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THE ASSESSMENT OF PHYTOCENOTICAL AND GEOBOTANICAL DIVERSITY OF THE SOUTHERN BUG VALLEY AT THE EXAMPLE OF THE SELECTED AREAS OF VINNYTSIA OBLAST (UKRAINE)

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The article presents the results of pilot study of floristic and geobotanical diversity of the selected areas in the Southern Bug Valley in Vinnytsia Oblast. The study as well as the analysis of its results have been carried out based on the concept of sigmassociations – one of methods applied in the global phytosociology in accordance with Géhu's [5] findings. The following are four sigmassociations (geobotanical landscape systems) forming the vegetation cover of the Southern Bug Valley in Vinnytsia Oblast: foreshore (mainly rushes), riparian (shrubs and arborescent vegetation and grasses of floodplains), xero-thermophilous (thermophilous grasslands and steppe vegetation), forest (mainly leafy forest).

Key words: the concept of sigmassociation, vegetation cover, the Southern Bug Valley, Vinnytsia Oblast.

The Southern Bug Valley is a valuable natural area with a rich and diverse vegetation cover. The Southern Bug (Yuzhnyi Boh, Південний Буг, Hypanis in ancient history) flows through the central part of Podolia. For 2.5–3 months in a year it is covered with ice, and its navigable section reaches as far as 150 km from the river mouth. In its beginnings it flows southeastwards through a boggy plain valley and then through Volynian-Podolian Upland forming a serpentine ravine with steep banks and multiple longitudinal granite rapids (fig. 1) [6; 7; 8].

The topography of the valley has a dual character. There are deep and steep sections as well as shallow areas where the water spreads wide. This benefits geobotanical, habitat and vegetation cover diversity. Larger towns located at the river are Khmelnytskyi, Khmilnyk, Vynnitsia and Mykolaiv [6].

The aim of this study is a pilot analysis of phytocenotical and geobotanical diversity of the selected areas in the Southern Bug Valley in Vinnytsia Oblast in Ukraine.

The assessment of floristic and geobotanical diversity of the Southern Bug Valley (at the example of the selected areas of Vynnitsia Oblast) has been carried out based on the concept of sigmassociations – one of methods applied in the global phyto-

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sociology in accordance with Géhu's [5] findings. It is a landscape study-oriented concept taking into account the scale of at least a region. The basic ideas of the concept are: the assessment of the vegetation landscape, its classification and the evaluation of its ecological diversity in the landscape [12]. In Poland such pilot study applying the concept of sigmassociations has been carried out in the mezoregions of the Bug Valley [2] and the Nida Basin [4].

Fig. 1. Podolia on the map of Ukraine [6; 8]

On the basis of materials acquired through phytosociological and floristic study complex sigmassociations have been distinguished as spatial, supra-ecosystem systems with similar habitat conditions and physiognomy. Within complex sigmassociations (Σ) basic sigmassociations (σ) have been identified as intra-ecosystem systems resulting from differences in habitat, including anthropogenic systems. Groups of those plant communities have been identified using the method of classical phytosociology as regarded by Braun-Blanquet [1]. The results of the analyses have been put together in tables using a four-scale geobotanical hierarchy: an association or an alliance → associations or alliances forming basic sigmassociations (σ) → higher syntaxonomic units forming complex (Σ) sigmassociations (geobotanical systems) → ecological or phytocenotical landscape system.

The study did not include synanthropic vegetation or degenerated vegetation communities. The focus of the study was exclusively on natural and semi-natural vegetation.

Geobotanical study was carried out in the selected terraces of the Southern Bug Valley near the towns of Gnivan, Komorovo, Mogilovka, Tyrov, Urozhnoie, Voroshylovka belongind to Vynnytsia Oblast [6; 7; 8].

Space types of the plant communities within the sigmassociations have been marked with the following symbols: "0" – continual "=" – linear, "+" – island, "·" – dispersed. In order to evaluate the degree of the vegetation cover Braun-Blanquet's [1] scale has been adopted. The first symbol denotes the space type of the examined plant community and the second one, after the slash sign, denotes its cover, for instance =/2 stands for a community with a linear space type, covering 5–25 % of the examined area.

Latin names of vascular plants were taken after Mirek et al. [11] and units of syntaxonomic groups after Matuszkiewicz [10].

The results of assessment of vegetation cover diversity in the Southern Bug are the effect of a pilot study carried out within the timeframe of one vegetative season on the turn of May and June 2010. They show the structure of randomly selected fragments of vegetation and have yet to be completed. Despite a limited scope of the study the concept of sigmassociations allowed to assess the structure of the valley's landscape.

Four geobotanical systems have been distinguished as complex sigmassociations (Σ) and 8 as basic sigmassociations (σ) as seen Géhu, and within them 35 plant communities in the rank of an association or an alliance as seen by Braun-Blanquet (tab. 1).

***Geobotanical system of foreshore landscapes* – Σ_1.** In the landscape of the valley foreshore plant communities form ecological and geobotanical systems that create a barrier preserving anthropogenic pollutants from getting into the water [9]. Such systems often reinforce oxbow lakes as enclaves and reservoirs of landscape and biological diversity [3].

In the Southern Bug Valley the foreshore area is dominated by rushes that create a widespread complex sigmassociation (Σ) along water currents. This system is formed by two basic sigmassociations (σ): typical rushes *(Phragmition)* and high-sedge rushes *(Magnocaricion).*

The vegetation of typical rushes (σ_1) forms along water currents linear space types dominated by the community of *Phragmitetum australis.* Communities of typical rushes were dominated by the following plants species: *Phragmites australis* (2-4), *Typha latifolia* (+-2), *Glyceria maxima* (+-2), *Acorus calamus* (+-3), *Schoenoplectus lacustris* (1-2), *Rorippa amphibia* (1-2), *Lysimachia vulgaris* (+-2), *Lythrum salicaria* (+-2), *Myosotis palustris* (+-1) and others. Among high-sedge rushes (σ_2) the following species had the biggest share: *Carex elata* (+-2), *Carex gracilis* (+-1), *Poa pratensis* (+-3), *Carex acutiformis* (+-2), *Rumex acetosa* (+-2), *Deschampsia caespitosa* (+-3), *Comarum palustre* (1-2), *Caltha palustris* (+-2), *Equisetum palustre* (+-2) and others.

***Geobotanical system of riparian landscapes (floodplains)* – Σ_2.** In riparian floodplains of the Southern Bug shrub, arborescent and grasses vegetation has been identified. Two σ units have been determined. The first one consists of shrub and arborescent vegetation formed by five communities (σ_1). The most populous here are the communities of osier beds, riverside wicker, poplar and alder carrs growing linearly. Trees and shrubs with the biggest share are: *Salix alba* (r-1), *S. purpurea* (+),

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S. viminalis (+), *S. cinerea* (+), *Populus alba* (+-1), *P. nigra* (+), *Ulmus minor* (+), *Alnus glutinosa* (+-1), *Ribes nigrum* (+-1).

Table 1

Phytocenotical diversity of the Southern Bug valley

Type of sigma-association		Spatial type of communities					
σ	Σ	Gn	Ko	Mo	Ty	Ur	Vo
Geobotanical system of foreshore landscapes – **Σ_1**							
Typical Rushes – σ_1	*Phragmitetum australis* Gams 1927	./r	=/3	./1			=/1
	Typhetum latifoliae Soó 1927	./r	+/2				
	Glycerietum maximae Hueck 1931		+/1				./+
	Acoretum calami Kobendza 1948		./+				
High-sedge rushes– σ_2	*Phalaridetum arundinaceae* Libb. 1931		+/2				+/1
	Caricetum elatae Koch 1926	./r	+/1				
	Caricetum acutiformis		./1				
	Caricetum gracilis R. Tx. 1937		./+				./+
Geobotanical system of riparian landscapes (flood zone) – **Σ_2**							
Shrubby and woody vegetation – σ_1	*Salicion albae* R.Tx.1955	0/2	./+				./r
	Ribeso nigri-Alnetum Sol.-Górn. (1975) 1987	=/1					
	Ficario-Ulmetum minoris Knapp 1942	+/+					
	Fraximo-Alnetum W. Mat.1952	+/+					
	Salicetum pentandro-cinereae Pass. 1961	+/+					
Grasses vegetation – σ_2	*Deschampsietum caespitosae* Horvatić 1930	+/1	./+	+/+			
	Agropyro-Rumicion crispi Nordh. 1940			+/1			0/5
	Calthion palustris R. Tx 1936		+/+				+/4
	Agrostis stolonifera-Potentilla anserina Oberd. 1979/1980	./+		+/1			
	Filipendulo-Geranietum W. Koch 1926	+/+	+/+				
	Lysimachio vulgaris-Filipenduletum Bal.-Tul. 1978	./+	+/+				
	Arrhenatheretum elatioris Br.-Bl. ex Scherz. 1925	./+	+/1	./+			
	Lolio-Cynosuretum cristatae R. Tx. 1937		./+	+/+			./r
	Alopecuretum pratensis Pass. 1964	./+	+/1	./+			
Geobotanical system of xerothermophilous landscapes – **Σ_3**							
Thermophilous grasslands– σ_1	*Koeleria glauca* community	+/+		+/1	./1	+/1	
	Corynephoro-Silenetum tataricae Libb. 1931	./+			+/+	+/1	
	Spergulo vernalis-Corynephoretum Libb. 1933	./r		./+	./+	./+	
	Festuco psammophilae-Koelerietum glaucae Klika 1931			+/+	+/+	./+	
Steppe vegetation – σ_2	*Koelerio-Festucetum rupicolae* Kornaś 1952	./+		+/2	./2	./+	
	Thalictro-Salvietum pratensis Medw.-Korn. 1959			./+	./+	+/+	
	Adonido-Brachypodietum pinnati Libb. 1933	./+		./1	+/2	./+	
	Sisymbrio-Stipetum capillatae Dziub. 1925	./+		+/1	+/1	./+	

Ending of tab. 1

Geobotanical system of forests landscapes – **Σ₄**								
Leafy forest – σ_1	*Tilio cordatae-Carpinetum betuli* Tracz. 1962	0/4		0/3				
	Querco roboris-Pinetum Mat.1981	+/1		+/2				
Coniferos forest – σ_2	*Cladonio-Pinetum* Juraszek 1927			./r				
	Peucedano-Pinetum Mat. (1962)1973			./r				
	Molinio-Pinetum Mat. 1973			./r				

Explanation of abbreviation:
Σ – complexal sigma-associations, σ – basic sigma-associations.
Research station:
Gn – Gnivan – 49,094N/28,358E; 242 m.a.s.l.
Ko – Komorovo – 49,144N/28,375E; 240 m.a.s.l.
Mo – Mogilovka – 49,091N/28,313E; 244 m.a.s.l.
Ty – Tyrov – 49,030N/28,494E; 240 m.a.s.l.
Ur – Urozhnoie – 49,149N/28,334E; 240 m.a.s.l.
Vo – Voroshylovka – 49,053N/28,329E; 233 m.a.s.l.
Predominations of spatial communities type: 0/ – continuous; =/ – linear; +/ – enclaved; ./ - diffused.
Total assessment coverage of mesoregion marked by Braun-Blanquet scale: /r, /+, /1, /2, /3, /4, /5.

The other unit are grasses of meadows and pastures (σ_2). The habitats of this vegetation are located further from the river and differ in terms of humidity and area. Island and dispersed space types have been identified here rather than continual ones. The communities of fertile meadows on wet and humid as well as temporarily flooded habitats are dominant here and include: *Agropyro-Rumicion crispi, Filipendulion ulmariae*, *Alopecurion pratesis*, *Calthion palustris.* Grasses dominating these phytocenoses were: *Deschampsia caespitosa* (1-3), *Agrostis stolonifera* (+-2), *Poa palustris* (1-2), *Alopecurus pratensis* (1-2), *Arrhenatherum elatius* (+-1), *Festuca rubra* (+-2).

***Geobotanical system of xerothermophilous landscapes* – Σ₃.** Communities of thermophilous and steppe grasslands form a specific geobotanical system so characteristic for the landscape of the valley. The heights with dry ground have turned out to be a perfect habitat for xerothermophilous vegetation. On dispersed habitats two different basic sigmassociations have been found: thermophilous grasslands (σ_1) and steppe vegetation (σ_2).

The community of thermophilous grasslands consists of psammophilous vegetation with clearly thermophilous and xerophilous requirements. This vegetation included the following communities: *Koeleria glauca*, *Corynephoro-Silenetum tataricae*, *Spergulo vernalis-Corynephoretum* and *Festuco psammophilae-Koelerietum glaucae*. Despite a rich floristic diversity these communities were dominated by the following species: *Koeleria glauca* (+-1), *Corynephorus canescens* (+-2), *Artemisia campestris* (+-1), *Thymus serpyllum* (1-2), *Galium verum* (+-1).

The second basic sigmassociation within xerothermophilous vegetation has manifested the features of steppe vegetation. This vegetation belongs to thermophilous steppe grasslands with a dry ground and neutral *pH.* In terms of phytosociology it falls under the class of *Festuco-Brometea.* Four island and dispersed communities on a dominant anthropogenic landscape, manifesting no characteristic species, have been identified. Single and small habitats of *Koelerio-Festucetum rupicolae, Adonido-Brachypodietum pinnati* and *Sisymbrio-Stipetum capillatae* communites could be met most frequently. These communities were dominated by the following species: *Brachypodium pinnatum* (+-2), *Koeleria glauca* (+-1), *Salvia pratensis* (+), *Festuca rupicola* (+), *Phleum phleoides* (+), *Thymus kosteleckyanus* (1-2), *Carex supina* (+-1).

Geobotanical system of forests landscapes – $\boldsymbol{\Sigma_4}$**.** Within this sigmassociation two basic sigmassociations have been distinguished: coniferous forest (σ_1) and leafy forest (σ_2).

"Dispersed" or "island" were the most frequent space types for leafy forests (*Querco roboris-Pinetum),* but also vast continual patches of them have been found *(Tilio cordatae-Carpinetum betuli).* Dominant species were: *Quercus robur* (+-1), *Carpinus betulus* (+-2), *Tilia cordata* (+-1), *Acer negundo* (+-2), *Robinia pseudo-acacia* (+-2), *Crategus monogyna* (+-1), *Acer pseudoplatanus* (+-1), *Euonymus verrucosa* (+), *Urtica dioica* (1-2), *Impatiens noli-tangere* (+), *Geranium robertianum* (+-1) and others.

Coniferous forest is hardly found on the examined area. Only scarce and single habitats of fresh coniferous forest *(Peucedano-Pinetum)*, rather than dry coniferous forest *(Cladonio-Pinetum)* or humid coniferous forest *(Molinio-Pinetum)* could be found. These communities had hardly any typical species.

The pilot study has shown that the vegetation cover of the Southern Bug Valley in Vinnytsia Oblast is formed mostly by four sigmassociations (geobotanical landscape systems). They are: foreshore (mainly rushes), riparian (shrubs and arborescent vegetation and grasses of floodplains), xerothermophilous (thermophilous grasslands and steppe vegetation), forest (mainly leafy forest).

The vegetation cover of the Southern Bug Valley has been under a strong anthropopression. In order to preserve its natural values and diversity new protected areas must be created and the existing ones must be extended. Ecological agriculture favoring biological diversity should be promoted.

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ОЦІНКА ФІТОЦЕНОТИЧНОЇ І ГЕОБОТАНІЧНОЇ РІЗНОМАНІТНОСТІ ДОЛИНИ ПІВДЕННОГО БУГУ НА ПРИКЛАДІ ВІННИЦЬКОЇ ОБЛАСТІ (УКРАЇНА)

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Описано результати пілотних досліджень фітоценотичної і геоботанічної різноманітності вибраних ділянок долини Південного Бугу в Вінницькій області. Дослідження і аналіз результатів проведено на основі концепції сігмасоціації, тобто одному з методів, який використовують у глобальній геоботаніці згідно теорії Ґегу. Рослинність в долині Південного Бугу Вінницької області складається з чотирьох основних сігмасоціацій (геоботанічних ландшафтних систем).

Ключові слова: концепція сігмасоціації, рослинність, долина Південного Бугу, Волинська область.

ОЦЕНКА ФИТОЦЕНОТИЧЕСКОГО И ГЕОБОТАНИЧЕСКОГО РАЗНООБРАЗИЯ ДОЛИНЫ ЮЖНОГО БУГА НА ПРИМЕРЕ ВИННИЦКОЙ ОБЛАСТИ (УКРАИНА)

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Описаны результаты пилотных исследований фитоценотического и геоботанического разнообразия выбранных участков долины Южного Буга в Винницкой области. Исследования и анализ результатов проведен на основе концепции сигмассоциации – метода глобальной геоботаники согласно теории Гегу. Растительность в долине Южного Буга Винницкой области состоит из четырех основных сигмассоциаций (геоботанических ландшафтных систем).

Ключевые слова: концепция сигмассоциации, растительность, долина Южного Буга, Волынская область.