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The 11th European Dry Grassland Meeting

STEPPES AND SEMI-NATURAL DRY GRASSLANDS: ECOLOGY, TRANSFORMATION AND RESTORATION

5–15th June 2014, Tula, Russia

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Abstracts & Excursion Guides

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Session 1

STEPPES AND DRY GRASSLANDS: DIVERSITY AND SUCCESSION

Status of Steppes and Steppe Forests of the Anatolian Diagonal

Didem Ambarli[1], Ayse Turak[2], Ugur Zeydanli[2], Yesim Kinikoglu[2], Ozge Balkiz[2], Hilary Welch[2], Deniz Ozut[2], Mustafa Durmus[1], C.Can Bilgin[1]

didem.ambarli@gmail.com

[1] Middle East Technical University, Ankara, Turkey
[2] Nature Conservation Centre, Ankara, Turkey

To understand the current status of biodiversity elements, threats and conservation status of steppes in transition from Central to Eastern Anatolia, we focused on 3.6 million ha of mountainous land. We carried out literature surveys, systematic fieldwork, vegetation mapping with Landsat images, and GIS analysis using census data, interview data and baseline maps.

The potential vegetation of the study area is mostly Astragalus steppes (49%) in the west, steppe woodlands of *Quercus brandtii* (30%) in the east, and pre-steppe oak forests of *Q. pubescens* at the transition zone (15%) and patches of sub-pontic pine forests (6%). The vegetation map by the year 2008 however showed that 17–50% of the land has been covered with croplands. Steppes, some of which were secondary, covered 34–50%. Woodlands, mostly oak and juniper, covered only 4–11%. Land use dynamics over thousands of years had caused the region's vegetation to change considerably from its natural state.

In the region, 102 endemic and threatened plant taxa, 180 butterfly taxa, and 183 bird, 49 herptile, 26 small mammal and 4 charismatic large mammal species were identified. Among animals, there were 44 nationally, and 14 globally threatened species. In addition, there were 13 Data Deficient butterfly species. None of those species or their habitats were actively protected or regularly monitored.

Seventeen types of threats acting at different scales were recognized, imposed by nine different sectors including forestry, agriculture, energy, hunting, and mining. Poaching, overgrazing by livestock due to transhumance grazing regime, mining and agricultural pollution were the major threats in the region. Converting natural or semi-natural vegetation into apricot orchards was only a case in warm valleys in the eastern parts.

We propose a sectoral approach to for viability of biodiversity of the region: All sectors using natural resources should incorporate measures related with biodiversity conservation into their practice for example promotion of high nature value farming by the agricultural sector. Conservation-related legislations should be improved and implemented effectively to prevent many site-level threats. Protected areas, which – in a Turkish context – are difficult to designate and manage, should be established only at irreplaceable sites. Regular monitoring and adaptive management are key concepts for maintaining diversity in the dynamic landscapes of steppe and steppe-forests of the region.

The Vegetation of the Carbonate Rock Outcrops of the Central Russian Upland (Within the Borders of the Russian Federation)

Elena Averinova

elena_averi@mail.ru

Bryansk State University, Bryansk, Russia

The Central Russian Upland is located in the center of the Russian Plain. Its extent from north to south is about 800 km and from west to east (in the latitude of the Orel City) is about 300 km. There are 3 vegetation zones (forest, forest-steppe and steppe) on the territory of the Central Russian Upland. The carbonate rocks (chalkstone, chalk and marl) have a dominant role in the relief formation. They crop out on the slopes of the gullies and river valleys. The calciphytic vegetation with the calciphilous species is formed in these ecotopes. The research is based on 400 relevés.

The calciphytic vegetation of the Central Russian Upland is presented by 3 classes. 4 associations (***Scabioso ochroleucae–Cervarietum rivinii***, ***Adonido vernalis–Anthericetum ramosi***, ***Trifolio alpestris–Iridetum aphyllae***, ***Carlino biebersteinii–Salvietum pratensis***) are referred to the class ***Trifolio–Geranietea sanguinei*** (alliance ***Geranion sanguinei***). The communities of these associations are spread in the forest zone.

The calciphytic vegetation of the forest-steppe zone is presented by 9 associations (***Asperulo cynanchicae–Onobrychidetum arenariae***, ***Allio rotundi–Astragaletum onobrychis***, ***Astero amelli–Potentilletum humifusae***, ***Gypsophilo altissimae–Stipetum capillatae***, ***Inulo ensifoliae–Stipetum pennatae, Carici humilis–Thymetum calcarei***, ***Stachyo rectae–Echinopetum ruthenici***, ***Allio paniculati–Gypsophiletum altissimae***, ***Diantho andrzejowskiani–Spiraeetum litwinowii***).

They are referred to the suballiance ***Bupleuro falcati–Gypsophilenion altissimae*** Averinova 2005 (alliance ***Festucion valesiacae***, class ***Festuco–Brometea***). The suballiance includes the calciphytic variants of the meadow steppes in which the typical steppe plants combine with the calciphilous species. The habitat of the suballiance covers the whole forest-steppe part of the Central Russian Upland.

The communities of the cretaceous rock outcrops of the southern part of the Central Russian Upland are most remarkable. Dwarf semishrubs (*Artemisia hololeuca, Hyssopus cretaceus, Thymus calcareus, Asperula tephrocarpa* etc.) predominate in these communities. They are the obligate calciphilous species. These communities are referred to 4 associations (***Thesio procumbentis–Inuletum ensifoliae***, ***Hedysaro ucrainici–Artemisietum hololeucae***, ***Astragalo albicaulis–Cephalarietum uralensis***, ***Polygalo sibiricae–Hyssopetum cretacei***) of the class ***Helianthemo–Thymetea***. The habitat of this class is located in the steppe zone.

Plant Species Diversity and Tree Colonization on Abandoned Grasslands in Broad-leaved Woodland Landscapes of European Russia

Maxim Bobrovsky, Svetlana Moskalenko

maxim.bobrovsky@gmail.com

Institute of Physicochemical and Biological Problems in Soil Science,
RAS, Pushchino, Russia

About 400,000 km^2 of agricultural lands were abandoned in Russia in 1980–1990. Spontaneous reforestation begun at that time and has been going on for 20–30 years now. The aim of our research was to study plant diversity and trees colonization on abandoned grasslands in the center of European Russia.

An object of our investigation was the abandoned dry grasslands (former pastures) surrounded by old-growth broad-leaved forest and located in the Reserve "Kaluzhskie Zaseki" (Kaluga region). The ancient forest consists of all regional species of broad-leaved trees, such as *Quercus robur*, *Fraxinus excelsior*, *Tilia cordata*, *Ulmus glabra*, *Acer platanoides*, *A. campestre*. The oldest trees in the stands are 300 years old. Cows' grazing had been strongly reduced 30 years ago and it was stopped in 1992.

Vegetation was sampled at plots (10 m x 10 m) along transects located transversely to the ancient forest; adjacent plots (2 m x 2 m) were also described along the transects to explore dispersal of forest herbs.

Our results show that complex communities with forest species and rich meadow-edge flora have been formed for 20 or 30 years on the abandoned grasslands. There are two main variants of the meadow reforestation.

(1) Betula and Salix forests with dense undergrowth from broad-leaved trees occur close to the old-growth forest in a strip of 80 m. Forest herbs dominate in the understorey with an average number of 30 species per 100 m^2.

(2) Groups of trees or single trees occur in the center of the meadows where trees' renewal is mainly confined to violation of the sod by digging activity of animals (pigs, moles and ants). Light-demand trees, such as *Quercus robur*, *Malus sylvestris*, *Pyrus communis* successfully renew there. *Fraxinus excelsior*, *Tilia cordata*, *Acer platanoides*, *A. campestre* are common. Meadow species dominate in the field layer with an average number of 50 species per 100 m^2.

Succession on former pastures can be regarded as the currently available model of succession in the pre-agricultural time when the existence of meadow flora was maintained by environment-forming activity of gregarious ungulates (Smirnova, 1998; Vera, 2000). Upon the termination of grazing, tree species of different groups, such as pioneer, late-successional, and forest-edge species settle the area almost simultaneously. The result is a complex community enclosing both intra-forest plants and species of open habitats. It means that the concept of early- and late-successional groups of tree species may be revised.

Summary of the Study of Lepidopterans Fauna (Insecta: Lepidoptera) of the Kulikovo Field Area (Tula Region)

Lavr Bolshakov

l.bol2012@yandex.ru

The State Museum-Reserve "The Kulikovo Field", Tula, Russia

Entomofauna studies on the territory of the present day Tula region began in the middle of the 19th century, however, specific data about the species inhabiting the nature landscapes of the historical Kulikovo Field and its vicinity first began to appear in print as late as 1990ies. A minimum of 5500 Insecta species can be expected to be found in the Kulikovo Field area (on a territory of about 1000 км^2). The best-studied order Lepidoptera now counts 1081 species. A large amount of insect species either of a specific local distribution or little-known ones have been found in this area. These species are indicative of the value of ecosystems that have survived in the forest and steppe zone after several centuries of its intensive agricultural development.

Three Lepidoptera species are so far known only in Tula region of all European Russia, specifically, in the Kulikovo Field area: *Lobesia virulenta mieana* Falck et Karsholt, 1998, *Epinotia* sp.pr. *subuculana* (Rebel, 1903) and *Grapholita lobarzewskii* (Nowicki, 1860). The following species are among the rarest ones found in Central European Russia: *Trichophaga scandinaviella* Zagulajev, 1960, *Agonopterix melancholica* (Rebel, 1917), *A. nervosa* (Haworth, 1811), *Deuterogonia pudorina* (Wocke, 1857), *Crassa unitella* (Hübner, 1796), *Casignetella gardesanella* (Toll, 1953), *C. pseudociconiella* (Toll, 1952), *Mompha propinguella* (Stainton, 1851), *Parascythris muelleri* (Mann, 1871), *Megacraspedus separatellus* (Fischer von Röslerstamm, 1843), *Aristotelia coeruleopictella baltica* A. Šulcs et J. Šulcs, 1983, *Cochylis pallidana* Zeller, 1847, *Aethes flagellana* (Duponchel, 1836), *Eugnosta magnificana* (Rebel, 1914), *Dichrorampha uralensis* (Danilevsky, 1948), *Grapholita andabatana* (Wolff, 1957), *G. difficilana* (Walsingham, 1900), *Cydia fagiglandana* (Zeller, 1841), *Sesia melanocephala* Dalman, 1816, *Cabera leptographa* Wehrly, 1936, *Eupithecia veratraria* Herrich-Schäffer, 1848, *E. addictata* Dietze, 1908, *E. spadiceata* Zerny, 1933, *Acontia melanura* (Tauscher, 1809) (titania auct.), *Schinia cardui* (Hübner, 1790) and others. Tula region forest and steppe zone studies allowed to describe the species *Udea sviridovi* Bolshakov, 2002, which has later been found in 4 other regions of middle Russia.

Issues of Don Basin Steppe Vegetation Classification

Olga Demina

ondemina@yandex.ru

Southern Federal University, Rostov-on-Don, Russia

The identified ecological and floristic properties of alliance ***Festucion valesiacae*** Klika 1931 associations from the class ***Festuco–Brometea*** Br.-Bl. et Tx. 1943 allow us to include them into such suballiances as ***Bupleuro falcate–Gypsophilenion altissimae*** Averinova 2005 and ***Phlomenion pungentis*** Saitov et Mirkin 1991, and also into the new suballiances ***Cleistogeno bulgaricae–Jurinenion stoechadifoliae*** Demina 2011 and ***Festuco rupicolae–Stipenion pennatae*** Demina 2012. New alliances consist of petrophytic thyme steppes near Donetsk, in the Azov area and of the communities belonging to true Eastern Black Sea steppes of Mid-Don and Seversky Donets respectively.

Dwarf semi-shrub desert steppe and bunchgrass desert steppe formed on the alkaline chestnut soils of the south-eastern Rostov region, have been referred to the new alliance ***Tanaceto achilleifolii–Artemisenion santonicae*** Demina 2012. In this alliance we can single out two following new suballiances: ***Trifolio arvensis–Limonienion sareptani*** and ***Artemisio lerchianae–Stipenion lessingianae***. The first one includes the Black Sea (Black Sea – Western Caspian) hemihalophylic steppes, the second one – trans-Volga and Kazakhstan hemihalophylic communities (Eastern Black Sea and Western Caspian ones).

After the Ukrainian phytocoenology, we refer the petrophytic vegetation of rocky outcrops to the class ***Helianthemo–Thymetea*** Romashchenko, Didukh et Solomakha 1996, to the order ***Thymo cretacei–Hissopetalia cretacei*** Didukh 1989, that combines the "hyssop flora" communities, or "tomillares". However, the association ***Sileno borysthenicae–Hyssopetum officinali*** Demina 2012 should be referred to another order of the class ***Helianthemo–Thymetea***. We have studied the taxonomy and phytocoenotic environment of *Hyssopus angustifolius* Bieb., discovered on the southern macroslope of Donetsk ridge, on the Ukrainian and Russian border. This is its only proved habitat on Eastern European plain, but its taxonomical position is still unclear, as many scientists believe this species to be the synonym of *Hyssopus officinalis* L.

Psammohytic communities of the terraces above the Don river floodplain belong to class ***Festucetea vaginatae*** Soo em. Vicherek 1972, order ***Festucetalia vaginatae*** Soó 1957 and alliance ***Festucion beckeri*** Vicherek 1972. Two new suballiances are singled out in this alliance: ***Chamaecytiso borysthenici–Artemisienion arenariae***, representing psammophytic vegetation pioneer communities, and ***Stipo borysthenicae–Artemisienion marschallianae***, including malformed psammophytic steppe communities.

Given that the volume and position of many syntax are interpreted by many authors in different ways, these decisions are considered preliminary.

Problems of Classification and Conservation of Don Basin Steppes Psammophytic Vegetation

Olga Demina, Pavel Dmitriev, Ludmila Rogal

ondemina@yandex.ru

Southern Federal University, Rostov-on-Don, Russia

Psammophyte community sand areas within the boundaries of the Don basin in Rostov region are represented by a syntaxonomically large variety and are considered by us as part of class ***Festucetea vaginatae*** Soo em. Vicherek 1972 order ***Festucetalia vaginatae*** Soó 1957 and alliance ***Festucion beckeri*** Vicherek 1972. Their high diversity depends on the degree the sands' mobility and overgrowing, total moisture and soil-forming processes development level. All syntaxon in rank associations can be divided into ecological sequences that reflect the dynamics of sandy landscape consolidation on the Middle and Lower Don.

On the one hand, syntaxons alliance ***Festucion beckeri***, established by Ukrainian phytocoenologists (Vicherek, 1972; Dubina et al, 2003), are floristically well separated from the ones that we single out. On the other hand, they also border with syntaxons of the alliance ***Euphorbion seguieranae*** Golub 1994, which is regarded as part of the order ***Artemisietalia tschernievianae*** Golub 1994 and class ***Artemisietea tschernievianae*** Golub 1994. However, the highest syntaxonomic vegetation units we are dealing with are not desert vegetation (Golub, 1994), but psammophytic communities of the steppe zone sandy areas.

The alliance ***Festucion beckeri*** communities are divided into two suballiances: ***Chamaecytiso borysthenici–Artemisienion arenariae***, which unites unformed psammophytic pioneer vegetation communities and ***Stipo borysthenicae–Artemisienion marschallianae***, consisting of ill-formed shrub steppe and meadow-steppe psammophyte communities (Dmitriev, 2013).

Psammophyte community associations ***Centaureo marschallianae–Agropyretum lavrenkoani***, ***Artemisio arenariae–Thymetum pallasiani***, ***Koelerio sabuletori–Juniperetum sabinae*** and ***Hieracio echioidis–Stipetum borysthenicae*** have the highest environmental significance, to assess which new approaches based on a consistent aggregation of quantitative criteria were used. These materials contained in the classification and Don basin psammophytic vegetation relevés database, have great potential in the field of nature conservation and environmental monitoring (Berg et al, 2014).

Psammophyte community associations are not represented within the boundaries of the territorial nature protection, and therefore, it is proposed to consider their habitats (Eunis – X35. Inland sand dunes) as cluster areas of the new projected Don steppe reserve.

Ecological and Floristic Peculiarities of Dry Meadow Communities of the Festuco-Puccinellietea Class in Ukraine

Tatiana Dziuba, Dmitriy Dubyna, Svetlana Iemelianova

tdziuba@mail.ru

M.G. Kholodny Institute of Botany, NAS of Ukraine, Kyiv, Ukraine

Communities of dry meadows of ***Festuco–Puccinellietea*** class in the Ukraine belong to four alliances and include eight associations.

To define the peculiarities of community ecological differentiation at the alliance level the DCA-ordination method of the R-project program and STATISTICA 6.0 program were used. Calculation of ecological parameters was implemented by phytoindication scales of Ja. P. Didukh (Didukh, 2011). The results showed that a humidity soil level is the leading factor of ecological differentiation. By the factor a vector almost fully coincides with the first ordination axis. Values of this parameter fluctuate from 4,8 to 6,4 grades. A humidity vector of climate is the nearest to the second ordination axis. The ***Camphorosmo–Agropyrion desertorum*** communities are differed by the highest values of this factor. On the whole, they range from 7,5 to 11,0 grades. Community differentiation by the variability of damping showed the most hydrocontrastphobianess of ***Atraphaxio–Capparion*** coenoses, the widest ecological range by this factor is typical for ***Festuco valesiacae–Limonion gmelinii*** alliance (8,7–10,2 grades). By soil salt regime the ***Atraphaxio–Capparion*** alliance showed the most range (8,5–13,5 grades), that is comparatively higher than the salt regime values the ***Glycyrrhizion glabrae*** alliance is marked with. Coenoses of all above mentioned alliances are formed at ecotopes with slight soil aeration (4,8–6,5 grades).

The coenoflora counts 256 vascular plant species, which belong to 143 genera and 39 families. Representatives of Asteraceae and Poaceae (35 and 29) prevail. A spectrum of vital forms of the class flora displays the prevalence of hemicryptophytes (34%) and therophytes (26%). Among therophytes the halophytes are more represented. Helophytes count 4 (2%). By zonal area type the representatives of submeridional (19%), temperate-submeridional (12%) chorological groups exceed. By regional area type the ancient Mediterranean (23%), Euro-Asian (9%) and hemicosmopolitan (8%) species predominate. In chorological spectrum of oceanity-continentality the preference is given to eucontinental (19%) and eurycontinental (16%) area forms and species indifferent to this gradient (30%). Coenoses are represented by endemic species, among which 21 are the Black Sea Region species. Diagnostic species of association are 72. 10 species are listed in the Red Data Book of Ukraine and 1 species is in the Addendum of the Bern Convention.

Plant Functional Types (PFTs) as Indices on Post-Fire Succession in a Semiarid Grassland

Hamid Ejtehadi, Fahime Rafiee, Mohammad Jankju

hejtehadi@yahoo.com

[1] Ferdowsi University of Mashhad, Mashhad, Iran

Secondary succession after wildfire usually leads to vegetation types that can differ from the original vegetation in terms of forage productivity and community stability. In the recent decades, ecologists have used plant functional types (PFT's) as ecological indices for assessing effects of disturbances on the natural plant communities. Accordingly, this research was aimed to identify, classify and analyze PFT's in three rangeland sites; burnt at 2004, at 2008 and control (2010), in Jowzak, North Khorasan, Iran. Floristic list, percent cover and 24 morphological, phenological and reproductive plant traits were recorded within 1 m^2 quadrats. PFT's were determined by applying hierarchical cluster analyses and discriminant function analysis on the matrices of 45 species by 24 traits and 45 species by 3 sites, using SPSS software. Four different PFT's were identified. Leaf wet weight, life forms and Twig dry matter contents were the most important traits for PFT classification. Two functional types identified as functional types adopted to fire, their abundance increased by passing time after fire. Two functional types also identified as sensitive functional types to fire and decreased over the time after fire. Forage availability for livestock was increased during the secondary succession after wildfire, because of reducing woody species and increasing herbaceous plants, which were mainly ephemeral and annuals.

East Siberian – Central Asian Steppes of the Cleistogenetea Squarrosae: Geography and Ecology of Higher Units

Nikolay Ermakov

brunnera@mail.ru

Central Siberian Botanical Garden, Novosibirsk, Russia

The ***Cleistogenetea squarrosae*** Mirkin et al. 1992 class includes zonal types of steppes located in Mongolia and surrounding areas of Southern Siberia and China. They represent a geographical vicarious type towards the West Palearctic steppes of the ***Festuco–Brometea*** and are related to the ultracontinental climate of the inner part of Eurasia. The study was carried out in three phases: 1) the creation of a relevé database (all set of 1400 relevés); 2) the classification of the steppe relevés using the Braun-Blanquet approach and identification of the plant communities within a formal phytosociological framework;

and 3) the ordination of relevés oriented along geographical sub-longitudinal transect in Southern Siberia using DECORANA (Hill 1979b) and investigation of climatic relationships using correlation analyses. The higher level of the steppe diversity includes three bioclimatic subzonal subdivisions corresponding to the order ***Festucetalia lenensis*** Mirkin in Gogoleva et al. 1987 (meadow-steppes occurring in moderately dry continental climate), ***Cleistogenetalia squarrosae*** Mirkin et al. ex Ermakov 2012 (typical steppes occurring in the dry continental climate) and ***Kochio prostratae–Stipetalia krylovii*** Ermakov 2012 (semiarid ultra-continental steppes). Floristic steppes peculiarities indicating their positions in South-Siberian-West Mongolian and Manchurian-Daurian floristic provinces as well as the differences related to specifics of substrates were characterized at the lower syntaxonomic levels (suborders and alliances). DCA ordination of all Central Asian steppes diversity was performed and ecological-geographical contents of the main axes were explained. The first two axes of the DCA ordination are important for understanding the relationships between steppes and climate. The scatterplot of axis 1 can be seen as a kind of distribution of the latitudinal steppe types and the axis 1 is correlated with latitude and precipitation. Axis 2 strongly correlated with values of temperatures and Conrad's continentality index and can be explained as axis of the integrated macro-climatic factor – oceanity-continentality. It is also correlated to longitude. The main bioclimatic steppe types are demonstrated in small-scale (1:1000000) vegetation map prepared for the Altai-Sayanian mountain region.

Soil Macrofauna of the Kulikovo Field (Tula Region, Russia)

Konstantin Gongalsky, Zhanna Filimonova, Yury Dorofeev

kocio@mail.ru

A.N. Severtsov Institute of Ecology and Evolution Russia, RAS, Moscow

As a hidden component of landscapes, soil fauna is a significant part of the total biomass of ecosystems, and has a significant impact on their functioning. Knowing the parameters of undisturbed ecosystems macrofauna is important for the monitoring and prognosis of ecosystem recovery after disturbance.
Fieldwork was conducted in the vicinity of the Kulikovo Field in August 2013. Three localities were studied – steppe, oak forest and abandoned field. The abundance of soil animals was assessed by a cylindrical soil corer 9.8 cm in diameter, sampling the entire litter layer and the upper 15 cm of soil. 5 samples were taken at each site. Soil samples were extracted in Tullgren extractors.
Across the three plots, 33 groups of soil animals were observed. Of these, the maximum number was presented in the oak forest (21). The total number did not differ significantly between the sites, but in the steppe it was slightly higher: 590 ind. per meter, compared with 498 and 550 in the abandoned field and in the oak forest, respectively.

The majority of the population in the oak forest were earthworms (131 ind. per meter) and myriapods (Lithobiidae, Julidae, Polydesmidae, Polyzonidae). Harvestmen and spiders, as well as the highest variety of families of Diptera and Coleoptera were found only in the forest. On the steppe plot, a specific complex of invertebrates was found. Among 16 groups, the larvae of Lagriidae beetles and aphids were the most abundant, and they were associated with the herbaceous vegetation. On the site, there were few earthworms and larvae of Diptera, which is probably determined by the season: the soil dries out at the end of summer and the animals either go into hibernation, like earthworms, or mault into adults as Diptera. The representatives of the steppe fauna were found: larvae of darkling beetles. Abandoned field was characterized as depleted version of the steppe: 12 groups in total were recorded here. Aphids and Lagriidae larvae were dominating too.

In the area of the Kulikovo Field, oak forest soil macrofauna was the most reach and steppe plots were characterized by a particular set of taxa and the structure of domination characteristic to grassland ecosystems. When abandoned field was formed in the same area, there was small difference from the steppe, mainly due to a lower abundance and diversity, but also in a strong mono-dominance of community.

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The Ecological Structure and Peculiarities of Lichenoflora on the Territory of the Museum-Reserve "Kulikovo Field"

Angelina Gudovicheva[1], Dmitry Himelbrant[2, 3]

gang80@mail.ru

[1] The State Museum-Reserve «The Kulikovo Field», Tula, Russia
[2] Saint-Petersburg State University, St.-Petersburg, Russia
[3] Komarov Botanical Institute of the Russian Academy of Sciences (BIN RAS), Saint-Petersburg, Russia

The territory of the State Museum and Natural Reserve «Kulikovo Field» is located in the forest-steppe area of the Tula Region and covers 16.5 thousand ha. In 2000–2003 and 2012–2013 the authors investigated the lichens of the Kulikovo Field, their diversity and ecology. The following main ecotopes were studied: meadow steppes with gravel limestone outcrops, steppificated oak forests, birch and pine plantations, edges of mires and semi-aquatic shrub vegetation. In total 453 samples of 93 lichen species were collected. Low diversity of lichens is typical for anthropogenically transformed arid and semi-arid lowlands. The following 6 species are included into the Red Data Book of Tula Region: *Cladonia subrangiformis* Sandst., *Collema limosum* (Ach.) Ach., *C. minor* (Pakh.) Tomin, *Diploschistes muscorum* (Scop.) R. Sant., *Evernia mesomorpha* Nyl. and *Platisma-*

tia glauca (L.) W. L. Culb. et C. F. Culb. Besides that, 12 species are rare and require special monitoring investigation.

The highest number of lichens was found in meadow-steppe communities (40 species) and forest habitats (36 species). Willow-shrubs on the edges of mires and riverside shrubs inhabited by 29 species. The lowest diversity was reported in mixed pine and spruce plantations (13 species).

The most diverse are corticolous lichens (58 species, 62% of lichen diversity). They were recorded on the bark of oak, birch, maple, willow, poplar, spruce, pear and also on twigs of wormwood. Ten lichen species were found on lignum (11%), and only 5 (5%) – on plant debris. Carboniferous and siliceous outcrops inhabited by 27 species (29%), among them 13 species were found on rare sandstone outcrops. The group of terricolous lichens includes only 13 species (14%), 5 of them are protected in the Tula Region.

Among the investigated protected areas («nature monuments») the highest number of lichens were recorded in Bol'sheberezovskoye mire (30 species), «Vodyanoye Polye» forest (29 species) and in the oak forest and on the steppe slope alonge the Rykhotka River (21 species).

The authors are planning to carry out monitoring of lichens on the Kulikovo Field to control the environment conditions.

Facilitation as a Crucial Biotic Interaction in Plant Communities of Alkali Grasslands, a Trait-based Approach

Andras Kelemen[1], Péter Török[2], Orsolya Valkó[2], Balázs Deák[1], Tamás Miglécz[2], Katalin Tóth[2], Ágnes Albert[2], Béla Tóthmérész[2]

kelemen.andras12@gmail.com

[1] MTA-DE Biodiversity and Ecosystem Services Research Group, Debrecen, Hungary

[2] University of Debrecen, Department of Ecology, Debrecen, Hungary

Dry, alkali short grasslands characterized by a unique flora and vegetation structure are endangered habitats and included in the Habitats Directive as priority habitats. However, there are only few studies concerning the plant-plant interactions in these types of grasslands, although it would be vital for their effective conservation. Positive and negative interactions usually co-occur in plant communities, and the facilitation often overwhelms the competition in stressed habitats. Several possible explanations were suggested in terms of relative importance of competition and facilitation, but the trait based analyses carrying out in stressed alkali grasslands are still lacking. We stressed the following hypotheses: (i) The amount of litter and the *Festuca* biomass affects positively the species richness and the biomass of subordinate species. (ii) There are also positive relationships between the subordinate species. (iii) The trait dissimilarity between species increases with increasing amount of litter and the *Festuca* biomass. We studied nine stands of dry, short alkali grasslands dominated by *Festuca pseudovina* in Hortobágy (East-Hungary). We collected thirty 20×20 cm aboveground biomass samples per stand and after drying sorted them to vascular plant species and litter. Dry weights were measured with 0.01 g accuracy. We used competitive traits (canopy height, seed weight, lateral spread and rooting depth) of subordinate species in trait-based analyses. The positive effect of litter and *Festuca* biomass on species richness suggests that the facilitation and the presence of plant material are important in species establishment in this harsh environment. There was positive relationship between the biomass and species richness of subordinate species permitted of the limited similarity of persistence traits. In these grasslands the trait dissimilarity supports the coexistence of species and the increased niche complementarity leads to higher productivity.

Invasive Plant Species Composed of the Kulikovo Field Alien Flora

Ludmila Khoroon

khoroon@mail.ru

Leo Tolstoy Tula State Pedagogical University, Tula, Russia

According to our data, the alien component of the Kulikovo Field flora includes 99 species of higher plants. Of these, 12 species can be attributed to the invasive group. These are the most aggressive species: *Sorbaria sorbifolia* (L.) A. Br., *Lupinus polyphyllos* Lindl., *Acer negundo* L., *Impatiens glandulifera* Royle, *I. parviflora* DC., *Hippophae rhamnoides* L., *Heracleum sosnowskyi* Manden., *Symphytum caucasicum* Bieb., *Echinocystis lobata* (Michx.) Torr. et Gray, *Aster x salignus* Willd., *Bidens frondosa* L., *Solidago canadensis* L.

All of them have the highest naturalization status within the Tula region – N 9, according to A.V. Krylov's classification. However, their activity within the study area varies considerably. This is explained by the relatively low level of anthropogenic development and predominantly agricultural impact on the territory. In this regard, all above species can be divided into 5 groups on the application of control measures.

In the first group we include the most aggressive species from different life forms. This is *Acer negundo*, *Aster x salignus*, *Echinocystis lobata*. They form extensive thickets in Monastyrshchino, Ivanovka and Tatinki. Local measures for this group of species are ineffective, they require the development of a national monitoring program.

Herbaceous annuals *Heracleum sosnowskyi* Manden. and *Impatiens glandulifera* found along the Nepryadva shore in Monastyrshchino places are infrequent. These are invasive species with great potential, but they are local and thickets can be mechanically destroyed.

The perennial herbaceous species group includes *Lupinus polyphyllos*, *Symphytum caucasicum*, *Solidago canadensis*. They are aggressive near the urban centers, but do not form pure thickets in the study area. Given the seriousness of the potential of these invasive species, the emerging thickets must be destroyed.

The next group can include shrubs *Sorbaria sorbifolia* and *Hippophae rhamnoides*. They should not be recommended for decorative landscaping, and the thickets of these species should be destroyed when they appear.

Herbaceous annual plant *Impatiens parviflora* grows in Ivanovka near the dwelling houses, but doesn't require control measures, as it does not harm the economically significant ecotopes.

Sandy Grasslands of the Forest and Forest-Steppe Zones of Ukraine: Syntaxonomy and Anthropogenic Transformation

Anna Kuzemko

anya_meadow@mail.ru

National Dendrological Park "Sofievka" NASU, Uman', Ukraine

The aim of the present study was to elaborate the syntaxonomy of sandy grassland vegetation in Forest and Forest-Steppe zones of Ukraine, and to determine the degree of it anthropogenic transformation. Materials for the study were 90 relevés, including the 73 relevés, fulfilled by the author. Data processing performed in JUICE software (Tichý 2002) using the algorithm TWINSPAN modified (Hill 1979, Roleček et al. 2,009), followed by methodologies of Luther-Mosebach et al. (2012) and DENGLER et al. (2012). Degree of anthropogenic transformation was determined using a modified coefficient of cenoses destruction – Kd (Bykov, 1969, Kuzemko 2006). The result was five vegetation units that have been identified as associations of the ***Koelerio–Corynephoretea*** Klika in Klika et Novák 1941 class: Ass. ***Corniculario aculeatae–Corynephoretum canescentis*** Steffen 1931 (All. ***Corynephorion canescentis*** Klika 1931, Ord. ***Corynephoretalia canescentis*** Klika 1934), Ass. ***Veronico dillenii–Secalietum sylvestris*** Shevchyk & Solomakha 1996, Ass. ***Diantho borbasii–Agrostietum syreistschikovii*** Vicherek 1972 (All. ***Koelerion glaucae*** Volk 1931, Ord. ***Festuco–Sedetalia acris*** R.Tx. 1951), Ass. ***Centaureo borysthenicae–Festucetum beckeri*** Vicherek 1972, Ass. ***Poo bulbosae–Caricetum colchicae*** Dubyna et al. 1994 (All. ***Festucion beckeri*** Vicherek 1972, Ord. ***Festuco–Sedetalia acris*** R.Tx. 1951). The lowest rate of Kd characterized the ***Corniculario aculeatae–Corynephoretum canescentis*** association (Mean 11,3 ± 1,38), the highest – the ***Poo bulbosae–Caricetum colchicae*** association (36,0 ± 2,71). The results allow supplementing the syntaxonomy of the insufficiently known in Ukraine class ***Koelerio–Corynephoretea***, and can also be used to monitoring of the state of grassland phytocenoses and study their vulnerability to invasive species.

Plant Communities on Solonetz Soils in the Volga Region

Tatiana Lysenko

ltm2000@mail.ru

Institute of Ecology of the Volga River Basin RAS, Togliatti, Russia

The research region is located in the Middle and Lower Volga and covers the area from Ulyanovsk to Volgograd. Concerning the botanical and geographical aspects, the territory lies in the forest-steppe and steppe zones. Vegetation of solonetz soils is the object of research. Phytocoenoses of solonetz soils in the Volga Region steppe zone are small, rare, and formed hemicryptophytes and therophytes. Plant communities on solonetz soils in the steppe zone are highly diverse. They are widely spread on the Left bank of the Volga river, and consist of hemicryptophytes, therophytes and chamaephytes. The geobotanic data was processed according to the floristic approach (Braun-Blanquet, 1964). Published data is included in the SynBioSys Europe (http://www.synbiosys.alterra.nl/synbiosyseu/) information system. 13 lower syntaxa cenoses were discovered in the forest-steppe zone on the solonetz soils. The community of 34 lower syntaxa was found in the steppe zone on the solonetz soils. A number of discovered syntaxa has spread to both two zones – forest-steppe and steppe, while some were found only in the forest-steppe or steppe zones. Studies have shown a high diversity of plant communities on solonetz soils in the Volga Region steppe zone in comparison with the forest-steppe zone, which is described with natural conditions – climate aridity and saline soil area increase when moving from north to south along the Volga. In addition, it is noted that the halophyte plants are more widespread in the plant communities of the steppe zone solonetz soils than in those of the forest-steppe zone.

Biodiversity of Lichens In Steppe Communities of the Central Russia

Evgeniya Muchnik

eugenia@lichenfield.com

Institute of Forest Science of RAS, Moscow, Russia

Central Russia (CR) includes 18 subjects of The Russian Federation (its total area exceeds 650 000 km^2). Zonal steppe is tilled to over 98%. Fragments of calcareous stone steppe have still somehow survived along gully slopes and river vallies with outcrops of calcareous rocks: limestone in northern parts and chalks in the south. In farsouth-east there still exist some remnants of sem-

idesert steppe. In addition, areas of steppe with sandstone outcrops of sandstones occur all over the region.
293 species of 73 genera grow in the steppe communities of the CR (34.7% of the total regional lichen biota). 28 genera and 155 species (18.2% of all the lichen biota) occur exclusively in steppe. The list of the most large genera includes *Caloplaca* – 31 species, *Lecanora* – 27, *Cladonia* – 21, *Verrucaria* – 20, *Lecania* – 12, *Rinodina* – 11, *Peltigera* and *Collema* – 9 either, *Acarospora* – 8, *Physcia* – 7, *Bacidia*, *Candelariella*, *Lecidella*, *Lepraria*, *Xanthoparmelia*, *Xanthoria* – 5 each. Most rich and various is the lichen biota of calcareous stone steppe – 234 species. Communities with sandstone outcrops bring together 99 species, while semidesert steppe – 54 species.
Saxicolous lichens are most widely represented – 150 species. These grow on limestones (110 species, and 57 of them are substrate specific), sandstones (63 species, including 39 specific), chalks, dolomites, marls (13 species, 15 specific), and also on concrete and other artificial substrates (13 species, 1 specific). 64 species, including 53 obligate epiphytes occur on tree and bush bark. The soil and earth matter on rock outcrops is populated with 51 and 21 species, respectively; 40 species inhabit mosses, 7 – plant debris, 2 – wood and bones either.
Red Books of Endangered Species of various levels include 53 species on the list of steppe lichen biota, with *Cetraria steppae* – in the Russian Federation Red Book of Endangered Species, while the rest – in regional Red Books. Most of persisting steppe fields are component parts of the Network of Protected Areas at federal or regional levels. 194 species occur within the federal network (i.e. 66.2% of representativeness), and 83 other species are found in the network of regional protected areas, so the overall representativeness amounts to 94.5%. Nevertheless, the problem of "official" protection and strict adherence to a nature management regime in the network of regional protected areas, as well as that of maintaining the semidesert steppe with its complex of specific terricolous lichensis still very pressing.

Diversity of Bryophyta Species in Steppe Communities of the Middle Part of Russia

Natalia Popova

leskea@vmail.ru

Voronezh State Institution of Physical Culture, Voronezh, Russia

Steppe ecosystems bryoflora within the Province of Middle Russian Upland, included in the zones of steppe and forest-steppe, was studied. Bryoflora includes about 70 species. In systematic spectrum Pottiaceae, Brachytheciaceae, Bryaceae, Amblystegiaceae prevailed; arid species dominate (45,5%); euriholarctic, nemoral and boreal species are presented in equal proportions

(15–17%), while arctoalpine ones include 4,3%. Mesoeutrophic and mesotrophic mesoxerophytes, neutrophyls and basiphyls (include 27% calcioyts) of mainly bunch and rough-carpeting forms play the most important role among ecological and life forms. Rates liverwort/moss is 1:8,5; top-fruit moss/side-fruit moss is 3,3:1; Pottiaceae/Amblystegiaceae is 5,4:1; dioecious species slightly prevail (54%); 32% of the species produce spores regularely, about 30% species do not form sporogones and the rest species seldom form sporogones.

According to landscape, vegetation and soil features the steppe communities are subdivided into several types. Based on floristic diversity and cenotic role of the moss, calcephyte-petrophyte meadow steppes ("low Alpine") are distinguished. About 40 species were found in the limestone variation; *Abietinella abietina, Brachythecium albicans, B. campestre* (up to 90–100% of the cover) prevail, about 10% of species are considered rare. In chalky variation there were 45 species; *Abietinella abietina, Camptothecium lutescens, Brachythecium glareosum, Hypnum vaucheri, Encalypta vulgaris* are significant on the cenosis; 23% of species are rare. In the Southern variation of calcephyte-petrophyte steppes (with *Hyssopus cretaceous, Thymus cretaceus*) there were 35 species; *Tortula ruralis* dominated; about 30% of species are rare.

In semidesert-steppe communities on stoned maroon black soil 23 species were found; *Polytrichum juniperinum*, *P. piliferum*, *Bryum caespiticium*, *Phascum cuspidatum*, *Tortula ruraliformis* were typical, ephemeric *Pterygoneurum ovatum*, *Pleuridium acuminatum* were present; 25% of species were considered rare. In placor forb meadow-feather-grass steppe on typical black soils only 14 species were found, no rare species. In sandy steppe 12 trivial species were found, *Tortula ruralis, Ceratodon purpureus*, *Bryum caespiticium* dominated.

In each type the most characteristic natural landmarks were determined, their role in nature protection significance was evaluated; moss component was analyzed based on regional and ecotopological representation.

Steppes of the European Russia: Ecology, Distribution, Transformation

Irina Safronova

irasafronova@yandex.ru

Komarov Botanical Institute, St.-Petersburg, Russia

In the European Russia, extensive areas are occupied by steppes. They dominate in a steppe zone and are an obligatory component of a vegetation cover of a forest-steppe zone. The steppe type of vegetation consists of communities of more or less xerophilous frost-resistant perennial plants of different life-forms.

In a forest-steppe zone the so-called meadow steppes are formed. They are characterized by the domination of mesophytic and xeromesophytic loose-

bunch grasses, sedges, mesophytic firm-bunch grasses and medow-steppe herbs.
In a steppe zone the communities of firm-brunch feather-grasses (*Stipa* spp.) growing on placors (flat drained watershed with loamy clay soils) are zonal types. In various ecological environments (on loamy sandy, sandy, saline or skeleton soils) plant communities of other biomorphs are formed: the firm-bunch grasses (of the genus *Festuca, Agropyron, Koeleria, Poa,* etc.), the loose-bunch and rootstock grasses (of the genus *Cleistogenes, Helictotrichon, Leymus,* etc.), the tufted sedges (of the genus *Carex*), the perennial herbs (of the genera *Allium, Galatella,* etc.), the dwarf semishrubs (of the genus *Artemisia* subgenus *Seriphidium, Camphorosma, Kochia, Thymus,* etc.) and shrubs (of the genus *Amygdalus, Caragana, Cerasus, Spiraea,* etc.). These communities are hemipsammophytic, psammophytic, halophytic or petrophytic ecological variants of the zonal type.
"The zonal type" does not mean "dominating". Depending on the regional conditions of the environment, this or that ecological variant can prevail.
According to changes of climatic indicators, with increase of degree of aridity, the structure of steppe communities changes. There are three latitudinal subzones: northern with herb-bunch-grass steppes, middle with bunch-grass steppes and southern with dwarf semishrub-bunch-grass steppes. Within each subzone the diversity of plant communities and the number of their ecovariants depend on the diversity of environmental factors.
Steppes both in the forest-steppe and steppe zones of the European Russia are strongly transformed now. The big areas are ploughed up and occupied by fields, deposits of different age with unstable communities (from groups of tall weeds to secondary steppe communities), haymakings, pastures. The natural steppe vegetation survives, mainly, on slopes and rocks and in Reserves.

Stepped Oak Forests of the Middle-Russian Upland as Element of the Forest-Steppe Landscapes in Central Russia

Yury Semenishchenkov[1], Alexandr Poluyanov[2], Elena Volkova[3]

yuricek@yandex.ru

[1] Bryansk State University, Bryansk, Russia
[2] Kursk State University, Kursk, Russia
[3] Tula State University, Tula, Russia

The unique relic natural complexes of stepped oak forests remained in Central Russia by small fragments. These forests are an important part of forest-steppe ladnscapes. Their coenofloras demonstrate the process of the steppization, which is corresponds to their zonal distribution. At the northern border of their area these forests are the reserves of rare steppe and forest-steppe species of plants.

On the basis of geobotanical materials collected by the authors in the Middle-Russian Upland (Belgorod, Kursk, Tula region) the 4 new associations within the subcontinental forest-steppe alliance ***Aceri tatarici–Quercion*** Zólyomi 1957 are established. Such forests are described within areas of important edificator species – *Acer tataricum* and *A. campestre* which northeast border generally corresponds to northeast border of the forest-steppe zone. For the alliance, authors propose an original combination of the diagnostic species for the Middle-Russian Upland.

Considering geographically caused floristic specificity of the forests of the region, we suggest to unite the established associations into the new suballiance ***Crataego curvisepalae – Quercenion roboris***, which represents the East European mesoxerophyte broad-leaved (with *Quercus robur*) forests of a forest-steppe zone of the Middle Russian subprovintion of the East European forest-steppe province. The diagnostic species of the suballiance: *Quercus robur, Acer platanoides, Chamaecytisus ruthenicus, Crataegus curvisepala, Frangula alnus, Melampyrum nemorosum, Sorbus aucuparia, Tilia cordata, Viburnum opulus*. The suballiance is diagnosed by absence in coenoflora of thermophilic *Quercus* species, in particular, *Q. petraea, Q. pubescens, Q. cerris,* etc., their hybrid forms, and also some Central European and Submediterranean trees and shrubs: *Acer pseudoplatanus, Carpinus betulus, Crataegus laevigata, C. monogyna, Cornus mas, Fagus sylvatica, Ligustrum vulgare, Sorbus aria, S. tomentosa, Tilia argentea, T. plathyphyllos, Viburnum lantana, Ulmus minor*.

Results of the research expand the information on distribution of the stepped broad-leaved forests in the Central Russia and will allow to outline in the future an actual geographical area of the alliance ***Aceri tatarici–Quercion*** in Eastern Europe. It may be the important base in the investigations of relationships of the forests and steppe in forest-steppe zone.

Forest and Steppe Fauna and Bird Population of European Russia at the Border of Tula and Lipetsk Regions

Olga Shvets[1], Vladimir Voronetsky [2], Oksana Brigadirova[3], Tatiana Chelnokova[1]

olgashvets@mail.ru

[1] Leo Tolstoy Tula State Pedagogical University, Tula, Russia
[2] Lomonosov Moscov State University, Moscow, Russia
[3] Scientific center RANS "Biodiversity protection", Moscow, Russia

The European Bird Census Council is currently working on the second edition of European Nestling Birds Atlas. The given essay features the regional materials for this project. The research sites have been defined in accordance with the European territory evaluation system (with the territory being subdivided into 50x50 km).

The basis for the evaluation of the fauna and bird population at the border of Tula and Lipetsk regions (quadrate 37UDV4) was the material of the field research in 2009–2013. Data correlation to the quadrate system has no real physic-geographical basis, which is why the principles of carrying out field work accepted in Russia were also taken into consideration while collecting materials. Track formation and data extrapolation were carried out with the consideration of the on-site habitat area ratio. The size of the evaluated territory is 220 km^2.

The territory is located in the forest-steppe zone. Arable lands take up 93% of it. Forests take up about 2% of the territory, and swamplands – about 1%. The river net belongs to the Don basin. 134 species of birds were found on the evaluated territory.

The maximum number of species (67) with a significant population density (up to 900 ind./km^2) is characteristic of forest outliers. The dominant species are *Fringilla coelebs, Anthus trivialis, Phylloscopus sibilatrix*.

The least number of species was found in human settlements and in semi-aquatic habitats (51 and 45 respectively). Maximum population density was found in human settlements (up to 900–2000 ind./km^2). The dominant species in towns are *Passer domesticus, Columba livia f. domestica, Apus apus, Corvus monedula*; and in villages – *Passer domesticus* and *Passer montanus, Corvus frugilegus*. The lowest population density (400–900 ind./km^2) is characteristic of semi-aquatic habitats.

The least number of species (34) and the least population density (120–360 ind./km^2) were found in meadow and field habitats. The dominant species are *Alauda arvensis, Motacilla flava, Saxicola rubetra*. *Alauda arvensis* and *Motacilla flava* were the most frequent species found in the evaluated quadrate. *Fringilla coelebs, Anthus trivialis, Saxicola rubetra* were the next frequent ones.

By analyzing these materials and the results of the search we had carried out in 1990–2001, we were able to find out the changes that have taken place over the last 10 years. Thus, we have discovered population changes for 26 species (a quarter of the local avifauna). It is also necessary to notice the appearance of new nestling species for this territory, such as *Locustella naevia, Locustella luscinioides, Iduna caligata, Saxicola torquata, Lanius minor*.

Observations on Stipa Ecology and Distribution in Steppe Zone

Vladimir Skvortsov

west-urnus@yandex.ru

Lomonosov Moscow State University, Moscow, Russia

The study is based on a historical land use analysis made by N. Rogova as a part of the project named Improving the Coverage and Management Efficiency of Protected areas in the Steppe Biome of Russia.

As concluded at the Project workshop held in 2011, there is no technical definition of the term 'steppe' shared by most of the Russian botanists. The genus *Stipa*, however, is usually considered as a good indicator of 'true' steppe communities in the field. Besides, its coverage, if dense enough, is often well-detected from space.

Using areas with different land use history, I carried out a field study to find out if the presence of *Stipa* helps reveal 'natural' or 'undisturbed' steppes and what different density of its canopy could indicate.

Below are the most interesting findings made in the study:

1. Many *Stipa* species can be very aggressive invaders that will occupy even recently abandoned fields or fresh fallows. The process is only limited by the availability of their seeds.
2. In some regions, old agricultural fields are now getting overgrown by a mixture of young trees and new feathergrass patches.
3. In steppe zones where recent fires have destroyed forests or protective forest stripes, it is often *Stipa* species that are becoming the most widespread herb plants with especially dense coverage.
4. Sometimes a dense and continuous canopy of *Stipa* is discovered in a place that was an agricultural field only two years ago. It is almost impossible to recognize any signs of agriculture there without using very recent satellite images.
5. Some grasslands looking like steppes on satellite images are in fact nothing than pure and extremely dense stands of *Stipa*, containing almost no other plants; such grasslands are not steppes at all.
6. The most developed dry grass communities with the highest diversity of plant species are those that have survived for decades on ravine slopes between agricultural fields. Their flora contains various *Stipa* species, but none of them behaves aggressively and there is always a neat balance between the numbers of different dominant plant groups.

The given results suggest that feathergrasses have very flexible ecology and are not necessarily the indicators or structural components of natural steppes, which, again, leads us back to the problem of what exactly a 'steppe' is and how to recognize it in nature.

Phytosociological Analysis of Steppe Sandy Forests in Northern Part of Rostov Region

Tatiana Sokolova

sta1562@yandex.ru

Institute of Arid Zones Southern Scientific Center, RAS, Rostov-on-Don, Russia

18 classes of species shape the cenoflora of forest vegetation alliances.

The basic class of all alliances' cenoflora is the ***Querco–Fagetea*** class and its species. A significant number of these species is found not only in broad-leaved forests, but also in black alder forests of ***Alnion incanae*** and ***Alnion glutinosae*** alliances.

The species of the ***Alnetea glutinosae*** class are most widely represented in the communities of the ***Alnion glutinosae*** alliance (27%). These forest and swamp species are less common for the mesophytic ***Alnion incanae*** alliance (7%), which speaks in favor of the black alder typological differentiation and allows to refer the last alliance to the ***Querco–Fagetea*** class. Forest swamp depletion (4%) is also in accord with the growing site aridity that is characteristic of the ***Aceri tatarici–Quercion*** alliance communities. This ecological pattern is confirmed by the growing variety of hygrophytic species of the ***Pragmito–Magnocaricetea*** class from the ***Aceri tatarici–Quercion*** alliance (2%) to the ***Alnion glutinosae*** alliance (9%), and by the participation of the alliances of the ***Salicetea purpureae*** (3–5%) class species in the formation of the cenoflora.

The presence of meadow species of the class ***Molinio–Arrhenatheretea*** (8–20%) in the cenoflora illustrates the process of communities' steppification, brought on by human impact, such as clear cutting, pasturing and recreation.

The sparsity of the ***Aceri tatarici–Quercion*** alliance forests is also beneficial for the light-demanding edge species of the ***Trifolio–Geranietea sanguinei*** (10%) class. These species are also plentiful in the communities of the ***Alnion incanae*** alliance (8 %), due to cenoflora steppification. The species of this class are few in the swamp forests of the ***Alnion glutinosae*** alliance (2%). However, the steppification is mostly reflected in the predominance of the steppe species of the ***Festuco–Brometea*** class and of the characteristic forest and steppe ***Rhamno–Prunetea*** class. The highest number of these species is traditionally found both in the ***Aceri tatarici–Quercion*** (17%) and ***Alnion incanae*** (11%) alliances.

The presence of species, belonging to such classes as ***Artemisetea vulgaris***, ***Bidentetea tripartitae***, ***Robinietea***, ***Galio–Urticetea***, ***Epilobietea angustifoliae*** and ***Stellarietea mediae*** is indicative of human impact and the disturbance of the alliances' cenoflora natural structure.

Thus, the phytosociological analysis demonstrates the complex structure of alliances' cenoflora, influenced by the significant variety of forest sites as well as the origin of communities and the disturbance mode.

Fungal Diversity of the Kulikovo Field

Tatiana Svetasheva, Ekaterina Murav'yova, Ekaterina Nikitina

foxtail_svett@mail.ru

Leo Tolstoy Tula State Pedagogical University, Tula, Russia

Up to date the studies of the fungal diversity of the Kulikovo Field have been mostly fragmentary. Only a few brief trips were carried out specially for the study of mycobiota in 1999, 2001, 2003, 2008, 2013. The main attention was paid to the forest communities like steppe oakeries (*Ouercus robur*), polydominant broadleaves forests (*Q. robur, Tilia cordata, Acer platanoides, A. campestre, Ulmus glabra, U. laevis, Fraxinus excelsior*), and tree-plantings; most often the open habitats were examined occasionally.
As the result, the total of 226 species of macrofungi were registered in the surroundings of the Kulikovo Field Museum-Preserve: 214 – basidiomycetes (178 agarics, 28 polypores, 10 gastrics, 2 heterobasidiomycetes) and 12 – ascomycetes. The vast majority of fungi consists of common species, widely spread in temperate zone of Europe, that are tolerant of intensive anthropogenic impact and visible landscape transformation. However, noteworthy species, rare for Tula region and even Russia were also found.
The old steppe oakeries growing on the carbonate soil (and sometimes other types of forests with oaks) turned out to be the most interesting communities for fungi. There are the species somehow associated with oak, including rare symbiotrophic fungi protected by Tula Region Red Book of Endangered Species: *Boletus impolitus, Inocybe bresadolae, Lactarius mairei, Russula aurea, R. illota*; as well as characteristic for the temperate and south forests xylotrophic fungi: *Mollisia olivacea, Pluteus petasatus*, and in addition uncommon soil saprotrophs: *Agaricus osecanus, A. porphyrizon, Entoloma araneosum*.
12 species were found in grasslands and other open habitats, among them is a rare for Tula region gasteroid fungus *Tulostoma brumale*.
It is notable that almost every visit to the Kulikovo Field brings new and interesting finds, so detailed mycological research could be very perspective.

The Fungies of the Volgograd Region Sandy Steppe

Tatiana Svetasheva[1], Evgeny Popov[2], Yury Rebriev[3], Nikolay Pridyuk[4]

foxtail_svett@mail.ru

[1] Leo Tolstoy Tula State Pedagogical University, Tula, Russia
[2] Komarov Botanical Institute, St.-Petersburg, Russia
[3] Institute of Arid Zones of the Southern Scientific Center, Rostov-on-Don, Russia
[4] M. G. Kholodny Institute of Botany, Kyiv, Ukraine

"Chapurnikovskaya balka" is one of the most unusual sites of Volgograd Region's nature. It is located about 10 km south of Volgograd. This is a dry valley stretching along the Volga riverbed and cutting through the Neogene sands and upper Palaeogene clays of the Yergeni hills. The valley profile is slanting with wide slopes and some expressed terraces. The profile depth is 50 meters, width – more than 1 km.

In October 2013 we investigated a site in the lower part of the valley near the railway station Chapurniki. Two types of vegetation can be marked here: 1) the steppe on the fixed sands with *Stipa sareptana*, *S. capillata*, *Agropyron sibiricum*, *Koeleria sabuletorum*, *Euphorbia seguieriana*, *Artemisia austriaca*, *A. arenaria*, *Chamaecytisus ruthenicus*, *Poa bulbosa, Atraphaxis frutescens*, *Centaurea arenaria* etc., as well as with well-developed moss-lichen layer; 2) psammophilous vegetation on the semi-fixed sands with *Koeleria sabuletorum, Artemisia arenaria*.

Our special interest was devoted to the diversity of macrofungi, especially to agaricoid and gasteroid basidiomycetes, and discomycetes. In spite of the scanty vegetation and poor soil, we have found a very interesting complex of fungi. The diversity is not very large and consists of 47 species. However, the qualitative composition is very unusual and specific. Most of these fungi are pioneer species confined to the poor undisturbed places, where they act mostly as soil saprotrophs, herbotrophs and bryotrophs. The highlight of this fungal complex is a high percentage (up to 50%) of very characteristic and rare species.

The largest group of the found fungi belongs to agaricoid basidiomycetes. There are 31 species, 14 of them are rare and specific for sandy grasslands or heathlands; and 6 species turned out to be new for Russia: *Arrhenia baespora, Conocybe herbarum, C. nigrodisca, Entoloma flocculosum, E. korhonenii, E. phaeocyathus*. Another interesting fact is the simultaneous presence of 5 species of *Arrhenia* while the most of them are rare: *Arrhenia auriscalpium, A. baeospora, A. spathulata*. *Mycena chlorantha*, growing on grass remains, is also a very rare and notable species.

The gasteroid fungi are presented by 10 species. *Disciseda bovista, Geastrum floriforme, G. hungaricum, G. schmidelii* are common in steppes. *Sphaerobolus stellatus* and *Cyathus olla* are also common, but more often in mesophytic meadows and forests. The genus *Tulostoma*, typical for arid regions, is repre-

sented here by two rare psammophilous species *Tulostoma pulchellum*, and *Tulostoma cf. polymorphum* as well as two unclear species demanding a deeper research.
The discomycetes are presented by soil inhabiting *Ascobolus geophilus* and *Peziza ammophila*, and by bryoparasitic *Lamprospora retispora*. The last one is new for Russia. The discovery of *P. ammophila*, a widespread inhabitant of sandy sea coasts in the depths of the continent is of special interest.

Moss Component of Plant Communities on the Territory of the Museum-Reserve "Kulikovo Field"

Victoria Teleganova

teleganovavika05@rambler.ru

Federal State Bidgetary Institution «National Park "Ugra"», Kaluga, Russia

The territory of the museum-reserve "Kulikovo Field" is located in the northern forest and steppe subzone and is characterized by low afforestation (2,5–4,3%). The forests are secondary and form in a ravines. Steppe communities are characteristic for limestone slopes and watersheds. Most territories are taken up by agricultural lands and land deposits. There are small sites of euthrophic hypnum mires in the protected zone.
The floral diversity of mosses of the basic vegetation communities and their cenotic value have been studies on the forest and forest-steppe plots and on the mires. The moss cover characteristics of the basic phytocenoses at the researched plots are presented (opp – abundance, n – number of species in a community, tn – total number of species in a given community type).
Oak herbal forests that were shaped in the oak plantations at the site of the destroyed ravine oak forests are presented on such plots as "Sredniy Dubik", "Nizhniy Dubik", "Tatinky". "Repnoye" and "Polugar". Opp<1%, n – 3–10, tn – 16. The characteristic species are: geophilic *Fissidens taxifolius*, *F. bryoides*, *Atrichum undulatum*; epiphytes and epixilical species *Brachythecium salebrosum*, *Pylaisia polyantha*, *Sanionia uncinata*, *Plagiomnium cuspidatum*, occasional *Orthotrichum speciosum*, *O. obtusifolium*, *Platygyrium repens*, *Pseudoleskeella nervosa*, *Brachythecium roteanum*, *Hypnum cupressiforme*, etc.
Oak and birch forests that were shaped in forest plantations are presented on such plots as "Tatinky", "Skupoye". Opp<1%, n – 6–9, tn – 13. Moss species composition and their significance for the vegetation cover is the same as in the oak forests. In damp forest edges, you can occasionally find *Rhytidiadelphus triquetrus*, *Rhytidiastrum squarrosum*, *Climacium dendroides*.
Spruce and birch forests that were shaped in forest plantations are presented on the "Vodyanoye Polye" land plot. Opp – 5–10%, n – 10. Soil cover contains *Plagiomnium affine, P. cuspidatum, Eurhynchium angustirete, Cirriphyllum pilif-*

erum, *Rhytidiadelphus triquetrus*. Most of these species are rare in Tula region, as the southern border of their area is limited to the spruce areal. Epiphytes and epixilical species are few.

Eutrophical herbal-hypnum mires ("Bolsheberezovskoye", "Podkosmovo") are characterized by the largest diversity of species and the highest percentage of mosses in the vegetation cover: opp – до 80 %, n – 6–22, tn – 22. The characteristic epigeous species are: *Brachythecium rivulare*, *Calliergon cordifolium*, *Calliergonella cuspidata*, *Cratoneuron filicinum*, *Drepanocladus aduncus*, *Plagiomnium ellipticum* and others. A rare species *Helodium blandowii* is found in the "Bolsheberezovskoye" mire.

In the meadow and steppe communities: opp<1%, n – 3–7, tn – 10. The dominating species are *Abietinella abietina, Brachythecium albicans*, with occasional *Campyliadelphus chrysophyllus*, *Bryum argenteum*, *B. caespiticium*, *Ceratodon purpureus*, *Tortula acaulon*, *T. truncata*, and *Schistidium* sp. on the lime rocks.

Carabid Assemblages of Dry Grassland Habitats in Helsinki

Stephen Venn

stephen.venn@helsinki.fi

University of Helsinki, Helsinki, Finland

Carabid beetles are a particularly species rich taxon of dry grassland habitats. They include species which are spermatophagous, and thus affect the composition of vegetation communities, and also predators, as well as a small number of parasites. In this study we apply NMDS ordination to a large dataset of carabid beetles recorded from eight habitats: rocky dry meadows, dry meadows, fortresses, fresh meadows, mesic meadows, lawns, fallow fields and ruderals sites. The ordination shows clear separation of these sites along a gradient, probably determined by moisture. Generalized Linear Mixed Modelling (GLMM) was applied to test the associations of particular species with particular habitats. On the basis of these results, we are able to identify assemblages of several grassland habitat types and identify habitat types that are of particular conservation priority and should be prioritized in conservation planning.

Floristic Diversity of the Priority Dry Grassland Habitat Types in the National Park of Prespa, Greece

Michael Vrahnakis[1], George Fotiadis[2], Yannis Kazoglou[3] and Ioannis Tsiripidis[4]

mvrahnak@teilar.gr

[1] Department of Forestry and M.N.E., Karditsa, Greece
[2] Department of Forestry and M.N.E., Karpenissi, Greece
[3] Municipality of Prespa, Prespa, Greece
[4] School of Biology, Aristotle University of Thessaloniki, Thessaloniki, Greece

Due to the determinant role of two large inland water bodies, the diverse topography, the long-lasting human influences (or "the long-lasting influences of human activities"), and the petrography (a limestone-dominated western sector, a granite-dominated eastern sector), several dry grassland vegetation types alternate in altitudes between 850 and 2400m thus creating a diverse mosaic-type landscape in the National Park of Prespa (NPP), northwestern Greece. The recent mapping in 2011 revealed four dry grassland priority habitat types (*6210, *6220, *6230 and *6260) occupying an area of 8,754 ha. This paper sets as its major goals to determine and compare the floristic diversity measures of these habitat types. Several models of community organization were fit to the species abundance data obtained from relevés sampled for this study. In addition, an estimation of species richness, after sample rarefaction method, was attempted to obtain an overall view of the potential species number these habitat types may sustain. A numerical profile of α-diversity was outlined by calculating: a) the Q-statistic, to obtain an arithmetic indication of diversity, b) the Shannon-Wiener measure of equitability (JH), and c) the Berger-Parker dominance index (d). The Solow randomization test was applied for detecting statistical differences between indices. Finally, habitat types were ranked according to their diversity profiles obtained after using the Renyi approach.

Towards a Revised Classification of Pontic-Pannonian Steppe Grasslands

Wolfgang Willner[1], Anna Kuzemko[2], Norbert Bauer[3], Thomas Becker[4], Claudia Bita-Nicola[5], Zoltán Botta-Dukát[6], Milan Chytrý[7], Jürgen Dengler[8], Ruzica Igic[9], Monika Janišová[10], Zygmunt Kacki[11], Iryna Korotchenko[12], Mirjana Krstivojevic[9], Eszter Ruprecht[13], Luise Schratt-Ehrendorfer[14], Yuri Semenishchenkov[15], Zvjezdana Stancic[16], Yulia Vashenyak[12] & Denis Vynokurov[12]

wolfgang.willner@vinca.at

[1] Vienna Institute for Nature Conservation and Analyses, Vienna, Austria
[2] National Dendrological Park "Sofiyvka" of NAS of Ukraine, Uman', Ukraine
[3] Hungarian Natural History Museum, Budapest, Hungary
[4] University of Trier, Trier, Germany
[5] Romanian Academy, Bucharest, Romania
[6] Hungarian Academy of Sciences, Vácrátót, Hungary
[7] Masaryk University, Brno, Czech Republic
[8] University of Bayreuth, Bayreuth, Germany
[9] University of Novi Sad, Novi Sad, Serbia
[10] Slovak Academy of Sciences, Bratislava, Slovakia
[11] University of Wroclaw, Wroclaw, Poland
[12] M. G. Kholodny Institute of Botany of NAS of Ukraine, Kyiv, Ukraine
[13] Babes-Bolyai University, Cluj Napoca, Romania
[14] University of Vienna, Vienna, Austria
[15] Bryansk State University, Bryansk, Russia
[16] University of Zagreb, Varaždin, Croatia

We studied the main phytosociological subdivision of Pontic-Pannonian steppe grasslands using a large dataset of vegetation plots covering the whole Carpathian Basin (Eastern Austria, Moravia, Slovakia, Hungary, Romania, N Croatia, N Serbia) as well as Ukraine and adjacent regions in southern Poland and south-western Russia (Bryansk region). Altogether 43 706 relevés from 11 countries were gathered. Species taxonomy and nomenclature was unified according to the Euro Med Checklist. Critical species were merged to aggregates. From this initial data set, we selected all relevés with the presence of at least one (of 143 pre-defined) diagnostic species of the target vegetation types (steppe meadows, meadow steppes and grass steppes), of rocky steppes or of Pannonian sand steppes. Thus, we included all units traditionally included or closely related to the class ***Festuco–Brometea***. Relevés with a plot size <9 m^2 or >100 m^2, and relevés with a shrub or tree layer covering >10% were excluded. To avoid biases due to oversampling of some areas, we applied a heterogeneity-constrained random resampling. The resampled data set was classified using TWINSPAN. Higher syntaxa (classes, orders, alliances) were identified and diagnostic species for the different syntaxonomic levels were calculated using various fidelity measures (phi coefficient, constancy ratio, total cover ratio). Finally, we re-assigned the plots using the summarised

cover of diagnostic species. As next step, a detailed classification on the association level of the units corresponding to steppe meadows, meadow steppes and grass steppes will follow.

The Steppe Vegetation of South Ural (Russia): Present State of Syntaxonomy

Sergey Yamalov

yamalovsm@mail.ru

Botanical Garden-institute Ufa Scientific Centre, RAS, Ufa, Russia

Aims: to reveal the diversity of steppe vegetation on the boundary of Europe and Asia.
Location: The study area includes the territory of South Ural and is located between 52–56° latitude and 53–60° longitude, its extent from the north to the south – 550 km, from the west to the east is 450 km, occupying the area of 143 sq. km.
Methods: A total of 700 releve´s were sampled. The classification of plant communities was carried out using the Braun-Blanquet approach (Westhoff, van der Maarel 1973). The releve´s were stored in the TURBOVEG database (Hennekens, Schamine´e, 2001). Detrended correspondence analysis (DCA) ordination using CANOCO 4.5 (ter Braak, Šmilauer, 2002) was carried out in order to show the position of the already distinguished vegetation types along the main gradients.
Results: The steppe vegetation is included in the Eurasian class ***Festuco–Brometea***. Within this class, vegetation is subdivided into 2 orders, 4 alliances, 8 suballiances and 28 associations. The spatial distribution, floristic and ecological differentiations of higher vegetation units are described. The DCA ordination of the releve´s was used to demonstrate patterns of floristic differentiation of the higher vegetation units in the Southern Ural.
Conclusions: The floristic and geographical differentiation of meadow steppes ***Festucetalia valesiacae*** order and true steppes ***Helictotricho–Stipetalia*** order in Southern Urals was investigated. The geographical differentiation of the two orders' communities is difficult, due to the complexity of the relief and a high fragmentation of the steppes communities. The floristic differentiation is possible by the absence diagnostic combination of meadow steppes ***Festucion valesiacae*** alliance in ***Helictotricho–Stipetalia*** orders' communities.

The Diversity of Fallow Vegetation in the Upper Don (Russia)

Sergey Yamalov[1], Elena Volkova[2, 4], Ekaterina Golovina[3], Olga Burova[4]

geobotanika@mail.ru

[1] Botanical Garden-institute Ufa Scientific Centre, RSA, Ufa, Russia
[2] Tula State University, Tula, Russia
[3] Komarov Botanical Institute, RSA, St.-Petersburg, Russia
[4] The State Museum-Reserve "The Kulikovo Field", Tula, Russia

Active anthropogenic press in the forest-steppe zone of the European Russia promoted intensive ploughing of lands for agricultural purposes. However, the decline of agriculture has caused the flooding of lands and putting them to fallows. Most fallow lands of the Upper Don area are 15–20 years old. According to Braun-Blanke classification, the fallow vegetation is presented by 1 association and 2 basal communities:

Class: ***Artemisietea vulgaris*** Lohmeyer et al. ex von Rochow 1951
Ordo: ***Agropyretalia repentis*** Oberdorfer et al. ex Th. Müller et Görs 1969
Alliancia: ***Convolvulo arvensis–Agropyrion repentis*** Görs 1966
Ass.: ***Convolvulo arvensis–Elytrigietum repentis*** Felfoldy 1943
Var.: ***Chenopodium album***
Var.: ***Conyza canadensis***
Community: ***Elytrigia repens–Poa angustifolia*** [***Artemisietea*** / ***Festuco–Brometea***]
Class: ***Festuco–Brometea*** Br.-Bl. et Tx. ex Soó 1947
Ordo: ***Festucetalia valesiacae*** Br.-Bl. et R. Tx. ex Br.-Bl. 1949
Community: ***Poa angustifolia*** [***Festucetalia valesiacae***]
Var.: ***Festuca pratensis***
Var.: ***Artemisia marschalliana***

The results showed that for 10–15-year fallows the assoc. ***Convolvulo arvensis–Elytrigietum repentis*** (class ***Artemisietea vulgaris***) is typical. Their composition is dominated by synanthropic plants (*Elytrigia repens, Euphorbia virgata, Carduus acanthoides, Cichorium intybus, Melandrium album, Cirsium setosum, Tripleurospermum perforatum*), the species of natural vegetation are very rare. As the age of the fallows increases, the constness of *Poa angustifolia* is increased, meadow (*Vicia cracca, Galium mollugo, Leontodon hispidus, Achillea millefolium*) and steppe (*Fragaria viridis, Galium verum, Filipendula vulgaris*) species begin to appear. Such communities (***Elytrigia repens–Poa angustifolia***) occupy an intermediate position between the classes ***Artemisietea vulgaris*** and ***Festuco–Brometea***. The species composition of the communities of both stages has 20–30 species.

The communities of the class ***Festuco–Brometea*** are represented the latest stage of fallow development (15–20-years-old) and characterized by high consistency of *Poa angustifolia, Galium verum, Fragaria viridis,* by presence of *Filipendula vulgaris, Amoria montana, Phlomoides tuberosa*. Often *Cirsium setosum, Conyza canadensis, Consolida regalis, Vicia hirsuta, Carduus acanthoides, Cichorium intybus, Artemisia absinthium, A. vulgaris* are saved in such communities. The richness of species increases dramatically and has 40–50 species.

Session 2

HISTORY, ECOLOGY AND ACTUAL MANAGEMENT OF STEPPES AND DRY GRASSLANDS

Using Remote Sensing Data for Steppe Sites Identification in the Caucasus Region

Elena Belonovskaya, Nikolay Sobolev

belena53@mail.ru

Institute of Geography, RAS, Moscow, Russia

The forest-meadow-steppe belt is usually located about 1200–2200 m above sea level in the intermountain depressions of the Central and Eastern Caucasus. The relevant local climate conditions are the result of their location in the "rain shadow" between Skalistyi and Bokovoy mountain ranges.

Difficulties of accessing the mountain regions emphasize the importance of remote sensing data for the study of mountain plant communities, including steppes.

Relief and vegetation cover data was interpreted using the multispectral satellite images from the space system 'Resurs-'F' (three colour filters, at 1:200 000 scale). In order to avoid the "shadow" effect and color components distortion of the satellite images that are inevitable for the mountain landscapes, more precise results were obtained by aerial photographs (at 1:30 000).

Plant communities' structure, density and productivity define their colour interpretation on the satellite images. It allows us to identify the mountain steppes on the images we have used by their typical yellowish colour.

However, alpine meadows are coloured similarly (light brownish tints) due to similar structure and productivity. This is a consequence of the temperature inversion in the considered intermountain depressions making their temperature regime similar to alpine one. Despite the fact that the precipitation in the alpine belt is higher than in the intermountain depressions, low temperatures in the high mountains make it hard for the alpine plants to access water (physiological dryness), which is similar to the steppe plants (climatic dryness).

In such cases stereoscopic airphotos showing the relief as expressed by form, texture, shadows, size and density of images, allow to differentiate mountain steppes (low positions) from alpine meadows (high positions).

Several research outputs are discussed.

Large-Scale Vegetation Mapping in Steppe and Forest-Steppe Zones Using High-Resolution Satellite Images

Yakiv Didukh[1], Nikolay Ermakov[2], Maria Polyakova[2], Igor Pestunov[3], Olga Kuzmanenko[1], Ludmila Vakarenko[1]

didukh@mail.ru

[1] M.G. Kholodny Institute of Botany NAS of Ukraine, Kyiv, Ukraine
[2] Central Siberian Botanical Garden SB RAS, Novosibirsk, Russia
[3] Institute of Computational Technologies SB RAS, Novosibirsk, Russia

The spatial structure of vegetation in key areas geographically located in forest-steppe and steppe zones of Ukraine (South and East regions) and Southern Siberia (West Sayan and Minusinsk intermountain basin) have been studied. The set of relevés performed in the key areas was input in TURBOVEG database and classified using the Braun-Blanquet approach. The ecological series of plant communities for every key area were established after the ordination of releves. They were used as basic units for evaluation of vegetation diversity and spatial patterns after high-resolution satellite images processing. The large-scale vegetation maps (1:10 000, 1:25 000) were built using the multispectral high-resolution (up to 2 m/pixel) satellite images derived from WorldView-2, Quick Bird, IKONOS, and Pleiades sensors. The remote sensing data were processed using originally elaborated techniques including non-parametric clustering algorithms (GRID-approach), ECCA ensemble clustering method and the method of spectral and structural segmentation. Additionally, the values of 12 environmental factors for some petrophytic (West Sayan, Karadag, Red river sites) and halophytic (Primorske site) series of communities were calculated with the use of synphytoindication method (ECODID database for plant species tolerance ranges to environmental factors) for determination of the factor gradients and correlation patterns. The special attention was paid to rare communities occurring in steppe and forest-steppe zones to be included into Red Lists in Europe, Ukraine and Russian Federation. The results are important for the monitoring and modeling the steppe ecosystems dynamic as well as for the nature conservation management plans development.

Integrated and Sustainable Management of Seagrass Ecosystems in the Marine Protected Area of Joal-Fadiouth (Senegal): a Study of the Impact of Pollutants

Djacbou D. Sylvie[1, 2], A. Guisse[2]

sylvie.djacbou@gmail.com

[1] University of Yaounde I, Senegal
[2] Cheikh Anta Diop University of Dakar, Senegal

Seagrass ecosystems are among the most productive in coastal marine environments because of their services. Their growth and distribution are controlled by physical, chemical and biological properties of their environment. The seagrass of Marine Protect Area at Joal-Fadiouth (made up of both species *Halodule wrightii* and *Cymodosea nodosa*) is subject to anthropogenic pressures (pollution) associated with the geological erosion plaguing the area which could modify the natural content of certain elements in the waters and lead to its decline. The main objective of this work was to contribute to the limitation of pollutants impact on this ecosystem. Specifically, determine the sources and types of pollutants found in the area and their impact. This through surveys, and the determination of physico-chemical, biological and bacteriological water sampling areas. The survey results showed that the socioeconomic activities are important sources of pollutant's entrance. They also showed that 66.7% of the local population investigated discharge their wastewater directly at the beach while 14.1% into water. It was also clear that, there is a flaw in the system of participatory pollution management. The chemical analysis show water pollution with copper, zinc, ammonia, PCBs and a lower rate of growth standards for sulfates, and nitrites. Physical analysis reveals an average temperature of 23.7°C, pH 7.78 and 8.05 respectively and an average electrical conductivity of 33.3 mS/cm. The bacteriological analyzes revealed no presence of *Salmonella* and germs found in the water were fecal coliforms and *E. colis*.
Generally, Joal water is contaminated on physico-chemical and bacteriological level closer to the coast (zone 1) to zone 2 (far) and this will lead eventually in the long run to the decline in water quality and negative impact on the health of seagrass ecosystems.

Effects of Drought on Canopy Facilitation, Plant Diversity and Abundance in a Semiarid Grassland

Mohammad Jankju[1], Hamid Ejtehadi[1], Madhur Anand[2]

mjankju@um.ac.ir

[1] Ferdowsi University of Mashhad, Mashhad, Iran
[2] University of Guelph, Guelph, Ontario, Canada

Species composition and diversity of the grasslands are results of interactions between environmental severities, heterogeneous topography and facilitative effects of nurse plants. Investigating all these factors, especially in regards to the life history of interacting plants, has rarely been considered in a single study. A mountainous semiarid grassland was selected in Baharkish, Quchan, Northeast of Iran. Density and canopy cover of all plant species were recorded under the canopy of four different shrubs and in open areas, in north and south-facing aspects, and in a normal and a drought year. Shannon diversity, total abundance (% cover) and the abundance of different growth forms were used as criteria for assessing effects of the environmental variables. Data were arranged in a factorial combination, and analyzed by 3-way ANOVA using a GLM analysis. Effects of drought and slope aspect were more profound on species diversity, whereas that of canopy facilitation was stronger on plant abundance. Shrubs with larger canopy area and nitrogen fixation capability increased, but those with allelopathic effects or a dense canopy structure decreased the diversity of understory species. Annual forbs and shrubs were more affected by drought, whereas geophytes and grasses were more responsive to slope aspects. Canopy facilitation allowed for the persistence of only annual forbs and shrubs in response to drought. Plant community responses to abiotic factors (slope and drought) were more dependent on the plant growth form, while responses to canopy facilitation were more dependent on the morphology and/or ecology of nurse shrubs.

Long-term Plant Diversity Dynamics at Community and Landscape Levels in the Forest-Steppe Region (On an Example of Voronezh State Nature Reserve)

Larisa Khanina[1], Vadim Smirnov[1], Elena Starodubtseva[2]

khanina.larisa@gmail.com

[1] Institute of Mathematical Problems in Biology, RAS, Puschino, Russia
[2] Voronezh State Nature Reserve, Voronezh, Russia

80-years dynamics of forest-steppe vegetation at landscape and phytocoenosis levels was analyzed for the Voronezh State Nature Reserve. Vegetation dynamics was evaluated by analyzing of 1100 relevès that have been collected during 80 years at temporal plots located in different landscape units identified for the Reserve area. Preliminary analysis and vegetation data quality assessment techniques, techniques of estimation of vegetation diversity in heterogeneous and incomplete data have been developed. Monte-Carlo procedures including randomization tests for a comparison of means and bootstrap-like algorithms were used as well as building of species cumulative curves by the analytical method.

We defined that dry grassland vegetation was widely spread in the Reserve in 1930s. The reason for this was the extensive human impact before the reservation. At that time the meadow – pine forest vegetation was found in all landscape units of the Reserve except for the floodplains. A significant decrease of vegetation alpha diversity in the Voronezh State Nature Reserve has been detected over the 80 years since the Reserve was established. This process is observed for the Reserve as a whole, for each community type and for each landscape level excepting floodplains and the western site of the second terrace above the floodplain of the Voronezh River. That site is located on deep sands. It is also shown that the observed increase of the total number of vascular plants from one time period to another is caused by the increasing number of relevés recorded in the relevant time periods. Results of statistical modeling on subsamples of a fixed size have shown that there is no reason to assume significant increase or decrease of the total number of vascular plant species in the Reserve over the time.

We have shown that autogenic succession leads to the increase of nemoral species abundance in all vegetation layers; soil fertility increased and light decreased in the course of the succession. Fires, mass tree-falls, and mowing are the main factors behind the allogenic succession in the Reserve. We show that a high level of the vegetation diversity in the Reserve is maintained nowadays by these factors, which are exogenous for the Reserve's ecosystems.

First Results of Large Steppe Sites Inventory in Siberia, Russia

Andrey Korolyuk[1], Nataliya Dulepova[2], Alexandr Egorova[1, 2], Ilya Smelansky[2]

akorolyuk@rambler.ru

[1] Central Siberian Botanical Garden, SB RAS, Novosibirsk, Russia
[2] NGO Siberian Environmental Center, Novosibirsk, Russia

Mapping of the of steppe grassland sites in Siberia is a part of countrywide steppe inventory within the framework of the UNDP-GEF project "Improving the coverage and management efficiency of protected areas in the steppe biome of Russia". Based on RSD, we have mapped every steppe area over 500 hectares having a high proportion of steppe vegetation (no less than 1/3 of the area). Such steppe sites were identified in 10 federal provinces of Russia (Table); the 3 Siberian provinces have no such sites.

Federal Province	Number of mapped steppe sites	Total steppe area, ha	Average area, ha	Share of steppe in the province area, %	Total grazing lands area*, ha
Tyva	186	2,764,083	14,861	16.39	3,460,500
Khakassia	126	703,423	5,583	11.42	1,025,200
Altai	60	530,798	8,847	5.71	1,523,100
Altai Territory	233	495,407	2,126	2.95	2,792,300
Buryatia	191	475681	2,490	1.35	1,858,000
Chelyabinsk	226	460,633	2,038	5.20	1,359,500
Novosibirsk	77	293,208	3,808	1.65	2,315,800
Irkutsk	15	92,961	6,197	0.12	641,400
Krasnoyarsk	46	46,696	1,015	0.65	1,337,100
Omsk	16	27,391	1,712	1.94	1,266,000
Total	**1,176**	**5,890,281**	**46,436**		**17,578,900**

* Government land statistics, 2010

Only a small portion of every federal province is comprised of large steppe sites (LSS). The biggest figure is found in Tyva, ca. 16.5%, and Khakassia, ca. 11.5%. The LSS occupy 5–6% of the province area of Altai and Chelyabinsk, ca. 3% of Altai Territory, and under 2% of every other.

Area of the LSS comprises less than 1/3 of the grazing lands area registered in the government land statistics for these provinces. Official data on pasture area cannot be effectively used as a predictor for the LSS area per province (r2=0.564).

Tyva is notable for the maximal figures of both total steppe area and average area of LSS. The province has the highest diversity of steppe ecosystems and the minimal share of arable lands, only 10% of which are still occupied with crops to date.
In Khakassia and Altai the share of arable lands is also low and steppes are relatively unfragmented even if not so extensive: LSS are not numerous but have large average area.
In Chelyabinsk, Altai Territory, and Buryatia steppes have survived only as small fragments.
In Novosibirsk only one vast area of Kurumbelskaya Steppe results in relatively high total steppe area and average area of LSS.
In the other three provinces steppe has survived as sparse small areas scattered among arable lands and other ecosystem types (forests, shrubs, wetlands, etc). Only few LSS has high conservation value (like Olkhon area on Baikal).

Environmental and Land-Use Effects on Diversity and Composition of Grasslands Within the Forest-Steppe Zone of Western Siberia

Wanja Mathar, Kathrin Gottbehüt, Johannes Kamp, Immo Kämpf, Sarah Weking & Norbert Hölzel

w.mathar@uni-muenster.de

University of Muenster, Institute of Landscape Ecology, Muenster, Germany

Central Europe and southern Western Siberia share a high number of taxa in flora and fauna but exhibit rather great differences in the type and intensity of land use. However in comparison to CE, studies on grasslands in WS are rather scarce. The aim of this study was to assess what effects present and historic land-use and environmental conditions have on diversity and composition of different grassland types within the forest-steppe zone of southern Western Siberia.
Our study was conducted in three study areas of 20 x 20 km^2 arranged along a climatic gradient from the forest-steppe zone to the sub-taiga in the West Siberian Oblast Tyumen (Russia). Prior to field sampling, major land-cover types such as cropland, semi-natural grassland, grassland on former cropland and forest were identified by multitemporal satellite image classification. We randomly placed 25–50 sampling plots in each of these types and analyzed them for vascular plants, butterflies, grasshoppers and birds. In each plot we measured several soil parameters (C/N, P/K, pH, conductivity), aboveground productivity (biomass) and the current management. First analyses showed that mosaic complexes of grasslands with birch forests were floristically most diverse with up to 55 vascular plant species per 100 m^2 on grasslands that were never ploughed or improved by seeding. These sites mostly have been

used by traditional management such as extensive mowing but are nowadays often abandoned. Although large areas of croplands have been reconverted into grasslands after breakdown of the Soviet Union, our results indicate that the recolonisation by the natural grassland vegetation is rather slow. We will discuss preliminary results and plans for our future research.

This work has been conducted in the framework of the research project "SASCHA", which aims on developing sustainable land-use strategies for the West Siberian Oblast Tyumen (Russia).

Assessment of Sumer Drought Tolerance and Persistence of Some Grass Cultivars in Algerian Semi-Arid Conditions

Mohammed Mefti[1], Hamena Bouzerzour[2], Abderrezak Chebouti[3] and Aissa Abedleguerfi[1]

mmeftidz@yahoo.fr

[1] National High School of Agronomy, Algiers, Algeria
[2] University of Sétif, Sétif, Algeria
[3] CRP Baraki, INRAA, Algiers, Algeria

Selection of perennial forage grasses is aimed at improving the economic and environmental sustainability of production from cattle and sheep. Tolerance to drought conditions, water use efficiency, persistence and high forage yields are the major traits that determine the adaptability of the tested genotypes. This study was conducted at the experimental site of the ITGC institute in Sétif during the cropping season 2008/2009 corresponding to the fourth year of production, with the objective of evaluating the performance and the persistence of 14 varieties of perennial grasses, belonging to two species: *Festuca arundinacea* Schreb. and *Dactylis glomerata* L. in a semi arid region. The results showed the existence of a wide range of variability due to the diversity of responses of the evaluated varieties of both species, particularly regarding biomass production, production cycle, persistence and water use efficiency, which are considered as one of the most important factors in the success of artificial grasslands in semi-arid areas. These results show high potential for the selection of a plant material adapted to the specific conditions of the semi-arid areas of the Algerian high plains.

Holocene Environment Dynamics and Human Activity in the Forest-Steppe Zone of European Russia (Satellite and Pollen-Based Reconstructions)

Elena Novenko

lenanov@mail.ru

Lomonosov Moscow State University, Moscow, Russia

The present research is aimed at assessing Holocene woody cover densities and vegetation dynamics in the forest steppe zone of European Russia using analogue-based methods of quantity reconstructions and one of the innovative approaches, which combines modern and fossil pollen datasets with MODIS satellite images. The main stages of our study were as follows: (1) creating the reference dataset, consisting of 965 surface pollen spectra and associated satellite (MODIS)-based estimates of woody cover density, (2) checking the accuracy of regional woody cover reconstructions using the BMA approach applied to the reference modern dataset, and (3) applying the method for reconstruction of vegetation disturbance in the key-region in the forest-steppe zone. The accuracy of regional woody cover reconstructions was tested by leave-one-out cross-validation (R2=0.57 and SEE=10.8%).

The study area is located in the central part of the East European Plain which includes the Upper Don River basin and its tributaries, the so-called Kulikovo Battlefield area. New pollen, plant macrofossil, micro-charcoal evidences and radiocarbon dates were revealed from "Podkosmovo" mire (N 53.67027 E 38.59055); these allow us to reconstruct the landscape and human activity for the time span ranging from the mid-Atlantic period to the present.

The obtained results show that the high biodiversity of the forest-steppe area made the upper Don River basin very attractive for early human populations. Signals of anthropogenic changes in the vegetation and human-induced fires are clearly pronounced in the pollen and micro-charcoal records in the Neolithic and Bronze Ages, however, human impact on plant cover was not significant until 2400 cal. yr. BP. Reconstructions of total woody cover show a good agreement with land-use history of the territory. An extensive agriculture during the periods of human occupation resulted in the decrease of forest coverage, and when the territory was abandoned, the forests recovered their areas. Large-scale landscape changes and the degradation of natural vegetation occurred in the medieval time and became conspicuous over the last two centuries.

Application of the best-modern-analogue technique to pollen data from the key-region in the forest-steppe zone of European Russia demonstrated that the changes in regional woody cover and have become a good tool for the reconstruction of anthropogenic disturbance in the prehistoric time.

This work was supported by RFBR grant 14-05-00550.

Some More Facts to the Debate About the Strictly Protected Eteppe. How Invertebrate Communities React to Haying, Grazing and 'Absolute Zapovednost'

Nina Polchaninova

polchaninova@mail.ru

Kharkiv National University, Kharkiv, Ukraine

For many years, two alternative methods – strict protection and periodical mowing, have been applied in Ukrainian and European Russian steppe reserves. Nowadays, some scientists consider that strict protection has already fulfilled its purpose, and litter accumulation resulted in higher humidity, lower air and soil temperature and eventually in steppe degradation and overgrowing with arboreal and bush vegetation. Their opponents insist on the rights of nature to develop on its own and offer to cease all activities in nature reserves.
We aimed at analyzing available data on the response of steppe invertebrates to different conservation practices. The data is scarce. Oribatid mites as well as grass dwelling and epigeic spiders prefer strictly protected steppe (SPS); collembola and grass dwelling beetles are more diverse in periodically moved steppe (PMS); carabid beetles and cursorial spiders do not show a single trend. SPS attracts some meadow and forest species, especially in the forest-steppe zone, while PMS is preferable for xerophilous species. The response may vary depending on climatic and orographical position of the habitat and mowing frequency.
Horse grazing is a rare practice for economic reasons, cattle grazing is allowed in the buffer zone of some nature reserves. Without grazing, arboreal and bush vegetation may overgrow gully bottoms and the habitat might lose its steppe character. Under moderate grazing, trophic structure of cursorial beetles changes in favor of saprophagous and carnivorous species; ecological diversity of beetle community remains high with a significant number of steppe dwellers. Spider community on pasture is poorer both in species and number than that on the plots without grazing. On the upper parts of gully slopes, the difference between cursorial invertebrate communities is not so significant.
The result is quite obvious: with a variety of steppe biota, no single conservation regime can be chosen as optimal for all its components. The best management we can implement is a creation of mosaic environment that will maintain steppe diversity.

Cursorial Spiders and Beetles of Steppe Habitats of the 'Galichya Gora' Spot (Lipetsk Region, Russia)

Nina Polchaninova[1]**, Mikhail Tsurikov**[2]

polchaninova@mail.ru

[1] Kharkiv National University, Kharkiv, Ukraine
[2] Nature Reserve 'Galichya Gora' of Voronez State University, Lipetsk, Russia

The spot Galichya Gora is situated in the central part of Lipetsk Region (Russia) on the high right bank of the Don River. Its area is 19 ha; steppe vegetation takes up a half of it. Four plots were chosen for the study: (1) calcarious steppe on limestone outcrops, (2) feather grass steppe, (3) forbs-bunchgrass steppe, and (4) shrubby steppe. The material was collected with pitfall traps in late April – early August 2011–2012. As a result, 5232 cursorial beetles and 1526 spiders were caught.

In total, 56 spider species from 14 families and 424 beetle species from 33 families were registered. Spider families Gnaphosidae (17 species) and Lycosidae (12) as well as beetle families Carabidae (54) and Curculionidae (42 species) were the mostly represented species. On the plot 1, 22 spider species and 69 beetle species were found, on the plot 2–31 and 115 species, on the plot 3–28 and 106 species; on the plot 4–43 and 154 species, respectively (on the third plot, the research was carried out one year only). Active density of spiders was maximal on the plot 3 (42.3 ind./100 trap-days) and varied insignificantly on the other plots (22,3–28,9 ind./100 trap-days). The density of beetle activity was different: maximal on the plot 4 (131.1 ind./100 trap-days), with the plot 2 (85.8 ind.), plot 3 (58.0 ind.), and plot 1 (38.4 ind./100 trap-days) following it. Spider species diversity was the highest on the plot 2 (Shennon ind = 2,8) and the lowest on the plot 4 (2,36) while that of the beetle species was higher on the 3rd and lower on the1st plot (Shennon ind = 4.22 and 3.66, respectively). Faunal and biocenotic similarity of both spider and beetle communities was the highest between the plots 2 and 3 (Sørensen index for spiders 0.78, for beetles 0.55; Renkonen index 0.77 and 0.65, respectively).

Spider and beetle meadow species dominated on the plots 1, 2, 3; forest edge dwellers preferred the plot 4, while steppe dwellers were more frequent on the plots 2 and 3. Steppe species predominated on the plot 1, in particular – a spider *Gnaphosa taurica* Thorell, 1875 (Gnaphosidae), which has an Eastern Ancient Mediterranean range and spreads to the north along chalk and limestone outcrops. Besides, a narrow endemic of the Central Russian Uppland, the beetle *Otiorhynchus asphaltinus creticola* L. Arnoldi, 1964 (Curculionidae), was registered only on this plot.

Large-Scale Mapping of Red Book of Endangered Species Steppe Communities with Satellite Images of High Resolution

Mariya Polyakova

galatella@mail.ru

Central Siberian botanical garden, SB RAS, Novosibirsk, Russia

Mountain steppes of South Siberia are characterized by high diversity and mosaic structure determined by different relief and heterogeneous bedrocks. All diversity of steppes is included in two classes – ***Festuco–Brometea*** Br.-Bl. et Tx. ex Soo 1947 and ***Cleistogenetea squarrosae*** Mirkin et al. ex Korotkov 1991 representing two bioclimatic vegetation types in Southern Siberia and Mongolia. Among the diversity of steppe vegetation there are certain communities where Red Book of Endangered Species plant species (*Phlox sibirica*, *Veronica reverdattoi*, *Lilium pumilum*, *Carex humilis*), endemics (*Adenophora rupestris*, *Oxytropis chakassiensis*, *O. bracteata*, *O. nuda*) and glacial relicts (*Minuartia verna*, *Patrinia sibirica*, *Kobresia filifolia*, *Leontopodium ochroleucum*, *Gentiana decumbens*, *Scorzonera radiata*, *Silene graminifolia*) are concentrated. They occur in ecologically different communities related to certain landscapes.

The DCA ordination results showed a demonstrated consolidation of all steppe releves on several groups according to the gradients of basic environmental factors – humidity and specific of bedrocks.

The greatest number of endemic and glacial relict species are concentrated in the cryo-petrophytic communities with extreme environment. Some endemic species are typical for xerophytic Mongolian steppes. A lot of species listed in the Red Book of Endangered Species are located in mesophytic non-petrophytic steppes ***Festuco–Brometea***.

The high-resolution images made it possible to establish a correct landscape position of Red Book of Endangered Species steppe communites. Three micro-combinations are displayed on the images, that are relevant to a specific part of the slope and slopes aspect or depression between slopes. The first micro-combination is related to south slopes with predominance of thermophilous cryo-petrophytic steppes. The second micro-combination is connected with the northern slopes and characterized by a predominance of the ***Festuco–Brometea*** steppes. The third micro-combination is located on the eastern and western slopes.

A Historical Land Use Analysis for Massive Steppe Mapping in European Russsia

Natalia Rogova

nrogova@gmail.com

Kazan Federal University, Kazan, Russia

A massive mapping project, Improving the Coverage and Management Efficiency of Protected areas in the Steppe Biome of Russia, started in 2011 as an attempt to fully reconsider the distribution of dry grasslands in modern Russia. I have recently completed the mapping work for the southern part of European Russia.

The steppe zone area of European Russia is very large, while the space images representing different parts of it vary a lot depending on landscape or local features, seasonal changes or man-made disturbance. It is impossible then to find any features (such as brightness, spectrum, NDVI index or texture) pertaining to steppes only.

As was concluded at the Project workshop held in 2011, there was neither the technical definition of the term 'steppe' that is universally accepted among Russian botanists, nor any criteria to distinguish "natural" steppes from those modified by humans.

Most research aimed at steppe remote delineation in Russia was based on data collected only from very small model areas, which makes the results almost useless for a larger scale mapping.

Given all that, a historical land use analysis by a series of satellite images seems to be the best solution for separating intact steppes from previously disturbed grasslands that now look like steppes. The analytical procedure went on as follows:

1. Using Landsat images for the period 2009–2013, I created a potential coverage of steppes for European Russia, with two essential requirements:
- dry grasslands without large water bodies, floodplains, open sands or forested areas on them;
- they show no signs of recent human impact, suffer no hard agricultural press, and do not include objects of industrial or agricultural infrastructure.

While not all these areas are going in fact to be steppes, it is obvious that there will be no steppes outside the coverage.

2. The potential coverage was then compared with satellite images for 1962–2003.

3. Areas, modified by humans, e.g. ploughed up or deprived of vegetation due to long-term overpasture, were excluded from the potential coverage.

The main result of the work is a map of steppes that have not experienced human impact for at least 40 years. I have also created a map representing areas once modified in the past, whose their disturbance period can be accurately dated back. This opens a possibility to compare the vegetation of different steppe areas using their actual age and predict their ability to become 'true' steppes again.

Productivity and Carbon Sequestration by Grasslands of the Forest-Steppe in European Russia

Arkady Tishkov, Elena Belonovskaya, Nadezda Tsarevskaya

tishkov@biodat.ru

Institute of Geography, RAS, Moscow, Russia

In compliance with the 2012 Kyoto Protocol to the UN Framework Convention on Climate Change, the importance of forest ecosystems for the carbon sequestration was confirmed.

This one-sided statement reduced the attention to the studying of the treeless ecosystems, primarily meadows and steppes in Russia. However, the latter play the leading role in the long-term carbon sequestration (Tishkov, 2005, 2010; Smelyansky, Tishkov, 2012). Besides, in the Kioto Protokol frame non-ecological activities on the forest planting in the native steppes were introduced. In addition, the protected areas have not been founded. The new evaluation of the Russian forest-steppes' impact to the process of the primary productivity and carbon sequestration was carried out. Three groups of information sources were used: (1) national data bases; (2) summaries on the ecosystems productivity (Bazilevich et al., 1986; Geography of productivity…, 2010); (3) modern articles on carbon deposits in chernozems.

It was revealed that meadow steppes deposit 15,0–35 t/ha of phytomass. Its production is 20,0–25,0 t/ha a year. 10,0–20,0 t/ha of dead biomass are accumulated here. Field measurement data and remote sensing (for example, NDVI) evaluation show high reserves and productivity indices of this biome. Their last decades' tendency to increase are outlined in Kurskaya oblast and on the northern borders of the meadow steppe area. The forest-steppe agricultural landscape is characterized by secondary treeless meadow steppe communities' expansion. The productivity indices of these communities are similar to those of the natural ones, but the structure of the phytomass is different. The maximum of the deposition and production characterizes the first "weed-wild-grass" stage of the anthropogenic vegetation succession.

The area of the forest steppe in Russia is 941,2 thousands km^2 which is similar to the area of the steppe (967,2 thousands km^2). The natural steppes occupy 500 thousands km^2. Carbon summarized stock of the steppe biome (in chernozems) is evaluated as 35 billion t, and potential stock with long-term fixation in 75 millon t/year over sequestration of 1,0–2,0 t/ha in a year. The forest steppe's chernozems sequestrate 500–700 t/ha. Despite the practically total transformation during the age-old agrarian use, it is nearly 30 % of all carbon in the soil cover of Russia.

In 2012–2013 Russia initiated to include steppes and other carbon intensive biomes – tundra and bogs to the Post-Kiote documents. It could be very beneficial for the development of steppe reserves national network, fight with steppe fires, forbidding of forest planting in natural stepped areas, progress of their ecological restoration measures.

Stepped Habitats on South-West of Russia (Kursk and Belgorod Regions): Inventory, Mapping Evaluation of Current Situation and Historical Dynamics

Svetlana Titova, Konstantin Kobyakov

canopuss@yandex.ru

Institute of Geography, RAS, Moscow, Russia

This study was made within the framework of the UNDP/GEF/MNR of Russia Project "The inventory of preserved steppe ecosystems in Russia". We mapped and verified natural steppe areas in the Kursk and Belgorod regions.

Steppe plots were distinguished using Earth remote sensing data: Landsat series space images with sensors MSS, TM, ETM+, OLI (1974–2013 years) and resolution 30 m/px; SPOT series space images with resolution 20 m/px and IRS-P6 satellite images for the identification of the cretaceous denudations with resolution 5,8 m/px.

In table 1 there are some final parameters of distinguished steppe plots and cretaceous denudations in the Kursk and Belgorod regions.

Tabl. 1. *Selection parameters of steppe plots and cretaceous denudations in the Kursk and Belgorod regions (* – including steppes in the SPA)*

	Kursk region		Belgorod region	
	Steppe*	**Chalk**	**Steppe***	**Chalk**
Total amount of plots	1038	967	625	4612
Min area of plot, ha	0,28	0,018	0,92	0,01
Max area of plot, ha	1150,8	14,7	857	193,5
Average area of plots, ha	34,7	0,75	59,4	1,8
Total area, ha	36049,4	726,9	37101,1	8217,3
Part from region area, %	1,2	0,024	1,37	0,3

Both these regions have a long development history. However, significant changes of vegetation began at the end of XVI century, when Russian government began to consolidate within the limits of the Central Black Earth Region. The rise of agricultural development on this territory had reached its maximum by 1890, when more than 70% of total land area had been under tillage. Today the most part of the natural plant types (steppes and forests) in the region has disappeared.

According to the historical reconstruction, total steppe area has been reduced about 40 times, from 75% to 1,2–1,4%. The total forest area has been reduced from 25% to 9,3% for Belgorod region and from 16,2% to 8% for Kursk region.

The watershed steppe vegetation is practically absent except for plots in the

special reserve areas (Central-Chernozemny and Belogorje Zapovedniks). Only a few plots can be distinguished, located in the Manturovsky, Kastorensky and Cheremisinovsky districts in Kursk region.
It is necessary to pay attention to all the preserved steppe plots. We are planning to implement a ranking according to their value for steppe ecosystems. Subsequently we need to provide a stable existence at least for these plots.

Determination the Effects of Different Growing Periods on Botanical Composition, Dry Matter Yield and Nutritive Value in a Lowland Pasture

M. Özgür Töngel, Zeki Acar, İlknur Ayan

zekiacar@omu.edu.tr

Ondokuzmayis University, Samsun, Turkey

Grazing is a natural behavior as animals consume plants to meet their energy and nutrient requirements. In order to maximize metabolizable energy for animals and to sustain vegetative growth in natural pastures, management programs should be designed and implemented for each natural pasture. This study was conducted to figure out pasture quality and quantity during seasonal grazing periods in consideration of dynamic structures of lowland pastures in coastal conditions of Black Sea in Turkey. To better understand pasture yield and quality under continuous grazing, ten different cage cuts were performed in the years of 2011 and 2012: I) every week, II) every two weeks, III) every three weeks, IV) every four weeks, V) every five weeks, VI) every six weeks, VII) every seven weeks, VIII) every eight weeks, IX) every nine weeks. Additional cages were also set up to find out annual yield by cutting the plants off at soil surface every month regarding soil temperature, soil moisture and air temperature. Botanical compositions of cage cuts were searched out by sorting the plant species as well. As an average of 2011 and 2012, the highest plant height was obtained from the every 5-week cage cuts as 35.83 cm whilst the lowest plant height was measured in every week cage cuts as 15.18 cm. Botanical composition, dry matter yield, crude protein, ADF, NDF and trace elements were also investigated in the experiment. Botanical composition of the pasture had significant variation regarding grazing period, grazing intensity and severity as well. The common plants species to be sorted during experiment were *Lolium perenne* L., *Cynodon dactylon* L., *Poa annua*, *Hordeum murinum* L., *Medicago hispida* L., *Trifolium resupinatum* L., *Trifolium repens* L., *Rumex angustifolius* L., *Euphorbia sp.*, *Bellis perennis* L, *Plantago lanceolata* L., *Eryngium creticum* Lam., *Eryngium campestre* L., *Centaurea iberica* Trevir. ex Spreng, *Cirsium sipyleum*, *Erodium acaule* (L.) Becherer, *Anagallis arvensis*.

Long-Term Dynamics of Flora and Vegetation on Fat Watersheds of Streletsky Steppe (Kursk Region)

Nikolay Zolotukhin[1], Irina Zolotukhina[1], Alexandr Poluyanov[2], Tatyana Filatova[1]

alekhin@zapoved-kursk.ru

[1] Central Black Earth State Nature Biosphere Reserve, Kursk region, Russia

[2] Kursk State University, Kursk, Russia

The Streletsky steppe (SS) which occupies 730 ha is a part of the Streletsky site of the Central Black Earth reserve founded in 1935. Over the history of flora research (1900–2013), 540 species of vascular plants have been registered in SS. 121 species are adventive or weedy, they are of little importance in the vegetation cover; we exclude them from the further analysis. We show number and percent of species of vascular plants of SS in the periods of flora research and on phytocoenotic groups – steppe (s), meadow (m), forest (f) species:
1930–1940: s – 153 (56,5%), m – 103 (38,0%), f – 15 (5,5%), total – 271;
1944–1957: s – 159 (56,0%), m – 108 (38,0%), f – 17 (6,0%), total – 284;
1958–1969: s – 171 (56,4%), m – 114 (37,6%), f – 18 (6,0%), total – 303;
1970–1990: s – 177 (52,4%), m – 123 (36,4%), f – 38 (11,2%), total – 338;
1991–2001: s – 176 (50,3%), m – 131 (37,4%), f – 43 (12,3%), total – 350;
2002–2013: s – 186 (46,2%), m – 148 (36,7%), f – 69 (17,1%), total – 403.
In 1970–1990 the restructure of the flora started: the total number of species was significantly but unevenly increased in all groups. Because of this process, steppe species now form less than a half (46%) of the SS flora. The distribution of 80 vascular plant species, initially discovered in 2002–2013: 12 – steppe, 18 – meadow, 26 – forest, 24 – weedy and adventive species. New meadow species are registered on all modes of SS (mowing, grazing and strictly protected), while forest species – generally on strictly protected mode.

Many steppe and meadow species of plants have kept high frequency throughout the last 100 years. However, the abundance and frequency of some species has changed considerably. Among them is *Arrhenatherum elatius*, which at the beginning of the XX century was found mainly in the forest and forest edges, and in the 60-ies XX century it has begun to spread. At present it is widespread and abundant. The following species have considerably increased their frequency in SS: *Calamagrostis epigeios*, *Hypericum perforatum*, *Linum nervosum*, *Phleum pratense*, *Prunus spinosa*. On the contrary, the quantity of these species has been reduced: *Agrostis syreistschikowii*, *Carex humilis*, *Dianthus andrzejowskianus*, *Helichrysum arenarium*, *Koeleria cristata*, *Myosotis popovii*, *Sedum acre*.

Vegetation mezofitization is observed first of all on strictly protected mode where the ***Stipo tirsae–Bromopsietum ripariae*** association (Redulesku-Ivan 1965) Averinova 2010 has been transformed into ***Polygonato odorati–Anemonetum sylvestris*** association (Redulesku-Ivan 1965) nom. nov.

Session 3

CONSERVATION AND RESTORATION OF STEPPES AND DRY GRASSLANDS

Fauna of the Ancient Settlement Kolesovka (Tula Region, Russia)

Andrey Aralov, Sofia Tatarintseva

Kassandra_7_13@mail.ru

Leo Tolstoy Tula State Pedagogical University, Tula, Russia

This scientific research is devoted to the study of the osteological materials of animals that lived in the Kolesovka settlement in 12–14 century (Tula region, forest-steppe). In 1998–2007 excavations by the Tula archaeological expedition of the State Museum "Kulikovo Field" were carried out there. The total excavation area is about 4000 m^2. The results of the excavated animal bones analysis allowed to identify the species structure. The investigated material belongs to the representatives of five classes (mammals, birds, fish, bivalves and gastropods), referring to 19 orders, 27 families, 45 genera and 48 species. The inventory of the osteological materials was made and their distribution over the medieval settlement Kolesovka excavation site was marked. Basically, animal bones are the remains of cooked meat. During the study, 17,992 items of osteological material were collected and processed. Fragments of all skeletal elements are largely presented in the collection. Free limb bones and fish scale are the most frequent findings. A large part of the osteological material (20.55% of total) is damaged due to external exposure by sharp and blunt hard objects and natural destruction. We have found practically no intact animal skeletons the in excavation pits. This fact speaks of a high degree of animal utilization. The analysis of osteological materials enabled us to make the following conclusions. The animal life around the settlement was quite diverse. The bones of different animal species indicate this. Domestic species of mammals and birds predominate among the remains. This means that the economy of the ancient Russian population was of a sedentary nature with the predominance of animal breeding. Hunting was an additional source of food. The inhabitants of the settlement also actively engaged in fishing. The largest amount of domestic animals' remains belongs to the ungulates. Large ungulates make up most of the hunted animals. Among the osteological materials there were bones of bears and red deer. These species were extirpated by the population. They don't live on this territory nowadays. Breeding cattle, pigs, horses, sheep, and chickens were the basis of animal breeding of the Kolesovka area population. Animal breeding was stable in this historical period and kept gradually developing.

The EU-LIFE-Project "Conservation and Development of the Steppe Grasslands in Thuringia"

Henryk Baumbach, Stephan Pfützenreuter

henryk.baumbach@steppenrasen.thueringen.de

LIFE project office of TMLFUN, Soemmerda, Germany

Thuringia harbours the largest area of Sub-Pannonic steppic grasslands (450 ha) in Germany. They are typical slope-steppes, confined to Permian and Triassic hills which are located in the Thuringian basin and the Kyffhaeuser Mountains. Steppic grasslands provide habitats for many highly specialised species. Among them, numerous species are distributed mainly in Mediterranean and Eastern Europe. Their populations in Thuringia are at the westernmost extent of their range and some are considered as national or European rarities.

The EU-LIFE project aims to achieve the long-term conservation and development of the Sub-Pannonic steppic grasslands (habitat type 6240*), semi-dry grasslands and scrubland areas on calcareous substrates (***Festuco–Brometalia***, important orchid sites 6210*), and rupicolous calcareous or basophilic grasslands of the ***Alysso–Sedion*** (6110*) in the Thuringian basin. The project also focuses on the improvement of infrastructure for transhumance, management actions for endangered species and promoting public acceptance of Natura 2000. Over a period of six years (1.1.2009–31.12.2014) and with a total budget of five million Euros, more than 100 individual projects will be implemented. Due to the outstanding significance of the project, the maximum funding rate of 75 % has been granted by the European Commission. The remaining 25 % is funded by the state of Thuringia.

Our project area comprises 14 Natura 2000 sites. Management plans, including grazing concepts, have been prepared for all these sites. So far, management actions (e.g. shrub removal) have been implemented on almost 300 ha. Furthermore, the project improves the sheep-farming infra-structure. It is the intention that land users will become long-term partners for biotope management, and comprehensive public relations activities inform the public about the importance of the target habitats. The management actions are closely monitored and indicator species evaluated.

The project can serve as a model and give a practical boost to steppic grassland conservation not only in Germany but also at the European scale. One important contribution to the network-building was the international conference "Steppe habitats of Europe" in Erfurt (2012) and the proceedings published in 2013. Due to the fact that the project is in the terminal phase, we will also draw some critical conclusions about the problems accompanying the implementation of large dry grassland conservation projects.

Mapping Rangeland Degradation: Integrating Local and Scientific Knowledge

Bahareh Behmanesh[1], Hossein Barani[2], Majid Ownegh[2], Majid Mohammad-Esmaeili[1]

bahareh_behmanesh@yahoo.com

[1] Gonbad Kavous University, Gonbad Kavous, Iran
[2] Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

Land degradation is a threatening issue for ecological health in rangeland ecosystems. Assessing and mapping of rangeland degradation is an essential step before implementing any restoration and land protection project. With determining degradation hot spots, lower costs can be allocated for renovation of these places to sustainable condition. In the present research, in order to mapping rangeland degradation intensity using ecological indicators, two approaches were selected; ecological scientific analysis approach (ESA) and ecological local knowledge approach (ELK). Studies were done in the semi-steppe rangeland of Dasht and the steppe rangeland of Mirza-Baylu located in South and eastern parts of Golestan National Park. For evaluating vegetation and soil indicators, Blocks consisting of three replications of 8 m^2 plots were put in the both study areas. Qualitative scoring of indicators were done by pastoralists, a questionnaire was arranged with Lickert method (scores from1 to 5) andthey were completed by three pastoralists separately in each study area. For ranking indicators by their coefficients, Analytic Hierarchy Process (AHP) was used. With paying attention to degradation number of each block, for assessing each degradation approach, a degradation intensity classification map with five classes was achieved by Geographical Information System. Results showed that using the two approaches evaluated outside the Park more degraded than inside. ESA approach showed that most parts of the Dasht had severe and moderate degradation (%47.57 and %28.87) while in the Mirza-Baylu, very severe and severe degradation intensities had the most areas (%49.77 and %21.03). ELK approach determined most parts of the Dasht with severe and moderate degradation intensities (%51.49 and %27.48) while in the Mirza-Baylu light and moderate degradation intensities had the most areas (%38.19 and %29.29). In the semi steppe rangeland of Dasht, pastoralists evaluated their land degradation similar to scientific method (the maps overlaid more than %50) while in the rangeland of Mirza-Baylu, degradation intensity map from integrating the two approaches had less overlaid areas. We suggest that for assessing rangeland health, using integrated indicators of local knowledge and scientific methods can due to a correct and nature adaptive result.

Development of the Strategy of the Establishment of the Steppe Protected Areas Network in the Republic of Kazakhstan till 2030

Tatyana Bragina, Assylkhan Assylbekov, Akmaral Agazhaeva, Janna Kuragulova

naurzum@mail.ru

Kostanay State Pedagogical Institute, Kazakhstan & Southern Federal University, Russia

Steppes are little involved in the network of protected areas and continue to degrade. To save the steppe biome the long-term solutions are needed. In Kazakhstan, the development of the new Strategy and Action Plan for the conservation and sustainable use of biological diversity by 2020 (2015–2020) and long-term plan to 2030 is completed. An important component of these documents is territorial protection and rational use of steppe ecosystems that take up almost half of the country. However, presently almost all types of steppe on potentially arable soils of the vast plains (chernozem, dark chestnut and, partially, chestnut soils) are taken up by farmlands and steppes are preserved in fragments only. The northern types of steppes on chernozem soils are particularly affected by cultivation. Cultivation on the plains areas in some places reaches 90%, and 30% in the melkosopochnik; dry steppes on the plains were cultivated at 50–60%, and in the melkosopochnik at 10–15%. Remaining steppe areas in these subzones (stony steppes and complex steppes) were significantly transformed as a result of overgrazing. The vegetation of piedmont steppes is almost completely cultivated (piedmonts of the Altai, Tien Shan). Mountain steppes were selectively cultivated and grazed (Rachkovskaya&Bragina, 2012). At the same time, the southern types of steppes are much better preserved.

The GEF/UNDP project “Steppe conservation and management” (2008–2013) goal was to conserve the globally significant steppe biodiversity of Kazakhstan by including the representative steppe ecosystem areas of different categories in the network of protected areas of Kazakhstan and develop and implement mechanisms of spatial planning and sustainable use of natural resources of steppe ecosystem.

New approaches were prepared as practical mechanisms for the expansion of the steppe network of protected areas in Kazakhstan as the Strategy in the Republic of Kazakhstan. By 2030, it was suggested to increase the protected forest-steppe areas to 11.43% of the area of a natural zone, real steppes to 7.99%, dry steppes to 4.55%; and deserted steppe to 9.74%. To achieve this goal, the inventory of the steppe ecosystems in each steppe subprovince was performed to identify and select realistic sites for the new PAs and their goals. The preparation of series of GIS-maps was also carried out.

The IUCN/CEM Support for Steppes of the Northern Hemisphere and "The Encyclopedia of the Great Steppe"

Tatyana Bragina[1], KarstenWesche[2]

tm_bragina@mail.ru

[1] Kostanay State Pedagogical Institute, Kazakhstan & Southern Federal University, Russia

[2] Thematic Group Leads of IUCN/CEM's Holarctic Steppes Working Group, Germany

The steppes of the Northern Hemisphere are among the largest terrestrial biomes, supporting a rich flora and fauna, and providing invaluable ecosystem services. Today, most of the Northern Hemisphere's grasslands are already lost; virgin steppes were converted to crop lands, settlements, mining sites, industrial areas, etc. Global climate change as well as agricultural land degradation and reduction of productivity are aggravating the losses of steppe ecosystems, leading to deteriorating livelihoods of millions of people. Thus steppe is one of the most transformed and exploited biomes, and at the same time the most underrated of landscapes. The IUCN/CEM Holarctic Steppe Thematic Group's goal is to promote the conservation of steppes and to harmonize this with the needs of the human society. One of the first steps could be to discuss the possibility of creating a virtual "Encyclopedia of the Great Steppe." The encyclopediais suggested to describe there maining parts of the model steppe eco-regions, which are important for biodiversity conservation. If this concept were to be accepted, we would need to develop a detailed proposal in the required format. We need to answer the following questions:

1. What is Steppe? Re-evaluation of steppes' value for the overall system's biological diversity;
2. What is the level of steppe ecosystem service? Is the steppe a rich ecosystem?
3. How to conserve? Expansion of the chain of protected areas in the steppe landscapes, the restoration of their biodiversity, ecological potential and the strategy of obtaining the benefits of biodiversity conservation.
4. How to manage? Prudent management of the steppe areas used for local livelihoods and increasing the state budget – the green economy of Nature.
5. Who are doing actions/programmes for steppe with results? Some pilot projects' results and lessons, derived from them.
6. What is the future of Steppes? Steppes and climate change.

These themes could be a part of the Ecosystem Management Programme (EMP) of IUCN as well as a part of the EDGG and contribute to the IUCN thematic areas: valuing and conserving biodiversity, nature-based solutions to climate change, managing ecosystems to improve food security, etc. This discussion can let us share the collective knowledge and gain a deeper understanding of an important goal for steppe diversity conservation/sustainable nature using and the role of steppe ecosystems for nature and people.

Rangelands Restoration in Arid Areas of Eastern Morocco

Chebli Youssef

chebli.youssef@gmail.com

INRA, Regional Agricultural Research Center of Tangier, Tangier, Morocco

Rangelands represent the most important feed sources for herds in arid areas of Eastern Morocco. The objective of the present study was to assess the effect of one improvement treatment on pasture production in Eastern Morocco. This study was conducted in pasture areas (Drâa El Berwag) exclusively used by sheep herds and dominated by Artemisia herba-alba. We studied two types of treatment have been analyzed: the open grazing and the shrub plantation (*Atriplex nummularia*) with furrows along the contours of gently sloping land. Shrubs are the most palatable range species and the preferable component of the sheep and goat in the region. The vegetation parameters (consumable biomass and plant cover) were measured during three periods of the year. According to the results, the consumable biomass and the plant cover were significantly different ($P < 0.05$) according to the applied treatment and the period of measurement. The consumable biomass was 1359 KgDM/ha and only 17.6 KgDM/ha respectively in the shrub plantation and the open grazing. The average vegetation cover was 50% and 11%, respectively. The rangeland improving methods, specifically the plantation of *Atriplex nummularia*, increased the consumable biomass as well as the plant cover of pasture areas, and create micro-environments that encourage the re-establishment of rangeland plants. These methods are strongly recommended to insure sustainability of pastoral resources.

The Effectiveness of the Agrosteppe Method for Recultivation of Degraded Grass Communities (The Central Yakutia)

Olga Chernenko

verlok87@ya.ru

Institute for Biological Problems of Cryolitozone, Yakutsk, Russia

The study of grass communities recultivation was conducted on the steppe plot under conditions of deficient moisture and zoogenic load. The studied area is situated in Central Yakutia, on the first terrace above floodplain.

The steppe plot, where we conducted our research, was characterized by the third stage of pasture digression. Predominance of segetal-ruderal plants in the plot, low values of vegetation cover (50%) have revealed the necessity for the recultivation experiment. For these purposes, the agrosteppe method was applied for the first time under conditions of Central Yakutia. In accordance with the agrosteppe method, the intact plot (Festuca community) featuring dense grass stand (cover values 60–70%), high species richness (24 species) including grasses, legumes and forb, was chosen.

Testing the agrosteppe method under conditions of Central Yakutia has shown the following results:

1. Complete likeness between the recultivated and intact communities was not reached. This can be explained by different ripening rates of seeds, their small mass and complicated soil-ecological conditions at the experimental plots. At the same time, similarity of appearance and predomination of steppe grasses in the experimental plot was discovered. The following parameters indicated recovery of fodder lands: increase of general vegetation cover values up to 80% by the fifth year of the experiment, significant prevalence of steppe grasses, and gradual reduction of the role of weed species.

2. Under vigorous climatic conditions and various degree of soil salinization in Central Yakutia, the effect of the agrosteppe method becomes apparent on the 4–6th years after its application, whereas in the southern regions of Russia the recultivation takes 2–3 years. To achievement the positive effect of the agrosteppe method, the optimal ratio of the areas of virgin and long-fallow lands is 1:1 or 1:2. This means that for recultivation of 1 hectare of the degraded area, the natural polycomponent mixture of seeds should be collected from 1 or 0,5 ha of intact lands correspondingly. This ratio is lower as compared to South Russia, where the ratio of 1:10 or 1:5 is used. This is explained by low seed productivity of plant communities of cryolithozone.

Complex Examination of Loess Steppe Oldfield Succesion in the Külső-gulya Meadow and its Expansion Area near Battonya (SE Hungary)

András István Csathó[1], András János Csathó[2], Klára Virágh[1], Judit Házi[1], Melinda Juhász[1], Cecília Komoly[1], Gábor Szabó[1], Szilárd Szentes[3], Zita Zimmermann[1], Judit Sallainé Kapocsi[4], Sándor Bartha[1]

csatho@verge.hu

[1] Institute of Ecology and Botany, Hungarian Academy of Sciences, Vácrátót, Hungary
[2] Somogyi B. u. 42/A. H-5830 Battonya, Hungary
[3] Rákóczi u. 20. H-8373 Rezi, Hungary
[4] Körös-Maros National Park Directorate, Szarvas, Hungary

The strictly protected Külső-gulya loess steppe meadow is one of the largest natural loess steppe in Hungary. To extend the 20.9 hectares grassland 26.77 hectares of arable land were abandoned in 2009. The project has great importance from a scientific point of view, as abandonment is very rare in this region owing to the high soil fertility. Additionally here the abandoned field is contiguous to the grassland. The abandoned area was an intensively managed wheat field in 2009. After the abandonment the most frequent species were *Sinapis arvensis*, *Triticum aestivum* (volunteer plants), *Silybum marianum* and *Tripleurospermum perforatum* in 2010 and *Tripleurospermum perforatum*, *Cirsium arvense* and *Sonchus asper* in 2011. In 2012 *Cirsium arvense*, *Tripleurospermum perforatum*, *Bromus sterilis* and *Capsella bursa-pastoris* were in the biggest amount. The dominant species was *Cirsium arvense* in 2013 as well but the annual *Bromus* spp. became more frequent. The species richness of the abandoned field was beyond the expected. In 2011 more than 200 vascular plant species were recorded. Some significant species has already occured until 2013: *Cirsium eriophorum subsp. degenii*, *Galatella punctata*, *Helminthotheca echioides*, *Lathyrus nissolia*, *Lindernia procumbens*, *Lotus angustissimus*, *Oenanthe silaifolia*, *Ranunculus lateriflorus*, *Ranunculus polyanthemos*, *Sideritis montana*, *Teucrium chamaedrys*, *Trifolium retusum* and *Verbascum austriacum*. The detailed coenological studies were commenced in 2011. In the abandoned field 13, while in the grassland 4 large permanent plots (1000 m^2) were established. Species-area relationships have been recorded annually within each plot using modified Dengler's method. For monitoring community assembly and spatial pattern genesis, we use specific microcoenological sampling methods developed in Hungary. Two permanent 52 m long transects of units of 5 cm × 5 cm contiguous microquadrats are sampled annually in the grassland and in the oldfield as well. In one separated part of the oldfield, seeds were sown in 2011, 2012 and 2013. The succession of the other parts of abandoned field is spontaneous.

Prescribed Fire as an Slternative Measure in Grassland Conservation

Balázs Deák[1], Orsolya Valkó[1, 2], Péter Török[2], Béla Tóthmérész[2]

debalazs@gmail.com

[1] MTA-DE Biodiversity and Ecosystem Research Group, Debrecen, Hungary
[2] University of Debrecen, Debrecen, Hungary

Fire as a management tool is rarely applied in European grasslands, but prescribed burning is an integral part of the North-American grassland conservation practice. According to the North-American experiences prescribed burning can be a vital solution for maintaining biodiversity and for several nature conservation problems. Our goal was to review those prescribed burning measures which could be integrated to the European grassland management practice and based on the literature we identified those circumstances when fire management potentially can be applied. We found that not only the application of fire management is scarce in Europe but there is also a lack of published studies on this topic. These studies – contrary to the North-American practice – usually use yearly dormant-season burning, and conclude that this burning type solely is not appropriate to preserve and maintain species-rich grasslands. In North-America application of burning has a stronger historical, practical and scientific background; it is fine tuned in terms of timing, frequency and generally combined with other measures, like grazing, seed sowing or herbicide application. By this complex approach several nature conservation goals can be fulfilled like increasing landscape-scale heterogeneity and invasion control. We emphasize that for the application of prescribed burning the general findings of carefully designed case studies should be combined with the practical knowledge of conservation managers concerning the local application circumstances to reach specific management objectives.

Historical Landscape Reconstruction in the North Forest and Steppe of the Upper Don Valley

Maya Glasko[1], Evgenia Gorskaya[2], Alexandr Alexandrovsky[1]

mglasko@mail.ru

[1] Institute of Geography, RAS, Moscow, Russia
[2] State Educational Institution for Continuing Vocational Education "Tula region Institute for Continuing Education and Professional Retraining of Education Workers", Tula, Russia

At present, when anthropogenic influence shapes new landscapes, it is necessary to know the landscapes evolution from their virgin state to the current condition. Only with this knowledge, we can evaluate vector and rate of landscape changes, as well as forecast their future condition.

A favorable combination of natural factors, characteristic of forest and steppe landscapes in the north Central Russian Upland and Upper Don basin in the vicinity of the Kulikovo Field has encouraged the development of a complex and multiphase taming process. This process has been especially intensive during the last millennium.

According to historical and archeological data, there have been several stages of Upper Don land taming, starting with the mesolite period and up to our days. These stages differ according to their intensity, the direction of land development and are separated by periods of disuse and restoration of the natural environment.

Our research objective is the landscape reconstruction of the XVI–XVIII centuries taming stage, as this period has contributed a lot to the shaping of the modern anthropogenic geosystem. Many years of archeological research in the Kulikovo Field area have discovered 46 settlement of this period, that differ in size (settlements, villages, hamlets, etc.) and the topographic character of settlement system (watershed, valley). This taming period is associated with

the building of Epifan fortress and the system of 11 settlements around it. They were located in the Don river valley. One of these settlements was discovered during a complex of historical, archaeological and paleogeographical research on the second bottom of the right bank of the Don River, near the present day Melgunovo village.
Analyzing the results we have obtained, we can determine the three-dimension structure of the taming territory (the size of arable lands, haylands, forests), the direction and the degree of soil properties and vegetation types transformation. Finally, we can draw a map of the reconstructed researched river valley plot. The ensuing research of similar settlements around Epifan will help us reach a conclusion concerning the rate, steadiness and main directions of bottomland landscape anthropogenic transformation in the north forest and steppe zone of the East European Upland.

Steppe Conservation or Rural Societies Development in the Arid Mediterranean Context? Case of the Southern Tunisian Steppe

Ali Hanafi

ali_hanafi@yahoo.fr

University of Manouba, Manouba, Tunisia

Arid Mediterranean region of Tunisia has been characterized by the extension of steppes; perennial vegetation, with low land cover based on chamaephytes, grasses and halophytes. Ecosystems were therefore characterized by a fragile complementarily equilibrium between limited resources, territories and activities. However, and since the 1960s, the region has experienced significant socio-economic and environmental changes (land privatization of 33.800 ha of collective pastures between 70 and 2005, private investment in agricultural development...) that affected this equilibrium and the steppe resources. In order to study this situation, we chose to work on two representative sites of the Tunisian arid region (Menzel Habib in the governorate of Gabes and Jeffara in the governorate of Medenine) between 1970 and 2005. We used a series of satellite images, topographic maps, and thematic maps. These documents were completed by two field surveys for which we have realized more than 500 vegetation notes and socio-economic field survey of about 600 households. The plain steppe lands were monopolized by immigrants who injected several investments into the agricultural development. Areas of rainfed agriculture were then increased by more than 600% during the period 1970–2005. This socio-economic mutation has conducted to a net degradation of steppe area (–12% in the same period) accompanied by a spatial steppe fragmentation, a deterioration of pastures quality and a floristic homogeneity. Thus, degradation of plant diversity could be a real threat of a possible return of desertification especially in the case of prolonged droughts. The superposition of the results of this agricultural pressure with land use systems showed that 58% of lands occupied by agriculture are fragile with low agricultural potentialities (stony or encrusted lands...). However, the agricultural pressure emanated from a legitimate aspiration of local people in economic and social development and has come under government policies that aimed to limit rural exodus. Moreover, appropriating lands and practicing agriculture are considered for immigrants as a "return to the homeland". However, their almost absence, accentuated by the rainfall irregularity has caused in many cases a further degradation of these sandy areas who lost their steppe vegetation allowing the wind to move the sand and we saw new wind accumulations. Some authors called this new form of desertification "The green desertification".

Effects of Livestock Grazing and Canopy Facilitation on the Mycorrhizal Symbiosis of Two Perennial Grasses in a Semiarid Grassland

Mohammad Jankju, Amir Lagzian

mjankju@um.ac.ir

Ferdowsi University of Mashhad, Mashhad, Iran

Mycorrhiza symbiosis may increase plant fitness, by amelioration the negative effects of drought and nutrient deficiency. However under the natural field conditions, other biotic and abiotic environmental factors may affect the mycorrhiza-plant interaction. Accordingly, this research was aimed to study effects of livestock grazing and shrub canopies on the natural mycorrhizal symbiosis of two perennial grasses (*Festuca ovina* and *Bromus kopetdaghensis*). Study was conducted in a semiarid grassland, in Baharkish, Quchan, northeast Iran. For comparing effects of grazing, two nearby sites (a 5 year exclosure and a grazing site) were selected. Five 50–100 meter belt transects were randomly established in different landscapes of each site. Five replicates of *B. kopetdaghensis* and five replicates of *F. ovina* were randomly selected along each transect. Therefore, 40 individuals of each grass species (20 in grazing and 20 in exclosure sites) were sampled for studying effects of livestock grazing on the mycorrhizal symbiosis. For comparing effects of shrub canopies, two perennial spiny shrubs (*Acantholimon prostegium* and *Astragalus meschedensis*) were selected. Along the line transects (or in a 2m distances from the line), 10 shrub individuals were chosen, that had harbored the grass species under their canopy. Above and belowground biomass of the selected grasses were harvested. In the laboratory, roots were stained (after Hayman & Philips 1970) and their colonization rate was measured (after Giovannetti, 1980). According to the re-

sults, average colonization rate of *B. kopetdaghensis* was 60.67% higher than that of *F. ovina* wad 40.95%. The nurse shrubs (*A. prostegium* and *A. meschedensis*) had similar effects on the mycorrhizal colonization of the grass species. Shrub canopies increased and livestock grazing reduced colonization rate of mycorrhiza with *B. kopetdaghensis*; i.e. it had the highest (71.24%) rate under canopy of shrubs in exclosure in open areas, but the lowest rate in the open areas of the grazing site (53.87%). Under the same treatment, the colonization rates of *F. ovina*, was respectively 47.06 and 32.26% respectively. Under the real field conditions, the outcome of plant-mycorrhiza symbiosis it is affected by the other biotic plant interactions. Livestock grazing may reduce but shrub canopies may increase plant-mycorrhizal colonization rates, but the magnitude of their effects is dependent on the type of grass and possibly mycorrhizal species.

Are Plant Traits Predictors for Establishment Success of Species in Semi Dry Grassland Restoration Sites?

Martin Magnes, Philipp Sengl

martin.magnes@uni-graz.at

Institute for Plant Sciences, University of Graz, Graz, Austria

We compared the establishment of semi dry grassland species on two former arable fields in a three year period. Both are bordering directly on species rich semi dry grasslands and don't differ significantly in P and K soil content from the grasslands. One site relied exclusively on spontaneous colonization while on the other a commercial seed mixture, gained from semi dry grassland in an area approx. 60 km afar was yielded.

We analyzed which species could be promoted by applying the seeds, which would neither colonize spontaneous not could be established by applying the seed mixture and if plant traits could explain the different establishment success. The investigated areas are located in the SE alpine foreland of Austria near the communities Bierbaum (B) (47,11°N/16,05°E; ca. 320 m a.s.l.) and St. Anna am Aigen (A) (46.81°N/15.98E; ca. 29 m a.s.l). The annual precipitation ranges from 730 (A) to 840 (B) mm, the annual average temperature from 9.0°C (B) to 9.3°C (A). As dataset for estimating the establishment success of species we used 80 relevés (Braun-Blanquet approach, 16 m^2), 11(B) and 8(A) from reference sites on adjacent semi dry grassland and 33 (B) as well as 28 (A) from the fields.

Of overall 167 species, 60 with low frequency were excluded, the rest was divided into 5 groups according to their migration behavior for comparison of all together 22 plant traits.

1. 32 species couldn't establish
2. 19 species colonized spontaneously and from the applied seeds

3. 23 species established by the applied seeds only
4. 9 species settled spontaneously only
5. 24 ruderal species

As most predictive for an establishment of semi dry grassland species we identified 8 plant traits: plant height, ratio of seed length and width, Ellenberg value for N, flowering phase (DIERSCHKE 1995), mowing tolerance, dispersal type, self imcompatibility and a main occurrence in extensively managed grasslands.

Less predictive are end of flowering, duration of flowering, seed length, seed weight, leaf persistence, strategy type and vegetative propagation.

As a result, we recommend for similar restoration projects the yielding of a suitable seed mixture (or other material containing diaspores of target species). Additionally, at the start of the project, species which are difficult to establish should be recognized, eventually by analyzing our proposed predictive plant traits. For these species a special treatment for collecting and applying should be adopted.

Conservation of Azonal Dry Grassland Ecosystems in Fragmented Forest Landscapes

Tatiana Rogova, Galiya Shaykhutdinova

shga@ksu.ru

Kazan Federal University, Kazan, Russia

The conservation of ecosystem diversity at biogeographical zonal ecotones needs special approaches to select protection objects. On the southern border of the boreal ecotone in the coniferous-broadleaves forests zone, coming into contact with the forest-steppe and steppe landscapes azonal dry grass land ecosystems occupy habitats whose properties depend on the natural conditions of the landscape on the one hand and on the factors of anthropogenic impact on the other. Steppe meadows occupy well-warmed southern slopes on shallow carbonate rocks under the influence of moderate grazing. Specificity of meadow flora composition, community spatial and functional structure and vegetation productivity depend on the moisture and soil richness, on the composition of the surrounding vegetation and the intensity of their use as hay and pasture land. The flora of the forest upland meadows and steppe meadows along with mesophytes and xerophytes species include the typically forest species. There are also marked seedlings and undergrowth of lime, oak, birch and other trees, indicating the possibility of vegetation change from meadows to forest. At the same time pine and oak forest communities on dry sand soils and on rocky slopes are suitable habitats for steppe species (*Stipa pennata* L., *Centaurea ruthenica* Lam., etc.). Floro-coenotic territorial forest-steppe complexes for a long time take those topological elements in the landscape that have become suitable for there existence through human activities. Stability and structure of communities with steppe formation signs are provided by the presence of habitats (warm, with high light intensity and soil moisture deficit) and by the regional species pool. Ecological factors mentioned above work as abiotic filters, selecting species at microsite and community level. Occurrence of species in the community is determined by the selection, which depends on the response of species to abiotic and biotic relationships. In this context, the biodiversity conservation task first of all demands the priority of habitats protection, which can be topped up as much as possible from the regional species pool, and sometimes saving those forms of human impact, which lead to its full implementation. For the protection of meadow steppes on the boundary of the boreal ecotone insufficient protection of local habitats, more efficient will be the protection of their complexes, inscribed in the natural framework of regional landscapes.

Restoration of Semi-Dry Grassland in SE Austria – a View on Facilitated Colonization

Philipp Sengl, Martin Magnes

martin.magnes@uni-graz.at

Institute for Plant Sciences, University of Graz, Graz, Austria

The issue of this study was to investigate the establishment of grassland species within the scope of a restoration project, which used threshed seeds of a donor site to recreate semi-dry grasslands on former arable fields.

The investigated area is located in the southeastern alpine foreland of Austria(47°06′22″ N/16°03′12″ E; 300–330 m a.s.l.). The soils are non calcaric Stagnosols with a pH between 4.5 and 5.5 consisting of clayey sands and silts. The annual precipitation is about 730 mm, the annual average temperature is about 9.0°C (1971–2000).

The study comprises two semi dry grassland sites (***Hypochoerido–Festucetum rupicolae***) which are mowed regularly once per year and two adjacent former arable fields (alternately cultivating crops and Styrian pumpkin). These fields are object of a restoration project since 2010. The restoration measures include late annual mowing with removal of biomass. Threshed seed material of semi-dry and mesophilic grasslands was applied. In the first year after the initiation a commercial seed mixture consisting particularly of Lolium perenne was applied additionally because of the low vegetation cover and danger of soil erosion.

Besides sampling the vegetation (Braun-Blanquet approach, 16 m^2) along seven transects, starting within the ***Hypochoerido–Festucetum rupicolae*** into

the restoration sites, we analysed soil parameters (K, P, pH) and recorded the distance each of the samples in the restoration area to the nearest boundary of semi dry grassland. We analysed the establishment of grassland species using detrended correspondence analysis (DCA) and regression analysis. For measuring the vegetation patterns linked to the reference sites – in terms of similarity – we used the Frequency-Positive Fidelity Index (FPFI).
In three years since initiation of the restoration project we could already observe a considerable establishing-rate of typical semi-dry and mesophilic grassland species. Although we too observed a significant correlation regarding the similarity and number of established target species with the distance to the bordering reference sites. Compared to natural colonization from adjacent reference sites only, a far higher establishment rate of target species can be achieved within a few years, though we cannot say by now if this is going to matter in a longer timeframe. As well some distortion of the local flora can be a side-effect if the donor sites of the seed material lie in a different biogeographic region.

Transformation of the Avifauna in the Model Landscape of the Steppe Zone of Ukraine

Tetiana Shupova

tv.raksha@gmail.com

Institute for Evolutionary Ecology, NAS Ukraine, Kyiv, Ukraine

In Ukraine the steppe zone is the most changed region. Agricultural lands occupy about 75% of the territory of the steppe zone of Ukraine. Changes in natural communities cause elimination of some species and cause introduction of other species. We analyze of avifauna in plot of steppe landscape which have weakly transform. It is located in the Kirovograd region in the northern part of the steppe zone of Ukraine. This complex of the plots of steppe grasses and gently sloping beams with trees and shrubs. Old clay pit is a main element of violation of the natural environment. Now mining of clays is not conducted. Farmlands are surrounding of model landscape. Nearby is a forest.
Avifauna of model territory from 1992 to 2012 amounted to 49 species of 14 orders. 20.8% of birds of the total number of recorded species nest here permanently. The main part of the nesting birds are species with a small density of nesting, not more than 1.0 pairs/km (69.2% – in 1992 and 66.7% – in 2012). Much of the avifauna is represented by dendrophilous species.
In 1992 on the model territory is dominated: *Riparia riparia* L., *Merops apiaster* L., *Passer montanus* L. In 2012 – Merops apiaster only. Riparia riparia completely ceases of nesting. Decreased the density of nesting of species typical in the region: *Acanthis cannabina* L., *Passer montanus* L., *Carduelis carduelis* L., *Acan-*

this cannabina L. Increased the density of nesting *Merops apiaster* L. and *Lanius collurio* L. There is a redistribution of nesting birds on the district as a whole. *Muscicapa striata* Pallas and *Coccothraustes coccothraustes* L. leave the gently sloping beams in steppe and nest in the forest. As result of evolution of the complex of avifauna is the introduction *Alauda arvensis* L., *Lanius minor* Gmelin, *Sturnus vulgaris* L. in the model landscape.
The average density of nesting birds has changed slightly. In 1992 it was 2.3 (0.48) pairs/km, and in 2012 – 2.1 (0.74) pairs/km of transect. The number species of nesting birds decreased by 61.5%. The composition of species were changed by 79.2%. In complex of avifauna the diversity of species decreased, the evenness of the wantonness of species deteriorated (over the indexes: Margalef, Menhinick, Simpson, Shannon, Pielou). The look-alike between the complexes of avifauna in 1992 and 2012 are 0.52 by index Jaccard and 0.69 by index Sørensen.

Steppe in the Potential Areas of Special Conservation Interest of the Russian Forest-Steppe Belt

Nikolay Sobolev

sobolev_nikolas@mail.ru

Institute of Geography, RAS, Moscow, Russia

Joint Programme of the EU and the Council of Europe for the Preparation of the Emerald Network of Nature Protection Sites aims to identify potential areas of special conservation interest (ASCI) inthe Eastern Europe and Caucasus. St. Petersburg Charitable Public Organization "Biologists for nature conservation" (also known as the Baltic Fund for Nature) coordinates the Programme implementation in the European Russia by the appointment of the Ministry of Natural Resources and Environment of the Russian Federation.
In 2009–2013 the Russian Working Group for the Emerald Network and regional experts have identified steppe ecosystems (E1.2 and x 18 habitat types by EUNIS classification) on 200 potential ASCIs in the forest-steppe belt (Republics of Chuvashia, Mordovia, Tatarstan, Udmurtia; Belgorodskaya, Kurskaya, Lipetskaya, Moskovskaya, Nizhegorodskaya, Orlovskaya, Penzenskaya, Ryazanskaya, Tambovskaya, Tul'skaya, Ulianovskaya, Voronezhskaya Oblasts). The Standing Committee of the Bern Convention has nominated 185 of them as Candidate Emerald Sites in 2012. We have submitted another 15 identified potential ASCIsfor the nomination in 2014.
The mentioned potential ASCIs host at least 155 species of European importance (plants – 29, invertebrates – 17, cyclostomatous – 1, fishes – 10, amphibians – 2, reptiles – 1, birds – 86, mammals – 9). The majority of theminhabit steppe biotopes.

As of species of Europeans importance, which are not rare in Russia, we consider their biotopes important for their survival if an inhabitancy of ecologically similar redlisted species proves high quality of the biotopes.
The total size of steppe spots in the potential ASCI is about 50 th ha including: no more 10 ha on 42 areas (A group), 11–100 ha on 84 areas (B group), 101–1000 ha on 59 areas (C group), 1–4 th ha on 15 areas (D group). We consider areasof A group as having enough biotope size only for plant, invertebrate, and amphibian populations; areas of B group – for populations of reptiles and small mammals; areas of C group – for breeding populations of small birds; areas of D group – for populations of middleclass size birds and mammals (meaning not the body size, but the area needed for a viable population). No areas are big enough to support the inhabitance of large birds and mammals. Species of the large size class use both steppe and cultivated biotopes. Anyway, we must improve ecological linkages between potential ASCIs for ensuring the survival of all the target species.

Agroecosystems of East European Steppe Region Under Changing Climate and Policy Reforms: Dynamics and Trends of Bioproductivity Derived from NDVI Time Series Analysis

Natalia Telnova, Nikolai Dronin, Natalia Kalutskova

maantiede@mail.ru

Lomonosov Moscow State University, Moscow, Russia

East European steppe regions cover 2.1 mln. km^2 and encompass the south of the European part of Russia, Ukraine and Moldova. This region's significance for national economies is defined by the large-scale agriculture, which frequently takes over 50% of the lands. Agriculture here is largely rain fed and mainly limited by temperature and summer precipitation, with frequent large-scale summer droughts. Besides the ongoing climate change, there is another driving force of the changes in biological productivity of agroecosystems and grain production over the last 30 years: it is the significant land use change following altering strategies in agricultural policy and management on regional level. Our analysis focuses on the bioproductivity dynamics of croplands and grasslands for the three ten-year periods with quite different climate and policy options: 1980-s, 1990-s and 2000-s. We analyze the trends in biological productivity using the long-term series of the annual sum NDVI derived from remote sensing data of low and medium resolution (Tucker et al., 2005; Huete et al., 2010). This variable represents the aggregate greenness and can be used as a proxy of the annual biomass productivity (Bai et al., 2008). For spatial-temporal trend analysis of NDVI time series, we used the Theil-Sen median trend and Mann-Kendall trend test (Eastman et al., 2009). For the first period of 1982–1990, changes in bioproductivity of both arable lands and grasslands are mainly positive throughout the whole region in study. It can be explained by the huge federal investment programs in agricultural policy (f.e. 1982 Food Programme) along with rather favorable climate conditions of this decade. An opposite picture features the 1990-s with the predominance of "browning" croplands and grasslands from west to east due to increasing climate aridity. The poor agricultural management during the privatization period is equally responsible for these negative trends in bioproductivity. Though many experts consider the period of 2001–2013 as the time of restoration in agriculture and increase of grain production (Liefert et al., 2009; Dronin, Kirilenko, 2013), spatial pattern of trends in bioproductivity is heterogenic for this period. Slight predominance of negative trends among croplands and grasslands can be explained by the effects of two severe droughts in 2010 and 2012 and on the other hand by some lagged effects of improving agricultural management.

Chalk Steppe Conservation in the North-East of Ukraine: National Natire Park "Dvorichansky"

Victor Tokarsky, Vladimir Ronkin, Galina Savchenko

v.tokarsky@mail.ru

V.N. Karazin Kharkiv National University, Kharkiv, Ukraine

Total area of the National Nature Park "Dvorichansky" is 3131 ha. The research team of biological faculty of Kharkiv National University developed the project and created the Park several years ago. It is the newest park where chalky steppes are protected. In northeastern Ukraine, the Park is one of the largest refuges of steppe flora. Chalk steppe occupies the hilly landscape of the right bank of the Oskol River, where Kharkiv Region neighbours Belgorod Region. More than 250 species of vascular plants occur in the Park including 40 rare and protected species (14 species are listed in the Red Data Book of Ukraine). Among rare plants, 17 endemics of chalky outcrops have been registered. Vegetation of chalky outcrops is characterized by two original types of phytocoenoses: 1) Primary community under the initial successional stages with domination of cretaceous species of dwarf subshrubs, mainly *Artemisia hololeuca*, *Thymus cretaceus*, *Hyssopus cretaceus* and *Scrophularia cretacea*. *Matthiola fragrans*, *Helianthemum cretaceum*, *Hedysarum grandiflorum* and other rare species are common here. 2) Climax Thyme calcareous-steppe. This dry grassland represents steppe gramineous plants *Stipa capillata*, *Bromopsis riparia*, *Festuca rupicola*, *F. valesiaca*, *Poa angustifolia*, *Koeleria cristata* and forbs *Astragalus albicaulis*, *A. onobrychis*, *Teucrium polium*, *Polygala cretacea*, *Onosma tanaitica*, *Salvia nutans*, *Crinitaria linosyris* etc. The biologists of our research team are planning to extend the area under protection up to 10,000 ha. It is necessary for the prevention of uncontrolled economic land use in the Oskol River valley. The purpose of the project is a recovery of territorial, historical and ecological integrity of the unique landscape of chalky hills and river flood plain. First, it aims to include in the Park all surrounding territories up to conditional boundaries of interpenetration and influences of the components of adjacent ecosystems. Second, this develops historical and ecological approaches in the conservation and wildlife management. Third, in the future the project can prove, whether the absolute protective regime is corresponding to the goals of ecosystem conservation.

Diversity Patterns of a Central Hungarian Steppe-Wetland Mosaic in Relation to Grazing Pattern and Land Use History

Csaba Tölgyesi, László Erdős, Zoltán Bátori

erdos.laszlo@bio.u-szeged.hu

University of Szeged, Szeged, Hungary

Steppes used to cover large areas of Hungary but due to their high-quality chernozem soils most of their stands have been transformed into croplands. In Central Hungary some patches could survive on isolated humps and ridges wedged among wetland patches. These mosaics, representing complex ecological and conservation units, have been used by humans for millennia without impairing their biota. Presently, however, land use changes pose a threat to them, which requires urgent action. In the present study we identified 7 patch types: heavily, moderately and non-grazed primary steppes, heavily and non-grazed primary wet meadows, and secondary steppes and wet meadows. Moderately grazed primary wet meadows were not available. Secondary patches were ploughed 60 years ago but were abandoned soon after that. We selected 3 localities for each type, sampled them with 50 cm × 50 cm quadrates (50 in each locality, 1050 in total) and used the total number of species and the average number of species per quadrate to characterize the diversity of each patch type. To explore the background of the diversity patterns, species were sorted into functional groups according to their role in the community (i.e. competitors, generalists, specialists, pioneers, disturbance tolerants and disturbance indicators) and the proportion of the groups was compared. Steppes were found very sensitive to grazing pressure, and reached the highest diversity and structural complexity with moderate grazing. Lack of grazing resulted in the exclusion of groups with low competitive ability whereas heavy grazing enriched the community in disturbance indicators. Secondary steppes were far less diverse than any of the primary ones. Generally, wet meadows were less diverse than steppes but grazing had less effect on them as heavy grazing resulted in an increase in disturbance tolerants (hence in diversity) but

had no effect on any other functional groups compared to the non-grazed type. Secondary wet meadows were less diverse than non-grazed primary ones but the difference was slight; specialists, however, were completely absent. According to our results, steppes and wet meadows react differently to grazing pattern, thus they should be treated separately during management planning: heavy grazing should be stopped on steppes and can be relocated to wet meadows, if needed. Ploughing of any steppes, which unfortunately still occurs, should be stopped, since it causes irreversible diversity loss.

Diversity and Density of Seeds in Hayseed Used in Traditional Management and Restoration of Species-rich Grasslands

Péter Török[1], Orsolya Valkó[1, 2], Dániel Babai[2], Zsolt Molnár[4], Katalin Tóth[1], Ágnes Albert[1], András Kelemen[2], Balázs Deák[2], Tamás Miglécz[1], Béla Tóthmérész[1, 2]

molinia@gmail.com

[1] University of Debrecen, Debrecen, Hungary
[2] MTA-DE Biodiversity and Ecosystem Services Research Group, Debrecen, Hungary
[3] Centre for the Humanities, Hungarian Academy of Sciences, Budapest, Hungary
[4] Centre for Ecology, Hungarian Academy of Sciences, Vácrátót, Hungary

Conservation and restoration of species-rich grasslands is one of the crucial points in sustaining biodiversity in agriculture dominated landscapes. In planning and managing conservation actions for maintaining species richness in grasslands traditional knowledge is increasingly integrated. We studied the seed content of hayseed used in traditional management of the grasslands in Gyimes (Eastern Carpathians, Romania). According to local farmers, seeding with hayseeds is used regularly on manured meadows. We hypothesised that seeding by hayseed contributes greatly for sustaining diversity in manured meadows. We analysed the seed content and species diversity of hayseed using samples originating from 16 meadows. We used the seedling emergence method, where three half litre hayseed sample per meadow were evenly spread on the surface of trays filled with steam sterilised potting soil. Before spreading, large vegetative hay parts were removed from the samples. Altogether 88,500 viable seeds of more than 80 species were germinated, and more than 2,500 seedlings were transplanted for growing during the study. The mean seed content of the samples ranged from 978 to 9,590 seeds per litre. The most frequent forbs species were *Bellis perennis*, *Capsella bursa-pastoris*, *Carum carvi*, *Cerastium vulgatum*, *Chrysanthemum corymbosum*, *Galium mollugo*, *Leucanthemum vulgare*, *Lotus corniculatus*, *Onobrychis cf. viciifolia*, *Plantago laceolata*, *Plantago media*, *Prunella vulgaris*, *Ranunculus polyanthemos*, *Salvia verticillata*, *Stellaria graminea*, *Taraxacum officinale*, *Trifolium medium*, *Veronica chamaedrys*, *Veronica officinalis*. Generally a high ratio of seeds

of graminoid species was detected in the hayseed samples. The most frequent identified graminoids were *Briza media*, *Bromus cf. arvensis*, *Dactylis glomerata*, *Poa annua* and *Trisetum flavescens*, but a high number of graminoid transplants are till unidentified. Our results clearly suggest that the use of hayseeds contributes greatly to the high diversity of manured meadows and should be increasingly considered in grassland restoration practiced in European agricultural landscapes.

Micro-topographic Heterogeneity Supports Plant Diversity in Grassland Restoration Projects

Orsolya Valkó[1, 2], Balázs Deák[2], Péter Török[1], Tamás Miglécz[1], András Kelemen[2], Béla Tóthmérész[2]

valkoorsi@gmail.com

[1] University of Debrecen, Debrecen, Hungary
[2] MTA-DE Biodiversity and Ecosystem Research Group, Debrecen, Hungary

Pannonian alkali grasslands are one of the best preserved nature-close grassland ecosystems in Europe. A major threatening factor for these habitats is fragmentation and altered water balance caused by the drainage channel systems established in the 1950' and 60's. Several landscape-scale restoration programmes aimed to eliminate channels by soil-filling to restore grasslands and improve landscape connectivity on more than 4000 hectares. We studied spontaneous alkali grassland recovery by sampling 1-year-old and 7-year-old filled channels in Hortobágy National Park, East-Hungary. For estimating environmental heterogeneity we surveyed micro-topography by a high-precision geodetic survey. We hypothesised that (i) recently filled channels are characterised by a random assemblage of plant species, with high species richness and (ii) large micro-topographic heterogeneity supports high species richness. Our results showed that grassland recovery on filled channels was fast as they were surrounded by target grasslands and had a low perimeter/surface ratio, which enabled the fast immigration of target species from the surroundings. We found that species richness was higher in the recently filled channels compared to the old filled ones. Micro-topographic heterogeneity had no effect on the studied vegetation parameters in recently filled channels. Conversely, in old filled channels higher micro-topographic heterogeneity resulted in a higher species richness and lower cover of the dominant grass *Festuca pseudovina*. Higher micro-topographic heterogeneity resulted in increased ruderality and decreased stress-tolerance, but it did not increase the diversity of mixed C-S-R categories. In contrast with former studies, we found that a couple of centimetres of micro-topographic heterogeneity had no effect in recently filled channels, but supported a high diversity in old filled ones. An important practical implication of our study is that in grassland restoration actions, creating and sustaining nat-

ural micro-topographic heterogeneity is crucial to sustain diversity. However, alkali grasslands typically have a species-poor vegetation with a high cover of *F. pseudovina*. Thus, if the goal is to facilitate the recovery of a closed vegetation dominated by perennial grasses, precise soil levelling is necessary.

The Restoration of Herbaceous Vegetation at the Kulikovo Field Area (Russia)

Elena Volkova[1, 2], Olga Burova[2], Sergey Yamalov[3], Ekaterina Golovina[4]

convallaria@mail.ru

[1] Tula State University, Tula, Russia,
[2] The State Museum-Reserve "The Kulikovo Field", Tula, Russia
[3] Botanical Garden-institute, Scientific Center, RAS, Ufa, Russia
[4] Komarov Botanical Institute, St.-Petersburg, Russia

The restoration of herbaceous vegetation is an important part of the landscape reconstruction. This activity began on the territory of the Kulikovo Field in 2000, several different methods are being used: 1 – transplantation of *Stipa* swards into semi-natural meadow-steppe communities; 2 – transplantation of *Stipa* swards from natural plots into arable land; 3 – sowing of herbal mixes which were cut on natural plots; 4 – sowing of *Stipa* and motley grass seeds with herbal mixes (agrostep method); 5 – sowing of *Stipa* seeds in rows and other herbal steppe plants between them (wide-row sowing). The vegetation of experimental fields is presented by 1 association and 2 basal communities.

The communities which were formed by method 4 (2–3-years-old) are typical for assoc. ***Carduetum acanthoidis*** (class ***Artemisietea vulgaris***). Their composition is dominated by *Carduus acanthoides*, *Anisantha tectorum*, *Convolvulus arvensis*, *Tripleurospermum perforatum*. Of the planted steppe species *Onobrychis arenaria* is frequent, *Stipa pennata* is rare.

The experimental 10–12-year old fields, which were formed by agrostep method (4) and transplantation of Stipa swards (1, 2), are typical for ***Galium verum*** community (class ***Festuco–Brometea***). This community is characterized by domination of *Poa angustifolia*, *Agrimonia eupatoria*, *Fragaria viridis*, *Galium verum*, *Amoria montana*. The *Cichorium intybus*, *Artemisia absinthium* are rare. The *Stipa pennata*, *Iris aphylla*, *Echinops ruthenicus*, *Linum flavum* appear in such communities.

The communities of ***Stipa pulcherrima*** (class ***Festuco–Brometea***) were formed by wide-row sowing (5) with *Stipa* and motley grass seeds (or withour motley grass). The age is 4–7 years. The "youngest" communities are typical for var. ***Polygonum aviculare*** and characterized by fullness of *Stipa capillata*, *S. pennata*, *S. pulcherrhima* and active growth of *Tripleurospermum perforatum*, *Lactuca serriola*, *Cirsium setosum*, *Convolvulus arvensis*. The percentage of the planted steppe species (*Centaurea ruthenica*, *Linum flavum*, *Onobrychis are-*

naria, *Securigera varia*) is low. ***Allium oleraceum*** communities are transitional and characterized by low species diversity. The mature communities with high abundance of *Stipa capillata*, *S. pennata*, *S. pulcherrima*, *Poa angustifolia*, *Securigera varia*, *Festuca valesiaca*, *Veronica teucrium*, *Linum flavum*, *Pyrethrum corymbosum* are typical for var. typica. *Conyza canadensis*, *Artemisia vulgaris*, *Artemisia absinthium*, *Convolvulus arvensis*, *Tripleurospermum perforatum*, *Cirsium setosum* do not exceed 15–20%.

EXCURSION GUIDES

Natural Conditions of the Kulikovo Field (Tula Region)

Elena Volkova[1,2], Olga Burova[2]

convallaria@mail.ru

[1] Tula State University, Tula, Russia
[2] The State Museum-Reserve "The Kulikovo Field", Tula, Russia

The Kulikovo Field basin is located in the central part of the Russian Upland, in the north-east of the Central Russian Upland, in the Upper Don basin. Geologically this territory is presented by the crystalline basement of the Russian Platform, overlapping with Devonian and Carbonic period deposits. Bedding rocks are widely covered with loess and loam and covering silt.

The most common landforms are watersheds and river valleys. The river valleys are very deep – up to 40 or 60 m. Bottom of the river valleys are taken up by floodplains. The quantity of mire in the floodplains is low. The highest landform surface is presented by the watersheds. The average prevailing watershed altitude is 180–220 m. with the maximum of 230 m. Watersheds and watershed slopes are covered with a network of river valleys and ravines.

The territory is located in the temperate zone, which defines its climate. The average precipitation is 450–540 mm per year. The highest percentage of precipitation is in summer. The average yearly temperature is about 8°C. However, the temperatures change drastically during different seasons: the average July temperature is +18°C, and the average January temperature is –10°C.

Climatic and hydrogeological conditions of the Kulikovo Field territory are a beneficial factor in the formation of the temporary and perennial stream system. Several large and small rivers flow here, and all of them belong to the Don basin.

The soil covering consists of forest and steppe zonal soils – black and gray forest soils, as well as several intrazonal soils, such as alluvial valley soils, meadow black soils, lowland mire soils. Black soils are widely spread in the watersheds and are shaped beneath the grassland vegetation. Gray forest soils are most common on ravines and valleys slopes and bottoms, and less common on watershed slopes. The common characteristic of all soil types is the influence of man-induced impact on the upper soil layer (Glazko and others, 2005).

The diversity of the vegetation cover in the Kulikovo field is due to this territory location in the forest and steppe zone. It explains the combination of steppe and forest communities, existing on different landforms. Intensive human impact has encouraged the formation of agricultural communities that are presented by arable lands and land deposits, and are located on watersheds and watershed slopes. This kind of agricultural communities takes up over 80% of the territory (Volkova, Burova, 2013).

The Museum-Reserve "Kulikovo Field" organizes experiments of the restoration of forest and steppe landscape on arable lands. An oak forests is being restored on a 20 ha territory. Experiments aimed at steppe vegetation restoration by several methods are carried out on a 50 ha territory (Danilov, 2005; Volkova, Burova 2011):

a) transplantation of Stipa swards into semi-natural meadow-steppe communities
b) transplantation of Stipa swards from natural plots into arable land
c) sowing of herb mixes which were cut on natural plots
d) planting of Stipa seeds in rows with other steppe herbs between them

Steppe communities have survived to the present day only on ravine and river valley slopes of the southern exhibition area, and now have the status of protected territories (Red Book, 2007). On the Kulikovo Field this kind of natural landmarks takes up 122 ha. Meadow steppes on ravine and watershed slopes are very common. The diversity of grass vegetation is represented below (Averinova, 2010, 2011; Averinova, Golovinova, 2012):

Class ***Festuco–Brometea*** Br.-Bl. et R. Tx. in Br.-Bl. 1949
Order ***Festucetalia valesiacae*** Br.-Bl. et R. Tx. ex Br.-Bl. 1949
Alliance ***Festucion valesiacae*** Klika 1931
Suballiance ***Achilleo setaceae–Poenion angustifoliae*** Tkachenko et al. 1987
Ass. ***Gentiano cruciatae–Stipetum pennatae*** Averinova 2010 ass. prov.
Subass. ***G. c.–S. p. typicum*** Averinova 2010 subass. prov.
Subass. ***G. c.–S. p. solidag*inetosum *virgaureae*** Averinova 2010 subass. prov.
Subass. ***G. c.–S. p. stipetosum pulcherrimae*** Averinova 2010 subass. prov.
Suballiance ***Bupleuro falcati–Gypsophilenion altissimae*** Averinova 2005
Ass. ***Stachyo rectae–Echinopetum ruthenici*** Averinova 2010 ass. prov.
Subass. ***S. r.–E. r. centauretosum ruthenicae*** Averinova 2010 subass. prov.
Subass. ***S. r.–E. r. stipetosum capillatae*** Averinova 2010 subass. prov.
Variants ***Astragalus onobrychis, typica***
Class ***Molinio–Arrhenatheretea*** R. Tx. 1937
Order ***Galietalia veri*** Mirkin et Naumova 1986
Alliance ***Scabioso ochroleucae–Poion angustifoliae*** Bulokhov 2001
Suballiance ***Koelerio cristatae–Thymenion marschalliani*** Averinova 2010
Ass. ***Astragalo danici–Koelerietum cristatae*** Averinova 2010
Subass. ***A. d.–K. c. typicum*** Averinova 2010
Subass. ***A. d.–K. c. eremogonetosum micradeniae*** Averinova 2010
Community ***Galium verum***

Forests take up less than 2% of the territory and grow in ravines and on watershed slopes. Forest vegetation is presented by steppificated oak forests of artificial origin. Forests take up 285 ha of Kulikovo Field territory. Many forest areas have the status of protected territories (Red Book of Protected Areas, 2007). The most common association is ***Lathyro pisiformis–Quercetum roboris***. Some mostly transformed plant communities do not have any syntaxonomical status («no rang» communities) (Semenishenkov and others, 2013). They are the stages of restoration of natural forest. The diversity of forest vegetation is represented below:

Class ***Querco–Fagetea*** Br.-Bl. et Vl. in Vl. 1937.
Order ***Quercetalia pubescenti–petraeae*** Klika 1933
Alliance ***Quercion petraeae*** Zolyomi ex Jakucs et Jakucs 1960
Ass. ***Lathyro pisiformis–Quercetum roboris*** ass. nov. prov.
Variants ***Prunus spinosa***, inops
facies ***Betula pendula***
Subvar. ***Hieracium murorum***
Variant ***typica***
Community ***Prunus spinosa–Quercus robur*** [***Quercetalia pubescenti–petraeae***]
Community ***Bromopsis inermis–Quercus robur*** [***Quercetalia pubescenti–petraeae***]
Order ***Fagetalia sylvaticae*** Pawł. in Pawł., Sokoł. et Wall. 1928
Community ***Carex pilosa–Quercus robur*** [***Fagetalia sylvaticae***]
Community ***Padus avium–Quercus robur*** [***Fagetalia sylvaticae***]
Community ***Poa angustifolia–Betula pendula***
Community ***Fragaria moschata–Quercus robur*** [***Querco–Fagetea***]

Vascular plant flora on the Kulikovo Field territory counts 705 species, with 484 species growing on protected territories. 47 of these species are protected (Red Book.., 2010). Among them are such plants as: *Adonis vernalis* L., *Allium flavescens* Bess., *Amygdalus nana* L., *Anthericum ramosum* L., *Artemisia armeniaca* Lam., *A. latifolia* Ledeb., *Aster amellus* L., *Astragalus onobrychis* L., *Asperula cynanchica* L., *Campanula altaica* Ledeb., *Centaurea ruthenica* Lam., *C. sumensis* Kalen., *Cotoneaster alaunicus* Golits., *Delphinium cuneatum* Stev. ex DC, *Dracocephalum ruyschiana* L., *Echinops ritro* L., *Galatella angustissima* (Tausch) Novopokr., *G. linosyris* (L.) Reichenb., *Gypsophila altissima* L., *Helianthemum nummularium* (L.) Mill., *Helictotrichon desertorum* (Less.) Nevski, *H. schellianum* (Hackel) Kitag., *Iris aphylla* L., Linum flavum L., *Oxytropis pilosa* (L.) DC., *Polygala sibirica* L., *Polygonum alpinum* All., *Prunella grandiflora* (L.) Scholl., *Scorzonera stricta* Hormen., *Spiraea crenata* L., *Stipa capillata* L, *S. pennata* L., *S. pulcherrima* C. Koch., *S. tirsa* Stev.

99 invasive species were registered during flora research (Khoroon, 2013).

The diversity of moss species is presented by 45 species, 37 of which grow on protected territories (Boychuck, Teleganova, 2013). The Kulikovo Field microbiota is presented by the 226 species of basidiomycetes and ascomycetes (Svetasheva, 2007, 2013). 72 species of lichens were found on the Kulikovo Field (Gudovicheva, 2010).

The 11 natural protected areas are located on the Kulikovo Field territory. The most valuable of them are "Srednyi Dubik" and "Tatinki". They are characterized by diverse forest and steppe vegetation and numerous rare species.

Protected area "***Srednyi Dubik***" is located on limestone slopes of Srednyi Dubik creek valley (Nepryadva river tributary) (Fig. 1). Forest vegetation is presented by oak forests "Skupoye" (37,3 ha), "Polugar" (5,8 ha), "Repnoye 1" (10,4 ha) and "Repnoye 2" (21,5 ha). The forest area is 75 ha. The forest vegetation is represented by assoc. ***Lathyro pisiformis–Quercetum roboris*** (with variants) and 4 communities: ***Bromopsis inermis–Quercus robur***, ***Carex pilosa–Quercus robur***, ***Padus avium–Quercus robur***, ***Fragaria moschata–Quercus robur*** with *Prunus spinosa*, *Cerasus fruticosa*, *Crataegus curvisepala*, *Brachypodium*

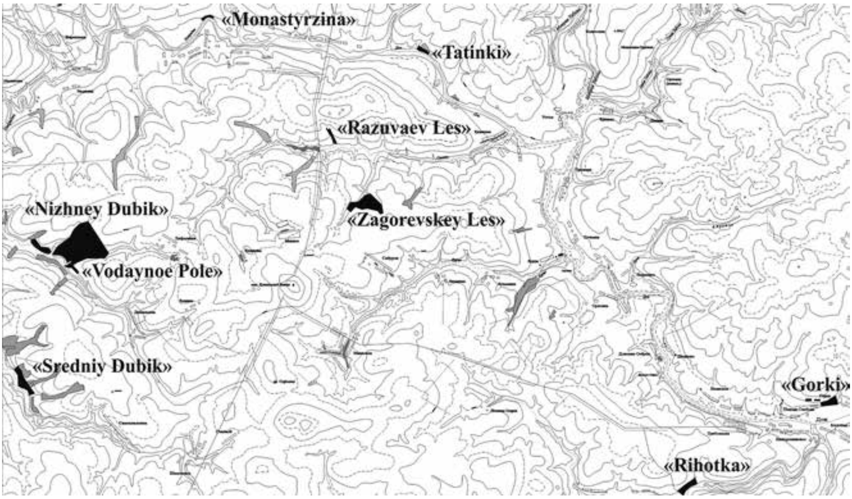

Fig. 1. The Location of Excursion Sites at Kulikovo Field (Tula Region)

pinnatum, *Carex montana*, *Brachypodium pinnatum*, *Campanula persicifolia*, *Carex montana*, *Laserpitium latifolium*, *Anthericum ramosum*, *Lilium martagon*, *Adenophora lilifolia*, *Veratrum nigrum*. The steppe vegetation (30 ha) is represented by 2 associations. ***Gentiano cruciatae–Stipetum pennatae*** and ***Stachyo rectae–Echinopetum ruthenici*** with *Adonis vernalis*, *Centaurea sumemsis*, *Anemone sylvestris*, *Iris aphylla*, *Gypsophila altissima*, *Linum flavum*, *Artemisia austriaca*, *Asperula cynanchica*, *Carex humilis*, *Scabiosa ochroleuca*, *Thymus marschallianus*, *Veronica jacquinii*, *Veronica spicata*. The flora counts 275 species of vascular plants and 12 species of mosses.

Protected area "***Tatinki***" is located on limestone slopes of the Don river valley (Fig. 1). Forest vegetation is presented by upland oak forest on the valley side slope. It is represented by assoc. ***Lathyro pisiformis–Quercetum roboris*** with *Aegopodium podagraria*, *Lysimachia nummularia*, *Rubus saxatilis*. The valley side slope features 20 ha of steppe vegetation, presented by assoc. ***Gentiano cruciatae–Stipetum pennatae*** with *Stipa pennata*, *Chamaecytisus ruthenicus*, *Carex humilis*, *Salvia pratensis*, *Lavatera thuringiaca*, *Vicia cracca*, *Centaurea jacea*, *Cirsium polonicum*. The flora counts 295 species of vascular plants and 12 species of mosses.

The most common and the rare species of vascular plants of these protected areas are given below.

Nowadays the fauna of the mentioned territory has a high diversity of terrestrial vertebrate species. 8 amphibian species, at least 3 species of reptiles, 97 bird species and 22 species of mammals are living here.

Table 1. Floristic catalogue

Achillea millefolium L.	*Lathyrus niger* (L.) Bernh.
Achillea nobilis L.	*Lathyrus pisiformis* L.

Acinos arvensis (Lam) Dandy
Actaea spicata L.
Adenophora liliifolia (L.) A. DC
Adonis vernalis L.
Aegopodium podagraria L.
Agrimonia eupatoria L.
Agrimonia hirsuta (Torr.) E. P. Bicknell
Agrostis tenuis Sibth.
Ajuga genevensis L.
Allium flavescens Bess.
Allium oleracium L.
Allium paniculatum L.
Allium rotundum L.
Amelanchier spicata (Lam.) C. Koch
Androsace septentrionalis L.
Anemone ranunculoides L.
Anemone sylvestris L.
Anthemis tinctoria L.
Anthericum ramosum L.
Anthyllis vulnararia L.
Arenaria micradenia P. Smirnov
Arenaria serpyllifolia L.
Artemisia absinthium L.
Artemisia armeniaca Lam.
Artemisia campestris L.
Artemisia latifolia Ledeb.
Asparagus officinalis L.
Asperula cynanchica L.
Asperula tinctoria L.
Aster amellus L.
Astragalus austriacus L.
Astragalus cicer L.
Astragalus danicus Retz.
Astragalus glycyphyllos L.
Atriplex nitens L.
Betonica officinalis L.
Brachypodium pinnatum (L.) Beauv.
Brachypodium sylvaticum (Huds.) Beauv.
Briza media L.
Bromopsis inermis (Leyss.) Holub.
Bromopsis riparia (Rehm.) Holub
Bunias orientalis L.
Calamagrostis arundianaceae (L.) Roth.
Calamagrostis epigeios (L.) Roth.
Lathyrus pratensis L.
Lathyrus sylvestris L.
Lathyrus vernus (L.) Bernh.
Lavatera thuringiaca L.
Leontodon autumnalis L.
Leontodon hispidus L.
Leucanthemum vulgare Lam.
Lilium martagon L.
Linum flavum L.
Lithospermum officinale L.
Lonicera tatarica L.
Lotus corniculatus L.
Lysimachia nummularia L.
Lysimachia vulgaris L.
Lythrum salicaria L.
Maianthemum bifolium (L.) F. W. Schmidt
Malus domestica Borkh.
Malus praecox (Pall.) Borkh.
Malva pusilla Schmith.
Medicago falcata L.
Medicago lupulina L.
Melampyrum nemorosum L.
Melandrium album (Mill.) Garcke
Melica nutans L.
Melilotus officinalis (L.) Pall.
Moehringia laterifolia (L.) Fenzl.
Moehringia trinervia (L.) Clairv.
Myosotis arvensis (L.) Hill.
Myosotis micrantha Pall.
Myosotis suaveolens Waldst. et Kit.
Neottia nidius-avis (L.) Rich.
Nepeta pannonica L.
Nonea pulla (L.) DC
Onobrychis arenaria (Kit.) DC
Origanum vulgare L.
Orobanche alba Steph.
Oxytropis pilosa (L.) DC
Padus avium Mill.
Paris quadrifolia L.
Pediculars kauffmanii Pinzger
Phleum phleoides (L.) Karst.s.l.
Phleum pratense L.
Phlomus tuberosa L.
Picris hieracioides L.

Campanula altaica Ledeb.
Campanula bononiensis L.
Campanula persicifolia L.
Campanula rapunculoides L.
Campanula rotundifolia L.
Campanula sibirica L.
Campanula trachelium L.
Caragana arborescens Lam.
Carduus acanthoides L.
Carex caryophyllea Latourr.
Carex contiqua Hoppe
Carex humilis Leyss.
Carex leporina L.
Carex montana L.
Carex pallescens L.
Carex pilosa Scop.
Carex supina Wahlenb.
Carum carvi L.
Centaurea jacea L.
Centaurea marshalliana Spreng.
Centaurea phrygia L.
Centaurea pseudophrygia C. A. Mey
Centaurea rithenica Lam.
Centaurea scabiosa L.
Cerastium arvense L.
Cerastium fontanum Baumg.
Cerasus fruticosa Pall.
Chaerophyllum prescottii DC.
Chamaecytisus ruthenicus Klaskova
Chenopodium album L.
Cirsium polonicum (Petrak) Iljin.
Clinopodium vulgare L.
Campanula glomerata L.
Campanula patula L.
Convallaria majalis L.
Convolvulus arvensis L.
Crataegus curvisepala Lindm.
Crepis sibirica L.
Cynoglossum officinale L.
Dactylis glomerata L.
Daucus carota L.
Delphinium cuneatum Stev. ex DC.
Deschampsia caespitosa (L.) P. Beauv.
Dianthus fischeria Spreng.
Pimpinella saxifraga L.
Plantago lanceolata L.
Plantago media L.
Platanthera bifolia (L.) Rich.
Poa angustifolia L.
Poa compressa L.
Poa nemoralis L.
Poa pratensis L.
Polygala comosa Schkuhr.
Polygala sibirica L.
Polygonatum multiflorum (L.) All.
Polygonatum odoratum (Mill.) Druce
Polygonum bistorta L.
Polygonum convulvulus L.
Potentilla alba L.
Potentilla arenaria Borkh.
Potentilla argentea L.
Potentilla goldbachii Rupr.
Potentilla heptaphylla L.
Primula veris L.
Prunella grandiflora (L.) Scholl.
Prunella vulgaris L.
Prunus spinosa L.
Pulmonaria angustifolia L.
Pulmonaria obscura Dumort.
Pyrethrum corymbosum (L.) Scop.
Pyrus communis L.
Quercus robur L.
Ranunculus acris L.
Ranunculus auricomus L.
Ranunculus cassubicus L.
Ranunculus polyanthemus L.
Rhamnus cathartica L.
Rosa canina L.
Rosa majalis Herrm.
Rubus caesius L.
Rubus idaeus L.
Rubus saxatilis L.
Rumex acetosella L.
Rumex confertus Willd.
Rumex obtusifolius L.
Rumex thyrsiflorus Fingerh.
Salvia pratensis L.
Salvia verticillata L.

Draba sibirica (Pall.) Thell.
Dracocephalum ruyschiana L.
Dryopteris carthusiana (Vill.) H.P.Fuchs.
Dryopteris filix-mas (L.) Schott.
Echinops ruthenicus Bieb.
Echium russicum J. Gmel.
Echium vulgare L.
Elytrigia intermedia (Host) Nevski
Elytrigia lolioides Nevski
Elytrigia repens (L.) Nevski
Epipactis helleborine (L.) Crantz.
Equisetum pratense Ehrh.
Equisetum sylvaticum L.
Eryngium planum L.
Erysimum cheiranthoides L.
Erysimum hieracifolium L.
Euonymus verrucosa L.
Euphorbia semivillosa Prokh.
Euphorbia subtilis Prokh.
Euphorbia virgata Waldst.
Euphrasia stricta D. Wolff ex J. F. Lehm.
Falcaria vulgaris Bernh.
Festuca pratensis Huds.
Festuca rubra L.
Festuca vallesiaca Gaud.
Filipendula vulgaris Moench.
Fragaria moschata (Duch.) Weston
Fragaria vesca L.
Fragaria viridis (Duch.) Weston
Frangula alnus Mill.
Gagea minima (L.) Ker-Gavl.
Galatella angustissima (Tausch.) Novopokr.
Galium aparine L.
Galium boreale L.
Galium mollugo L.
Galium verum L.
Genista tinctoria L.
Gentiana cruciata L.
Geranium pratense L.
Geranium sanguineum L.
Geranium sylvaticum L.
Geum urbanum L.
Grossularia reclinata (L.) Mill.
Gypsophilla altissima L.
Sambucus racemosa L.
Sangiosorba officinalis L.
Scabiosa ochroleuca L.
Scorzonera humilis L.
Scorzonera purpurea L.
Scorzonera stricta Hornem.
Scrophularia nodosa L.
Scutellaria hastifolia L.
Securigera varia (L.) Lassen
Sedum acre L.
Senecio integrifolius (L.) Clairv.
Senecio jacobaea L.
Serratula coronata L.
Serratula tinctoria L.
Seseli annuum L.
Silene chlorantha (Willd.) Ehrh.
Silene nutans L.
Silene viscosa (L.) Pers.
Silene vulgaris (Moench) Garcke
Solidago virgaurea L.
Sonchus arvensis (L.) Hill
Spiraea crenata L.
Stachus recta L.
Stellaria graminae L.
Stellaria holostea L.
Stipa capillata L.
Stipa pennata L.
Tanacetum vulgare L.
Taraxacum officinale L.
Thalictrum minus L.
Thesium arvense Horvat.
Thymus marshallianus Willd.
Tragopogon dubius Scop.
Trifolium alpestre L.
Trifolium arvense L.
Trifolium medium L.
Trifolium montanum L.
Trifolium pratense L.
Trifolium repens L.
Trinia multicaulis (Poir.) Schischk.
Trommsdorffia maculata (L.) Bernh.
Valeriana rossica P. Smirn.
Veratrum lobelianum Bernh.
Veratrum nigrum L.

Helianthemum nummularium (L.) Mill.
Helichrysum arenarium (L.) Moench.
Helictotrichon desertorum (Less.) Nevski
Helictotrichon pubescens (Huds.) Pilger
Helictotrichon schellianum (Hack.) Kitagawa.
Hieracium baihinii Bess.
Hieracium onegense Norrl.
Hieracium sylvularum Jord. Ex Boreau
Hieracium umbellatum L.
Hypericum elegans Steph. Ex Willd.
Hypericum hirsutum L.
Hypericum maculatum Crantz.
Hypericum perforatum L.
Inula hirta L.
Inula salicina L.
Iris aphylla L.
Jurinea arachnoidea Bunge
Knautia arvensis (L.) Coult.
Koeleria cristata (L.) Pers.
Laserpitium latifolium L.
Verbascum lychnitis L.
Verbascum nigrum L.
Verbascum phoeniceum L.
Veronica arvensis L.
Veronica chamaedrys L.
Veronica incana L.
Veronica jacquinii Baumg.
Veronica spicata L.
Veronica teucrium L.
Viburnum opulus L.
Vicia cracca L.
Vicia sepium L.
Vicia sylvatica L.
Vicia tenuifolia Roth
Vincetoxicum hirundinaria Medikk.
Viola canina L.
Viola hirta L.
Viola mirabilis L.
Viola riviniana Reichenb.
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Natural Conditions of the Streletsky Steppe (Kursk Region)

Nikolay Zolotukhin[1], Irina Zolotukhina[1], Alexandr Poluyanov[2], Tatiana Filatova[1]

zolotukhin@zapoved-kursk.ru

[1] Central Black Earth State Biosphere Reserve, Kursk, Russia
[2] Kursk State University, Kursk, Russia

Kursk region is situated on the boundary between broad-leaved forests (north-west part, forest cover is 13–14%) and forest-steppe vegetation zones. The forest-steppe vegetation is characterized by low forest cover – from 10% in south-west part to 1–3% in east part of region. The main tree species is oak. The steppe vegetation is conserved in the Central Black Earth Reserve.
Central Black Earth State Biosphere Reserve named after Professor V.V. Alyokhin was founded in 1935. It consists of six sections, located in the Kursk region. Its size is 5287,4 ha. The Streletsky site of the Reserve occupies 2046 ha in the Kursk district, 10 km south of Kursk (Fig. 1). Steppes, meadows and oak forests are represented on the site.

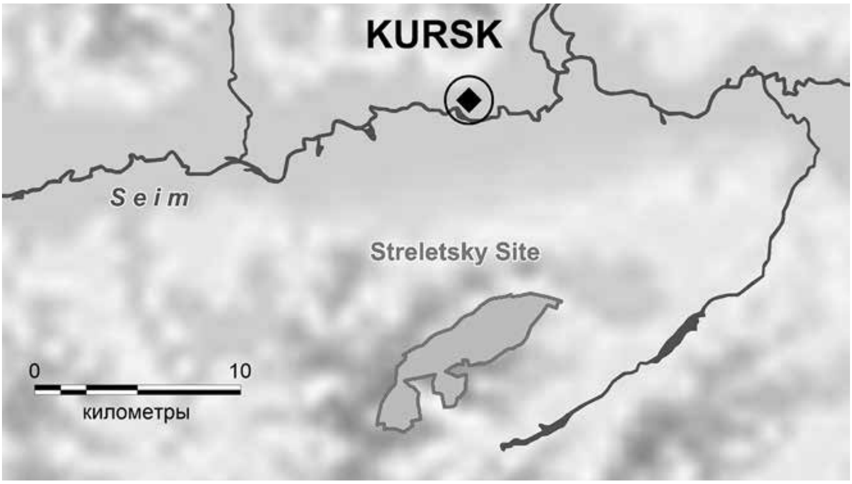

Fig. 1. The Location of Streletsky Steppe (Kursk Region)

The Streletsky Steppe is located in the West of the Central Russian Upland, in the middle of the forest-steppe zone, it belongs to the Dnieper basin. The climate of this territory is temperately cold. The average temperature during the overall observation period (from 1947 to 2013) is +5,8°C. The coldest month of the year is January, with the air temperature –7,8°C, and the warmest is July (+19°C). The Streletsky Steppe is located in a temperate humidity zone. The average yearly precipitation during the observation period is 572,8 mm. Considering the annual march of precipitation, the minimum occurs in February (29,3 mm), and the maximum in July (76,5 mm). The data were collected by the weather station of the Reserve.

The relief of the site is a typically erosional one, it is drained by ravines with multiple branches. The altitude of the Streletsky territory ranges between 177 and 262 meters above sea level. The parent material of soils is loessic loam underlain by chalk deposits.

The soils are presented mostly by typical and black soil (chernozyom). Top 10 centimeters of chernozyom contain up to 10–11 % of humus. The soil water regime of the Streletsky Steppe deep black soils is intermittently percolative. The groundwater is 12–14 meters deep. The soil is moistened by the atmospheric precipitation only. The virgin black soils of the Central Black Earth Reserve is the standard for evaluation of the degree of arable land degradation.

V.V. Alyokhin was the first to start studying the flora and vegetation of the Streletsky Steppe in 1907 (Alyokhin, 1909). Later his work was carried on by many other researchers. The Steppe was preserved from ploughing due to the fact that for several centuries it had been used for hay making and cattle grazing only (Alyokhin, 1909, 1940a, b).

Nowadays the upland part of the Streletsky Steppe, including the smooth hillside near the water-divide comprises 730 ha (Zolotukhin, Zolotukhina, 2001). It is the largest of all the zonal virginal meadow steppe masses that are preserved in the Eastern Europe. Approximately 140 ha of ravines are also a part of the Streletsky Steppe.

The Streletsky steppe has several modes of management: with mowing, with cattle grazing and «strictly protected» (no mowing and grazing). The mowing mode is the most traditional and covers the largest area. Nowadays several types of this mode are practiced: annual mowing; five-year mowing cycle without grazing (4 years of mowing, and no mowing in the fifth year); ten-year mowing cycle (9 years of mowing, and no mowing in the tenth year) with grazing on aftermath (Ryzhkova, 2012).

The Streletsky meadow steppe communities are characterized by an extremely rich biodiversity, which allowed V.V. Alyokhin to call this steppe "Kursk botanic anomaly". Researchers have registered up to 76–87 species of vascular plants for 1 square meter (Alyokhin, 1934, 1935; Golubev, 1962), and up to 98–120 plant species for 100 square meters.

The grass layer is notable for the high density of sward. The plants' foliage cover at the height of the vegetation development reaches up to 90–100%. The total above-ground phytomass in the mowing management mode can at certain years exceed 70–90 centner/ha (Sobakinskikh, 1997).

A rapid change of the plants' physiognomic appearance is specific of the meadow steppe. It is possible to determine up to 8–9 coloring phases during the vegetative season.

At the beginning of the last century the steppe was characterized by the predominance of herbs in the phytomass as well as in the number of species; graminoids also played a significant role in the communities structure, but they were less numerous in comparison with the herbs (Alyokhin, 1909, 1926, 1935). At present, broad-leaved long-rhizomatous grasses prevail in the phytomass of the upland Streletsky Steppe, while herbs and firm bunchgrasses are also largely represented.

According to the Braun-Blanquet ecologico-floristical approach, all the communities of the mowed flat Streletsky Steppe belong to one association – ***Stipo tirsae–Bromopsietum ripariae*** (Redulesku-Ivan 1965), (Averinova, 2010; Poluyanov, Averinova, 2012). The communities of the non-mowed Streletsky Steppe are also considered one association ***Polygonato odorati–Anemonetum sylvestris*** (Reduleskou-Ivan, 1965) nom. nov. prov. (syn. ***Bromus riparius+Stipa pennata–Herba*** Redulesku-Ivan 1965 nom. invalid., ***Bromus riparius–Herba*** Redulesku-Ivan 1965 nom. invalid.).

The Streletsky Steppe vegetation syntaxa prodromus

Class ***Festuco–Brometea*** Br.-Bl. et R. Tx. ex Soó 1947
- Order ***Festucetalia valesiacae*** Br.-Bl. et R. Tx. ex Br.-Bl. 1949
  - Alliance ***Festucion valesiacae*** Klika 1931
    - Suballiance ***Achilleo setaceae–Poenion angustifoliae*** Tkachenko et al. 1987
      - Ass. ***Stipo tirsae–Bromopsietum ripariae*** (Redulesku-Ivan 1965) Averinova 2010
      - Ass. ***Bupleuro falcati–Bromopsietum ripariae*** ass. nov. prov.
      - Ass. ***Nepeto pannonicae–Campanuletum bononiensis*** ass. nov. prov.

Class ***Trifolio–Geranietea sanguinei*** T. Müller 1962
- Order ***Origanetalia vulgaris*** Th. Müller 1962
  - Alliance ***Geranion sanguinei*** R. Tx. in T. Müller 1962
    - Ass. ***Polygonato odorati–Anemonetum sylvestris*** (Redulesku-Ivan 1965) nom. nov. prov.
    - Ass. ***Vicio craccae–Centauretum pseudophrygiae*** ass. nov. prov.

The steppe ravines are in the non-mowing management mode. The vegetation of their slopes is characterized by significant exposition distinctions. The vegetation communities of the north- facing slopes belong to the ***Vicio craccae–Centauretum pseudophrygiae*** association nov. prov. (Poluyanov, Dorofeyeva, 2013), while the associations ***Bupleuro falcati–Bromopsietum ripariae*** nov. prov. (Poluyanov and others, 2011; Poluyanov, Dorofeyeva, 2013) and ***Nepeto pannonicae–Campanuletum bononiensis*** ass. nov. prov. have been discribed on the south-facing slopes.

Since the foundation of the Central Black Earth Reserve (1935), 535 species of vascular plants have been registered in the Streletsky steppe taking into account only the flora of the flat watersheds without ravines. The largest families are: Asteraceae – 95, Rosaceae – 53, Poaceae – 52, Fabaceae – 36, Lamiaceae – 24 species; the largest genera are: Rosa – 12, Hieracium – 12, Viola – 10, Veronica – 9, Carex – 8, Galium – 8, Centaurea – 7, Campanula – 7, Crataegus – 6, Poa – 6, Potentilla – 6, Ranunculus – 6 species.

The plants are attributed to the ecophytocenological groups as follows: steppe species – 193, meadow species – 152, weeds – 86, forest species – 65, introduced and adventive species – 39. Weeds and adventive species do not play a significant role in the plant cover of the Streletsky Steppe, they mainly occur along the roads and on the pasture.

7 species of vascular plants that are listed in the Red Data Book of the Russian Federation (2008) grow in the Streletsky Steppe: *Iris aphylla* L. – often found in steppes and on forest borders, *Fritillaria ruthenica* Wikstr. – sometimes found in the steppe ravines and on forest borders, occasionally found in upland steppe, *Paeonia tenuifolia* L. – occasionally found in upland steppe, *Stipa dasyphylla* (Lindem.) Trautv. – small quantities of this plant are often found in steppe communities, *Stipa pennata* L. – large quantities of this plant are often found in upland steppe and on ravine slopes, *Stipa pulcherrima* C. Koch. – occasionally found in steppes and on ravine slopes, sometimes in large quantities, *Stipa zalesskyi* Wilensky s. l. (incl. *S. rubens* P. Smirn., *S. glabrata* P. Smirn.) – occasionally found on steppe slopes. *Fritillaria meleagris* L. is often found in large quantities on meadow slopes and in ravine bottoms.

32 more species of the Streletsky Steppe flora are listed in the Red Data Book of the Kursk region (2001). Of these species, the most common for upland steppes are: *Adonis vernalis* L., *Anemone sylvestris* L., Carex humilis Leyss., *Centaurea sumensis* Kalen., *Delphinium litwinowii* Sambuk (*D. cuneatum* auct. non Stev. ex DC.), *Echium russicum* J.F. Gmel., *Linum flavum* L., *Linum nervosum* Waldst. et Kit., *Linum perenne* L., *Prunella grandiflora* (L.) Scholl, *Pulsatilla patens* (L.) Mill., *Scorzonera purpurea* L., *Stipa tirsa* Stev. (*S. stenophylla* (Czern. ex Lindem.) Trautv.), *Valeriana rossica* P. Smirn.

The most common and the rare (listed in the Red Data Books of the Russia Federation and the Kursk region) species of vascular plants of the Streletsky steppe – 340 species – are given below.

In terms of species, the diversity of the Central Black Earth Reserve (6 sites) is represented by 1287 vascular plants, over 4 thousands insects, 191 spiders, 10 amphibians, 5 reptiles, 226 birds and 50 mammals.

Table 1. Floristic catalogue

Acer negundo L.	*Leontodon autumnalis* L. s. l.
Acer tataricum L.	*Leontodon hispidus* L.
Achillea millefolium L. s. l.	*Leonurus quinquelobatus* Gilib.
Achillea nobilis L.	*Leucanthemum vulgare* Lam.
Achillea setacea Waldst. et Kit. s. l.	*Linaria vulgaris* L.
Acinos arvensis (Lam.) Dandy	*Linum flavum* L.
Adonis vernalis L.	*Linum nervosum* Waldst. et Kit.
Aegopodium podagraria L.	*Linum perenne* L.
Agrimonia asiatica Juz.	*Lithospermum officinale* L.
Agrimonia procera Wallr.	*Lonicera tatarica* L.
Agrostis capillaris L.	*Lotus corniculatus* L. s. l.
Agrostis syreistschikowii P. Smirn.	*Lysimachia nummularia* L.
Ajuga genevensis L.	*Malus domestica* Borkh.
Allium flavescens Bess.	*Malus praecox* (Pall.) Borkh.

Allium oleraceum L.
Allium rotundum L.
Alopecurus pratensis L.

Amoria montana (L.) Sojak
Amoria repens (L.) C. Presl
Androsace septentrionalis L.
Anemone sylvestris L.
Anthemis tinctoria L. s. l.
Anthericum ramosum L.
Anthoxanthum odoratum L.
Anthriscus sylvestris (L.) Hoffm.
Anthyllis macrocephala Wend.
Arabidopsis thaliana (L.) Heynh.
Arenaria viscida Hall. fil. ex Lois.
Arrhenatherum elatius (L.) J. et C. Presl
Artemisia absinthium L.
Artemisia armeniaca Lam.
Artemisia austriaca Jacq.
Artemisia campestris L. s. l.
Artemisia vulgaris L.
Asparagus officinalis L. s. l.
Asperula cynanchica L.
Aster amellus L. s. l.
Astragalus cicer L.
Astragalus danicus Retz.
Atriplex patula L.
Ballota nigra L.
Barbarea vulgaris R. Br. s. l.
Berteroa incana (L.) DC.
Betula pendula Roth
Brachypodium pinnatum (L.) Beauv.
Briza media L.
Bromopsis inermis (Leyss.) Holub
Bromopsis riparia (Rehm.) Holub
Bromus japonicus Thunb.
Buglossoides arvensis (L.) Johnst.
Bunias orientalis L.
Bupleurum falcatum L.
Calamagrostis epigeios (L.) Roth
Campanula bononiensis L.
Campanula glomerata L. s. l.
Campanula patula L.
Campanula persicifolia L.
Medicago falcata L. s. l.
Medicago lupulina L.
Melampyrum argyrocomum (Fisch. ex Ledeb.) K.-Pol.
Melampyrum cristatum L.
Melandrium album (Mill.) Garcke
Myosotis arvensis (L.) Hill
Myosotis popovii Dobrocz.
Nepeta pannonica L.
Nonea rossica Stev.
Oberna behen (L.) Ikonn.
Odontites vulgaris Moench
Onobrychis arenaria (Kit.) DC.
Origanum vulgare L.
Oxytropis pilosa (L.) DC.
Padus avium Mill.
Paeonia tenuifolia L.
Pastinaca sylvestris Mill.
Pedicularis kaufmannii Pinzg.
Peucedanum oreoselinum (L.) Moench
Phleum phleoides (L.) Karst.
Phleum pratense L. s. l.
Phlomoides tuberosa (L.) Moench
Picris hieracioides L.
Plantago lanceolata L. s. l.
Plantago media L.
Plantago urvillei Opiz
Poa angustifolia L.
Poa compressa L.
Poa palustris L.
Polygala comosa Schkuhr
Polygonatum odoratum (Mill.) Druce
Polygonum aviculare L. s. l.
Populus tremula L.
Potentilla alba L.
Potentilla argentea L. s. l.
Potentilla goldbachii Rupr.
Potentilla humifusa Willd. ex Schlecht.
Potentilla patula Waldst. et Kit.
Potentilla recta L. s. l.
Primula veris L.
Prunella grandiflora (L.) Scholl.
Prunella vulgaris L.
Prunus spinosa L. s. l.

Campanula rapunculoides L.
Campanula rotundifolia L.
Campanula sibirica L.
Capsella bursa-pastoris (L.) Medik.
Caragana arborescens Lam.
Carduus acanthoides L.
Carduus hamulosus Ehrh.
Carduus thoermeri Weinm.
Carex caryophyllea Latourr.
Carex humilis Leyss.
Carex michelii Host
Carex praecox Schreb.
Carum carvi L.
Centaurea jacea L.
Centaurea pseudomaculosa Dobrocz.
Centaurea pseudophrygia C.A. Mey.
Centaurea scabiosa L.
Centaurea sumensis Kalen.
Cerastium holosteoides Fries
Cerasus fruticosa Pall.
Chamaenerion angustifolium (L.) Scop.
Chenopodium album L. s. l.
Chrysaspis aurea (Poll.) Greene
Cichorium intybus L.
Cirsium polonicum (Petrak) Jljin
Cirsium setosum (Willd.) Bess.
Cirsium vulgare (Savi) Ten.
Clematis integrifolia L.
Clematis recta L.
Clinopodium vulgare L.
Convolvulus arvensis L.
Conyza canadensis (L.) Cronq.
Crataegus curvisepala Lindm.
Crataegus monogyna Jacq. s. l.
Crataegus volgensis Pojark.
Crepis praemorsa (L.) Tausch
Cynoglossum officinale L.
Cytisus ruthenicus Fisch. ex Woloszcz.
Dactylis glomerata L.
Daucus carota L.
Delphinium litwinowii Sambuk
Dianthus andrzejowskianus (Zapal.) Kulcz.
Dianthus deltoides L.
Pulmonaria angustifolia L.
Pulsatilla patens (L.) Mill.
Pyrethrum corymbosum (L.) Scop.
Pyrus pyraster (L.) Burgsd.
Quercus robur L.
Ranunculus illyricus L.
Ranunculus pedatus Waldst. et Kit.
Ranunculus polyanthemos L.
Rhamnus cathartica L.
Rhinanthus aestivalis (N. Zing.) Schischk. et Serg.
Rosa canina L. s. l.
Rosa dumalis Bechst.
Rosa jundzillii Bess.
Rosa majalis Herrm.
Rosa mollis Smith
Rosa rubiginosa L.
Rosa subpomifera Chrshan.
Rosa villosa L.
Rubus idaeus L.
Rumex acetosa L.
Rumex acetosella L.
Rumex confertus Willd.
Rumex crispus L.
Rumex thyrsiflorus Fingerh.
Salix caprea L.
Salvia nutans L.
Salvia pratensis L.
Salvia verticillata L.
Sambucus nigra L.
Sambucus racemosa L.
Sanguisorba officinalis L.
Scabiosa ochroleuca L.
Scorzonera purpurea L.
Securigera varia (L.) Lassen
Sedum acre L.
Senecio erucifolius L.
Senecio jacobaea L.
Senecio schvetzovii Korsh.
Serratula lycopifolia (Vill.) A. Kerner
Serratula tinctoria L.
Seseli annuum L.
Seseli libanotis (L.) Koch
Silene chersonensis (Zapal.) Kleop.

Draba nemorosa L. s. l.
Draba sibirica (Pall.) Thell.
Dracocephalum ruyschiana L.
Echium russicum J.F. Gmel.
Echium vulgare L.
Elytrigia intermedia (Host) Nevski
Elytrigia repens (L.) Nevski
Eremogone micradenia (P. Smirn.) Ikonn.
Erigeron acris L.
Eryngium planum L.
Erysimum marschallianum Andrz.
Euphorbia sareptana A. Beck.
Euphorbia seguieriana Neck.
Euphorbia semivillosa Prokh.
Euphorbia subtilis Prokh.
Euphorbia virgata Waldst. et Kit.
Euphrasia pectinata Ten.
Falcaria vulgaris Bernh.
Fallopia convolvulus (L.) A. Löve
Festuca pratensis Huds.
Festuca rubra L.
Festuca valesiaca Gaudin s. l.
Filipendula vulgaris Moench
Fragaria vesca L.
Fragaria viridis (Duch.) Weston
Fraxinus lanceolata Borkh.
Fraxinus pennsylvanica Marsh.
Fritillaria ruthenica Wikstr.
Gagea erubescens (Bess.) Schult. et Schult. fil.
Galatella linosyris (L.) Reichenb. fil.
Galium aparine L.
Galium boreale L.
Galium mollugo L.
Galium tinctorium (L.) Scop.
Galium verum L. s. l.
Genista tinctoria L.
Gentiana cruciata L.
Geranium pratense L.
Geranium sanguineum L.
Geum urbanum L.
Gladiolus tenuis Bieb.
Glechoma hederacea L.
Gymnadenia conopsea (L.) R. Br.
Silene nutans L.
Sisymbrium loeselii L.
Sisymbrium polymorphum (Murr.) Roth
Solidago virgaurea L.
Sonchus arvensis L. s. l.
Sorbus aucuparia L.
Stachys annua L.
Stachys officinalis (L.) Trevis.
Stachys recta L.
Stellaria graminea L.
Steris viscaria (L.) Rafin.
Stipa capillata L.
Stipa dasyphylla (Lindem.) Trautv.
Stipa pennata L.
Stipa tirsa Stev.
Tanacetum vulgare L.
Taraxacum officinale Wigg. s. l.
Tephroseris integrifolia (L.) Holub
Thalictrum flexuosum Bernh. ex Reichenb.
Thalictrum lucidum L.
Thalictrum simplex L.
Thesium arvense Horvat.
Thesium ebracteatum Hayne
Thymus marschallianus Willd.
Thymus × *tschernjajevii* Klok. et Shost.
Torilis japonica (Houtt.) DC.
Tragopogon dubius Scop.
Tragopogon orientalis L.
Trifolium alpestre L.
Trifolium arvense L.
Trifolium medium L.
Trifolium pratense L.
Trinia multicaulis (Poir.) Schischk.
Tripleurospermum inodorum (L.) Sch. Bip.
Trollius europaeus L.
Trommsdorfia maculata (L.) Bernh.
Turritis glabra L.
Ulmus glabra Huds.
Ulmus laevis Pall.
Ulmus minor Mill.
Urtica dioica L.
Valeriana rossica P. Smirn.
Veratrum nigrum L.

Helichrysum arenarium (L.) Moench
Helictotrichon pubescens (Huds.) Pilg.
Helictotrichon schellianum (Hack.) Kitag.
Heracleum sibiricum L.
Hieracium bauhini Bess. s. l.
Hieracium pilosella L.
Hieracium praealtum Vill. ex Gochn. s. l.
Hieracium robustum Fries
Hieracium umbellatum L.
Hieracium virosum Pall.
Hyacinthella leucophaea (C. Koch) Schur
Hylotelephium stepposum (Boriss.) Tzvel.
Hypericum elegans Steph.
Hypericum perforatum L.
Inula britannica L.
Inula ensifolia L.
Inula hirta L.
Inula salicina L.
Iris aphylla L.
Jurinea arachnoidea Bunge
Knautia arvensis (L.) Coult.
Koeleria cristata (L.) Pers.
Koeleria delavignei Czern. ex Domin
Lactuca serriola L.
Lathyrus pisiformis L.
Lathyrus pratensis L.
Lavatera thuringiaca L.
Verbascum lychnitis L.
Verbascum marschallianum Ivanina et Tzvel.
Verbascum nigrum L.
Verbascum phoeniceum L.
Veronica chamaedrys L.
Veronica incana L.
Veronica jacquinii Baumg.
Veronica prostrata L.
Veronica serpyllifolia L.
Veronica spicata L.
Veronica spuria L.
Veronica teucrium L.
Veronica verna L.
Viburnum opulus L.
Vicia cracca L.
Vicia sepium L.
Vicia tenuifolia Roth
Vicia tetrasperma (L.) Schreb.
Vincetoxicum hirundinaria Medik. s. l.
Vincetoxicum rossicum (Kleop.) Barbar.
Viola accrescens Klok.
Viola ambigua Waldst. et Kit.
Viola arvensis Murr.
Viola canina L. s. l.
Viola hirta L.
Viola rupestris F.W. Schmidt
Xanthoselinum alsaticum (L.) Schur

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Natural Conditions of the Surroundings of the Stanitsa Veshenskaya (Rostov region)

Olga Demina[1], Valentina Fedyaeva[1], Tatiana Sokolova[2]

ondemina@yandex.ru

[1] Southern Federal University, Rostov-on-Don, Russia
[2] Institute of Arid Zones of the Southern Scientific Center, Rostov-on-Don, Russia

Rostov region is located in the south of the East European Plain. Its territory is a rolling terrain with elevation changes ranging from over 200 meters in the uplands and below 50 meters in the lowlands

Flat terrains with low uplands prevail on the protected territory of the Don river basin. According to the topographic features, we can single out the northern part, which is more elevated, and the southern part, which is relatively lower. The two parts are separated by the Lower Don river-valley. The highest uplands, presented by the outskirts of the Donetsky Kryazh, the Central Russian upland and the Yergen uplands, are located in the western, northern and south-eastern parts of the region respectively. The plain and the uplands outskirts are ploughed by the Don, Seversky Donets, Sal, Manych, Mius and Kagalnik river-valleys and their tributaries. This area is also covered with a network of ravines and gorges.

The predominance of temperate continental climate is caused by the region's geographical location in the south of the East European Plain. The main parameters of climate are temperature and precipitation ratio. The average yearly temperature in the region is 8,2°C, ranging from 9,5°C in the south and 6,5°C in the north. The average precipitation is 479 mm a year, of which the minimum of 340–360 mm falls on to the south-eastern areas, and the maximum of 500–525 mm – onto the western and south-western areas (Panov and others, 2006).

The soil cover consists of different types of soil (Environmental conditions, 2002). Black soil takes up the western part of the region. The black soil here is of two types – common black soil and southern black soil. Black soil is characterized by a high black mould humus level, high calcareousness and soil permeability.

Chestnut soils are shaped in the conditions of desert steppes. These soils develop with inconstant and insufficient atmospheric precipitation. Chestnut soils on the northern border of their range zone are similar to southern black soil and the ones on the southern border of their range zone are similar to brown desert-steppe soils. Salt marshes and sodic soils are formed as the result of chestnut soil salination.

Rostov region is located in the steppe zone. Steppes as an area-base vegetation type are characteristic of smooth and gently sloping watershed areas, where they develop on heavy clayey and loamy soils.

Two types of steppes are encountered in the region – herb-buhcngrass and bunchgrass steppes and desert-steppes. According to such reports as "The vegetation of the European part of the USSR" (1980) and "The steppes of Eurasia" by E. M. Lavrenko, the prevailing types of this region are: herb-bunchgrass steppes, presented by west-Black Sea and east-Black Sea regional types; and bunchgrass steppes, presented by west-Black Sea, east-Black Sea and trans-Volga and Kazakhstan steppes. Half-shrub-bunchgrass desert steppes are located in the south-east of the region.

As steppes used to be the dominant natural phenomena that took up about 90% of Rostov region (Gorbachyov, 1974; Demina, 2007), they were completely ploughed up. At present small fragments of preserved steppes are found upon untillable lands and take up about 16,6–17,3% of the whole region. This is caused by intensive human intervention.

The communities of intrazonal aquatic, semi-aquatic, swamp and meadow vegetation, as well as the communities of extrazonal forest vegetation and azonal halophytic vegetation develop in the negative landforms, such as river-valleys, ravines and lakes.

In this region we can find both authentic and steppe meadows, nonsaline and saline, as well as marshy ones (Gorbachyov, 1974). Aquatic vegetation takes up the open spaces of rivers, lakes and dam lakes.

Natural origin forests take up very little space – less than 1% of the overall territory (Zozulin, 1992). Man-made forests are widely spread. The overall forested area, including both natural origin and man-made forests, is 249,1 thousand ha. Forests are most common in the north, north-east, north-west and in the floodplains of the largest rivers. According to their topological position, they are classified as ravine, floodplain and sandy forest. There is no forest vegetation in the south-east of the region.

On the whole, the terrains, climate, soils and vegetation shape a unique and heterogeneous landscape structure of the region.

Stanitsa (the local Cossack term for a village) Veshenskaya is in the north of Rostov region, in Mid-Don region. This territory is a rolling plain. It includes the south-eastern branches of Central Russian upland with the datum level that reaches 237 m on the watershed of Mid and Lower Don, at the head of Kalitva and Tikhaya rivers. Kalachskaya upland is north of Mid-Don valley and the south of it is the Don chalk ridge, that gradually slopes into the low-inclined Don and Donetsk plain.

Eastern Black Sea steppes that E. M. Lavrenko also called north province subtype or Mid-Don steppes, are very common here. According to the phytogeographical province splitting of the Black Sea and Kazakhstan subregion of the Eurasia steppe region, they are included into the Mid-Don subprovince of the Black Sea steppe province (Lavrenko, 1970).

The diversity of dry grassland communities is presented by numerous different ones (Demina and others, 2013):

Syntaxa prodromus of steppe vegetation

Class ***Festuco–Brometea*** Br.-Bl. et Tx. 1943

Order ***Festucetalia valesiacae*** Br.-Bl. et Tx. 1943

Alliance ***Festucion valesiacae*** Klika 1931

Suballiance ***Festuco rupicolae–Stipenion pennatae*** Demina 2012

Ass. ***Trifolio alpestris–Stipetum tirsae*** Demina 2012

Subass. ***T. a.–S.t. typicum*** Demina 2012

Subass. ***T. a.–S.t. echietosum russici*** Demina 2012

Subass. ***T. a.–S. t. stachyetosum officinali*** Demina 2012

Subass. ***T. a.–S. t. linetosum nervosi*** Demina 2012

Ass. ***Artemisio marschallianae–Stipetum dasyphyllae*** Demina 2012

Subass. ***A. m.–S. d. ferulagoetosum galbaniferi*** Demina 2012

Ass. ***Stipetum capillatae*** Dzjubaltowski 1925

Subass. ***S. c. stipetosum pennatae*** Kukovitza et al. 1998

Ass. ***Bellevalio sarmaticae–Stipetum pennata***e Demina 2012

Subass. ***B. s.–S. p. typicum*** Demina 2012

Subass. ***B. s.–S. p. pedicularietosum kaufmannii*** Demina 2012

Subass. ***B. s.–S. p. centauretosum ruthenicae*** Demina 2012

Suballiance ***Phlomenion pungentis*** Saitov et Mirkin 1991

Ass. ***Plantagini urvillei–Stipetum tirsae*** Demina 2012

Ass. ***Stipetum lessingianae*** Soó 1949

Ass. ***Astragalo asperi–Stipetum lessingianae*** ass. nov. prov.

Petrophytic steppes develop on rank soils that appear on malmstones and chalks, and are presented by such communities as ***Astragalo albicaulis–Stipetum capillatae*** ass. nov. prov. and ***Astro amelli–Elytrigetum trichophorae*** ass. nov. prov. Petrophytic steppe dwarf semi-shrub communities of thymes and hyssops on Mid-Don chalk downs:

Class ***Helianthemo–Thymetea*** Romashchenko, Didukh et Solomakha 1996

Order ***Thymo cretacei–Hissopetalia cretacei*** Didukh 1989

Alliance ***Centaureo carbonatae–Koelerion talievii*** Romashchenko, Didukh et Solomakha 1996

Ass. ***Matthiolo fragrandis–Atraphaxietum frutescens*** ass. nov. prov.

Ass. ***Hedysaro cretacei–Melicetum transsilvanicae*** ass. nov. prov.

Ass. ***Lepidio meyeri–Scrophularietum cretacei*** ass. nov. prov.

Ass. ***Erysimo cretacei–Festucetum cretacei*** ass. nov. prov.

In the Seversky Donets basin:

Alliance ***Artemisio hololeucae–Hyssopion cretacei*** Didukh 1989

Ass. ***Artemisio hololeucae–Polygaletum cretaceae*** Didukh 1989.

Psammophytic vegetation develops on the sands in the river valleys of Don and its tributaries, and on the territory of Kazansko-Veshensky sand massif:

Class ***Festucetea vaginatae*** Soó ex Vicherek 1972

Order ***Festucetalia vaginatae*** Soó 1957

Alliance ***Festucion beckeri*** Vicherek 1972

Suballiance ***Chamaecytiso borysthenici–Artemisienion arenariae*** suball. nov. prov.

Ass. ***Koelerio sabuletori–Juniperetum sabinae*** Demina, Dmitriev, Rogal 2012

Ass. ***Chamaecytiso borysthenici–Thymetum pallasiani*** ass. nov. prov.
Ass. ***Artemisio arenariae–Festucetum beckeri*** ass. nov. prov.
Subass. ***A. a.–F. b. dianthetosum squarrosii*** subass. nov. prov.
Subass. ***A. a.–F. b. leymetosum racemosii*** subass. nov. prov.
Ass. ***Artemisio arenariae–Thymetum pallasiani*** Demina, Dmitriev, Rogal 2012
Subass. ***A. a.–T. p. linarietosum dulci*** subass. nov. prov.
Suballiance ***Stipo borysthenicae–Artemisienion marschallianae*** suball. nov. prov.
Ass. ***Artemisio marschallianae–Stipetum borysthenicae*** ass. nov. prov.
Ass. ***Centaureo marschallianae–Agropyretum lavrenkoani*** ass. nov. prov.

The State Museum-Reserve named after M. A. Sholokhov is in stanitsa Veshenskaya. Its territory has the status of protected landscape. The environment of this landscape is very diverse. Alongside with the surviving steppes, ravine forests are very common on the right bank of Mid-Don. This bank is the southern border of various steppe and forest species' habitats. Don valley slopes with their richest petrophytic vegetation of the chalk downs are very picturesque. Wide sandy terraces above the flood-plain with their quicksands, psammophytic vegetation, birch, alder, oak and pine forests. Flood-plain forests, river meadows, lakes and loop lakes are found in the flood-plain.

The following botanical and geological nature monuments of Sholokhovsky area are of especial great interest: "Veshensky oak" (a giant oak over 400 years old), a fragment of stipa-thyme-fescue steppe on the "Paniky" plot, 95-year-old sand plantings "Antipovsky bor", black alder massif on the "Chern" plot. The "Ostrovnoye" plot near stanitsa Veshenskaya has the status of specially protected area.

The flora of the Don chalk ridge and the Mid-Don left bank around stanitsa Veshenskaya is very diverse. This diversity is largely due to the fact that many boreal and nemoral plant species have the southern border of their habitats in the natural forests of this territory. On the whole, the flora counts 66 species of mosses and 1475 species of vascular plants (Babenko, Fedyayeva, 2001; Fedyayeva, 2004). Numerous rare and endangered plant species grow in the vicinity of the museum-reserve: *Crambe aspera* Bieb., *Anemone sylvestris* L., *Astragalus pubiflorus* (Pall.) DC., *Diplotaxis cretacea* Kotov, *Echium russicum* J.F.Gmel., *Erysimum cretaceum* (Rupr.) Schmalh., *Lepidium meyeri* Claus, *Centaurea ruthenica* Lam., *Hedysarum cretaceum* Fisch., *Crocus reticulatus* Stev. Ex Adam., *Iris pumila* L. *subsp. Taurica* (Llod) Rodion., *Linaria cretacea* Fisch. Ex Spreng., *Matthiola fragrans* Bunge, *Onosma tanaitica* Klok., *Tulipa biebersteiniana* Schult. &Schult.fil., *T. gesneriana* L., *Bellevalia sarmatica* (Pall. ex Georgi) Woronow, *Scrophularia cretacea* Fisch. Ex Spreng., *Hyssopus scretaceus* Dubjan., *Pulsatilla bohemica* (Skaliskỳ) Tzvel., *P. pratensis* (L.) Mill., *Polygala cretacea* Kotov, *Silene cretacea* Fisch. Ex Spreng., *Stipa borysthenica* Klok. Ex Prokud., *S. dasyphylla* (Lindem.) Trautv., *S. pennata* L., *S. pulcherrima* C. Koch, *S. tirsa* Stev., *S. ucrainica* P. Smirn., *S. zalesskii* Wilensky (Red Book.., 2004). The most common and the most rare species of vascular plants are given below.

The surroundings of the stanitsas Veshenskaya, Elanskaya, Lebyazyi Yar, Olshanskyi and Kalininskyi are characterized by different habitats (substrates) with assoc. ***Stipetum capillatae***, ***Trifolio alpestris–Stipetum tirsae***, ***Artemisio marschallianae–Stipetum dasyphyllae***, ***Stipetum lessinginae***, ***Astragalo ponticae–Brometum squarrosi***, ***Ajugo orientalis–Festucetum pseudovinae***, ***Astragalo asperi–Stipetum lessingianae***, ***Astragalo albicaulis–Stipetum capillatae***, ***Gypsophilo glomeratae–Artemisietum lerchinae***, ***Medicago romanicae–Stipetum ucrainicae*** are typical for "steppe" sites (class ***Festuco–Brometea***); assoc. ***Hedysaro cretacei–Melicetum transsilvanicae***, ***Lepidio meyeri–Scrophularietum cretacei***, ***Sileno borysthenicae–Hyssopetum officinali***, ***Artemisio hololeucae–Polygaletum cretaceae***, ***Genisto scythicae–Artemisietum salsoloidis*** occur on the chalk slopes (class ***Helianthemo–Thymetea***); assoc. ***Secalo–Stipetum borysthenicae***, ***Hieracio echioidis–Stipetum borysthenicae***, ***Artemisio arenariae–Festucetum beckeri***, ***Artemisio arenariae–Thymetum pallasiani*** occur on the sands (class ***Festucetea vaginatae***) (Fig. 1).

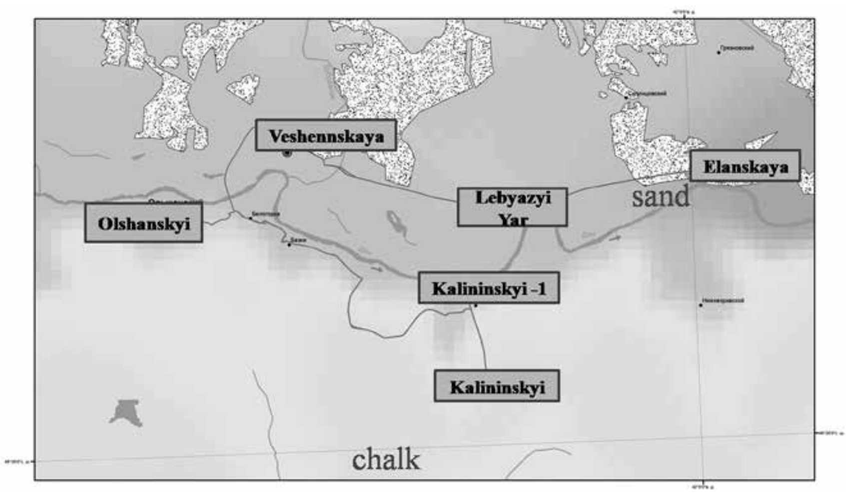

Fig. 1. The Location of Steppe Sites Near Stanitsa Veshenskaya (Rostov Region)

The species composition of the fauna in the vicinity of the museum-reserve named after M. A. Sholokhov is exceptionally rich. 67 mammal species, 161 bird species, 11 reptile species, 10 amphibian species and about 100 fish species live there. Over 40 of these species are of hunting and commercial value. Thus, the vicinity of stanitsa Veshenskaya is characterized by a high landscape and biological diversity.

Table 1. Floristic catalogue

Achillea leptophylla Bieb.
Achillea micrantha Willd.
Achillea nobilis L.
Achillea pannonica Scheele
Achillea setacea Waldst. & Kit.
Inula oculus-christi L.
Iris pumila L.
Isatis costata C. A. Mey.
Jurinea multiflora (L.) B. Fedtsch.
Jurinea arachnoidea Bunge

Achillea stepposa Klok. & Krytzka
Acinos arvensis (Lam.) Dandy
Adonis wolgensis Stev.
Aegilops cylindrica L.
Agropyron pectinatum (Bieb.) Beauv.
Agrostis maeotica Klok.
Allium flavescens Bess.
Allium inaequale Janka
Allium oleraceum L.
Allium sphaerocephalon L.
Alyssum gymnopodium P.Smirn.
Alyssum hirsutum Bieb.
Amoria montana (L.) Soják
Anchusa popovii (Gusul.) Dobrocz.
Androsace elongata L.
Anemone sylvestris L.
Anthemis subtinctoria Dobrocz.
Arabidopsis thaliana (L.) Heynh.
Arabidopsis toxophylla (Bieb.) N. Busch
Arenaria uralensis Pall. ex Spreng.
Artemisia arenaria DC.
Artemisia austriaca Jacq.
Artemisia marschalliana Spreng.
Artemisia nutans Willd.
Artemisia salsoloides Willd.
Asparagus polyphyllus Stev.
Asperula cynanchica L.
Asperula graveolens Bieb. ex Schult. & Schult.fil.
Asperula tephrocarpa Czern. ex M. Pop. & Chrshan.
Astragalus albicaulis DC.
Astragalus asper Jacq.
Astragalus cornutus Pall.
Astragalus henningii (Stev.) Klok.
Astragalus macropus Bunge
Astragalus onobrychis L.
Astragalus pseudotataricus Boriss.
Astragalus tanaiticus C. Koch
Astragalus testiculatus Pall.
Astragalus ucrainicus M.Pop. & Klok.
Bellevalia sarmatica (Pall. ex Georgi) Woronow
Bromopsis riparia (Rehm.) Holub
Bromus japonicus Thunb.
Jurinea cyanoides (L.) Reichenb.
Jurinea multiflora (L.) B. Fedtsch.
Jurinea polyclonos (L.) DC.
Kochia laniflora (S.G.Gmel.) Borb.
Kochia prostrara (L.) Schrad.
Koeleria cristata (L.) Pers.
Koeleria sabuletorum (Domin) Klok.
Lamium amplexicaule L.
Lappula patula (Lehm.) Menyharth
Lappula squarrosa (Retz.) Dumort.
Lepidium densiflorum Schrad.
Lepidium meyeri Claus
Leymus racemosus (Lam.) Tzvel.
Limonium bungei (Claus) Gamajun.
Limonium platyphyllum Lincz.
Linaria dulcis Klok.
Linaria genistifolia L.
Linaria macroura (Bieb.) Bieb.
Linaria vulgaris Mill.
Linum austricum L.
Linum ucrainicum (Griseb. ex Planch.) Czern.
Lolium perenne L.
Lotus olgae Klok.
Lotus ucrainicus Klok.
Marrubium praecox Janka
Matthiola fragrans Bunge
Medicago romanica Prod.
Melampyrum cretaceum Czern.
Microthlaspi perfoliatum (L.) F. K. Mey.
Mollugo cerviana (L.) Ser.
Myosotis micrantha Pall. ex Lehm.
Nepeta parviflora Bieb.
Onobrychis tanaitica Spreng.
Onosma subtinctoria Klok.
Ornithogalum fischeranum Krasch.
Ornithogalum kochii Parl.
Orobanche alba Steph.
Orobanche arenaria Borkh.
Orobanche bartlingii Griseb.
Orobanche caesia Reichenb.
Orobanche coerulescens Steph.
Orobanche cumana Wallr.

Buglossoides czernjajevii (Klok.) Czer.
Bupleurum falcatum L.
Bupleurum rotundifolim L.
Calamagrostis epigeios (L.) Roth
Calystegia lineatus L.
Camelina microcarpa Andrz.
Campanula sibirica L.
Camphorosma monspeliaca L.
Carduus acanthoides L.
Carduus hamulosus Ehrh.
Carex colchica J. Gay
Carex praecox Schreb.

Carex supina Wahlendb.
Carlina intermedia Schur
Centauerea carbonata Klok.
Centaurea gerberi Stev.
Centaurea pseudomaculosa Dobrocz.
Centaurea adpressa Ledeb.
Centaurea apiculata Ledeb.
Centaurea biebersteinii DC.
Centaurea diffusa Lam.
Centaurea majorovii Dumb.
Centaurea sophiae Klok.
Centaurium erythraea Rafn
Cephalaria uralensis (Murr.) Schrad. ex Roem. & Schult.
Cerastium semidecandrum L.
Ceratocarpus arenarius L.
Ceratocephala testiculata (Crantz) Bess.
Cerinthe minor L.
Chaenorhinum klokovii Kotov
Chenopodium urbicum L.
Chondrilla graminea Bieb.
Cleistogenes squarrosa (Trin.) Keng
Clematis pseudoflammula Schmalh. ex Lipsky
Clematis integrifolia L.
Consolida paniculata (Host) Schur
Corispermum hyssopifolium L.
Corispermum marschallii Stev.
Crepis ramosissima D'Urv.
Cynanchum acutum L.
Dianthus andrzejowskianus (Zapal.) Kulcz.

Orobanche purpurea Jacq.
Otites borysthenica (Grun.) Klok.
Otites chersonensis (Zapal.) Klok.
Otites densiflora (D'Urv.) Grossh.
Otites media (Litv.) Klok.
Otites sibirica (L.) Rafin.
Otites wolgensis (Hornem.) Grossh.
Oxytropis pilosa (L.) DC.
Papaver dubium L.
Peucedanum ruthenicum Bieb.
Peucedanum alsaticum L.
Peucedanum borysthenicum Klok. ex Schischk.
Peucedanum oreoselinum (L.) Moench
Peucedanum ruthenicum Bieb.
Phelipanche laevis (L.) Holub
Phleum phleoides (L.) Karst.
Phlomis pungens Willd.
Picris rigida Ledeb. ex Spreng.
Pimpinella titanophilla Woronow
Plantago arenaria Waldst. & Kit.,
Plantago lanceolata L.
Plantago maritima L.
Plantago urvillei Opiz
Poa angustifolia L.
Poa bulbosa L.

Poa crispa Thuill.
Polycnemum arvense L.
Polycnemum majus A.Br.
Polygala cretacea Kotov
Polygonum patulum Bieb.
Potentilla supina L.
Potentilla arenaria Borkh.
Potentilla argentea L.
Potentilla astracanica Jacq.

Potentilla heptaphylla Jusl.
Potentilla impolita Wahlenb.
Potentilla obscura Willd.
Potentilla orientalis Juz.
Potentilla patula Waldst. & Kit.
Potentilla recta L.
Potulaca oleracea L.

Dianthus campestris Bieb.
Dianthus capitatus Balb. ex DC.
Dianthus pallens Sibth. & Smith
Dianthus platyodon Klok.
Digitaria sanguinalis (L.) Scop.
Digitaria aegyptiaca (Retz.) Willd.
Digitaria ischaemum (Schreb.) Muell.
Diplotaxis cretacea Kotov
Draba nemorosa L.
Dracocephalum thymiflorum L.
Echinochloa caudata Roshev.
Echinops ruthenicus Bieb.
Echium russicum J. F. Gmel.
Echium vulgare L.
Elisanthe viscosa (L.) Rupr.
Elytrigia intermedia (Host) Nevski
Elytrigia trichophora (Link) Nevski
Equisetum ramosissimum Desf.
Eragrostis minor Host
Eremogone biebersteinii (Schlecht.) Holub
Eremogone longifolia (Bieb.) Fenzl
Eremopyrum orientale (L.) Jaub. & Spach
Eremopyrum triticeum (Gaertn.) Nevski
Erigeron podolicus Bess.
Erodium cicutarium (L.) L'Her.
Erophila verna (L.) Bess.
Erucastrum cretaceum Kotov
Erucastrum gallicum (Willd.) O. E. Schulz
Eryngium campestre L.
Erysimum cheiranthoides L.
Erysimum cretaceum (Rupr.) Schmalh.
Erysimum diffusum Ehrh.
Erysimum hieracifolium L.
Erysimum versicolor (Bieb.) Andrz.
Euphorbia seguieriana Neck.
Euphorbia kaleniczenkii Czern.
Euphorbia leptocaula Boiss.
Euphorbia petrophila C. A. Mey.
Euphorbia seguieriana Neck.
Euphorbia stepposa Zoz ex Prokh.
Euphrasia pectinata Ten.
Falcaria vulgaris Bernh.
Ferulago galbanifera (Mill.) Koch
Festuca beckeri (Hack.) Trautv.
Psammophiliella stepposa (Klok.) Ikonn.
Puccinellia distans (Jacq.) Parl.
Pulsatilla pratensis (L.) Mill.
Pulsatilla bohemica (Skaliskỳ) Tzvel.
Pulsatilla patens Mill.
Ranunculus illyricus L.
Ranunculus oxyspermus Willd.
Ranunculus polyanthemos L.
Reseda lutea L.
Rhinanthus minor L.
Rochelia retorta (Pall.) Lipsky
Salvia aethiopis L.
Salvia tesquicola Klok. & Pobed.
Salvia verticillata L.
Scabiosa ochroleuca L.
Scirpoides holoschoenus (L.) Soják
Scleranthus annuus L.
Scorzonera austriaca Willd.
Scorzonera ensifolia L.
Scorzonera stricta Hornem.
Scrophularia cretacea Fisch. ex Spreng.
Secale sylvestre Host
Securigera varia (L.) Lassen
Sedum acre L.
Sedum maximum (L.) Hoffm.
Sedum stepposum Boriss.
Senecio borysthenicus (DC.) Andrz.
Serratula erucifolia (L.) Boriss.
Seseli libanotis (L.) Koch
Seseli tortuosum L.
Silene sibirica (L.) Pers.
Silene supina L.
Silene tatarica (L.) Pers.
Sisymbrium polymorphum (Murr.) Roth
Stachys atherocalyx C. Koch
Stipa borysthenica Klok. exProkud.
Stipa capillata L.
Stipa dasyphylla (Lindem.) Trautv.
Stipa pennata L.
Stipa pulcherrima C.Koch
Stipa tirsa Stev.
Syrenia cana (Pill. & Mitt.) Neilr.
Syrenia montana (Pall.) Klok.
Taraxacum erythrospermum Andrz.

Festuca cretacea T. Pop. & Proskor.
Festuca pseudovina Hack. exWeisb.
Festuca regeliana Pavl.
Festuca rupicola Heuff.
Festuca valesiaca Gaudin
Ficaria stepporum P. Smirn.
Filago arvensis L.
Filipendula vulgaris Moench
Fragaria viridis Duch.
Fritillaria ruthenica Wikstr.
Galatella angustissima (Tausch) Novopokr.
Galatella villosa (L.) Reichenb.
Galium humifusum Bieb.
Galium octonarium (Klok.) Soó
Galium verum L.
Glaucium corniculatum (L.) J.Rudolph
Gnaphalium rossicum Kirp.
Goniolimon tataricum (L.) Boiss.
Gypsophila altissima L.
Gypsophila paniculata L.
Hedysarum cretaceum Fisch.
Helichrysum arenarium (L.) Moench
Herniaria besseri Fisch. ex Hornem.
Herniaria glabra L.
Herniaria polygama J.Gay
Hieracium echioides Lumn.
Hieracium pilosella L.
Hieracium umbellatum L.
Hieracium vaillantii Tausch
Hieracium virosum Pall.
Hierochloë stepporum P. Smirn.
Hordeum leporinum Link
Hypericum elegans Steph.
Hypericum perforatum L.
Hyssopus cretaceus Dubjan.
Inula aspera Poir.
Inula hirta L.
Taraxacum officinale Wigg.
Teucrium polium L.
Thalictrum minus L.
Thesium arvense Horvat.
Thymelaea passerina (L.) Coss. & Germ.
Thymus calcareus Klok. & Shost.
Thymus pallasianus H.Br.
Tragopogon dasyrhynchus Artemcz.
Tragopogon desertorum (Lindem.) Klok.
Tragopogon ucrainicus Artemcz.
Tragus racemosus (L.) All.
Tribulus terrestris L.
Trifolium alpestre L.
Trifolium arvense L.
Trinia hispida Hoffm.
Trinia multicaulis (Poir.) Schischk.
Turritis glabra L.
Valeriana officinalis L.
Valeriana tuberosa L.
Verbascum densiflorum Bertol.
Verbascum phoeniceum L.
Veronica dillenii Crantz
Veronica barrelieri Schott.
Veronica incana L.
Veronica jacquinii Baumg.
Veronica orchidea Crantz
Veronica spicata L.
Vincetoxicum cretaceum (Pobed.) Wissjul.
Vincetoxicum hirundinaria Medik.
Vincetoxicum maeoticum (Kleop.) Barbar.
Viola ambigua Waldst. & Kit.
Viola arvensis Murr.
Viola collina Bess.
Viola kitaibeliana Schult.
Viola rupestris F.W. Schmidt
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