dnipro area. Significant anthropogenic impact led to losses of many species, and a significant amount of them is identified to rare and is included in various nature-protection lists (Table).

Table. Rare species of animals

Class of animals	Species of animals	International list	Рівень загрози для тварин*
Insects	great capricorn beetle <i>Cerambyx cerdo</i> L.	IUCN Red List	VU
	red wood ant <i>Formica rufa</i> L.		LR 3
	emperor dragonfly <i>Anax imperator</i> L.	Red Book of Ukraine	RBU – VU
	European stag beetle <i>Lucanus cervus</i> L.		(RBM – EN, RBU – EN)
	mammoth wasp <i>Scolia maculata</i> Drury		RBM – EN, RBU – EN
	southern festoon <i>Zerinthia polyxena</i> Denis		RBM–CR, RBU – EN
	Jersey tiger <i>Callimorpha quadripunctaria</i> Poda		RBM–VU, RBU – EN
	Old World swallowtail <i>Papilio mahaon</i> L.		RBM–VU, RBU – EN
	European mantis <i>Mantis religiosa</i> L.		RBM–VU
	giant peacock moth <i>Saturnia pyri</i> Schiffermuller		RBM – EN
Birds	corn crane <i>Crex crex</i> L. **	IUCN Red List	NT
	common pochard <i>Aythya ferina</i> L. **		NT
	ferruginous duck <i>Aythya nyroca</i> Guldenstadt ***		NT
	pygmy cormorant <i>Phalacrocorax pygmaeus</i> Pallas©		NT
	lesser white-fronted goose <i>Anser erythropus</i> L. ±		VU
	greater spotted eagle <i>Aquila clanga</i> Pallas ±		VU
	red-breasted goose <i>Branta ruficollis</i> Pallas ±		VU
	great bustard <i>Otis tarda</i> L.±		VU
	pallid harrier <i>Circus macrourus</i> Gmelin±		NT
	mute swan <i>Cygnus olor</i> Gmelin **	Red Book of Ukraine	RBM–VU
	European honey buzzard <i>Pernis apivorus</i> L. **		RBM – EN
	stock dove <i>Columba oenas</i> L. **		RBM – EN
	whooper swan <i>Cygnus cygnus</i> L. ***		RBM–VU, RBU – EN
	common goldeneye <i>Bucephala clangula</i> L. ***		RBU – VU

Class of animals	Species of animals	International list	Рівень загрози для тварин*
Birds	short-eared owl <i>Asio flammea Pontoppidan</i> ***	Red Book of Ukraine	RBM – EN
	little egret <i>Egretta garzetta</i> L.©		RBM–CR
	golden eagle <i>Aquila chraesaetos</i> L. ±		RBM–CR, RBU – VU
	black stork <i>Ciconia nigra</i> L. ±		RBM–CR, RBU – EN
	hen harrier <i>Circus cyaneus</i> L. ±		RBM–CR
	Montagu's harrier <i>C. pygargus</i> L. ±		RBM–CR
	osprey <i>Pandion haliaetus</i> L. ±		RBM–CR, RBU – VU
	saker falcon <i>Falco cherrug</i> Gray ±		RBM–CR, RBU – III
	white-tailed eagle <i>Haliaeetus albicilla</i> L. ±		NT
Mammals	pond bat <i>Myotis dasycneme</i> Boie	IUCN Red List	VU
	forest dormouse <i>Dryomys nitedula</i> Pallas		LR
	Eurasian otter <i>Lutra lutra</i> Brisson		NT
	European badger <i>Meles meles</i> L.	Red Book of Ukraine	RBM–VU, RBU – EN
	European pine marten <i>Martes martes</i> L.		
Reptiles and amphibians	European tree frog <i>Hyla arborea</i> L.	IUCN Red List	NT
	European pond turtle <i>Emys orbicularis</i> L.		LR
	garlic toad <i>Pelobates fuscus</i> Laurenti	Red Book of Ukraine	RBM–CR
	agile frog <i>Rana dalmatina</i> Bonaparte		RBU – VU
	smooth snake <i>Coronella austriaca</i> Laurenti		RBM – EN, RBU – EN
Fish	ide <i>Leuciscus idus</i> L.		VU
	common barbel <i>Barbus barbus</i> L.		RBM – EN, RBU – EN

*Categories of species under threat: CR – critically endangered, EN – endangered, VU – vulnerable, LR – lower risk, Nt (or LR / nt) – near threatened.

nesting; * overwintering; ©oversummering; ±migrating

Nature observations revealed that wildlife of the city and the outskirts is the reflection of climatic, vegetative and in particular environmental (land, water bodies) conditions. Therefore, the fauna of hydrobiota is represented by broadly distributed species of Gastropoda and Bivalvia mollusks *Theodoxus fluviatilis*, *Viviparus viviparus*, *Dreissena polymorpha*; larvae of insects range Trichoptera – of streams, Plecoptera – freckle, Ephemeroptera – one-day; Crustaceans, both lower (orders *Amphipoda*, *Isopoda*, *Copepoda* and others) and higher representatives of order *Decapoda*. Broadly distributed are Oligochaeta *Nais communis* and larvae of Chironomidae.

Bank and slope-ravine natural complexes with domination of stepped vegetative and shrub groups are habitats for rare and threatened species of vertebrates: amphibians (green frog *Pelophylax lessonae* Fizinger), reptiles (common European adder *Vipera berus* L., snakes – ordinary *Natrix natrix* L. and water snake *N. tessellata* Laurenti). Near the islands and meanders of the Dniester where the current of water is weak, there occurs European marsh turtle (*Emys orbicularis* L.). Among agrocoenoses, there are mainly steppe areas, which are adjacent to the upper part of the forested slopes, inhabited by the lizard is agile (*Lacerta agilis* L.).

Diverse conditions of Yampil and its suburbs are optimum for nesting to a great number of birds. Most often, there are seen, both flying and at the nests, species of detachment Sparrows ((common starling *Sturnus vulgaris* L., Eurasian tree sparrow *Passer montanus*

L., European goldfinch *Carduelis carduelis* L., field skylark *Alauda arvensis* L., Eurasian golden oriole *oriolus oriolus* L.). There is a quite large amount of representatives of families Raven (gray Raven *Corvus cornix* L., common raven *Corvus corax* L.) and Picidae (great spotted woodpecker *Dendrocopus major* L., lesser spotted woodpecker *Dendrocopus minor* L.). There were seen nesting storks *Ciconia ciconia* L., and also some species of diurnal birds of prey of Falconiformes order and representatives of nocturnal birds of prey of Strigiformes order (long-eared owl *Asio otus* L. and little owl *Athene noctua* Skopoli).

West of Yampil, in the valley of the Dniester, there are wetlands (5,394.28 ha) that are protected by the Ramsar Convention. Many birds use these areas to nest, overwinter or stay before the flight for wintering, particularly mallard *Anas platyrhynchos* L., common coot *Fulica atra* L., common goldeneye *Bucephala clangula*, mute swan *Cygnus olor*, whooper swan *Cygnus cygnus*, *Mergus* – common merganser *Mergus merganser* L., red-breasted merganser *M. serrator* L. and smew *M. albellus* L., tufted duck *Aythya fuligula* L., Eurasian wigeon *Anas penelope* L., greylag goose *Anser anser* L., *Ardea* – grey heron *Ardea cinerea* L. and great egret *A. Alba* L. Among those birds, there are lesser white-fronted goose *Anser erythropus* L., ferruginous duck *Aythya nyroca* Gueldenstadt, white-tailed eagle *Haliaeetus albicilla* Pallas, greater spotted eagle *Aquila clanga* Pallas, great bustard *Otis tarda* L., included in the Appendix I of the Convention of Protection of Migrating Species of Animals, and al-

most all of them are in the list of species strictly protected by the Berne Convention (for example, little grebe *Tachybaptus ruficollis* Pallas, little egret *Egretta garzetta*, white stork *Ciconia ciconia*, smew *Mergus albellus* L., common sandpiper *Actitis hypoleucos* L.). Some rare species regularly overwinter in the area: common merganser *Mergus merganser* L. (RBM – DD), red-breasted merganser *Mergus serrator* L. (RBU – EN) merlin *Falco columbarius* L. (RBM – DD) (Matviichuk, Pirkhal, Reminnyi, 2015).

In the bend of the Dniester River, the rocks of the Cretaceous marlstones (near the cave complex of Oksanivka village) are the nesting places of the colonies of wild ducks and swans. In some caves and natural recesses of the canyon, wild birds of Accipitridae family are nesting. There also occur swallows, hoo-poes, crows, eagle-owls.

Birds of wetlands concentrate mostly in the zones of shallow water and places where the Dniester flows slowly: the extension of the river stream bed, area of its bends, recreation zones near the alluviums, formed by the Murafa and Rusava tributaries. There are more of such places in the western suburban part of the city on the left bank of the river. Nonetheless, the diving ducks and Old World cormorants are not that attracted to such plots. Birds gather to rest on the sandspits, the shallow water areas, which become exposed from time to time, piles of rocks, trunks of fallen trees in the areas with any current speed. In winter, the birds are concentrated in non-freezing shallow water areas of the river, and diving species in deep water areas where they feed. Therefore, they may occur right near the city, which is rarer in other seasons.

Indirect signs such as traces to burrows indicate presence of such mammals as European hare (*Lepus europaeus* Pallas), red fox (*Vulpes vulpes* L.), European badger (*Meles meles* L.), least weasel (*Mustela nivalis* L.). Rarely there occur reports of wild boar (*Sus scrofa*

L.), roe deer (*Capreolus capreolus* L.), muskrat (*Ondatra zibethicus* L.) and Eurasian otter (*Lutra lutra* Brisson).

Biodiversity of ichthyofauna of the Dniester and the areas adjacent to Yampil is characterized by the effect of artificially created dams of the Dubăsari Dam and Novodnistrovsk Hydroelectric Power Station which completely exclude the opportunities of migration for species of fish (catadromous, straddling): representatives of sturgeons *Acipenseridae*, *Clupeidae*, freshwater eels *Anguillidae*. Aquatic animals are especially vulnerable, both invertebrates and vertebrates, in the periods of reproduction, spawning, when they need stable abiotic factors (temperature, pH, salt content, speed and level of water, presence of suspensions in the form of slit-sandy components, etc). Unfortunately, the period of reproduction of aquatic animals coincides with the spring high water, when the dams cause intense water discharges, thereby taking an extremely negative effect on the following course of reproduction and preservation of species.

At the same time, in the Dniester and the mouth of the Rusava, there often occur common roach (*Rutilus rutilus* L.), common bream (*Abramis brama* L.), common bleak (*Alburnus alburnus* L.), common carp (*Cyprinus carpio* L.), Prussian carp (*Carassius gibelio* Bloch), European perch (*Perca fluviatilis* L.), pike (*Esox lucius* L.), common rudd (*Scardinius erythrophthalmus* L.), common chub (*Squalius cephalus* L.), gudgeon (*Gobio gobio* L.) and others.

In the landscape aspect, the area is characteristic of floodplain and above floodplain-terrace loess plains. Their natural appearance had been lost, as well as attractiveness and esthetic value. The destructive factors are the use of the subsoil and extraction of construction materials by open method both by individuals and companies, construction of roads, high voltage power lines, pipelines and structures (Fig. 1). There are all kinds of chemical and physical pollutions: wastes of

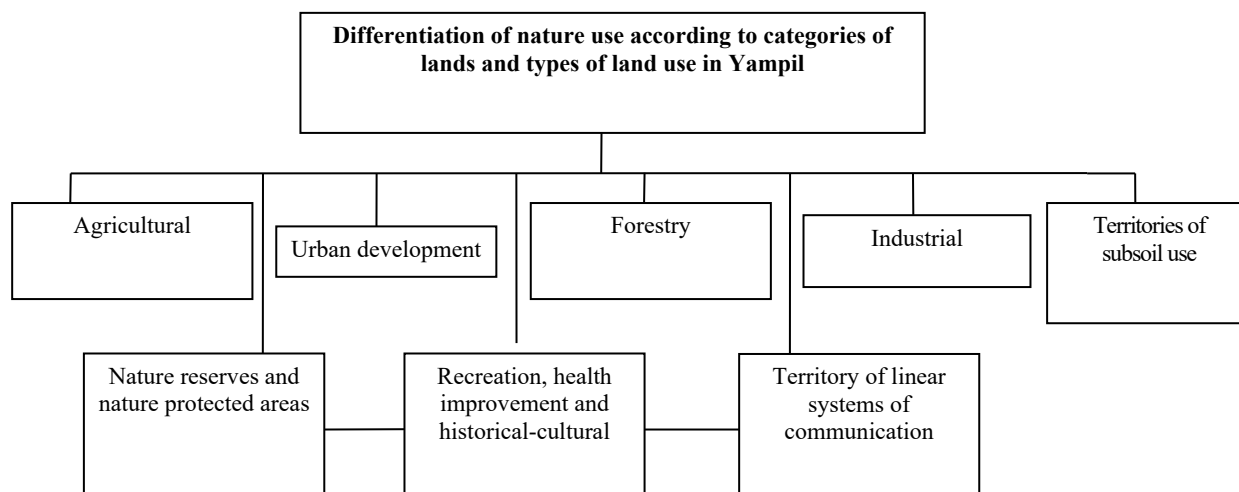


Fig. 1. Directions of nature use in Yampil

industrial and agricultural activities, traces of fertilizers and pesticides.

Most notable changes in anthropogenic load are as follows:

- Changes in landscapes and loss of attractiveness of notable places (for example changes in the lower mouth part of the Rusava river and vanishing of the natural tributary near the current city park).

- Decrease in the esthetic attractiveness of herbaceous-shrub slope areas of the northern outskirts of the city due to loss of natural appearance as a result of irrational nature use (private mining, massive construction, etc);

- Decrease in the esthetic attractiveness of slope and floodplain and above floodplain herbaceous groups due to decrease in bright flowering plants and insects (butterflies) and impact of degradation;

- Obvious changes in the stream bed of the Rusava, decrease in the thickets around the river.

At the same time, the threats increase the significance of the protection of natural complexes of the region of study, the need in which is indicated by:

- significant decrease in bioproductivity of forest and pasture ecosystems;

- changes in the opportunities for growing some species and many varieties of agricultural crops;

- reduction of resistibility of the areas with trees (sessile oak *Quercus petraea*, ash, hornbeam, and others), especially those that are young and those that originated from alien species (black locust, Scots pine and *Pinus nigra*);

- optimization of the structure of natural ecosystems and unfavorable changes in the ratio of open and vegetation-covered areas, decrease in water protection function of shrubs and trees;

- intensification of displacement of aboriginal species by aggressive alien species such as *Ailanthus*, box elder *Acer negundo* and emergence of plant species which are new to the territory, mostly weed aggressive invasive species;

- likely disappearance of some large birds of prey, birds of open areas and species that live in the southern borders of the range;

An important condition is that vulnerable environment is poorly protected by the traditions and laws.

Decrease, prevention and liquidation of negative impact of agricultural and other activities of Yampil on the environment, as well as preservation of natural resources, genetic fund of wildlife may be promoted by development of the city's econetwork. First of all, it manifests in changes in the structure of land fund of the city through identification (based on substantiation of ecological safety and economical expedience) of some agricultural lands to categories that require special protection with restoration of the diversity they are

characterized by such an approach correlates with the modern views of researchers, according to whom, the econetwork should be developed on the basis of optimization and re-naturalization (naturalization) of anthropogenically modified geosystems, first of all landscapes (Buček, 2013; Moyzeová M., Kenderessy P., 2015] where biotic component is considered a stabilizing factor providing ecologic balance.

As of 01.09 2020, the general area of lands of the city council accounted for 2,546. 0 ha. Quite a significant part is occupied by lands of agricultural use – 1,698.85 ha (63.92 % of the total area).

According to our estimations, the promising econetwork of Yampil may include:

- forest and other forest-covered areas – 279.0 ha;
- degraded lands – 8.2 ha;
- low-productive arable lands – 249.55 ha;
- multi-years plantations (gardens) – 152.25 ha;
- pastures – 13.4 ha;
- greeneries of general use – 93.1 ha;
- gullies and steep slopes – 4.75 ha;
- areas of aquatic fund – 86.5995 ha;
- lands used for recreation and other open areas (including cemeteries) – 11.2783 ha;

To create a substantial buffer zone, the lands of the econetwork should include arable lands of the store – 35.3 ha and lands of the reserve – 102 ha. Thus, the overall area of the lands included in the network by the city council accounts for 1,035.43 ha, i. e. 40.67 % of its overall area (2546.0 ha).

Traditional methods of forming elements of the ecosystem are based on unification of already existing objects of the nature reserve fund (Shelyag-Sosonko, Grodzinskij, Romanenko, 2004) that usually are the basis for the biocenters at any level of National Econetwork. In the conditions of functioning nature-reserve objects, their contours automatically result in configuration of key territories of the econetwork. Unfortunately, within Yampil, there is only one nature protection area – the Yampil Layers – geological nature relic of local significance (Fig. 2), the area of which equals 0.05 ha. The projected spatial-functional structure of the local Econetwork of Yampil comprises natural (location of key territories, hydrographic network of the city, presence of forest and herbaceous and shrub areas, etc) and social conditions (residential area and industrial constructions, etc). Hierarchic structure of Yampil econetwork (Fig. 2) consists of 4 key territories (all of local significance), 36 connective territories (including 1 of International, 2 – National, 1 – Regional and 32 Local significances). The key and connective territories of local econetwork of Yampil are compartmentalized based on the adopted criteria of selection and are indicated on the map (Fig. 2).

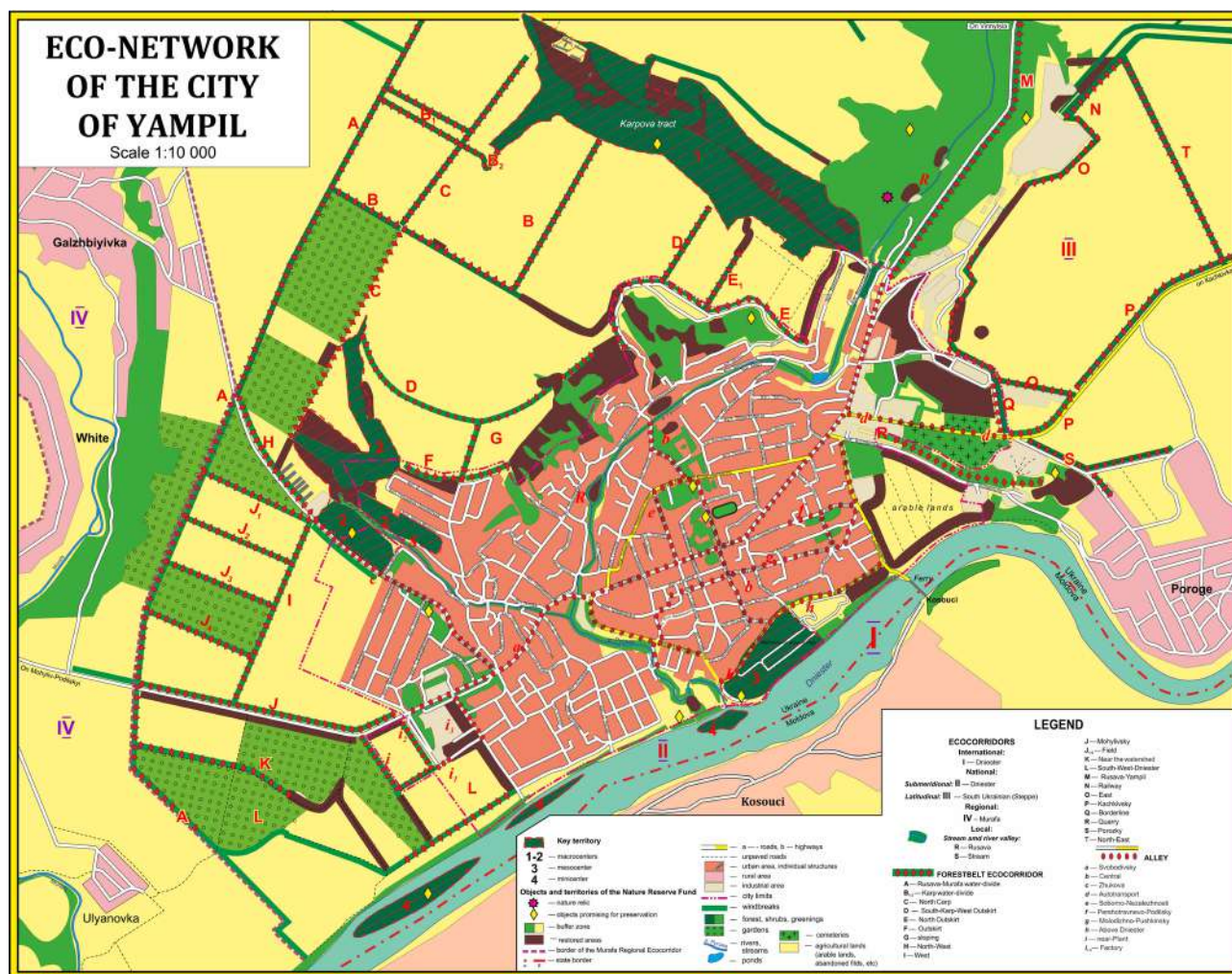


Fig. 2. Project of econetwork of Yampil

The map of promising econetwork has been developed first of all based on visual observations and expedition surveys of the territories, by indicating the key, buffer and restoring territories on the maps. To develop it, we used topographic maps of the area, aerial photographs, schematic maps of soils, localities of rare species and plant groups; maps of various scales (general geographic, tectonic and geological structure, climate). We employed fund materials of services of the city council, geobotanical materials of forest management, state service of the nature protection in Vinnytsia Oblast and other available materials.

Using the qualitative background method, we indicated: the main elements (key, connective, buffer, restoring territories) of the local econetwork; natural and anthropogenized territories and objects, particularly: individual categories of lands (arable lands, fallow lands; lands with constructions, city and village development, lands of industrial objects); windbreaks; types of vegetation (forest, turf-shrub); hydronetwork (river valleys, ponds), industrial and transport infrastructure (roads, highways and soil and field roads), etc.

- Furthermore, the integrated map indicates nature-protected objects and promising reserve territories, including linear: street network; city borders; State border and the border of the Murafa ecocorridor of Regional Value.

- For better visualization, the key elements of the local econetwork are hatched.

- The structural specifics of the projected local econetwork should include:

- its relative easiness due to significant development and constructions in the territories;

- presence of four key territories (2 macrocenters, 1 mesocenter and 1 mini center) that represent landscape and biotic diversity of the studied territory;

- presence of distinct ecocorridors – the core Rusava and supporting Dniester ecocorridors. The latter is a contact element of the local econetwork of the city and regional, National and trans-national econetworks;

- Proximity to the Murafa ecocorridor of the Regional Level;

- Distinct expression of “protection” of the key territory of the Dniester Islands and the northwest part the Karpova Tract and slight expression of this aspect

around the natural center the Northern Outskirts and the Rusava ecocorridor in the most part of its strike;

- Presence of eleven elements of econetwork within the territories and objects promising for protection which would increase the effectiveness of the econetwork.

No doubt, the Yampil local econetwork is a component of the ecosystems of a higher level – International, National and Regional. First of all, it requires correlation with the regional one, development of which is currently still underway. Nonetheless, some of its main structural elements are already determined by the Decision of Session 10 of Vinnytsia Oblast Administration VI convocation № 282 from February 14 2012 when there was adopted the Regional Scheme of the Oblast Econetwork and which enable the corresponding allocation. Therefore, in the west, the lands of Yampil directly border with the basin of the Murafa river, the valley of which is a regional ecological corridor that is connected with the sub-meridian Dniester ecocorridor in the north and forms one of the three National nature centers of Vinnytsia Oblast – the Dniester-Murafa. In the north, it connects to the regional landscape park Murafa. The latter, having the area of 3,452.7 ha, was created in 2008 in the territories of Chernivetska and Mohyliv-Podillia districts of Vinnytsia Oblast. It comprises the alley of the Murafa river from the urban settlement Chernivtsi to Sloboda-Bushanska village, the lower part of the valley of the Lozova river, the Vazlui river and the Haidamatsky gully in the Bushanka river.

The Rusava river is an interactive element in the development of regional econetwork and at the same time, is one of the main ecological corridors in the formation of local econetwork.

The territory of Yampil local econetwork crosses the Dniester meridian corridor of International (All-European) value, the main pathway of seasonal migra-

tions of the fauna through Ukraine and Steppe National latitudinal corridor. On the Dniester River, the Dniester Regional Landscape Park borders with the Moldova Unguri-Holosnita wetlands of International significance (Ramsar site).

Conclusions.

The development of the project of the local scheme of the econetwork for Yampil is a logical continuation of the efforts on creating the regional econetwork of Vinnytsia Oblast. It is a reflection of one of the three links of interrelated, subsequent in execution algorithmic 3-stage scheme of development of complete network where stage I is the development of the project of the initial regional scheme of econetwork, stage II – development of projects of local schemes of econetworks and stage III – development of the regional scheme.

Taking into account that the Yampil Local Econetwork is a component of econetworks of higher levels – International, National and Regional, it first of all requires correlation with the regional one, development of which is currently still underway. The correlation of the scheme with the project of National Econetwork of Moldova remains the important issue, because the territory of Yampil local econetwork is located at the place where it crosses the Dniester meridian corridor of international (All-European) significance, the main pathway of migration of fauna through Ukraine. Constant monitoring is required for the processes of transformation of the structures of lands which are indicated in the General Plan of the city, first of all, significant increase in the area of lands of the settlement with constructions. Any planned improvements should be substantiated and pose no threats to biotic and landscape diversities, both in Yampil specifically and Transnistria in general.

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