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A Study of the Emerald Network objects in Ukrainian Forest-Steppe of Dnieper Ecological Corridor

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Received: 20.03.2020. Accepted: 21.04.2020

The national ecological network is being developed in Ukraine to create pan-European ecological network. The legislative framework is adopted, the network of nature reserve fund objects is expanded, and ecological corridors of national and regional significance are formed. The Dnieper Ecological Corridor is one of the largest ones in Ukraine and has trans-boundary significance. Thus, the priority task is to study flora, fauna, and natural habitats of the region in order to preserve and reproduce the rare components of biotic and landscape diversity. To fulfill these tasks, the Emerald Network was created. It includes territories of special nature conservation significance. The Emerald Network of Ukraine ensures conservation of the most valuable and typical components of landscape and biotic diversity, including habitats of rare and endangered animals and plants species. These areas include natural objects in the valley of the forest steppe part of Dnieper River basin, where there is a combination of reservoirs cascade with the remnants of the Dnieper flood plain and mouth areas. In 2016, the list of 271 Emerald objects of Ukraine was approved. A total of 11 objects were designated on the forest steppe territory of the Dnieper Ecological Corridor. The article gives a brief description of the Emerald objects, as well as a list of habitats from Resolution No 4 and species from Resolution No 6 found on this territory. These objects with habitats and species are: Kanivskiyi Nature Reserve – 89 species and 17 habitats, Holosiivskiyi National Nature Park – 36 and 23, Nyzhnovorskiyanskiy Regional Landscape Park – 48 and 21, Nyzhniosulskiyi National Nature Park – 57 and 17, Kremenchutski Plavni Regional Landscape Park – 38 and 19, Kremenchutske Reservoir – 43 and 20, Kanivske Reservoir – 89 and 19, Dniprodzerzhynske Reservoir – 35 and 21, Ponyzia Stuhny – 40 and 10, Cherkaskiyi Bir – 66 and 12, Mykhailivskiyi – 74 species and 12 habitats, respectively. As a result of the Emerald network objects analysis, a total of 33 habitats from Resolution No 4 and 118 species from Resolution No 6 were identified. We suggested that the considered areas, despite their significant human transformation, can be considered as important territories to conserve and reproduce rare animal and plant diversity in the plain area of Ukraine.

Keywords: Resolution No 4; Resolution No 6; The Emerald object; Biodiversity; Habitats

Introduction

Modern biodiversity, based on natural habitats of Ukraine, is rather specific, due to the combination of natural and human-made landscapes of these territories (Mudrak, 2013; Nagorniuk, Mudrak, 2017). High ploughings of previously natural landscapes, especially in the forest-steppe and steppe zones of the country, resulted in a decrease of natural vegetation on these areas. In addition, significant deforestation of natural forests caused the necessity of artificial reforestation of released areas (Furdychko, 2014; Furdychko, Stadnyk, 2012). Significant expansion of ravine-beam systems led to their reforestation, mostly by *Robinia pseudoacacia* L. In addition, reduction of the economic use of steppe and meadow vegetation caused spontaneous overgrown with woody and shrub vegetation of previously natural objects.

In recent decades Europe faces the processes of creating pan-European ecological network and its components – national ecological networks (Jongman, 2011, Mudrak, 2018). Ukraine has been also developing a national ecological network. A legislative framework is being created, a network of nature reserve fund objects is expanding, and ecological corridors of national importance are designed, namely 5 latitudinal and 5 meridian eco corridors. From below mentioned list, Dnieper Ecological Corridor is one of the largest. It starts from the northern borders of Ukraine, and ends on the Black Sea coast, crossing three natural zones – Forest, Forest-Steppe and Steppe. At the same time, Dnieper meridional corridor crosses all the latitudinal corridors of national importance (Dnieper..., 2008; Mudrak, 2012).

A large number of different types of natural and semi-natural ecological systems (forest, meadow, steppe, wetland, etc.) is found within the limits of Dnieper Ecological corridor. Due to this, representatives of more than a half of Ukrainian fauna and flora live on its territory. Dnieper Ecological Corridor is one of the three main migration routes for birds. Each year millions of birds use it. Despite the fact that the Dnieper is transformed into a cascade of reservoirs, the river is of great importance to preserve fish species diversity. The Emerald Network is an ecological network, which includes territories of special nature protection significance. It represents a system of interconnected coherent territories that are necessary to be managed, monitored and controlled. It ensures the preservation of the most valuable and typical components of landscape and biotic diversity of the region, including the habitats of rare and endangered species of animals and plants (Nagorniuk, Mudrak, 2017; Mudrak., 2018). These areas include natural

objects in the valley of Dnieper Forest-steppe. The combination of cascade of reservoirs with the remnants of the Dnieper flood plain and the mouths of the left and right-bank inflows of Dnieper River has created unique opportunities for the conservation of natural biodiversity. The complex of natural objects artificially created and naturally reproduced forest plantations on cultivated lands and biotopes in floodplains of rivers as a whole recently allowed to consider this territory as Dnieper Ecological Corridor.

To organize an effective biodiversity conservation of the Dnieper Ecological corridor in Ukrainian Forest-Steppe it is necessary to characterize the objects of the Emerald Chain, which are present on this territory with the reproduction of the general habitat characteristics, and the main features of natural and anthropogenic vegetation as the main link of biodiversity conservation. Background of scientific principles development and the actual formation of the Emerald Network are interesting in general and in Ukraine in particular. Thus, in 1979, in Bern (Switzerland), the Convention on the conservation of European Wild Life and Natural Habitats, which was known as the Bern Convention, was created and signed by the countries of the Europe (Convention, 1979). Ukraine joined in 1996. The main task of the Convention is the protection of wild flora and fauna and their natural habitats. It focuses on species of endangered animals and plants, or vulnerable species, including migratory ones (Mudrak., 2018).

To fulfill its articles, namely 1, 2, 3, 4, 6b and 9, the Convention Standing Committee adopted several resolutions and recommendations (Recommendation No.16 "On Areas of Special Conservation Interest", 1989) and Resolution No.3, 1996) which were used when creating the Emerald Network, which includes Areas of Special Conservation Interest (Grodzinska-Jurczak, Cent, 2011). According to the Standing Committee Recommendation No 16, Area of Special Conservation Interest is an area which corresponds to one or more of the following conditions, namely: it contributes substantially to the survival of disappearing, endemic or any other species listed in Annex I and II of Bern Convention; it is an object of large species number existence on the territory with rich biodiversity or significant populations of one or more species; it contains an important and/or representative sample of endangered biotopes), or there are biotopes of a special type or different types; it represents an important area for one or more migratory species; it specifically influences the achievement of the Convention objectives.

The use of the Bern Convention principles when preparing and implementing of European Habitat Directive (Council Directive 92/43/EEC "On the Conservation of Natural Habitats and Species of Wild Fauna and Flora", 1992) stimulated revision of certain points regarding the Emerald Network (Evans, 2006). In 1998, the Standing Committee adopted Resolution No 6, which contains a list of endangered species of flora and fauna, to protect them it is necessary to implement special measures for the conservation of their habitats (biotopes). The growth of these species on the natural territory of the country is one of the main criteria for giving it the status of the Emerald object. However, at the 31st meeting of the Bern Convention Standing Committee in 2011, an annex to Resolution No 6 was reconsidered (Appendix 1: Species requiring specific habitat conservation measures). It contains a list of plant and animal species. To conserve them special measures for the conservation of their natural habitats must be applied. New species are also added.

In 1996, the Standing Committee approved Resolution No 4, which introduced the list of endangered settlements that require special measures to preserve them. However, in 2014, the Standing Committee reconsidered Annex I to Resolution No 4 of the Bern Convention on Endangered Natural Living with EUNIS habitat classification to coordinate the list of natural habitats protected by Habitat Directive. Formation of the Emerald Network in Ukraine is one of the key conditions to preserve species from Resolution No.6, as well as habitats listed in Resolution No.4 (Onyshchenko, 2016).

Besides above-mentioned Habitat Directive, EU adopted Directive 79/409/EEC on "Conservation of wild birds" in 1979 (Birds Directive). Directive 2009/147 /EC "Conservation of Wild Birds" replaced this Directive. The changes are mostly formal. According to the Article 3 from Habitat Directive "On the territory of European Union countries, a unique European environmental network of special areas of conservation, called Natura 2000, has to be formed" (Žmihorski..., 2016).

The Bern Convention, the Birds Directive and the EU Habitat Directive have common aims. All these international legal documents are aimed at preserving natural flora, fauna and habitats. Their main differences come from the area where they are applied (directives are for the EU members, and the convention is for Europe as a whole and part of northern Africa). According to the Resolution No 5 of the Bern Convention, for Contracting Parties, which are members of the EU, special areas of conservation of Natura 2000 network can be considered as territories of the special environmental value of the Emerald Network. Therefore, Natura 2000 objects are the Emerald objects. The Natura 2000 network has stronger legal base as the EU directives are obligatory to apply. The Council of Europe has developed a special computer program that contains common databases for Natura 2000 objects and for Emerald objects. The Birds Directive and the Habitat Directive foresees formation of Natura 2000 objects, both for birds' conservation and for the conservation of birds and other species and habitats.

The same situation is about the Emerald Network. The National ecological network of Ukraine is based on the approaches and principles of the pan-European ecological network. The Emerald objects of Ukraine can be considered the key territories of the National ecological network of Ukraine. The procedure of Ukrainian Emerald objects formation is contained in the book "Emerald Network of Ukraine" (Protsenko, 2011). On the first stage of the Council of Europe and the European Union Cooperative Program implementation on the development of the Emerald Network by Ukraine, the Republic of Belarus, the Republic of Moldova, the Russian Federation, Armenia, Azerbaijan and Georgia in 2009–2011, Ukraine identified 151 potential objects of the Emerald Network. At the meeting of the Bern Convention Standing Committee in November 2012, these objects received the status of Emerald object candidates of this network. On the second stage of the Cooperative Program (2013–2016), in 2013, some eight new potential Emerald objects were prepared. In 2014 these eight objects were examined in accordance with international criteria established by the Bern Convention and were given the status of the Emerald object candidate. Thus, as of 2014, the Bern Convention granted the status of Emerald object candidates to 159 potential Emerald objects that were developed by Ukrainian experts.

However, since the release of the book, there have been significant changes in the structure of the species and habitats in Resolution No.6 and 4, which should be protected by the Emerald Network. Thus in 2016, data to the 271 Emerald object of Ukraine were presented to the Council of Europe. At the 36th meeting of the Bern Convention Standing Committee (Strasbourg, France, 2016), on the basis of positive assessments of the European Council experts, the list of Emerald objects of Ukraine was approved. It includes 271 potential Emerald objects which received from the Bern Convention official status of Emerald objects (Solomakha, 2016). The maps and the databases of approved Emerald objects can be viewed on the Emerald Viewer website which was developed by European Council experts (Emerald., 2019).

The list of 271 Emerald objects is not exhaustive and further development work on potential Emerald objects is continuing. The first stage of planning and development of the "shadow list" which is proposed to be included in the Emerald Network lasted from September 2016 to August 2017 during the year. As of September 2017, the "shadow-list" of the Emerald Network of Ukraine has 78 territories (Kuzemko, 2017). Also, a management and monitoring system for rare and endangered species of plants and animals

and natural habitats that needs to be maintained in the framework of the implementation of the Bern Convention should be established in the future.

Since the main type of the Emerald objects vegetation of the Dnieper Ecocorridor Forest-Steppe of Ukraine is forest ecosystems, our attention will be given to them (Dnieper, 2008). According to the Article 46 of the Forest Code of Ukraine, forest monitoring is an integral part of forest management. Forest management involves identifying typical and unique natural complexes, places of growth and settlements of rare and endangered species of animal and plant world and have to be reserved. Landowners and permanent land users of forestry, which is a part of the Emerald objects, have to identify, monitor and reserve plants, animals, and natural habitats on the territory of Ukraine. Information on the Emerald objects and the composition of plants and animals species and habitats of European significance within their limits is provided by the Ministry of Ecology and Natural Resources of Ukraine on the basis of a request from the administrations of nature reserve fund objects, owners or users of forest lands containing Emerald objects, in the form of a standard data form on the Emerald object. This data form also contains information about other valuable plants and animal species, threats to biodiversity, the area of the site and other related data. In standard data form there is no information about geographical coordinates of species and natural habitats (Emerald, 2019).

The existence of species, group or habitat on the territory has to be confirmed by a specialist or a group of specialists. Discovered groups, habitats and species are to be put on digital and paper maps of the Emerald objects. The geographical coordinates of new species and boundaries coordinates of forest ecosystems, habitats of species on the area are recorded using GPS and digital and paper maps. Without these maps, it is impossible to evaluate whether the state of the conservation status of the species and habitat will be favorable.

In order to preserve species and habitats, the Habitat Directive involves development of management plans and their implementation. Such approach should be applied in Ukraine, giving legal status to management plans and identifying the role of landowners, land users and natural resources managers, as well as the role of the state in the development and implementation of management plans. For the Emerald object, it is necessary to develop a management plan of an object or management plans to keep safe certain species of plants, animals and habitats. Land and forest users are legally responsible for preserving species and habitats of European significance, species from the Red Data Book of Ukraine. They have to carry out appropriate environmental campaigns, which are prescribed in the documents, including territory organization and natural complexes protection projects, management plans, security commitments, regulations, projects of organization and development of forestry.

Material and Methods

The object of study is the territories of special conservation importance of the Dnieper ecological corridor, which in their unity create the Emerald Network - the basis of the ecological network that functionally integrates the centers of biotic and landscape diversity into a single spatial-territorial system. To organize the effective conservation of the biodiversity of the Dnieper Ecological Corridor of the Forest-Steppe of Ukraine, the Emerald Network distinguished the existing habitats of natural and anthropogenic origin, using a number of principles and approaches.

Among the basic principles for the creation and effective functioning of the Emerald Network were the following: scientific: ecological (environmental, habitat-forming), geographical (biogeographic, zoogeographic, physico-geographical, landscape-ecological), evolutionary; natural-social: cultural-educational, ethical, aesthetic, recreational (health, medical, balneological), resource-economic (Mudrak, 2012, 2013, 2015).

Among the scientific approaches of functioning of the Emerald Network were the following: 1) *rare* - requires scientific research to conserve rare ecosystems, phytocoenoses and species of flora, fauna and mycobiota, primarily relict, endemic or endangered. A rare approach allows you to reserve and protect the most valuable components of any biome; 2) *categorical and functional* - allows to form a single structure of complementary categories and functions of objects of the nature reserve fund, and if necessary to develop new ones; reserve natural areas under the reserved. Categorical structure allows to be dynamic depending on the priority goals of protection and change of functions of its some elements; 3) *conservation regime* - provides for the introduction of all scientifically sound types of ecosystem conservation regimes, which is combined with the system of nature management and territorial management.

This system is formed together with a single system of objects of the nature reserve fund; 4) *monitoring* - the Emerald Network is formed to fulfill European, national, regional and local tasks. It will be objective and complete only if it has an extensive network of structural interconnected elements necessary for monitoring the anthropogenic and natural processes occurring at different environmental levels of organization biome (Mudrak, 2012, 2015, 2018).

The Emerald Network, which uses the mentioned classical and modern principles and approaches, will enable the implementation of an ecosystem approach in the process of functional-spatial analysis of the territory of the Dnieper ecological corridor of the Forest-Steppe of Ukraine. It will become a basic tool for sustainable development of the ecological network at the landscape and ecosystem level only by maintaining ecological functions: 1) preservation of a representative set of habitats of species (habitats) that provide species populations with the necessary territory (for feeding, distribution of young and adult individuals or for colonization of other habitats of species); 2) providing opportunities for seasonal migrations, genetic exchange between different local populations, their displacement from those habitats that have deteriorated, and migration due to global warming; 3) protection of the integral nature of vital environmental processes (from fire, flood, drought, environmental successions, etc.); 4) conservation and reproduction of ecosystem diversity; 5) stabilization of ecological balance in a certain territory; 6) increase of biotic productivity of landscapes; 7) improving the environment and ensuring the sustainable development of society in a particular region (Mudrak, 2018).

Results and Discussion

A total of 11 Emerald objects were found on the territory of the Dnieper Ecocorridor of the Forest-Steppe region. They are characterized by specific habitat characteristics and have certain differences and features in the distribution of natural, human-made and spontaneous vegetation, where considerable number of endangered and rare species of plants and animals is kept. These are such Emerald objects: Kanivskiy Nature Reserve, Holosiivskiy National Nature Park, Nyzhnovorskiy Regional Landscape Park, Nyzhniosulskiy National Nature Park, Kremenchutskiy Plavni Regional Landscape Park, Kremenchutske Reservoir, Kanivske Reservoir, Dniprodzerzhynske Reservoir, Ponyzia Stuhny, Cherkaskiy Bir, and Mykhailivskiy.

All these objects play an important environmental role and cover all types of this territory's habitats. On the Dnieper Ecocorridor Emerald objects, the species of plants and animals that are protected by the Bern Convention occur. Thus, first of all the Emerald Network should be created to conserve species and habitats from Resolutions No 6 and No 4 of the Bern Convention. It should be

pointed out that the selection of potential Emerald objects and the creation of the Emerald Network should be done in a way to fulfill another condition, which means to ensure the long-term viability of the species and habitats of European importance. This condition is mentioned in "Revised Criteria for assessing the National Lists of proposed Areas of Special Conservation Interest (ASCIs) at the bio-geographical level and the procedure for examining and approving the Emerald candidate sites", discussed at the 33rd meeting of the Bern Convention Standing Committee in 2013. Therefore, it is not necessary to create an Emerald object on the territory if there are force majeure circumstances (current or possible) that will not allow to conserve its species and habitats of European significance in the future.

Further, we give a brief description of these objects with the habitats listed in Resolution No 4, and also Amphibians, Birds, Fish, Invertebrates, Mammals, Plants and Reptiles from Resolution No 6 (Emerald., 2019).

Kanivskiy Nature Reserve (UA0000012) is located in Kaniv district of Cherkasy region (Onyshchenko, Andrienko, 2012). It is a structural subdivision of Taras Shevchenko National University of Kyiv. The area of the Emerald object is 8663 hectares. The reserve is located in the central part of the forest-steppe zone on the right and left banks of the Dnieper River. According to the physico-geographical zoning (Ecological., 2006), its territory belongs to the Kyiv highland region of the Podilsko-Prydniprovskiy district and the North Dnieper Terrace Lowland Region of the Livoberezhno-Dniprovskiy territory of the Forest-Steppe Zone. According to geobotanical zoning (National., 2008), the territory belongs to two districts (the Northern Right-Bank Prydniprovskiy hornbeam-oak, oak forests, steppe meadow, meadow steppes and Left-bank Dniprovskiy lime-oak, hornbeam-oak, pine (terraced) forests, meadows, halophytic and bog vegetation) of eastern European Forest-Steppe province of the Eurasian Steppe region.

The territory includes highland right bank area (1415 hectares), flood plain islands Shelestiv (394 hectares) and Kruhlyk (82 hectares), as well as the area of the first floodplain terrace on the left bank of the Dnieper river, which is called the Zmiinyi Islands (116 hectares). The right bank part is considerably eroded, there are many ravines. This Emerald object also includes the Trakhtemyriv-Buchach block (3265.2 hectares) with broadleaf forests and artificial afforestation, located within administrative boundaries of the Hryhorivska village council of Kaniv region and some other objects.

According to forest management, forest vegetation occupies 92% of the area. Prevailing species is *Carpinus betulus* L., mainly on the right bank. Pine plants, mostly of artificial origin, are presented in all mentioned areas of the reserve. Mostly, on the stiff slopes of the "mountainous" part ravines of the reserve, artificial plants of *Robinia pseudoacacia* occupy large areas. There is significant oak planting of *Quercus robur* L. The basis of the floodplain forests is *Salix alba* L., *Populus alba* L. and *Populus nigra* L., less commonly *Acer negundo* L. Within the right-bank part of the reserve there are areas with domination of *Betula pendula* Roth, *Tilia cordata* Mill., *Fraxinus excelsior* L., *Acer platanoides* L. Considerable areas on the floodplain are occupied by *Amorpha fruticosa* L. and *Salix acutifolia* Willd.

On the territory of Kanivskiy Nature Reserve there were found out 17 habitats from Resolution No 4 (Table 1) (Emerald., 2019). The following types from Resolution No 6 were found on the territory (Table 2): Amphibians – 1, Birds – 60, Fish – 6, Invertebrates – 11, Mammals – 3, Plants – 8, Reptiles – 1.

Table 1. Habitats from Resolution No 4, which are found on the Emerald network objects of Dnieper Ecological corridor of Ukrainian forest steppe.

Habitat	The Emerald network objects										
	1	2	3	4	5	6	7	8	9	10	11
C1.222 Floating <i>Hydrocharis morsus-ranae</i> rafts				+	+	+	+	+			+
C1.223 Floating <i>Stratiotes aloides</i> rafts				+	+	+	+	+			
C1.224 Floating <i>Utricularia australis</i> and <i>Utricularia vulgaris</i> colonies					+		+	+			+
C1.225 Floating <i>Salvinia natans</i> mats	+	+	+	+	+	+			+		
C1.226 Floating <i>Aldrovanda vesiculosa</i> communities					+		+	+			
C1.25 Charophyte submerged carpets in mesotrophic waterbodies					+						
C1.32 Free-floating vegetation of eutrophic waterbodies					+		+	+	+		+
C1.33 Rooted submerged vegetation of eutrophic waterbodies					+		+	+	+		+
C1.3411 <i>Ranunculus</i> communities in shallow water	+	+	+				+	+	+		
C1.3413 <i>Hottonia palustris</i> beds in shallow water					+						
C1.67 Turlough and lake-bottom meadows					+				+		+
C2.33 Mesotrophic vegetation of slow-flowing rivers	+	+	+	+	+	+	+	+	+	+	+
C2.34 Eutrophic vegetation of slow-flowing rivers						+		+			
C3.4 Species-poor beds of low-growing water-fringing or amphibious vegetation	+										+
C3.51 Euro-Siberian dwarf annual amphibious swards (but excluding C3.5131 Toad-rush swards)	+					+	+	+	+		+
D5.2 Beds of large sedges normally without free-standing water					+	+	+	+	+		+
E1.2 Perennial calcareous grassland and basic steppes					+	+	+	+		+	+
E1.9 Open non-Mediterranean dry acid and neutral grassland, including inland dune grassland	+	+	+	+	+	+	+	+	+	+	+
E2.2 Low and medium altitude hay meadows	+	+	+	+	+				+	+	+
E3.4 Moist or wet eutrophic and mesotrophic grassland	+	+	+	+	+	+	+	+	+	+	+
E5.4 Moist or wet tall-herb and fern fringes and meadows	+	+	+	+	+	+	+	+			+
E6.2 Continental inland salt steppes					+	+	+	+			
F3.247 Ponto-Sarmatic deciduous thickets					+	+				+	+
F9.1 Riverine scrub	+	+	+	+	+	+	+	+			+
G1.11 Riverine <i>Salix</i> woodland	+	+	+	+	+	+	+	+			+

G1.21 Riverine Fraxinus – Alnus woodland, wet at high but not at low water	+											
G1.22 Mixed Quercus–Ulmus–Fraxinus woodland of great rivers	+	+	+	+								
G1.3 Mediterranean riparian woodland	+		+	+	+	+	+	+				+
G1.7 Thermophilous deciduous woodland	+	+	+									+
G1.8 Acidophilous Quercus–dominated woodland	+											
G1.A1 Quercus – Fraxinus – Carpinus betulus woodland on eutrophic and mesotrophic soils	+	+	+							+	+	
G3.4232 Sarmatic steppe Pinus sylvestris forests	+	+	+		+		+	+	+	+	+	+
X35 Inland Sand Dunes	+	+	+		+	+	+	+	+	+	+	
Total habitats	17	23	21	17	19	20	19	21	10	12	12	

Note. The Emerald network objects: 1 – Kanivskiy Nature Reserve, 2 – Hosiivskiy National Nature Park, 3 – Nyzhnovorsklianskiy Regional Landscape Park, 4 – Nyzhniosulskiy National Nature Park, 5 – Kremenchutski Plavni Regional Landscape Park, 6 – Kremenchutske Reservoir, 7 – Kanivske Reservoir, 8 – Dnipordzerzhynske Reservoir, 9 – Ponyzia Stuhny, 10 – Cherkaskiy Bir, 11 – Mykhailivskiy

Table 2. Species from Resolution No 6, which are found on the Emerald network objects of Dnieper Ecological corridor of Ukrainian Forest-Steppe.

Species	The Emerald network objects											
	1	2	3	4	5	6	7	8	9	10	11	
Plants												
<i>Aldrovanda vesiculosa</i> L.				+		+	+					
<i>Crambe tataria</i> Sebeok	+											
<i>Echium russicum</i> J.F. Gmel.	+											
<i>Iris hungarica</i> Waldst. et Kit. (<i>I. aphylla</i> L. subsp. <i>hungarica</i> (Waldst. et Kit.) Hegi)	+			+			+		+	+		
<i>Iris pineticola</i> Klok. (<i>I. humilis</i> Georgi subsp. <i>arenaria</i> (Waldst. et Kit.) A. et D. Love)												+
<i>Jurinea cyanooides</i> (L.) Rchb.	+	+	+	+			+			+	+	+
<i>Liparis loeselii</i> (L.) Rich.	+	+	+	+			+				+	
<i>Marsilea quadrifolia</i> L.							+					
<i>Ostericum palustre</i> (Bess.) Bess. (<i>Angelica palustris</i> (Bess.) Hoffm.)	+	+		+			+					
<i>Pulsatilla patens</i> (L.) Mill.	+	+					+		+	+	+	+
<i>Thesium ebracteatum</i> Hayne	+											
Invertebrates												
<i>Bolbelasmus unicornis</i> Schrank, 1789	+	+										
<i>Catopta thrips</i> Hübner, 1818	+		+	+	+				+	+	+	
<i>Cerambyx cerdo</i> Linnaeus, 1758	+	+									+	+
<i>Dytiscus latissimus</i> Linnaeus, 1758				+		+	+	+				+
<i>Euplagia quadripunctaria</i> Poda, 1761 (<i>Callimorpha quadripunctaria</i> Poda, 1761)	+		+	+	+				+	+	+	
<i>Graphoderus bilineatus</i> De Geer, 1774							+	+	+	+		
<i>Leptidea morsei</i> Fenton, 1881	+											
<i>Leucorrhina pectoralis</i> Charpentier, 1825	+	+		+	+	+	+					
<i>Lucanus cervus</i> Linnaeus, 1758	+	+	+			+	+	+	+	+	+	+
<i>Lycaena dispar</i> Haworth, 1802	+	+	+	+	+				+	+	+	
<i>Ophiogomphus cecilia</i> Fourcroy, 1785				+								
<i>Polyommatus eroides</i> Frivaldszky, 1835	+											
<i>Rosalia alpina</i> Linnaeus, 1758	+											
<i>Unio crassus</i> Philipsson, 1788					+	+	+					
<i>Xylomoia strix</i> Mikkola, 1980	+											
Fish												
<i>Aspius aspius</i> Linnaeus, 1758	+		+	+	+	+	+	+				+
<i>Cobitis taenia</i> Linnaeus, 1758	+		+	+	+	+	+	+	+	+	+	+
<i>Gymnocephalus baloni</i> Holcuk & Hensel, 1974	+		+				+					
<i>Misgurnus fossilis</i> Linnaeus, 1758	+		+	+	+		+	+	+	+		
<i>Pelecus cultratus</i> Linnaeus, 1758	+		+		+		+	+				
<i>Rhodeus sericeus amarus</i> Bloch, 1782	+	+	+	+	+	+	+	+	+	+	+	+
<i>Rhynchocypris percunurus</i> Pallas, 1814 (<i>Phoxinus percunurus</i> Pallas, 1814)											+	
<i>Romanogobio albipinnatus</i> Lukasz, 1933 (<i>Gobio albipinnatus</i> Lukasz, 1933)				+		+	+					
<i>Sabanejewia aurata</i> De Filippi, 1863								+				
Amphibians												

<i>Nycticorax nycticorax</i> Linnaeus, 1758	+						+		+	+	+	
<i>Pandion haliaetus</i> Linnaeus, 1758	+						+				+	+
<i>Pelecanus onocrotalus</i> Linnaeus, 1758	+						+					
<i>Pernis apivorus</i> Linnaeus, 1758	+		+				+				+	+
<i>Phalaropus lobatus</i> Linnaeus, 1758	+						+					
<i>Philomachus pugnax</i> Linnaeus, 1758	+						+					+
<i>Picus canus</i> Gmelin, 1788	+	+	+	+	+	+	+			+	+	+
<i>Pluvialis apricaria</i> Linnaeus, 1758	+						+					+
<i>Podiceps auritus</i> Linnaeus, 1758	+						+					
<i>Porzana parva</i> Scopoli, 1769	+		+	+	+	+	+			+		+
<i>Porzana porzana</i> Linnaeus, 1766	+		+	+	+	+	+			+	+	+
<i>Sterna albifrons</i> Pallas, 1764	+						+	+	+			+
<i>Sterna hirundo</i> Linnaeus, 1758	+	+	+	+	+	+	+			+	+	+
<i>Sylvia nisoria</i> Bechstein, 1795	+	+	+	+	+	+	+	+	+	+	+	+
<i>Tringa glareola</i> Linnaeus, 1758	+						+				+	+
<i>Xenus cinereus</i> Gldenstdt, 1775	+						+					+
Mammals												
<i>Barbastella barbastellus</i> Schreber, 1774	+						+					
<i>Canis lupus</i> Linnaeus, 1758							+			+		
<i>Castor fiber</i> Linnaeus, 1758	+	+	+	+	+	+	+	+	+	+	+	+
<i>Lutra lutra</i> Linnaeus, 1758	+	+	+	+	+	+	+	+	+			
<i>Mustela eversmanii</i> Lesson, 1827												+
<i>Mustela lutreola</i> Linnaeus, 1758										+		+
<i>Sicista subtilis</i> Pallas, 1773										+		+
Total species:	89	36	48	57	38	43	89	35	40	66	74	

The Emerald network objects: 1 – Kanivskyi Nature Reserve, 2 – Hosiivskyi National Nature Park, 3 – Nyzhnovorskliański Regional Landscape Park, 4 – Nyzhniosulskyi National Nature Park, 5 – Kremenchutski Plavni Regional Landscape Park, 6 – Kremenchutske Reservoir, 7 – Kanivske Reservoir, 8 – Dnipordzerzhynske Reservoir, 9 – Ponyzia Stuhny, 10 – Cherkaskyi Bir, 11 – Mykhailivskyi

Hosiivskyi National Nature Park (UA0000043) is located in Kyiv and Kyiv-Svyatoshynsky district of Kyiv region (Onyshchenko, Andrienko, 2012). The area of the object is 11071 hectares. The park is subordinated to the Ministry of Ecology and Natural Resources of Ukraine. NNP "Hosiivskyi" is located in the northern part of the Forest-Steppe zone. According to the physic-geographical zoning (Ecological..., 2006), the territory belongs to the Kyiv highland region of the Podilsko-Prydniprovskyi territory and the North-Dnieper Terraced Lowland Region of the Left Bank-Dniprovskyi territory of the Forest-Steppe zone. According to geobotanical zoning (National..., 2008), the territory belongs to two districts: the Northern right-bank Dnieper district of hornbeam-oak, oak forests, steppe onions and meadow steppes, and the left-bank Dniprovskyi district of lime-oak, pine terraces forests, onions, halophytic and marsh vegetation. Both areas belong to the Eastern European Forest-Steppe province of the Eurasian Steppe region. The territory includes several tracts separated by territories, which do not belong to the NNP. Bychok tract (59 hectares) is located within the Dnieper floodplain.

Most of the territory of the NNP (about 3500 hectares) makes a complete shape, which is located mainly on the first sandy floodplain terrace of the Dnieper River, as well as in the flood plain of the Vita River (southern part of the park). The Hosiivskyi forest (788 hectares), the neighboring Maksym Rylskyi Hosiivskyi Park (127 hectares) and Teremky tract (90.3 hectares) are located on hilly forest area. Forest vegetation predominates on the territory of NNP "Hosiivskyi". According to forest management data, it occupies 93% of the territory. Almost half of the park territory is occupied by pine trees, which are spread mainly in the southern part of the territory, on the floodplain Dnieper terrace. The second place by area is taken by the forest plantations of oak *Quercus robur*, located mainly in the northern part of the territory, the largest area is in the Hosiivskyi forest. The following species are black-haired, hornbeam forests, ash-tree, black-and-throat, birch, lime, and willow woodland forests. On the territory of Hosiivskyi National Nature Park there were found out 23 habitats from Resolution No 4 (Table 1) (Emerald., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 2, Birds – 21, Fish – 1, Invertebrates – 5, Mammals – 2, Plants – 4, Reptiles – 1.

Nyzhnovorskliański Regional Landscape Park (UA0000072) is located in the lowland of Vorskla River, which is the left inflow of the Dnieper River. Its area is 23187 hectares. It is located on the territory of the Kobeliatskyi district of Poltava region. According to the physic-geographical zoning of Ukraine (Ecological..., 2006), there is the boundary between the South Dnieper Lowland Region of the Left-bank Dnieper territory of the Forest-Steppe zone and the Orilsko-Samarskyi Lowland Region of the Left-Bank Dniipro-Pryazovskyi territory of the Northern-Step subzone of the Steppe zone. The largest areas in vegetation cover are forest plantations, different in their cenotic composition. There are pine forest stands on a pine terrace. Deciduous forests are connected with the floodplain. They are also located in the ravine-beam systems. They are represented here by deciduous forests with predominance of oak tree (*Quercus robur*) with addition of asparagus *Fraxinus excelsior*, *Tilia cordata*, *Acer platanoides*, *Ulmus laevis* Pall. and small-leaved forests with the predominance of *Populus tremula* L., *Populus nigra*, *Populus alba* and *Salix alba*. On the territory of Nyzhnovorskliański Regional Landscape Park there were found out 21 habitats from Resolution No 4 (Table 1) (Emerald, 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 2, Birds – 31, Fish – 5, Invertebrates – 5, Mammals – 2, Plants – 2, Reptiles – 1.

Nyzhniosulskyi National Nature Park (UA0000082) is located on the territory of the Hlobynskyi, Semenivskyi and Orzhytskyi districts of Poltava region and Chornobaiivskyi district of the Cherkasy region (Onyshchenko, Andrienko, 2012). The area of the site is 18703 hectares. The park is subordinated to the Ministry of Ecology and Natural Resources of Ukraine. According to the physic-

geographical zoning of Ukraine (Ecological..., 2006), the territory is located in the Forest-steppe zone, Livoberezhnodniprovskiyi land, the South Dnieper Terraced Lowland Region at the boundary with the North-Dnieper terraced lowland region. The boundary between physical and geographical areas passes along the high right bank of the river Sula.

According to geo-botanical zoning of Ukraine (National..., 2008), the territory of the park belongs to the Eurasian steppe region, the Forest-steppe sub-region, the East European forest-steppe province, the Livoberezhnodniprovskiyi district of oak, hornbeam-oak, pine (on terraces) forests, onions, halophytic and marsh vegetation. The territory is located in the valley of the Sula River, mainly in its flood plain. The vegetation is quite diverse. Water, coastal water, swamp, meadow vegetation, remains of floodplain oak and poplar-willow plantations, as well as steppe areas on the slopes of ravines and beams are combined here. Forest vegetation is common in the flood plain, on the first floodplain (pine) terrace of the Sula and the Dnieper rivers, as well as on the native bank. One of the largest areas are the tracts of Stinka 1 and Stinka 2. These are deciduous stands, which are located on the stiff (up to 20°) slopes, and near Mokhnach village in relatively hump-shaped areas. The composition of the forest stand in these areas is very diverse. The basis is formed by *Quercus robur*, *Fraxinus excelsior*. A significant mixture is made by *Tilia cordata*, *Acer platanoides* (Vorobiov..., 2017). Forests on Dubina Island are relatively young, but the forest crops of *Quercus robur* and *Acer platanoides* are closed. Considerable area is occupied by flood forest ecosystems dominated by *Salix alba* and *Populus nigra*. Pine stands are common in Drachka tract and in some other places. *Alnus glutinosa* group near Velyka Buryinka village, which is not essential on the park's territory, significantly enlarges forest vegetation.

On the territory of Nyzhniosulskiyi National Nature Park we found out 17 habitats from Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 we found on the territory (Table 2): Amphibians – 1, Birds – 37, Fish – 6, Invertebrates – 5, Mammals – 4, Plants – 5.

Kremenchutski Plavni Regional Landscape Park (UA0000087) is located in the flood plain of the Dnieper River at the upper reaches of the Kamianske reservoir in Kremenchuk district of Poltava region. Its area is 5098 hectares. It covers water area, islands and riverside of the Dnieper River. The park is located in the southwestern part of the Middle Prydnirpovia. This part of the flood plain is a unique natural complex and can be considered as sample area remained after six large reservoirs on the Dnieper River. Right here that you can see the features of the ancient riverbed of the Dnieper River. According to the physic-geographical zoning of Ukraine (Ecological..., 2006), the territory of Regional Landscape Park is located within the limits of the Bovtysko-Svitlovodskiyi district of Southern Prydniprovskiyi hill region of Podilsko-Prydniprovskiyi territory and Obolon-Hlobynskiyi district of South Dnieper Terraced Lowland Region of the Left-bank Dnieper territory of the Forest-Steppe zone. The parks territory includes such natural complexes as forest, meadow, water and coastal water. On the territory of Kremenchutski Plavni Regional Landscape Park there were found out 19 habitats from Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 2, Birds – 23, Fish – 5, Invertebrates – 5, Mammals – 2, Reptiles – 1.

Kremenchutske Reservoir (UA0000110) is located on the Dnieper River in the Poltava, Kirovohrad and Cherkasy regions. It was filled in 1959-1961. Its area is 222513 hectares, the length is 185 km, the largest width is 30 km, the deepest place is 28 m. The length of the coastline is 800 km. It has seasonal flow regulation with 5.25 m fluctuation of water level. The banks of the reservoir are high (up to 30-40 m). They are cliff, erosion processes are common. Water vegetation is the most common in shallow water. In the summer there is "flowering of water". This process covers up to 70 percent of the reservoir, especially in the southern part and in the bays, worsening the water quality. The largest rivers flowing into the reservoir from the right bank are Ros, Vilshanka, Tiasmyn, and Tsybulnyk; on the left one – Supii, Zolotonoshka, Irklyi, Kovrai, and Sula. As a result of flooding, the morphology of the islands has changed considerably, flooded with numerous ancient islands at the confluence of Sula and the Dnieper. At the same time, many new islands emerged from the floodplain areas and pine terraces, the former dunes. On the territory of Kremenchutske Reservoir there were found out 20 habitats from Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 2, Birds – 28, Fish – 4, Invertebrates – 5, Mammals – 2, Plants – 1, Reptiles – 1.

Kanivske Reservoir (UA0000111) is located on the Dnieper River in Kyiv, within the Kyiv and Cherkasy regions. It is the youngest in the cascade of reservoirs created on the Dnieper River. Its was being filled with water during 1974-1976. Kanivske reservoir covers an area of 67234 hectares, its length is approximately 123 km, the maximum width is 8 km, the deepest place is 21 m. Near the coastline the Kanivske reservoir is very shallow. The largest rivers running into are: Stuhna and Trubizh. The Kyiv part of the reservoir completely coincides with the channel, sleeves, straits and outlines of the islands that existed on the Dnieper River before filling the reservoir. The only change is the small increase in water level and the lack of bedding in the summer due to water level regulation. On the territory of Kanivske Reservoir there were found out 19 habitats from Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 2, Birds – 60, Fish – 8, Invertebrates – 5, Mammals – 4, Plants – 7, Reptiles – 2.

Dniprodzerzhynske Reservoir (UA0000135) is located on the Dnieper River in Kirovohrad, Poltava and Dnipropetrovsk regions (from November 8, 2017 Kamianske reservoir). It was filled in 1964. The area of the reservoir is 53994 hectares, the length is 114 km, the width is no more than 8 km, the deepest place is 16 m. The length of the coastline is 360 km. The right bank of the reservoir is highly (up to 10-25 m), steep, sometimes snapped, dissected by beams and ravines; left one is low (up to 2-5 m), flat, bordering shallow water areas. Fluctuations of water level do not exceed 0.5-1 m. The maximum levels are observed during the spring flood. The Vorskla, Psel and several smaller rivers flow into the reservoir. On the territory of Dniprodzerzhynske Reservoir there were found out 21 habitats from Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 2, Birds – 20, Fish – 5, Invertebrates – 3, Mammals – 4, Reptiles – 1.

Ponyzia Stuhny (UA0000175) is located in Vasylykiv and Obukhiv districts of Kyiv region. Area is 6824 hectares. It is located in the central part of the forest-steppe zone on the right bank of the Dnieper River. According to the physic-geographical zoning (Ecological, 2006), its territory belongs to the Vasylykiv-Kaharlytskyi region of the Kiev highland region of Podilsko-Prydniprovskiyi Forest-Steppe region of the Forest-Steppe zone. According to geo-botanical zoning (National..., 2008), the territory belongs to the Northern Right Bank of the Prydniprovskiyi district of hornbeam-oak, oak forests, steppe meadows and meadow steppes of the Eastern European Forest-Steppe province of the Eurasian Steppe region. On the territory of Ponyzia Stuhny there were found out 10

habitats from Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 2, Birds – 23, Fish – 4, Invertebrates – 5, Mammals – 3, Plants – 2, Reptiles – 1.

Cherkaskyi Bir (UA0000254) is located on the right bank of the Dnieper not far from Cherkasy, its area is 55,441 hectares. It consists of Cherkasy forest, Irdyn bog and Moshnohirskiy range. Most of the territory, namely Cherkaskyi Bir, is located on the first floodplain terrace of the Dnieper. The Irdyn bog (1500 ha) was formed in the ancient riverbed. The river Irdyn flows here now. Moshnohirskiy range, covered with hornbeam-oak forest plantations, is the regional part of ice-tectonic formations. The object of the Emerald Network "Cherkaskyi Bir" is located in the middle part of the Forest-Steppe zone. According to the physic-geographical zoning (National..., 2008), the territory belongs to the Cherkasko-Chyhyrskiy district of the Central Prydnirpovskiy Highland region of the Podilsko-Prydniprovskiy Forest-Steppe region of the Forest-Steppe zone. On sandy and sandy loam soils of pine and oak-pine stands predominate. Clear pine stands occupy dry high places. In Cherkaskyi Bir leafy forest plantings are also found on relatively poor soils, namely, oak and hornbeam-oak forests. On Moshnohirskiy range, broadleaf stands predominate, mainly hornbeam-ash-oak. In the woodland *Carpinus betulus*, *Fraxinus excelsior*, *Quercus robur*, sometimes *Tilia cordata* prevail. On Irdyn bog, a large area is occupied by the conifer with the dominance of black alder (*Alnus glutinosa* (L.) Gaertn.). On the territory of Cherkaskyi Bir there were found out 12 habitats of Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 1, Birds – 47, Fish – 3, Invertebrates – 5, Mammals – 4, Plants – 5, Reptiles – 1.

Mykhailivskiy (UA0000256) is located in the Kaniv district of Cherkasy region. The area is 4778 hectares. It is subordinated to the Mykhailivskiy division of Kaniv Forestry of the Cherkasy Regional Forestry and Hunting Management. The object is located in the central part of the forest-steppe zone on the right bank of the Dnieper River. According to the physic-geographical zoning (Ecological..., 2006), its territory belongs to the Bukrynsko-Kanivskiy district of Kyiv highland region of Podilsko-Prydniprovskiy Forest-Steppe region of the Forest-Steppe zone. According to geo-botanical zoning (National..., 2008), the territory belongs to the Northern Right-Bank Prydnirpovskiy district of hornbeam-oak, oak forests, steppe meadows, meadow steppes of the Eastern European Forest-Steppe province, and the Eurasian Steppe region. On the territory of Mykhailivskiy there were found out 12 habitats from Resolution No 4 (Table 1) (Emerald..., 2019). The following species from Resolution No 6 were found on the territory (Table 2): Amphibians – 1, Birds – 61, Fish – 3, Invertebrates – 6, Mammals – 1, Plants – 2, Reptiles – 1.

Conclusion

The Emerald Network of Ukraine allows preserving of the most valuable and typical components of landscape and biotic diversity, including habitats of rare and endangered animals and plants species. An overview of specific object features and the existing conditions for biodiversity conservation generally suggests that studied areas, despite of their significant human transformation, can be considered as important in terms of preserving and reproducing of rare animal and plant diversity in low land part of Ukraine. There are 11 objects of the Emerald network on this territory, which are almost 4% from the total number. We registered 33 specific habitats and detected several species from Resolution No 6, which need special protection, among them Amphibians – 2 species, Birds – 72, Fish – 9, Invertebrates – 15, Mammals – 7, Plants – 11, and Reptiles – 2 species.

Preservation, reproduction and enrichment of rare species and habitats are one of the main tasks to create protected areas and ecological networks. It is necessary at the country level to assist eliminating anthropogenic fragmentation of biogeocenotic cover that has developed in the process of historical development of society, to create its persistence and functional integrity and strengthening due to its ability to self-recovery. The genus of sea buckthorn (*Hippophae* L.) – includes perennials, related to the family *Elaeagnaceae* Lindl, order *Rosales* L. and combines three types of: sea buckthorn (*H. rhamnoides* L.), sea buckthorn willow-leaved (*H. salicifolia* Don.) and sea buckthorn tibetan (*H. tibetana* Schlecht). Until recently, genus *Hippophae* L. was represented by only two species: *H. rhamnoides* L. and *H. canadensis* L., the last was later classified as a separate genus *Schepherdia* Nutt. (Mikolajko & Shlapak, 2014).

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Citation:

Solomakha, I.V., Konishchuk, V.V., Mudrak, O.V., Mudrak, H.V. (2020). A Study of the Emerald Network objects in Ukrainian Forest-Steppe of Dnieper Ecological Corridor. *Ukrainian Journal of Ecology*, 10(2), 209-218.



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