

LANDSCAPE OF PSAMMOSTEPPEES OF THE ILEK AND KHOBDA INTERFLUVE (NEIGHBOURHOOD OF ORENBURG – RUSSIA)

¹Alexander A. Chibilyov, ²Valerian A. Snytko, ³Tadeusz Szczypek,
⁴Stanisław Wika

¹Russian Academy of Sciences, Ural Branch, Institute of Steppe, Pionerskaya 11, 460000
Orenburg, Russia

E-mail: orensteppe@mail.ru

²Russian Academy of Sciences, Siberian Branch, Institute of Geography, Ulanbatorskaya 1,
664033 Irkutsk-33, Russia

E-mail: snytko@irigs.irk.ru

³University of Silesia, Faculty of Earth Sciences, Bzdzińska 60, 41-200 Sosnowiec, Poland

E-mail: kgf@ultra.cto.us.edu.pl

⁴University of Silesia, Faculty of Biology and Environment Protection, Jagiellońska 28, 40-032
Katowice, Poland

E-mail: swika@us.edu.pl

Introduction

Steppes in the Eurasian continent make a compact zonal belt, extending – omitting eastern Austria and Hungary – from the western Ukraine through southern Russia, northern Kazakhstan up to Trans-baikalia and northern Mongolia. Their distribution results from defined climatic conditions, whose physiognomic reflection is predetermined by herbaceous vegetation, which is usually rich in species and mainly cover the fertile chernozem or chestnut soils. But in many places, where sandy deposits of different genesis occur in the substratum, significantly poorer herbaceous vegetation of sandy steppes, i.e. psammosteppes, developed. Similar situation also occurs in the main steppe belt of Russia – in the neighbourhood of Orenburg. Therefore the aim of this paper is to present the typical features of sandy steppe landscapes in the above-mentioned area on the basis of data from literature and field observations of authors.

1. Methodology

The method of geomorphological mapping of selected blown sandy areas was applied in the present study. The obtained results are given in sketches and geomorphological profiles. The character of vegetation in the area investigated was determined by means of phytosociological method by Braun-Blanquet (1964). Some phytosociological surveys were made and served as a basis for distinguishing three similar plant communities.

2. General physico-geographical characteristics

The area of investigation is located SW of the southern slopes of the Ural Mts. Between the valleys of Ilek and Malaya (Small) Khobda, which are the tributaries of the Ural river south of Orenburg (Fig. 1A).

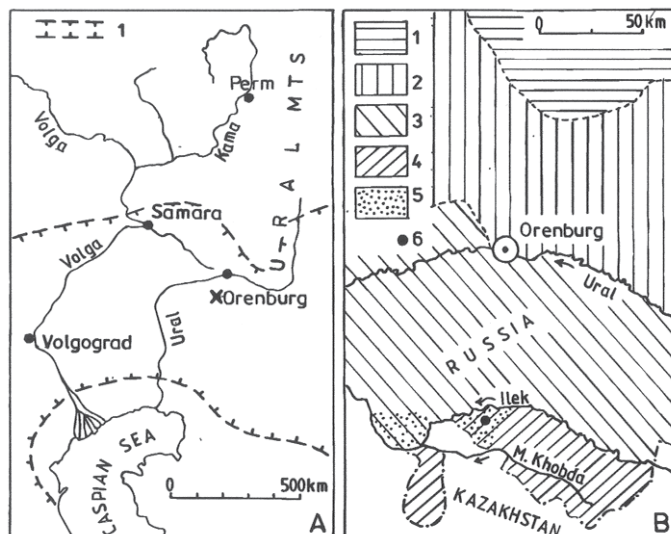


Fig. 1 A – Location of investigated area (x) against a background of limit of steppe zone (1), B – location of investigation area against a background of steppe landscapes (after: Географический ..., 1999): 1 – southern zone of forest-steppe (meadow steppe), 2 – zone of northern steppe (grassy-feather grass steppe), 3 – zone of typical steppe (fescue-feather grass steppe), 4 – zone of southern steppe (absinthium-grassy steppe), 5 – psammosteppes, 6 – area of investigation.

1 pav. A – tirtoji (x) stepių zonos (1) teritorija, B – tirtoji teritorija stepių kraštovaizdžio atžvilgiu (pagal : Географический..., 1999): 1 – pietinė miškastepės zona (pievinė stepė), 2 – šiaurinės stepės zona (žolinė-ašuojinė stepė) 3 – tipinės stepės zona (eraičininė-ašuojinė stepė), 5 – psamostepė, 6 – tirtoji teritorija.

The geological composition is represented by rocks of different age – from the Palaeozoic up to the Quaternary – Mesozoic deposits being the dominant ones in the surface: from the Lower Triassic red sandstones through to Albian and Cenomanian chalkstone. Removed sandstone mantle often occurs here in the form of inequigranular sands and dusty sands, covering mother rocks (Белкин и др., 1961; Донецков, Харин, 1971).

From the point of view of geomorphology the discussed area is represented by asymmetrically shaped surface of flat watershed, clearly elevating above river valleys.

The interfluvium of the Ilek and Khobda lies in the zone of severe, very dry and warm continental climate. The sums of mean annual precipitation amount here to 280–320 mm, mean temperatures of July reach 22° C, and of January – -15°C, but the highest summer temperatures can reach up to 42°C, and the lowest winter temperatures – up to -44°C. Mean annual temperature is here about 4.5°C (Агроклиматические..., 1971; Географический..., 1999; Исмаков, 2003).

The landscape of the Ilek and Khobda interfluvium belongs to the zone of southern steppes (Fig. 1B). In general the absinthium-grassy steppes predominate here with large fragments of psammosteppes. They are shaped on sandy dark chestnut soils, whereas psammosteppes – on sandy soils (Климентьев, 1977; Географический..., 1999).

3. Landscape of psammosteppes

The above-mentioned natural conditions as well as irrational human economy (extensive cattle, sheep and goat grazing, extensive ploughing) are responsible for dominant average to strong (10–15% of area) eastern winds in winter and western ones in summer. The southern

winds are also of equal importance (Географический..., 1999; Исмаков, 2003; Рябуха, 2003).

The above-mentioned winds result in: 1) significant soil losses, which can reach extreme values of up to 26t/ha/year (Исмаков, 2003) and 2) typical aeolian relief in some areas, responsible for specific morphological landscape of Orenburg steppes.

Therefore, against the background of typical absinthium-grassy steppe vegetation with large share of feather grass *Stipa* sp. (Fig. 2), landscapes of sandy steppes (psammosteppes) with typical species and plant communities appear here.



Fig. 2. Steppe of feather grass *Stipa* sp. in eluvial, monotonous area of watershed in the neighbourhood of the site Kumakskoye (Photo by T. Szczypek).

2 pav. *Ašuočinė (Stipa sp.) stepė eliuvinėje monotoniškoje vandenskyros zonoje netoli Kumakskoje gyvenvietės (T. Szczypek'o nuotr.)*

The landscape of Orenburg psammosteppes will be presented on the example of one site – Kumakskoye. Ryabukha (Рябуха, 2003) describes its type of sand relief as a dune–depression. This relief has originated on a slightly wavy area built of dusty sands as a result of damage to steppe vegetation by inflicted by animal breeding in the last 150 years.

The site discussed is representative for the whole area of the Ilek and Malaya Khobda interfluve. A geomorphological sketch of a typical fragment of this site is given in Fig. 3A.

Deflation landforms, formed by W and SW winds, obviously predominate there. A large deflation plain sloping in the western direction and covered by scanty herbaceous vegetation is the main form. It has two remnants, which probably, used to be transverse dunes with asymmetrically shaped slopes. The leeward slopes have survived until present, although their actual state is, undoubtedly, a result of the contemporary eolian processes and material removal to the east, where the deflation plain enters the eluvial plain. The slope gradient is there typical and equals to 29–32°. The formerly windward slopes also have a typical gradient of 8–10°. Yet the occurrence of clear westward deflation edge and small deflation basins imply their degradation (Fig. 3A, B, C). Clear deflation undercut, thanks to which the slope of remnant shelves towards N at the angle of 32°, also implies an intensive blowing (Fig. 3A, B; Fig. 4).

Apart from dominant effects of destructive wind activity in the site discussed the contemporary landforms of aeolian accumulation are also visible, but they are of undoubtedly smaller importance. On one side there is a rather large slightly wavy cover of blown sands,

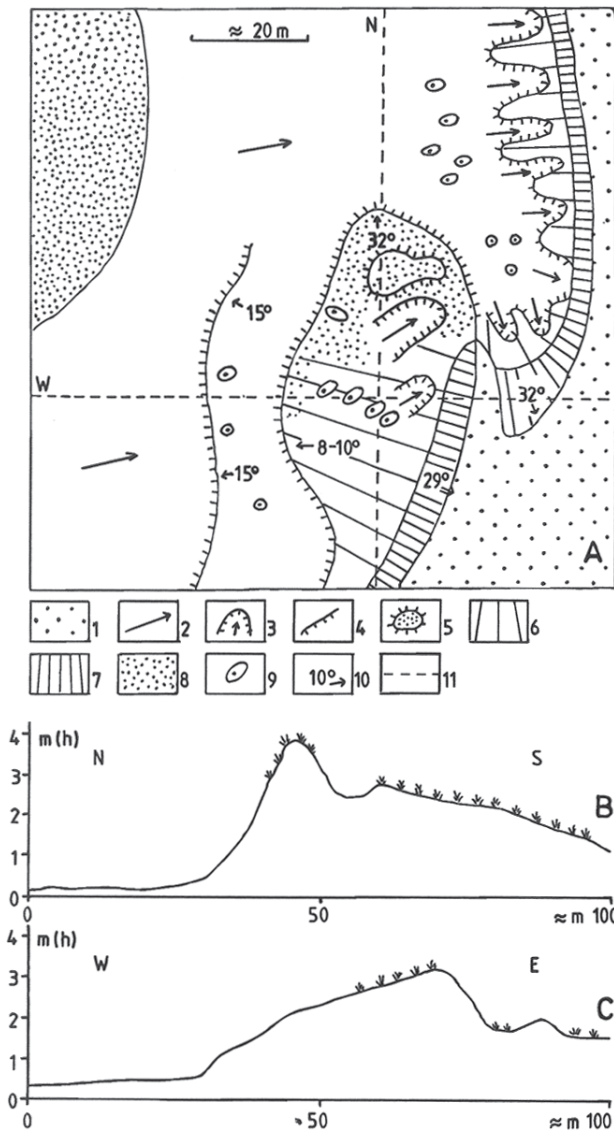


Fig. 3. Geomorphological sketch of psammostepe fragment in the site Kumakskoye (A): 1 – eluvial plain, 2 – deflation plate, 3 – deflation basins, 4 – deflation edges, 5 – deflation remnants, 6 – windward slopes, 7 – leeward slopes, 8 – covers of blown sands, 9 – sand shadows of nebkha type, 10 – size and direction of slope gradient, 11 – profile lines (compare B and C).

3 pav. Psammostepės fragmento prie Kumakskoje (A) gyvenvietės geomorfologinė schema: 1 – eliuvinė lyguma, 2 – defliacinė plokštuma, 3 – defliacinis baseinas, 4 – defliaciniai kyšuliai, 5 – defliaciniai atlaikai, 6 – priešvėjiniai šlaitai, 7 – pavėjiniai šlaitai, 8 – pustomo smėlio danga, 9 – nebkhos tipo smėlio kopos, 10 – šlaito gradiento dydis ir kryptis, 11 – profilio linijos (žr. B ir C).

whereas on the other side – relatively scanty and small sand shadows of nebkha type, originating at the shadow of equally small clumps of grassy vegetation.

Psammosteppes are communities of herbaceous vegetation, built mainly of hemicryptophytes. The presence of Bryophyta and lichens was not stated in the analysed site Kumakskoye. But grasses, especially *Calamagrostis epigeos* and *Leymus racemosus*, play there the essential role. *Festuca bockeri*, *Bromus tectorum* and *Hordeum jubatum* rather often accompany them. Their coverage (quantitative share) is usually small: from + up to 5%.

The vegetation cover of Orenburg psammosteppes is rather homogenous and poor. The mean coverage of herbaceous grasses amounts to 36%, but it can range within the limits of 15–90%. In deflation areas it is obviously lower; on the leeward slopes it approximates 90%. On the base of 5 phytosociological relevés, made by the method of Braun-Blanquet (1964), the general number of species was determined to 20. In particular phytosociological relevés their number fluctuates from 5 to 13. Many flowering plants sporadically appear in the blown areas. They are: *Alyssum lenense*, *Hieracium echiodens*,

Lactuca tatarica and others. Other species penetrate here from the neighbouring absinthium-grassy steppes, e.g. *Achillea gerleri*, *Chondrilla* sp., *Galium ruthenicum*, *Scorzonera ensifolia*. Their coverage rarely exceeds 5%.



Fig. 4. Fragment of deflation remnant in Kumakskoye site (Photo by T. Szczypek).
4 pav. *Defliacinio atlaiko fragmentas prie Kumakskoję gyvenvietęs* (T. Szczypek'o nuotr.)

A small number of phytosociological relevés does not allow determining the final number of vegetation communities in the area discussed within psammosteppes. Now it is possible to discuss three separated but closely related phytocenoses, i.e. communities from *Calamagrostis epigeos*, with *Leymus racemosus* and with *Xanthium strumarium*, or one syntaxon *Artemisia arenaria*–*Euphorbia virgata*, which is internally branching into three above mentioned variants with the given dominants. Solution of this question requires collection of richer factographic material from other sandy sites of the Ilek and Khobda interfluve.

Conclusions

Preliminary observations on psammosteppes in the area of the Ilek and Khobda interfluve indicate that they make the essential element relieving the landscape of wide typical steppe surfaces. Against the background of monotonous flat plains small but variable intensively developing deflation aeolian landforms, both concave and convex, appear what lead to the increase in height amplitude. Blown sandy substratum is the habitat for new vegetation species, resistant to such conditions. Simultaneously some typical steppe species enter bare sands, whereas psammosteppe species, in connection with blowing out and sand removing – enter the area of typical steppes. The ecotone, temperate vegetation zone is developing, in which mixing of species of different features takes part, what undoubtedly enriches vegetation of these areas.

Therefore the development of psammosteppes, notwithstanding the disadvantageous economic aspect (soil degradation), leads to an increase of their attractiveness – not only scientific and cognitive, but also tourist.

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¹Alexander A. Chibilyov, ²Valerian A. Snytko, ³Tadeusz Szczypek, ⁴Stanislaw Wika

¹Rusijos mokslų akademija, Uralo skyrius, Stepių institutas, Orenburgas, Rusija

²Rusijos mokslų akademija, Sibiro skyrius, Geografijos institutas, Irkutskas, Rusija

³Silezijos universitetas, Žemės mokslų fakultetas, Sosnovecas, Lenkija

⁴Silezijos universitetas, Biologijos ir aplinkos apsaugos fakultetas, Katowicai, Lenkija

Ileko–Chobdos tarpupio smėlio stepių (Orenburgo apylinkės, Rusija) kraštovaizdžiai

Santrauka

Šio darbo tikslas – atskleisti Ileko–Chobdos tarpupio Orenburgo smėlio stepių kraštovaizdžio tipiškus bruožus (1 pav.). Jie išskiriami tipišku stepių fone (2 pav.). Čia vyrauja kontinentinis klimatas, kuriam būdinga didelė sezoninė temperatūros kaita ir mažas kritulių kiekis (280–320 mm). Žiemą vyrauja rytų, vasarą – vakarų krypties vėjas. Smėlio stepės formuojasi tiek gamtinėmis, tiek neracionalios ūkinės veiklos (intensyvi ganiava ir arimas) poveikio sąlygomis. Dėl šių priežasčių stepės intensyviai išpustomos, išnešama daug dirvožemio (iki 26 t/ha/m.), formuojasi tipiškas defliacinis eolinis reljefas (2, 3 pav.). Tokio tipo reljefas lemia savitą Orenburgo stepių morfologiją. Stepinės pelyninės–įvairiažolės augalijos su vyraujančia ašuote *Stipa* sp. fone formuojasi smėlio stepių kraštovaizdžiai su būdingomis augalų rūšimis ir bendrijomis.

Orenburgo smėlio stepių augalijos danga – monotoniška ir skurdi. Atlikus fitosociologinius tyrimus Braun–Blanquet metodu, išskirtos šios bendrijos: 1) *Calamagrostis epigeos*, 2) *Leymus racemosus* ir 3) *Xanthium strumarium*. Kitaip tariant, čia galima išskirti vieną sintaksoną *Artemisia arenaria–Euphorbia virgata*, susidedantį iš trijų minėtų bendrijų.