

DOI: 10.21570/EDGG.PG.57.17-25

Photo Story

Ravine-gully landscapes of Kharkiv Region (Ukraine) as loci of meadow steppes biodiversity

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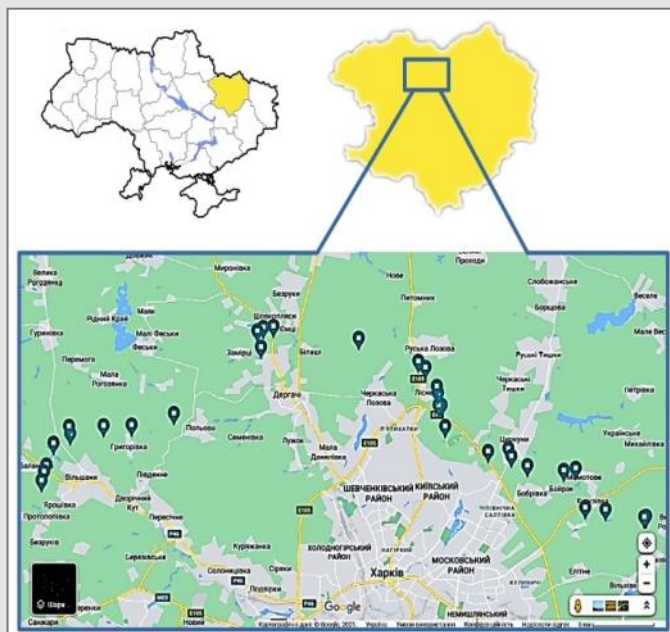
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Catastrophic losses of Eurasian steppe grassland vegetation, especially in Ukraine, create a special urgency for the preservation of even small remaining areas of steppe vegetation due to their pivotal importance. For the territory of Ukraine, steppes are not only a natural biome, but also a significant part of its history. They are associated with the development of culture, life, and worldview of the freedom-loving Ukrainian people and their identity. At the beginning of the current era, the steppe biome occupied more than one-third of the area of present-day Ukraine (about 40% of its territory) but today, the area of the steppes has decreased by more than 50 times (to less than 1%). Therefore, the fate of the steppe landscapes can be considered truly tragic, so that these ecosystems and their biodiversity need special protection.



The location of reference points in the studied area.



Oksana Tyshchenko collecting plant specimens.
Photo: V. Tyshchenko.



Oksana Tyshchenko during an assessment of the floristic composition of the vegetation cover at the observation points. Photos: V. Tyshchenko.

Our expeditionary research began in September-October 2021 under a contractual agreement with LLC Science Center "Ecology" as part of the environmental impact assessment procedure. The purpose of our work was to assess the biodiversity and analyze the potential impact on the Emerald network sites in the Kharkiv region resulting from the planned construction of a new 330 kV high-voltage power line with a total length of 62 km. The overhead power line was planned to pass through the regional landscape park "Feldman Ecopark" and two sites of the Emerald Network (Tsyrkunivskiy forest (UA0000290) and Upper part of Uda river valley (UA0000292)), as well as near four local nature conservation sites and three other Emerald Network sites (UA0000283, UA0000287, and UA0000294).

The territory of our study is located in the forest-steppe zone and is characterized by a diverse range of landscapes. Geomorphologically, it belongs to the southern part of the Central Russian Upland, which is a plain with a well-developed network of ravines, gullies, and valleys of the Murom, Kharkiv, Lozovenka, Lopan, and Uda rivers. These types of dry gullies or steep-sided ravines, known as balkas in Ukraine, are typically found in the steppe regions of Ukraine and other Eastern European countries. The hydrographic network of the research area belongs to the Siverskyi Dnests river basin. Elevation ranges from 105.1 to 216.7 m.



Volodymyr Tyshchenko registers signs of mammal activity - *Spalax microphthalmus* mounds. Photo: I. Davydenko.



Volodymyr Tyshchenko and Oleksandr Govorun are conducting ultrasonic bat recording and collecting insects attracted to light during nighttime. Photos: I. Davydenko.



Volodymyr Tyshchenko, faunistic research of meadow steppe fragments in the upper reaches of the ravine to the north of Sorokivka village. Photo: O. Tyshchenko.



Igor Davydenko during research on bird migration routes. Photo: V. Tyshchenko.



Oleksandr Govorun during research on the diversity of entomofauna. Photos: V. Tyshchenko.



Oleksandr Govorun catches insects using light as one of the methods to study the diversity of invertebrates. Photos: V. Tyshchenko.

In the fall of 2021, the vast majority of the study area was occupied by agricultural lands interspersed with forest protective strips, and to a lesser extent, by deciduous forests and ravine-gully landscapes, where meadow steppe vegetation was still preserved. A fairly large part of the territories adjacent to the city of Kharkiv were used for spontaneous recreation, construction, and other economic needs. However, due to the rugged topography and dense thickets of woody, shrubby, and herbaceous plants, a certain part of them has remained relatively well-preserved, close to their natural state.

Meadow-steppe vegetation in the Kharkiv region has been almost completely plowed and now exhibits "island distribution". Steppes are located diffusely and remain only in small patches, mostly on "non-farm" lands, and are represented by gullies and ravines, as well as in a number of protected territories and in the Emerald network of areas of special conservation interest.



Fallow lands and hay meadows of the reference site located near the road from Shovkoplasny village to Dergachi town. Photo: V. Tyshchenko.



The edge of the forested area adjoining the ravine with fallows, which are gradually becoming overgrown. Photo: V. Tyshchenko.



Fragment of the northern slope of the ravine west of the Vilshany village. Photo: V. Tyshchenko.



A fallow overgrown with *Fraxinus excelsior*, *Ulmus glabra*, *Acer negundo*, *Elymus repens*, *Calamagrostis epigejos*, *Solidago canadensis*, and other species. Photo: V. Tyshchenko.



A fragment of a transformed area of steppe vegetation in the ravine to the west of the Vilshany village. Photo: V. Tyshchenko.



Fallow, vegetation restoration of steppe meadows. Photo: V. Tyshchenko.



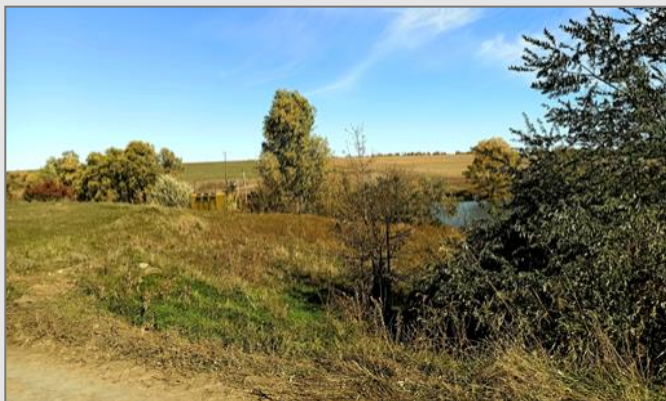
General view of the southern slope of the ravine to the west of the Vylshany village. Photo: V. Tyshchenko.



Mesophytic plant communities of the bottom of the ravine to the west of the Vylshany village. Photo: O. Tyshchenko.



Pastures and fallows in the bottom of a steppe ravine on the outskirts of Zinkivske village. Photos: V. Tyshchenko.



Meadow and wetland ecotopes of the area on the dam between the ponds northwest of the outskirts of Vylshany village. Photo: V. Tyshchenko.



Bottom of a steppe ravine to the west of Hryhorivka village. Photo: V. Tyshchenko.



Overgrown fallow land between the E40 highway and the Kharkiv river, located to the north of the Velyka Danylivka district in Kharkiv city. Time for evening faunistic research. Photo: V. Tyshchenko.



Slopes of a steppe ravine to the west of Hryhorivka village, time for evening faunistic research. Photo: V. Tyshchenko.

During our research, we established 30 observation reference points and a network of transects to cover the full range of landscapes in the studied area. The biodiversity of the area was studied through field and camera botanical and zoological research during daytime and night-time. Analysis of the species composition of plant cover was conducted with collection of herbarium specimens, photography, and processing of the collected data. Studies of the mammal, amphibian, and reptile fauna were carried out along the recording transects, including recording of animal activity traces (footprints, excrements, mounds, gnawings, burrows, and other shelters). A study of the species composition and number of

bats was carried out by acoustic-visual recording of animals at recording points and transects (on foot and from moving vehicles). The recording was conducted using an ultrasonic bat detector and a voice recorder with further processing of audio materials using special software. The study of bird fauna was carried out by visual and audio identification. The invertebrate fauna was studied by collecting insects on the surface of plants and soil, catching them with an entomological net, light trapping at night, and by manual methods in places where imagoes stay during the day (plants, trunks, stumps).



A fallow area on the left bank of the Uda River, to the north of Hryhorivka village. Photo: V. Tyshchenko.



Hayfield area on the dam above the pond in the floodplain of the Nemyshlia River, to the south of Kutuzivka village. Photo: V. Tyshchenko.



Meadow steppe fragments in the upper reaches of the ravine to the north of Sorokivka village. Photos: V. Tyshchenko & O. Tyshchenko.



Green strawberry (*Fragaria viridis*), field eryngo (*Eryngium campestre*) and meadow clover (*Trifolium pratense*) as components of the ravine vegetation cover. Photos: O. Tyshchenko.

Most of the revealed species diversity was associated with meadow steppe vegetation at different stages of demutation. This type of vegetation was recorded in several ravines located mostly between agricultural lands in different parts of the Kharkiv district (north of Kharkiv) with a total area of about 200 hectares. In particular, such fragments of steppes were located on the slopes and at the bottom or upper zone of the ravines to the west of Vilshany, Hryhorivka, and Poljova villages, to the north of Sorokivka and Lisne villages, and to the south of Zinkivske village. The restoration of meadow-steppe grasslands in these areas is evident by the presence of sozophytes of national and regional importance, such as *Stipa capillata* L., *S. lessingiana* Trin. & Rupr., *Clematis integrifolia* L., *Asparagus officinalis* subsp. *polyphyllus* (Steven) Tzvelev, *Hypericum elegans* Steph. ex Willd., and common representatives of meadow-steppe vegetation communities, including *Caragana frutex* (L.) K. Koch, *Chamaecytisus lindemanii* (V.I. Krecz.) Klask., *Prunus spinosa* L., *Elytrigia intermedia* (Host) Nevski, *Koeleria macrantha* (Ledeb.) Schult., *Festuca valesiaca* Schleich. ex Gaudin, *Artemisia austriaca* Jacq., *Phlomis tuberosa* L., *Galatella villosa* (L.) Rchb.f., *G. linosyris* (L.) Rchb.f., *G. biflora* (L.) Nees, *Eryngium campestre* L., *Falcaria vulgaris* Bernh., *Marrubium peregrinum* L., *Origanum vulgare* L., *Salvia pratensis* L., *S. verticillata* L., *Asparagus officinalis* L., *Medicago falcata* L., *Securigera varia* (L.) Lassen, *Silene nutans* L., *Euphorbia stepposa* Zoz ex Prokh., *Vincetoxicum hirsundinaria* Medik., *Centaurea pseudocoriacea* Dobroc., *C. pseudo-maculosa* Dobroc., *C. scabiosa* L., *Achillea pannonica* Scheele, *A. nobilis* L., *Allium sphaerocephalon* L., *Lavatera thuringiaca* L., *Thymus marschallianus* Willd., etc.



Stipa capillata, *Phlomis tuberosa*, *Caragana frutex*, *Euphorbia stepposa* and *Asparagus officinalis* subsp. *polyphyllus* - the components of the meadow-steppe communities of the ravine to the north of Sorokivka village.

Photos: O. Tyshchenko.



Blackthorn (*Prunus spinosa*), agrimony (*Agrimonia eupatoria*), wood small-reed (*Calamagrostis epigejos*), and solitary clematis (*Clematis integrifolia*) - the components of the meadow-steppe communities of the ravine to the north of Hryhorivka village. Photos: O. Tyshchenko.



The ponds are the habitats of aquatic and wetland birds.
Photo: V. Tyshchenko.

As a result of our research, the following animal species diversity was recorded on the study area: 54 species of insects belonging to nine orders and 27 families; 39 species of birds belonging to eight orders and 23 families, of which 35 species have conservation status; 11 species of amphibians belonging to two orders and six families, all with conservation status; 29 species of fishes belonging to six orders and 12 families, of which seven species have conservation status; 43 species of mammals belonging to six orders and 15 families, of which 29 species have conservation status, including the recorded activity of seven species of bats, all with conservation status.

Since the planned construction of a new overhead power line could have a direct and indirect impact on the biodiversity of the region, during the study we prepared recommendations for minimizing the negative impact on rare species, communities, and their habitats. In particular, the laying of the overhead power lines could be carried out with the use of only minimally invasive technologies, or completely avoiding interventions in the relatively undisturbed areas of native steppes.



The floodplain of the Uda River is a sanctuary for waterfowl and wetland birds. Photo: I. Davydenko.



The ravine to the north of the Sorokivka village with areas of natural steppe vegetation. Photo: I. Davydenko.



European badger's (*Meles meles*) burrow in the bottom of a steppe ravine near Hryhorivka village. Photo: V. Tyshchenko.



A group of pheasants (*Phasianus colchicus*) in the territory of the ravine. Photo: V. Tyshchenko.

A developed complex of biotechnical measures is aimed at minimizing the number of dangerous contacts of animal species with electrical equipment.

Unfortunately, the continuation of our research, which was supposed to cover the beginning and middle of the next growing season, has become impossible due to the outbreak of a full-scale war

in Ukraine initiated by Russian aggression. The studied territory was under occupation, and it suffered military interventions and destruction. The consequences of these interventions on the natural meadow-steppe habitats currently require a detailed assessment.



Phasianus colchicus male and female in the ravine to the north of Lisne village. Photo: I. Davydenko.



Phasianus colchicus male in the ravine to the north of Lisne village. Photo: I. Davydenko.



Cignus olor in the water bodies to the west of Vilshany village. Photo: I. Davydenko.



Flock of *Perdix perdix* in the ravine to the west of the Vilshany village. Photo: I. Davydenko.



Buteo buteo over the ravine to the north of the Lisne village. Photo: I. Davydenko.

Thus, our preliminary data indicate that the greatest biodiversity of the studied region is associated with the identified meadow-steppe vegetation located in ravine-gully landscapes, despite their small number and dispersion between agricultural lands.

The catastrophic situation of the rapid loss of steppe grasslands in Ukraine, caused by anthropogenic activities, calls for concerted efforts towards sustainable use, environmental management, preservation of even small areas of zonal steppe vegetation as refuges of steppe biodiversity and the exploration of new directions for the restoration of steppe vegetation.



Corvus corax to the east of the Bilashi village. Photo: I. Davydenko.



Lanius excubitor, a species from the Red Book of Ukraine. Photo: I. Davydenko.



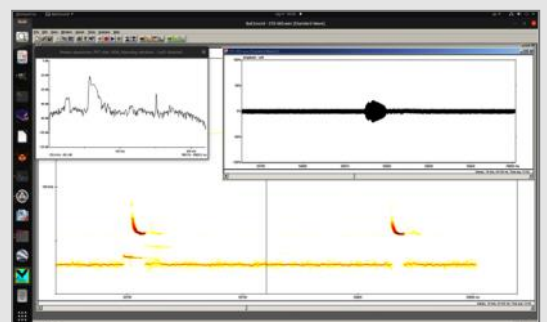
Spalax microphthalmus mounds in a hayfield. Photo: V. Tyshchenko.



Lucilla sericata on *Prunus spinosa* fruit. Photo: I. Davydenko.



Coenonympha pamphilus. Photo: I. Davydenko.



Computer decryption of ultrasonic signals of the pipistrelle bat (*Pipistrellus pygmaeus*). Photo: V. Tyshchenko.