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ECOLOGICAL FEATURES AND ANTHROPOGENIC TRANSFORMATION OF WETLANDS AS PART OF URBAN FLORAS OF UKRAINE

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Abstract
Living conditions of plant species and their communities are changing due to urbanization. This affects the composition of urban flora and vegetation, especially those species and communities that grow in excessively wet habitats. The article considers the anthropogenic transformation of vegetation cover of wetlands in such cities of Ukraine as Vinnytsia, Kharkiv and the Donetsk-Makiyivka agglomeration. There is a tendency of increasing the drought-resistant species in studied wetlands. At the same time, the presence of adventive species in the vegetation cover of wetlands indicates that the urban flora is gradually adapting to coexistence with humans. Ecological analysis of hygrophytic plant communities indicates the process of changing them by ruderal coenoses. The plant communities with wide ecological amplitude and the participation of adventive species form the wetlands' vegetation of studied cities.

Keywords: ecomorphs, anthropogenic transformation, urban floras, vegetation, wetlands, Ukraine.

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INTRODUCTION

According to the Ramsar Convention (1971), wetlands are areas of swamps, peatlands or water bodies – natural or artificial, permanent or temporary, stagnant or flowing, fresh, brackish or salty, including marine water areas, the depth of which does not exceed six meters. Also, these are coastal areas that are adjacent to wetlands, islands, or other natural formations located deeper than six meters at low tide, located inside the area. The objects of the study belong to the river type of wetlands, which include wetlands along rivers and streams. Most wetlands have undergone varying degrees of anthropogenic digression. The restoration of excessively wet habitats is complicated by the weak anthropotolerance of the vegetation cover and the instability of ecological conditions inherent in such natural complexes. The leading factors in the degradation of such complexes are the reduction of the natural flow of rivers, its pollution by mineral and organic substances, toxins, untreated effluents, man-made destruction of coastal strips, damming, construction of dams, meliorative hydraulic construction, recreation and pollution by household waste, etc. Increasing the area of vegetation cover due to the shallowing of riverbeds, the overgrowth of shallow artificial reservoirs, unfortunately, does not compensate for the loss of species and cenotic diversity of wetlands.

The rapid process of urbanization significantly changes both qualitative and quantitative parameters of the environment. Under these conditions, it is necessary to understand the impact of this process on the nature of urban areas, in particular on flora and vegetation as the most important environment-forming factors (Dolan et al. 2011, McDonnell & Hahs 2013). On the one hand, as shown by O. Bastian et al. (2020), highly varied habitat mosaic configurations were found in cities. On the other hand, it was found (Corlett 2016) that anthropogenic impact includes such negative factors as “habitat loss, fragmentation and degradation, overexploitation, invasive species, pollution and anthropogenic climate change”. It is known that the overall level of temperature in urban areas exceeds this indication for suburban areas, resulting in the formation of the so-called Urban Heat Island (Ningrum 2018). Under such conditions, it should be expected changes in the ecological structure of urban flora and vegetation cover to the direction of increasing thermophilic species (Schmidt 2014), which will be followed by the process of xerophytization. Urban Heat Island (UHI) is a microclimatic phenomenon that affects people’s living conditions and the functioning of the infrastructure elements of settlements. The causes of the UHI are excessive and dense development of the city territory, insufficient green areas, increase in atmospheric emissions from mobile pollution sources (transport), stationary pollution sources etc. Such a process is observed in the structure of a significant number of European urban floras (Burda 1991, Dolan et al. 2011, Buse et al. 2015, Zvyagintseva 2015, Glukhov & Derevyanska 2016). The mesophytization of urban vegetation is observed in the cities of the steppe zone (Moysiyenko 1999, Melnyk 2001, Iepikhin 2008, Maltseva 2019, Karmyzova & Baranovsky 2020). Thus, the participation of ruderal species in the flora increases and the participation of steppe species significantly reduces.

The purpose of this work is to identify ecological features of wetlands’ flora and vegetation in the city of Vinnytsia, Kharkiv and Donetsk-Makiyivka agglomeration (Ukraine) and find out the degree of their anthropogenic transformation.

MATERIALS AND METHODS

Characteristics of the research area

According to the hydrological zoning of Ukraine (Marynych & Shishchenko 2005), Donetsk-Makiyivka agglomeration, Kropyvnytskyi and Primorsk are located in the zone of insufficient water content, Kharkiv and Vinnytsia are in the zone of sufficient water content (Tab. 1).

Table 1. The main characteristics of the studied cities.

Studied cities of Ukraine	Location of the city by hydrological zoning of Ukraine	General area (km^2)	Human population size (number of individuals)	City age (years)	The total number of urban vascular plant species
Kharkiv	Left-bank Dnieper region of sufficient water content zone	350.05	1426427	367	1094
Vinnytsia	Right-bank Dnieper region of sufficient water content zone	113.2	370601	658	841
Donetsk-Makiyivka	Siverskodonetsk-Dnieper region of insufficient water content zone	996.7	1245701	152	897
Kropyvnytskyi	LowerBug-Dnieper region of insufficient water content	103	221045	267	1165
Primorsk	Pryazovsk region of insufficient water content zone	12.8	35095	221	504

Kharkiv is located in the north-east of Ukraine between the Central Russian Highlands and the Donetsk Lowlands. Donetsk-Makiyivka agglomeration is located in the central part of Donbas, south of the Donetsk Ridge. Geographically, it belongs to the steppe zone, in the upper reaches of the Kalmius River. Vinnytsia is located on the right bank of the Dnipro River within the Podilsk Highlands on the Southern Bug River, in the forest-steppe zone of Ukraine within the Volyn-Podilskyi crystalline massif. Kropyvnytskyi is located within the Dnieper Highlands, on the banks of the Ingul River, where the Sugoklia and Biyanka tributaries flow into it. Primorsk is located in the Azov region on the Obitochna River at the confluence of the Kiltichcha River, on the northwestern shore of Berdyansk Bay in the northern part of the Sea of Azov (Fig. 1).

The Donetsk-Makiyivka agglomeration in terms of anthropogenic transformation occupies the first place among listed cities – 86.2 % of Donetsk territory and 66.0 % of Makiyivka territory were changed due to human economic activity. A significant number of metallurgical, coke and mining enterprises are concentrated here. The machine-building and light industry predominate in Kharkiv, Kropyvnytskyi and Vinnytsia.

The territory of Kharkiv is a hilly plain cut by river valleys, streams and ravines. Kharkiv is located on the territory of a relatively deep erosion basin, formed by the activity of the Kharkiv, Lopan, Udy and Nemyshlya Rivers, which belong to the Siversky Donets basin. In addition, there are small reservoirs on the territory of the city – Zhuravlivske, Oleksiivske, Lozovenkivske, Novobavarske and a number of ponds (Gamulya & Zvyagintseva 2010). The rivers divide the city into three parts, which differ little in area, but have a characteristic relief. Lowland areas (90–105 m above sea level) make up 45.5 %, medium (105–166 m) – 48.2 %, and high (between 166–192 m) – 4.3 % of the entire city area. Most of the city territory (about 55 %) consists of elevated areas (105–192 m). Field study of wetlands of Kharkiv was conducted along the Udy, Lopan, Kharkiv, Nemyshlya Rivers and Zhuravlivske, Oleksiivske, Pavlivske reservoirs.

The studied wetlands of Kropyvnytskyi are connected with the water areas of the Ingul, Sugoklia and Biyanka Rivers within the administrative boundaries of the city. These are interconnected floristic complexes with conditions of excessive moisture and temporary flooding of plant species (Arkushyna & Popova 2010).

Primorsk is a health resort area, where recreation is actively developed. The study of the wetlands of Primorsk was held on the territories along the shore of the Sea of Azov, the Obitochna River and its tributary the Kiltichiya River (Maltseva 2019).

Figure 1. The location of the studied cities in Ukraine. (The map from Nations online: https://www.nationsonline.org/oneworld/map/ukraine-political-map.htm).

The researched territories of Vinnytsia are connected with the water area of the Southern Bug River within the administrative boundaries of the city. Peculiarities of geological history, in particular, the influence of the Pleistocene glaciations caused the formation on the territory of Central Podillia, including in the valley of the Southern Bug, natural complexes characteristic of much more northern regions (Kuzemko 2011). All these features affect the composition and ecological characteristics of wetlands.

Data collection and analysis

The study of wetlands' flora of the Donetsk-Makiyivka agglomeration was carried out by G. Derevyanska (2014) during 2008–2014. Similar studies of such cities as Vinnytsia (during 2016– 2018) and Kharkiv (during 2009–2018) were conducted by O. Dobrovolska (2004) and K. Zvyagintseva (2015). The geobotanical research of wet habitats of Kharkiv was made by H. Kazarinova (2018–2021) according to the Braun-Blanquet approach. We compared the structure of studied wetlands with the available in the literature floristic data of wet habitats of Primorsk (Maltseva 2019) and Kropyvnytskyi, until 2016 – Kirovograd (Arkushyna & Popova 2010). For this comparison we have selected only those species that are obligatory connected with the conditions of excessive moisture.

The nomenclature of species was given by "World Plants. Synonymic Checklist and Distribution of the World Flora" (Hassler 2023). The ecological analysis of plant species in relation to three leading ecological factors (soil water regime, total salt regime and light) was carried out by ecological scales of Ya. Didukh (2011). Life forms were accepted according to the classification of C. Raunkiaer (1934). The definition of anthropotolerance of plant species was carried out by G. Zukopp et al. (1981), R. Burda et al. (2004)

and the concept of urbanization's degree by R. Burda and Ya. Didukh (2003), M. McKinney (2006), N. Müller and P. Werner (2010). Detection of coenotic diversity of wetlands' vegetation of Kharkiv was based on analysis of 30 relevés on plots of 50–100 m^2 along rivers, canals, streams, ponds and reservoirs within the city. All relevés were made according to the Braun-Blanquet approach (Braun-Blanquet 1964). Small plant communities were described from the whole area they occupied. Estimation of quantitative participation of species in stands was carried out using Braun-Blanquet's modified cover scale, where "+" – less than 1 %, "1" – 1–5 %, "2" – 6–15 %, "3" – 16–25 %, "4" – 26–49 %, "5" – 50 % and more. The vegetation plots were stored in TURBOVEG 2.91 database (Hennekens 2008). To perform analysis and classification we used JUICE software version 7.0.127 (Tichý & Holt 2006). Materials were processed using PC-ORD (McCune & Mefford 2006) algorithm with "pseudospecies" cut levels at 0, 5, 15, and 25 %. The grouping of relevés in small phytocoenones was conducted with the Sørensen coefficient (Sørensen 1948) at a "flexible beta" – 0.25. The concept of fidelity is adopted in the establishment of diagnostic species of syntaxa (Chytrý et al. 2002). The threshold values for the corresponding coefficient are taken at the level of 0.25. For highly diagnostic species, the *phi* coefficient exceeds 0.5. The obtained phytocoenones have been identified by the latest overview of the vegetation of Ukraine (Dubyna et al. 2019). Ecological analysis of the identified communities was carried out according to the method of synphytoindication applying ecological scales of Ya. Didukh (2011) for determining the ecological optimums of plant communities in relation to the leading ecological factors.

RESULTS AND DISCUSSION

Systematic analysis

The wetland flora of Kharkiv includes 146 species from 40 families (Zvyagintseva 2015), Vinnytsia – 42 species of 22 families (Dobrovolska 2004), Donetsk-Makiyivka agglomeration – 63 species of 9 families (Fig. 2). Such a significant difference in the species composition is due to the different area of the studied territories, hydrological conditions and degree of anthropogenic transformation. The ratio of the wetland species number to the total number of urban flora species is as follows: Vinnytsia 1: 20; Donetsk-Makiyivka 1: 14.2; Kharkiv 1: 7.5. For comparison, this ratio for Primorsk city is 1: 5.8 (the number of wetland species – 86, the total number of urban flora species – 504), and for Kropyvnytskyi city 1: 11.7 (the number of wetland species – 100, the total number of urban flora species – 1165).

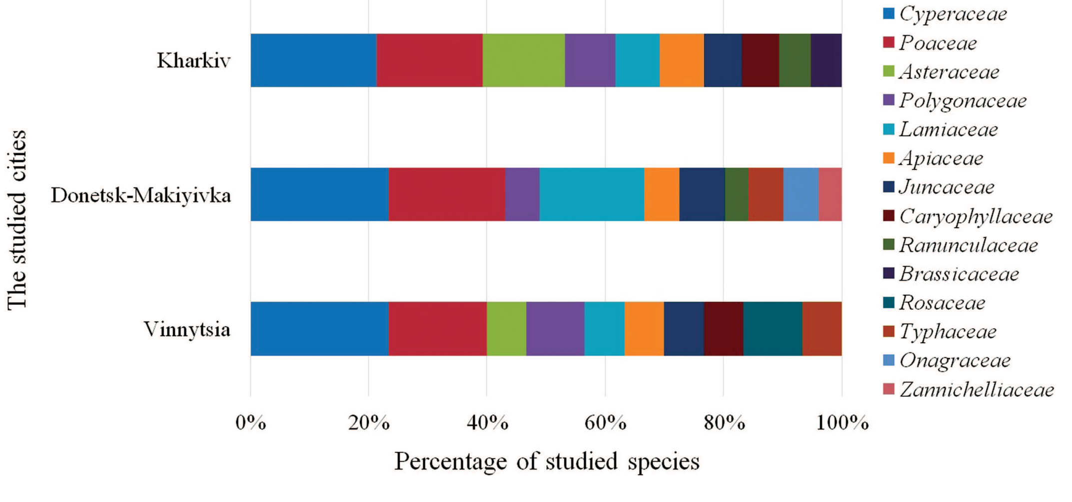

Figure 2. Proportion of number of plant species within families of wetland flora in studied territories.

Taxonomic analysis showed the following distribution of dominant families: Cyperaceae – Kharkiv (20 species), Donetsk-Makiyivka (12), Vinnytsia (7); Poaceae – Kharkiv (17), Donetsk-Makiyivka (10), Vinnytsia (5); Asteraceae – Kharkiv (13), Vinnytsia (2); Polygonaceae – Kharkiv (8), Donetsk-Makiyivka (3), Vinnytsia (3); Lamiaceae – Kharkiv (7), Donetsk-Makiyivka (9), Vinnytsia (2); Apiaceae – Kharkiv (7), Donetsk-Makiyivka (3), Vinnytsia (2); Juncaceae – Kharkiv (6), Donetsk-Makiyivka (4), Vinnytsia (2); Caryophyllaceae – Kharkiv (6), Vinnytsia (2); Ranunculaceae – Kharkiv (5), Donetsk-Makiyivka (2); Brassicaceae – Kharkiv (5); Rosaceae – Vinnytsia (3); Typhaceae – Donetsk-Makiyivka (2), Vinnytsia (2); Onagraceae and Zannichelliaceae – Donetsk-Makiyivka (3/2). Some families are absent in the dominant spectrum of wetland flora. This may be related to the following features: city area, area of wetlands, hydrological zoning, degree of anthropogenic load.

Biomorphic analysis

According to the authors' field data the plant species of studied territories are divided into several groups of life forms. Perennials dominate, which corresponds to the general pattern of urban flora development in Ukraine (Protopopova 1991). The proportion of perennials is as follows: Vinnytsia – 88.1 % of the wetlands species total number, Donetsk-Makiyivka – 85.7 % and Kharkiv – 70.5 %. Annuals are represented by a much smaller proportion – 9.5 %, 12.7 % and 29.5 %. This proportion is typical for wetlands, as the number of perennials increases with increasing humidity (Didukh 1978).

Ecological analysis

The process of flora xerophytization is especially noticeable in the Donetsk-Makiyivka agglomeration. According to Burda (1991) the proportion of species which grow in conditions of moderate humidity is about 64.8 % and the proportion of drought-resistant species – only 28.4 % in the flora of South-Eastern Ukraine. The proportion of drought-resistant species is 41.9 %. The same tendency is observed in Kharkiv – the gradual aridization of the ecosystem due to urbanization, which leads to the xerophytization of the city flora. As for Primorsk, it is the city with the least anthropogenic impact among considered ones. Primorsk is located along the Azov Sea coast, thus the distribution area of wetland species increases (Maltseva 2019).

The results of ecological analysis of wetlands in relation to three leading ecological factors (soil water regime, total salt regime and light) are shown in figures 1–3. Hygro-mesophytes, which adapt to damp forest-meadow habitats, completely dominate in wetlands of Vinnytsia (38.1 % of the total number of species) and Donetsk-Makiyivka (22.9 %) (Fig. 3). The same pattern is observed in the wetlands of Kropyvnytskyi and Primorsk. As for Kharkiv, the mesophytes of fresh forest-meadow habitats rank first place (33.3 %). Predominance of the meso-hygrophytic group among the hygromorphes is an indicator of conditions at the boundary between terrestrial and aquatic habitats. The increase in number of mesophytes, as well as the appearance of meso-xerophilic group species, occurs due to invasion of weeds into the riverside phytocoenoses. Such a process is observed in many urban riparian vegetation communities as the urban stream syndrome (USS) (Walsh et al. 2005; Grella et al. 2018).

Mesotrophes growing on rich sod-podzolic, gray forest and meadow marsh soils with leaching regime, and eutrophes of well enriched chernozems and developed sod-podzolic soils, dominate in wetlands of all urban floras (Fig. 4). However, the role of the latter in the wetland structure of Kharkiv urban flora decreases due to an increase of semi-eutrophes (27.1 %) which grow on dark-grey forest soils and podzolic chernozems. Presence of sub-glycotrophes, glycotrophes and meso-halotrophes indicates the degree of soil salinity (Didukh 2011). These plants grow on soils with carbonate and sulfate soda types of salting. We explain such results with the physical and geographical location of cities and regional soil conditions.

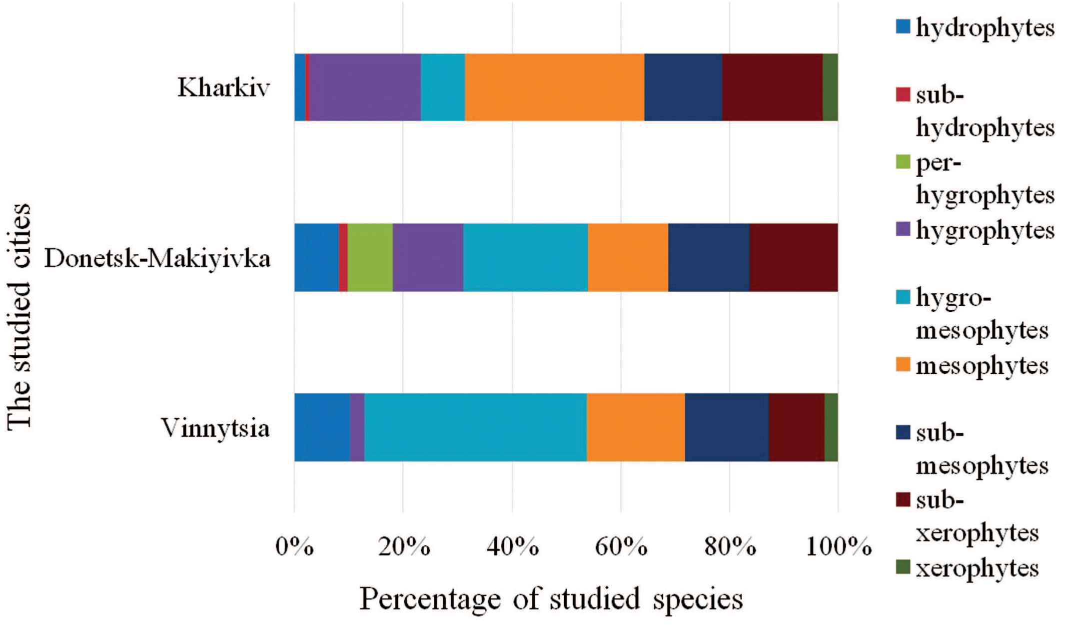

Figure 3. Proportion of number of plant species within soil water regime ecogroups in studied territories.

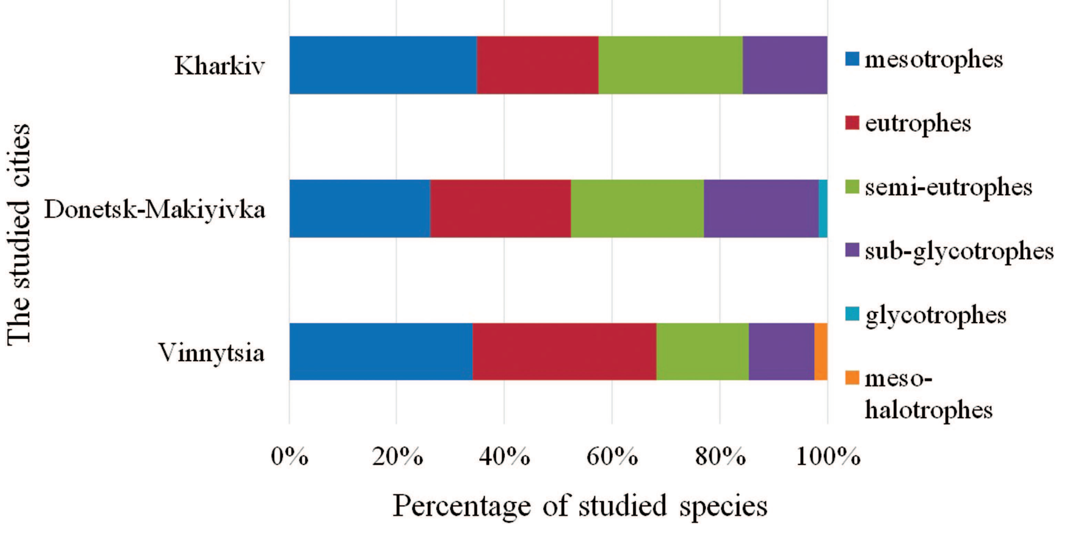

Figure 4. Proportion of number of plant species within total salt regime ecogroups in studied territories.

The spectrum of ecogroups by light corresponds to the ecological conditions of growth (Fig. 5). The vast majority of species of all studied territories belong to the heliophytes and sub-heliophytes, which are plants of open and semi-shaded areas along water bodies (Didukh 2011).

Analysis of adventive fraction

The native plant species dominate in the composition of wetlands (Fig. 6). The majority of them are members of Cyperaceae (20 native species / 0 adventive species), Poaceae (12/5), Juncaceae

(5/0), Typhaceae (3/1) Apiaceae (7/0), Lamiaceae (7/0) families. The dominance of adventive species was revealed in Asteraceae (5/8), Amaranthaceae (0/3), Balsaminaceae (0/2). Such adventive species as *Acorus calamus* L., *Cyclachaena xanthiifolia* (Nutt.) Fresen., *Typha laxmannii* Lepech. form plant communities, being the dominant species. Other species like *Atriplex tatarica* L., *Bidens frondosa* L., *Erigeron canadensis* L., *Impatiens parviflora* DC., I. *glandulifera* Royle, *Lepidium densiflorum* Schrad. are diagnostic for most ruderal phytocoenoses (Dubyna et al. 2019).

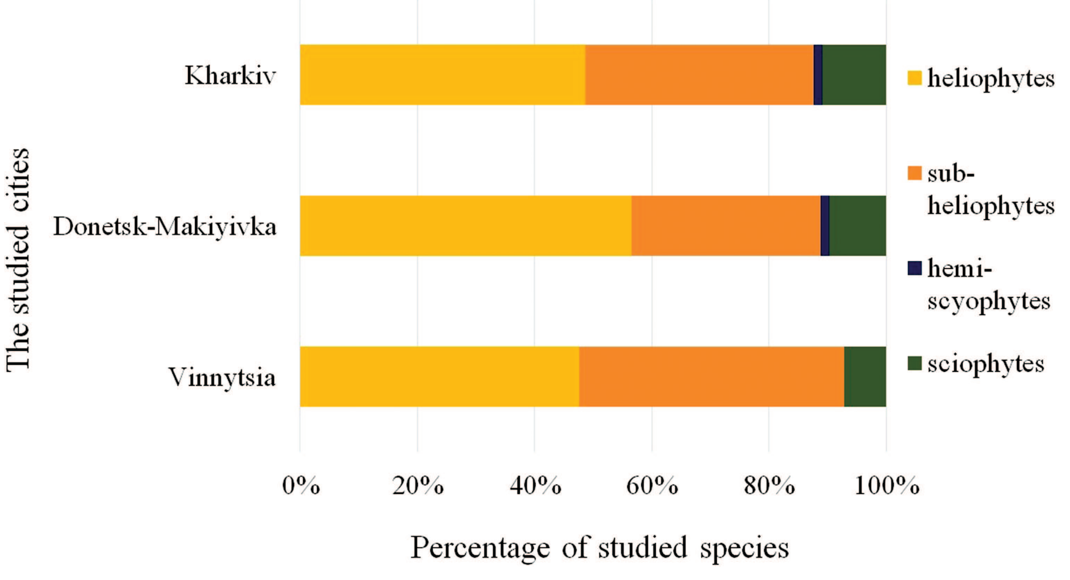

Figure 5. Proportion of number of plant species within light ecogroups in studied territories.

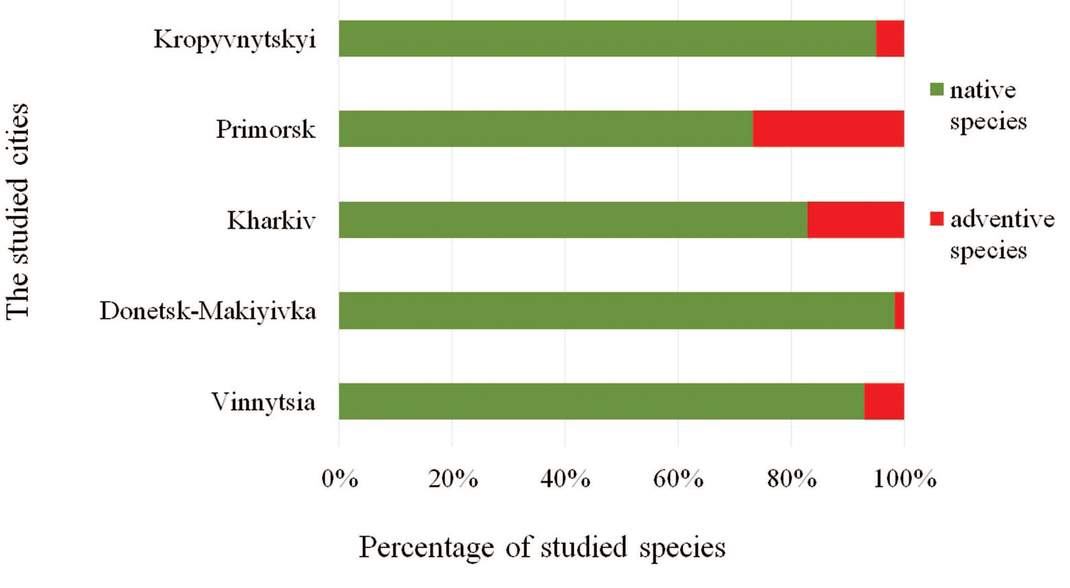

Figure 6. Proportion of number of native and adventive plant species in wetland flora in studied territories.

Analysis by the degree of urbanization

The spectra of the studied wetlands differs from each other in relation to urbanization. A large amount of urbanophobes are noted for wet habitats of Kropyvnytskyi (79 %) and Kharkiv (57.6 %) (Fig. 7) Urbanoneutrals are widely represented in all studied territories, and they are dominating in Vinnytsia (81 %). Urbanophiles are presented in a small amount or they are absent in Vinnytsia. These indicators show the peculiarities of socio-economic development, zoning of the considered cities, as well as the location and degree of development of the hydrographic network. Most species of wet habitats (*Persicaria hydropiper* (L.) Delarbre, *Sonchus palustris* L., *Phragmites australis* (Cav.) Trin. ex Steud., *Veronica anagallis-aquatica* L.) grow in the recreational area of Ukrainian cities (Dubyna et al. 2021).

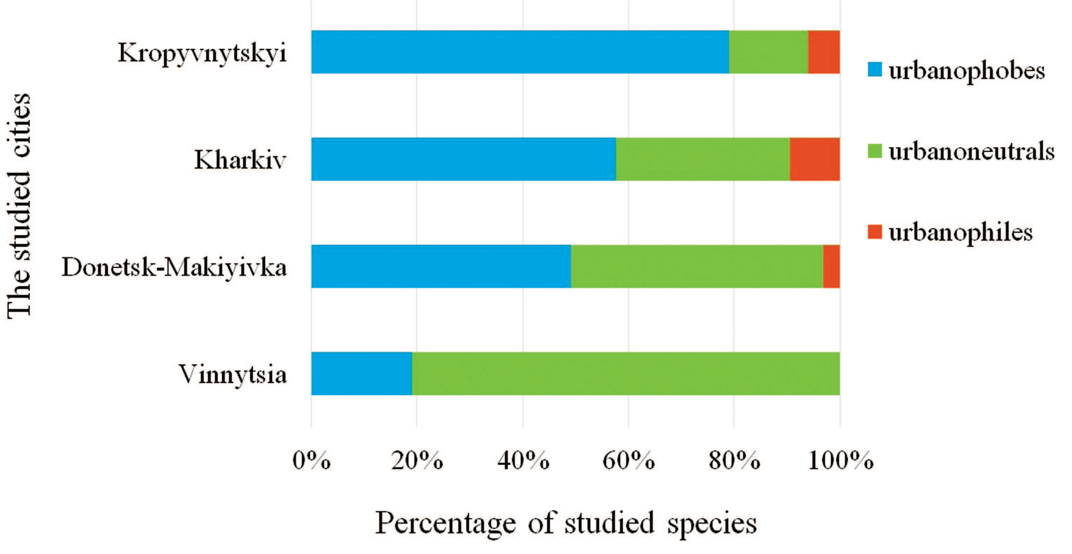

Figure 7. Proportion of number of wetlands plant species by the degree of urbanization in studied territories

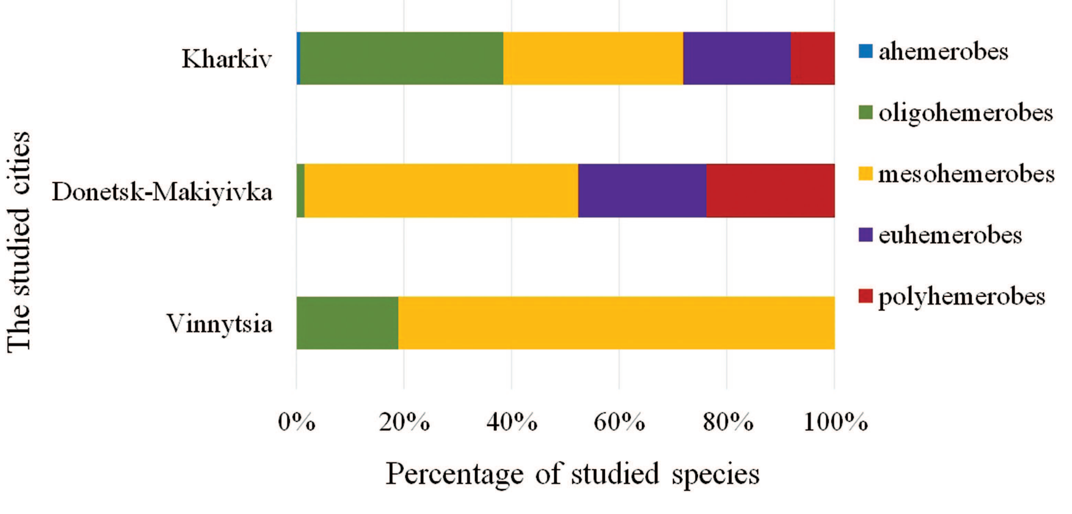

Figure 8. Proportion of number of wetland plant species by hemerobia in studied territories.

Analysis by hemerobia

According to hemerobia, the plant species of studied wetlands are divided into five groups (Fig. 8). Only *Comarum palustre* L. belongs to the group of agemerobes in the wetlands of Kharkiv. Oligohemerobes are represented mainly in the wetland flora of Kharkiv and Vinnytsia. In Donetsk-Makiyivka agglomeration there is only *Equisetum fluviatile* L. Mesohemerobes are presented in large amount in all studied territories. Species of groups under constant and strong anthropogenic influence – eugemerobes and polyhemerobes – grow in the wetlands of Kharkiv (19.9 % and 8.2 %) and the Donetsk-Makiyivka agglomeration (23.8 % for each group). There are especially many polyhemerobes in the latter territory because the Donetsk region ranks the first place in Ukraine in the discharge of wastewater into surface water bodies (Derevyanska 2014). Mine waters and industrial effluents of the metallurgical and coke-chemical industries play a significant role in this fact (Cirtina et al. 2016).

Phytocoenotic diversity of wetlands

The vegetation of wet habitats that forms in riversides and shallow waters of freshwater and brackish water bodies is usually represented by classes *Phragmito-Magnocaricetea* Klika in Klika et Novák 1941, *Isoëto-Nanojuncetea* Br.-Bl. et Tx. in Br.-Bl. et al. 1952, *Bolboschoenetea maritimi* Vicherek et Tx. in Tx. et Hülbusch 1971, *Littorelletea uniflorae* Br.-Bl. et Tx. ex Westhoff et al. 1946, *Salicetea purpureae* Moor 1958, *Alnetea glutinosae* Br.-Bl. et Tx. ex Westhoff et al. 1946 with a participation of anthropogenic vegetation in cities. The wetlands' vegetation of Kharkiv is represented mainly by unions *Phragmition communis* Koch 1926, *Carici-Rumicion hydrolapathi* Passarge 1964, *Senecionion fluviatilis* Tx. ex Moor 1958, *Chelidonio-Acerion negundi* L. Ishbirdina et A. Ishbirdin 1991. These plant communities grow along rivers, canals, streams and reservoirs within the city. Hygrophytes of wide ecological amplitude and high forming ability of dominants form plant communities with the participation of adventive species *Acorus calamus* L., *Ambrosia artemisiifolia* L., *Bidens frondosa* L., *Erigeron canadensis* L., *Echinochloa crusgalli* (L.) P. Beauv., *Echinocystis lobata* (Michx.) Torr. & A. Gray, *Impatiens parviflora* DC., I. *glandulifera* Royle, *Fallopia convolvulus* (L.) Á. Löve, *Erigeron annuus* (L.) Pers., *Parthenocissus inserta* (A. Kern.) Fritsch, *Phragmites altissimus* (Benth.) Mabille (Dubyna et al. 2021).

Ecological characteristics of wetland vegetation

The results of determining the ecological optima of plant communities by authors field data in relation to the variability of damping and total salt regime (Fig. 9) indicate the adaptation of studied plant communities to the conditions of irregular moisture from fresh forest-meadow habitats (4.9 points by ecological scales) to dry steppe or damp habitats (7.6 points) and sufficient salts in the soil (semi-eutrophic and eutrophic conditions with 7.3–9.2 points). The diagram shows the distribution of plant communities *Typhetum angustifoliae* Pignatti 1953, *Typhetum latifoliae* Nowiński 1930, *Sparganietum erecti* Roll 1938, *Phragmitetum australis* Savič 1926 and *Chelidonio-Acerion negundi* L. Ishbirdina et A. Ishbirdin 1991 along the gradient in the direction of irregular wetting of soil and decreasing soil enrichment in salt. The plant communities *Carici-Rumicion hydrolapathi* Passarge 1964 and *Senecionion fluviatilis* Tx. ex Moor 1958 demonstrate the same tendency, but at higher values of variability of damping. The results indicate the adaptability of hygrophytic communities to fluctuations in moisture and eutrophic conditions. This corresponds to the results of the structural analysis of the class *Phragmito-Magnocaricetea* Klika in Klika et Novák 1941 (Dubyna et al. 2015).

The values of the ecological optima of plant communities regarding soil aeration and nitrogen content in the soil were obtained based on the authors field data (Fig. 10). These ecological factors are leading in the formation of riparian vegetation. We can see the trend of decrease in soil aeration from hemi-aerophobic (7.1 points, aeration 35–50 %) to mega-aerophobic conditions (12.6 points, aeration 1–3 %) on soils enough provided with mineral nitrogen (5.5–7.9 points). These data confirm previously conducted ecological studies of hygrophytic plant communities of the class *Phragmito-Magnocaricetea* in Ukraine (Dubyna et al. 2014)

The distribution of *Carici-Rumicion hydrolapathi* Passarge 1964, *Senecionion fluviatilis* Tx. ex Moor 1958 and *Chelidonio-Acerion negundi* L. Ishbirdina et A. Ishbirdin 1991 is determined by the decrease in soil aeration and nitrogen

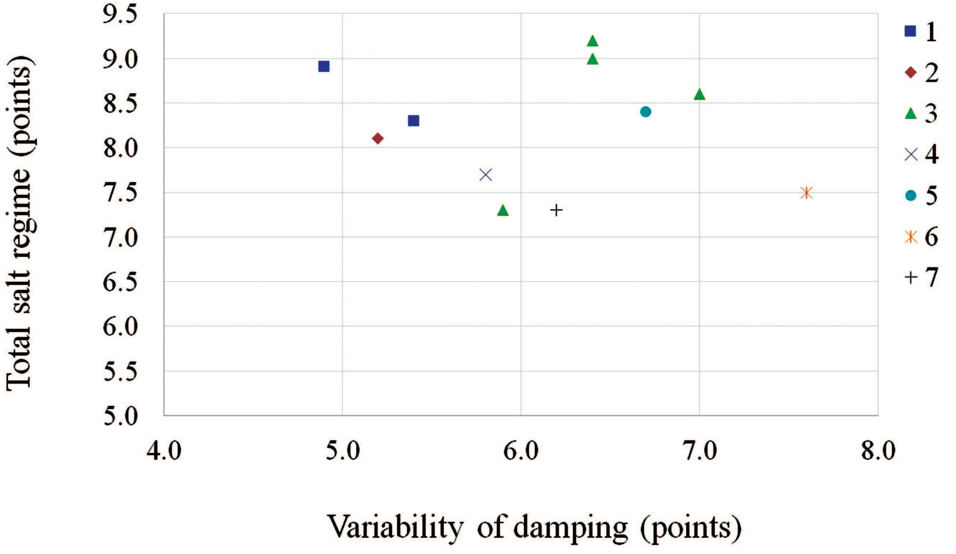

Figure 9. Distribution of plant communities by variability of damping and total salt regime, where 1: *Typhetum angustifoliae* Pignatti 1953; 2: *Typhetum latifoliae* Nowiński 1930; 3: *Phragmitetum australis* Savič 1926; 4: *Sparganietum erecti* Roll 1938; 5: *Carici-Rumicion hydrolapathi* Passarge 1964; 6: *Senecionion fluviatilis* Tx. ex Moor 1958; 7: *Chelidonio-Acerion negundi* L. Ishbirdina et A. Ishbirdin 1991.

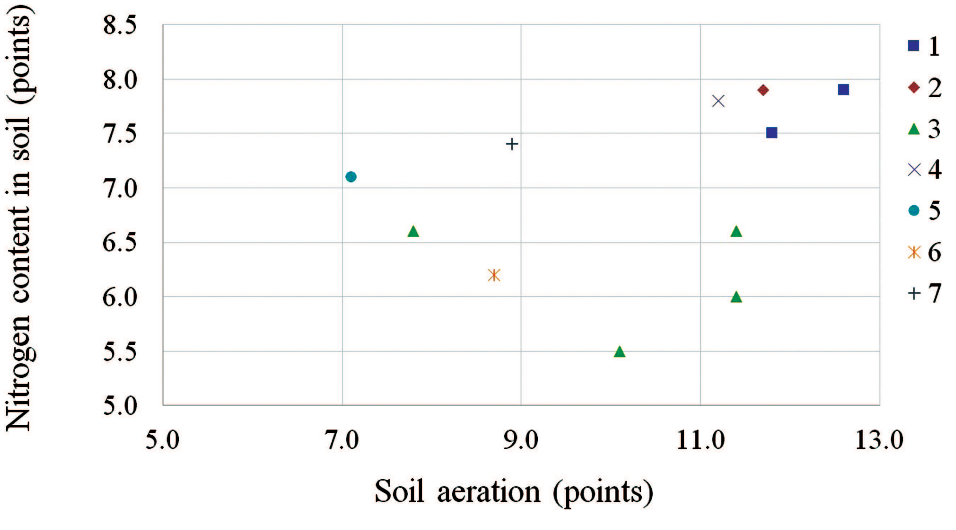

Figure 10. Distribution of plant communities by soil aeration and nitrogen content in soil (legend explanation is given in figure 9).

content in soil. The wide range in values for *Phragmitetum australis* Savič 1926 is due to the different contribution of ruderal species found in these communities. Based on the obtained values, it is possible to trace the growth of hygrophytic plant communities *Typhetum angustifoliae* Pignatti 1953, *Typhetum latifoliae* Nowiński 1930 and *Sparganietum erecti* Roll 1938 in aerophobic conditions on soils sufficiently supplied with mineral nitrogen.

Thus, the wetlands' vegetation of the city due to the influence of eutrophication, nitrification and xerophytization is gradually replaced by ruderal vegetation with a significant share of adventive species in its composition.

CONCLUSIONS

The peculiarities of socio-economic development, zoning of the considered cities, as well as their location cause ecological structure of wetland vegetation cover. With the increase of the urban area and the growth of anthropogenic impact, the number of hygrophytic species in the urban flora decreases. On the one hand, the dominance of meso-hygrophytic group, mesotrophes and eutrophes, heliophytes and sub-heliophytes corresponds to wet habitat conditions with regional soil and hydrological features. On the other hand, the presence of meso-xerophilic species, eugemerobes and polyhemerobes indicates constant and strong anthropic influence which leads to invasion of weeds into wetland vegetation. We can see this process in changing typical hygrophytic plant communities on ruderal coenoses. Most plant communities are formed with the participation of adventive species. The results of synphytoindication show the adaptability of hygrophytic communities to fluctuations in moisture and eutrophic conditions, reducing soil aeration with a high content of nitrogen compounds.

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