

Assessment of forest ecosystems of Eastern Podillya natural reserve fund in the regional econet structure

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The article presents the assessment of the forest ecosystems of the nature reserve fund of Eastern Podillya in the structure of the regional ecological network from the standpoint of forest-typological, forestry and administrative-territorial zoning. The research was carried out on the basis of the forest fund of 11 forest enterprises of the Vinnytsia Regional Forestry and Hunting Management. An analysis of taxonomic descriptions of the regional forestry showed that the quantitative index of the nature reserve fund within their boundaries is not optimal. As a result of field inspections, it has been established that a large proportion of the forest ecosystems of the nature reserve fund falls into the risk zone of biotic diversity loss against the backdrop of climate change in the region. Conducted field studies have made it possible to establish that in the Eastern Podillya, there is a risk of ecosystem diversity loss in 837.5 hectares of protected forest areas.

Keywords: Forest ecosystems; nature reserve fund; biodiversity; ecological assessme; risks

Introduction

Forest ecosystems are the most productive ecosystems, which is an important factor in the restoration and optimization of the natural environment. Given this, their conservation and reproduction is a priority area for the formation of an ecological network of any level. The need for the expansion of protected areas is because currently the protected areas and territories are bordered by intensively used agricultural land or adjacent to industrial sites. They are ecological islands surrounded by significantly altered natural conditions (Buksha, et al., 2011; Hensirik, 2002).

Materials and methods

The purpose of the research is to investigate the ecological state and risks of the functioning of forest ecosystems as objects of the natural reserve fund of Eastern Podillya in the structure of the regional ecological network.

The object of the study is the network of forest ecosystems as part of the natural reserve fund of the Eastern Podillya in the structure of the regional Econet.

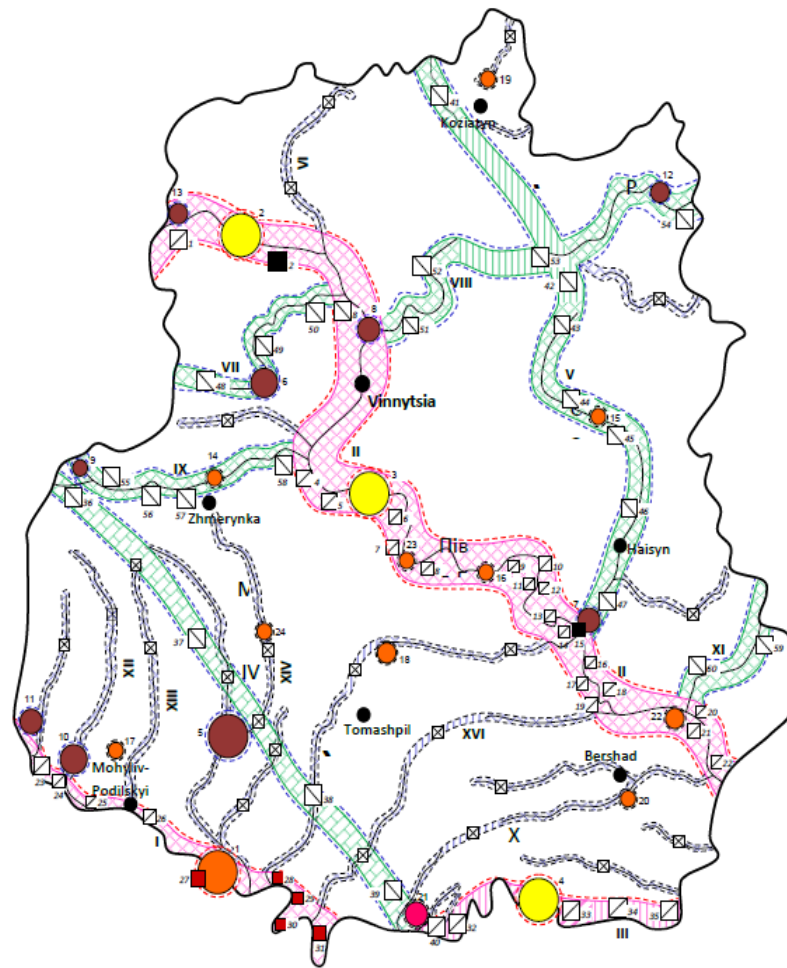
The article is based on field research and analysis of forest management materials of forest enterprises of the Vinnytsia Regional Forestry and Hunting Department and the Register of the Nature Reserve Fund of Vinnytsia region. The methodological basis for conducting research was the methodological recommendations developed by the Ukrainian Research Institute of Forestry and Agroforestry. AHEM. Vysotsky (Mudrak, 2008; Rekomendatsii, 2010; Sheliah-Sosonko, 2004).

Research results

The framework of the regional ecological network of the Eastern Podillya (Vinnytsia region) is the territory and objects of the Nature Reserve Fund (NRF) and other territories of particular value in terms of biodiversity conservation (Figure 1) (Mudrak, 2018; Ostapenko & Tkach, 2002). As of January 1, 2018, 420 objects with a total area of 59797.0 hectares were located in the region, which is 2.25% of the total area of its territory.

According to the forest-typological zoning of Ukraine, the territory of Eastern Podillya is located in the wet (D3), fresh (D2) and dry (D1) pond. The main types of forest are wet (D3GD) and fresh hornbeam oak (D2GD) in which the main forest species are oak, ash tree, maple, and the main accompanying breeds are hornbeam and linden small-leaf linden (Rekomendatsii, 2010). According to the data of the Vinnytsia Regional Forestry and Hunting Management Department, the forest fund in the context of 11 forest farms is 211.9 thousand hectares, of which the forest land amounts to 198.3 thousand hectares. The average age of forest plantations is 61 years. The area of forest ecosystems of the Eastern Podillya protected areas is 15.0 thousand hectares, which is 7% of the total forest area (Table 1).

Since the second half of the nineteenth century, coniferous and deciduous tree species have been introduced that resulted in the rock forest composition change. The creation of the majority of the protected forestry objects mainly occurs at times when tree species-introdents were distributed almost throughout the region. Therefore, in modern Vinnytsya region VFR, forest types that do not correspond to the indigenous types of forest are much represented since they are partially or completely transformed under the influence of forestry activities (Hordiienko & Korniienko, 2009; Mudrak, et al., 2014; Mudrak, & Ovchynnykova, 2017).



Notes to figure 1

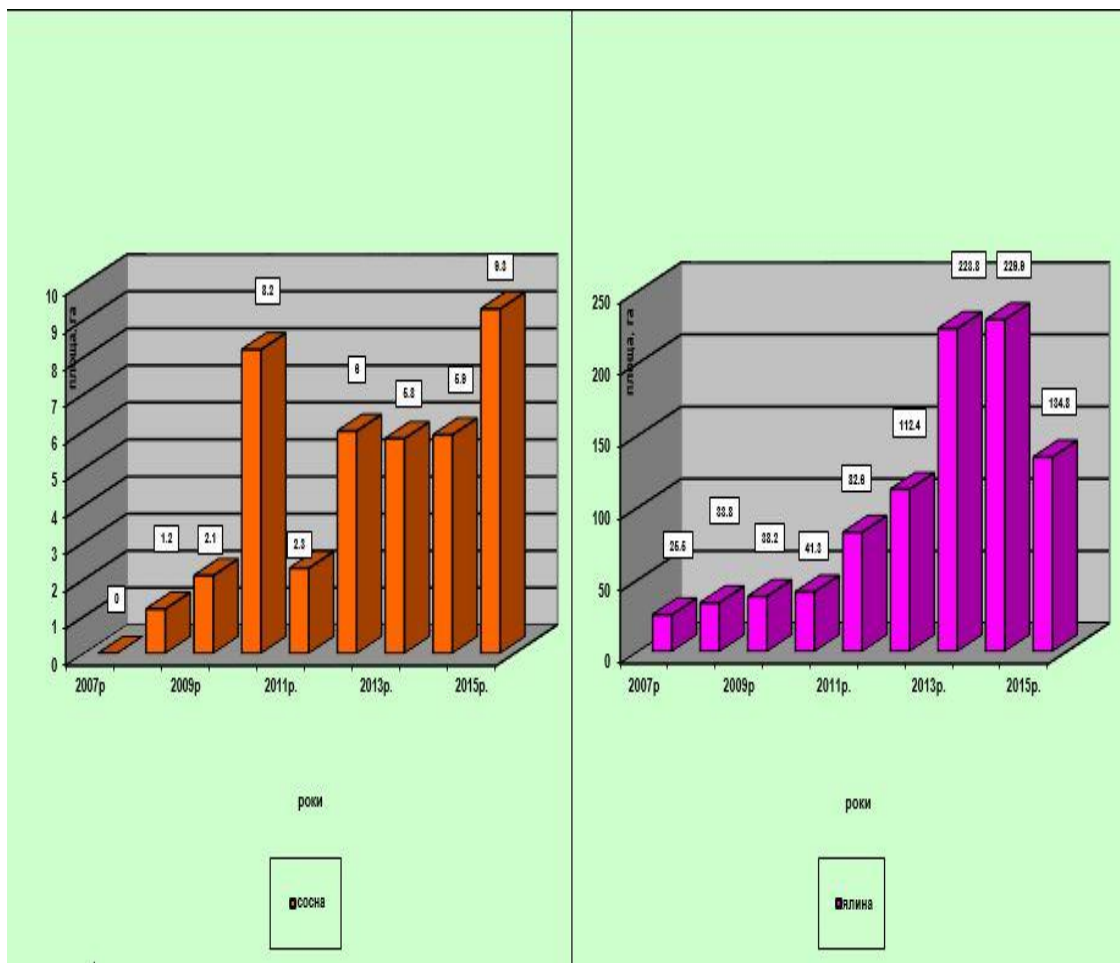
TYPES OF CONNECTING TERRITORIES		BUFFER ZONES (width)	
	- valley river		- 500 m
	- forest steppe		- 100 m
	- forest		- 50 m
	- Tovtry	AREAS OF KEY TERRITORIES (natural nuclei)	
	- of national level		- more than 10 000 ha
	- of regional level		- 10 000- 5 000 ha
	- of local level		- 5 000 - 2 000 ha
	- international		- 2 000-1 000 ha
	- national		- 1000 - 500 ha
	- regional		- less than 500 ha
	- local	AREAS OF REHABILITATING TERRITORIES (RT)	
TYPES OF REHABILITATING TERRITORIES (RT)			- more than 400 ha
	- RT are situated within the natural nucleus of international level or national EC		- 400-300 ha
	- RT are situated within the natural nucleus of national level or national EC		- 299-200 ha
	- RT are situated within the natural nucleus of regional level or regional EC		- 199-100 ha
	- RT are situated within the natural nucleus of local level or local EC		- less than 100 ha
	- RT are situated within the promising natural nucleus or promising EC	NAMES OF ECOLOGICAL CORRIDORS	
I. Dnistrovskiy		IX. Rivskiy	
II. Buzkyy (Pivdenno-Buzkyy)		X. Dokhnianskyy	
III. Pivdenno-Podilskyy (Southern Ukrainian)		XI. Udytskyy	
IV. Murafsko-Tovtrovyy		XII. Liadovskyy	
V. Hnylopyatsko-Sobskyy		XIII. Nemyiskyy	
VI. Snyvodskyy		XIV. Murafskyy	
VII. Zharskyy		XV. Rusavskyy	
VIII. Desniansko-Roskyy		XVI. Silnytskyy	

Figure 1. Scheme of the ecological network of Eastern Podilia.

Table 1. Categories of land in terms of enterprises of Vinnitsa OLULMG.

Forestr menage (FM)	Categories of land				
	Area of earth of forest fund, ha	From them covered a sylva, ha	Naturally commandment fund, ha	Huntings lands, ha	Middle age of planting (years)
Bershadske FM	15188	14389	2082	25462	69
Vinnitsa FM	24789	22776	1424,6	11100	66
Haysinskaya FM	19427	18221	530	15322	59
Dashivske FHM	5703	5441	116	55514	45
Zhmerinskaya FM	18116	16995	52,37	16,1	61
Illinetske FM	17300	16228	563	6700	45
Kryzhopolsky FM	19228	18095	1088	18559	68
Mogilev-Podolsky FM	31256	28784	2654	22849	54
Tulchinskaya FHM	23286	22036	1205	53750	66
Khmelnitsky FM	21103	19590	479	17723	58
Chethelnitsky FM	16518	15773	4807	15328	82
Total	211914	198328	15000,97	242323,1	61

In today's conditions of climate change and lowering of groundwater levels in the region, there is a problem of the further growth and development of most coniferous introductive species, including European fir, pine, and common hardwood. At the present time, their mass extinction occurs both on the territories of protected objects and in exploitation forests. The corresponding process is accompanied by volumes increase of selective and continuous sanitary logging by the forest farms of the region. According to the data of the State Specialized Forestry Enterprise "Vinnitsilysozahist" in the forestry enterprises of Vinnytsya State Forest Research Institute during the last 7 years, continuous and selective sanitary felling is carried out on an area not less than 10 hectares in exploitation forests and not less than 3-5 hectares in forestry facilities (Figure 2).

**Figure 2.** Dynamics of continuous sanitary felling in pine and spruce stands for 2007-2015.

Plantations of coniferous species make up 10.7 thousand hectares, which is more than 5% of the total forest area of the region, of which about 2 thousand hectares are located in the NFP and they are presented in operational forests and protected sites with clean and mixed plantings. After analyzing the data from the forest management materials and conducting the survey, we have determined that at present, the forest ecosystems of the Vinnytsya Oblast NFP are included in the risk zone with a total area of 837.5 hectares, since they concentrate the main areas of coniferous introductions. Since this area is not continuous, the risk zone is extended to the entire area of the region with the allocation of key risk areas. The risk zone was analyzed according to Figure 1-schemes of the ecological network of the Eastern Podillya (O.V. Mudrak, et al., 2018) (Ostapenko & Tkach, 2002) and was divided into areas according to the ball scoring, which is graded according to the size of the forest ecosystems of coniferous introducers: 1 point-up to 10 hectares, 2 points-from 10 to 20 hectares, 3 points-from 20 to 50 hectares, 4 points-from 50 to 100 hectares, and 5 points-from 100 to 500 hectares (Figure 3).

For the conditions of the Eastern Podillya, the scale of the design of the national connecting territories shows that the Galitsko-Slobozhansky latitudinal eco-corridor is in risk areas with a score of 1-5 points. In this eco-corridor, there are areas of risk for forest ecosystems of Vinnytsia (77.9 ha), Illinetsky (80.9 ha), Haysinsky (145.1 ha), Dashevsky (5.2 ha), Zhmerinsky (16.3 ha), Tulchinsky (10.1 ha) and Khmelnytsky (4.9 ha) forest farms.

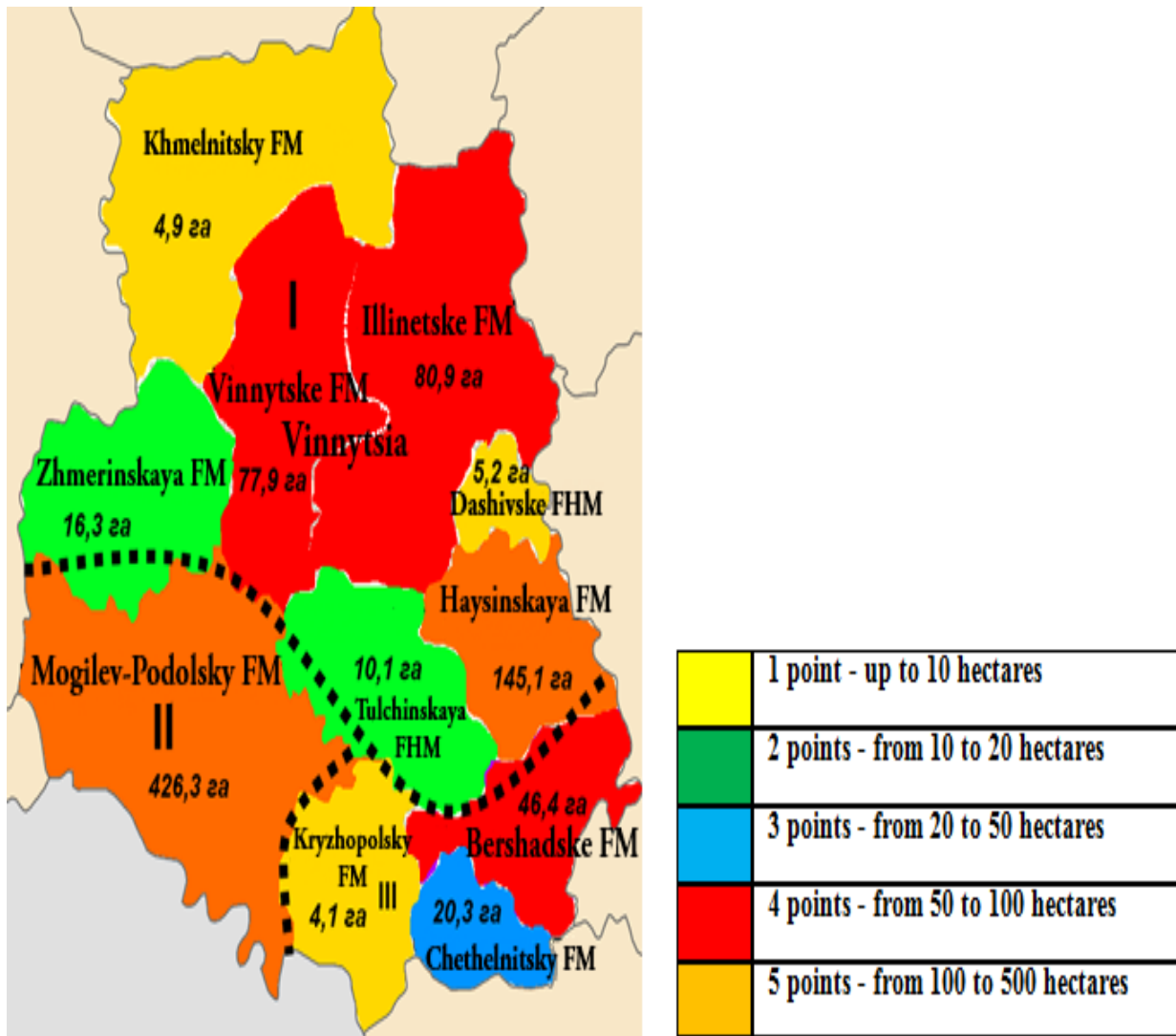


Figure 3. Zones of risk in the structure of the regional ecological network of Eastern Podillya.

In the bounds of the projected South-Ukrainian latitudinal eco-corridor the score is 1-3 points, and in this connectable territory of the national level, such areas of risk of forestry farms of Kryzhopil'skii (4.1 ha), Chechelnyts'ky (20.3 ha) and Bershadsky (46.4 ha) fall into this area. In the bounds of the projected Dniester Latitude-Meridian Eco-corridor, the score is 5 points, and in this connectable territory of the national level, one area of forest risk is located-Mogilev-Podolsky (426.3 ha).

The surveyed forest ecosystems in the structure of the Eastern Partnership are the important components of the regional and national ecosystems that serve as biocentres (natural nuclei). Therefore, an important aspect of their preservation is the possibility of preventing the impoverishment of biodiversity in conditions of climate change. Since tree breeds of introducers have been artificially introduced into the structure of forests, it is expedient to monitor them in order to predict the situation with their drying. In the event of aggravation of such a situation, it will be necessary to carry out the process of artificial reforestation by aboriginal tree species on the basis of forest typology, as well as to pay attention to the introduction of other species-introducers into the structure of forest PRF. However, the introduction of new introducers must go through a detailed study of them in forest research facilities.

Also, an equally important threat to the functioning of the objects and territories of the NFP in the structure of the regional Econet is its disproportionate functional and spatial structure, which is explained by the presence in the categorical structure of small objects, the area of which is usually from 0.01 to 1 ha (Table 2) (Ovchynnykova, 2017; Yelisavenko, 2013, 2015).

Table 2. Functional-spatial structure of the NFP of Eastern Podillya.

Size, ha	Reserve categories					
	NNP	RLP	Customers	NM	RT	PMGA
< 1			1	160		
1.0-5.0			7	47	3	7
5.1-10.0			4	8	11	6
10.1-25.0			26	6	6	13
25.1-50.0			21	5	7	8
50.1-100.0			13	3	2	3
100.1-250.0			21	2	1	
250.1-500.0			10			
500.1-1000.0			6			
1000.1-2500.0			5			
2500.1-5000.0		2	3			
5000.1-10000.0		2				
10000.1-25000.0	1					
Total	1	4	117	231	30	37

Note: NNP-national natural park; RLP-regional landscape park; NM-natural monument; RT-reserve tract; PMGA park-monument of garden art

Functional-spatial features of the Eastern Part of the Eastern European sub-lot consist of the fact that in its structure predominant objects dominate the area, which does not exceed 1 hectare, and such objects are not functional in the process of complex preservation of biotic and landscape diversity. There are 160 such units in the region in the total number of objects and territories in the region of 420. There are only 8 territories in the structure of the NFP that cover an area of 2500 hectares to 25,000 hectares, while the rest is allocated to objects and territories whose area is from 1 to 2,500 hectares.

Usually, such objects are represented in the structure of the NFP by botanical monuments of the local nature (which includes mainly age-old and old-fashioned indigenous and introduced trees) or hydrological monuments of the local nature, which include sources.

Accordingly, in conditions of climate change on the territory of Eastern Podillya, there is a threat of the loss of its own protected areas among botanical monuments of local significance, which are represented by trees, introducents, and indigenous trees, whose age is more than 200 years. Such trees have a low level of tolerance to natural and anthropogenic environmental factors that cause their death.

In connection with the decrease of groundwater levels in the region, there is also a potential risk of loss of a number of hydrological monuments of local significance. Since such objects of the PRF are sufficiently small in quantitative terms and they are not self-sustaining. Therefore, they need intensive care and support. Consequently, in the conditions of Eastern Podillya, for the effective preservation of biotic and landscape diversity and the formation of a non-exhaustive ecological network, it is necessary to create large-scale areas of the NFP.

Conclusions

In the conditions of Eastern Podillya, the share of the nature reserve fund is rather low, respectively, the percentage of the territory's conservation is at a critical level. In the structure of the forest fund, the share of the nature reserve fund is also not optimal, therefore it can not effectively preserve the biotic and landscape diversity of the region. The forest fund within the Eastern Podillya is the main base, a potential reserve for the formation of the framework of the regional ecological network, and can also become the basis for the formation of new protected sites and territories. However, not always created forest objects of the nature reserve fund correspond to the root types of forest. We have determined that at present, the forest area and the territory of the nature reserve fund of Vinnytsia oblast on the total area of 837.5 hectares are in the risk zone and the process is quite dynamic, which creates an additional threat of biodiversity loss. We also determined that there is a threat of the loss of almost 160 objects of the nature reserve fund in the region, as they have a low level of tolerance to the natural and anthropogenic factors of the environment that cause their death.

References

- Buksha, I. F., Pasternak, V. P., Pyvovar, T. S., Buksha, M. I., & Yarotsky, V. Y. (2011). Methodical materials on the monitoring of forestry level I and ensuring its quality. Skhvaleno Vchenoyu radoyu UkrNDILHA Protokol № 8 vid 8.07. 2011. Kharkiv: UkrNDILHA.
- Hensiruk, S. A. (2002). Lisy Ukrainy. Lviv (in Ukrainian).
- Hordiienko, M., & Korniienko, V. (2009). Lisy v ekomerezhi Ukrainy. Rozbudova ekomerezhi Ukrainy. Kiev (in Ukrainian).
- Mudrak, O. V. (2008). Ekolohichna bezpeka Vinnychchyny. Vinnytsia (in Ukrainian).
- Mudrak, O. V., Mudrak, H. V., Polishchuk, V. M., Kushnir, S. L., & Yelisavenko, Yu. A. (2014). Etalony pryrody Vinnychchyny. Vinnytsia (in Ukrainian).
- Mudrak, O. V., & Ovchynnykova, Yu. Iu. (2017). Skhidne Podillia-reprezentatyvnyi rehion natsionalnoi ekomerezhi. Ahroekolohichnyi Zhurnal, 4, 7-13.
- Mudrak, O. V., Ovchynnykova, Yu. Yu., Mudrak, G. V., & Nagornyuk, O. M. (2018). Eastern Podilia as a Structural Unit of a Pan-European Environmental Network. Journal of Environmental Research, Engineering and Management, 74(3), 55-63 (in Lithuania).
- Ostapenko, B. F., & Tkach V. P. (2002). Lisova typolohiia. Ch. 2. Navchalnyi posibnyk. Kharkiv: KhDAU im. V.V. Dokuchaeva. 204 s.
- Rekomendatsii z Lisovoi Sertyfikatsii Lisohospodarskykh Pidpriemstv (2010). Kharkiv. (in Ukrainian).

Sheliah-Sosonko, Yu. R. (2004). Formuvannia rehionalnykh skhem ekomerezhi. Metodichni rekomendatsii. Kyiv (in Ukrainian).

Yelisavenko, Yu. A. (2013). Optymyzatsiya funktsionalno-prostranstvenoi struktury pryrodno-zapovednogo fonda dlia proektyrovanyia rehionalnoi ekolohycheskoi sety Vynnytskoi oblasti. *Agrarian Science*, 2, 39-43 (in Russian).

Yelisavenko, Yu. A. (2015). Naturally-protected business in the forest landscape of the Vinnytsya Region. *Europa wielkich szans-zrownowazony rozwoj Polski szansa dla Europy (Europe of great opportunities-sustainable development of Poland as an opportunity for Europe)*. Warszawa. Wydawnictwo SGGW (in English).

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