

THE VEGETATION OF SANDS IN THE CHERNIHIV CITY (UKRAINE)

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Abstract:

The vegetation of the Chernihiv city sands (natural and technogenic origin) has rather high syntaxonomic diversity (17 associations and 5 initial communities) and the ruderal phytocoenoses prevail. Natural phytocoenoses are represented to a small extent (*Cyperetum flavescens* Koch 1926, *Dichostylidi–Helochloetum alopecuroidis* (Timar 1950) Pietsch 1973, *Artemisia scoparia–Dianthus borbasii* community, *Kochietum arenariae* Fijalk 1978). Synanthropic psammophytes species communities that are more resistant to anthropogenic influence, are formed under urban conditions. The ecological range of vegetation of sandy alluvia varies from xerophytic phytocoenoses in mineral-poor sand (*Kochietum arenariae*) to the communities, which indicate waterlogged areas with increased mineralization of water and saline bottom sediments (*Typhetum laxmannii* Nedulcu 1968). It is possible to observe the adventization and apophization of sand vegetation, one of the indicators of which is the rupture of coenotic connections between the species of the community. These phenomena indicate that the process of synanthropization of the vegetation cover of the city keeps intensifying, and first of all, occurs in places of newly formed technogenic ecotopes.

Key words: vegetation, sands, Chernihiv city, anthropogenic influence.

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INTRODUCTION

The vegetation of the city of Chernihiv undergoes anthropogenic influence in one way or another. It leads to emergence of synanthropic elements of flora in its composition and formation of synanthropic communities. Psammophytic vegetation is one of the most dynamic components of vegetation. In urban conditions vegetation of sands is an indicator of the degree of anthropogenic influence on landscapes.

Special investigations of sand vegetation under urban conditions were carried out. The researches on the peculiarities of the overgrowth of boreal sands in the Ukrainian Polesye were carried out (Andrienko, 1994). The information on the composition and distribution of synanthropic plant communities, occurring on sands in the Ukraine is given in the monograph of Solomakha *et al.* (1992). The goal of our work is to determine a syntaxonomic composition and peculiarities of plant communities of alluvial, boreal and alluvial sands in Chernihiv.

STUDY AREA

Chernihiv is located in the Polesye within the forest climatic zone (region). The climate is mild, moderately con-

tinental. Its formation occurs mainly under the influence of the Atlantic air masses. The annual mean air temperature is +6.5°C, the annual mean maximum temperature is +2.5°C and the annual mean minimum temperature is -10.8°C. The mean temperature of January is -6.7°C and of July is +19.4°C. The relative air humidity is 79%. The annual mean rainfall is 597 mm, the mean rainfall of the warm period is 359 mm and of the cold period is 180 mm (Council, 2008).

Chernihiv is located in the eastern part of Chernihiv Polesye on the right bank of the Desna River in the zone where a river valley joins with the Liubetsko-Chernihivska moraine-outwash plain. The main morphostructural elements in the city are Liubetsko-Chernihivska moraine-outwash plain and the Desna River valley with a complex of Quaternary terraces, characterized by a variety of landforms. The Liubetsko-Chernihivska moraine-outwash plain occupies most of the territory of Chernihiv, adjacent to the right bank of the Desna River. It is characterized by significant landscape dismemberment. Sandy loam soil, glacial and glaciofluvial deposits play a significant role in the structure of the plain. Within Chernihiv, the moraine-outwash plain is dismembered by river valleys of two right tributaries of the Desna River – the river Strizhen and the river Belous. There is a big net of ravines and gullies to the slopes of the valleys of these rivers (Ecological passport of the Chernihiv area, 2017).

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MATERIAL AND METHODS

The material was collected during field research of the vegetation on sand of the Chernihiv city (coniferous forest terraces and backwaters of the Desna River, Stryzhen and Bilous rivers) in 2016–2018. The field study of the vegetation was carried out by geobotanical methods (Korchahin, 2012). The vegetation relevés were carried out during the vegetation and flowering of plants in test areas of 30–80 m². The general projective coverage of the vegetation community and the coverage of each species were fixed. 66 phytosociological relevés were made. Syntaxa were identified according to Matuszkiewicz (2001) for natural vegetation and Solomakha *et al.* (1992) for synanthropic vegetation.

RESULTS

The 26 phytosociological relevés were identified on a fluvial sand of the Desna River, the mouth of the Strizhen River and the Belous River within the boundaries of the city of Chernihiv (Table 1).

The communities of the *Bidentetea* class – summer-annual pioneer vegetation of seasonally flooded nutrient-rich river alluvia, lacustrine banks and heavily nutrient-loaded anthropogenic habitats, are often found. The *Bidentetalia tripartiti* order is diagnosed by *Bidens tripartita* L. and *Rorippa palustris* L. The *Bidentetalia tripartiti* alliance is diagnosed by *Bidens cernua* L.

We described only a single phytocoenosis (relevé 1), which belongs to the *Rumicetum maritime* association. The total projective covering on this plot is 80% and diagnostic species of the association are *Rumex maritimus* L., projective covering of which is 30%. The projective covering of *Bidens tripartita*, *Conyza canadensis* (L.) Cronquist, *Echinochloa crus-galli* (L.) P. Beauv. and *Plantago major* L. is 2–5%. *Rorippa palustris*, *Bidens cernua*, *Chenopodium rubrum* L., *Taraxacum officinale* Wigg. Aggr., *Lycopus europaeus* L., *Lepidium ruderales* L., *Oenanthe aquatica* (L.) Poir., *Calamagrostis epigeios*, *Festuca ovina* L., *Mentha aquatica* L., *Salix* L. can be found occasionally. The projective covering of *Agrostis capillaris* L. is 20%. The number of species is 17.

The *Bidentetum tripartitae* association is represented in relevés 2, 3. The total projective covering is 30–35%. The diagnostic species of the association are *Bidens tripartita*, *Polygonum hydropiper* L. with the projective covering of 20% and 5% respectively. The communities include *Bidens frondosa* L., *Juncus articulatus* L., *Mentha aquatica*, *Elytrigia repens* (L.) Nevski, the projective covering of which are 5–10%. Such diagnostic species of the Poetum annuae association as *Plantago major* L., *Poa annua* L. and *Potentilla anserina* L. are represented in these relevés. Their projective covering is insignificant (up to 2%). *Rorippa palustris* L., *Bidens cernua*, *Chenopodium rubrum*, *Echinochloa crus-galli*, *Lycopus europaeus*, *Agrostis stolonifera* L., *Alopecurus geniculatus* L., *Juncus com-*

pressus Jacq., *Potentilla anserina* L., *Conyza canadensis*, *Deschampsia caespitosa* (L.) P. Beauv., *Salix viminalis* L. and *Trifolium repens* can be found occasionally. The number of species is 22.

The *Bidens frondosa* community (relevés 4) is diagnosed by *Bidens frondosa* with the projective covering of 5%. *Bidens tripartita* occurred in the community with the projective covering of 5%. Such diagnostic species of the Poetum annuae association as *Plantago major*, *Poa annua* and *Potentilla anserina* L. are represented in this relevé occasionally. *Rorippa palustris*, *Bidens cernua*, *Polygonum hydropiper*, *Chenopodium rubrum*, *Echinochloa crus-galli*, *Agrostis stolonifera* L., *Alopecurus geniculatus* L., *Potentilla anserina*, *Conyza canadensis*, *Deschampsia caespitosa*, *Populus nigra* L., *Salix viminalis*, *Trifolium repens* can be found in the community occasionally.

The *Xanthio riparii–Chenopodietum rubri* association (relevés 5–7). The projective covering is 50–90%, *Xanthium albinum* is the species which diagnoses the association. The projective covering of *Xanthium albinum* is 20–50%. *Xanthium albinum* is a new species from the North America. As for the Ukraine, the species began to spread quickly from Kyiv along the Dnipro and in a rather short time took a wide area. It forms large colonies on the outskirts of large cities, along the river banks and pastures, in the wilderness, coastal spit. In the community there are such species as *Bidens tripartita* (5%), *Bidens frondosa* (7%), *Echinochloa crus-galli* (3%), *Juncus bufonius* L. (20%), *Plantago major* (7%), *Mentha aquatica* (15%), *Myosotis palustris* (L.) L. (3%), *Salix viminalis* (3%). *Rorippa palustris*, *Bidens cernua*, *Chenopodium rubrum*, *Butomus umbellatus* L., *Sparganium emersum* Rehm., *Typha latifolia* L., *Oenanthe aquatica*, *Alopecurus geniculatus*, *Conyza canadensis*, *Melissa officinalis* L., *Juncus articulatus* L. can be found occasionally.

The *Isoëto–Nanajuncetea* class is diagnosed by presence of *Centaureum pulchellum* (Sw.) Druce, *Juncus bufonius*, *Juncus tenageia* Ehrh. ex L. and *Plantago intermedia*. The diagnostic species of the *Cyperetalia fusci* order are *Gnaphalium uliginosum* L. and *Potentilla supina* L. The diagnostic species of the *Elantini–Eleocharition ovatae* alliance are *Eleocharis acicularis* (L.) Roem. et Schult and *Cyperus fuscus*. We recorded only 2 associations of this alliance.

The *Cyperetum flavescens* association is represented in relevés 8 and 9. The projective covering of the described communities is 70%. The communities are formed by such species as *Cyperus flavescens* L., *Sagina nodosa* (L.) Fenzl with the projective covering of 10%. The communities are represented by such species as *Bidens tripartita* (10%), *Rumex maritimus* L. (5%), *Bidens frondosa* (up to 5%), *Xanthium albinum* (up to 5%), *Gnaphalium uliginosum* (up to 10%), *Juncus bufonius* (25%), *Cyperus fuscus* (5%), *Cyperus flavescens* L. (10%), *Sagina nodosa* (L.) Fenzl (10%), *Lycopus europaeus* (5%), *Mentha aquatica* (35%), *Centaureum pulchellum* (Sw.) Druce (1%). Such species as *Melissa officinalis* L., *Conyza canadensis*, *Agrostis capillaris*, *Ambrosia artemisiifolia* L., *Typha latifolia*, *Myo-*

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Table 1. Floristic structure of the plant communities of the alluvial sands of of Chernihiv city

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Area [m ²]	16	100	16	12	40	80	80	24	3	18	20	100	9	30	4	30	48	25	6	30	28	35	15	12	12	12
Layer cover [%]	75	30	35	20	90	50	61	62	75	60	78	85	35	55	85	40	90	70	83	70	40	25	20	50	96	67
DAss. <i>Rumicetum maritimi</i>																										
<i>Rumex maritimus</i>		4	+	.	.	.	.	.	+	1	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.
DAss. <i>Bidentetum tripartitae</i>																										
<i>Bidens tripartita</i>	1	3	1	1	1	+	1	.	2	.	2	+	.	2	.	2	1	2	.	2	1	1	+	.	.	.
<i>Polygonum hydropiper</i>	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
DCom. <i>Bidens frondosa</i>																										
<i>Bidens frondosa</i>	.	.	1	3	.	1	.	1	1	+	.	.	.	.	.	1	.	.	.	.	1	1	2	.	.	.
ChAll. <i>Bidention</i>																										
<i>Bidens cernua</i>	+	+	+	+	.	.	+	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.
ChAss. <i>Xanthio riparii–Chenopodietum rubri</i>																										
<i>Xanthium albinum</i>	.	.	.	.	4	3	4	+	1	+	1	+	+	2	.	.	1	1	.	+	.	.	.	.	.	.
DAll. <i>Chenopodium fluviatile</i>																										
<i>Chenopodium rubrum</i>	+	.	.	.	+	+	+	+	+	+	1	1	.	.	+	+	+	.	.	+	+	1	+	+	.	.
<i>Chenopodium album</i>	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ChCl <i>Bidentetea tripartiti</i>																										
ChO. <i>Bidentetalia tripartiti</i>																										
<i>Bidens tripartita</i>	1	3	1	1	1	+	1	.	2	.	2	+	.	2	.	2	1	2	.	2	1	1	+	.	.	.
<i>Rorippa palustris</i>	+	+	+	+	+	.	+	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
DAss. <i>Cyperetum flavescens</i>																										
<i>Cyperus flavescens</i>	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sagina nodosa</i>	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ChAll. <i>Elantini–Eleocharition ovatae</i>																										
<i>Eleocharis acicularis</i>	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Cyperus fuscus</i>	.	.	.	.	.	.	.	1	+	+	+	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.
DAss. <i>Dichostylidi–Helochloetum alopecuroidis</i>																										
<i>Dichostylis micheliana</i>	.	.	.	.	.	.	.	.	.	1	1	+	+	3	.	.	.	.	.	.	.	.	.	.	.	.
<i>Schoenoplectus supinus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ChAll. <i>Heleochoo–Cyperion micheliani</i>																										
<i>Cyperus schoenoides</i>	.	.	.	.	.	.	.	+	+	+	2	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.
ChO. <i>Cyperetalia fusci</i>																										
<i>Gnaphalium uliginosum</i>	.	.	.	.	.	.	.	2	+	1	+	+	2	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Potentilla supina</i>	.	.	.	.	.	.	.	+	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.
ChCl. <i>Isoëto–Nanojuncetea</i>																										
<i>Centaurium pulchellum</i>	.	.	.	.	.	.	.	1	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juncus tenageia</i>	.	.	.	.	.	.	.	.	+	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Plantago intermedia</i>	.	.	.	.	.	.	.	+	+	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juncus bufonius</i>	.	.	.	3	.	.	.	+	3	3	2	3	+	+	.	.	.	.	.	.	.	.	.	1	.	.
ChAss. <i>Echinochloa–Setarietum</i>																										
<i>Echinochloa crus-galli</i>	1	+	+	+	+	+	1	+	+	+	1	2	+	.	4	.	.	.	.	.	.	.	.	.	.	.
<i>Raphanus raphanistrum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ChAll. <i>Panico–Setarion</i>																										
<i>Setaria pumilla</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
ChO. <i>Polygono–Chenopodietalia</i>																										
<i>Capsella bursa-pastoris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Stellaria media</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
ChCl <i>Stellarietea mediae</i>																										
<i>Stellaria media</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
<i>Galeopsis speciosa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.
DAs. <i>Poetum annuae</i>																										
<i>Poa annua</i>	.	+	+	+	.	.	.	.	.	.	.	.	.	2	.	.	2	.	.	.	.	.	.	.	.	.
<i>Potentilla anserina</i>	.	+	+	+	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	+	+	+	.	.
<i>Taraxacum officinale</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
ChAll. <i>Polygonion avicularis</i>																										
<i>Polygonum aviculare</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.
ChO. <i>Plantaginetales majoris</i>																										
ChCl. <i>Plantaginetea majoris</i>																										
<i>Plantago major</i>	1	1	+	+	2	.	+	.	+	+	2	1	3	.	.	2	1	+	.	+	+	1	.	.	.	
ChAss. <i>Sagittario–Sparganietum emersi</i>																										
<i>Sparganium emersum</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	5	.	.	1	.	.	.	.	.
ChAss. <i>Typhetum latifoliae</i>																										
<i>Typha latifolia</i>	.	.	.	.	.	.	+	.	+	.	+	.	.	.	.	.	.	+	.	4	5	1	.	.	.	.
ChAss. <i>Oenanthe–Rorippetum</i>																										
<i>Oenanthe aquatica</i>	+	.	.	.	.	.	+	.	+	.	.	.	.	.	.	1	.	1	1	+	4	.	.	.	+	.

Table 1 (continuation). Floristic structure of the plant communities of the alluvial sands of Chernihiv city

Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Area [m ²]	16	100	16	12	40	80	80	24	3	18	20	100	9	30	4	30	48	25	6	30	28	35	15	12	12	12	
Layer cover [%]	75	30	35	20	90	50	61	62	75	60	78	85	35	55	85	40	90	70	83	70	40	25	20	50	96	67	
ChAll. Phragmition																											
<i>Lycopus europaeus</i>	+	+	.	.	.	1	.	1	.	+	1	2	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.
<i>Lysimachia vulgaris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.
<i>Agrostis stolonifera</i>	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.
<i>Myosotis palustris</i>	.	.	.	.	.	1	+	+	+	.	.	+	.	.	.	.	.	1	+	1	+	.	.	.	.	.	.
<i>Butomus umbellatus</i>	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	1	.	+	3	2	1	.	.	.	.	.	.
ChO. Phragmitetalia																											
ChCl. Phragmitetea																											
<i>Phragmites australis</i>	.	.	.	.	.	.	.	+	.	+	.	+	.	.	.	.	.	+	1	1	2	.	.	.	.	.	.
<i>Rumex hydrolapatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.
ChAss. Blysmo–Juncetum compressi																											
<i>Juncus compressus</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	2	.	.
ChAll. Agropyro–Rumicion crispi																											
ChO. Trifolio fragiferae–Agrostietalia stoloniferae																											
ChCl. Molinio–Arrhenatheretea																											
<i>Alopecurus geniculatus</i>	.	.	+	+	.	.	+	.	.	.	.	.	.	.	2	+	+	1	.	3	1	1	+	.	.	.	.
<i>Juncus compressus</i>	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2	2	.	.	.
<i>Potentilla anserina</i>	.	+	+	+	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	+	+	+	.	.	.
DCom. Artemisia abrotanum																											
<i>Artemisia abrotanum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	4	5	4
D.s. All. Arction lappae																											
<i>Arctium lappa</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Ballota nigra</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Artemisia vulgaris</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Urtica dioica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Elytrigia repens</i>	.	.	2	.	.	.	.	.	.	.	1	2	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Leonurus cardiaca</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
D.s. Ord. Artemisietalia vulgaris																											
Tanacetum vulgare																											
<i>Tanacetum vulgare</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tussilago tarfara																											
<i>Tussilago tarfara</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
D.s. Cl. Artemisietea vulgaris																											
Urtica dioica																											
<i>Urtica dioica</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Anthriscus sylvestris																											
<i>Anthriscus sylvestris</i>	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chelidonium majus																											
<i>Chelidonium majus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lamium maculatum																											
<i>Lamium maculatum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Glechoma hederacea																											
<i>Glechoma hederacea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species																											
<i>Agrostis capillaris</i>	3	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
<i>Ambrosia artemisiifolia</i>	.	.	.	.	.	.	.	.	+	1	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Calamagrostis epigeios</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Caragana arborescens</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.
<i>Conyza canadensis</i>	1	+	.	+	.	+	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Deschampsia caespitosa</i>	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	+	.	+	.	4	3
<i>Festuca ovina</i>	+	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	2	.
<i>Lemna minor</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.
<i>Lepidium ruderales</i>	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Linum perenne</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Melissa officinalis</i>	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Mentha aquatica</i>	+	1	.	.	.	3	+	4	+	4	3	2	.	.	.	.	.	+	1	.	.	.	.	.	.	.
<i>Oenothera biennis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Populus nigra</i>	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	+
<i>Populus tremula</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Rubus caesius</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Salix viminalis</i>	+	.	+	+	1	.	+	.	.	.	+	.	.	.	.	1	.	.	.	.	+	.	+	.	.	.	.
<i>Spirodela polyrrhiza</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Trifolium repens</i>	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Juncus articulatus</i>	.	.	1	.	.	.	+	.	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	+	.	+
<i>Ulmus laevis</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Note: **Cover abundance scale:** + – up to 1%, 1 – 1–5%, 2 – 6–12, 3 – 13–25%, 4 – 26–50%, 5 – >50%. **Syntaxon:** Rumicetum maritimi (relevés 1), Bidentetum tripartitae (relevés 2, 3), Bidens frondosa (relevés 4), Xanthio riparii-Chenopodietum rubri (relevés 5-7), Cyperetum flavescens (relevés 8, 9), Dichostylidi-Helochloetum alopecuroidis (relevés 10-14), Echinochloo-Setarietum (relevés 15), Poetum annuae (relevés 16), Sagittario-Sparganietum emersi (relevés 17), Typhetum latifoliae (relevés 18,19), Oenanthro-Rorippetum (relevés 20), Blysmo-Juncetum compressi (relevés 21-23), Artemisia abrotanum (relevés 24-26). **Locality of relevés:** 1-13 – flat shore of the Desna River, 14-26 – estuary of the Strizhen River and the Belous River, 25-26 – estuary of the river Strizhen/ **The date of relevés:** 1-9 – 19.09.2017, 10-13 – 23.09.2017, 14-24 – 10.10.2017, 25 – 12.09.2015, 26 – 28.09.2016. **Authors of relevés:** 1-13 – H.Danko, 14-24 – O.Lukash, H.Danko, 25-26 – O.Lukash.

solis palustris (L.) L., *Oenanthe aquatica*, *Plantago major*, *Echinochloa crus-galli*, *Crypsis schoenoides* (L.) Lam., *Potentilla supina* L., *Plantago intermedia*, *Juncus tenageia*, *Rorippa palustris* are represented in the community occasionally. The amount of species is 29.

The *Dichostylidi-Helochloetum alopecuroidis* association (relevés 10–14) contains the diagnostic species of *Dichostylis micheliana* L.) Nees and *Schoenoplectus supinus* (L.) Palla. *Bidens tripartita* (the projective covering is 9%), *Rumex maritimus* L. (5%), *Chenopodium rubrum* (3%), *Echinochloa crus-galli* (8%) that are represented in the phytocenoses. All the relevés clearly represent the diagnostic species of the *Xanthio riparii-Chenopodietum rubri* association – *Xanthium albinum* projective covering of which is 10%. In the phytocenoses there are such species as *Gnaphalium uliginosum*, *Juncus bufonius*, *Cyperus fuscus* L., *Elytrigia repens*, *Crypsis schoenoides*, *Poa annua*, *Echinochloa crus-galli*, *Lycopus europaeus*, *Plantago major*, *Ambrosia artemisiifolia* L. and *Mentha aquatica*, projective covering of which is 5–26%. *Rorippa palustris* Bess, *Bidens cernua*, *Bidens frondosa*, *Centaureium pulchellum* (Sw.) Druce, *Juncus tenageia*, *Galeopsis speciosa* Mill., *Potentilla anserina*, *Festuca ovina*, *Typha latifolia*, *Lepidium ruderales*, *Populus nigra*, *Agrostis capillaris*, *Myosotis palustris*, *Potentilla supina* L., *Plantago intermedia* are represented in the community occasionally. The number of species is 33.

The *Stellarietea mediae* class is diagnosed by the annual weed species such as *Stellaria media* (L.) Nees, *Galeopsis speciosa* Mill., *Polygonum aviculare* L. The diagnostic species of the *Polygono-Chenopodietalia* order are *Capsella bursa-pastoris* (L.) Medik., *Echinochloa crus-galli* i *Stellaria media*. The diagnostic species of the *Panico-Setarion* alliance are *Setaria glauca* (L.) P. Beauv., *Setaria viridis* (L.) P. Beauv. and *Rumex acetosella* L.

The *Echinochloa-Setarietum* association (relevé 15). The total projective covering on the plot is 85%. The association is diagnosed by *Echinochloa crus-galli* (the projective covering is 40%). The association is also diagnosed by *Raphanus raphanistrum* L. (represented occasionally). Other species of the community are *Caragana arborescens* Lam., *Lepidium ruderales*, *Linum perenne* L., *Populus nigra*, *Chenopodium rubrum*, *Sparganium emersum* Rehmman (occasionally), *Echinochloa crus-galli* (40%), *Butomus umbellatus* (3%), *Oenanthe aquatica* (5%), *Alopecurus geniculatus* (10%), *Elytrigia repens* (5%), *Ambrosia artemisiifolia* (5%) and *Calamagrostis epigeios* (2%).

The *Plantaginetales majoris* class is diagnosed by *Plantago major*. The diagnostic species of the *Plantaginetales majoris* order and the *Polygonion avicularis* alliance are *Plantago major* and *Poa annua*. The phytocenoses (relevé 16) of the *Poetum annuae* association has the total projective covering of 40%. The diagnostic species are *Plantago major*, *Poa annua*, *Potentilla anserina*, *Taraxacum officinale*. (the projective covering is up to 10%). Such species as *Bidens tripartita*, *Bidens frondosa*, *Elytrigia repens*, *Salix viminalis* and *Juncus articulatus* have the projective covering of 2–7%. *Echinochloa crus-galli*, *Alopecurus*

geniculatus, *Conyza canadensis*, *Potentilla anserine* and *Populus nigra* are represented occasionally.

The *Phragmitetea* class and the *Phragmitetalia* order are diagnosed by *Phragmites australis*, *Typha latifolia* and *Rumex hydrolapathum* Huds. The diagnostic species of the *Phragmitetalia* alliance are *Lycopus europaeus*, *Myosotis palustris*, *Lysimachia vulgaris* L., *Agrostis stolonifera* and *Butomus umbellatus*. The alliance consists of 3 associations.

The *Sagittario-Sparganietum emersi* association (relevé 17) has a total projective covering of the phytocenoses of 90%, the diagnostic species of the association is *Sparganium emersum* Rehmman, projective covering of which on the plot is 70%. Such species as *Bidens tripartita*, *Xanthium albinum*, *Plantago major*, *Oenanthe aquatica* and *Myosotis palustris* have the projective covering 1–5%. *Mentha aquatica*, *Lemna minor*, *Alopecurus geniculatus* and *Typha latifolia* can be found occasionally.

The *Typhetum latifoliae* association (relevés 18 and 19). The total projective covering of the plots is 70% and 83%. The diagnostic species of the association is *Typha latifolia*, with its projective covering on the plot of 30% and 35%. There is a group of species with the projective coverings from 1 to 15%. These are *Bidens tripartita* (10%), *Xanthium albinum* (5%), *Butomus umbellatus* (10–15%), *Myosotis palustris* (up to 5%), *Oenanthe aquatica* (2%), *Alopecurus geniculatus* (3%), *Mentha aquatica* (1%) and *Deschampsia caespitosa* (10%). *Ulmus laevis* Pall., *Spirodela polyrrhiza* (L.) Schleid., *Salix viminalis*, *Populus tremula*, *Oenothera biennis* L., *Melissa officinalis* L., *Lemna minor*, *Agrostis capillaris*, *Sparganium emersum* Rehmman, *Lycopus europaeus*, *Lysimachia vulgaris*, *Agrostis stolonifera*, *Phragmites australis* (Cav.) Trin. ex Steud., *Rumex hydrolapathum*, *Taraxacum officinale* and *Plantago major* can be rarely found.

The *Oenanthe-Roripetum* association (relevé 20) has the total projective covering of the plot equal 70%, the diagnostic species of the association is *Sparganium emersum* Rehmman, projective covering of which on the plot is 35%. There are species with the projective coverings of 2–20%. These are *Bidens tripartita* (7%), *Typha latifolia* (2%), *Butomus umbellatus* (4%), *Sparganium emersum* Rehmman (2%) and *Alopecurus geniculatus* (16%). There were single finds of *Spirodela polyrrhiza*, *Lemna minor*, *Myosotis palustris*, *Agrostis capillaris*, *Lycopus europaeus*, *Lysimachia vulgaris*, *Phragmites australis*, *Rumex hydrolapathum*, *Plantago major*, *Xanthium albinum*, *Chenopodium rubrum* and *Bidens cernua*.

The *Molinio-Arrhenatheretea* class, *Trifolio fragiferae* – *Agrostietalia stoloniferae* order and *Agropyro-Rumicion crispis* alliance are diagnosed by *Alopecurus geniculatus*, *Juncus compressus* and *Potentilla anserine*.

The *Blysmo-Juncetum compressi* association (relevé 21–23) has the total projective covering of 20–40%. The diagnostic species of the association is *Juncus compressus* (the projective covering is 7–15%). The species with the projective covering of 1–10% are *Bidens tripartita* (up to 5%), *Bidens frondosa* (up to 7%), *Chenopodium rubrum* (1%), *Plantago major* (1%), *Alopecurus geniculatus* (up to 5%) and *Populus nigra* (5%). *Juncus articulatus*, *Salix viminalis*,

Conyza canadensis, *Deschampsia caespitosa* and *Potentilla anserina* can be found in the community occasionally.

The *Artemisietea vulgaris* class is diagnosed by *Urtica dioica* L., *Anthriscus sylvestris* (L.) Hoffm., *Chelidonium majus*, *Lamium maculatum* and *Glechoma hederacea* L. The *Artemisietalia vulgaris* order is diagnosed by *Tanacetum vulgare* L. and *Tussilago tarfara* L. The *Arctium lappae* alliance is diagnosed by *Arctium lappa* L., *Ballota nigra*, *Artemisia vulgaris* L., *Urtica dioica* L., *Elytrigia repens* and *Leonurus cardiaca* L.

The *Artemisia abrotanum* community (relevés 24–26) has the total projective covering of the plots equal 50–96%. The diagnostic species of the community is *Artemisia abrotanum* (the projective covering is 40–70%). *Artemisia abrotanum* was called God's tree for its high healing qualities, decorative form and pleasant aroma. It came out of human control and is now widespread along the banks of the rivers of the forest-steppe zone. It occurs near houses, in floodplains, on forest margins. Sometimes it forms brushwoods on the coastal cliffs. It was recorded in Chernihiv five years ago.

The species with the projective covering of 2–30% are: *Juncus bufonius* (5%), *Agrostis capillaris* (2%), *Caragana arborescens* Lam. (2%), *Deschampsia caespitosa* (up to 30%) and *Festuca ovina* (7%). *Juncus articulatus*, *Rubus caesius* L., *Ambrosia artemisiifolia*, *Artemisia vulgaris* L., *Urtica dioica*, *Elytrigia repens*, *Leonurus cardiaca* L., *Anthriscus sylvestris* (L.) Hoffm., *Chelidonium majus* L., *Lamium maculatum*, *Glechoma hederacea* L., *Tanacetum vulgare* L., *Tussilago tarfara*, *Oenanthe aquatica* and *Chenopodium rubrum* can be found on the plot occasionally.

The syntaxonomic composition of natural vegetation is limited by the phytocoenoses belonging to the *Isoëto–Nanajuncetea* class: *Cyperetum flavescens* and *Dichostylidi–Helochloetum alopecuroidis*. It is worth mentioning that *Crypsis schoenoides* (L.) Lam, rare in Polesye, occurs in the latter community. The species diagnoses the *Helechloa–Cyperion micheliani* alliance.

The synanthropic vegetation, represented by the classes of *Bidentetalia tripartiti*, *Stellarietalia mediae*, *Plantaginetea majoris* and *Artemisietea vulgaris* prevails on fluvial sand. Hemiprophytes are presented in those classes. The largest area is occupied by the summer annual species communities of the *Bidentetalia tripartiti* class: *Bidentetum tripartiti*, *Bidens frondosa* and *Xanthio riparii–Chenopodietum rubri*. The communities are the indicators of nitrification of the substrate. 22 species were observed in the described phytocoenoses.

The community with domination of the North American species of *Bidens frondosa* and *Xanthium albinum*. is a sign of disturbance of coastal ecosystems in the urban zone of Chernihiv with bioinvasions. The phytocoenoses of *Bidens frondosa* have projective coverage of the diagnostic species up to 50%. Often the accompanying species are the ruderal species of *Polygonum hydropiper*, *Chenopodium rubrum*, *Echinochloa crus-galli*, *Conyza canadensis* and *Deschampsia caespitosa*. The communities, belonging to the *Xanthio riparii–Chenopodietum rubri* association,

have the projective covering of up to 90%. The projective covering of the dominant and diagnostic *Xanthium albinum* species reaches 50%.

Thus, the vegetation of fluvial sands of the Desna River, the Belous River and the mouth of the Stryzhen River within the boundaries of the city of Chernihiv is represented by the phytocoenoses that belong to 7 classes, 7 orders, 9 alliances and 13 associations. According to the results of the studies, a classification scheme of vegetation of fluvial sand was made.

Class: *Bidentetalia* Tx. et al. ex von Rochow 1951

Order: *Bidentetalia tripartiti* Br.-Bl. et R.Tx. 1943

Alliance: *Bidentetalia tripartiti* Nordh. 1940

Association: *Rumicetum maritimi* Siss. 1946

Association: *Bidentetum tripartiti* Koch 1926 em. Kopecky et Hejny 1974

Community: *Bidens frondosa*

Alliance: *Chenopodium fluviale* R.Tx. 1960

Association: *Xanthio riparii–Chenopodietum rubri* Lomn. et Walther 1950

Class: *Isoëto–Nanajuncetalia* Br.-Bl. et R.Tx. 1943

Order: *Cyperetalia fuscis* (Klika 1935) Muller-Stoll et Pietsch 1961

Alliance: *Elantini–Eleocharition ovatae* Pietsch 1965

Association: *Cyperetum flavescens* Koch 1926

Alliance: *Helechloa–Cyperion micheliani* Br.-Bl. 1952

Association: *Dichostylidi–Helochloetum alopecuroidis* (Timar 1950) Pietsch 1973

Class: *Stellarietalia mediae* R.Tx., Lohm. et Prsg 1950

Order: *Polygono–Chenopodietalia* (R.Tx. et Lohm. 1950) J.Tx. 1961

Alliance: *Panico–Setarion* Siss. 1946

Association: *Echinochloa–Setarion* Krusem. et Vlieg. (1939) 1940

Class: *Plantaginetea majoris* R.Tx. et Prsg 1950

Order: *Plantaginetealia majoris* R.Tx. et Prsg 1950

Alliance: *Polygonionavicularis* Gams 1927 em. Jehlikin Hejny et al. 1979

Association: *Poetum annuae* Gams 1927

Class: *Phragmitetalia* R.Tx. et Prsg 1942

Order: *Phragmitetalia* Koch 1926

Alliance: *Phragmition* Koch 1926

Association: *Sagittario–Sparganietum emersi* R.Tx. 1953

Association: *Typhetum latifoliae* Soo 1927

Association: *Oenanthe–Rorippetum* Lohm. 1950

Class: *Molinio–Arrhenatheretea* R.Tx. 1937

Order: *Trifolio fragiferae–Agrostietalia stoloniferae* R.Tx. 1970

Alliance: *Agropyro–Rumicion crispis* Nordh. 1940 em.

R.Tx. 1950

Association: *Blysmo–Juncetum compressi* (Libb. 1930)

R.Tx. 1950

Class: *Artemisietea vulgaris* Lohm., Prsg et R.Tx. in R.Tx. 1950

Order: *Artemisietalia vulgaris* Lohm. in R.Tx. 1947

Alliance: *Arction lappae* R.Tx. 1937 em. 1950

Community: *Artemisia abrotanum*.

30 relevés of vegetation were done on the boreal sand of the Desna River, the Belous River and the Strizhen River within the city of Chernihiv (Table 2).

The *Koelerio glaucae*–*Corynephoretea canescentis* class unites the communities of one order of *Corynephoretalia canescentis* and of *Koelerion glaucae* alliance. The diagnostic species of the class and the order are *Cladonia* sp., *Festuca ovina*, *Helichrysum arenarium* (L.) Moench, *Jasione montana* L., *Polytrichum piliferum* Hedw., *Rumex acetosella*, *Scleranthus perennis* L., *Sedum acre* L., *Thymus serpyllum* L. and *Trifolium arvense* L. The characteristic species of the *Koelerion glaucae* alliance are *Chondrilla juncea* L., *Koeleria glauca*, *Silene tatarica* (L.) Pers. and its diagnostic species are *Carex ericetorum* Pollich, *Chamaecytisus ruthenicus*, *Oenothera rubricaulis* Klebahn and *Peucedanum oreoselinum* (L.) Moench.

There are no typical Polesye phytocoenoses of the *Koelerio glaucae*–*Corynephoretea canescentis* class among the boreal sand vegetation. The new community is defined, based on 25 relevés. The *Artemisia scoparia*–*Dianthus borbasii* community, which predominates on the boreal sand and floristic composition of which does not correspond to any known association of the above-mentioned class. The diagnostic species of the *Artemisia scoparia*–*Dianthus borbasii* association are *Artemisia scoparia* Waldst. et Kit., *Centaurea phrygia* L., *Dianthus borbasii* Vandas, *Potentilla argentea* L. and *Euphorbia cyparissias* L.

The species with the projective covering of up to 30% (relevé 3) is *Agrostis capillaris*; up to 15% there are *Cladonia* sp., *Helichrysum arenarium*, *Polytrichum piliferum* Hedw., *Rumex acetosella*, *Sedum acre*, *Trifolium arvense*, *Calamagrostis epigeios* (L.) Roth, *Verbascum lychnitis* L., *Berteroa incana*, *Achillea millefolium* and *Galium verum* L. (the diagnostic species of the *Trifolio*–*Geranietea sanguinei* class), *Chenopodium album* L., *Pteridium aquilinum* (L.) Kuhn and *Veronica officinalis* L. The species with the projective covering of 1–5% are: *Peucedanum oreoselinum* (5%), *Anthericum ramosum* L., *Carex rhizina* Blytt ex Lindb., *Conyza canadensis*, *Genista tinctoria* L., *Hieracium pilosella* L. and *Jurinea cyanoides* (L.) Rchb. The last species is a rare species of a pine forest, a species including to Appendix I of the Convention on the Conservation of European Wildlife and Natural Habitats. *Scleranthus perennis*, *Chondrilla juncea*, *Koeleria glauca*, *Silene tatarica* (L.) Pers., *Carex ericetorum* Pollich, *Chamaecytisus ruthenicus* (Fish. ex Woloszcz.) Klaskova, *Oenothera rubricaulis*, *Fragaria vesca* L., *Glechoma hederacea*, *Daucus carota*, *Tanacetum vulgare*, *Conyza canadensis*, *Descurainia Sophia* (L.) Webbet Prantl, *Campanula patula* L., *Leontodon autumnalis* L., *Plantago lanceolata*, *Rumex acetosa*, *Clinopodium vulgare* L., *Medicago falcata* L., *Trifolium alpestre* L., *Pleurozium schreberi* (Brid.) Mitt.,

Pinus sylvestris L., *Ajuga reptans* L., *Allium vineale* L., *Centaurea pseudomaculosa*, *Cerastium caespitosum* Gilib., *Chenopodium rubrum*, *Echinochloa crus-galli*, *Epilobium montanum* L., *Galinsoga parviflora* Cav., *Hypochoeris radicata* L., *Ononis arvensis*, *Phalacrolooma annuum* (L.) Dumort., *Phalacrolooma septentrionale* (Fernald & Wiegand) Tzvelev, *Rumex acetosa*, *Sedum ruprechtii* (Jalas) Omelcz., *Senecio jacobaea* L., *Silene vulgaris* (Moench) Garcke, *Veronica chamaedrys* L., *Veronica incana* L., *Veronica spicata* L. and *Viola matutina* Klok can be found occasionally. *Sempervivum ruthenicum* Schnittsp. et C.B. Lehm (rare for the Chernihiv region species) was discovered in the “Swyate” tract (relevés 7 and 8) in the area of 2.5 m², 1 m² and 0.5 m². The total projective covering of the described areas is 20–100%. The number of species is 73.

The *Epilobietea angustifolii* class and the *Epilobietalia angustifolii* order are diagnosed by *Chamaenerion angustifolium* (L.) Holub, *Fragaria vesca* L. and *Rubus idaeus* L. The characteristic species of the *Epilobion angustifolii* alliance is *Chamaenerion angustifolium*, the diagnostic species is *Rumex acetosella*.

The *Calamagrostietum epigeji* association is represented in the relevés 26 and 27. The total projective covering of the plots is 35 and 80%. The diagnostic species of the association is *Calamagrostis epigeios* (the projective covering is 15% and 70%). *Rumex acetosella* has a projective covering of 15%. The species with the projective covering of up to 5%: *Helichrysum arenarium*, *Artemisia scoparia* Waldst. et Kit., *Chamaerion angustifolium* (L.) Holub, *Plantago lanceolata*, *Agrostis capillaris*, *Carex rhizina* Blytt ex Lindb., *Centaurea pseudomaculosa*, *Hieracium pilosella*, *Veronica chamaedrys*, *Jasione montana*, *Rumex acetosella*, *Chamaecytisus ruthenicus*, *Oenothera rubricaulis*, *Peucedanum oreoselinum*, *Dianthus borbasii*, *Potentilla argentea*, *Euphorbia cyparissias* L., *Fragaria vesca*, *Rubus idaeus* L., *Rumex acetosella*, *Artemisia vulgaris*, *Verbascum lychnitis* L., *Berteroa incana*, *Conyza canadensis*, *Lepidium ruderalis*, *Clinopodium vulgare*, *Medicago falcata*, *Trifolium alpestre*, *Pleurozium schreberi*, *Allium vineale* L., *Conyza canadensis*, *Ononis arvensis*, *Phalacrolooma annuum* and *Silene vulgaris* can be occasionally found in the community. The number of species is 36.

Some of the described phytocoenoses belong to the *Artemisietea vulgaris* class – perennial (sub)xerophilous ruderal vegetation of temperate and sub-mediterranean regions of Europe. The phytocoenoses of two orders of this class: *Onopordetalia acantii* and *Artemisietalia vulgaris* were recorded.

The diagnostic species of the *Onopordetalia acanthii* order are *Artemisia absinthium* L., *Cichorium intybus* L., *Melilotus albus* Medik., *Oenothera biennis* and *Verbascum thapsus*. The communities of the order are formed by thermophilic and subthermophilic xerophytic species, which occur on dry plots. The communities belong to *Dauco*–*Melilotion* alliance. The alliance is represented by the community of biennial and perennial hemicryptophytes, which occur on both sides of the roads, waste grounds. The diagnostic species of the alliance are *Daucus carota*, *Echium*

vulgare L., *Picris hieracioides* L., *Tanacetum vulgare* and *Verbascum lychnitis* L.

The diagnostic species of the *Berteroetum incanae* association (relevé 28) are *Berteroa incana*, *Centaurea diffusa* Lam., *Senecio viscosus* L., *Berteroa incana* (L.) DC and *Calamagrostis epigeios*, with the projective covering of 20%, and they are the dominants in the community. *Silene vulgaris*, *Solanum nigrum* L., *Phalacrolooma septentrionale*, *Galinsoga parviflora*, *Conyza canadensis*, *Echinochloa crus-galli*, *Chenopodium album* L., *Ajuga reptans* L., *Achillea millefolium*, *Lepidium ruderales*, *Descurainia sophia*, *Senecio viscosus*, *Centaurea diffusa* Lam., *Artemisia absinthium* L., *Cichorium intybus*, *Melilotus albus*, *Oenothera biennis*, *Verbascum thapsus*, *Artemisia vulgaris*, *Glechoma hederacea*, *Lamium maculatum*, *Potentilla argentea* and *Polytrichum piliferum* Hedw can be found occasionally. The number of species is 27.

The *Stellarietea mediae* class is diagnosed by *Alsine media* L., *Fallopia convolvulus* (L.) A. Löve, *Galeopsis speciosa* Mill., *Polygonum aviculare* and *Viola arvensis* Murray. *Sisymbrietalia* order and *Sisymbriion officinalis* alliance – by *Conyza canadensis*, *Descurainia sophia*, *Lactuca serriola* L. and *Lepidium ruderales*.

The *Hordeum jubatum*–*Bromus hordeaceus* community (relevés 29 and 30) differs from the central and western European communities, described by Matuszkiewicz (2001), by the diagnostic species of *Hordeum murinum*.

The diagnostic species of the described communities are *Hordeum jubatum* L. and *Bromus hordeaceus* L. and *Achillea millefolium* L., the diagnostic species of different syntaxons of the *Molinio*–*Arrhenatheretea* class, is well represented in the *Hordeum jubatum*–*Bromus hordeaceus* community (the projective covering is up to 7%). The projective covering of *Euphorbia cyparissias* L. (the diagnostic species of the *Festuco*–*Brometea* class) and *Dianthus borbasii* is up to 3%, of *Festuca ovina* is 25%, of *Trifolium arvense* – 7%, *Pteridium aquilinum* (L.) Kuhn – 6%, *Potentilla argentea* – 5%, *Conyza canadensis* and *Phalacrolooma septentrionale* – 4%, *Chenopodium album* L. – 2%. The diagnostic species of the *Stellarietea mediae* class (*Alsine media* L., *Fallopia convolvulus* (L.) A. Löve, *Galeopsis speciosa* Mill., *Polygonum aviculare*, *Viola arvensis* Murray.) and the *Sisymbriion officinalis* alliance (*Descurainia sophia*, *Lactuca serriola*, *Lepidium ruderales*, *Chenopodium rubrum*, *Echinochloa crus-galli*, *Galinsoga parviflora*, *Hieracium pilosella*, *Solanum nigrum* L.) can be found occasionally. The number of species is 25.

Thus, formed in the same edaphic conditions with phytocenoses of non-cultivated territories, the vegetation of boreal sands in the city of Chernihiv differs from typical for Polesye psamophyte communities of the *Koelerio glaucae*–*Corynephoretea canescens* class by the species compound. In urban conditions, communities are formed from more resistant to anthropogenic influence species or synanthropic psamophytes. There is a decrease in the contrast of phytocenoses of boreal sand and its distribution on boreal terraces under conditions of urban areas of ruderal plant communities.

Thus, the vegetation of sand on the boreal terraces of the Desna, Strizhen, Bilous rivers in the city of Chernihiv is represented by phytocenoses belonging to 4 classes, 4 orders, 4 alliances, 2 associations and 2 communities. We give a classification scheme for the vegetation of boreal sand within the city of Chernihiv.

Class: *Koelerio glaucae*–*Corynephoretea canescens*
Klika in Klika et Novak 1941

Order: *Corynephorotalia canescens* Klika 1934 em. R.Tx.
1962

Alliance: *Koelerion glaucae* Klika 1934

Community: *Artemisia scoparia*–*Dianthus borbasii*

Class: *Epilobietea angustifolii* R.Tx. et Prsg 1950

Order: *Epilobietalia angustifolii* R.Tx. 1950

Alliance: *Epilobion angustifolii* (Rubel 1933) Soo 1933

Association: *Calamagrostietum epigeji* Juraszek 1928

Class: *Artemisietea vulgaris* Lohm., Prsg et R.Tx. in R.Tx.
1950

Order: *Onopordetalia acanthii* Br.-Bl. et R.Tx. 1943 em.
Gors 1966

Alliance: *Dauco*–*Melilotion* Görs 1966

Association: *Berteroetum incanae* Siss. et Tideman in Siss.
1950

Class: *Stellarietea mediae* R.Tx., Lohm. et Prsg, 1950

Order: *Sisymbrietalia* J.Tx. 1961

Alliance: *Sisymbriion officinalis* R.Tx., Lohm, Prsg 1950

Community: *Hordeum jubatum*–*Bromus hordeaceus*.

Until the middle of the 20th century, reed and sedge marshes were distributed in the southeastern outskirts of the city of Chernihiv, located in the flood plain of the Desna River. From the late 1970s to the mid-1980s, the marshes were filled up with sand. It was planned to build housing. However, the construction of the residential area did not start due to a number of reasons. The area was used as a quarry for unauthorized extraction of sand in large amounts. At present, the local people use the place as an unauthorized landfill. 10 relevés were done (Table 3) on the artificial sandy alluvia in the flood plain of the Desna River.

The relevés revealed the diagnostic species of the *Artemisietea vulgaris* class: *Artemisia vulgaris*, *Cirsium arvense* (L.) Scop., *Helianthus tuberosus* L. and *Glechoma hederacea*. The class is represented by the only order of *Onopordetalia acanthii*, which unites mesophyte communities of moderately moistened sandy soils. The diagnostic types of the order are *Artemisia absinthium*, *Cichorium intybus* and *Melilotus albus*. The *Dauco*–*Melilotion* alliance is diagnosed with *Daucus carota*, *Echium vulgare* L., *Picris hieracioides* L., *Tanacetum vulgare* and *Verbascum lychnitis* L.

The *Echio*–*Melilotetum* association (relevés 1–3) has total projective covering of the plots equal 85–87%. The diagnostic species of the association are *Anchusa officinalis* L., *Echium vulgare* L. (15–20%), *Melilotus albus*, *Oenothera*

biennis and *Oenothera rubricaulis* (kenophytes of the North American origin), and *Verbascum Thapsus*. The species with the projective covering of 5–30% are *Conyza canadensis*, *Helichrysum arenarium*, *Calamagrostis epigeios*, *Artemisia scoparia* Waldst. et Kit. and *Berteroa incana* (L.) DC. The species with the projective covering of up to 3% are *Bromus inermis* Leys., *Bromus secalinus* L., *Cyclachaena xanthiifolia* (Nutt.) Fresen, *Daucus carota*, *Hippochaë rhamnoides* L. (seeds are brought from the country arrays that are located next to it), *Lactuca tatarica* (L.) C.A. Mey., *Trifolium alpestre*, *Tanacetum vulgare* etc. can be found occasionally. The number of species is 34.

The *Stellarietea mediae* class is diagnosed by *Alsine media* L., *Fallopia convolvulus* (L.) A. Löve, *Polygonum aviculare* and *Viola arvensis* Murray. The *Sisymbrietalia* order and the *Sisymbrium officinalis* alliance are diagnosed by *Lactuca serriola*, *Conyza canadensis*, *Descurainia sophia*, *Lepidium ru* and *derale* and *Phalacroloma annuum*.

The *Sisymbrium sophiae* association (relevé 4) belongs to this class. The total projective covering of the plot is 45%. The diagnostic species of the association are *Descurainia sophia* and *Velarum officinale* (L.) Rchb. (*Sisymbrium officinale* (L.) Scop.) with the projective covering of 15 and 5% respectively. The species with the projective covering of up to 5% are *Calamagrostis epigeios*, fixing sand and *Conyza Canadensis*, *Stellaria media*, *Fallopia convolvulus* (L.) A. Löve, *Polygonum aviculare*, *Viola arvensis* Murray, *Lactuca serriola*, *Descurainia sophia*, *Lepidium ruderalis*, *Phalacroloma annuum* and *Equisetum ramosissimum* Desf. can be found occasionally. The number of species is 14.

The *Bidentetea tripartiti* class and the *Bidentetalia tripartiti* order are diagnosed by *Bidens tripartita* and *Rorippa palustris* (L.) Besser. The *Chenopodium fluviatile* alliance is diagnosed by *Atriplex prostrata* Boucher ex DC., *Chenopodium rubrum* and *Echinochloa crus-galli*.

The *Xanthium albinum*–*Anisantha tectorum* community is represented in the investigated site (relevé 5). The total projective covering on the site is 80%. The diagnostic species of the community are *Xanthium albinum* and *Anisantha tectorum* (L.) Nevski with the projective covering of 40% on the researched plot. The species with the projective covering of up to 10% are *Setaria viridis* (L.) P. Beauv., *Setaria glauca* (L.) P. Beauv., *Ambrosia artemisiifolia*, *Artemisia vulgaris*, *Melilotus albus*, *Descurainia sophia*, *Phalacroloma annuum*, *Rorippa palustris* (L.) Besser, *Bidens tripartita*, *Atriplex prostrata* Boucher ex DC., *Chenopodium rubrum*, *Echinochloa crus-galli*, *Calamagrostis epigeios*, *Artemisia scoparia*, *Lactuca tatarica* (L.) C.A. Mey can be found occasionally. The number of species is 17.

The *Molinio*–*Arrhenatheretea* class is diagnosed by *Plantago lanceolata*, *Poa pratensis* L. and *Rumex acetosa*. The *Trifolium fragiferae*–*Agrostietalia stoloniferae* order and the *Agropyro*–*Rumicion crispis* alliance are diagnosed by *Inula britannica* L., *Juncus compressus*, *Trifolium fragiferum* and *Lysimachia nummularia*.

The *Blysmo*–*Juncetum compressi* association is represented on the plot (relevé 6) with the total projective covering of 30%. The diagnostic species of the association are

Blysmus compressus (L.) Panz. ex Link, *Juncus compressus* and *Trifolium fragiferum*. The projective covering of up to 7% of *Persicaria maculata* (Raf.) Á. Löve & D. Löve, *Typha angustifolia* L., *Populus nigra*, *Lythrum salicaria* L., *Lysimachia nummularia*, *Inula britannica*, *Rumex acetosa*, *Poa pratensis*, *Plantago lanceolata* and *Lepidium ruderalis* are represented on the plot occasionally. It should be noted that isolated individuals of the characteristic species of the *Isoëto*–*Nanojuncetea* class were found on the plot (*Cyperus fuscus* and *Juncus bufonius*). The presence of these species indicates the ephemerality of the formed community. The diagnostic species of *Juncus compressus* indicates salinity caused by anthropogenic factors. The amount of species is 15.

The *Phragmitetea* class is diagnosed by *Alisma plantago-aquatica* L., *Lycopus europaeus*, *Phragmites australis*, *Rorippa amphibia* (L.) Besser. The *Typhion laxmannii* alliance unites communities of the coastal areas of reservoirs, as well as waterlogged areas with increased mineralization of water and saline bottom sediments.

The *Typhion laxmannii* alliance and the *Typhetum laxmannii* association are diagnosed by *Typha laxmannii* Lepech., the projective covering on the plots (relevés 7 and 8) of which is 20 and 30%. The total projective covering is 35 and 80% respectively. In the described communities the *Juncus bufonius* and *Dichostylis micheliana* (L.) Nees characteristic species of the *Isoëto*–*Nanojuncetea* class have the projective covering of up to 10%.

Along with *Typha laxmannii* Lepech. occasional individuals of *Alisma gramineum* Lej., *Alisma lanceolatum* With, *Alisma plantago-aquatica* L., *Bolboschoenus maritimus* (L.) Palla, *Scirpus tabernamontani* C.C. Gmel., *Triglochin palustre* L., *Rumex ucranicus* Fisch. ex Spreng., *Rumex maritimus*, indicating insignificant salinity of the soil, have been fixed. *Odontites vulgaris* Moench, *Acorellus pannonicus* (Jacq.) Palla, *Allium vineale* L., *Bolboschoenus maritimus* (L.) Palla, *Typha angustifolia* L., *Rorippa amphibia*, *Phragmites australis*, *Lycopus europaeus*, *Alisma plantago-aquatica* L., *Xanthium albinum*, *Chenopodium rubrum*, *Conyza canadensis*, *Tanacetum vulgare* and *Artemisia absinthium* can be found occasionally. The number of species is 24.

The *Koelerio glaucae*–*Corynephoretea canescentis* class and the *Corynephoretalia canescentis* order are diagnosed by *Festuca ovina*, *Helichrysum arenarium*, *Jasione montana*, *Rumex acetosella* and *Trifolium arvense*. The order unites the species of psamophil meadows and poor sandy soils. The *Koelerion glaucae* alliance is diagnosed by *Chondrilla juncea*, *Kochia laniflora* (S. G. Gmel.) Borb., *Oenothera rubricaulis* and *Plantago arenaria* Waldst. et Kit.

The *Kochietum arenariae* association is diagnosed by the dominant species – *Kochia laniflora* (S.G.Gmel.) Borb., the projective covering of which on the described plot (relevé 9) is 25%. It must be noted that this plot is on a hill. The total projective covering on the plot is 35%. *Helichrysum arenarium* and *Festuca ovina* have the projective covering of up to 5%. *Plantago arenaria* Waldst. et

Kit., *Oenothera rubricaulis*, *Chondrilla juncea*, *Trifolium arvense*, *Rumex acetosella* and *Jasione montana* can be found occasionally. The number of species is 10.

The *Epilobietea angustifolii* class and the *Epilobietalia angustifolii* order are diagnosed by *Calamagrostis epigeios* and *Fragaria vesca*. The *Epilobion angustifolii* alliance is diagnosed by *Chamaenerion angustifolium* and *Rumex acetosella*.

The *Calamagrostietum epigeji* association is represented on the plot (relevé 10), a total projective covering of which is 100%. The association is diagnosed by the dominant species of *Calamagrostis epigeios* with the projective covering on the plot of 60%. *Cirsium arvense*, *Artemisia absinthium*, *Tanacetum vulgare*, *Chamaenerion angustifolium*, *Rumex acetosella*, *Achillea millefolium* and *Artemisia scoparia* can be found occasionally. The number of species is 8.

Thus, the vegetation of the artificial sandy alluvia of the Liskovitsa district is represented by the phytocoenoses belonging to 7 classes, 7 orders, 7 alliances, 6 associations and 1 initial community. According to the results of the research, the classification scheme of fluvial sand vegetation in the "Liskovitsa" district (Chernihiv) was done:

Class: *Artemisietea vulgaris* Lohm., Prsg et R.Tx. in R.Tx. 1950

Order: *Onopordetalia acanthii* Br.-Bl. et R.Tx. 1943 em. Gors 1966

Alliance: *Dauco-Melilotion* Görs 1966

Association: *Echio-Melilotetum* R.Tx. 1947

Class: *Stellarietea mediae* R.Tx., Lohm. et Prsg, 1950

Order: *Sisymbrietalia* J.Tx. 1961

Alliance: *Sisymbrium officinalis* R.Tx., Lohm, Prsg 1950

Association: *Sisymbrietum sophiae* Kreh. 1935

Class: *Bidentetea tripartiti* R.Tx., Lohm. et Prsg 1950

Order: *Bidentetalia tripartiti* Br.-Bl. et R.Tx. 1943

Alliance: *Chenopodium fluviatile* R.Tx. 1960

Community: *Xanthium albinum-Anisantha tectorum*

Class: *Molinio-Arrhenatheretea* R.Tx. 1937

Order: *Trifolio fragiferae-Agrostietalia stoloniferae* R.Tx. 1970

Alliance: *Agropyro-Rumicion crispis* Nordh. 1940 em. R.Tx. 1950

Association: *Blysmo-Juncetum compressi* (Libb. 1930) R.Tx. 1950

Class: *Phragmitetea* R.Tx. et Prsg 1942

Order: *Bolboschoenetalia* Hejný in Holub *et al.* 1967

Alliance: *Typhion laxmannii* Losev et V. Golub 1988

Association: *Typhetum laxmannii* Nedulcu 1968

Class: *Koelerio glaucae-Corynephoretea canescentis* Klika in Klika et Novak 1941

Order: *Corynephoretalia canescentis* R.Tx. 1937

Alliance: *Koelerio glaucae* (Volk 1931) Klika 1935

Association: *Kochietum arenariae* Fijalk. 1978

Class: *Epilobietea angustifolii* R.Tx. et Prsg 1950

Order: *Epilobietalia angustifolii* R.Tx. 1950

Alliance: *Epilobion angustifolii* (Rubel 1933) Soo 1933

Association: *Calamagrostietum epigeji* Juraszek 1928.

Thus, the formation of plant communities on artificially deposited sand differs from the most common processes in plains of river floods on natural fluvial sediments and boreal sand. Considering the fact that most of the alluvia are occupied by sand, the plant communities are represented by classical communities without defined attachment (the *Echio-Melilotetum*), ephemeral communities of weakly saline soils (the *Blysmo-Juncetum compressi* association) and typical psammophyte communities (the *Kochietum arenariae* association).

It should be noted that the anthropogenic impact on meadow-swamped saline areas (the *Typhetum laxmannii* association) that limit the sand from the east, is increasing thanks to building of cottages and recreational loading. Therefore, ruderal communities (the *Sisymbrietum sophiae* association) resistant to anthropogenic influence are formed, as well as large areas are occupied by synanthropic communities of *Xanthium albinum-Anisantha tectorum*.

CONCLUSIONS

The vegetation on sandy massifs of natural origin (boreal and fluvial sand) and of man-made origin within Chernihiv has a rather high syntaxonomic diversity. At the same time it is characterized by spatial unevenness and mosaic patterns, which are noticeable even in small areas. Ruderal plant communities prevail. Natural phytocenoses are represented to a small extent (*Artemisia scoparia-Dianthus borbassii*, *Kochietum arenariae*, *Cyperetum flavescens* and *Dichostylidi-Helochloetum alopecuroidis*).

Formed in the same edaphic conditions with the phytocenoses of non-urbanized territories, the vegetation of Chernihiv boreal sand differs from the psammophytic communities of the *Koelerio glaucae-Corynephoretea canescentis* class typical for Polesye by its species composition. Under urban conditions, the communities of more resistant to anthropogenic influence species of synanthropic psammophytes are formed. A decrease in the contrast of the phytocenoses of the boreal sand and the ruderal plant communities spread on the boreal terraces within the urban zone are observed.

On the alluvial sands of Chernihiv the communities of synanthropic vegetation of the *Bidentetea tripartiti*, *Stellarietea mediae*, *Plantaginetea majoris* and *Artemisietea vulgaris* classes have been formed. The largest areas are occupied by the summer annuals from the *Bidentetea tripartiti* class that are indicators of nitrification of the substrate: *Bidentetum tripartiti*, *Bidens frondosa* and *Xanthio riparii-Chenopodietum rubri*. The phytocenoses with domination of invasive North American species, such as

Table 3. Floristic structure of plant communities of the artificially-deposited sands of the city of Chernihiv

Relevé number	1	2	3	4	5	6	7	8	9	10
Area [m ²]	20	47	50	16	35	25	100	20	4	42
Layer cover [%]	85	85	87	45	80	30	35	80	35	100
ChAss. Echio-Melilotetum										
<i>Anchusa officinalis</i>	+	+								
<i>Echium vulgare</i>	3	3	+							
<i>Melilotus albus</i>	+	+	+		+					
<i>Oenothera biennis</i>	+	+	+							
<i>Oenothera rubricaulis</i>		+							+	
<i>Verbascum thapsus</i>	+	+	+							
ChAll. Dauco-Melilotion										
<i>Daucus carota</i>		+	+							
<i>Echium vulgare</i>	3	3	+							
<i>Picris hieracioides</i>	+	+								
<i>Tanacetum vulgare</i>			+				+			+
<i>Verbascum lychnitis</i>	+	1								
ChO. Onopordetalia acanthii										
<i>Artemisia absinthium</i>	+		+				+			+
<i>Cichorium intybus</i>		+	+							
ChCl. Artemisietea vulgaris										
<i>Artemisia vulgaris</i>	+	+	+		+					
<i>Cirsium arvense</i>	+	+	+							+
<i>Helianthus tuberosus</i>		+								
<i>Glechoma hederacea</i>	+		+							
ChAss. Sisymbrietum sophiae										
<i>Descurainia sophia</i>				3	+					
<i>Velarium officinale</i>				1						
DAll. Sisymbriion officinalis										
ChO. Sisymbrietalia										
<i>Lactuca serriola</i>				+						
<i>Conyza canadensis</i>	1	3	4	1			+			
<i>Lepidium ruderales</i>				+		+				
<i>Phalacrolooma annuum</i>	+	+		+	+					
ChCl. Stellarietea mediae										
<i>Alsine media</i>				+						
<i>Fallopia convolvulus</i>				+						
<i>Polygonum aviculare</i>				+						
<i>Viola arvensis</i>				+						
Dcom. Xanthium albinum-Anisantha tectorum										
<i>Anisantha tectorum</i>					4					
<i>Xanthium albinum</i>					4		+			
ChAll. Chenopodion fluviatile										
<i>Atriplex prostrata</i>					+					
<i>Chenopodium rubrum</i>					+		+			
<i>Echinochloa crus-galli</i>					+					
ChCl. Bidentetea tripartiti										
ChO. Bidentetalia tripartiti										
<i>Bidens tripartita</i>					+					
<i>Rorippa palustris</i>					+					
ChAss. Blysmo-Juncetum compressi										
<i>Blysmus compressus</i>							+			
<i>Juncus compressus</i>							2			
<i>Trifolium fragiferum</i>							+			
ChAll. Agropyro-Rumicion crispi										
ChO. Trifolio fragiferae-Agrostietalia stoloniferae										
<i>Inula britannica</i>							+			
<i>Lysimachia nummularia</i>							+			
ChCl. Molinio-Arrhenatheretea										
<i>Plantago lanceolata</i>		+					+			
<i>Poa pratensis</i>	+						+			
<i>Rumex acetosa</i>		+					+			
DAss Typhetum laxmannii										
DAll Typhion laxmannii										
<i>Typha laxmannii</i>							3	5		
ChCl. Phragmitetea										
<i>Alisma plantago-aquatica</i>										
<i>Lycopus europaeus</i>									+	+
<i>Phragmites australis</i>			+						+	+
<i>Rorippa amphibia</i>									+	+
ChAss. Kochietum arenariae										
<i>Kochia laniflora</i>										
<i>Kochia laniflora</i>										3
ChAll. Koelerion glaucae										
<i>Kochia laniflora</i>										
<i>Kochia laniflora</i>										3
<i>Oenothera rubricaulis</i>		+								+
<i>Plantago arenaria</i>										+
ChO. Corynephorretalia canescentis										
ChCl. Koelerio glaucae-Corynephoretea canescentis										
<i>Festuca ovina</i>										
<i>Festuca ovina</i>										1
<i>Helichrysum arenarium</i>			1							1
<i>Jasione montana</i>										+
<i>Rumex acetosella</i>		+								+
<i>Trifolium arvense</i>										+
ChAss. Calamagrostietum epigeji										
<i>Calamagrostis epigeios</i>										
<i>Calamagrostis epigeios</i>	3	2	2	1	+					5
DAll. Epilobion angustifolii										
<i>Chamaerion angustifolium</i>										
<i>Chamaerion angustifolium</i>										+
<i>Rumex acetosella</i>										+
ChO. Epilobietalia angustifolii										
ChCl. Epilobietea angustifolii										
<i>Calamagrostis epigeios</i>										
<i>Calamagrostis epigeios</i>	3	2	2	1	+					5
Other species										
<i>Achillea millefolium</i>		+								+
<i>Acorellus pannonicus</i>									+	
<i>Alisma gramineum</i>										+
<i>Alisma lanceolatum</i>										+
<i>Allium vineale</i>									+	
<i>Ambrosia artemisiifolia</i>	+						1			
<i>Artemisia scoparia</i>	+	3					+			+
<i>Berteroa incana</i>	1	+								
<i>Bromus inermis</i>	1									
<i>Bromus secalinus</i>	1									
<i>Centaurea phrygia</i>	+									
<i>Centaurea pseudomaculosa</i>			+							
<i>Clinopodium vulgare</i>	+									
<i>Cyperus fuscus</i>									+	
<i>Cyclachaena xanthiifolia</i>	+									
<i>Dichostylis micheliana</i>										1
<i>Equisetum ramosissimum</i>							+			
<i>Juncus bufonius</i>								2	2	
<i>Hippochaë rhamnoides</i>	+		+							
<i>Lactuca tatarica</i>	+						+			
<i>Lythrum salicaria</i>									+	
<i>Odontites vulgaris</i>										+
<i>Persicaria maculata</i>									1	
<i>Populus nigra</i>			4						+	
<i>Rumex maritimus</i>										+
<i>Rumex ucranicus</i>										+
<i>Scirpus tabernaemontani</i>										+
<i>Setaria glauca</i>								2		
<i>Setaria viridis</i>								2		
<i>Trifolium alpestre</i>	+									
<i>Triglochin palustre</i>										+
<i>Typha angustifolia</i>								+	+	

Note: **Cover abundance scale:** + – up to 1%, 1 – 1–5%, 2 – 6–12, 3 – 13–25%, 4 – 26–50%, 5 – >50%. **Syntaxon:** Echio-Melilotetum R.Tx. 1947 (relevés 1-3), Sisymbrietum sophiae Kreh. 1935 (relevés 4), Xanthium albinum-Anisantha tectorum (relevés 5), Blysmo-Juncetum compressi (Libb. 1930) R.Tx. 1950 (relevés 6), Typhetum laxmannii Nedulcu 1968 (relevés 7, 8), Kochietum arenariae Fijalk. 1978 (relevés 9), Calamagrostietum epigeji Juraszek 1928 (relevés 10). **Locality of relevés:** 1-10 – Liskovytsya. **The date of relevés:** 1-7 – 29.07.2017, 8 – 05.07.2008, 9-10 – 29.07.2017, 25 – 12.09.2015, 26 – 28.09.2016. **Authors of relevés:** 1-7, 9-10 – O.Lukash, H.Danko, 8 – O.Lukash.

Bidens frondosa and *Xanthium albinum* are among these communities.

The ecological range of vegetation of sandy alluvia varies from xerophytic phytocoenoses of the sand, poor in mineral components (the *Kochietum arenariae* association) to the communities, which indicate waterlogged areas with increased water mineralization and saline bottom sediments (the *Typhetum laxmannii* association).

In general, there are both adventitization of sand vegetation and its apophization, one of the indicators of which is a rupture of coenotic connections between the species of the community. These phenomena indicate that the process of synanthropization of the vegetation cover of the city is intensifying, and first of all in the places of the newly formed technogenic ecotope.

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