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BIOLOGICAL DIVERSITY OF ASIAN STEPPE

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В сборнике опубликованы материалы III Международной научной конференции «Биологическое разнообразие азиатских степей».В докладах рассмотрены итоги исследований и перспективы сохранения биологического разнообразия степных экосистем, островных и ленточных лесов и водного-болотных угодий степной зоны Евразии, охраны природных территорий и популяций видов особого природоохранного значения, формирования экологической сети и вклада вузов в изучение биоразнообразия. Книга предназначена для ученых и практиков, работающих в области изучения и сохранения биологического разнообразия, преподавателей вузов, аспирантов, студентов, работников природоохранных учреждений.

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Таким образом, поголовье охотничьих видов копытных в Оренбургской области удается сохранить в стабильном состоянии благодаря рациональному планированию лимитов добычи и выполнению биотехнических мероприятий. Для успешного сохранения редких копытных в области проводятся различные охранные мероприятия: охрана на ООПТ, искусственное расселение или разведение в полувольном состоянии, полный запрет на добычу и занесение в региональную Красную книгу.

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ROLE OF KURGANS IN PRESERVING STEPPE PLANT SPECIES IN NORTHERN KAZAKHSTAN

Роль курганов в сохранении степных видов растений в Северном Казахстане

Balázs Deák [1], Tatyana M. Bragina [2,3], Csaba Tölgyesi[4], András Kelemen [5,6], Zoltán Bátori [4], Róbert Gallé [4], Erkin A. Abil[2], Orsolya Valkó [1]
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Introduction.

As a result of agricultural intensification Eurasian grasslands have suffered a serious decline in their extent, which also led to a serious loss of biodiversity (Deák et al. 2016a, Dengler et al. 2014, Wesche et al. 2016). Habitat loss is especially typical in the steppe region of Eurasia, where a considerable part of the natural habitats disappeared due to land transformation to arable lands, tree plantations and settlements (Brinkert et al. 2016, Smelansky and Tishkov 2012). These unfavourable changes were more typical in the Central- and Eastern European parts of the steppe zone, such as Hungary and Ukraine. Thus, intact steppe habitats with the largest extension could remain in the Asian steppes such as in Kazakhstan and Mongolia. Compared to the European steppes, land transformation campaigns started later, in the 50's and 60's in Kazakhstan. A large extent of steppes (250,000 km^2; approximately 90 % of steppes with fertile soils and 60 % of dry steppes) was transformed into arable lands during the ‘‘Virgin Lands Campaign’’, but still huge steppes could remain (Rachkovskaya and Bragina 2012).

Besides their nature conservation role, steppes represent our cultural heritage as well, including historical and cultural values. An iconic landscape element of the steppes are kurgans, which are ancient burial mounds of ancient steppe nations such as the Yamnaya culture, Cimmerians, Scythians and Hungarians (Bede 2015, Deák et al. 2016a). The history of the kurgans dates back to the Eneolithics (3500 BC) but kurgans were built even in the Medieval. Kurgans were generally built by the topsoil of the surrounding lands and have a hemi-spherical shape. In many cases the ditches used for excavating soil are visible even in present days (Tóth et al. 2014).

Since a large proportion of kurgans have not been disturbed for millennia, they could preserve steppe vegetation even when embedded in intensively used agricultural lands (Deák et al. 2015a, Deák et al. 2016b, Dembicz et al. 2016). Given their special micro-topography (slopes with different exposure, ditch) they provide a heterogeneous habitat for steppe species. The study of Sudnik-Wójcikowska et al. (2011) reported 71 protected species such as *Astragalus borysthenicus, A. dasyanthus, Cerastium ucrainicum, Crocus reticulatus, Dianthus lanceolatus, Elytrigia stipifolia* and *Phlomis hybrida* from altogether 106 kurgans in Ukraine. Vegetation of the different micro-habitats in the different position has the potential to maintain species with different environmental preferences (Lisietskii et al. 2016). The topographic heterogeneity of the kurgans strongly determines the presence of abiotic filters, such as salt and drought stress (Deák et al. 2015b). These environmental conditions can be more suitable for grassland specialist plant species than for generalist, competitor and/or weed species (Deák et al. 2015b). The highest proportion of characteristic species of the phytosociological class Festuco-Brometea was reported from the northern slopes (Moysiyenko and Sudnik-Wójcikowska 2008).

The aim of our study was to test the species composition differences in the four typical grassland positions (north and south slopes of the kurgans, ditch and the surrounding steppe) regarding the proportion of steppe species. We expected the highest proportion of steppe species in the steppes and the northern slopes. We also aimed to define the indicator plant species of the four grassland positions.

Data collection.

For our study we selected three kurgans surrounded by plain steppes formed on southern chernozem soil in Kostanay Oblast, Northern-Kazakhstan (N 52° 51', E 62° 54'). The studied kurgans were constructed in the Early Iron age (Figure 1). The mean height of the kurgans was around 1.5 metres and their diameter around 15 metres. All studied kurgans had a well detectable ditch with approximate depth and width dimensions of 0.2 and 1.4 metres, respectively.

Location of kurgans was derived from the State List of the historical and cultural monuments of republican significance, Kazakhstan (2014; http://adilet.zan.kz/rus/docs/P080000279). The three kurgans had similar attributes, such as height, diameter, ditch size, age and landscape context (surrounded by plain steppe vegetation). We surveyed the vegetation of the four typical grassland positions (north, south slope, ditch and steppe) in all kurgans. In each position we surveyed the species list and percentage cover of vascular plant species in five randomly placed 1m×1m plots in July 2016. For the classification of the species to steppe, ruderal and neutral species we used the Flora of the USSR (Komarov 1963) and Brinkert et al. (2016).

Figure 1 - One of the studied kurgans near Rudny. Foto by Bátori Z.

Statistical analyses.

To assess the differences in the vegetation composition of the four studied zones we used PCA ordinations (CANOCO 4.5; Lepš and Šmilauer, 2003). For the calculations we used the log transformed percentage cover scores as main matrix; the functional types (i.e. steppe specialists, ruderal species and neutral species) and total cover were included as an overlay. We performed an indicator species analysis to detect plant species indicating different grassland positions (Dufrêne & Legendre 1997). For the analyses we used the 'labdsv' package in an R environment.

Results.

Vegetation of the north slope and the ditch showed a considerable similarity, while the vegetation of the southern slopes was plotted separately. Plots of the steppe were plotted in an intermediate position (Figure 2).

Cumulative percentage variance of species-environment relation was 39.6 and 57.3 for the first and second axis, respectively. Several steppe specialist grasses and forbs such as *Festuca valesiaca*, *Stipa pennata*, *Galium verum* were typical for the northern slope and to the ditch. Indicator species of the northern slopes were *Dianthus borbasii, Eremogone procera, Gypsophila paniculata, Thymus pulegioides* and *Veronica spuria* (IndVal, $p<0.05$). Proportion of ruderal, neutral and annual species was low in these positions. Dwarf shrub species characteristic for steppe vegetation (*Artemisia pontica*, *Spiraea hypericifolia* and *Thymus pulegioides*) were typical for the northern slope and for the ditch. Total vegetation cover was typically higher in these two positions. Indicator species of the ditch were *Allium pallasii, Artemisia pontica* and *Stipa pennata* (IndVal, $p<0.05$). The southern slopes and the steppe harboured several steppe indicator species such as *Agropyron cristatum*, *Allium saxatile*, *Ephedra distachya*, *Hedysarum gmelinii*, *Iris pumila* and *Stipa capillata*. Indicator species of southern slopes were *Carex stenophylla, Iris pumila* and *Ferula caspica,* and *Festuca valesiaca* for the ditch (IndVal, $p<0.05$).

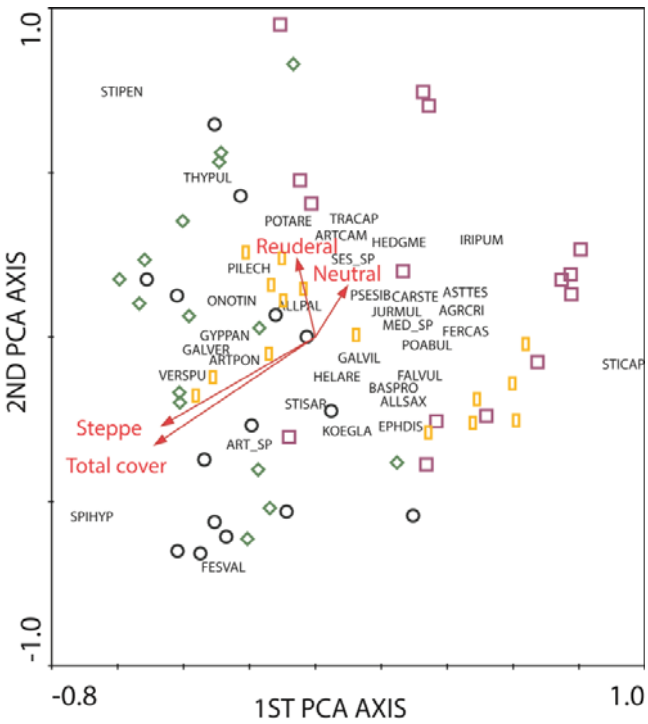

Figure 2 - PCA ordination diagram of the studied kurgans displaying the species composition of the four studied grassland positions. Arrows represent the percentage cover of steppe specialists, ruderal, neutral species and total vegetation cover. Notations: round – north slope, squares – south slopes, diamonds – ditch, rectangle – steppe. Species were abbreviated by the first three letters of their genus and species names respectively

Discussion.

We found the highest proportion of steppe species in the ditch and on the northern slope. Northern slopes likely supported the presence of steppe species by ensuring favourable environmental conditions such as lower solar radiation and temperature, higher humus content of the soil and higher soil moisture (Lisetskii et al. 2016, Moysiyenko and Sudnik-Wójcikowska 2008). While in case of the northern slopes the main driving factor was the exposure, in case of the ditch the main driving factor was likely the deep micro-topographical position. Dry habitat conditions provided by the southern slopes filtered out several steppe species confined to moderately moist habitats and favoured steppe species adapted to dryer conditions such as *Carex stenophylla* and *Iris pumila*. Given the high naturalness of the studied steppe habitats the proportion of ruderal species was low. Our study demonstrated that even though kurgans have a small area, they can effectively increase landscape level biodiversity by harbouring steppe species that are rare in plain steppe conditions (see also Deák et al. 2016a). Besides they were only 1.5 m high, their micro-topographical heterogeneity allowed them to act as local biodiversity hotspots (see also Bátori et al 2016). Given their nature conservation importance together with their cultural and historical role it is an important task for the society to preserve the kurgans of the steppe region for the new generations.

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РАСТИТЕЛЬНЫЙ И ЖИВОТНЫЙ МИР СТЕПНЫХ ЭКОСИСТЕМ

PLANT AND ANIMAL WORLD OF STEPPE ECOSYSTEMS