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Stephen Venn, University of Łódź, Poland
Frank Yonghong Li, Inner Mongolia University, China
Jianshuang Wu, Chinese Academy of Agricultural Sciences, China

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The respective authors are solely responsible for the contents of their contributions in this book.

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As the largest continent of the world, Asia offers great opportunities for researchers with its vast grasslands, diverse and unique environmental conditions, rich biodiversity, and varied ecological and evolutionary processes, some of which are not observed elsewhere. Simultaneously, it poses great challenges for nature conservation and sustainable livelihoods due to climatic and land use changes. With the Asian Grassland Conference (AGC 2022), we aim to bring latest works on research and conservation of Asian Grasslands together. We invite researchers from all over the world to the very first Asian Grassland Conference to present or listen to studies on the flora, fauna, biodiversity, ecology, management and conservation of these precious habitats.

The conference takes place during three-half days on an online platform from 19th to 21st April 2022. We are happy to host ca. 180 participants from more than 17 countries from Asia and elsewhere. Besides keynote talks, regular oral presentations and speed-talks with posters, the conference offers networking events, workshops and happy hours. In conjunction with the conference, we also plan to produce Special Features in a number of international peer-reviewed scientific journals.

Participation in the Asian Grassland Conference is free of charge owing to generous contributions of IAVS and Inner Mongolia University. The organization of this online conference would not be possible without their financial support. We thank to our sponsors for supporting special events of the AGC 2022: Frontiers in Ecology an Evolution, Grassland Research and Pensoft.

We are grateful to three distinguished scientists who agreed to give plenary talk in our conference: Prof. Norbert Hölzel from Institute of Landscape Ecology, University of Münster, Germany; Prof. Shuli Niu from the Institute of Geographic Science and Natural Resources Research, Chinese Academy of Science, China and Prof. Zhigang Jiang from Institute of Zoology, Chinese Academy of Sciences, China.

AGC 2022 offers a diversity of special events, thanks to several colleagues for being in front or back of the stage. We’d like to thank all editors joining the Meet the Editors event for sharing their valuable information and experience about publishing grassland papers in high-impact journals: Tolgyesi Csaba, Jürgen Dengler, Dunlian Qiu, Orsolya Valkó, Jianshuang Wu, Jianguo Wu and Yanpei Wu. Furthermore we thank several colleagues who took part in the organization of the special events: Idoia Biuruun and Riccardo Guarino for the organization and facilitation of the workshop, Rocco Labradessa for designing the conference calls, thank Edy Fantinato and all the jury members for organising the photo competition, and Falko Glöckler for preparing the registration tool. Coin Turizm from Turkey worked as a secretary, did the technical management of the event and prepared the layout of this book. We thank them for their work. We thank Chenrui Guo for providing support during the live event. Finally we’d like to thank the Scientific Committee and EDGG Executive Committee 2021-2023 for support from the beginning of the organization.

We are very excited to come together with researchers and conservationists all around Asia. We hope the conference will contribute to collaboration and information exchange for further research and conservation of grassland habitats in Asia.

Asian Grassland Conference Organising Committee

Didem Ambarlı, Alla Aleksanyan, Stephen Venn, Frank Yonghong Li and Jianshuang Wu
## CONFERENCE PROGRAM

**19 April 2022, Day 1**

*A participant of the Young Investigator Competition*

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<td>09:15-10:30</td>
<td>14:15-15:30</td>
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<td><strong>Keynote Talk by Prof. Shuli Niu</strong>&lt;br&gt;Chair: DİDEM AMBARLI</td>
<td><strong>Regular Talk Session: Biodiversity of grasslands</strong>&lt;br&gt;Chair: ALLA ALEKSANYAN</td>
<td><strong>Regular Talk Session: Ecology and taxonomy of grassland animals</strong>&lt;br&gt;Chair: BALAZS DEAK</td>
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<td>10:30-11:15</td>
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<td><strong>Regular Talk Session: Vegetation distribution, mapping and classification</strong>&lt;br&gt;Chair: RICCARDO GUARINO</td>
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<td>10:30-10:45</td>
<td>15:30-15:45</td>
<td>07:30-07:45</td>
<td>Oral Presentation 18&lt;br&gt;The GrassPlot database: collecting and analyzing multi-scale and multi-taxon vegetation-plot data from Palearctic grasslands and other open habitats, Jürgen Dengler</td>
<td>Oral Presentation 12&lt;br&gt;Classification of Armenian dry grasslands: first insights into their syntaxonomy, Denys Vynokurov</td>
<td>Oral Presentation 01&lt;br&gt;Has Endangered Anatolian Chamois a Future at Lesser Caucasus Alpine Grasslands?, Hüseyin Ambarli</td>
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<td>10:45-11:00</td>
<td>15:45-16:00</td>
<td>07:45-08:00</td>
<td>Oral Presentation 39&lt;br&gt;Species-area relationships and fine-grain beta diversity in Palearctic grasslands, Iwona Dembičz</td>
<td>Oral Presentation 40&lt;br&gt;Floristic and syntaxonomic diversity of chalk outcrops of An-Ural plateau and adjacent territories, Yaroslav Golovanov</td>
<td>Oral Presentation 28&lt;br&gt;Review of the conservation status of subterranean mammals in the Eurasian grasslands – are they at risk?, Orsolya Maldovan</td>
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<td>11:00-11:15</td>
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<td>08:00-08:15</td>
<td>Oral Presentation 17&lt;br&gt;Scale dependence of species-area relationships is widespread but generally weak in Palearctic grasslands, Jinghui Zhang</td>
<td>Oral Presentation 08&lt;br&gt;Biogeographical patterns of the grasslands' syntax distribution in the Northern Eurasia, Elena Belonovskaya</td>
<td>Oral Presentation 19&lt;br&gt;Effects of grazing and mowing on butterfly diversity, a case study from the East of Turkey, Evrim Karaçetin</td>
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<td>11:15-11:45</td>
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<td><strong>BREAK</strong></td>
<td><strong>Regular Talk Session: Livelihoods and sustainability of pastoral communities</strong>&lt;br&gt;Chair: JIANSHUANG WU</td>
<td><strong>Regular Talk Session: Grassland conservation, management and restoration</strong>&lt;br&gt;Chair: HÜSEYİN AMBARLI</td>
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<td><strong>Regular Talk Session: Ecology and taxonomy of plant and fungi species</strong>&lt;br&gt;Chair: ALLA ALEKSANYAN</td>
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<td>11:45-12:00</td>
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<td>08:45-09:00</td>
<td>Oral Presentation 07&lt;br&gt;Assessing the Roles of Nitrogen, Biomass, and Niche Dimensionality as Drivers of Species Loss in Grassland Communities, Nir Band (*YIC)</td>
<td>Oral Presentation 31&lt;br&gt;Household poverty evaluation and prediction in pastoral areas, Peng Han (*YIC)</td>
<td>Oral Presentation 11&lt;br&gt;Legacy of prehistoric civilisations strengthens the system of protected areas: A global synthesis of conservation role of steppic burial mounds, Balázs Dedek</td>
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<td>12:00-12:15</td>
<td>17:00-17:15</td>
<td>09:00-09:15</td>
<td>Oral Presentation 21&lt;br&gt;Grazing-induced biodiversity loss impairs grassland ecosystem stability at multiple scales, Maowei Liang</td>
<td>Oral Presentation 34&lt;br&gt;Governance and livelihood adaptations of agro-pastoral communities residing in a resource scarce landscape, Shivani Barthwal</td>
<td>Oral Presentation 22&lt;br&gt;Promoting high mobility of herders is key to rangeland conservation in the Dzungarian Gobi, Mongolia, Lena Michler</td>
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<td>12:15-12:30</td>
<td>17:15-17:30</td>
<td>09:15-09:30</td>
<td>Oral Presentation 32&lt;br&gt;Grass phytoliths in discriminating rainfall zones of northern Western Ghats, Maharashtra, India, Ranita Biswas</td>
<td>Oral Presentation 38&lt;br&gt;Private CBA analysis of herders' mobility in central and eastern parts of Mongolia, Sugar Damdindorj</td>
<td>Oral Presentation 41&lt;br&gt;Soil cracking is a critical turning point in the collapse processes of Kobresia ecosystems on Tibetan Plateau, Yujie Niu (*YIC)</td>
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<td>12:30-13:30</td>
<td>17:30-18:30</td>
<td>09:30-10:30</td>
<td><strong>Speed Talk (Poster) Session and Q&amp;A: Biodiversity of grasslands</strong>&lt;br&gt;Chairs: JÜRGEN DENGLER, ALIREZA AQINEZAD</td>
<td><strong>Speed Talk (Poster) Session and Q&amp;A: Livelihoods and sustainability of pastoral communities</strong>&lt;br&gt;Chairs: RICCARDO GUARINO, JIANSHUANG WU</td>
<td><strong>Speed Talk (Poster) Session and Q&amp;A: Grassland conservation, management and restoration</strong>&lt;br&gt;Chairs: HÜSEYİN AMBARLI, DİDEM AMBARLI</td>
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<td>Poster Presentation 04&lt;br&gt;Plant diversity of subalpine and alpine zones of high mountains of Fereydunshahr (Central Zagros, Iran), Ali Bagheri</td>
<td>Poster Presentation 29&lt;br&gt;A study on greenhouse gas emissions from mounds made by plateau zokor (Eospalax baileyi) on the Qinghai–Tibet Plateau, Zhuangsheng Tang</td>
<td>Poster Presentation 71&lt;br&gt;Legacy of prehistoric civilisations strengthens the system of protected areas: A global synthesis of conservation role of steppic burial mounds, Balázs Dedek</td>
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## 19 April 2022, Day 1
* A participant of the Young Investigator Competition

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<td>Poster Presentation 06</td>
<td>Poster Presentation 33</td>
<td>Poster Presentation 23</td>
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<tr>
<td>Floristic composition of plant communities of rare species of the steppe belt of the Northern Tian Shan, Kanime Abidkulova</td>
<td>Climatic conditions for the distribution of steppe vegetation in western Mongolia, Kohei Suzuki</td>
<td>Small mammals on the Qinghai-Tibet Plateau: grassland pest or keystone species, Limin Hua</td>
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<td>Poster Presentation 09</td>
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<tr>
<td>Plant diversity of Golestankoo area in Isfahan province, Iran, Azadeh Akhavan Roofigar</td>
<td>The impacts of heavy grazing on plant diversity at tuz lake salt steppes, Ahmet Emre Yaprak</td>
<td>Rare and endangered species of mammals of the kostanay region (Kazakhstan) and their current status, Tatyana Bragina</td>
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<td>Poster Presentation 20</td>
<td>Poster Presentation 21</td>
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<tr>
<td>Geographical distribution and drivers of biodiversity in Inner Mongolia, Gang Feng</td>
<td>Mongolian herders’ ecological understanding in their landscape and landscape change, Gantuya Botdelger</td>
<td>Results of monitoring of reintroduced species in primary seed production sites in the foothills of Uzbekistan, Tolibjon Mukimov</td>
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<td>Poster Presentation 64</td>
<td>Poster Presentation 36</td>
<td>Poster Presentation 51</td>
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<tr>
<td>High-elevation halophytic communities in the Pamir Mountains, Central Asia – habitat requirements and distribution via ecological niche modeling, Anna Wróbel (*YIC)</td>
<td>On the Defining Role of the Steppe in the Formation of Humanity: Stepnism as an Innovative Convergent Doctrine, Sergey Levykin</td>
<td>The only way to increase pasture productivity, Tolibjon Mukimov</td>
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<td>16:30-18:00</td>
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<td>Land use alters relationships of grassland productivity with plant and arthropod diversity in Inner Mongolian grassland, Xinyu Wang</td>
<td>Sustainability of pasture horse breeding (pastoral communities) in the production of environmentally friendly food and the development of ecotourism, Sergey Levykin</td>
<td>Summer grazing of three herbivore species at moderate intensity enhances the primary productivity and drives the divergence in community structure of a semi-arid steppe, Yanlong Li (*YIC)</td>
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<td>18:30-20:00</td>
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<td>Poster Presentation 60</td>
<td>Poster Presentation 55</td>
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<td>Red List of endemic vascular plants of Iran with approach in devising conservation priorities, Sina Kholvati (*YIC)</td>
<td>Dynamic Study on the Effect of Oats Mixed with Vicia villosa var. glabrescens, Qian Liu</td>
<td>Effect of Potassium Silicate Fertilization on Miscanthus sinensis Community Structure and Physical Properties of Thatch, Yuto Inoshima (*YIC)</td>
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### BREAK

#### 14:00-15:30
WORKSHOP
Introduction to EDGG and Grassplot Database
Chairs: JÜRGEN DENGLER, IWONE DEMIBCZ, ROCCO LABRADESSA

#### 14:00-16:30
HAPPY HOUR
Join us at https://app.wonder.me/?spaceId=c4d0142a-a300-464b-a0a7-051fa6963c3
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<td>09:15-10:30</td>
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<td>KEYNOTE TALK by Prof. Norbert Hözel</td>
<td>REGULAR TALK SESSION: Biodiversity of grasslands</td>
<td>REGULAR TALK SESSION: Grassland ecosystems under global change</td>
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<td>Chair: ALIREZA NAQINZEHAD</td>
<td>Chair: MARCELO STERNBERG</td>
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<td>ORAL PRESENTATION 02</td>
<td>ORAL PRESENTATION 14</td>
<td>ORAL PRESENTATION 16</td>
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<tr>
<td>Scale-dependent patterns and drivers of plant diversity in steppe grasslands of the Central Alborz Mts., Iran, Amir Talebi</td>
<td>The Use of digital maps of forestry and CORINE to generate the first steppe map of Turkey, Didem Ambarlı</td>
<td>The Coexistence of Wolves and People in Grasslands of Central Asia, Özgün Emre Can</td>
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<td>ORAL PRESENTATION 16</td>
<td>ORAL PRESENTATION 21</td>
<td>ORAL PRESENTATION 25</td>
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<tr>
<td>Effects of climate and grazing on plant diversity and forage condition in eastern Mongolian steppe, Yun Jäschke</td>
<td>Plant biogeography and vegetation types of the Zagros mountain range, Jollí Noroozi</td>
<td>The Coexistence of Wolves and People in Grasslands of Central Asia, Özgün Emre Can</td>
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<td>ORAL PRESENTATION 13</td>
<td>ORAL PRESENTATION 27</td>
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<tr>
<td>Compared to soil bacterial and fungal diversity, mowing significantly mitigate the adverse effects of fertilization on plant diversity in grassland, Fengshi Li</td>
<td>Long-term grazing effects on grassland in Mongolia: Variation among steppe types, Munkhzul Oyunbileg</td>
<td>The Coexistence of Wolves and People in Grasslands of Central Asia, Özgün Emre Can</td>
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<tr>
<td>Can active restoration priming and improving self-restoring in extremely degraded alpine meadows?, Zhanhuan Shang</td>
<td>How land cover changes and land use intensity affect ecosystem services and their relationships in the Wulagai River Basin of Inner Mongolia, China, Chenwei Chang</td>
<td>The Coexistence of Wolves and People in Grasslands of Central Asia, Özgün Emre Can</td>
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| Chairs: FRANK YONGHONG LI, DIDEM AMBARLI | Chairs: ALLA ALEKSANYAN, STEPHEN VENN | Chairs: EVRİM KARAÇETİN, JIANSHUANG WU
## 20 April 2022, Day 2

*A participant of the Young Investigator Competition*

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<td>Poster Presentation 37</td>
<td>Poster Presentation 38</td>
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<td><strong>Comparison of embryo and nutrient loss in alfalfa seeds under long-term storage conditions,</strong> Jiaqing Li (<em>YIC</em>)</td>
<td><strong>STEPPE VEGETATION OF MOUNTAIN RANGES IN THE SOUTHEAST OF KAZAKHSTAN,</strong> Lillya Dimeyeva</td>
<td><strong>The influence of fertilization type and environmental variables on soil mite community structures from grasslands,</strong> in Romania, Minodora Manu</td>
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<td>Poster Presentation 54</td>
<td>Poster Presentation 52</td>
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<td><strong>Intraspecific differences of section on root head of siler (Saposhnikovia divaricata (Turcz.) Schischkin) in Mongolia,</strong> Azzaya Jukov</td>
<td><strong>Toward an Iranian national vegetation database: Vegiran,</strong> Alireza Naqinezhad</td>
<td><strong>Insights into the population genetics and evolutionary history of endangered Eld’s deer (Rucervus eldii),</strong> Mirza Ghafranfarullah Ghazi</td>
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<td><strong>Ethnobotany of Tajik non-forest plant communities - the extent of vegetation use and its implications,</strong> Marcin Kotowski</td>
<td><strong>Influence of Invasive and expanding Species on Carbon Storage in Grassland Ecosystems of Armenia,</strong> Alla Aleksanyan</td>
<td><strong>Consequences of the virgin megaproject and strategic approaches to the development of post-virgin steppe land use in the Urals and Siberia,</strong> Sergey Levykin</td>
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<td><strong>New alien invasive plant species in the flora of Adjara (Georgia),</strong> Irakli Mikeladze</td>
<td><strong>Germination responses to salinity and drought in the plants of the Central Anatolian Steppe,</strong> Cihan Ünal Değirmenci (<em>YIC</em>)</td>
<td><strong>Environmental determinants of graminoids in open vegetation types of Central Asia,</strong> Sebastian Świerszcz</td>
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<td><strong>Lava flows support high diversity of grassland plants including threatened species in a meadow area managed by burning,</strong> Airi Asada (<em>YIC</em>)</td>
<td><strong>Multi-data approach for identification of land degradation extent in Central Asia,</strong> Elizaveta Khazieva</td>
<td><strong>Factors causing intraspecific variation in functional traits of grassland species along an urban-rural gradient,</strong> Taichi Nakata (<em>YIC</em>)</td>
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<td><strong>Vegetation composition of wet grasslands of Kaziranga National Park,</strong> Assam, India, Monika Sharma Monika</td>
<td><strong>Spatiotemporal patterns of land use change and landscape ecological risk assessment in the Mongolian Plateau from 2001 to 2015,</strong> Jingpeng Guo (<em>YIC</em>)</td>
<td><strong>Soil texture mediates plant cover response to precipitation in temperate grasslands of China,</strong> Xiaotian Gao</td>
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<td><strong>Landscape context determines soil fungal diversity in a fragmented habitat,</strong> Suneir Suneir (<em>YIC</em>)</td>
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### BREAK

13:30-14:00
18:30-20:00
10:30-11:00 (GMT)

### WORKSHOP

**Workshop on the Vegetation Typologies in Asia**
**Chairs:** IDOIA BIURRUN, RICCARDO GUARINO

14:00-15:30
19:00-20:30
11:00-12:30 (GMT)

### HAPPY HOUR

Join us at https://app.wonder.me/?spaceId=c4d0142a-a300-464b-aa07-051f4a69b3c3

14:00-16:30
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<td>06:15-07:30</td>
<td><strong>Keynote Talk by Prof. Zhigang Jing</strong>&lt;br&gt;Chair: STEPHEN VENN</td>
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<td><strong>Regular Talk Session: Grassland conservation, management and restoration</strong>&lt;br&gt;Chair: JÜRGEN DENGLER</td>
<td><strong>Regular Talk Session: Vegetation distribution, mapping and classification</strong>&lt;br&gt;Chair: JALIL NÖROÖZİ</td>
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<td><strong>Speed Talk (Poster) Session and Q&amp;A:</strong>&lt;br&gt;Grassland conservation, management and restoration&lt;br&gt;Chair: DİDEM AMBARLI, ROCCO LABRADESSA</td>
<td><strong>Speed Talk (Poster) Session and Q&amp;A:</strong>&lt;br&gt;Ecology and taxonomy of plant and fungi species&lt;br&gt;Chairs: JALIL NÖROÖZİ, ALLA ALEKSANYAN</td>
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<td>The assessment of heavily overgrazed mountain pastures with use of satellite and ground data, Dmitry Malakhov</td>
<td>Gramineous fraction in some arid ecosystems of Armenia, Anahit Ghukasyan</td>
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<td>Invasive plant species as threat to rare grassland's ecosystems, George Fayvush</td>
<td>Diversity of feather grasses (Poaceae: Stipa) in grasslands of Central Asia, Marcin Nobis</td>
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<td>Verification of goat eating behavior in Mongolian grasslands using biologging real-time grazing analysis, Kiyokazu Kawada</td>
<td>Effects of Different seed Soaking Treatments on seed Viability and Germination Characteristics of Qinghai Poa pratensis (Poa pratensis L. cv. Qinghai), Xianze Hua (<em>YIC</em>)</td>
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## CONFERENCE PROGRAM

### 21 April 2022, Day 3

* A participant of the Young Investigator Competition

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<td>Effects of continuous digging on the community dominated by the invasive alien species giant goldenrod on the Kirigamine Heights, Kumiko Okubo</td>
<td>Micro-morphometric variability and significance of bilobate grass phytoliths from coastal grasslands, West Bengal, India, Madhav Maskar</td>
<td>Plant-pollinator network dynamics and pollination services in the process of grassland restoration, Goku Hirayama (<em>YIC)</em></td>
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<td>Mixed grazing at moderate grazing intensity significantly improves ANPP and community stability in alpine grasslands on the Qinghai-Tibet Plateau, Yuzhen Liu (<em>YIC)</em></td>
<td>Food CWR resources in the non-forest plant communities of Tajikistan, Marcin Kotowski</td>
<td>Effects of dung arthropods and precipitation on decomposition of different grazing livestock dung in a semi-arid grassland, Cheng Jianwei</td>
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<td>Impact of abandonment and human disturbance on ecosystem services in Japanese temperate grasslands, Mylene Martinez</td>
<td>Phytosociological classification and characterisation of the grasslands of Mt. Damavand, Iran, along a 3000-m elevational gradient, Amir Talebi</td>
<td>Effects of grassland utilization on the functional traits of dominant plants in temperate typical steppe, Jinhui Zhang</td>
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<td>Rangelands of Indian Hindu Kush Himalayas – Condition and trends, Shivani Barthwal</td>
<td>Caspian remnant coastal dunes: how do natural and anthropogenic factors impact on plant diversity and vegetation, Samereh Tirgan (<em>YIC)</em></td>
<td>Disentangling the effects of animal defoliation, trampling, and excretion deposition on plant nutrient resorption in a semi-arid steppe, Tongrui Zhang (<em>YIC)</em></td>
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<td>Ten years’ fencing has limited influence on plant nutritional quality of desert steppes in Northwest Tibet, Weiling Niu</td>
<td>Floristic composition of plant communities involving Rhaponticum serruloides (Georgii) Bobr in the desert steppes of Kazakhstan, Saule Mamyrova (<em>YIC)</em></td>
<td>Mixing up plant litter and herbivore dung alters their decomposition rate in a semi-arid grassland ecosystem, Yanan Wang (<em>YIC)</em></td>
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### 12:30-13:00 (GMT) BREAK

### 13:00-13:30 (GMT) CLOSING CEREMONY

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**Chairs:** DİDEM AMBARLI, ALLA ALEKSANYAN

### 13:30-15:00 (GMT) WORKSHOP

**Meet the Editors**

**Chair:** STEPHEN VENN

### 13:30-16:00 (GMT) HAPPY HOUR

*Join us at https://app.wonder.me/?spaceId=c4d0142a-a300-464b-aa07-051f6a9b3c3*
Impact of Post-Soviet Land-Use Change on Central Asian Steppe Ecosystems

Norbert Hölzel

University of Münster, Germany

Temperate grassland regions have been hotspots of land-use change that led their destruction via conversion to cropland and overgrazing but also to restoration through abandonment of cropland and the alteration of gazing regimes. It is poorly understood how these changes affect interrelations between vegetation properties, herbivory and fire.

Large scale land-use changes are widespread on the Eurasian steppe, where the dissolution of the Soviet Union in 1991 triggered the abandonment of cropland and pasture on globally relevant scales. Thus, to determine how relationships between plant functional composition, fire and grazing patterns changed after the Soviet Union dissolved, we studied a 358,000 km² region in the dry steppe of Kazakhstan, combining a large field dataset on plant functional traits with multi-scale satellite data. We found that increases in burned area corresponded to decreases in livestock grazing across large areas. Further, fires occurred more often under high cover of grasses with high leaf dry matter content and thus higher flammability, whereas higher grazing pressure favoured grazing-tolerant woody forbs and ruderal plants with high specific leaf area. The current situation of low grazing pressure represents a historically exceptional, potentially non-analogue state. We suggest that the dissolution of the Soviet Union caused the disturbance regime to shift from grazer to fire control. As grazing and fire each result in different plant functional compositions, we propose this led to widespread increases in grasses and associated changes in steppe plant community structure. These changes have potentially occurred across an area of more than 2 million km², representing much of the world’s largest temperate grassland area, with globally relevant, yet poorly understood implications for biodiversity and ecosystem functions such as carbon cycling. Additionally, future steppe management must also consider positive implications of abandonment (‘rewilding’), because reverting the regime shift in disturbance and associated changes in vegetation would require grazing animals to be reintroduced across vast areas.
Wild ungulates on the grasslands in China: Status and Conservation

Zhigang Jiang1,2

1Institute of Zoology, Chinese Academy of Sciences, Beijing 100101
2College of Life Science, University of Chinese Academy of Sciences, Beijing 100049
jiangzg@ioz.ac.cn

China is the country with the most diverse ungulate species in the world (70 species, 21% endemic), of which, more than one third (25 species) are the ungulates roaming in array of herbaceous plants dominated landscapes, ranging from deserts, arid grasslands, steppe to wetlands. Among the 22 wild ungulates live in the grasslands of broad sense: meadows, steppe, and arid grasslands (hereafter called grassland), there are world known flagship species: Tibetan antelope (Pantholops hodgsonii), Mongolian gazelle (Procapra gutturosa), Wild Bactrian Camel (Camelus ferus), Przewalski’s Wild Horse (Equus ferus) in the bioregions of the grassland biome. In this study, I elaborated the following questions: (1) What are the habitat affiliation of the ungulates in array of grasslands in China? I classified the ungulates on grasslands in the country into three major habitat groups according to the precipitation and elevation in these habitats: Steppe Habitat Type, Desert Habitat Type and Alpine Habitat Type, a fourth unique type, the Plateau Habitat Type is a distinctive set within the Alpine Habitat Type (Figure 1); (2) What are the living status of those ungulates? According to assessment of China’s Biodiversity Red List (2021), 15 ungulate species in grassland of China are threatened species (those species of IUCN Red List categories of Critically Endangered, Endangered and Vulnerable), marking the ratio of threatened species as high as 83% in grassland ungulate fauna in comparison with that 23% of world mammals and 26% of China’s mammals are threatened species. All ungulate species in desert habitat are threatened, while 83%, 57% and 50% of the ungulate species in steppe, alpine and plateau habitats are threatened, respectively; (3) What are the threats to those ungulate species? The threats to grassland-dwelling ungulates of the country include a) livestock ranging, land reclamation or farming, livestock ranging, in term of over–stocking caused grassland deterioration, occurred in all habitats of the 22 ungulates, b) transportation development and human disturbance occurred in the habitats of 16 species, c) natural system modifications in term of grassland fence occurred in habitats of 14 species, d) climate change and extreme weather threatened 11 species e) disease and parasites.
occurred in at least 6 species, causing mortality in those species. f) wildfires also threatened the Mongolian Gazelle and Mongolian Wild Ass (g) hybridization with their closely related domesticated counterparts, like occurred in Wild Yak and Przewalski’s Wild Horse (Figure 2); (4) Have we achieved the goal of “Bending the curve”? After four decades of conservation, while status of some of endemic ungulates like Przewalski’s Gazelle and Tibetan Antelope are improved, most others are not. IN particularly, I reviewed the conservation re-introduction of Saiga and Przewalski’s Wild Horse in China and the status and conservation of the Mongolian gazelle. While the re-introduced wild horse is now on field release trail, the re-introduced Saiga population collapsed after disease recently, Mongolian Gazelle is retreated to the Sino-Mongolian border region as its habitats are engulfed by domestic ungulates and human settlements in the past century; (5) How can we achieve the goal of biodiversity conservation and sustainable development of the Eurasia grasslands? Grasslands in broad sense include meadows, grasslands, steppe, semiarid and arid steppe, deserts, which is a large terrestrial biome accounted for 3.93 million square kilometers in China. As the grasslands are transforming into a substances production base with ever increasing significance for human beings, grasslands in country are integrated parts of the Belt-and Road Initiative, the conservation issue is ever more pressing as two ungulate species are extinct in wild and majority of the ungulate species are threatened in the country. We shall set aside more space as protected areas for the wild ungulates, dismantle grassland fences in the critical important habitats and migratory corridors of wild ungulates; grassland fences fragment the habitats, hinder the free movement cut-off the international migration routes and even cause mortality. We shall study the functions of wild ungulate in the grassland ecosystems, integrate the biodiversity conservation, green development into the local social-economic development. We shall monitor the zoonotic disease and parasite diseases in wild ungulate and to seek for methods of prevention and eradicating the wild animal pandemic. The speaker will explore how to integrating the wild ungulate species into the national and international grassland and migratory species conservation.

**Keywords:** Wild hooved animals, Grassland, Steppe, Qinghai-Tibetan Plateau, Threatened Species, Conservation, the Belt-and Road Initiative

**Figure 1.** Wild ungulates in steppe habit, the desert habitat and the highland habitat

**Figure 2.** Threats to the wild ungulate species in grasslands of China
Prof. Shuli Niu
Keynote Speaker

Prof. Shuli Niu’s research focuses on ecosystem carbon and nitrogen cycles and their coupling in response to global change. By setting up a few global change manipulative experiments in grasslands, her group has comprehensively studied biodiversity, community structure, and ecosystem functions in response to multiple global change factors. She has (co-)authored over 160 scientific articles that have been cited over 8500 times (data from Google Scholar). She is a member of the Science Steering Committee of AsiaFlux and serves as associate editor for the journals Ecology Letters, Functional Ecology, and Journal of Geophysical Research-Biogeosciences. Her keynote talk will be about the response of alpine grassland to global change gradients.

http://sourcedb.igsnrr.cas.cn/yw/zjrck/201303/t20130306_3787558.html
https://scholar.google.com/citations?user=f7PNK1QAAAAJ&hl=en&oi=ao
https://www.researchgate.net/profile/Shuli_Niu2?sorting=recentlyAdded

Grasslands Response to Global Change Gradient - From Sites to Globe
Shuli Niu¹, and the Niu’s Ecolab members

¹Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Research, Chinese Academy of Sciences, Beijing 100101, China. Email: sniu@igsnrr.ac.cn

Global climate change is a gradual process, and the responses of ecosystem structure and function to climate change gradients should also be nonlinear. Theoretically, there exists a response threshold beyond which ecosystem change can not be reversible. However, our current understanding of the mechanisms underlying ecosystem response to climate change gradients is still very limited, which hinders the accurate prediction of future ecosystem status. By combining field climate change gradient experiments, global meta analysis, and eddy-covariance data synthesis, this talk presents a series of mechanisms underlying the responses of grassland carbon cycle processes to climate change gradients, from site-level to regional and global scales. The results showed that: (1) soil water availability determined the response direction and magnitude of grassland carbon fluxes to warming gradient. Lower soil moisture caused positive feedback of carbon fluxes to climate warming, while higher soil moisture caused negative feedback of carbon fluxes to climate warming. (2) Key processes of grassland carbon cycling generally responded nonlinearly to nitrogen addition gradient with low-level N promoting and high-level N inhibiting them through different mechanisms. The dominant mechanisms for maintaining ecosystem stability also changed with this gradient. (3) Grassland carbon fluxes and their components responded nonlinearly to precipitation gradient with different sensitivities. Extreme drought significantly destroyed ecosystem structure and function and reduced ecosystem productivity and resistance. Plant species asynchrony was the key variable determining the stability of productivity in response to extreme drought. (4) Global synthesis on ecosystem nitrogen cycle revealed the large-scale patterns and mechanisms of ecosystem carbon and soil N cycling processes in response to climate changes at the global scale. These results systematically elucidate the response thresholds, mechanisms and global patterns of ecosystem processes in response to climate gradients, which not only advance our understanding on ecosystem-climate feedback, but also provide data and theoretical basis for land models.
AGC has several special events devoted to strengthen collaboration and information exchange during the conference.

Meet the Editors: This interactive event aims to bring participants and editors of relevant journals together. Participants can ask any questions about all stages of the publishing process, such as submission, evaluation criteria, language issues, how to reply to editors and how to respond to a rejection. Participants will also have the opportunity to learn more about the "kitchen" of publishing. On the podium there are several experienced editors from a wide range of relevant international scientific journals:

- Tolgyesi Csaba, Global Ecology and Conservation, Restoration Ecology,
- Jürgen Dengler, Vegetation Classification and Survey, Journal of Vegetation Science and Tuexenia, Applied Vegetation Science
- Dunlian Qiu, Journal of Mountain Science,
- Orsolya Valkó, Biological Conservation, Frontiers of Ecology and Evolution, Hacquetia,
- Jianshuang Wu, Frontiers in Ecology and Evolution,
- Jianguo Wu, Landscape Ecology,
- Yanpei Wu, Grassland Science

Workshop on the vegetation typologies in Asia and their crosswalks to/overlaps with phytosociological syntaxa: The aim of this workshop is to better understand vegetation typologies of Asia from a global point-of-view. Specifically, we would like to harmonize Asian typologies with that of GrassPlot, an EDGG-associated database of multi-scale vegetation-plot data of Palaearctic grasslands and other open habitats (https://edgg.org/databases/GrassPlot). All the vegetation plots incorporated in the GrassPlot database are assigned to a vegetation typology, which include 22 vegetation types grouped into six coarse units (https://onlinelibrary.wiley.com/action/downloadSupplement?doi=10.1111%2Fjvs.13050&file=jvs13050-sup-0002-AppendixS2.pdf). While this two-level classification, along with its syntaxonomic crosswalk, is reasonably tested for Europe, many "grey" and undefined zones remain for the Asian continent, both in the GrassPlot classification and the syntaxonomic classification. Any contribution about the phytosociological classification of grasslands and other open habitats from any part of the Asian continent, as well as any critical review of the current GrassPlot typological classification, are highly welcome in this workshop. If successful, we anticipate a joint publication on the topic from this workshop. Coordination and contact: Idoia Biurrun (idoia.biurrun@ehu.es) and Riccardo Guarino (guarinotro@hotmail.com).

For newcomers, EDGG will be presented with its multitude of activities, such as the Eurasian Grassland Conferences, the EDGG Field Workshops (research expeditions), its diamond open access journal Palaearctic Grasslands, its Special Features and edited books, its vegetation-plot database GrassPlot, its website and online tool GrassPlot Diversity Explorer. This event will provide a good opportunity to get in touch with the EDGG Chairs.

Young Investigator Competition: This competition will reward young scientists for excellent presentations of their research. Young scientists (not older than than 30 years old) are asked during registration if they wish to participate in the contest. During her/his presentation, the applicant is required to clearly indicate her/his contribution to the presented work. Talks and posters are evaluated separately.

Photo competition: To celebrate the first Asian Grassland Conference, EDGG organised a Photo Competition on Asian Grasslands. The aim of this photo competition is to highlight this wealth of immense beauty and conservation value with the following topics:

- Asian grassland plants
- Asian grassland animals
- Asian grassland landscapes
- Humans and grasslands in Asia

A Jury will evaluate the photos and the winners will be announced during the conference. The jury members are Edy Fantinato (Chair), Magdalena Firanek-Fulcher, Anna Kuzemko, Rocco Labadessa, Jim Martin, Alireza Naqinezhad, Jalil Noroozi and Salza Palpurina.

Happy Hour

At the end of the daily sessions, all participants are invited to join a happy hour, where they can interact with other participants freely and talk. For this purpose, we offer a cozy virtual event space where people can meet and talk. Guests have the possibility of chatting with their peers or to join conversations in small groups.
ASIAN GRASSLAND CONFERENCE

19-21 April 2022
Virtual Conference

Abstracts of Oral Presentations*

*Ordered in alphabetically by surname
HAS ENDANGERED ANATOLIAN CHAMOIS A FUTURE AT LESSER CAUCASUS ALPINE GRASSLANDS?

Hüseyin Ambarlı1, Didem Ambarlı2

1Wildlife Ecology and Management, Duzce University, 81620 Duzce, Turkey
2Dept. of Biological Sciences, Middle East Technical University, 06531 Ankara, Turkey

E-mail: huseyinambarli@gmail.com

Anatolian chamois (Rupicapra rupicapra asiatica) is the only endangered chamois subspecies and locally distributed at Alpine grasslands in northeastern Turkey and along the border of Georgia. There have been extremely limited studies about the species because of the difficulties in habitat accessibility and species detectability. From former observations, it seems that Anatolian chamois has probably different habitat requirements than its counterparts in Europe. Its distribution and population in the last three decades dramatically declined, but it has also been probably recovering at some remote montane habitats in the last years. Our aim is to reveal the current distribution, temporal change in the area of occupancy, and habitat preference of this endangered species. We collected presence data between 2002-2018 by direct observations during field studies, camera trap studies, citizen-science data, and trophy hunting locations in eastern and north-eastern Turkey (Lesser Caucasus) and southwestern Georgia. The study area is about 300,000 km². We conducted habitat suitability modeling with environmental variables including climate, vegetation cover, terrain, elevation, human disturbance, food availability, and interspecific competition. We used regression-based models including a generalized linear model in R and maximum entropy modeling by MaxEnt software. The best-predicted model showed that maximum temperature, terrain type, elevation, and human disturbance are the most important variables for species distribution and suitable habitats. The predicted suitable habitats are much smaller than the former habitats of the species, but still suitable alpine habitats are larger than the current distribution. Anatolian chamois use mostly alpine grasslands except during snowing in wintertime. In conclusion, there are still suitable alpine grassland habitats to sustain viable populations of Anatolian chamois in the Lesser Caucasus, but human disturbance including trophy hunting, infrastructural constructions, and mining activities specifically above 2000 m on Alpine grassland habitats of Anatolian chamois should be restricted.

A PRELIMINARY MAP OF STEPPES IN TURKEY USE OF DIGITAL MAPS OF FORESTRY AND CORINE TO GENERATE THE MAP OF STEPPES IN TURKEY

Uğur Zeydanlı1, Didem Ambarlı1,2, Semiha Demirbaş Çağlayan1

1Nature Conservation Centre, Ankara, Turkey
2Department of Biological Sciences, Middle East Technical University, Ankara, Turkey

E-mail: uguur.zeydanli@dkm.org.tr

Vegetation mapping is crucial for sustainable management and conservation of vegetation types. Mapping steppes is necessary but challenging due to their very dynamic nature and their several transitional states to woodlands and croplands. To be able to map the steppes of Anatolia, which potentially cover one-third of Turkey, we adopted a practical approach and made use 1/25,000 digital forestry maps (General Directorate of Forestry 2015), CORINE land cover maps (European Environment Agency 2011) and NDVI (Normalized Vegetation Difference Index) for quick assessment. In those maps, non-steppic land cover types are usually mapped precisely. Therefore our approach was to exclude those after careful evaluation and checking, and reveal the steppic land. We focused on a 321,765 km² region as potential steppe and steppe-forest land based on Thornwaite Dryness Index (Ambarlı et al. 2016). We defined steppes as dry grasslands with less than 10% woody cover and forest-steppes with less than 40% canopy cover. Within this region, we used CORINE map and excluded all water bodies, coastal dunes, inland and salt marshes; all constructed areas, croplands including permanent croplands, orchards, olive yards, greenhouses, bare soils and rocks from the potential steppe land. One problematic Corine class was “Land principally occupied by agriculture with significant areas of natural vegetation” (34,528 km²), which incorporates both steppe and low intensity agricultural fields. These polygons further refined by using NDVI. From the forestry maps, we excluded areas covered with higher than 40% canopy cover. We further examined the sites between 10-40 % canopy cover by using NDVI, as the accuracy of the forestry maps for these areas was lower. In the end, we found that steppes and forest steppes cover a total of 177,947 km² which is 54% of the potential distribution. Only 0.7% (2,369 km²) by forest steppes. The remaining steppes in central and southeastern Anatolia are very fragmented, whereas steppes areas in Eastern Anatolia are rather less patchy and continuous. Most of the steppe areas are converted to croplands.

References
ASSESSING THE ROLES OF NITROGEN, BIOMASS, AND NICHE DIMENSIONALITY AS DRIVERS OF SPECIES LOSS IN GRASSLAND COMMUNITIES

Band Nir¹, Kadmon Ronen¹, Mandel Micha² & DeMalach Niv³

¹Department of Ecology, Evolution & Behavior, The Hebrew University of Jerusalem, Givat Ram, 9190401 Jerusalem, Israel
²Department of Statistics, The Hebrew University of Jerusalem, Mount Scopus, 9190501 Jerusalem, Israel
³Institute of Plant Sciences and Genetics in Agriculture, The Hebrew University of Jerusalem, 76100 Rehovot, Israel

E-mail: nir.band@mail.huji.ac.il

Eutrophication is a major driver of species loss in plant communities worldwide. However, the underlying mechanisms of this phenomenon are controversial. Previous studies have raised three main explanations: (1) High levels of soil resources increase standing biomass, thereby intensifying competitive interactions (the ‘Biomass-driven Competition Hypothesis’)¹. (2) High levels of soil resources reduce the number of limiting resources that function as niche axes, thus reducing the potential for species coexistence (the ‘Niche Dimension Hypothesis’)². (3) Increasing soil nitrogen causes stress by changing the abiotic or biotic conditions (the ‘Nitrogen Detriment Hypothesis’)³. Despite several syntheses of resource addition experiments, so far, no study has tested all hypotheses together. This is a major shortcoming since the mechanisms underlying the three hypotheses are not mutually exclusive. In this study we tested the three hypotheses simultaneously using a meta-analysis of 630 resource addition experiments located in 99 sites worldwide. Our results provide strong support for the Nitrogen Detriment Hypothesis, weaker support for the Biomass-driven Competition Hypothesis, and negligible support for the Niche Dimension Hypothesis. The results further show that the indirect effect of nitrogen, mediated by an increase in standing biomass, accounts for only ~2% reduction in richness, while the total effect of nitrogen addition is a reduction of ~20%. Moreover, the effect of nitrogen on richness is much larger than that of all other resources (phosphorus, potassium, and water). We conclude that nitrogen-specific mechanisms are more important than biomass or niche dimensionality as drivers of species loss under high levels of soil resources. This conclusion is highly relevant for future attempts to reduce biodiversity loss caused by global eutrophication.

References

GOVERNANCE AND LIVELIHOOD ADAPTATIONS OF AGRO-PASTORAL COMMUNITIES RESIDING IN A RESOURCE SCARCE LANDSCAPE

Shivani Barthwal¹, Ruchi Badola¹, Syed Ainul Hussain¹, VB Mathur²

¹Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun 248001;
²National Biodiversity Authority, Chennai

E-mail: shivani.chandola@gmail.com

Question: The trans-Himalayan region of India is an interesting landscape, with meagre precipitation, high altitudes, large diurnal temperature variation and intense solar radiations. These climatic features along with the diverse physical landforms results in unique floral and faunal assemblage. In this region where it is difficult for the life-forms to survive without adaptations, the study aims to explore if pastoral communities’ survival and adaptive tactics are learnt from the global trends or from the local experiences, and to explore the changing forms of local governance in wake of building resilient local communities.

Location: The study was undertaken in the union territory of Ladakh, India, located in the trans-Himalaya.

Methods: Questionnaire survey and focus group discussions were undertaken to study the livelihood and governance system.

Results: The study found that the local communities have traditionally been agro-pastoral and played important role in trade along the silk route until the mid twentieth century. Sparse human population was adept to sustainably use the scarce resources. The local governance system played an important role in natural resource management, including the rangelands. The rotational grazing allowed for the natural regeneration and also resulted in co-existence of livestock and the mountain ungulates. With disruption of the trade routes the livelihood pattern changed, resulting in people amassing wealth in form of more livestock. Government policies encouraged livestock holding and diversion from the traditional livestock to the economy oriented goats and sheep. Increased livestock holding per household caused conflicts over grazing rights. The scenario changed after opening of Ladakh to the tourists in 1980s. Tourism, livestock and agriculture now have diversified the livelihoods and increased resilience of the communities. Local governance and social networks were found to be the most important precursor for the resilience building through livelihood diversification.

Conclusion: we conclude that the pastoral communities’ survival and adaptive tactics are driven by both local and global trends. In wake of growing tourist influx, and to maintain the social and natural resilience, there is a dire need to monitor the tourism influx and income. The national and regional policies should be applied at the local scale with caution. An adaptive, integrated and locally relevant governance approach that is able to address well-being of communities and develop their stakes in conservation of these fragile ecosystems is called for.
Question: The rangelands of the Indian Himalayan Region (IHR) are fragile, remote, isolated, and susceptible to climate change impacts. Historically, these rangelands were considered ‘common lands’ governed to meet the needs of the local people or as ‘wastelands’ that can be easily diverted for other uses. Does present-day governance of these rangelands recognise the important regulatory and buffering services they provide to people in the Indian subcontinent. With this question, the study aimed to critically analyse the policies and regulations impacting the rangelands of the IHR.

Location: IHR represents the rangelands covering about 35% of the geographical area in Jammu and Kashmir, Ladakh, Himachal Pradesh, Uttarakhand, West Bengal, Sikkim and Arunachal Pradesh.

Methods: The study adopted a multistage approach to systematic analysis, where in the first stage, policies and other legislation concerning rangeland management were reviewed. In the second stage, the efficacy of these instruments to address climate change was reviewed.

Results: The rangelands of IHR are least protected ecosystems, they remain unprotected unless they are notified as PAs under the Wildlife (Protection) Act, 1972. Unless they are brought under the purview of this act they remain susceptible to the provisions of the Land Acquisition Act that facilitates the state to take over these lands for development and other purposes. Rangelands are influenced by policies of at least four sectors, i.e. forests, agriculture and animal husbandry, rural development and land use. No policy addresses the issue of differential institutional arrangements to manage different ecosystems or the issues of climate change.

Conclusion: These multi-sectoral origin policies and acts are contradictory and overlapping, resulting in confusing land records. Lack of clear ownership and rights, and ambiguous responsibilities have accelerated the rangeland degradation in the Himalayas. Realizing the open access nature of rangelands situated outside of the protected or notified areas, we recommend regulating them through the provision of Environment (Protection) Act, 1986. Appropriate rangeland policies should comply with emerging ecological principles, recognise the multiple functions of rangelands, account for the potential impacts of climate change, and promote equitable access to rangeland resources. A policy mix with the blend of anticipation, adaptation and preparation for future environmental challenges such as climate change is advocated for.

Question (Aims): As it was mentioned in the review on Russian temperate meadows and steppes (Tishkov et al., 2020), for Northern Eurasia, and, consequently, for Russia, grasslands are an inherent element of a treeless landscapes. They form great diversity of natural and secondary (anthropogenic) communities, occupying large spaces on plains within tundra and forest zones, forming steppes biome and widely spreading above timberline in high-mountains. According to the recent phytosociological overview (Ermakov, 2012), the diversity of Russian grasslands comprises 23 classes, 50 orders, and 117 alliances. Our aim is to identify the important borders of their distribution and reveal peculiarities and factors responsible for it.

Location: Territory of Russian Federation.

Materials and Methods: Analysis of the main grasslands classes’ geographical distribution according different biogeographic regions.

Results: The boundaries between the biogeographic units identified in Russia (for example, Mediterranean, Caucasian, Siberian, Central Asia, Far Eastern, Beringian, and others) are traceable regarding the distribution and composition of temperate grassland communities. For example, wide spread European communities of natural and semi-natural meadows of Molinio-Arrhenatheretea are replaced in the central Siberia and Far East by vicarious communities of eastern class Calamagrostietea Ianegdorffii. The same situation with steppes. In the East communities of dry grasslands of the class Cleistogenetea squarrosae take place of the European steppes of Festuco-Brometea. It appeared to be that while the Urals Mts is of no significance in this respect, the wide valley of the Yenisei River is an important boundary both for above mentioned communities and for many of the inhabitants of the grasslands. The steppes fauna demonstrates effects of some species vicariance from west to east. A good example is the sequence of the Sciuridae rodents’ species replacing one another from western to the east.

Conclusions: Apparently, the main reason of this phenomenon is ancient disjunction of two pre-Cambrian platforms: of the Russian and Siberian ones estimated by several hundreds of millions years. As for vegetation of meadows in tundra and high-mountains, communities of the main classes are met all along of the continent. Absence of diversity and lack of clear biogeographical boundaries can be explained by the relative youth of the northern and mountains territories (caused by recent glaciations and aridization cycles) estimated only by several hundreds and decades of thousands years. However, this is not yet sufficient for the processes of phylocenogenesis, which form high-level syntaxa and establish biogeographic boundaries.

References
GRASS PHYTOLITHS IN DISCRIMINATING RAINFALL ZONES OF NORTHERN WESTERN GHATS, MAHARASHTRA, INDIA

Manjuree Karmakar1*, Ranita Biswas1*, Oindrila Biswas2, Biswajit Mukherjee1, Dipak Kumar Paruya1, K. Althaf Ahamed Kabeer3, Ruby Ghosh4** & Subir Bera1**

1Centre of Advanced Study, Department of Botany, University of Calcutta, 35, Ballygunge Circular Road, Kolkata 700019, India (ranitabiswas1@gmail.com)
2Department of Botany, School of Basic Sciences, SRM University, Gangtok 737102, Sikkim
3Central Botanical Laboratory, Botanical Survey of India, Howrah- 711103, West Bengal, India
4Birbal Sahni Institute of Palaeosciences, 53, University Road, Lucknow 226007, India

**Corresponding author: berasubir@yahoo.co.in; rubyghosh06@gmail.com

Question (Aims):
- To identify the dominating grasses i.e., C3 or C4 from grasslands and grass dominated regions of northern Western Ghats.
- To interpret modern grass phytolith-climate relationships

Locations: Grassland patches and other grass dominated areas of the northern Western Ghats, Maharashtra, India.

Methods: Eighty-seven living grasses were collected from different grassland patches and other grass dominated locality. Phytoliths from the collected grasses were extracted following the standard protocol of Pearsall (2000). About 350 phytolith morphs were counted for each grass sample. The recovered phytoliths were identified and named following ICPN 2.0 (Neumann et al. 2019). The phytoliths were measured by using a compound microscope and properly photographed using a Zeiss Axioscop 2 microscope at 600x magnification.

Results: In the study area, C4 grasses (sixty-seven in collection) are dominating with sporadic C3 grasses (ten in collection), therefore, different ratios of C3/C4 diagnostic morphotypes cannot be utilized to indicate climatic conditions of this region. Also, among the collected C4 grasses, only nine are dry loving Chloridoid while the remaining sixty-eight are wet loving Panicoid; hence, climatic conditions of the area cannot be related with diagnostic wet/dry indicating phytolith morphs. Morphometric analysis of the dominating C4 Panicoid grasses was done to overcome this problem (Bourel and Novello 2019). BILOBATES with shank length < 4 μm were recovered from high rainfall zone grasses, while bilobates with shank length > 4 μm were found in low rainfall zones.

Conclusions: Grasslands are important terrestrial ecosystems since C3/C4 grass composition can indicate climate conditions of a region. C3 grass-dominated grasslands indicate cool-moist climate while C4 grass-dominated grasslands indicate warm-humid/arid climate. Dominance of BILOBATE morphs diagnostic for C4 Panicoids indicate warm-humid climatic conditions in the area, while BILOBATE shank lengths can be used to distinguish between different rainfall zones. Grass phytoliths or grass silica short cell phytoliths (GSSCPs) are excellent eco-climatic indicators (Biswas et al. 2016). This data can be utilized as a modern analogue to interpret regional fossil phytolith assemblage studies related to palaeoclimate reconstruction (Strömberg et al. 2018).

References
THE COEXISTENCE OF WOLVES AND PEOPLE IN GRASSLANDS OF CENTRAL ASIA

Özgün Emre Can¹

¹Ankara University, Faculty of Science, Department of Zoology, Dögöl Street, Beşevler, 06560 Yenimahalle Ankara, Turkey
E-mail: oecan@ankara.edu.tr

Grey wolves (Canis lupus) have been suggested as a model for understanding early humans. Therefore, a better understanding of how human-wolf interaction evolved in different parts of the world may lead to a better understanding of the minds of our ancestors, and so ourselves. But why did some societies exterminate wolves while others have managed to coexist with wolves? According to the dominant view, from prehistoric times to today, communities that were vulnerable to wolf depredation grew to hate wolves. However, in and around Central Asian grasslands, communities have been always vulnerable to wolf depredation throughout the history. Nevertheless, people have managed to coexist with wolves to a large extent. Today, Central Asian grasslands and surrounding regions host about one third of the global wolf population. From a historical perspective, are perceptions of people living in and around the grasslands in Central Asia more positive towards wolves than those of people living in the grasslands (prairies) of North America? I will tackle this question by using the evidence in the peer-reviewed literature spanning across several academic disciplines: wildlife ecology, human geography, social anthropology, linguistics, psychology and neuroscience. Here, by focusing on human-wolf interaction in selected grasslands of Asia (encompassing Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkey, Turkmenistan, and Uzbekistan), I show that the dominant view on human-wolf interaction is oversimplified, the reality is complex, and the “communities that were vulnerable to wolf depredation grew to hate wolves” hypothesis does not explain the hatred for wolves that has been persistent in some societies throughout the history. Better understanding of human-wolf interaction in Central Asian grasslands may enable us to develop better conservation initiatives for the region. In fact, a key to effective wildlife management and conservation across the globe may lie somewhere in the grasslands of Central Asia.

PRIVATE CBA ANALYSIS OF HERDERS’ MOBILITY IN CENTRAL AND EASTERN PARTS OF MONGOLIA

Sugar Damdindorj¹, Ganzorig Gonchigsumlaa²

¹Mongolian University of Life Sciences · Department of Agricultural and Applied Economics, School of Economics and Business 17024 Zaisan, Khan-uul District, Ulaanbaatar Mongolia
²Mongolian University of Life Sciences · Department of Agricultural and Applied Economics, School of Economics and Business 17024 Zaisan, Khan-uul District, Ulaanbaatar Mongolia
E-mail: ec20e005@muls.edu.mn, ganzorig.g@muls.edu.mn

Many researchers argued that mobility is the most optimal strategy for extensive animal husbandry, as it helps fatten the animal and gives the grassland opportunity to recover. However, there is an extremely limited number of research estimating those benefits brought by herders’ mobility. This research focuses on the mobility costs and benefits of 288 herder households from 11 soums in central and eastern part of Mongolia including Tuv, Khentii, Sukhbaatar and Dornod provinces. The primary data was collected from herders for MORESTEP project. In order to estimate the benefits of the mobility, 3 positive effects such as livestock weight benefit, milk benefit, the amount of hay saved were included in this study. The positive effects of mobility were modeled using the multiple linear regression method. Due to the reason that the main independent variable “mobility” can be measured by both distance and frequency, the research employed 2 different models (Frequency of mobility and Distance of mobility). The result of the 2 models differed considerably as the net benefit per sheep unit was 4,334.6₮ (using the number of mobility as an independent variable), or 1.13$ (using the distance of mobility as an independent variable). Mobility total benefit started decreasing after households moved more than 4 times a year. On the other hand, the farther the households moved the more they benefited. Geographically, households from Bayantsagaan soum of Tuv province had the highest net benefit of mobility for each sheep unit, while the herders from Erdenetsagaan soum of Sukhbaatar province had the lowest.
OP11

LEGACY OF PREHISTORIC CIVILISATIONS STRENGTHENS THE SYSTEM OF PROTECTED AREAS: A GLOBAL SYNTHESIS OF CONSERVATION ROLE OF STEPPIC BURIAL MOUNDS

Balázs Deák1,2, Ádám Bede1, Zoltán Rádai1, Csaba Tóth1, József Dózsai4, Iwona Dembicz5, I. Ivan Miosienko6, Barbara Sudnik Wójcikovska5, Iva Apostolova7, Georgi Nehrizov8, Fedor Lisetskii9, S. Anna Burinchik9, A. Zhanna Buryak9, Szabolcs Kis10, Sándor Borza1,10, Laura Godó1, Róbert Gallé2, Péter Batáry2, Tatyana M. Bragina11, Ilya Smelansky12, Ábel Molnár13, Miklós Bán10, Ferenc Báthori1, Zoltán Argay14, János Dani15 & Orsolya Valkó1

1Lendület Seed Ecology Research Group, Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary
2’Lendület’ Landscape and Conservation Ecology, Centre for Ecological Research, Institute of Ecology and Botany, Vácrátót, Hungary
3Debreceni Deák Ferenc Talent Development High School Vocational College, Debrecen, Hungary
4“Riparia” Association of Environmentalists, Subotica, Serbia
5Department of Ecology and Environmental Conservation, Institute of Environmental Biology, Faculty of Biology, University of Warsaw, Warsaw, Poland
6Department of Botany, Kherson State University, Kherson, Ukraine
7Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia, Bulgaria
8National Archaeological Institute with Museum, Bulgarian Academy of Sciences, Sofia, Bulgaria
9Belgorod State National Research University, Russia
10University of Debrecen, Debrecen, Hungary
11Kostanay State Pedagogical University Named After Omirzaq Sultangazin, Kostanay, Kazakhstan
12NGO Siberian Environmental Center, Novosibirsk, Russia
13Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary
14Ministry of Agriculture, Budapest, Hungary
15Déri Museum, Debrecen, Hungary

Due to the large-scale land transformation actions, the Eurasian steppe holding a considerable proportion of the Earth’s temperate grasslands is among the most endangered biomes. In transformed agricultural landscapes, steppe grasslands could often remain in small fragments that play an essential role in conservation. In our study, using a continental-scale dataset containing 1072 data records on the localities, land cover and presence of cultural, historical and sacred objects on kurgans situated in eight countries in continental Eurasia, we evaluated the conservation potential of prehistoric burial mounds (kurgans), the most widespread historical monuments of the steppes. By using Bayesian logistic generalized regressions and proportional odds logistic regressions, we aimed to reveal the potential of kurgans in preserving grasslands considering landscapes with different levels of land use transformation. We also compared the conservation potential of kurgans situated inside and outside protected areas (PAs) and assessed whether the presence of cultural, historical or spiritual values support the maintenance of grasslands on the kurgans. We revealed that kurgans had high importance in maintaining grassland vegetation even in non-protected transformed landscapes outside PAs; thus, they could act as additional pillars for conservation. Kurgans covered by grasslands might have a landscape-dependent conservation role. They have the potential to act as habitat islands in highly transformed landscapes, stepping stones in moderately transformed landscapes and biodiversity hotspots in intact landscapes. We found that besides their steep slopes hindering ploughing, the existence of cultural, historical or religious values could almost double the chance for grassland occurrence on kurgans due to the related extensive land use and the respect of local communities. By using kurgans as a model system, our results highlight that an integrative social-ecological approach in conservation could enhance the synergistic positive effects of conservation, landscape and cultural values.
OP39

SPECIES-AREA RELATIONSHIPS AND FINE-GRAIN BETA DIVERSITY IN PALAEARCTIC GRASSLANDS

Iwona Dembicz1, Jürgen Dengler2,3,4, Idoia Biurrun5, Manuel J. Steinbauer6, Tom J. Matthews7,8, Francois Gillet9 & the Grass Plot Consortium10

1Department of Ecology and Environmental Conservation, Institute of Environmental Biology, Faculty of Biology, University of Warsaw, Warsaw, Poland
2Plant Ecology, Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Bayreuth, Germany
3Vegetation Ecology Group, Institute of Natural Resource Sciences (IUNR), Zurich University of Applied Sciences (ZHAW), Wädenswil, Switzerland
4German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Leipzig, Germany
5Plant Biology and Ecology, University of the Basque Country UPV/EHU, Bilbao, Spain
6Sport Ecology, Department of Sport Science & Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Bayreuth, Germany
7CE3C – Centre for Ecology, Evolution and Environmental Changes/Azorean Biodiversity Group, Univ. dos Açores, Açores, Portugal
8GEES (School of Geography, Earth and Environmental Sciences) and Birmingham Institute of Forest Research, University of Birmingham, Birmingham, United Kingdom
9UMR Chrono-environnement, Université Bourgogne Franche-Comté, Besançon, France
10https://edgg.org/databases/GrassPlot

E-mail: iwona.dembicz@uw.edu.pl

Aims: Species-area relationships (SARs) are fundamental scaling laws in ecology. We asked which function describes SARs best at small grains and explored how sampling methodology or the environment influence SAR shape. Then, we asked which factors influence the slope parameter of the power law SARs (z-value), as a measure of fine-grain (within-plot) beta diversity of vegetation.

Location: Palaearctic biogeographic realm (Extra-tropical Asia, Europe, North Africa).

Methods: We used the GrassPlot database, containing standardised vegetation-plot data spanning a wide range of grassland types throughout the Palaearctic. For testing SARs we selected 2,057 nested-plot series with at least seven grain sizes ranging from 1 cm² to 1024 m². Using non-linear regression, we assessed the appropriateness of different SAR functions (power, power quadratic, power breakpoint, logarithmic, Michaelis-Menten). Based on AICc, we tested whether the ranking of functions differed among four taxa (vascular plants, bryophytes, lichens, all), methodological settings, biomes or vegetation types. For analyses of z-values, we extracted 4,654 nested-plot series. We calculated z-value for each series and the four taxonomic groups. Then, we tested whether z-values differed between taxonomic groups, biomes, vegetation types, and with respect to biogeographic gradients (latitude, elevation, macroclimate), site characteristics (several stress-productivity, disturbance and heterogeneity measures, land use), and alpha diversity (c-value of the power-law SAR).

Results: The power function was the most suitable function across the studied taxonomic groups. Mean z-values were highest for lichens, intermediate for vascular plants and lowest for bryophytes. For vascular plants, the strongest predictors of z-values were herb layer cover (negative), elevation (positive), rock and stone cover (positive) and the c-value (u-shaped). All tested metrics related to land use led to a decrease in z-values. Among the biomes, mean z-values were particularly high in the Mediterranean biome and the Dry tropics and subtropics. Alpine and Mediterranean vegetation types had particularly high z-values whereas managed mesic grasslands and saline communities were characterised by particularly low z-values.

Conclusions: Our results support the general appropriateness of the power function for modelling species diversity over a wide range of grain sizes. The poor performance of the Michaelis-Menten function demonstrates that richness within plant communities generally does not approach any saturation. Congruent with expectations, productivity had negative and heterogeneity positive effects on z-values, while the effect of disturbance varied depending on type and intensity. These patterns can be explained via the effects of these drivers on mean occupancy of species, which is mathematically linked to beta diversity.

References
Aims: The Palaearctic biogeographic realm is the largest such realm on Earth. To the largest extent, it is covered by natural and semi-natural grasslands and similar open habitats. These grasslands s.l. are very diverse and range from very species poor to extraordinarily species rich types. They even host most of the world records of vascular plant species richness for grain sizes below 100 m² (Wilson et al. 2012). They can also be very species rich in bryophytes and/or lichens. Understanding the drivers of this small-scale species richness beyond regional idiosyncrasies was hitherto hampered by the lack of comprehensive high-quality environmental data across these habitats in the whole Palaearctic biogeographic realm. We thus developed the GrassPlot database, whose content and application we will present in the talk.

Location: Palaearctic biogeographic realm (Extra-tropical Asia, Europe, North Africa).

Methods: The GrassPlot database (Dengler et al. 2018; Biurrun et al. 2020) is a collaborative initiative within the Eurasian Dry Grassland Group (EDGG) that collects high-quality vegetation-plot records from grasslands and other open habitats (mires, screes, saline vegetation, dunes, tall-herb communities,...) from the Palaearctic biogeographic realm. Most of them are nested-plot data, typically sampled with the EDGG methodology (Dengler et al. 2016), but also non-nested plots with comprehensive floristic data from the eight standard grain sizes (0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1000 m²) are welcome. Many plots also contain records of bryophytes and lichens and/or extensive soil and other environmental variables.

Results: We present patterns of alpha diversity across grain sizes for regions, grassland types and taxonomic groups (see Biurrun et al. 2021). The individual data are available for studies via application to the GrassPlot Consortium. The aggregated data have been published as an open access database and are continuously updated in the GrassPlot Diversity Explorer (https://edgg.org/databases/GrasslandDiversityExplorer).

Conclusions: The GrassPlot data have already given rise to a range of international papers on species-area relationships, within-plot beta diversity and alpha diversity. Further papers on alpha diversity, between-plot beta diversity, distance decay, species-abundance distributions are currently in preparation. Through the strict quality control, the standardised plot sizes and the careful curation of bryophytes, lichens and in situ measured environmental data, GrassPlot sticks out from other supranational vegetation-plot databases and allows analyses which are not possible or problematic with these. GrassPlot welcomes further data contributions, particularly from underrepresented regions in extra-tropical Asia as well as North Africa. Contributors will become members of the GrassPlot Consortium with the possibility to become co-authors of future GrassPlot publications or to use GrassPlot data for own studies.

References


OP03
BIOLOGICAL INVASION BY LIVESTOCK AND DOGS IN WET GRASSLANDS OF BRAHMAPUTRA FLOODPLAINS OF ASSAM AFFECTING ITS INTEGRITY

Anita Devi¹, Syed Ainul Hussain¹, Monika Sharma¹ & Ruchi Badola¹

¹Wildlife Institute of India, Post Box # 18, Chandrabani, Dehra Dun 248001, Uttarakhand, India

E-mail: anushrn4@gmail.com

Questions: Protected Areas are increasingly facing the challenges of livestock grazing and incidents of feral dogs interacting with wildlife, increasing the probability of transmission of zoonotic diseases. Additionally, livestock competes with wild ungulates for forage, pushing the wild ungulates to inferior habitats. Grazing by livestock also alters the vegetation structure, with a preponderance of invasive plant species. The dogs (feral, stray or domestic) deplete the prey base for carnivores. Expansion of human settlements around the Kaziranga Tiger Reserve (KTR), a wet grassland in Assam, India, has increased the livestock and dog populations around the reserve. The impact of these changes is poorly studied. This study aims to provide information on the incidence of livestock grazing, the presence of dogs, and identifying its consequence on the integrity of KTR.

Methods: The fieldwork was conducted from January 2014 to May 2016. Observations were recorded from three habitats: tall grassland (TG), short grassland (SG), and woodland. For livestock (buffalo, cow and goat), opportunistic sightings of their grazing were recorded. The observations of dogs chasing wild herbivores were also recorded. The observations of dogs chasing wild herbivores were also recorded.

Results: In 416 grazing observations, a total of 58,000 livestock individuals were recorded, of which the highest sightings were recorded from TG (90.53%), followed by SG (9.17%) and woodland (0.31%). Among livestock, cows with the highest number of individuals (n=40914) and mean group size (MGS) of 106.27 (±5.89) were recorded primarily from TG (92.66%), followed by SG (7.14%) and woodland (0.21%). Similarly, goats with 16,923 individuals and MGS of 42.31 (±1.56) were recorded mainly from TG (85.29%), followed by SG (14.15%) and woodland (0.56%). Buffaloes with 163 individuals and MGS of 27.17 (±4.09) were recorded only in TG. In 55 dog observations, 111 individuals with MGS of 2.02 (±0.20) were recorded chasing wild herbivores, of which the maximum numbers of chasings were recorded from TG (53.15%), followed by SG (45.95%).

Conclusions: We conclude that TG is under high pressure as compared to other habitat types due to livestock grazing. Among livestock, cows exert more grazing pressure on the KTR, which is exacerbated by dogs often attacking the wild animals. We recommend regular monitoring, regulating livestock grazing, formulating livelihood programmes for villagers to reduce livestock dependency, improving veterinary assistance and dog sterilization programmes to manage their population. However, scientific evidence is needed to understand the impact of biological invasion on the grasslands habitat dynamic, wild animals population, disease transmission, and competition.

OP45
GEOGRAPHICAL DISTRIBUTION AND DRIVERS OF BIODIVERSITY IN INNER MONGOLIA

Gang Feng¹

¹School of Ecology and Environment, Inner Mongolia University

E-mail: qaufenggang@163.com

Geographical distribution of biodiversity is associated with multiple spatial and temporal scale factors, e.g., geological events, paleoclimate change, current climate, topographic heterogeneity, and local biotic interactions. However, so far, no studies has systematically assessed the links between these factors and biodiversity distribution in Inner Mongolia. This presentation will first introduce the geographic distribution of bird, mammals, plant and insect diversity, and then discussed their associations with paleoclimate change, current climate, topographic heterogeneity and local biotic interactions. In addition, this presentation will also talk about the effects of land use changes on similarities/beta diversity of bird communities across Inner Mongolian grassland. The results showed that in addition to the effects of regional climate factors, local biotic interactions (i.e., inter-specific competition and food diversity) are also highly correlated with geographical distribution biodiversity in Inner Mongolia. The conversion from nature grassland to woodland, cropland and residual area has significantly promoted the biotic homogenization of bird communities, in terms of dimensions of taxonomic, phylogenetic and functional diversity. These findings suggest that the massive human activities in this region has caused serious biodiversity loss. Future biodiversity conservation should avoid the further disturbance of human beings, pay more attention on the ecosystem restoration, and keep the whole ecosystem healthy and intact.
OP40

FLORISTIC AND SYNTAXONOMIC DIVERSITY OF CHALK OUTCROPS OF SUB-URAL PLATEAU AND ADJACENT TERRITORIES

YAM Golovanov & SM Yamalov
South Ural botanical garden-institute of Ufa Federal Scientific Centre of Russian Academy of Sciences
E-mail: jan1986@mail.ru

Question (Aims): The results of long-term studies of the floristic and syntaxonomic diversity of chalk outcrops of the Orenburg region (Russian Federation) and North-West Kazakhstan on Sub-Ural plateau and adjacent territories are presented. Chalk outcrops are unique botanical-geographical sites located in steppe and desert zones of Eurasia. Specific communities of calciphyte plant species have spread in these areas, in places of outcrops or close occurrence from the surface of upper-Cretaceous carbonate rocks. The aim of this work is to characterize floristic and syntaxonomic diversity of chalk outcrops of Sub-Ural plateau and adjacent territories.

Location: The study area with 15 massifs of chalk outcrops includes the Orenburg region, and Aktobe and Atyrau regions of the Republic of Kazakhstan. The investigated sites are mostly located on the Sub-Ural Plateau, which extended from the southern regions of the Orenburg region to the Emba River in the territory of Aktobe region. They are less common within the Obshchii Syrt. The study area covers a wide range of zonal vegetation from dry steppes in the northern part of the gradient to northern deserts in the southern one.

Methods: The dataset includes 270 relevés of chalk outcrops communities performed by the authors in 2014–2019. Classification was carried out following the Braun-Blanquet method. The analysis of cenoflora was carried out according to traditional methods of floristic research.

Results: Vegetation of Sub-Ural plateau and adjacent territories is new class Anabasietea cretaceae Golovanov 2021 which includes 1 order, 3 alliances, 6 associations, 3 subassociations, 2 variants and 9 facies (Golovanov et al., 2021). Class combines calciphytic, mainly semi-shrub communities on the outcrops of chalk and marl rocks of the south of the Orenburg region and North-West Kazakhstan within the steppe (subzones of the true and desert steppes) and desert zone.

The flora of chalk outcrops includes 218 species of vascular plants from 35 families and 121 genera. Species with a constant of more than 70%: Anabasis cretacea, Matthiola fragrans, Echinochloa meyeri, Euphorbia seguieriana, Scabiosa isetensis, Seseli glabratum, Sterigmostemum caspicum, Zygophyllum pinnatum, Agropyron desertorum, Rhaponticoides kasakorum, Asparagus underiensis, Artemisia lerchiana.

The flora is characterized by a great amount of rare species, mainly endemic, associated with peculiar substrates, the locality of habitats, and the historical past of the area of outcrops location.

Reference

OP31

HOUSEHOLD POVERTY EVALUATION AND PREDICTION IN PASTORAL AREAS

Peng Han1, Qing Zhang1, 2*, Yanyun Zhao1 & Frank Yonghong Li1, 2

1Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau, School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, China
2 Collaborative Innovation Center for Grassland Ecological Security (Jointly Supported by the Ministry of Education of China and Inner Mongolia Autonomous Region), Hohhot 010021, China
E-mail: qzhang82@163.com

Accurate poverty prediction is the foundation for poverty reduction, the first target of sustainable development goals. Household surveys are considered the standard approach to predict poverty, and remote sensing, as an emerging technology, shows excellent potential in household poverty prediction. The Inner Mongolia Autonomous Region is a key minority area where the state implements poverty alleviation projects. Due to factors such as a fragile ecological environment and frequent natural disasters, the poverty problem in this area is significant. Therefore, it is of great practical significance to explore the poverty situation and driving factors of pastoral households in Inner Mongolia grassland.

Based on the household services and spatial information of 404 households, a multidimensional poverty index system and measurement model were constructed to evaluate the situation of household poverty and the relationship between multidimensional poverty and the environment in the pastoral area. We found that 1. The leading factors of household poverty are living and health poverty. 2. Multidimensional poverty is more common in this area but stands low. 3. Multidimensional poverty has a significant positive correlation with the average annual precipitation and the student number of households. It also has a significant negative correlation with the education level of the household head, the pasture area, and the pasture grazing intensity of the household. The management style of the household has a significant impact on multidimensional poverty, while community-related factors have a weaker impact.

Furthermore, we used high-resolution remote sensing data with 1 m resolution and households data to evaluate the utility and optimal scale for predicting household poverty in this region. We found that the model that combined indicators from four scales (building land, household, neighborhood, and regional) provided the most accurate prediction of household poverty. Meanwhile, building area was the most efficient indicator of household poverty. Compared to conducting household surveys, the analysis of HRRS data is a cheaper and more time-efficient method for predicting household poverty.

In this study, we used multidimensional poverty, sustainable development theory, and remote sensing to evaluate household poverty in the pastoral areas, which will provide technical support and a theoretical basis for policymaker and world poverty reduction.

Keywords: Inner Mongolia; typical steppe; household poverty; multi-scale; high-resolution remote sensing
Abstract of Oral Presentations

OP16

EFFECTS OF CLIMATE AND GRAZING ON PLANT DIVERSITY AND FORAGE CONDITION IN EASTERN MONGOLIAN STEPPE

Yun Jäschke¹, Ouyunbileg Munkhzul² ³, Uuganjargal Khailiunaa³, Karsten Wesche¹ ⁴ ⁵

¹Department of Botany, Senckenberg Museum of Natural History Görlitz, 02826 Görlitz, Germany
²Botanical Garden and Research Institute, Mongolian Academy of Science, 13330, Ulaanbaatar, Mongolia
³Department of Biology, School of Arts and Sciences, National University of Mongolia, 14200, Ulaanbaatar, Mongolia
⁴International Institute Zittau, Technische Universität Dresden, Markt 23, 02763 Zittau, Germany
⁵German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, 04103 Leipzig, Germany

E-mail: yun.wang@senckenberg.de

Question: The Mongolian steppes cover large parts of the Palearctic steppe biome and are still relatively intact in spite of a long history of nomadic pastoralism. As livestock numbers have increased over the last two decades, grazing has been considered the main cause of pasture degradation. However, it is unclear how grazing and abiotic factors, particularly climate, have influenced critical transitions in plant communities, as well as forage quality and quantity.

Location: Eastern Mongolian steppe

Methods: We did vegetation surveys at 11 core sites from four provinces from the middle to the east of the Mongolian steppe, covering environmental and disturbance gradients. Investigated potential indicators included plant species composition, vegetation cover, species richness, aboveground biomass, proportions of unpalatable plant species. Ordination and variation partitioning were used to explore the relative importance of the potential explanatory variables.

Results: Plant species composition (i.e., species identity and abundance) was largely controlled by macroclimate (explaining nearly 6 % of the total variation) and geographical location explained ca. 5 % of the variation. Factors related to local disturbance level, such as distance to human settlement center, total dung cover, and total livestock number at the administrative level, all had a significant impact on plant species composition (together explaining 4 % of the variance). Large unexplained variation might be related to soil conditions, the abundance of wildlife, and grassland management. Most of the investigated indicators did not show a simple linear relationship with climate factors. Species richness, an important indicator for ecosystem integrity, was highest in the north-eastern sites but was generally lower in the western sites. Plant compositional dissimilarities at the site level were highest in the moistest eastern site. Potential forage quantity (i.e., summer biomass) was higher where the distance to the human settlement center was greater. Forage quality was higher in the east, as shown by the lower proportion of unpalatable plant species, but the change along the local disturbance gradient was not consistent.

Conclusion: The regional impact of climate and abiotic environment on vegetation is dominant, whereas grazing effects are also significant, but vary across regions and sites.

OP19

EFFECTS OF GRAZING AND MOWING ON BUTTERFLY DIVERSITY, A CASE STUDY FROM THE EAST OF TURKEY

Evrim Karaçetin¹, Mustafa Durmus², Yıldıray Lise²

¹Dept. of Environmental Engineering, Erciyes University, 38039, Kayseri, Turkey,
²Doğa Koruma Merkezi (Nature Conservation Centre, DKM), 06530, Ankara, Turkey

E-mail: ekaracetin@erciyes.edu.tr

Questions (Aims): Biodiversity loss has been viewed as one of the greatest threats to ecosystem functions and services. Livestock production is one of the main human activities in grasslands and it is known that both overgrazing and undergrazing have negative impacts on biodiversity. Therefore, understanding the effects of livestock grazing on biodiversity is crucial for developing sustainable grazing management. This study uses butterflies as an indicator species group to evaluate the effects of grazing on biodiversity.

Location: The study takes place in the East Anatolia (Erzurum and Ardahan) in Turkey. The main agricultural activity in this region is livestock production. The study area is chosen among the forest openings where local villagers traditionally share the common land as meadows for either mowing or grazing. The area is considered as one of the biodiversity hotspots with a significant butterfly diversity and overgrazing has long been an important concern for the region. However, there is no study on the impact of livestock production on the butterfly diversity.

Methods: The study was carried out in July and August, the peak season for the butterfly diversity, in 2021. We visited 38 different meadows and recorded the presence of grazing or moving, intensity of grazing, habitat parameters, and the butterfly species for each of the location. Statistical analyses including multivariate methods were used to compare butterfly communities across the sites.

Results: The analyses show that grazing had a strong influence on butterfly communities. When areas were overgrazed, butterfly species richness declined significantly. Whereas in areas with mosaic structure of grazing and mowing, the species richness was higher. This presentation will discuss the details of the findings of these analyses and how these recommendations were incorporated into forestry management plans.

Conclusion: Grazing management mostly concentrates on the requirement of stock against potential growth. However, biodiversity is an important part of natural meadows and while planning, biodiversity should be included. This study sets an example on how indicator species like butterflies can be used for understanding the impact of grazing and how the biodiversity parameters can be incorporated into management plans.
**OP14**

**BREEDING ECOLOGY OF EURASIAN MAGPIE *PICA PICA BACTRIANA*, IN A HIGH-ALTITUDE TRANS-HIMALAYAN GRASSLAND OF LADAKH, INDIA**

Iqbal Ali Khan1,2, Anil Kumar1 and Dinesh Bhatt2

1Zoological Survey of India, Northern Regional Centre, Dehradun -248195, Uttarakhand
2Department of Zoology & Environmental Sciences, Gurukula Kangri (deemed to be University), Haridwar -249404, Uttarakhand

E-mail: khanbb555@gmail.com

Ladakh is the high altitude cold desert in India, characterized by north-western Himalayan alpine shrub and meadows, and inhabited by a number of peculiar faunal elements. These are known to deliver a wide range of ecosystem services and to play crucial/key role in the ecology and environment. Study of such species is likely to be important to understand the intricacies and functions of high altitude montane ecosystem, possibly to adopt better management and conservation strategies. Eurasian Magpie is an important avian species of montane grasslands and shrublands ecoregion of Ladakh, India. However, information is scanty on the behavioural ecology and sociobiology of this species from Ladakh. Keeping this in view, present study was aimed to document the breeding behaviour of the Eurasian Magpie *Pica pica bactriana* from Ladakh. Field work was carried out from March 2019 to May 2021 at two study locations in the Kargil area of Ladakh. Analysis of the data revealed that shrub fragments, leaves, grasses, clay, and occasionally electric wire trash were used to construct the nest. The courtship dance, nest building, and monogamous pairing of the Eurasian Magpie are described. The average pre-nesting period was around four weeks (mean: 24.87±0.83). In a clutch, the female laid 4 to 5 eggs (mean: 3.89±0.85). The eggs were exclusively incubated by the female individuals, and the nest was guarded by the male. Three weeks was the average incubation period (mean: 13.89±1.83). Both sexes took part in parental chores till after the hatching. The period of a fledgling was around four weeks (mean: 26.8±0.74).

**OP29**

**IMPACT OF CHANGING GRAZING AND PRECIPITATION ON POPULATION GENETICS OF TWO KEY-STONE DRYLAND SPECIES OF CENTRAL ASIAN GRASSLANDS**

Khurelpurev Oyundelger1,2, Christiane M. Ritz1,2, Oyunbileg Munkhzul3,4, Karsten Wesche1,3,5

1Department of Botany, Senckenberg Museum of Natural History Görlitz, D-02826, Görlitz, Germany
2Chair of Biodiversity of Higher Plants, Technical University Dresden, D-01069, Dresden, Germany
3Department of Biology, School of Arts and Sciences, National University of Mongolia, 210646, Ulaanbaatar, Mongolia
4Institute of General and Experimental Biology, Mongolian Academy of Science, 210646, Ulaanbaatar, Mongolia
5German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Germany

E-mail: oyundelger.khurelpurev@senckenberg.de

Mongolia hosts a large share of the dry Central Asian grasslands, and these habitats are influenced by steadily increasing numbers of livestock. Thus, land degradation has become one of the main issues in Mongolian grassland research. Biomass productivity in grasslands is known to be water-limited in the first place, yet grazing leads to nutrient depletion, changes in functional trait composition, and may even have effects on the genetic diversity of plant species. To determine if and how climatic factors and grazing disturbance impact on genetic structure of key grassland species, we chose two plant species differing in their response to grazing: *Stipa glareosa* is one of the most valuable forage grasses in various steppes, and the composite *Artemisia frigida* is one of the most abundant species on dry and grazing-disturbed sites. Six and eleven populations of each species, respectively, were sampled along a large precipitation gradient in Mongolia (100–300 mm differences in mean annual precipitation from South to North) combined with three different levels of grazing intensity (heavily-grazed, moderately-grazed, and least-grazed). For population genetic analyses, we used highly polymorphic Simple Sequence Repeat (SSR) markers specifically developed for the respective species.

Populations of *S. glareosa* showed a lower level of genetic diversity compared to *A. frigida* (He = 0.53 and 0.73, respectively). Linear mixed model analyses demonstrated that the genetic diversity of *S. glareosa* was affected by grazing and altitude, while summer precipitation and soil phosphorous availability was significantly associated with the genetic diversity of *A. frigida*. In particular, genetic diversity of *S. glareosa* tended to decrease with less grazing, while no effect of grazing was found for *A. frigida*. The coefficient of genetic differentiation across populations was low in both species (mean FST = 0.06 and 0.04), indicating that considerable gene flow exists among populations across the grasslands of Mongolia. Overall, our data suggest that species respond differently to local grazing disturbances, and climatic constraints affect the genetic diversity and structure of both species.
OP05

GRASSLAND LEGACY REMAINING IN VEGETATION AND SEEDBANKS IN PLANTATION FORESTS OF JAPAN

Asuka Koyama¹ & Kei Uchida²

¹Forestry and Forest Products Research Institute, Japan
²Institute for Sustainable Agro-Ecosystem Services, The University of Tokyo, Japan

E-mail: asukoyama@affrc.go.jp

Species-rich semi-natural grasslands have been drastically transformed into agricultural areas and plantation forests worldwide (e.g., Koyama et al. 2017). Grassland legacy—the impacts of a past grassland-use history on biological communities—is often detected in clear-cut forests that were formerly grasslands (e.g., Milberg et al., 2019). This study assessed whether grassland plant species remain in the standing vegetation and soil seedbanks in transformed former grasslands of Japan. We surveyed standing vegetation and soil seedbanks in traditionally-managed grasslands and plantation forests with a grassland history, and compared plant species richness and species composition between them. Grassland species remained but had lower species richness in plantations than standing vegetation in managed grasslands. There were no differences in grassland species richness or the number of individuals in seedbanks between managed grasslands and plantations. Thus, our study detected grassland legacy in both standing vegetation and soil seedbanks in plantation forests with a grassland history, although the species seemed to be limited. These results highlight the potential importance of plantation forest management for grassland restoration and securing grassland seed sources.

References

OP13

COMPARSED TO SOIL BACTERIAL AND FUNGAL DIVERSITY, MOWING SIGNIFICANTLY MITIGATE ADVERSE EFFECTS OF FERTILIZATION ON PLANT DIVERSITY

Fengshi Li¹*, Hugjiltu Minggagud¹*, Scott Jarvie ², Yonghui Wang¹, Yongzhi Yan¹, Xiaqian Gong¹, Peng Han¹, Qing Zhang¹,³

¹Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau, School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, China
²Otago Regional Council, Dunedin 9016, New Zealand
³Collaborative Innovation Center for Grassland Ecological Security (Jointly Supported by the Ministry of Education of China and Inner Mongolia Autonomous Region), Hohhot 010021, China
E-mail: qzhang82@163.com

Fertilization and mowing are commonly used grassland management measures. However, how plant, soil bacteria, and soil fungal diversity respond to these two management measures are limited. Using data from a seven-year grassland management experiment in Inner Mongolia, China, we explored the effects of fertilization and mowing on plant, soil bacteria, and soil fungal diversity. We found that: (1) fertilization significantly reduced plant and functional diversity. However, mowing can mitigate the adverse effects of fertilization on plant diversity. (2) Fertilization and a combined fertilization and mowing regime has no significant effect on soil bacterial and fungal diversity. (3) A structure equation model showed fertilization reduced plant diversity not only directly through light competition, but also indirectly through soil acidification. The effect of light competition is also higher than that of soil acidification. Mowing mainly mitigates the adverse effects of fertilization on plant diversity through reduces light competition. Our research confirmed that light competition and soil toxic hypotheses are maintenance mechanisms affecting grassland plant diversity under fertilization and mowing measures. The combination of fertilization and mowing is a feasible grassland management measure.

Keywords: fertilization; Inner Mongolia grassland; light competition; mowing; soil acidification; soil toxicity.
OP21

GRAZING-INDUCED BIODIVERSITY LOSS IMPAIRS GRASSLAND ECOSYSTEM STABILITY AT MULTIPLE SCALES

Liang Maowei¹, Liang Cunzhu², Hautier Yann³, Wilcox R. Kevin⁴ & Wang Shaopeng⁵

Department of Environmental Sciences, University of Virginia, Charlottesville, VA 22904, USA
School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, P. R. China
Ecology and Biodiversity Group, Department of Biology, Utrecht University, Padualaan 8, 3584 CH Utrecht, Netherlands
Department of Ecosystem Science and Management, University of Wyoming, Laramie, WY 82071, USA
Institute of Ecology, College of Urban and Environmental Science, and Key Laboratory for Earth Surface Processes of the Ministry of Education, Peking University, Beijing 100871, P. R. China

E-mail: maowei.liang@virginia.edu

Question (Aims): Livestock grazing is a major driver shaping the functioning and stability of grasslands. Although previous studies have documented the effect of grazing on grassland stability, whether this effect is scale-dependent remains unclear.

Location/Methods: We conducted a sheep-grazing experiment in a temperate grassland on the Mongolia Plateau during 2014-2018, where four sheep-grazing intensities were implemented (Xilin Gol, Inner Mongolia, China). We examined the effects of grazing on the biodiversity and temporal stability (1/CV) of vascular plants across organizational levels (i.e., from populations to communities) and spatial scales (i.e., from local to regional). We explored the underlying mechanisms of consumer top-down effects and producer bottom-up anti-herbivory strategies.

Results: Sheep-grazing decreased species diversity of vascular plants, at both local (i.e., decreased α diversity by 29%) and regional scales (i.e., decreased γ diversity by 36%). The more pronounced decrease of diversity at the regional scale was explained by a decrease of β diversity. Across the gradient of grazing, population stability of vascular plants increased by 195% whereas community and metacommunity stability decreased by 20% and 17%. Grazing substantially decreased species asynchrony at the local scale, while it increased spatial asynchrony slightly at the regional scale. Taken together, grazing reduced by half the net stabilization factor from population to metacommunities, which explained the contrasting responses of stability at population and metacommunity levels. Grazing effects on biodiversity and stability of vascular plants increased with an increase of grazing intensity both at the local and regional scales.

Conclusions: Our study demonstrates, for the first time to our knowledge, the scale dependence of the effects of grazing on biodiversity and stability, which provides critical insights for bridging local-scale research with large-scale management. Our findings thus have useful implications for livestock management and wildlife conservations in rangelands.

OP20

MEDICINAL PLANTS IN PERIL DUE TO CLIMATE CHANGE IN THE HIMALAYA

Kumar Manish¹

¹Department of Environmental Studies, Dr. Bhim Rao Ambedkar College, University of Delhi, Delhi, India

E-mail: kumaran mish910@gmail.com

Climate change is causing many irreversible changes in the Himalayan ecosystems. In this study, an attempt was made to understand the ecological response of medicinal plant species to changing climate conditions in the Sikkim Himalaya, a part of the Eastern Himalayan biodiversity hotspot. Maximum Entropy Species Distribution Modelling (SDM) approach was used to analyze the potential habitat distribution of 163 medicinal plant species in current and future climates (2050, 2070). An attempt was also made to identify the most suitable areas for conservation and test the effectiveness of the existing Protected Area (PA) network in conserving medicinal plant species in current and future climate scenarios through the Habitat Suitability Area and Overlap Analyses. SDM analyses revealed that the majority of the medicinal plant species are found in the tropical and sub-tropical regions in the Sikkim Himalaya (300-2000 m) at present. In future climates, however, most of the species are likely to show an upward and northward shift in their distributions. Maximum species-rich regions are likely to shift by 200 m and 400 m in 2050 and 2070, respectively. A total of 13-16% of medicinal plant species currently found in the region are likely to lose their existing potential habitats by 2050 and 2070. The results highlight that species that are restricted to specific localities and have a narrow elevational distribution are the most vulnerable species and likely to go extinct due to climate change in the Himalaya. Habitat suitability analyses indicated that elevations ranging from 860-2937 m serve as highly suitable habitats for medicinal plant species in Sikkim Himalaya. Consequently, these areas can be focused for conservation actions in order to mitigate the effect of climate change. The results of Overlap Analysis indicated that out of 8 PAs in Sikkim Himalaya, only 5 PAs are effective in the conservation of medicinal plant species in current and future climates. The boundaries of existing PAs need to be expanded in order to accommodate the upward shifts in the spatial distribution of species, especially in the case of those PAs that are located in the lower elevations or tropical regions.
OP23
HIGH-ALTITUDE WETLANDS IN THE EASTERN PAMIR (TAJIKISTAN): DISTRIBUTION, SPECIES COMPOSITION AND PLANT RESPONSE TO N AVAILABILITY

Monika Metrak1, Marcin Sulwinski1, Pawel Pawlowski1, Lukasz Chachulski2, Piotr Pokarowski3, Elizaeta Rojan2, Malgorzata Suska Malarska1,3

1Faculty of Biology, Biological and Chemical Research Centre, University of Warsaw, Żwirki i Wigury 101, 02-089 Warsaw, Poland
2Warsaw University of Life Sciences, Faculty of Agriculture and Botany, Department of Botany, Nowoursynowska 159, 02-776 Warsaw, Poland
3Faculty of Mathematics, Informatics and Mechanics, University of Warsaw, Banacha 2, 02-097 Warsaw, Poland
4Faculty of Geography and Regional Studies, University of Warsaw, Krakowskie Przedmiescie 30, 00-927 Warsaw, Poland
5International Platform for Dryland Research and Education, Tottori University, 1390 Hamasaka, Tottori, 6800001 Japan

E-mail: m.metrak@uw.edu.pl

Aims: Characterization of high-altitude wetlands ecological functioning by (1) identifying environmental factors that shape distribution and diversity of plant communities; (2) examining the influence of selected environmental factors on plant N:P ratio under locally variable conditions in alpine landscape; (3) assessing the impact of local differences in soil chemistry on plant fractionation of N isotopes as a response to N availability.

Location: The Pamir Mountains are located in the southeastern part of Central Asia. Their eastern part is characterized by cold desert climate, with an annual sum of precipitation below 100 mm, high insolation and strong winds. The wetlands in the Eastern Pamir are located in the vicinity of lakes or in the river valleys and constitute important water sources and forage grounds.

Methods: During field expeditions organized between 2014 and 2019 we performed vegetation survey and collected samples of plant biomass and soils from wetlands located in the watersheds of Yashilkul and Rangkul lakes. Samples were dried, ground and their salinity (soils), CNP content and isotopic ratios (soils and biomass) were analyzed with standard analytical methods.

Results: Studied wetlands were characterized by highly differentiated micro-relief and complex water sources, leading to local differences in soil moisture, salinity and nutrient content. The identified 10 distinct plant communities were distributed accordingly to soil features and formed a repetitive mosaic on the studied lake terraces and river floodplains. This mosaic was usually dominated by alpine sedge meadows and salt marshes. Community-level plant response to N availability expressed as plant N:P ratio was affected by both regional (geographical and climatic) and local (soil properties) factors. According to threshold values of plant N:P ratio, most of the studied vegetation types were N-limited. However, due to specific climatic conditions influencing weathering processes, plants were also strongly influenced by soil PO43- content and in some cases P limitation was observed. Contrastingly, plant δ15N remained uncorrelated with regional drivers and depended only on local factors.

Conclusions: The described plant functional traits showed differentiated response to regional and local drivers, indicating that their proper choice seems to be crucial in any experimental or modeling set-up.

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OP22
PROMOTING HIGH MOBILITY OF HERDERS IS KEY TO RANGELAND CONSERVATION IN THE DZUNGARIAN GOBI, MONGOLIA

Lena M. Michler1, Petra Kaczensky2,3 & Anna C. Treydte1,4

1University of Hohenheim, Ecology of Tropical Agricultural Systems, Germany;
2Inland Norway University of Applied Sciences, Dept. of Forestry and Wildlife, Norway
3University of Veterinary Medicine, Research Institute of Wildlife Ecology, Austria
4Stockholm University, Dept. of Physical Geography, Sweden

E-mail: lena.m.michler@gmail.com

Globally, rising livestock numbers and climatic change raise concerns over rangeland health. Mobility is a key strategy for herders worldwide to provide nutritious forage to their livestock and distribute grazing impacts on rangelands. However, pastoral mobility is declining as walking distances by livestock are often reduced and camp changes become less frequent, increasing grazing pressure around camp sites and ultimately resulting in degradation. In Mongolia, socio-economic drivers have resulted in reduced movement distances and a concentration of herder camps closer to urban centres. In the Great Gobi B Strictly Protected Area, which is far from urban centres, nomadic herders have seasonal access to limited-use and buffer zones of the protected area which is home to several globally threatened ungulate species. The shared use within the protected area makes understanding the impact of livestock grazing on the ecosystem an important research priority. To understand travel and grazing mobility patterns of small livestock herds we used GPS tracking data in combination with vegetation assessment on a landscape and local scale as well as socio-ecological information. We tracked 19 livestock herds over 20 months, assessed herder preferences for camp selection, determined use and nutrient contents of the most dominant plant communities, and sampled plant species richness, vegetation cover, and biomass within different grazing radii around camps. We found that herders in this area practice altitudinal migrations from the Gobi plains to the mountainous summer pastures, covering distances of 70–123 km between camps. Herders were still highly mobile, with on average 9 camp changes per year, and stayed on average 25–49 days in a camp, depending on season. Camps were mainly located in Stipa spp. communities, preferred by herders due to its high forage value. Livestock use intensity was highest within a radius of 100 m from camp where small livestock spend over 13–17 hours per day. On the Gobi plains this use intensity decreased steeply with distance from camp, however, with limited evidence for grazing gradients in plant species richness, vegetation cover, and biomass. We conclude that, as long as mobility of herders is maintained and livestock numbers and camp sites are controlled, traditional pastoral systems can be compatible with protected area’s conservation goals.
Subterranean species represent a very special group among the mammals. They have a whole series of morphological, physiological and immunological adaptations, what makes them extremely interesting for researchers in many fields of biology. However, the subterranean mammals are neglected from conservation point of view.

Based on information from the IUCN Red List of Threatened Species, we built a database on their conservation status and vulnerability. We reviewed the extent to which the group’s Asian representatives were at risk and also examined what threats they were expected to face in the future.

Of the 257 subterranean mammal species, 61 occur in Asia (24%) belonging to 3 families; Talpidae, Cricetidae and Spalacidae. Half of Asian species are associated with grassland habitats, primarily temperate dry grasslands. Several of these species have been shown to be keystone species in grasslands. Of the Asian species, only 3% are classified as threatened, while 62% are not threatened, but 10% of the species are data deficient and even 25% of them have not been assessed by the IUCN. Thus, about a third of the species (34%) our knowledge is insufficient. The population trend of no species is increasing, 15% are stable and 8% are decreasing, but 77% of all Asian species have an unknown population trend. The main threat to these species is habitat loss by agricultural and urban-industrial development.

At the same time, the lack of knowledge is a very significant problem as well. For many members of this group, there are serious taxonomic problems, which is why the true number of species is likely to be much higher than is currently known. Some of the unidentified species may be threatened. It is very difficult to map their distribution due to their special lifestyle. As well as, monitoring the populations and identifying population trends. Identifying threatening factors is also a difficult task. Because of these, species or populations can easily drift unnoticed to the brink of extinction.

The proportion of grassland-dwelling species of subterranean mammals in Europe is also significant (80%) while, the proportion of endangered species is extremely high (25%), and the vast majority of the latter are associated with dry grassland habitats. Thus, compared to their European counterparts, Asian species are likely to be at serious risk in the future because of the more intensive economic development and larger-scale habitat transformation. Therefore, clarifying the taxonomic issues and monitoring population changes is of paramount importance.
SOIL CRACKING IS A CRITICAL TURNING POINT IN THE COLLAPSE PROCESSES OF KOBRESIA ECOSYSTEMS ON TIBETAN PLATEAU

Yujie Niu1,2, Anke Jentsch2 & Limin Hua1
1College of Grassland Science, Gansu Agricultural University / Key Laboratory of Grassland Ecosystem of the Ministry of Education, Lanzhou 730070, China
2Department of Disturbance Ecology, BayCEER, University of Bayreuth, Bayreuth, 95440, Germany
E-mail: yujie.niu@uni-bayreuth.de

Soil cracking is an important feature of degraded terrestrial ecosystems, which cuts the closed and intact grassland, alters microtopography and also influences the dynamics of soil nutrients and water, then further affecting plant community composition and distribution. Despite their importance, the patterns and causes of soil cracks related to overgrazing on alpine grasslands of Tibetan plateau have rarely been reported previously. We used a comprehensive cross-scale approach to investigate the distribution of crack-soil areas at eastern Tibetan plateau (mainly in traditionally grazed alpine steppes, meadows, and swamps), then selected the grazing-induced parameter that was closely related to the cracks at a small scale (i.e. 1 ha), and quantified the effects of microtopography (raised areas and healed cracks) induced by cracking on water infiltration at a micro scale (i.e. crack patch). Additionally, we evaluate the crucial role of soil cracking for the degradation of alpine grasslands.

Our results suggest that cracks only formed in Kobresia-dominated alpine grasslands after exceeding the local carrying capacity by overstocking. Soil cracking was closely related to the increased soil compaction caused by overgrazing. The initial infiltration rate and steady infiltration rate of the healed cracks were significantly higher than those in the raised areas in the centre of the mosaic crack patches.

We propose a new model of alpine meadow degradation considering the cracking phenomenon due to overgrazing and provide key and easy-to-measure indicators to prevent overgrazing and cracking. We suggest that the cracking stage is the most critical turning point in the process of alpine grassland degradation and that grassland managers should pay more attention to crack phenomena to prevent severe degradation. Linking patch dynamics and plant functional traits to emerging disturbance theory, our future work will focus on the nonlinear responses of plant communities in alpine Kobresia ecosystems facing collapse.

Keywords: overgrazing; Tibetan plateau; soil crack; rangeland degradation; natural recovery, disturbance, plant functional traits

PLANT BIOGEOGRAPHY AND VEGETATION TYPES OF THE ZAGROS MOUNTAIN RANGE

Jalil Noroozi¹, Amir Talebi², Moslem Doostmohammadi³ & Ali Bagheri4
1Department of Botany and Biodiversity Research, University of Vienna, Vienna, Austria
2School of Biology and Center of Excellence in Phylogeny of Living Organisms, College of Science, University of Tehran, Tehran, Iran
3Department of Biology, Faculty of Sciences, Shahid Bahonar University of Kerman, Kerman, Iran
4Department of Plant and Animal Biology, Faculty of Biological Science and Technology, University of Isfahan, Isfahan, Iran
E-mail: jalil.noroozi@univie.ac.at

Aims: In this work, we present the phytogeography, vegetation types, and endemic hotspots of the Zagros mountain range and their conservation status.

Location: Zagros is the largest mountain range of the SW Asia, stretching from northeast Iraq to south Iran and has high mountain peaks exceeding 4,000 m a.s.l. It is located inside of the Irano-Turanian biogeographical region and the Irano-Anatolian biodiversity hotspot. The climate is continental and the precipitation regime is Mediterranean with cold and wet winters and warm and dry summers.

Methods: Our database lists 3,642 vascular plant species for this mountain range extracted from different local and national floras. Distribution range of these species in different biogeographical regions and adjacent mountain ranges were databased. All major vegetation types, their character species and ecological requirements were collected from all published literature and our own field studies.

Results: More than 70% of the species of Zagros are IT elements and the rests are widespread species occurring in two or several biogeographical regions. This mountain range is identified as an area of endemism and 21% of the entire flora are Zagros elements. Endemic hotspots are mostly associated with the regions with high elevational amplitude covering different vegetation types from low montane to subnival zones. The major vegetation types of the Zagros are oak woodlands, Amygdalus-Pistacia shrublands, montane steppe shrublands, wetlands, chasmophytic habitats, subalpine, alpine and subnival zones.

Conclusions: Anthropogenic activities are threatening the unique flora and vegetation types of this mountain range. The conservation gaps of the endemic hotspots are remarkable, and a strong conservation policy is recommended.
THE PISTACIETEA KHINJUKI-VERAE: A NEW CLASS OF OPEN WOODLANDS IN TRANSITIONAL FOREST-STEPPE ZONE IN IRANO-TURANIAN MOUNTAINS

A. Nowak1,2, S. Świerszcz3, A. Naqinezhad4, M. Nobis5

1Botanical Garden, Center for Biological Diversity Conservation, Polish Academy of Sciences; Prawdziwka 2, 02-973 Warszawa, Poland
2Institute of Biology, University of Opolo, Oleska 22, 45-052 Opolo, Poland
3The Franciszek Górski Institute of Plant Physiology, Polish Academy of Sciences; Niezapominażej 21, 30-239 Kraków, Poland
4Department of Plant Biology, Faculty of Basic Sciences, University of Mazandaran, P.O. Box: 47416-95447, Babolsar, Iran
5Institute of Botany, Jagiellonian University; Gronostajowa 3, 30-387; Kraków, Poland

E-mail: anowak@uni.opole.pl

Question: What vegetation class represents the pistachio open woods? Location: Irano-Turanian phytogeographical region.


Results: We found that pistachio open woods are very distinct in terms of structure and species composition. It was already found by Zohary that pistachio wild orchard is a distinct vegetation, however on the base of scarce phytosociological data, he merged it with juniper groves and published invalidly (Junipero-Pistacietea atlanticae Zohary, 1973, invalid name, art. 2d). Pistacia open-woodlands are a typical vegetation of warm and subhumid to semi-arid subtropical environments of the Irano-Turanian region, particularly Middle East, Iran and Middle Asia. This type of vegetation inhabits colline and montane belts of Irano-Turanian mountain ranges (e.g. Kopet-Dagh, Pamir-Alai, western Tian-Shan, Hindukush, Zagros, Alborz and other Central Iranian mountains). Pistacia open woods (also called pistachio-almond open xeromorphic scrub) form complex transitional ecosystems between scrublands and pseudosteppes and are often included in forest-steppe vegetation that is considered to be shaped by ‘two works’, very distinct in terms of structure, ecology and function. Our observations in Pamir-Alai, Kopet-Dagh and Iranian mountains proved that juniper groves and pistachio open woods form two distinct zonal vegetation at montane-subalpine and colline-submontane belts respectively. Therefore, this two latter vegetation units do not share unique diagnostic species or ecological requirements. The new class, namely Pistacietae khinjuki-verae, is presented here with Pistacietaetalia verae as the type order and Pistacietae verae as the type alliance. The potential distribution of this vegetation extends from the Zagros and Alborz Mts. towards Tajikistan, Afghanistan, Uzbekistan and Pakistan.

Conclusion: The Pistacietae khinjuki-verae certainly still needs to be examined and compared with similar vegetation in the Eastern Mediterranean and western Irano-Turanian regions. Nevertheless, our research on almost 1,000 plots of different types of open wood vegetation in Irano-Turanian and East Mediterranean regions can, in our opinion, be summarised at this stage with the proposal of the new vegetation class.

References

LONG-TERM GRAZING EFFECTS ON GRASSLAND IN MONGOLIA: VARIATION AMONG STEPPE TYPES

Oyunbileg Munkhzuil,1,2 Khurelpurev Oyundelger1,4, Yun Jäschke3, Batlai Oyuntsetseg2, Uuganjargal Khaium1, Karsten Wesche1,2,4,5

1Botanical Garden and Research Institute, Mongolian Academy of Science, 13330, Ulaanbaatar, Mongolia
2Department of Biology, School of Arts and Sciences, National University of Mongolia, 14200, Ulaanbaatar, Mongolia
3Department of Botany, Senckenberg Museum of Natural History Götting, 02826 Götting, Germany
4International Institute Zittau, Technische Universität Dresden, Markt 23, 02763 Zittau, Germany
5German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, 04103 Leipzig, Germany

E-mail: munkhzul@mas.ac.mn

The Mongolian steppes with a long history of nomadic pastoralism cover large area of the Palaearctic steppe biome and are still relative intact. As livestock number has increased over last two decades, grazing has been considered as the main reason of pasture degradation. However, the impact of grazing on vegetation dynamics, and its interaction with climate, is still not clear. We reviewed 44 publications in Mongolian language, covering 109 sites in five main steppe types, i.e., desert, dry, meadow, mountain and high mountain steppe, with a mean annual precipitation and temperature range from 120 to 370 mm and from -6 to +5 °C, respectively. We calculated relative changes in vegetation cover, species richness and aboveground biomass from heavily grazed with respect to lightly/non-grazed conditions. Multiple linear regression models were used to test the impact of environmental factors, i.e., mean annual precipitation, coefficient of variation for precipitation, mean annual temperature and elevation. Grazing had a stronger effect on the vegetation of dry, desert and high mountain steppe, whereas its effect was less pronounced in the meadow and mountain steppes with mesic climate and high productivity. Vegetation cover, species richness and aboveground biomass were reduced by heavy grazing in dry, desert and high mountain steppes. In meadow steppes, grazing reduced vegetation cover, but increased richness and had nearly no effect on biomass. In mountain steppe, richness and cover were not affected, but biomass was reduced by heavy grazing. Additionally, grazing effects on biomass tended to be more pronounced at sites with higher amounts of annual precipitation, and effects on cover changed from negative to positive as elevation increased. In conclusion, grazing effects in Mongolian steppes are overall negative in desert, dry and high mountain steppes, but no or even positive effects are found in meadow and mountain steppes. Especially, grazing showed a detrimental effect on all vegetation variables in desert steppes, indicating the existence of combined pressure of climate and grazing in arid habitat, making them potentially sensitive to overgrazing and climate change. Grassland conservation and management should consider characteristics of different steppe types and give importance on local environmental conditions.

Keywords: steppes, grazing, diversity, biomass, climate, human impact
OP36

SOIL SEED BANK POTENTIAL OF DISTURBED HIMALAYAN ALPINE GRASSLANDS - A CASE STUDY FROM TUNGNATH TIMBERLINE

Shyam S. Phartyal1*, Bobbymoore Konsam2, Ajit K. Negi2 and Saurabh Chauhan2

1School of Ecology and Environment Studies (SEES), Nalanda University, Rajgir, Bihar, India
2Department of Forestry and Natural Resource, H.N.B. Garhwal University, Srinagar-Garhwal, Uttarakhand, India

E-mail: shyamphartyal@gmail.com

Many alpine plants disperse dormant seeds at maturity towards the last leg of the growing season characterized by cool temperature, which is not suitable for immediate seed germination. These seeds then get accumulated in soil and germinate in the next growing season or are buried in the ground for different duration of time. Since soil seed bank potential depends on species-specific (intrinsic) and site-specific (extrinsic) characteristics, thus it is worth asking: do disturbed Himalayan alpine grasslands have the potential to form a soil seed bank? We sampled a total of 260 soil cores in two layers down to 10 cm depth from 13 plots systematically located approx. 2 km parallel to Tungnath timberline. Soil sampling was done thrice, first in autumn 2017, second in spring 2018, and third in autumn 2018, then incubated ex-situ (net-house) and in-situ (on-site field) conditions for seedling emergence. Overall, 2141 seeds/m² were found buried in the soil and belong to 13 species (10 dicots and three monocots). Soil density and species number significantly decreased with increasing soil depth. The upper layer (0-5 cm) had a mean seed density of 3586 seeds/m² of five species, whereas the lower layer (5-10 cm) had 697 seeds/m² of two species, respectively. The layer-wise seed density of dicots was higher than monocots both in upper and lower soil layers. Our study shows that disturbed Himalayan grassland has low soil seed bank potential. High disturbance pressure like grazing and high human footfalls probably damaged the reproductive phase of plant life and led to low seed production, so the low seed inputs in the soil. Additionally, some methodological issues to study soil seed banks of alpine plants were also discussed.

Keywords: Alpine grassland, Bugyal, Garhwal Himalaya, Seed ecology, Soil seed bank, Treeline

OP09

HOW LAND COVER CHANGES AND LAND USE INTENSITY AFFECT ECOSYSTEM SERVICES AND THEIR RELATIONSHIPS IN THE WULAGAI RIVER BASIN OF INNER MONGOLIA, CHINA

Chenwei Shang1

1Inner Mongolia Key Laboratory of Grassland Ecology, School of Ecology and Environment, Inner Mongolia University

E-mail: shang@imu.edu.cn

Temperate grasslands are the most endangered of all major biomes on earth, with more than 50% converted to agricultural, urban and other land uses and only less than 5% currently protected. Understanding how land use/land cover change alters ecosystem function and ecosystem services in these grassland landscapes is crucial for their protection and sustainability. To address this question, our study focused on the Wulagai River Basin, a biodiversity-rich steppe region known as the “last beautiful grassland” in Inner Mongolia, China. We quantified the spatiotemporal patterns of several main variables of ecosystem function and services, including NDVI, food, fresh water, carbon sequestration and storage, and soil erosion prevention for the years of 1979, 1989, 2000, 2006, and 2016, based on remote sensing images and survey data. Our results show that during the past four decades the land use and land cover pattern of the Wulagai River Basin changed profoundly: wetlands decreased from 361 km² to 168 km², saline meadows increased from 51 km² to 121 km², and saline-alkali lands increased from 51 km² to 93 km². These changes decreased the flow of water in streams and reduced the water supply from 27 mm to 8 mm, the carbon storage dropped slightly from 48 Mg/hm² to 42 Mg/hm². Grass production, water yield, water retention, carbon storage and soil conservation usually had positive effects. While soil loss by wind erosion was negatively correlated with other ecosystem services. This is consistent with recent studies confirming that the trade-off between provisioning and regulating services can be balanced or even reversed in low-intensity land systems. Over the past 40 years, the Wulagai River Basin has experienced severe landscape fragmentation and land degradation. In the meanwhile, water and wetland have kept decreasing, fragmentation is still accelerating, and reclamation and coal mining remain problems. The ecosystem services of the Wulagai River Basin kept decreasing. The Wulagai Reservoir altered the regional hydrological system, and these changes exacerbated the degradation of ecosystem services in the middle and lower reaches.

Keywords: Inner Mongolia, Wulagai River Basin, Grasslands, Ecosystem Services, Human-environment interactions
CAN ACTIVE RESTORATION PRIMING AND IMPROVING SELF-RESTORING IN EXTREMELY DEGRADED ALPINE MEADOW?

Zhanhuan Shang1

1College of Ecology, State Key Laboratory of Grassland Agro-ecosystems, Lanzhou University, Lanzhou 730000, China
E-mail: shangzhh@lzu.edu.cn

Abstract:

The primary task and approach is how to prime the succession of restoration and enhance the self-ability, and then urge the vegetation to recovery as to the aim of normal meadow.

Methods: Here, we conducted experiments of active restoration to recovery to restore the extremely degraded meadow with toxic plants in Tibetan plateau with different restored years.

Results: In short time (2-3 years) after restoration, the vegetation and soil were controlled by additional seeds and fertilization of active restoration. The sown grassland vegetation (additional species) could keep dominant status at least five years, and after 7 years vegetation and soil nutrition declined. After 10 years of active restoration without control measures, the plant community degraded significantly, soil total nutrient did not significantly increased, but increased turnover and stability of soil carbon and nitrogen pool. After 20 years of artificial active restoration, where the community species diversity and soil seed bank recovered to the level of native grassland, but there was still a lack of plant species of Kobresia. However, soil carbon pool and root biomass did not recover at the level of natural grassland. 8-10 years is the critical period for the continuous restoration of active restoration for the extremely degraded grassland, and at that period, the regulation approach of restoration should be strengthened and carried out again to promote and accelerate the restoration process.

Conclusion: In conclusion, there were three key points of active restoration for priming and improving self-restoring ability of extremely degraded alpine grassland on Tibetan plateau. (1) Native seed donation: higher species number mixed and density of seed. (2) Toxic plant control: Eliminating the toxic plant and control at least 5 years. (3) Soil cultivation: Moderate grazing in winter can improve soil nutrition and vegetation succession.

EFFECTS OF GRAZING SEASON ON COMMUNITY STRUCTURE IS MEDIATED BY PLANT LITTER MASS IN A TYPICAL STEPPE GRASSLAND

Chunjun Shi1,2, Yanlong Li1,2, Zheng Bai1, Lin Wu1, Hao Wang1,2, Tongrui Zhang1,3, Qiu Chang2, Frank Yonghong Li1,2

1Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau & Inner Mongolia Key Laboratory of Grassland Ecology, School of Ecology and Environment, Inner Mongolia University, Hohhot, 010021, China
2Collaborative Innovation Center for Grassland Ecological Security, Ministry of Education of China, 235 University West Street, Hohhot, 010021, China
3Institute of Grassland Research, Chinese Academy of Agricultural Sciences, Hohhot, 010021, China
E-mail: scj3792@163.com

Abstract:

Aims: Understanding the inter-relation among the changes in soil factors, plant litter mass, and plant community structure and production, in response to different season grazing regimes may help formulate the best practice in grassland management.

Methods: 3-year experiment was conducted to investigate the effects of seasonal grazing on plant community structure and production in a typical steppe grassland. The experiment was designed with 20 fenced paddocks of 50 m × 50 m to arrange the five seasonal grazing treatments, namely spring grazing, summer grazing, autumn grazing, winter grazing and no grazing control, replicated four times. We monitored the changes in soil properties, plant litter mass and plant species composition and production across grazing treatments.

Results: We found that the litter accumulation under different seasonal grazing played an crucial role in mediating grazing effects on vegetation. Litter accumulation significantly improved soil moisture by increasing snow accumulation in winter, and reducing soil surface water runoff and evaporation in the growing season, benefiting plant growth in the semi-arid steppe. Litter mass can largely explain the variation in plant community properties across four seasonal grazing treatments. Cold season grazing (i.e. spring and winter grazing), with better litter cover over winter period but not the plant growing season, significantly improved soil moisture and temperature in plant re-greening period, compared to warm season grazing (i.e. summer and autumn grazing), benefiting to plant growth and production.

Conclusions: Our results imply that cold season grazing is better than the complete fencing, the current widely-used measures to exclude animal grazing for the recovery of degraded grassland. It is suitable to incorporate the cold season grazing in the development of sustainable grazing grassland systems.
Biogeophysical (albedo, sensible and latent heat fluxes) and biogeochmical (carbon flux) effects driven by land-use change can have different and even opposite consequences for climate. The objective of this study was to quantify the differences in these effects across diverse land-cover types independent of variations in climatic conditions. We used a mosaic of different ecosystems in close proximity (within 2 km) under dry Mediterranean climate in central Israel (mean annual temperature = 20.8°C, annual mean precipitation of 403 mm and aridity index =0.4). Managed grassland (affected by grazing) was compared to a planted pine forest (pinus halepensis), naturally regenerated, broad-leaf oak dominated maquis (Quercus calliprinos), and wheat field agriculture. Campaign-based measurements were made using a unique Mobile Laboratory including eddy-covariance flux measurements of CO₂, (Net Ecosystem Productivity, NEP), H₂O (Latent Heat flux, LE), and heat (sensible heat flux, H) as well as radiative (short-wave, long-wave, and Photosynthetic Active Radiation, PAR) and meteorological parameters (vapor pressure deficit, temperature) during 2016-2018, in different seasons that included short and dry heat waves. The results indicated that the grass ecosystems (managed grassland and wheat field) have higher peak season NEP (between 2-3 gC m⁻² d⁻¹) than the trees ecosystems (less than 1 gC m⁻² d⁻¹), but are expected to be a less reliable carbon storage on annual scale, as the grassland is mostly degraded during the dry summer or consumed by animals, and the wheat is harvested and consumed by humans and animals. The grass-type ecosystems also showed the highest tolerance to drought, keeping positive rates of NEP during heat waves, while maquis and pines NEP is reduced to almost zero, or even become negative, with a net emission of carbon to the atmosphere. The highest albedo was measured in the grassland during all seasons (0.21), and the lowest was in the planted pines (0.13), with important implications for the energy dissipation balance. Most of the excess energy absorbed by the pines plantation was dissipated via large H (up to 600 W m⁻² in summer), termed as a ‘convector effect’, while in the grassland LE was typically higher (200 W m⁻²) in spring) or similar to H. Overall, the results indicate that under the future climate change scenarios for this region, it can be expected that the maquis’ southern limit will transition northward towards, being replaced by pines, which will ultimately be replaced by grasslands.
OP06
URBANIZED GRASSLANDS WITHIN FRAGMENTED AGRICULTURAL LANDS FAVOR SPECIES WITH SHORT GENERATION TIMES

Hiroki Fujimoto1, Kei Uchida2 and Atushi Ushimaru1,2
1Faculty of Human Development, Kobe University
2Graduate school of Human Development and Environment, Kobe University

E-mail: ushimaru@kobe-u.ac.jp

Question (Aim): Plant and animal species in urban areas are likely to be impacted in different ways, depending on their life history traits. Here, we examine the impacts of urbanization on semi-natural grassland plant and herbivore diversity within paddy ecosystems around a megacity in Monsoon Asia. Specifically, we address a following question: Whether are species with short lifespans lost more quickly than long-lived ones in urban areas or not?

Location: Semi-natural grasslands around paddy fields, the Osaka-Kobe megacity, western Japan.

Methods: We set 60 belt-plots across 20 paddy sites along an urban–rural gradient in a western part of the Osaka-Kobe megacity and examined richness of plants, butterflies and orthopterans.

Results: The semi-natural grasslands in urbanized areas had less than half the perennial plant, butterfly, and orthopteran species richness than those in rural areas. The increased relative dominance of species with short generation times (annuals and multivoltine butterflies) over long-lived species (perennials and univoltine and bivoltine butterflies) in urban grasslands supported the habitat template hypothesis but not the extinction debt hypothesis. Increased soil pH facilitated the establishment of annuals, including exotic species in urbanized semi-natural grasslands. Habitat fragmentation, split, and degradation (increased anthropogenic disturbance and soil pH) decreased perennial plant richness, leading to loss of univoltine and bivoltine butterflies and orthopterans indirectly. Habitat loss and fragmentation had stronger direct negative impacts on species richness of multivoltine butterflies and orthopterans.

Conclusions: The effects of urbanization on biodiversity differed depending on taxonomic groups and life-history traits. Organisms with short generation times (high reproductive rates) are potentially more adaptive in eutrophic and disturbed urban environments. The generality of these findings should be further examined using more diverse taxonomic groups in other urban areas.

OP27
SMALL NATURAL AND ANTHROPOGENIC FEATURES AS BIODIVERSITY HOTSPOTS IN THE STEPPE: MARMOT BURROWS AND BURIAL MOUNDS IN KAZAKHSTAN

Orsolya Valkó1, Csaba Tölgyesi2, András Kelemen1,2, Zoltán Bátori2, Róbert Gallé1, Zoltán Rádai1, Tatjana M. Bragina4, Balázs Deák1
1Lendület Seed Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research, Vácártó, Hungary
2Department of Ecology, University of Szeged, Szeged, Hungary
3Landscape and Conservation Ecology Research Group, Institute of Ecology and Botany, Centre for Ecological Research, Vácártó, Hungary
4Kostanay State Pedagogical University Named After Omirzaq Sultangazin, Kostanay, Kazakhstan

E-mail: valkoosi@gmail.com

Environmental heterogeneity is a crucial driver of the biodiversity patterns in grasslands. Heterogeneity acts at different spatial scales from microrelief to mountain ranges. At intermediate scales, several natural and anthropogenic features can introduce a high level of environmental heterogeneity to plain lowland landscapes. We evaluated the vegetation of small natural features (marmot burrows) and man-made earthworks (burial mounds called ‘kurgans’). Our study sites were situated in Kostanay Oblast, North-Kazakhstan. In the first study, we compared the vegetation of marmot burrows with the surrounding intact feathergrass steppes to identify differences in species composition and plant functional groups (Valkó et al. 2021). Burrows were characterised by lower vegetation cover, higher cover of annuals and lower cover of perennial grasses compared to the intact steppe. We found an increased cover of ruderal species on the burrows, but also several specialist species, such as Agropyron cristatum, Anabasis salsa, Kochia prostrata, and Petrosimonia spp. were confined to the burrow vegetation. In the second study, we assessed whether kurgan micro-habitats (north- and south-facing slope and surrounding ditch) harbour different species pools and functional groups from those found on the surrounding steppes (Deák et al. 2017). Kurgan micro-habitats had diverse vegetation and supported the co-existence of plant species with different environmental needs. We identified several steppe specialist plant species confined to kurgan micro-habitats, such as Festuca valesiaca, Iris pumila, and Stipa pennata. We found that the vegetation of the burrows and mounds was structurally and compositionally different from the intact steppe vegetation. Our results suggest that these features increase the landscape-scale heterogeneity of the steppe vegetation and could act as stepping stones for the dispersal of several steppe-specialist species.

References
OP12
CLASSIFICATION OF ARMENIAN DRY GRASSLANDS:
FIRST INSIGHTS INTO THEIR SYNTAXONY

Denny Vynokurov1,2, Alla Aleksanyan3, Thomas Becker4, Elena Belonoskaya5, Ivona Dembicz6, Martin Magnes7, Daria Shyriaieva8,9, Yulia Vasheniak9, Jürgen Dengler10,11,12
1Geobotany and Ecology Department, M.G. Khlopotov Institute of Botany, NAS of Ukraine, Terschenhenkivska str. 2, 01601 Kyiv, Ukraine
2Department of Plant Biology and Ecology, University of the Basque Country UPV/EHU, P.O. Box 644, 48080 Bilbao, Spain
3Department of Geobotany and Plant Eco-Physiology, Institute of Botany after A.L. Takhhtajan, NAS RA, Acharyan 1, 0040, Yerevan, Armenia
4Department of Geobotany, University of Trier, Behringstr. 21, 54296 Trier, Germany
5Department of Biogeography, Institute of Geography, Russian Academy of Sciences, Staremonetnny per. 29, 119017 Moscow, Russia
6Institute of Environmental Biology, Faculty of Biology, University of Warsaw, ul. Zwicki i Wigury 101, 02-089, Warsaw, Poland
7Division of Plant Sciences, Institute of Biology, Karl-Franzens-University of Graz, Graz, Austria
8Department of Botany and Zoology, Masaryk University, Kamenice 753/5, 62500 Brno, Czech Republic
9Department of Biology, Chemistry and Biotechnologies, Vasyli Stus Do-netsk National University, 600-richva str. 21021, Vinnytsya, Ukraine
10Vegetation Ecology Research Group, Institute of Natural Resource Sciences (IUNR), Zurich University of Applied Sciences (ZHAW), Grünentalstr. 14, 8820 Wädenswil, Switzerland
11Plant Ecology, Bayreuth Center of Ecology and Environmental Research (BayCEER), Universitätsstr. 30, 95447 Bayreuth, Germany
12German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Puschstr. 4, 04103 Leipzig, Germany

E-mail: denys.vynokurov@gmail.com;

Question (Aims): The vegetation of Armenia has not been studied using Braun-Blanquet approach so far. The grasslands of the Southern Caucasus were only sparsely and fragmentarily studied in the neighbouring countries (Azerbaijan: Peper et al. 2010, Etzold et al. 2016, Jabbarov et al. 2020; Georgia: Pyšek & Štrůk 1989; Nakhtusirshili et al. 2022 etc.). Our aim thus is to shed light on the syntaxonomy and diversity of the dry grasslands of this poorly studied dry grasslands in one of the global biodiversity hotspots.

Location: Armenia. We included five administrative regions of the country (Shirak, Araratozn, Gegharkunik, Vayots dзор, Ara-rat) and an elevational range from 1338 to 2400 m a.s.l.

Methods: The data were collected by an international research team of 19 scientists during the 13th EDGG Field Workshop in 2019 (Aleksanyan et al. 2020). Using the standardized EDGG methodology, we sampled 29 EDGG Biodiversity Plots (= nested-plot series of 0.0001 to 100 m²; see Dengler et al. 2016) and 53 additional 10-m² plots, mainly focusing on meso-xeric, xeric and rocky grasslands. For the classification purposes we use only 10 m² plots (e.g., 58 from the nested-plot series and 53 additional normal plots, in total – 111 plots). For each of the plots all vascular plants, terricolous bryophytes and lichens as well as an extensive set of soil and other environmental variables were determined. To develop a classification system, we use a combination of unsupervised and supervised methods. Unsupervised classification of the vegetation plots is performed using the Modified TWINSPAN algorithm (Roleček et al. 2009). Based on the diagnostic species of the received groups we will create an electronic expert system.

Results: Previously, we revealed high fine-grain species richness of vascular plants comparable with the well-known biodiversity hotspots in Transylvania and the White Carpathians (Aleksanyan et al. 2020). The majority of our plots belong to the vegetation class Festuco-Brometea. Preliminary, we can distinguish several major phytosociological groups: dry steppes with Artemisia fragrans, mountain steppes of higher altitudes, meso-xeric grasslands, thorn-cushion communities. Their syntaxonomical position is currently being specified. All vegetation units will be extensively characterized in terms of their species combination, site conditions and spatial distribution.

Conclusions: Although based on a relatively small dataset, our study is a major contribution to the syntaxonomic system of the Caucasus Mt. and of the Palaeartic in general as it fills a major gap between existing systems in Russia, Turkey and Iran. The electronic expert system provided allows the unambiguous assignment of future relevés to the proposed classification system. At the same time, our pioneer study indicates that more intensive phytosociological studies in this biodiversity country are urgently needed.

References
OP42
MECHANISMS EXPLAINING LOW GRASSLAND PLANT DIVERSITY IN SKI RUNS CONSTRUCTED BY FOREST CLEARING
Yuki A. Yaida1, Taiki Inoue2, Tanaka Kenta2, & Atsushi Ushimaaru1
1Graduate School of Human Development and Environment, Kobe University
2Sugadaira Research Station, Mountain Science Center, University of Tsukuba, Nagano, Japan
E-mail: yuki.yaida@gmail.com

Aims: To clarify the underlying mechanisms of the legacy effect in ski run grasslands, which were constructed by clearing secondary forests or Larix kaempferi plantations, by two ecological processes: loss of grassland soil seed bank and recruitment limitation due to lower dispersal ability of grassland species.

Location: Ski runs in Sugadaira highland of central Japan, which has been maintained by annual mowing. Ski run grasslands on an old pasture (pasture-origin run) have a high potential to support numerous native grassland plant species, which has successional grassland management for at least 160 years. In contrast, most ski runs, which were abandoned in 1900’s and constructed by clearing of forest in 1960’s-1990’s (via-forest run).

Methods: We firstly compared soil seed banks between via-forest and pasture-origin ski runs and neighboring forests which used to be pasture. We also conducted a vegetation survey on pasture-origin runs and via-forest ski runs with different construction timing and spatial positioning from seed source grasslands.

Results: In the 100 study plots (1 m²) on ski runs, we identified 139 plant species including 27 native grassland species. Seedling abundances of total and native grassland species in via-forest runs were significantly higher than those in pasture-origin runs and adjacent forest floor. Those of the anemochorous species was as well, but the richness of barochorous species did not significantly differ.

In the 100 study plots (1 m²) on ski runs, we identified 139 plant species including 90 native and grassland species. The barochorous (short disperser) and anemochorous (long disperser) grassland species richness were significantly lower in via-forest ski runs than pasture-origin ski runs. The anemochorous grassland species richness significantly increased with the duration of grassland management, while the barochorous one did not significantly increase.

Conclusions: This study demonstrated that native grassland plant diversity has been slowly returned after ski run construction due to seed bank loss and dispersal limitation. We implied the continuous ski run management such as annual mowing over 50 years could contribute to recruitments of longer disperser species, but shorter disperser species are not likely to recover in cleared ski run grassland.

OP26
STRATEGIC MANAGEMENT OF TURKEY’S STEPPE ECOSYSTEMS
Nihan Yenilmez Arpa1, Aysegul Selisk2, Tugba Usta3, Esra Esina4, Turkan Ozdemir5, Mustafa Bulur6
1Food and Agriculture Organization of the United Nations, Sub-regional Office for Central Asia (FAOSSEC), Ankara, Turkey.
2Food and Agriculture Organization of the United Nations, Sub-regional Office for Central Asia (FAOSSEC), Ankara, Turkey.
3General Directorate of Nature Conservation and National Parks, Ministry of Agriculture and Forestry, Ankara, Turkey.
4General Directorate of Pant Production, Ministry of Agriculture and Forestry, Ankara, Turkey.
5General Directorate of Forestry, Ministry of Agriculture and Forestry, Ankara, Turkey.
E-mail: nihanyenilmez@fao.org; nihanarpa@gmail.com

Steppes are important and vulnerable areas in Anatolia in terms of biodiversity and abundance of genetic resources, almost 80% of endemic plant species in Turkey are distributed in the steppes, however the most threatened ecosystems. In recent years, works geared towards mitigation of these threats and conservation of the steppes have become more crucial. CEF funded, “Conservation and Sustainable Management of Turkey’s Steppe Ecosystems” is a leading project with the aims of conservation of Turkey’s steppe biodiversity. Within the project, besides development of the in-situ conservation measures, the policy documents, such National Steppe Conservation Strategy and Action Plan, have been prepared to support at policy level and in strategically of this unique ecosystems. The overall aim of the Strategy is to ensure the sociological, ecological and economic sustainability of the steppes of Turkey. 4 strategic goals and, under these, 12 strategic objectives were identified to achieve the goal. Through the preparation period of the strategy, it is found that the potential zone of steppe and steppe forest ecosystems in Turkey spans an area of approximately 33.5 million hectares, approximately 17 million ha of steppes and 552,334 ha of steppe forest within the potential steppe zone. Of all steppes of Turkey, 42% is situated in Central Anatolia, 36% in Eastern Anatolia, 14% in Southeastern Anatolia, 5% in the Black Sea, 2% in the Mediterranean and 1% in the Aegean Regions. There are 75 protected areas holding a legal status, and approximately 4% of 33.5 million ha is under protection. However, of steppes and steppe forests within the potential steppe zone, only 2.9% is legally protected. The Strategy is a leading document in the management of steppes at national level with propose alternate conservation measures, effective governance and cooperation. In addition, it contributes to the fulfillment of international commitments such as those arising from the Aichi Biodiversity Targets of the CBD. In order to provide an ownership to implement of the strategy, set up a governance mechanism and monitoring system for the effective implementation, monitoring, and evaluation of the National Strategy is one of the most essential requirements.

References
OP17

SCALE DEPENDENCE OF SPECIES-AREA RELATIONSHIPS IS WIDESPREAD BUT GENERALLY WEAK IN PALAEARCTIC GRASSLANDS


1. School of Ecology and Environment, Inner Mongolia University, Hohhot, China 2. Faculty of Biology, Białowieża Geobotanical Station, University of Warsaw, Warsaw, Poland 3. Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium 4. Department of Plant Biology, Faculty of Basic Sciences, University of Mazandaran, Babolsar, Iran
5. Centre for Applied Ecology Prof. Baeta Neves, School of Agriculture, University of Lisbon, Lisbon, Portugal
6. Department of Ecology, University of Debrecen, Debrecen, Hungary
7. Institute for Alpine Environment, Eurac Research, Bolzano, Italy
8. School of Biology and Center of Excellence in Phylogeny of Living Organisms, College of Science, University of Tehran, Tehran, Iran
10. School of Biology and Environmental Science, Earth Institute, University College Dublin, Dublin, Ireland
11. Zoology, School of Natural Sciences, Trinity College Dublin, Dublin, Ireland
12. Institute of Botany after A.L. Kholodny, M.G. Kholodny Institute of Botany NAS of Ukraine, Kyiv, Ukraine
13. Key Laboratory of Ecology and Resource Use of the Mongolian Plateau, Ministry of Education of China, Hohhot, China
14. UMR Chrono-environnement, Université Bourgogne Franche-Comté, Besançon, France
15. Institute of Ecology and Botany, Centre for Ecological Research, Vác, Hungary
16. Environmental Science Center, Qatar University, Doha, Qatar
17. Plant Biology and Ecology, Faculty of Science and Technology, University of the Basque Country UPV/EHU, Bilbao, Spain
18. Department of Plant Ecology and Environmental Conservation, Institute of Botany, University of Warsaw, Warsaw, Poland
19. Plant Ecology, Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Bayreuth, Germany
20. Department of Biological Sciences, University of Bergen, Bergen, Norway
21. Mountain Ecosystems and Societies Lab (LESSEM), University Grenoble Alpes, INRAE, LESSEM, St-Martin-d’Hères, France
22. Department of Forest Biodiversity, Faculty of Forestry, University of Agriculture in Kraków, Kraków, Poland
23. Foundation for Biodiversity Research, Warsaw, Poland
24. Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium
25. Geobotany and Ecology Department, M.G. Kholodnny Institute of Botany NAS of Ukraine, Kyiv, Ukraine
26. Chair of Biology and Biotechnology, Armenian National Agrarian University, Yerevan, Armenia
27. Institute of Geobotany and Plant Eco-Physiology, Institute of Botany after A.L. Takhhtajan of NAS RA, Yerevan, Armenia
28. Faculty of Biology, Białowieża Geobotanical Station, University of Warsaw, Białowieza, Poland
29. Institute of Botany, Czech Academy of Sciences, Praha, Czech Republic
30. BioInvasions, Global Change, Macroecology Group, Department of Botany and Biodiversity Research, University Vienna, Vienna, Austria
31. Department STEBICEF - Botanical Unit, University of Palermo, Palermo, Italy
32. Biology Education, Dokuz Eylül University, Buca, İzmir, Turkey
33. Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic
34. Landscape Ecology and Environmental Systems Analysis, Institute of Geocology, Technical University of Braunschweig, Braunschweig, Germany
35. Department of Plant Science, School of Biology, College of Science, University of Tehran, Tehran, Iran

*Corresponding author: 1. School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, China
E-mail: jhzhang1001@126.com

Questions:

Species-area relationships (SARs) are fundamental for understanding biodiversity patterns and are generally well described by a power law with a constant exponent z. However, z-values sometimes vary across spatial scales. We asked whether there is a general scale dependence of z-values at fine spatial grains and which potential drivers influence it.

Location: Palaearctic biogeographic realm.

Methods:

We used 6,696 nested-plot series of vascular plants, bryophytes and lichens from the GrassPlot database with two or more grain sizes, ranging from 0.001 to 1.024 m² and covering diverse open habitats. The plots were recorded with two widespread sampling approaches (rooted presence = species “rooting” inside the plot; shoot presence = species with aerial parts inside). Using GAMs, we tested for scale dependence of z-values by evaluating if the z-values differ with grain size and tested for differences between the sampling approaches. The response shapes of z-values to grain were classified by fitting quadratic GLMs with logit link to each series. We tested whether the grain size where the maximum z-value occurred is driven by taxonomic group, biogeographic or ecological variables.

Results:

For rooted presence, we found a strong monotonous increase of z-values with grain sizes for all grain sizes below 1 m². For shoot presence, the scale dependence was much weaker, with hump-shaped curves prevailing. Among the environmental variables studied, latitude, vegetation type, naturalness and land use had strong effects, with z-values of secondary peaking at smaller grain sizes.

Conclusions:

The overall weak scale dependence of z-values underlines that the power function generally is appropriate to describe SARs within the studied grain sizes in continuous open vegetation, if recorded with the shoot presence method. When clear peaks of z-values occur, this can be seen as an expression of granularity of species composition, partly driven by abiotic environment.
EXPLORING SEASONAL PASTURE CONDITIONS IN MONTANE CENTRAL ASIA UNDER ENVIRONMENTAL CHANGE: DEGRADATION DYNAMICS OR TRANSITIONAL STATES?

Munavar Zhumanova¹ & Geoffrey M. Henebry¹,²

¹Center for Global Change and Earth Observation, Michigan State University, East Lansing, MI, USA
²Department of Geography, Environment, and Spatial Sciences, Michigan State University, East Lansing, MI, USA

E-mail: zhumanov@msu.edu

Seasonal pastures in montane Central Asia are characterized by complex terrain and spatially heterogeneous vegetation. Long-term grazing under different management regimes has played a critical role in sustaining livelihoods in rural Central Asia. Over the past few decades, changing environmental conditions and management practices have altered pasture structure and properties. In Kyrgyzstan, degraded seasonal pastures are still treated as if they can return to a (nearly) non-degraded reference state through control of stocking rate and grazing system adjustment. Yet, there is insufficient evidence to show that controlling stocking rate or prescribed grazing could return degraded pastures to a non-degraded state. It is unclear (i) whether assessments should refer to an initial reference state or to a transitional state updated according to vegetation-climate-livestock feedback, (ii) which factors should be considered for characterizing degradation types and associated vegetation changes, and (iii) by which technique new degradation types should be evaluated. We propose a novel unified framework to classify vegetation changes and degradation types relying on historical datasets and survey data from 2016-2021, which provide a contemporary picture of seasonal pasture conditions. In July 2021, data were collected from 48 accessible seasonal pastures in two districts of Naryn province in the Inner Tien-Shan region. Sites represent six main vegetation types in the Tien-Shan mountains: desert, desert steppe, mountain steppe, forest-meadow-steppe, high mountain steppe, and alpine meadows. Two types of data were collected at each site: near-nadir high-resolution digital photographs every 2 m along with a pair of 100 m orthogonal transects; vegetation and soil cover data using line-point and canopy-gap intercept methods. Abundance estimates used the Daubenmire scale. Species were assigned functional groups based on life forms, palatability, and indicator values. We gathered ecological and management-related characteristics of dominant species and 30 indicator species. We analyzed 4807 digital photos for comparable features. Each seasonal pasture site was characterized as ex-ante, ex-post, or currently grazed considering five factors: (i) wet/normal or dry year; (ii) seasonality of grazing; (iii) total fractional cover linked to phenological patterns; (iv) composition by palatability and life forms; and (v) apparent recovery from earlier grazing. We developed a decision tree based on available historical and collected data analyses to classify altered vegetation status. These procedures can be applied to all seasonal pastures to define and generalize vegetation state and degradation types, quantify potential transitions, and develop grazing prescriptions according to seasons of use and analogous vegetation types of mountain ecosystems.
ASIAN GRASSLAND CONFERENCE

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Abstracts of Speed-Talk Poster Presentations*
PS06
FLORISTIC COMPOSITION OF PLANT COMMUNITIES OF RARE SPECIES OF THE STEPPE BELT OF THE NORTHERN TIAN SHAN
Dayana Almabek1, Ayagoz Tolenova1, Anna Ivashchenko2 & Karime Abidkulova3
1Al-Farabi Kazakh National University, Almaty, Kazakhstan
2Institute of Zoology of the Ministry of Education and Science of the Republic of Kazakhstan, Almaty, Kazakhstan
3E-mail: karime.abidkulova@kaznu.kz

According to Botanical geography of Kazakhstan and Middle Asia (Desert region) (2003) Northern Tian Shan altitudinal zonation types include steppe belt. 21 species of ephemeroid geophytes listed in the Red Book of Kazakhstan occur in this belt. Two of them – Gymnospermium altaicum (Pall.) Spach. (Berberidaceae) and Tulipa tarda Stapl. (Liliaceae) are declining due to habitat destruction and an increase of the recreational load. Both are poorly studied and there is nothing about plant community’s composition with their participation. Our aim was to research plant communities floristic composition with participation of these species in the steppe belt.

The researches were conducted in 2008–2014 and in 2020 on the northern macro hillside of the ridge Trans-Ili Alatau (Northern Tian Shan), where we surveyed in detail plant communities with the participation of G. altaicum and T. tarda. The investigations of the vegetation were carried out according to generally accepted methods. The nomenclature of taxa is based on the summary by S.A. Abdulina (1999).

According to our data, plant communities with G. altaicum participation include 156 species of 48 families. The majority (84%) is herbaceous plants; 25 species – trees and shrubs, 9 of which are non-native species. Representatives of 10 basic families occupy the leading position with 65% of total number. Ten species: Malus sieversii, Brachypodium sylvaticum, Milium effusum, Urtica dioica, Geum urbanum, Geranium pretense, Lavatera thuringiaca, Hypericum hirsulum, Viola suavis, Bupleurum aureum are the permanent companions of G. altaicum. Another 29 species are also included in the floristic core of the surveyed communities. In terms of ecological characteristics, the majority (70%) is forest and forest-meadow elements, the rest – meadow, single meadow-steppe.

The plant communities with the participation of T. tarda mainly are multi-component, the steppe, semi-steppe, or meadow-steppe, more frequently with the shrubs. Generally, 199 species of 45 families are contained in these communities. The richest families (from 5 to 21 species) are 16, which comprise 78% of the total number. Herbaceous plants (about 90%) predominate; the shrubs are much less – 20 species, tree – only one (Acer semenovii). The floristic core of the studied plant communities consists of 5 shrubs and 8 herbaceous perennials, most of which, as T. tarda, belongs to the steppe and petro-lithophilic ecological elements.

Our studies filled in certain gaps in the ecology and composition of plant communities of two poorly studied species G. altaicum and T. tarda. We are continuing an in-depth study of their population’s state.

References

PS09
PLANT DIVERSITY OF GOLESTANKOOH AREA IN ISFAHAN PROVINCE, IRAN
Azadeh Akhavan Roofigar1 & Ali Bagheri2
1Natural Resources Research Department, Isfahan Agricultural and Natural Resources Research and Education Center, AREEO, Isfahan, Iran
2Department of Plant and Animal Biology, Faculty of Biological Science and Technology, University of Isfahan, Isfahan, Iran
E-mail: a.akhavan@areeo.ac.ir

Golestankoooh, with an area of 130000 ha, is located in Isfahan Province. The present study was carried out in order to identification of flora of the aforementioned region, as a result. 620 taxa in total, belonging to 61 families and 303 genera, were identified. Asteraceae, represented by 104 species, was the largest family, following with Fabaceae, Lamiaceae and Brassicaceae with 63, 60 and 59 species, respectively. The genus Astragalus, with 33 species, was the most diverse among the genera studied. Hemicryptophytes with 41% and therophytes with 34% are dominant life forms in the region. With regard to geographical distribution, 300 species (48%) were found to be Irano-Turanian elements. Moreover, 131 species, 21.1% of the identified plant taxa from the region, were found to be endemic to the flora of Iran. Due to high species diversity in the Golestankoooh area, it seems necessary to use appropriate strategies for their Conservation.

References
PS05

INFLUENCE OF INVASIVE AND EXPANDING SPECIES ON CARBON STORAGE IN GRASSLAND ECOSYSTEMS OF ARMENIA

Alla Aleksanyan1,2, Georgiy Fayvush1
1Department of Geobotany and eco-physiology, Institute of Botany aft. A.L. Takhhtajan NAS RA, Yerevan, Armenia
2Chair of Biology and Biotechnologies, Armenian National Agrarian University, Teryan 74, 0009, Yerevan, Armenia
E-mail: alla.aleksanyan@gmail.com

Carbon cycling and sequestration in ecosystems are the trending global environmental topics because of the relation to climate change and carbon emissions.

Grassland ecosystems cover more than 50% of the Armenia’s territory and represent high diversity of habitats spread out through the country with different biodiversity value. Taking into consideration that in Armenia one of the main threats for biodiversity and natural ecosystems is climate change, its impact is visible and predicted climate change is making them more vulnerable, the other big threat is invasive alien and expanding native species, and many grasslands in Armenia more or less are invaded with these species, there was a need to assess impact of invasive plants on carbon sequestration in different grassland ecosystems of Armenia.

For assessment of carbon storage was used methodology developed within the framework of the TeaTime4Science project (http://www.teatime4science.org/about/the-project/). The data allowed accurately describe influence of invasive and expanding species on carbon storage. Research was carried out in 11 grassland ecosystems in 5 regions of Armenia with different natural conditions and invaded with different invasive species: Ambrosia artemisiifolia, Conyza canadensis; Helianthus tuberosus, Astragalus galegiformis, Tanacetum vulgare, Heracleum sosnowskyi, Glycyrrhiza glabra, Goebelia alopecuroides, Lythrum salicaria, Centaurea solstitialis, Solidago Canadensis, Onopordum acanthium, Chondrilla juncea.

The results show that highest rate of decomposition in Armenia is in grassland located in Northeastern part invaded with Ambrosia artemisiifolia and Conyza canadensis, the lowest rate is in grassland from Central Armenia invaded with Glycyrrhiza glabra. The highest rate of stabilization was calculated again for grassland with domination of Ambrosia artemisiifolia and Conyza canadensis, the lowest rate is in grassland again from Central Armenia but invaded with Goebelia alopecuroides.

Based on results we can several conclusions: There is a direct correlation between
1. density and diversity of species and domination of invasive and expanding species on sequestration volume. As higher density and diversity as higher sequestration volume. Sequestration volume in invaded ecosystems is higher than in control ecosystems without these species. In ecosystems where invasive species are dominating the sequestration volume higher than in ecosystems where distribution of these species is spare.
2. Temperature, humidity, altitude and sequestration volume in ecosystems. As hot and humid conditions as faster are decomposition processes, slower stabilization processes, higher sequestration volume and vice versa.
We can conclude that impact of invasive alien and expanding native species on carbon storage for grasslands of Armenia is positive or neutral.

PS02

LAVA FLOWS SUPPORT HIGH DIVERSITY OF GRASSLAND PLANTS INCLUDING THREATENED SPECIES IN A MEADOW AREA MANAGED BY BURNING

Airi Asada1, Atsushi Ohwaki2, Yuki A. Yaida3, Shuhei Nakano1 & Atushi Ushimaru1,3
1Faculty of Global Human Sciences, Kobe University 2Mount Fuji Research Institute, Yamanashi Prefectural Government 3Graduate School of Human Development and Environment, Kobe University
E-mail: airi.asada2000@gmail.com

Question (Aims): Are there any soil bedrocks on which high diversity of common and threatened semi-natural grassland plants have been maintained only by burning management, which are known to largely diminish the diversity? Do grasslands on lava flow and scoria bedrocks differ in threatened species diversity? Which environmental factors might be involved in the bedrock effect?

Location: Nashigahara, a training ground of the Japan Self-Defense Force, Yamanashi Prefecture, Japan

Methods: In the study site, meadows were maintained only through burning once a year. We compared diversity of total, native grassland and red list plants, vegetation height and soil pH and water content between meadows on lava flow and scoria bedrocks which were formed in different historical periods. We also examined relationships between each diversity index and vegetation and soil variables.

Results: Total, native grassland and red list species diversity were the highest in meadows on new lava flows and the lowest in those on old scoria bedrocks. Vegetation height was the highest in meadows on new scoria bedrocks and the lowest in those on new lava flows. Soil pH did not vary among bedrock types. All diversity indices significantly decreased with increasing vegetation height. Also, red list diversity significantly increased with soil pH.

Conclusions: This study demonstrates that more native grassland plants including threatened species grew in the meadows on lava flows than those on the other bedrock types. It is suggested to be owing to that lower levels of vegetation height have been maintained on the new lava flows, although we have not revealed mechanisms by which lava flows cause low vegetation height yet. In the future study, we should examine the effects of soil physical and chemical properties on meadow vegetation to clarify the mechanisms.
**PS04**

**PLANT DIVERSITY OF SUBALPINE AND ALPINE ZONES OF HIGH MOUNTAINS OF FEREYDUNSHAHR (CENTRAL ZAGROS, IRAN)**

Mohsen Yaselyani¹, Ali Bagheri², Hojjatollah Saeidi³ & Jalil Noroozi⁴

¹Department of Plant and Animal Biology, Faculty of Biological Science and Technology, University of Isfahan, Isfahan, Iran
²Department of Plant and Animal Biology, Faculty of Biological Science and Technology, University of Isfahan, Isfahan, Iran
³Department of Plant and Animal Biology, Faculty of Biological Science and Technology, University of Isfahan, Isfahan, Iran
⁴Department of Botany and Biodiversity Research, University of Vienna, Vienna, Austria

*E-mail: a.bagheri@sci.ui.ac.ir*

In this study the plant diversity of subalpine and alpine zones of the mountains of Fereydunshahr in Central Zagros of Iran (southeastern part of Irano-Anatolian biodiversity hotspot) were evaluated. Plant taxa of the study area during the growing seasons of 2018 to 2020 were collected and identified. A complete list of species was prepared including their chorotypes, biological forms and altitudinal ranges. A total of 310 vascular plant species have been identified belonging to 185 genera and 47 families. Pteridophyta and Gymnosperms have one species each and the rest of species belong to Angiosperms. Dicotyledons have 263 species (85%) and monocotyledons have 45 species (15%). The largest plant families identified in the area are Asteraceae with 45 species, Fabaceae 33, Brassicaceae 29, Lamiaceae 27, Apiaceae 20 and Poaceae 18. Hemicyryptophytes with 150 (49%) species, Therophytes 60 (19%), Chamaephytes 43 (14%), Geophytes 43 (14%), Phanerophytes 13 (4%) and Cryptophytes one (0.3%) are the life forms of the study area. Most of the species are Irano-Turanian elements (65%). Of the 310 species identified in the study area 84 species (27%) are endemic to Iran and 25 species (8%) are endemic to the Zagros. The area is under high pressure of anthropogenic activities, especially very strong overgrazing but it is not protected. Therefore an efficient conservation planning for the region is recommended.

**PS56**

**GOVERNANCE AND LIVELIHOOD ADAPTATIONS OF AGRO-PASTORAL COMMUNITIES RESIDING IN A RESOURCE SCARCE LANDSCAPE**

Shivani Barthwal¹, Ruchi Badola¹, Syed Ainul Hussain¹, VB Mathur²

¹Wildlife Institute of India, Post Box # 18, Chandrabani, Dehradun 248001; ²National Biodiversity Authority, Chennai

*E-mail: shivani.chandola@gmail.com*

**Question:** The trans-Himalayan region of India is an interesting landscape, with meagre precipitation, high altitudes, large diurnal temperature variation and intense solar radiations. These climatic features along with the diverse physical landforms result in unique floral and faunal assemblage. In this region where it is difficult for the life-forms to survive without adaptations, the study aims to explore if pastoral communities’ survival and adaptive tactics are learnt from the global trends or from the local experiences, and to explore the changing forms of local governance in wake of building resilient local communities.

**Location:** The study was undertaken in the union territory of Ladakh, India, located in the trans-Himalaya.

**Methods:** Questionnaire survey and focus group discussions were undertaken to study the livelihood and governance system.

**Results:** The study found that the local communities have traditionally been agro-pastoral and played important role in trade along the silk route until the mid twentieth century. Sparse human population was adept to sustainably use the scarce resources. The local governance system played an important role in natural resource management, including the rangelands. The rotational grazing allowed for the natural regeneration and also resulted in co-existence of livestock and the mountain ungulates. With disruption of the trade routes the livelihood pattern changed, resulting in people amassing wealth in form of more livestock. Government policies encouraged livestock holding and diversion from the traditional livestock to the economy oriented goats and sheep. Increased livestock holding per household caused conflicts over grazing rights. The scenario changed after opening of Ladakh to the tourists in 1980s. Tourism, livestock and agriculture now have diversified the livelihoods and increased resilience of the communities. Local governance and social networks were found to be the most important precursor for the resilience building through livelihood diversification.

**Conclusion:** we conclude that the pastoral communities’ survival and adaptive tactics are driven by both local and global trends. In wake of growing tourist influx, and to maintain the social and natural resilience, there is a dire need to monitor the tourism influx and income. The national and regional policies should be applied at the local scale with caution. An adaptive, integrated and locally relevant governance approach that is able to address well-being of communities and develop their stakes in conservation of these fragile ecosystems is called for.
PS21
MONGOLIAN HERDERS’ ECOLOGICAL UNDERSTANDING IN THEIR LANDSCAPE AND LANDSCAPE CHANGE
Gantuya Batdelger1,2, Marianna Biró3, Abél Molnár3, Ákos Avar4, Abolfazl Sharifian Bahraman5, Dániel Babai6, Zsolt Molnár2
1Botanic Garden and Research Institute, Mongolian Academy of Sciences, Ulaanbaatar 13330, Mongolia,
2Centre for Ecological Research, Institute of Ecology and Botany, Vác, Hungary,
3Hungarian University of Agriculture and Life Sciences, Doctoral School of Biological Sciences, Gödöllő, Hungary
4Department of Mongolia and Inner Asian Studies, Eötvös Loránd University, Budapest, Hungary
5Department of Rangeland and Watershed Management, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran,
6Institute of Ethnology, Research Centre for the Humanities, Budapest, Hungary
7Doctoral School of Biology, Institute of Biology, Eötvös Loránd University, Budapest, Hungary
E-mail: bgantuyad@gmail.com

Traditional habitat knowledge, like how people partition their landscape into habitats, is an emerging but still understudied part of traditional ecological knowledge. Evidence shows that Mongolian herder’s knowledge can serve as a valuable body of information about ongoing ecological processes. Among other things, a deeper understanding of how herders perceive ecological changes would be useful for improving pasture management and promoting natural regeneration processes. Our objectives were to reconstruct the folk habitats and the partitioning of the landscape into these folk habitats by Mongolian herders and to reveal how herders perceive ecological changes.

Our study areas were located in the mountain forest-steppe region in Mongolia. In 2017-2020, we interviewed 33 people using photos of plant species and habitats and semi-structured interviews focusing on landscape change.

Mongolian herders distinguished 88 folk habitat types, and we documented the habitat preference of 76 plant species. The habitat classification was multidimensional: key dimensions were geomorphological and edaphic. There were some species (e.g., botyuuul, hyag, shireg) and species groups (hot plants and leafy plants) that were often used to describe habitat types. We found 32 indicators on how herders perceived landscape and vegetation changes for the 14 main habitat types studied. Herders attributed various changes to diverse drivers on their grasslands, wetlands, and forests. The perceived changes and indicators could be grouped into three main categories, (long-term trends, regenerative successions after disturbance, and recurrent fluctuations). Some of the long-term trends reported by herders are well-known, others are rarely mentioned in the scientific literature, if at all. South-facing mountain slopes and flat areas in valleys are changing most rapidly.

To reverse adverse changes, herders wish to cooperate with each other to deal with adverse changes: to increase mobility, stop overgrazing, and help nature to regenerate their worsening pastures. We conclude that conducting research on folk habitats will contribute to a deeper understanding of how nature is perceived by locals and to a more efficient management of the Mongolian pastures. As well as, herders have a reliable and widely shared understanding of landscape changes that could help with this cooperation.

PS10
CONTAMINATION OF PLANTS IN STEPPE PASTURES OF THE EAST KAZAKHSTAN REGION
Tatyana Bragina1, Gulnar Aidarkhanova2
1A. Baitursynov Kostanay Regional University, 110000, Kostanay, Baitursynov Str., 47, Kazakhstan
2S. Seifullin Kazakh Technical University, 010011, Nur-Sultan Zhenis avenue, 62, Kazakhstan
E-mail: tm_bragina@mail.ru; exbio@yandex.kz

The agro-ecosystems, formed in the steppes of the East Kazakhstan region, are additionally disturbed as a result of many years of nuclear tests at the Semipalatinsk Polygon. On the territory of the Semipalatinsk nuclear test site, due to atomic explosions, significant territories (18,500 sq. km) have been alienated from agricultural use, and the steppe vegetation has undergone certain changes. The purpose of the paper is to analyze technogenic changes in the vegetation cover (contamination of some pasture land plants) in the steppe pastures within the Semipalatinsk test site (nuclear polygon).

Location. Semipalatinsk nuclear test site is located on the steppe in northeast Kazakhstan, south of the valley of the Irtysh River (50°07′N 78°43′E) in the East Kazakhstan Region (Oblast).

Methods: Samples (68) of steppe pasture plants (6 species) were taken. Radionuclides (137Cs, 90Sr) were isolated by the antimony-iodide method of radiochemical analysis in plants and determined by gamma spectrometry [1].

Results: In the region, 88.6% of the area is occupied by natural forage lands. This determined the main specialization of agriculture - animal husbandry. Pastures provide 61% of all types of feed. In the northern parts of the Semipalatinsk Polygon Stipa capillata L. dominates, Festuca valesiaca Gaudin is subdominant; forbs are represented by Artemisia frigida Willd., subshrubbs (Salsola orientalis Gmel., Galatella sp.), Potentilla acaulis L. The coverage is up to 35-50%. In the dry climate of Kazakhstan, radionuclides in soils are practically not removed from the soil profile. They accumulate in the humus horizon, presenting great danger to ecosystems for a long time. The least radioactive contamination 137Cs was observed in Stipa sareptana L. (137Cs - 6-47 Bq/kg), the highest in Rumex confertus Willd. (137Cs 74-726 Bq/kg).

Average concentrations of 137Cs in pasture plants - 44,6±2,23. Maximum Allowable Concentrations (MACs) for 137Cs is 370 Bq/kg. The least radioactive contamination of 90Sr was observed in Festuca sulcata Gaudin. (90Sr - 11-18 Bq/kg), the highest in Mililotium officinale L. (90Sr 52-670 Bq/kg). MACs for 90Sr is 50 Bq/kg.

Conclusion: In modern radioecological conditions in the Semipalatinsk nuclear test site, the range of 137Cs activity in plants of natural pastures was within 6-726 Bq/kg; 90Sr activity varied within 11-670 Bq/kg. The radioactivity of some investigated plant species in the steppe pastures exceeds the MACs up to a dozen times.

References
PS11
RARE AND ENDANGERED SPECIES OF MAMMALS OF THE KOSTANAY REGION (KAZAKHSTAN) AND THEIR CURRENT STATUS

Tatyana Bragina
A. Baitursynov Kostanay Regional University, Kostanay, 110000, Kostanay, Baytursynov Str., 47, Kazakhstan
E-mail: tm_bragina@mail.ru

In the past, large herds of wild horses and other herbivore species roamed the Kazakh Steppes. Nowadays, in the Kostanay region they have almost disappeared, only free herds of domestic horses and cattle you could see in the steppe landscapes near settlements. The aim of this paper is the analysis of the present status of rare and endangered species of mammal fauna in the Kostanay Region, especially the herbivore species.

The Kostanay Region, located in Northern and Central Kazakhstan with an area of 196 001 sq. km, includes the junction of several physical-geographical regions and natural zones, the deep interpenetration of northern and southern types of natural complexes and species, migration routes of animals. It has the presence of large strictly protected natural areas, such as Naurzum Reserve (1910 sq. km), as part of the UNESCO World Heritage Site “Saryarka - Steppes and Lakes of Northern Kazakhstan”, and Alty Dala Reservat (4897,7 sq. km).

The Strategy for the restoration of steppe biodiversity was prepared and included in the international “Alty Dala Conservation Initiative (ADCI)” in 2006-2007 when the author was the coordinator during these first two years. ADCI was prepared by the joint efforts of the World Wide Fund for Nature (WWF), Frankfurt Zoological Society (FZS), BirdLife International, Royal Society for the Protection of Birds (RSPB) in cooperation with scientists and the government of Kazakhstan. Before, in 2003, the author had initiated the creation of Alty Dala Reservat in the Turgay steppes, and in 2007 organized a field complex scientific expedition to the region with support from ADCI. PA was established in 2012 by government structures. Some special studies have been carried out on the distribution and current status of rare and endangered species in the region.

Wild ass, or kulan (Equus hemionus), in Kazakhstan became extinct approximately in the 1930s. The reintroduction of this species had started in the 1950s. The kulan population was created anew from individuals of the Turkmen subspecies. To the Kostanay region, the first nine kulans were brought in 2018, two kulans - in 2019 by ACBK and partners.

In the Kostanay region lot of work was done for the conservation and restoration of the largest remaining Betpakdala population of saiga antelope (Saiga tatarica). In 2014, the Irguz-Turgai-Zhilanshik ecological corridor was created, covering 20075,82 sq. km. In 2019, the Betpakdala population of saiga antelope included 111500 individuals, in 2021 - 285000.

At present time the reintroduction of Przewalski’s horse (Equus przewalskii) in the landscapes of Alty Dala Nature Reservat and its nearest territories is planned.

In total, the list of rare and endangered species of mammals of the Kostanay region, exception above species, includes 12 species [2], of which 2 species - desman and marten - are included in the Red Book of the Republic of Kazakhstan. IUCN’s VU (vulnerable taxon) lists include 1 species - desman, 9 species included in the IUCN’s low-risk category.

References
**PS13**

**THE IMPACT OF MARMOTS ON VEGETATION COVER AND PLANT NUTRIENT CONTENT IN A COLD, EXTREMELY ARID MOUNTAIN ENVIRONMENT**

Piotr Chibowski¹, Marcin Zegarek², Aleksandra Zarzycka³, Małgorzata Suska Malawska¹,³

¹Faculty of Biology, Biological and Chemical Research Centre, University of Warsaw, Poland
²Mammal Research Institute, Polish Academy of Sciences, Białowieża, Poland
³International Platform for Dryland Research and Education, Tottori University, Tottori, Japan

E-mail: p.chibowski2@uw.edu.pl

**Aims:** We wanted to check the paradigm that the effect size of ecosystem engineering increases with increasing abiotic stress, in a cold and extremely arid high mountain habitat.

**Location:** Koksoy river valley, Ujsu glacier foreland, Eastern Pamir, Tajikistan.

**Methods:** We performed a burrow survey and looked for mounds of burrow material that were colonised by plants. We measured the content of nitrogen and phosphorus, and nitrogen stable isotopes in plant biomass in a distance gradient up to 20 meters from marmot burrows, as well as in marmot faeces. We captured aerial images of the area inhabited by marmots to study the spatial distribution of vegetation.

**Results:** There was no relationship between the presence of burrows and vegetation cover. Burrow mounds were not colonised by plants. A significant increase in N and P in aboveground green plant biomass in the proximity of burrows was found in one out of six studied species. Stable N isotopes did not give further insight into N routing.

**Conclusions:** We assume that plant growth is strongly limited by water availability, which prevents them from utilizing the local increase in nutrients, certainly provided by marmot activity. The results are contrary to numerous studies which showed that the role of burrowing animals as ecosystem engineers increases with increasing abiotic stress, including aridity. This shows a lack of this type of study in the end of the gradient of abiotic factors.

**PS14**

**GERMINATION RESPONSES TO SALINITY AND DROUGHT IN THE PLANTS OF THE CENTRAL ANATOLIAN STEPPE**

Cihan Ünal Değirmenci¹,², Seda Yirmibesi¹,³, Efe Dalya¹,³, Omar Khalid Nashat¹,³, Seyfullah Bektür¹,³, Sinem Özcan¹, Yeşilü Beyza Erdal¹, Nuran Çiçek¹, Yasemin Ekmekçi¹, Ahmet Emre Yapra⁴, Çağatay Tavşanoğlu²

¹Institute of Science, Hacettepe University, Beytepe 06800, Ankara, Turkey
²Division of Ecology, Department of Biology, Hacettepe University, 06800, Beytepe, Ankara, Turkey
³Division of Botany, Department of Biology, Hacettepe University, 06800, Beytepe, Ankara, Turkey
⁴Division of Botany, Department of Biology, Faculty of Science, Ankara University, Ankara, Turkey

E-mail: chihanunal.degrirmenci@gmail.com

Understanding plant traits in the early stages of growth and development, such as germination and seedling stages, is of critical importance to shed light on their tolerance and resilience to climate change. Dryer and more saline conditions in the soils of semi-arid and temperate grasslands of Central Anatolia, Turkey, are expected due to increased temperatures and evaporation driven by climate change in the near future. With this study, the effects of climate change were evaluated for the first time within the framework of germination response on plant species in the Central Anatolian steppe. It was studied the germination response of plants in the Central Anatolian steppe, a threatened ecosystem by several human activities, to various drought and salinity conditions in a controlled growth chamber. The seeds of 41 plant taxa were collected from different types of habitats from the Central Anatolian steppe. The seeds were exposed to different osmotic potential levels [0 (control), -0.25, -0.50, -0.75, -1.00 MPa] of PEG 6000 and NaCl treatments for 40 days. Germination data were analyzed using a generalized linear model assuming a binomial distribution. The germination percentages showed a decreasing trend with increased drought (66% of the studied taxa) and salt (63% of taxa) stresses. Different species could tolerate different osmotic potentials. It was observed that a significant decrease in the germination percentage of 29% and 27% of taxa under drought and salinity conditions above -0.25MPa, respectively. Among the studied taxa, 19% tolerated up to -0.25MPa and -0.50 MPa, and 17% to -0.75MPa drought levels, while 22% tolerated up to -0.25MPa, and 19% to -0.50MPa salinity levels. Some species studied could not tolerate neither drought (15% of taxa) nor salinity (7% of taxa) (i.e., significant difference in comparison to the control). On the other hand, Fumana aciphylla and Taeniatherium medusa had high germination percentages even at a salinity level of -1.0 MPa, while Salsola stenoptera showed high germination percentage at -1.0 MPa level in both stress conditions. The results indicated that plants in the Central Anatolian steppe showed significant variation in their drought and salinity tolerance. In this context, our study outputs will contribute to making predictions on the tolerance and resilience of the Central Anatolian Steppe vegetation against climate change effects in the future.
PS38

STEPPE VEGETATION OF MOUNTAIN RANGES IN THE SOUTHEAST OF KAZAKHSTAN

Liliya Dimeyeva, Kapar Usen, Valeriya Permitina, Bedel Kaliev, Anastasiya Islamgulova, Azhar Imanalino

Institute of Botany and Phytointroduction, 360 Timiryazev Str., 050040 Almaty, Kazakhstan

E-mail: l.dimeyeva@mail.ru

Question: To find common and distinctive features in steppe vegetation.

Study area: Zhetysu Alatau, North, West Tien Shan mountain systems.

Methods: Classical geobotanic field research, Remote sensing, GIS technologies.

Results: Steppes are characteristic for each mountain range; their distribution extends from foothills to alpine zone. In general, the steppe belt is divided into sub-belts: dwarf semishrub-bunch grass desert, forb-bunch grass typical, rich forb-grass-fescue meadow steppes.

In the Zhetysu Alatau desert steppes are dominated by Stipa capillata, S. sareptana, S. lessingiana, Festuca valesiaca, and Artemisia sublessingiana. In typical steppes in addition Stipa zalesskii, Helictotrichon desertorum, Koeleria pyramidalis, Phleum phleoides are distributed. The herbs include: Galium verum, Thalictrum minus, Salvia dumetorum, Alcea nudiflora. Meadow steppes dominants are Festuca valesiaca, Bothriochloa ischaemum with forbs (Melilotus officinalis, Trifolium hybridum, Achillea millefolium, Salvia deserta, etc.). High mountain steppes are formed by Festuca valesiaca, F. rupicola, Helictotrichon tianschanicum with abundant forbs (Androsace dasypylla, Leontopodium leontopodioides, Potentilla nervosa).

The North Tien Shan ridges steppes have differences in species composition. Typical steppes of the Ile Alatau comprise Festuca valesiaca, Stipa capillata, S. lessingiana, Koeleria macrantha, Ajania fastigiata, Salvia stepposa. Agropyron cristatum is also found as dominant species in Ketmen ridge. In Terskey Alatau ridge, there are also Stipa kirghisorum and Helictotrichon hookeri steppes. The steppe belt of the Kyrgyz Alatau range is characterized by an abundance of ephemerals (Bromus japonicus, Poa bulbosa, species of Gagea, Tulipa) and savannoids (Tantiatherum caput-medusae, Aegilops cylindrica, Botriochloa ischaemum).

The West Tien Shan steppes are dominated by fescue, feather grass and savannoids (Hordeum bulbosum, Ferula tenuisecta, Eremurus regelii, Elymus hispidus).

The steppe of the mountain ranges are rich in crop wild relatives. The foothill steppes are mostly plowed. They are partially preserved only in natural reserves.

Conclusions: Almost all ranges have a steppe altitudinal belt, excluding the West Tien Shan, where steppes can be found only on the southern slopes. Number of ephemerals and savannoids increases from the north to the south.

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PS17

RELATIVE EFFECT OF PLANT-PLANT INTERACTIONS AND ABIOTIC FACTORS ON BIODIVERSITY FACETS OF ROCKY OUTCROPS IN NORTHERN IRAN

Fahime Rafiee1, Hamid Ejtahedi1, Mohammad Farzam2, Habib Zare3 & Maral Bashirzadeh2

1Department of Biology, Faculty of Science, Ferdowsi University of Mashhad, Mashhad, Iran
2Department of Range and Watershed Management, Faculty of Natural Resources and Environment, Ferdowsi University of Mashhad, Mashhad, Iran
3Herbarium of Nowshahr Botanical Garden, Research Center of Agriculture and Natural Resources of Mazandaran, Mazandaran, Iran

E-mail: mjankju@um.ac.ir

Question (Aims): Rocky outcrops are severe ecosystems in terms of abiotic environmental conditions, i.e., low soil moisture, nutrient deficits and microclimate harshness. Under such conditions, nurse plants may play critical role in supporting species diversity. Although, the impacts of plant-plant interactions are fully understood in different major biomes, the relative effects of environmental factors and plant–plant interactions on biodiversity have been poorly studied in the rocky outcrops. Therefore, we studied relative effects of two nurse shrubs, Artemisia aucheri Boiss. (Asteraceae) and Cerasus pseudostrata Pojark (Rosaceae) on the plant taxonomic, functional and phylogenetic diversity indices.

Location: The study was conducted in 6 sites, along a precipitation gradient (160-910 mm) and under different soil fertility levels, in rocky outcrops and their nearby rangeland sites in north Iran, Shahrourd to Gorgan rout crossing the Alborz Mountain range.

Methods: We established 1m² paired quadrates in vegetation patch scale and 90 plot 5m² in the community scale. We measured the taxonomic, functional and phylogenetic diversity using Rao Q, MPD indices. Relative interaction index (RII) was calculated for quantifying interaction type and intensity, the Chao–Jaccard abundance-based similarity index was used to evaluate the degree of microhabitat amelioration. Partitioning variation analysis was performed to determine the relative effects of biotic interactions and abiotic factors on structuring the plant biodiversity.

Results: We found increases in taxonomic, phylogenetic and functional diversity in outcrop and a decrease in taxonomic, phylogenetic and functional diversity in covered lands, when considering presence of nurse species. Biotic interactions and abiotic factors affected biodiversity facets in rocky outcrops and cover lands. However, nurse plant showed more contributions than abiotic factors by promoting facilitation effects under high stress conditions in outcrop communities. While in covered lands, nurse plants imposed consistently negative effects on the diversity indices, but in the outcrops, it followed a humped shape trend, with highest facilitation being found under the intermediate stress conditions.

Conclusions: Our findings show critical role of nurse plants on preserving species diversity under the stressful rocky outcrop ecosystems.

Keywords: Biodiversity facets, Precipitation gradients, Biotic interaction, Rocky outcrops, Facilitation.
PS18
INVASIVE PLANT SPECIES AS THREAT TO RARE GRASSLAND’S ECOSYSTEMS
Georgi Fayvush¹, Alla Aleksanyan¹ & Hripsime Hovhannisyan¹
¹Institute of Botany after the name of A. Takhadjan NAS RA
E-mail: gafayvush@yahoo.com

All the main ecosystems of the Caucasus (with exception of humid subtops) are represented in Armenia. Among these ecosystems, there are both widespread in the Holarctic, the Ancient Mediterranean, the Caucasus and Armenia, as well as extremely rare, occupying just a few hectares. Invasive alien species are very dangerous threat to the ecosystems, and assessment of their impact on biodiversity and ecosystems is one of the most important preliminary actions for nature conservation. We selected several very rare, almost unique grassland’s ecosystems, and tried to assess the threat from the alien invasive plant species.

E1.2E13 - Mountain Stipa-Festuca steppes with Rhaponticoides hajastana as co-dominant. Some other rare species are growing in this ecosystem (Centaurea takhtadjanii, Cousinia brachysperta, Tomanthea phaeopappa, etc.). This ecosystem is represented only in Shirak region on the North-West of Armenia. The main threat for this ecosystem could be from Cirsium incanum, Centaurea solstitialis and Chondrilla juncea, which are very abundant in the vicinities of this habitat and can invade it especially as result of overgrazing.

E1.2E22 - Steppes with wild wheat species dominance. Unique ecosystem is represented in Central Armenia and considered as “Erebuni” State reserve. Three wild wheat species are dominants here (Triticum boeoticum, T. araraticum, T. urartu), and some other wild relatives of cereals are represented. Carthamus turkestanicus, Tanacetum parthenium, Conyza canadensis penetrate into it. The main driver of expansion of these species is climate change.

E1.3361 – Salt-wort semi-desert with Salsola dendroides and Cistanche armena. Ecosystem occupy very limited area (less than 1 ha) in Central Armenia, and could be threaten by Acer negundo, which is growing in its vicinity on the shores of drainage canals. If water regime of this area will change, this species can expand its distribution.

PS66
SOIL TEXTURE MEDIATES PLANT COVER RESPONSE TO PRECIPITATION IN TEMPERATE GRASSLANDS OF CHINA
Xiaotian Gao¹, Frank Yonghong Li²*
¹School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, China; xtigao@163.com
²E-mail: lifyhong@126.com

Precipitation is a major determinant of grassland vegetation growth, but how it affects vegetation structure composition has been challenging to generalize. There is uncertainty in the response of temperate grassland vegetation to precipitation: as rainfall increases, the vegetation cover of different grasslands may subsequently increase, or decrease. Clarifying the principles of temperate grassland vegetation response to precipitation is critical to the prediction of global grassland vegetation cover. Based on remote sensing products and Chinese digital soil maps, we analyzed how soil texture mediates the response of vegetation cover to precipitation climatology in temperate grasslands of China at 6851 sites collected. We aim to elucidate the interrelationships among soil texture, precipitation, and vegetation cover. We found the following: (1) Grassland vegetation cover increased with precipitation, and the extent of this increase varied depending on soil texture. Under high rainfall conditions (precipitation >260 mm/yr), clayey soils supported higher vegetation cover; conversely, at lower precipitation levels (precipitation <260 mm/yr), vegetation cover was more dominant in sandy soils. (2) Soil texture and precipitation have an interactive effect. The degree of regulation generated by soil texture is governed by annual precipitation; in some cases, the role of soil texture on vegetation cover is more dominant than precipitation. These results provide new insights into the influence of precipitation climatology on grassland vegetation cover and demonstrate the importance of different textured soils in regulating the structure of grassland vegetation.

References
Grasslands constitute one of the most threatened biomes on earth, being particularly prone to habitat degradation, loss and fragmentation as a direct consequence of accelerated rate of land use change due to urbanization and agricultural expansion. Biodiversity inhabiting these species-rich ecosystems are also highly threatened. Therefore, obtaining prompt knowledge on demographic and population genetic structure of threatened grassland species is crucial for guiding conservation and management practices. Eld’s deer (Rucervus eldii) represents one of the most threatened cervids distributed in the grassland habitats of South and Southeast Asia. Over the last century, the species has undergone substantial range contractions and several local extinctions across its distribution range. Its management largely depends on the human-mediated restoration of population units and genetic diversity through species recovery programs. This study attempts to investigate the phylogeography, genetic structure and demographic history of Eld’s deer using mitochondrial and microsatellite markers to provide information on its genetic status across its distribution range in South and Southeast Asia.

The results showed that the Siamese Eld’s deer (R. e. siamensis) exhibits two divergent mitochondrial lineages (mainland China and Hainan Island), which diverged around 0.2 Ma (95% HPD 0.1–0.2), possibly driven by the changing sea levels during the Early Holocene. The separation of the Indian subspecies (R. e. eldii) and R. e. siamensis occurred around 0.4 Ma (95% HPD 0.3–0.5). The divergence is presumed to be associated with their adaptations to warm and humid climatic conditions and the abundance of open grassland corridors that facilitated their dispersal. The genetic diversity estimates revealed low diversity at both the analyzed markers with comparatively high diversity in the wild population compared to the captive stock. Demographic analysis revealed periods of expansion and contraction in the effective population size with pronounced historical genetic bottleneck events in the recent past and small contemporary effective population size (median = 7, 4.7–10.8 at 95% CI).

Our findings provide crucial information on the genetic status of Eld’s deer with conservation and management implications required to direct the ongoing species recovery programs and effective planning of grassland habitats to ensure its ecological integrity. The findings also highlight the need to maintain the ecological connectivity and functionality of grassland habitats to ensure the continued survival of resident biota and minimize the effect of fragmentation.

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**PS08**

**GRAMINEOUS FRACTION IN SOME ARID ECOSYSTEMS OF ARMENIA**

Anahit Ghukasyan¹ & Georgi Fayvush¹

¹Institute of Botany after the name of A. Takhadjan NAS RA

**E-mail:** anyaghukasyan@gmail.com

The role of species of the Poaceae family is extremely important in the composition of arid grasslands. We have analyzed representatives of the Poaceae family involved in the formation of four arid herbaceous ecosystems: Steppes with wild wheat species dominance (E1.2E22), Sandy patches in Ararat valley (H5.323), Salt steppes and solonchaks grasslands (E6.25), and Wormwood semi-desert of Armenia (E1.451).

In the Poaceae family of Armenia, the vast majority of species are widely distributed, and they migrated to the territory of Armenia from the side of the Boreal sub-kingdom, or from the side of the Ancient Mediterranean sub-kingdom.

It has been established that 13 species of grasses are found in the ecosystem E1.2E22. 12 of them are associated with the Ancient Mediterranean, and 1 is distributed, mainly in the Boreal sub-kingdom. 9 species are diploids and 4 polyploids.

In the ecosystem H5.323 19 species of Poaceae were recorded. Among them, 14 diploids and species associated with the origin of the Ancient Mediterranean sub-kingdom (17) predominate. The two diploid species are widely distributed in Eurasia and throughout the world. All five polyploid species originated in the Ancient Mediterranean sub-kingdom, and them migrated to the Caucasus and Armenia as the Tethys dried up.

In the ecosystem E6.25 33 species of grasses are registered. By their distribution and origin, most of them (23) are associated with the Ancient Mediterranean, and migrated to Armenia, most likely in the Tertiary period, as the Tethys dried up.

In the ecosystem E1.451 27 species of grasses are registered. Here, there are significantly more diploids (19) than polyploids (7). Of these species, 21 are associated with the Ancient Mediterranean. Six species that are widely distributed in the northern regions of the Old and New Worlds most likely appeared on the territory of Armenia either during or after the Ice Age.

We can conclude that the gramineous fraction of four ecosystems is predominantly of Ancient Mediterranean origin, and in general is an allochthonous component of the Armenian flora.
PS12

CLIMATE OVERWHELMED LAND-USE AND MINERAL NUTRIENTS TO CONTROL PLANT BIOMASS AND DIVERSITY OF ALPINE GRASSLANDS ACROSS NORTH TIBET

Chenrui Guo1,2, Jingpo Yang2, Weiling Niu1, Ben Chen1, Jianshuang Wu1*

1Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences, 100081 Beijing, China. guo.chenrui@outlook.com
2School of Environmental Science and Engineering, Hebei University of Science and Technology, 050018 Shijiazhuang, China.

*Correspondence: J.Wu, wujianshuang@caas.cn

Questions: Overgrazing and climate warming are responsible for alpine grassland degradation on the Tibetan Plateau. However, it is still unclear whether short-term grazing exclusion (since 2006) can indirectly affect plant species diversity and productivity via the recovery of topsoil mineral elements.

Location: North Tibet, China.

Methods: Plant species diversity, aboveground biomass (AGB) and mineral element contents (Ca, Cu, Fe, Mg, Mn, and Zn) in topsoil (0-10cm) were measured for fenced vs grazed sites, three pairs of quadrats per site, across alpine meadows (AM, n = 5), steppes (AS, n = 6), and desert-steppes (DS, n = 4) in the plant growing season, 2012. Growing season temperature and precipitation (GST and GSP) were also collected for each site. First, we used two-way ANOVA (two land uses × thee grassland types) to examine the differences in vegetation and soil variables. Next, the colinearity among climate, vegetation, and soil variables was analyzed and shown in a correlation matrix. Finally, we disentangled the relative contribution of each explanatory variable to AGB and diversity indices with the best-fitted general linear mixed model.

Results: Neither AGB, plant diversity, nor mineral elements were altered by short-term fencing. AGB, species richness, and Fe content in DS were considerably smaller than in AM (P < 0.01). The highest Ca content was found in DS (P < 0.01), and no significant difference existed between AS and DS (P > 0.05). High colinearity was found among GST, GSP, AGB, species richness, and Ca content in topsoil and also among Cu, Fe, Mg, Mn, and Zn contents. Except for Ca, AGB has no apparent relationship with other mineral elements across North Tibet. Precipitation overwhelmed mineral elements to control the variances in plant AGB and species richness across the entire North Tibet. The effects of mineral elements on plant AGB and diversity became stronger than climate variables at the grassland type level.

Conclusions: Short-term grazing exclusion by fencing has limited influences on soil mineral element contents across alpine grassland in North Tibet. Climate conditions primarily regulate biomass production, while soil mineral elements are critical for local community composition.

PS28

SPATIOTEMPORAL PATTERNS OF LAND USE CHANGE AND LANDSCAPE ECOLOGICAL RISK IN THE MONGOLIAN PLATEAU FROM 2001 TO 2019

Jingpeng Guo1, Yonghong Li1, Jianmin Niu1

1College of Ecology and Environment, Inner Mongolia University, Hohhot 010018, China
E-mail: 2211501@imu.edu.cn

Ecological risk assessment (ESR) is the basis of regional sustainable development. The Mongolian Plateau (MP) is an important agricultural and pastoral production area in the hinterland of the Eurasian continent, with an extremely fragile ecological environment and a more sensitive and typical region in response to global climate change and external disturbances. In this study, based on the MODIS remote sensing images of 2001, 2005, 2010, 2015, and 2019 in the MP, geostatistical analysis methods, gravity model, multiple landscape index model, and other analysis methods were selected to analyze the temporal and spatial pattern characteristics of land use change and landscape ecological security from 2001 to 2019. The results show that:

1) from 2001 to 2019, the MP is mainly dominated by grassland and desert (accounting for more than 80%), its desert, forest, and waterbodies are decreasing gradually in the area (70465.25 km², 10904 km² and 1158.25 km² respectively), and mainly converted into grassland, wetland, farmland and other land types.
2) During 2001-2019, the dominant characteristics of “many-to-many” transfers continue, reciprocal conversions of forest and grassland in the northeastern, desert and grassland in the southwest, agricultural land and grassland in the central region, and wetlands and grassland in the eastern region show significant differences.
3) The center of gravity of deserts, forests, arable land and construction land shifted to the southwest, grasslands and wetlands shifted southward, and permanent ice and water shifted to the northwest.4) The fragmentation and separation indexes of permanent ice and snow and wetland showed a continuously decreasing trend during the whole period. And the fragmentation and separation index of grassland was relatively lower compared with other land use types.
5) The high and medium risk areas were mainly distributed in the western part of the Daxinganling, the southern part of the Yinshan Mountains, along the border between Inner Mongolia and Mongolia in Erlianhot, the southern part of the Hangai Mountains and the Altay Mountains, and the area of medium-risk areas showed an upward trend as a whole. To improve the ecological security of the MP, it is suggested to strengthen international cooperation and jointly prepare the spatial plan for the sustainable development of the MP, based on the characteristics of landscape ecological risk and spatial heterogeneity. To realize the sustainable development of the MP, we should adopt the strategy of “planning guidance, Land usage regulation, bottom line constraint, Partition management and combination of prevention and treatment”.

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Abstracts of Speed-Talk Poster Presentations

PS19

PLANT-POLLINATOR NETWORK DYNAMICS AND POLLINATION SERVICES IN THE PROCESS OF GRASSLAND RESTORATION

Gaku S. Hirayama¹, Tanaka Kenta², Hiroshi S. Ishii³ & Atushi Ushimaru¹

¹Graduated School of Human Development and Environment, Kobe University, 3-1, 1 Tsukubakuro, Kobe 657-8501, Japan. For correspondence
²Sugadaira Research Station, Mountain Science Center, University of Tsukuba, 1278-294 Sugadaira Kogen, Ueda, Nagano 386-2204, Japan.
³Graduate School of Science and Engineering, University of Toyama, Toyama, Japan
E-mail: gaku10321@gmail.com

Questions (Aims): Natural or semi-natural grasslands have rapidly declined owing to land-use changes such as abandonment and forestation, leading to diversity loss of grassland plant species (Török & Dengler, 2018). Although grassland restorations have been conducted worldwide, plant diversity often could not recover compared to the past level (Kiehl et al., 2010; Helm et al., 2019). Pollination services by pollinators are essential for reproduction of many grassland species but have often degraded by land-use changes for long terms. Pollinator and plant species losses due to land-use changes have caused generalised pollination networks, which in turn can result in low community-level pollination services (Traveset et al., 2016). Thus, network generalisation due to land-use changes would have long-lasting negative effects on recovery of zoophilous species in restored grasslands. In this study we tested following questions: (1) Do decreased pollinator and plant species richness cause generalisation of pollination networks, resulting in low pollination success of zoophilous species? (2) Do degraded pollination networks and services recover with continuous management?

Location: Sugadaira Highland of central Japan, which has been maintained by annual mowing.

Methods: We compared structure of plant-pollinator networks and pollination success of six native entomophilous species between old and new ski grasslands. Both old and new ski grasslands had been used as pastures at least 160 years ago (Inoue et al., 2020). Old ski grasslands were established directly on the old pastures. Meanwhile new grasslands had once experienced forestation for a few or several decades and then their grassland managements were restarted. We also examined relationships between duration of grassland period and network structure and pollination services in the new grasslands.

Results: We found that new grassland networks were significantly more generalised than those of old grasslands. Pollination success of six entomophilous species significantly lower in new grasslands than in old ones and significantly increased as increasing duration of grassland period. We also found a negative correlation between the degree of network generalisation and the pollination success of these species.

Conclusions: Our findings suggest that generalised pollination networks limits grassland plant restoration owing to degraded pollination services in restored ski grasslands. Moreover, networks of new grasslands gradually became to specialised ones, which were closer to those of old grasslands when grassland management has been continued over decades, leading to recovery of pollination services. In the presentation, we would discuss temporal dynamics of plant-pollinator networks and their pollination services in restored grasslands.

References
PS23

SMALL MAMMALS ON THE QINGHAI-TIBET PLATEAU: GRASSLAND PEST OR KEYSTONE SPECIES

Hua Limin

College of Grassland Science, Gansu Agricultural University, Lanzhou 730070, Gansu Province, China Engineering and Technology Research Center for Alpine Rodent Pests Control, National Forestry and Grassland Administration, China

E-mail: Hualm@gsau.edu.cn

The Qinghai-Tibet Plateau (QTP) has the largest alpine grassland with an average altitude of 4000 m above sea level in the world. The vast grassland plays a vital role on biodiversity conservation, animal husbandry development, water supply, as well as ethnic culture preservation in China and in eastern-south Asian. However, the grassland has been suffering the degradation because of climate change and increased livestock populations. The degraded grassland created a higher fitness habitat for small mammals, as a result, the population of grassland rodents increased and the rodents severely damaged the grassland. Of the 260 living rodent species in China, over 50 species occur on the QTP. Among these small mammals, plateau pika (Ochotona curzoniae), plateau zokor (Eospalax baileyi) and Himalayan marmot (Marmota himalayana) are regarded as the main pests because these animals forage plants, dig many holes and make lots of mounds on the grassland, and has the potential infectious source of plague. as a result, the grassland productivity, capacity of carbon sequestration and soil and water conservation of grassland are decreased, and the health of local people are threatened. In China, these species have been targeted with intensive control measures using poison bait for the past two decades. These control activities have been carried out every year because local governments and livestock owners believe that these small mammals have a negative impact on their grassland. However, when the population of these small mammals are not over the safety threshold that non-damage to the alpine grassland, these animals have many great benefits on biodiversity maintenance, food web and plant community stability, etc. Therefore, there are great challenges for pests control and biodiversity conservation. Our team has rich experiences on the animal-plant interaction, behavior, habitat selection of plateau zokor and plateau pika. We suggest that the current grassland pests management should focus on three aspects, involving damage threshold assessment of rodent pests, non-rodenticides management and damaged pasture restoration. We also believed that some new technologies, such as drone, AI image recognition, etc. have been wildly applied on the rodent pests management.

Keywords: Qinghai-Tibet Plateau; Alpine Grassland; Rodents.

PS65

EFFECTS OF DIFFERENT SEED SOAKING TREATMENTS ON SEED VIABILITY AND GERMINATION CHARACTERISTICS OF QINGHAI POA PRATENSIS

Xianze Hua, Yin Liu, Shili Du, Xuanbo Zhou, Jinping Qin, Bin He, Yushou Ma

Academy of Animal Science and Veterinary Medicine, Qinghai University, Xining 810016, China

E-mail: hxz lzxn@163.com

In order to understand the effects of different seed soaking agent concentration and seed soaking time on the seed germination and seedling growth of Qinghai Poa pratensis, this study used 5 seed soaking agents, respectively setting 3 seed soaking concentrations and 2 different seed soaking times, which were implemented to soak Qinghai Poa pratensis. After soaking the seeds, use the TTC method to determine the seed viability. Conducting a germination experiment to determine the seed viability. Conducting a germination experiment to determine the seed germination percentage, vitality index, germination index, seed germination index, influence index and other indicators to obtain the optimal seed soaking treatment way. The results showed that: (1) Seed soaking treatments can improve the germination rate and seedling vigor of Qinghai Poa pratensis seeds. The germination percentage of seeds increased by 39.96% under 1.5mmol/L citric acid soaking treatment, and under 2% potassium nitrate soaking treatment. Seed vigor increased by 228.20%; (2) Seed viability and germination rate were significantly positively correlated, but viability was slightly higher than germination rate. (3) By comprehensively judging by each index of 1% potassium nitrate soaking for one day, the germination percentage and seedling activity of Qinghai Poa pratensis have been improved to a certain extent. In summary, in the actual production of Qinghai Poa pratensis, seed viability can be used to replace the germination percentage of seeds, shortening the germination percentage test time; soaking seeds with 1% potassium nitrate for one day can significantly increase the germination percentage and seedling activity of Qinghai Poa pratensis, and can shorten the germination time before production.
**PS70**

**EFFECT OF POTASSIUM SILICATE FERTILIZATION ON MISCANTHUS SINENSIS COMMUNITY STRUCTURE AND PHYSICAL PROPERTIES OF THATCH**

Yuta Inoshima¹, Kiyokazu Kawada²

¹Master’s program in Mountain studies, University of Tsukuba ²Faculty of Life and Environmental Sciences, University of Tsukuba

E-mail: inoshima.yuta.sg@alumni.tsukuba.ac.jp

**Question:** Grasslands in Japan have been managed by mowing, and it contributes to maintain a high biodiversity. However, productivity of thatch such as *M. sinensis* has decreased in recent year, and grassland area expect to decrease due to management abandoned. To improve of productivity, we focused on potassium silicate fertilization which improve paddy yield. The aim of this study is to clarify the effect of fertilization on the yield and quality of thatch and on biodiversity of grassland community.

**Location:** Tsukuba Campus of High Energy Accelerator Research Organization (Tsukuba, Ibaraki, Japan)

**Methods:** Total 24 study plots were set by randomized blocked design and the fertilization of potassium silicate was conducted in April, 2021 0, 20 and 40 kg ha⁻¹ approximately. Vegetation survey was conducted from March to October in 9 m² quadrats. Multiplied Dominance Ratio (MDR) was calculated by multiplied a coverage and the highest plant height. The conclusive height and yield of *M. sinensis* were recorded in December. Five individuals of *M. sinensis* were collected from study sites to measure the number of internodes, and for the 2nd, 5th and 10th internodes, internode length, top and bottom inner diameter, and top, middle and bottom outer diameter. Bending stress, bending fracture stress and bending modulus were measured by the three-point bending method.

**Results:** The number of species tended to decrease with the amount of fertilizer applied, and the diversity index in September was significantly lower in the fertilizer treatments. MDR showed that the occurrence of Poaceae increased after June, and *M. sinensis* was the dominant species in many months in all treatments. The coverage, grass height and MDR of *M. sinensis* tended to be greater in the 20 kg treatment. Grass height did not differ among treatments, but yield tended to increase in the 40 kg treatment. The wall thickness at the top of the 2nd internode was significantly different between the control and 40 kg treatment. Bending stress, bending fracture stress were significantly different in the 10th internode between the control and fertilizer treatments, but there was no difference in bending modulus.

**Conclusions:** Potassium silicate fertilization can increase the hardness and yield of *M. sinensis*, although it decreases biodiversity. However, since there was no difference in biodiversity between the 20 kg and 40 kg treatments, the 40 kg treatment was considered to be better for producing more *M. sinensis*.

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**PS26**

**EFFECTS OF DUNG ARTHROPODS AND PRECIPITATION ON DECOMPOSITION OF DIFFERENT GRAZING LIVESTOCK DUNG IN A SEMI-ARID GRASSLAND**

Jianwei Cheng¹,², Frank Yonghong Li²*, Yadong Wang², Yanan Wang²,³, Xinmin Liu¹, Le Zhang², Zheng Bai², Ying Guo²

¹School of Geography Science, Taiyuan Normal University, Jinzhong 030619, China ²Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau & Inner Mongolia Key Laboratory of Grassland Ecology, School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, China ³College of Life Science and Technology, Inner Mongolia Normal University, 010022 Hohhot, China

E-mail: lifyhong@126.com  
*Author for correspondence: Frank Yonghong Li

Dung decomposition is a complex process, and is jointly affected by multiple factors such as climate, dung quality and soil biota communities. However, the relative contribution of climate, dung quality and dung arthropods and their interaction on dung decomposition process remain less explored. We did an in situ experiment using the ‘dung and soil’ mesocosm to investigate the separate and combined effects of dung arthropods and precipitation on the decomposition processes of the dung from horse and cattle. We determined the changes in dung mass, dung C and N contents, microbial respiration from the ‘dung and soil’ mesocosm or from the soil beneath the dung pats under five treatments (CK, soil only; E, exposed dung, dung pat was placed directly on the grassed soil surface; U, unexposed dung, dung pat was placed in a wire-mesh-cage (0.425 mm holes); E+P, exposed dung with additional water (50% more than natural rainfall); and U+P, unexposed dung with additional water (50% more than natural rainfall)) were applied to the dung of two major grazers with different digestive systems in native steppes in northern China, over a year period following dung deposition. We found that (1) the direct effect of precipitation on the dry mass loss of horse dung was stronger than on that of cattle dung, which was related with the relatively higher C/N ratio, larger porosity and lower hardness of the horse dung compared to cattle dung. (2) The presence of dung arthropods significantly reduced microbial respiration of dung at day 7 and 15 of the experiment, but precipitation addition increased microbial respiration of mesocosm with horse dung at day 1, 3 and 7 of the experiment. (3) Dung C and N loss were mainly controlled by dung arthropods and dung quality in the early stage of decomposition, whereas they were mainly controlled by precipitation that regulated microbial respiration in the later stage of decomposition. Our results suggest that dung quality mediated precipitation effect on dung decomposition regardless of dung arthropods presence, and also provide new insights into the mechanisms of biotic and abiotic factors on dung decomposition and nutrient cycling in a semi-arid grassland.

**Keywords:** dung arthropods; precipitation; dung decomposition; nutrient release; microbial activity
INTRASPECIFIC DIFFERENCES OF SECTION ON ROOT HEAD OF SILER (SAPOSHNIKOVIA DIVARICATA (TURCZ.) SCHISCHKIN) IN MONGOLIA

Gombo Oyungerel1, Tsambaa Battseren2, Jukov Azzaya2, Narantsetseg Amartuvshin2* and Munkhtur Davaagerel2

1Ministry of Environment and Tourism of Mongolia, Ulaanbaatar 15160, Mongolia
2Botanic Garden and Research Institute, Mongolian Academy of Sciences, Ulaanbaatar 13330, Mongolia

E-mail: amraa19721017@gmail.com
*Corresponding author: Narantsetseg Amartuvshin

Present study reveals intraspecific differences of root head section of Saposhnikovia divaricata and explain controlling factors. Root head section have divided into three categories and compared to the factors of geography, climate, fire and human activities. Clearly recognized section dominantly recorded in Dornod and Selenge-Tuv-Arkhangai provinces but it showed lower percentage in Khentii and Sukhbaatar. Within the administrative province, it was higher in Bayan-Uul, Sergelen, Dashbalbar and Tsagaan-Ovoo sites, Dornod province; in Dadal, Norovlin and Bayan-Khutag sites, Khentii province and ZuunUREN and Altanbulag, Selenge province. The percentage of clearly recognized section was higher with drought events during early summer and lower aridity index, burning and in pasturelands. It was higher on wild roots of S. divaricata than on cultivated ones. Percentage of poorly recognized section was higher in ZuunUREN, Nomgön and Siakhan site, Selenge province while that of not-sectioned root head was higher on cultivated roots. The results of our study suggest that clearly and poorly recognized sections on root head of S. divaricata is morphological signs of larger and smaller amounts of storage but not-sectioned root head is of smallest amount. The clearly recognized section can be changed to poorly recognized section and/or not-sectioned roots, caused by coldness, strong fire frequency, trampling and/or gathering and cultivation.

Keywords: Saposhnikovia divaricata, section on root head, wild root, cultivation

AN AMAZING AND ENDANGERED ECOSYSTEM IN ARMENIA

Mark Kalashian1, George Fayvush2

1Scientific Center of Zoology and Hydroecology NAS RA, P. Sevak str. 7, Yerevan 0014, Armenia
2Institute of Botany after the name of A. Takhtadjan NAS RA, Acharyan str. 1, Yerevan 0063, Armenia.

E-mail: mkalashian1@gmail.com

Aeluropus spp. dominated habitats (E6.251 – Fayvush, Alexanyan, 2016) are peculiar ecosystems formerly widely distributed in Ararat valley in Armenia, as well as in Turkish part of the valley and in Nakhichevan AR of Azerbaijan. These are typical hygro-halophilous habitats characterized by rather rich and peculiar flora and fauna with dominance of A. littoralis. Despite rather deep groundwater standing level located at a depth of 0.75-2.5 m, the appearance of communities usually looks mesophilic. Its flora consist of about 100 species, in the grass coverage usually presented Alhagi pseudalhagi, Puccinellia distans, Carex divisa, Gypsophila anatolica, Cryptis aculeata, Atriplex verrucifera, etc. Invertebrate fauna is poorly known; among rather well studied groups can be mentioned beetles with more than 120 species belonging to 22 families. These habitats inhabit a number of rare plants included in the Red Book of Plants of Armenia (Tamanyan et al., 2010), e.g. Halostachys belangeriana, Kalidium capsicum, Nitraria schoberi. There are the only ones for a rare invertebrate – Ararat cochineal Porphyphora hammei included in the Red Book of Animals of Armenia. Aeluropus spp. and more rarely Phragmites australis are only feeding plants for this invertebrate. Another species living here, beetle Cteniopus persimilis is also included in the Red Book (Kalashyan, 2010). During the last century in Armenia these areas have significantly decreased due to the ongoing measures for desalinization and cultivation of land. According to Sarkisov et al. (2010) who measured the range of cochineal, this range drastically decrease from 3000 ha to 2000 ha during 10 years (1975-1985), and continued decrease further because of desalinization and drainage of soil in vast areas of Ararat valley. For conservation of cochineal, special State Sanctuary “Vordan Karmir” was established. It covers 220 ha divided into 2 two plots surrounded by agricultural land in Armavir marz of Armenia which clearly not enough for conservation of this interesting habitats.
**PS31**

**VERIFICATION OF GOAT EATING BEHAVIOR IN MONGOLIAN GRASSLANDS USING BIOLOGGING REAL-TIME GRAZING ANALYSIS**

Kiyokazu Kawada1, Kengo Takahashi2,3, Narangerel Tseden Ish4 & Undarmaa Jamsran4

1Faculty of Life and Environmental Sciences, University of Tsukuba, Japan
2Graduate School of Life and Environmental Sciences, University of Tsukuba, Japan
3Grass & Forage Crop Research Group, Hokkaido Research Station, Snow Brand Seed Co., LTD., Japan
4Center for Ecosystem Studies, Mongolian State University of Agriculture, Mongolia

**E-mail:** kawada.kiyokazu.gu@u.tsukuba.ac.jp

**Question:** Grassland degradations in steppe regions of Northeast Asia is mainly due to the increase in the number of livestock. It is said that goat are more likely to cause strong impact on plants than sheep because they eat plants from their roots. However, most of the descriptions of this phenomenon are based on the experience of local residents. The reason why the scientific basis cannot be shown is that even if it can be observed as a phenomenon, it is difficult to record the factors of when, what, and how much was eaten, which is necessary for the evaluation of grazing.

**Location:** Hustai National Park, Mongolia

**Methods:** This study was conducted from June 19th to July 4th, 2016. Five survey sites were set up, and grazing tests were conducted using two goats at each site. Two grazing levels were adjusted by wire length (2 m and 3 m), and one goat was placed on each survey plot. Two 1 x 1 m quadrates were set in each survey plot, and vegetation surveys were conducted before the grazing test (0 h), about 6 hours after grazing (6 h), and about 12 hours after grazing (12 h). Regression analysis was performed to estimate above-ground biomass (E-AGB). A wearable camera was attached to goat, and the eating behavior of the goat was observed over time by biologging real-time grazing (BRG). The data were summarized in chronological order and analyzed for changes in goat food resource selection.

**Results:** E-AGB in the 2 m plot decreased by 66.9% at 6 h and decreased by 69.5% at 12 h. E-AGB in the 3 m plot decreased by 58.6% at 6 h and decreased by 69.4% at 12 h. Goat ate plants leaving it about 2 cm from the ground, but goats ate plants from roots was not observed. The result of 3 m plot, goat mainly selected Allium bidentatum, Haplophyllum dauricum and Convolvulus ammanii by 1 hour grazing from the start of survey. After 2 hours, the time to eat Artemisia frigida increased. After 9 and 12 hours of grazing time, the eating time of A. bidentatum and A. frigida increased. Analysis of the images revealed that the eating behavior during this time was that the plants that had already been eaten again. Stipa krylovii had a low resource utilization time despite being a dominant species around the survey site.

**Conclusions:** This study showed that the BRG methods can use to observe the eating behavior of the goat. Goats did not eat plants from their roots if food resource was enough in steppe. However, if an amount of plant for goat food is not enough, goats might try to eat palatable plants by any means.

**PS16**

**MULTI-DATA APPROACH FOR IDENTIFICATION OF LAND DEGRADATION EXTENT IN CENTRAL ASIA**

Elizaveta Khazieva1, Ziga Malek2 & Peter Verburg3

1Environmental Geography Department, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, De Boelelaan 1111, 1081HV, Amsterdam, the Netherlands
2Environmental Geography Department, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, De Boelelaan 1111, 1081HV, Amsterdam, the Netherlands
3Environmental Geography Department, Institute for Environmental Studies, Vrije Universiteit, Amsterdam, De Boelelaan 1111, 1081HV, Amsterdam, the Netherlands

**E-mail:** es.khazieva@gmail.com

Grasslands are one of the most important and least protected global ecosystems experiencing a high rate of conversion, yet getting low priority in global agendas. Grassland degradation in Central Asia (CA) is one of the greatest threats to biodiversity and food security, especially in a context of climate change. For combating land degradation worldwide the concept of land degradation neutrality (LDN) has been embraced as a target for the Sustainable Development Goals (SDG).

In this paper we performed analysis of spatial extent of land degradation in CA using three sub-indicators of LDN: Net Primary Production (NPP), Soil Organic Content (SOC) and Land cover. We compared global and regional land cover datasets, showing that the selection of land cover datasets have a significant impact on the overall assessment of degradation state. Hence, commonly used global datasets (such as Land Cover of the Climate Change Initiative (LCCI) and MODIS) tend to underestimate degraded areas (15% and 19% respectively), more detailed global land cover map (GlobalLand30) shows 34% of degradation, while the land cover map developed for CA demonstrates 22%.

LDN concept stipulates “like-for-like” approach, meaning the extent of degraded areas should be counterbalanced with areas of the same size and quality where land was improved. We developed a holistic soil quality map (so called bonitet) for CA based on several soil characteristics: SOC, clay and water content, pH, nitrogen content, bulk density and salinity. Calculated land degradation patterns coupled with bonitet map show that area of degraded land on high quality soils twice as high as area, where land condition was improved (12% versus 6%). Low soil quality areas demonstrate the similar trend, but the variance is not so significant (13% versus 10%).

The results of this study demonstrate that selection of land cover dataset plays crucial role in LDN assessments. For regional or country level evaluation complementary datasets on regional level should be included in order to properly evaluate if the LDN requirements are fulfilled.
Due to the long tradition relating to herbal use and the high-
ly agricultural nature of the economy, wild-growing useful plants
continue to have a strong influence on Tajik people. Because of
the scarce access to conventional medicine and food products,
people have gradually become highly dependent on the natural
useful resources of grassland communities that dominates in set-
tlement vicinities such as pseudostepes, steppes, pastures, fields,
meadows, forbs or ruderal plant communities. Our study shows
that of the 2835 non-forest species found in Tajikistan, 1263 have
useful properties. The largest number of plants are used in med-
icine (773 species), 498 species are used as fodder plants, 358
have culinary values, 221 are valued as ornamental species, 201
have found use in industry, and 160 are used for various domestic
purposes. In terms of conservation, 303 species of useful non-for-
est plants are currently considered endangered in Tajikistan and
56 are known to be globally threatened. Among them, there are
7 species with useful properties that are considered critically en-
dangered both nationally and globally. These are: Phlomoides
ebacteolata (Popov) Adyl., Kamelin & Makhm., Phlomoides
botschantzevii (Regel) Adyl., Phlomoides nuda (Regel) Adyl., R.
Kam. & Machmedov, Eremurus lachnostegius Vved., Isatis vi-
olascens Bunge, Rhinopetalum stenantherum Regel and Silene
monantha Bondar. & Vved.

Our analyses indicate that the distribution of beneficial non-for-
est species is related to population distribution in Tajikistan and,
consequently, the impact of human management on them. In ad-
dition, in the presented research we discuss whether useful prop-
nerties of endangered grassland species should be considered as
a threat or a feature that should become an additional tool for their
conservation.
PS35

CONSEQUENCES OF THE VIRGIN MEGAPROJECT AND APPROACHES TO DEVELOP THE POST-VIRGIN STEPPE LAND USE IN URALS AND SIBERIA

Sergey Levykin1, Yuri Gulyanov1, Murat Nurushev2, Grigoriy Kazachkov1, Ilya Yakovlev1

1The Institute of the Steppe of the Ural Branch of the Russian Academy of Sciences, Orenburg, Russia
2L.N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan

E-mail: stepevedy@yandex.ru

The Virgin land megaproject (1954-1963) for the plowing of 43 million hectares of virgin and fallow lands was implemented mainly in the steppe space of the Southern Urals, Western Siberia and Northern Kazakhstan. It has become the most important determining factor in the transformation and fate of the steppes. The history, essence and consequences of the virgin megaproject are unique and have been studied by us for 30 years. At the moment, the next cycle of generalizations is being completed. Using historical-geographical, field landscape, bioclimatic potential, abstract modeling and axiomatic methods, the assessment of landscape consequences of this project has been updated and systematized, and geographical factors of transformation of the Soviet virgin space into modern post-virgin space have been identified. The results made us revise the evaluation paradigm of this megaproject and interpret it as a global experiment on the largest renewal of steppe phytocenoses and associated steppe ecosystems of the Holocene in Eurasia. The scale of the steppe lands plowed at a time and abandoned 40 years later, is close. As a result, the highly self-regenerative potential of steppe vegetation has been realized. Thickets of Stipa lessingiana with the combination of favorable factors have recovered themselves in less than for 10 years. The self-restoration was accompanied by a sharp increase in populations of marmot, little bustard and other titular steppe species.

The potential of steppe ecosystems restoration in the post-virgin space has been studied and its regional manifestations have been systematized. The key areas and cores of virgin and secondary steppe ecosystems in the post-virgin space have been identified, ideas about the steppe land reclamation fund have been developed, and data on the dynamics of bioclimatic potential, technological equipment of agriculture and prospects for the introduction of modern nature-like technologies have been generalized. Based on the results, some ideas to optimize steppe land use in the post-virgin area of the Southern Urals and Western Siberia have been developed. The innovations are: methodological approaches to agroecological and technological expertise of the level of development and adaptation of post-virgin land use, the concept of an innovative land management unit that maintains compliance with the quality and area of arable land with the capabilities of a minimum complete set of equipment for the implementation of intensive soil-saving agriculture, the strategic principle of polarization of post-virgin space with the allocation of agricultural and environmental poles and flexible land use between them.

PS36

ON THE DEFINING ROLE OF THE STEPPE IN THE FORMATION OF HUMANITY: STEPNISM AS AN INNOVATIVE CONVERGENT DOCTRINE

Sergey Vyacheslavovich Levykin1, Murat Zhussypbekovich Nurushev2, Grigoriy Viktorovich Kazachkov, Ilya Gennadievich Yakovlev1

1The Institute of the Steppe of the Ural Branch of the Russian Academy of Sciences, Orenburg, Russia
2L.N. Gumilyov Eurasian National University, Nur-Sultan, Kazakhstan

E-mail: stepevedy@yandex.ru

The development of steppe science and the foundations of the Eurasian steppe restoration using genealogical and step-centric approaches, historical-geographical, geobotanical, abstract modeling and axiomatic methods will allow us to identify the leading factor of hominization and the development of civilization – grasslands. The first impetus was the origin of grasses from tree seedlings due to interaction with phytophages. The second was the development of ungulates in the steppes, including odd-toed – horses in the steppes of the Holartic, which played a fundamental role in the entry of civilization into the industrial stage. The third was the expansion of grasslands at the end of the tertiary time, which forced a group of monkeys to descend from the crowns of trees to the ground and master walking upright. The fourth impetus was the reduction of fruit resources familiar to Dryopithecus, combined with an increase in herbivore herds and the unoccupied ecological niche of the diurnal predator. Meat protein pushed the development of the brain. It was not so much labor in general that created man, as specialized work to breed herds of herbivores as a food and material base. Hunting and processing tools, the cult of hunting, funeral rites, art are mainly associated with the cult of steppe megafauna and hunting. Man received from the steppes a space for walking upright, herds of ungulates, a wheel, a horse, copper melting, nomadism, and the most convenient soils for agriculture. In fact, man is not a child of nature in general, but of the steppes; and the emergence of civilization to the industrial level is the result of the co-evolution of man and horse. As a result of this co-evolution, both man and horse managed not only to occupy all biomes, but also to reach the modern level.

The parent steppe landscape has become the most developed and transformed, so our ideas substantiate the ethical basis for the steppe’s preservation as a filial duty. We invite the scientific community to discuss the relevance of the convergent social scientific and philosophical doctrine of the steppe as a leading factor in the development of human civilization – “stepnism”, which can become the worldview of the XXI century, to overcome the existing anthropogenic challenge to the grasslands of the Northern Hemisphere. The consolidating role of the stepnism is important for the development of international scientific cooperation, primarily the main Holartic steppe countries-owners. This new scientific idea will launch a new round of international cooperation.
PS40

SUSTAINABILITY OF PASTURE HORSE BREEDING IN THE PRODUCTION OF ENVIRONMENTALLY FRIENDLY FOOD AND THE DEVELOPMENT OF ECOTOURISM

Murat Nurushev¹,², Nurlan Kasymbekov², Sergey Levykin³, Ilya Yakovlev³ & Grigory Kazachkov³

¹Union of Horse Breeders of Kazakhstan in the form of an Association of Nur-Sultan, Kazakhstan
²National Historical and Cultural Natural Museum-Reserve “Ulytau” in Ulytau village, Kazakhstan
³The Institute of the Steppe of the Ural Branch of the Russian Academy of Sciences, Orenburg, Russia

E-mail: nurushev@mail.ru

Climate change is a serious danger. Now the biodiversity of the planet, agriculture and the entire infrastructure of mankind are under threat.

Humans, like all mammals— are heat engines, but our bodies need to cool down sometimes to maintain their performance. To do this, the air temperature should be low enough. If the average temperature rises by 7°C, most of the land around the equator will become dangerous for humans. The situation in the tropics will only get more complicated due to the fact that the humidity will become dangerous for humans. Just moving around in such conditions at 40°C can be deadly. If the temperature rises by 11°C, half of the world’s population will die.

In connection with the above, all countries need to make efforts to take preventive measures to climate change, develop biological resources, breed animals on natural pastures, and obtain environmentally friendly food.

A horse in Kazakhstan, like a kangaroo in Australia, is a national symbol of the country.

The strategic goal of our Association of Horse Breeders of Kazakhstan is to bring the horse breeding industry to the most advanced positions in the world, becoming a leader in horse breeding, taking into account the feed intensity of pastures and the possibility of feed production in each individual area. Our long-term Plan for the development of horse breeding until 2050 provides for the achievement of the breeding level of 10.750 million horses, ahead of the USA and Mexico. There are every opportunity in Kazakhstan, we aim to increase the number of horses in the 3.5-4.0 times, not reducing the rate of production of horse meat, koumiss and export to foreign countries.

The implementation of our strategy with the participation in the Olympic equestrian sports, will give the opportunity to obtain the assistance from development Institutions such as the FAO, UNEP and IOC.

The real achievement of this goal will be carried out by coordinating the efforts of horse breeders by our Association, investment and innovative breeding methods, feed production technology, attracting investors and creating joint ventures, leading companies of the country.

PS20

ANALYZING THE RELATIONSHIP BETWEEN ANIMAL DIVERSITY AND THE REMOTE SENSING VEGETATION PARAMETERS: THE CASE OF XINJIANG, CHINA

Jinhui Wu¹,²,³,†, Haoxin Li¹,³,†, Huawei Wan¹,³, Yongcai Wang¹, Chenxi Sun¹ & Hongmin Zhou² & Author¹

¹Satellite Environmental Application Center of Ministry of Ecology and Environment, Beijing 100094, China; jwu@mail.cgs.gov.cn(J.W.); haoxin_lj94@163.com(H.L.); kqbinfang@163.com(Y.W.); mailsunchenxi@126.com(C.S.)
²China Institute of Geo-Environment Monitoring, China Geological Survey, Beijing 100081, China
³School of Ecology and Environment, Inner Mongolia University, Hohhot 010020, China
⁴Beijing Engineering Research Center for Global Land Remote Sensing Products, State Key Laboratory of Remote Sensing Science, Faculty of Geographical Science, Beijing Normal University, Beijing 100875, China; zhouhm@bnu.edu.cn

*Correspondence: livelyhw@163.com
†Co-first author, these authors contributed equally to this work.

An explicit analysis of the impact for the richness of species of the vegetation phenological characteristics calculated from various remote sensing data is critical and essential for biodiversity conversion and restoration. This study collected long-term the Normalized Difference Vegetation Index (NDVI), the Leaf Area Index (LAI), the Fraction of Absorbed Photosynthetically Active Radiation (FAPAR), and the Fractional Vegetation Cover (FVC), and calculated the six vegetation phenological characteristic parameters: the mean of the growing season, the mean of the mature season, the mean of the withered season, the annual difference value, the annual cumulative value, and the annual standard deviation in the Xinjiang Uygur Autonomous Region. The relationships between the vegetation phenological characteristics and the species richness of birds and mammals were analyzed in spatial distribution. The main findings include: (1) The correlation between bird diversity and vegetation factors is greater than that of mammals. (2) For remote sensing data, FAPAR is the most important vegetation parameter for both birds and mammals. (3) For vegetation phenological characteristics, the annual cumulative value of the LAI is the most crucial vegetation phenological parameter for influencing bird diversity distribution, and the annual difference value of the NDVI is the most significant driving factor for mammal diversity distribution.

References
**PS37**

**COMPARISON OF EMBRYO AND NUTRIENT LOSS IN ALFALFA SEEDS UNDER LONG-TERM STORAGE CONDITIONS**

Jiaqing Li¹, Zhenwu Wei², & Xueyang Min¹

¹College of Animal Science and Technology, Yangzhou University, Yangzhou, 225009, PRC
²College of Animal Science and Technology, Yangzhou University, Yangzhou, 225009, PRC

E-mail: lijiaqing1995@foxmail.com; zhenwu_weihotmail.com

The materials targeted in this study were alfalfa (*Medicago Sativa* L.) seeds harvested from the Institute of Grassland Science, Yangzhou University, Yangzhou City, Jiangsu Province. The harvest time was 2004, and the storage conditions were normal temperature. The goal is to reveal the viability of forage seeds stored at long-term condition.

As a section of a series of experiments, this study is divided into two parts. The first part is the measurement of seed nutrient loss. The water content, protein concentration, starch content and fat content of the samples under long-term storage conditions were determined by freeze-drying, BCA method, Anthrone colorimetric method and Soxhlet extraction method, respectively. The above experiments refer to the experimental methods of Zhou (Zhou et al. 2012), Liang (Liang et al. 2020) and McCleary (McCleary, Charmier and McKie 2019). The results of the assay are compared with seeds of the same variety harvested in 2020 to obtain the amount of nutrients lost in the seeds during long-term storage. The second part is the observation of seed embryo structure. The epidermis and embryo structure of the samples were observed by environmental scanning electron microscope, and compared with the seeds harvested in 2020, the mechanical damage at harvest and the effect of storage environment on seed preservation under long-term condition were observed. The observations refers to the experimental steps of Zhang (Zhang et al. 2012).

**References**


**PS68**

**SUMMER GRAZING OF THREE HERBIVORE SPECIES AT MODERATE INTENSITY ENHANCES THE PRIMARY PRODUCTIVITY AND DRIVES THE DIVERGENCE IN COMMUNITY STRUCTURE OF A SEMI-ARID STEPPE**

Yanlong Li¹, Chunjun Shi¹, Frank Yonghong Li¹*

¹Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau & Inner Mongolia Key Laboratory of Grassland Ecology, School of Ecology and Environment, Inner Mongolia University, Hohhot, 010021, China

E-mail: lifyhong@126.com

*Author for correspondence: Frank Yonghong Li

**Aims:** Grazing of large herbivores alter plant species composition and affects productivity of natural grassland, while the information are less available on the effects of different herbivore species on grassland community structures.

**Location:** Xilingol, Inner Mongolia, China

**Methods:** We studied the grazing effects of three major livestock species on a typical steppe vegetation in a 4-year field experiment using a random block-design consisting of four livestock treatments (sheep, goat, cattle or nil grazing), replicated by four block. The summer grazing (from June and August) at a moderate intensity was applied for all the grazing treatment.

**Result:** We found that (i) Sheep preferred *L. chinensis* and mixed subordinate species, cattle preferred *S. grandis*, and goat preferred *C. korshinskyi* and *C. squarrosa*. (ii) In consistent with the forage preference of three livestock species, sheep grazing increased the relative biomass of *S. grandis*, but reduced that of *C. korshinskyi*; cattle grazing reduced the relative biomass of *S. grandis* and *C. korshinskyi*, but increased that of mixed subordinate species; and goat grazing reduced the relative biomass of *C. squarrosa* and *C. korshinskyi*, but increased that of mixed subordinate species. (iii) Livestock summer grazing at a moderate intensity significantly increased the ANPP of plant community, and the increase was mainly a consequence of the ANPP increase of dominant rhizomatous grass *L. chinensis* and a group of subordinate species, instead of dominant bunchgrass *S. grandis*.

**Conclusions:** Our findings show that summer grazing of all the three livestock species at moderate intensity increases ANPP of the steppe grassland, and their selective defoliation drives the divergent changes in grassland community. This result implies that livestock composition can be used as an efficient mean to mediate vegetation dynamics.
PS39
MIXED GRAZING AT MODERATE GRAZING INTENSITY SIGNIFICANTLY IMPROVES ANPP AND COMMUNITY STABILITY IN ALPINE GRASSLANDS ON THE QTP

Yuzhen Liu, Wentin Liu, Xiaoxia Yang, Bin Feng, Jie Gao, Xue Zhang, Quanmin Dong

1Academy of Animal Science and Veterinary Medicine, Qinghai University, Xining 810016, China
E-mail: qmdong@qhu.edu.cn

How to improve the management and sustainable use of alpine grasslands on the Qinghai-Tibet Plateau through rational utilization has been a hot research topic in the field of grassland ecology. In order to clarify how different herbivore assemblage under moderate grazing intensity regulate the relative effects of plant community characteristics and soil environmental factors on the above-ground net primary productivity (ANPP) and the stability of community structure in alpine grasslands. In this study, we set up grazing plots with different herbivore assemblage (single yak grazing, Tibetan sheep single grazing, yak-Tibetan sheep 1:2 mixed grazing, yak-Tibetan sheep 1:4 mixed grazing, yak-Tibetan sheep 1:6 mixed grazing) and enclosure plots based on moderate grazing intensity, and systematically analyzed the changes of plant community characteristics, soil physical and chemical properties and above-ground net primary productivity of alpine grassland under different herbivore assemblage after 8 years of continuous grazing treatment, hoping to The optimal grazing combination was determined. The results showed that (1) different herbivore assemblage had no significant effects on species richness and diversity index, but significantly reduced the height and cover of alpine grassland plants. (2) The plant community characteristics under 1:2 mixed grazing of yak and Tibetan sheep were similar to those under exclusion, and the plant community under 1:2 mixed grazing of yak and Tibetan sheep was the most stable, with the highest level of organization, the highest ANPP and the highest livestock intake. (3) Enclosures can significantly reduce soil bulk density, while single grazing by Tibetan sheep significantly increases soil bulk density and soil available N and P content. (4) Grazing activities at medium intensity weakened the effect of alpine grassland vegetation diversity on ANPP and strengthened the effect of soil environmental factors. In conclusion, 1:2 mixed grazing by yak and Tibetan sheep at medium grazing intensity is the ideal way to utilize alpine grassland on the Tibetan Plateau. In order to improve the management of alpine grassland, it is recommended to adopt the coupled vegetation-livestock-soil management based on moderate grazing intensity and 1:2 mixed grazing of yak and Tibetan sheep to achieve the sustainable use and development of alpine grassland ecosystem.

PS55
DYNAMIC STUDY ON THE EFFECT OF OATS MIXED WITH VICIA VILLOSA VAR. GLABRESENS

Liu Qian1, Qiao Xuefeng2 & Tao Ya3

1liuqianxichang@163.com
2Institute of Agricultural Science, Liangshan Yi Autonomous Prefecture, Xichang 615042
E-mail:liuqianxichang@163.com

Objective: To address the shortage of high quality forage and to make full use of the winter idle fields to establish mixed leguminous-grass forage grasses to broaden the source of forage, we selected Avena sativa ‘Monida’ and Vicia villosa var. glabrens cv. liangsha for the mixed sowing trial.

Location: Winter fields in the Liangshan region.

Methods: The experiment had five treatments with three replications each. Oats were sown alone, 75% oats + 25% Vicia villosa, 50% oats + 50% Vicia villosa, 25% oats + 75% Vicia villosa and Vicia villosa were sown alone. Above-ground biomass and nutrient quality dynamics and interspecific competition were studied by measuring plant height, fresh hay yield, the proportion of each component of bean and grass and crude protein content.

Result: Forage yields from uncast and mixed sowings increased gradually as the phenological period progressed, with the highest hay yields being achieved at the milking stage of oats. The hay yields of 50% oats + 50% Vicia villosa and 75% oats + 25% Vicia villosa were 24512.55 kg/hm2 and 23029.80 kg/hm2, respectively, which were 3.91% and 10.61% higher than the hay yield of oats sown alone and 69.15% and 80.04% higher than the hay yield of Vicia villosa. The hay yield of the mixed treatments showed a trend of gradually increasing forage yield as the proportion of oats increased. The crude protein content of the forage gradually decreases as the fertility period is delayed, and is at its lowest when the oats are at the milking stage and the pods are set. In terms of environmental resource utilisation, the 50% oats + 50% Vicia villosa was a good complementary use of resources, with oat grass having a clear and stable competitive advantage. The combination of hay and crude protein yields and resource stability concluded that 50% oats + 50% Vicia villosa is the best bean-grass mix for winter cropping in the Liangshan region.

References
Aims: To evaluate the condition of natural pastures within the protected area of Upper Koksu Wildlife Sanctuary (UKWS) and to provide recommendations on sustainable management of natural resources of the area.

Location: UKWS is located in Jungar Alatau Mountains (South-East Kazakhstan) under approximately E 79° 30’ and N 44° 45’. The area of the UKWS is about 240 000 ha. Approximately 30 000 ha of the total area is designated as livestock pastures. UKWS was created to protect endemic amphibian Ranodon sibiricus Kessler, 1866. Other subjects of protection are Ursus arctos issabellinus, Uncia uncial Schreber, Bubo bubo L., Aegypius monachus L. and a variety of rare and endangered plant species (Pinaceae, Rosaceae, Liliaceae, etc).

Methods: Ground measurements of 2021 were conducted at more than 80 sampling points, encompassing major pasture types in the basin of Koksu River. Ground measurements included the measure of NDVI with handheld sensor Trimble GreenSeeker, the measuring of the biomass, calculated by a weighting of cut plants at each sampling point, the estimation of grass cover, and the content of unpalatable species along with the detailed description of plant communities. Satellite data of Landsat-8 and Sentinel -2 (high-resolution optical sensors), synchronous to ground measurements were processed to calculate a series of vegetation indices.

Results: The intense degradation of natural pastures is obvious if consider two parameters: the seasonal biomass dynamics and the unpalatable species content. Biomass falls drastically in the middle of summer when, normally, it should reach its peak values. The content of unpalatable grass may reach 50-70% of the total biomass. Some indices (like DWSI, IRECI, GreenNDVI, OSAVI) demonstrating relatively high correlations to ground data (r-value varies as 0.68-0.94) were selected to produce a series of maps depicting the distribution of biomass, grass cover, and unpalatable species content within grazing areas.

Conclusions: This work is a part of a continuous project devoted to the assessment of the UKWS ecosystem stability concerning Ranodon sibiricus wellbeing. After additional study during 2022, the results of this particular work will provide the basis for further activity aimed at regulating or prohibiting livestock grazing within the UKWS area.
**THE INFLUENCE OF FERTILIZATION TYPE AND ENVIRONMENTAL VARIABLES ON SOIL MITE COMMUNITY STRUCTURES FROM GRASSLANDS, IN ROMANIA**

M. Manu¹, R.I. Bânciă²,⁴, O. Mountford⁴, T. Marușca³, V.A. Blaj⁵ & M. Onete¹

¹Romanian Academy, Institute of Biology Bucharest, Department of Ecology, Taxonomy and Nature Conservation, street Splaiul Independenței, no. 296, zip code 0603100, PO-BOX 56-53, Bucharest, Romania
²Faculty of Natural Sciences, University Ovidius Constanța, Constanța, Romania
³Department of Biospeleology and Soil Edaphobiology, “Emil Racoviță” Institute of Speleology, Romanian Academy, 13 Septemberie Road, No. 13, 050711, Bucharest, Romania, bancila_ralucaioana@yahoo.com
⁴Centre for Ecology and Hydrology, Maclean Building, Benson Lane, Crowmarsh Gifford, Wallingford, Oxfordshire, OX10 8BB, UK, e-mail: om@ceh.ac.uk
⁵Grassland Research and Development Institute Brașov, Romania, Cucului str., No. 5, 500128, Brașov, Romania, e-mail: maruscat@yahoo.com; blajadi@pajisti-grassland.ro

E-mail: minodoramunu@gmail.com and marilena.onete@gmail.com

The objectives of the study was to analyse the difference between Mesostigmata communities structures from some chemical and organically fertilized grassland plots and the influence of five biotic and abiotic factors (vegetation cover, soil temperature, soil moisture content, pH, soil resistance at penetration) on mites. The research was carried out in the Bucegi Mountains, Romania, at 1875 meters altitude. The fieldwork was conducted in July, 2017. The four chemical and organically fertilized grassland plot were acarological compared with one control plot (without any controlled fertilizers). In total 250 random soil samples were collected, with a MacFadyen soil core, at 10 cm depth. The soil samples were collected randomly. The mites were extracted for 10-14 days using the Berlese–Tullgren method. The above presented environmental variables were quantified. The multivariate statistical procedures were implemented in R 4.0.2 software. Considering environmental variables, the authors demonstrated that vegetation cover, soil moisture content and soil temperature differed significantly between the experimental grassland treatments. Each experimental plot was defined by: characteristic environmental conditions, showing clearly distinguishable patterns; specific indicator species; and structural parameters (as species richness and numerical abundance). The indicator species are characteristic for temperate grassland ecosystems, some of them being resistant to the different chemical treatments of soil. In total, 30 species of Mesostigmata mites, with 1163 individuals were identified. The structural characteristics of mite communities, specific to each grassland, are due to the significant differences of environmental variables between plots, demonstrated through multivariate analysis. The effect of environmental variables was demonstrated at species level. We shown that the controlled and informed use of agrochemicals improves the soil environmental conditions for mites, fact demonstrated by the lowest value of species richness and numerical abundance of mite community from control plot, in comparison with those fertilized. The study demonstrated that the differences between Mesostigmata communities from some chemical and organically fertilized grasslands are connected with the type of fertilization and with some abiotic factors. In the same time, this research highlighted the importance of knowing the ecology of the mite communities, as important tools for environment assessment.

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**IMPACT OF ABANDONMENT AND HUMAN DISTURBANCE ON ECOSYSTEM SERVICES IN JAPANESE TEMPERATE GRASSLANDS**

M. Martinez¹, K. Heinsoo², A. Ohwaki³, M. Geetha³, D. Das⁴, K. Uchida⁵, K. Takeuchi⁶,⁷ & I. Melts¹

¹Chair of Biodiversity and Nature Tourism, Estonian University of Life Sciences, Estonia
²Division of Natural Environmental Science, Mount Fuji Research Institute, Japan
³Institute for the Advanced Study of Sustainability, United Nations University, Japan
⁴School of Agriculture, Seacom Skills University, India
⁵Institute for Sustainable Agro-ecosystem Services, The University of Tokyo, Japan
⁶Institute for Future Initiatives, The University of Tokyo, Japan
⁷Institute for Global Environmental Strategies, Japan

E-mail: mylene.martinez87@gmail.com

**Question:** What is the impact of different interventions on species richness, functional groups, biomass yield and properties in semi-natural Miscanthus sinensis grasslands?

**Study area:** Satoyama landscape in Nagano and Yamanashi prefectures in Honshu island, Japan.

**Methods:** The fieldworks conducted in 2017 and included semi-natural grasslands with different land management types. Botanical inventory included the list and coverage+abundance of all plant species in total nine quadrats per sites. All listed species were separated into functional groups and according their habitat preferences. For biomass potential estimation, the plants rooted inside the plots were harvested and the dry weight was determined in the laboratory. Different chemical parameters of biomass and soil samples were analysed by standardised methods.

**Results:** We detected total 151 species in Nagano and 177 species in Yamanashi prefecture. The higher species and functional groups’ richness were associated by higher pH, and lower organic matter and NPK concentration in soil. The highest species richness was found in the sites managed by mowing in Yamanashi and burning+mowing in Nagano prefecture. The lowest species richness was detected in the abandoned sites. Abandonment and burning is suitable for the highest yield of biomass. The lowest yield of biomass was detected from sites managed by mowing. Organic compounds in biomass were influenced by different functional groups - mainly grasses followed by forbs, vines and other groups. Mineral concentration was more affected by coverage of other forbs. We did not detect any impact of legumes on chemical composition of biomass collected from semi-natural Miscanthus sinensis grasslands.

**Conclusions:** Sustainable management is prerequisite to maintain open semi-natural Miscanthus sinensis grasslands and their ecosystem services in the Satoyama landscape in Japan. Mowing and mowing+burning are suitable land management types for biodiversity, but burning and abandonment could be feasible for biomass production to shift toward bio-based economy together with the best knowledge of local farmers, nature conservationists and other stakeholders.
NEW ALIEN INVASIVE PLANT SPECIES IN THE FLORA OF ADJARA (GEORGIA)

Irakli Mikeladze¹

¹Institute of Phytopathology and Biodiversity, Batumi Shota Rustaveli State University (BSU), Kobuleti, Adjara,

E-mail: Georgia.irakli.mikeladze@bsu.edu.ge

Adjara floristic region is located in the South Western part of Georgia, on the Black Sea coast, at an altitude of 0-2995 m above sea level. Area 2919 km², is divided into two parts: coastal Adjara and inner mountainous Adjara. Floristically rich and various. There are over 2000 species, among them about 500 species are alien. Between them 178 species are of woody plants - trees and shrubs, the rest are herbaceous.

156 species of Adjara alien flora are of Mediterranean origin and it is 32% of the whole flora, 134 species (27%) of East Asian origin is on the second place, 108 species (22%) are of European origin, other continents are represented with the following number of species - North America 59, South America 23 and Australia 8.

The appearance of alien plants in Adjara is connected to the introduction of cultural plants. The introduction of southern (sub-tropical) plants and distribution into culture has been going on since ancient times.

At the end of the XIX century there were 134 alien species in the flora of Adjara. In the 1920s -168, in the forties 281, since 1950 the number of alien plants grow by 30-40 species in every 10 years, which reached to 450 species in 2010. After 2010 many new alien species were described by us.

As a result of research conducted the last period, we have described several new alien species, among them is remarkable dangerous invasive species, they are:

Sicyos angulatus L., - widely spread on the agricultural grounds, particularly maize field, citrus crops and represents as a serious weed for farmers. It is also found in semi-natural habitats, on the riverbanks and nearby territories, roadsides, mainly in the swampy and moist soils.

Solidago canadensis L., - wide spread in seaside on roadsides, canals, ruderal areas, tea plantation, cultivated fields, forest margins and semi natural areas. Its invasive potential is high.

Cenchrus longispinus (Hack.) Fernald (=Cenchrus pauciflorus var. longispinus (Hack.) Jansen & Wacht.) - at this stage it is not wide spread. Found in the Kobuleti lowlands, on the seaside dunes. But they are characterized by abundant fruiting and rapid spread. It is dangerous invasive plant.

Verbena brasiliensis Vell., - is spread out seaside Adjara, roadways, ruderal sites, abandoned pastures, forest margins and abandoned lawns. In spreading areas, it takes the dominant position and completely changes plant environment.

VEGETATION COMPOSITION OF WET GRASSLANDS OF KAZIRANGA NATIONAL PARK, ASSAM, INDIA

Monika Sharma¹, Anita Devi¹, Syed Ainul Hussain¹ & Ruchi Badola¹

¹Wildlife Institute of India, Post Box # 18, Chandrabani, Dehra Dun 248001, Uttarakhand, India.

E-mail: monikasharma7777@gmail.com

Questions: Wet grasslands are biologically diverse ecosystems maintained by climate, hydrology, soil condition, and management interventions. Climate change is threatening the biodiversity, vegetation composition and ecosystem processes of these grasslands directly by affecting rainfall and temperature and indirectly by extreme climate conditions. The wet grasslands in the Brahmaputra floodplains of Kaziranga National Park (KNP), Assam, India are maintained by annual floods and burning practices. The consequence of the change in the intensity of these processes to the vegetation composition of the park is understudied. Necessitating the up-gradation of the available information on vegetation composition of the park. This study aims to provide information on vegetation composition of KNP in terms of species groups viz., angiosperms, pteridophytes and gymnosperms; monocots and dicots; and growth forms such as grasses, sedges, climbers, herbs, ferns, shrubs and trees.

Methods: Information on the vegetation composition of the park was gathered through an extensive literature review of available offline and online scientific articles, reports and books between 1970 and 2020. Offline, the literature available in the Wildlife Institute of India’s library was reviewed. Online, the literature available was accessed through search engines like Google Scholar, Research Gate, Mendeley and scientific databases like Shodhganga and Biodiversity Heritage Library, using keywords like ‘flora of KNP’, vegetation composition of KNP, medicinal plants and trees of KNP for review.

Results: One thousand and five plant species belonging to 585 genera and 147 families were documented. Of these, 965 were angiosperms, followed by 39 pteridophytes and one gymnosperm. In angiosperms, the highest number of species were represented by dicots (n=691) followed by monocots (n=274). Ficus with 23 species was the dominating genera, followed by Cyperus (n=15) and Paspalum (n=10). Poaceae with 134 species was the dominating family, followed by Leguminosae (n=82) and Compositae (n=38). Among seven growth forms, the highest number of plant species were documented in herbs (n=272), followed by trees (n=263), shrubs (n=187), grasses (n=133), climbers (n=78), ferns (n=38) and sedges (n=34).

Conclusions: We conclude that KNP is rich in terms of flora although more scientific studies are needed to explore the pteridophytes and gymnosperms of the area. In the future, updated information on the vegetation composition of KNP will provide baseline information to understand the effects of climate change on vegetation composition. Which will further help develop sustainable grassland species-specific conservation strategies.
PS50

RESULTS OF MONITORING OF REINTRODUCED SPECIES IN PRIMARY SEED PRODUCTION SITES IN THE FOOTHILLS OF UZBEKISTAN

Toliibjon Mukimov¹, Rustam Muradov², Musurmon Norkulov³

¹Samarkand State University, Samarkand, Uzbekistan
²UNDP, Tashkent, Uzbekistan, ramuradov@gmail.com
³Uzdaverloiha, Tashkent, Uzbekistan, musurmonnorgulov@mail.ru

E-mail: mukimovt56@mail.ru

Introduction: The increase in the areas of degraded pastures, digression of pastures, deterioration of biotic communities (ecosystems), reduction of soil fertility, erosion and desiccation, aging of forests, reduction of biodiversity, illegal and haphazard cutting of shrubs and trees, haymaking, harvesting of fuel and medicinal herbs have led to the disappearance of many types of forage grasses from the herbage.

Study area: Primary seed nurseries have been established in the foothill and mountainous areas of Tashkent, Kashkadarya and Surkhandarya regions.

Methods: Sowing of plants in the spring on degraded areas of pastures by the strip method, followed by seed planting by harrowing.

Results: Within the framework of the UNDP-GEF project “Sustainable use of natural resources and forestry in key mountain regions important for globally significant biodiversity species”, in 2018-2021, the reintroduction of perennial, highly productive pasture plants was carried out by sowing species of Kochia prostrata and Ceratoides eversmanniana in degraded areas of the foothill zones of Uzbekistan. The costs of sowing are one-time, the productive longevity of the species is 15-20 years. The maximum yield of feed mass and seeds is noted 1,2-1,4 t/ha. The growing season is 230-240 days. 100 kg of absolutely dry feed contains 83.5 -45.9 feed units. They are characterized by a high intensity of regrowth after mowing, drought and heat resistance, well withstands double pasture and hay use.

Conclusions: The creation of drought-resistant perennial forage plants will make it possible to obtain about 240 kg of seeds from 2 hectares in the 3rd year of vegetation and use them in the future to improve the adjacent degraded pastures. Additionally, you can get 3.0-3.2 tons of dry weight, which will allow you to have a stable feed base throughout the year.

Key words: foothill pastures, monitoring, degradation, fodder plants, seeds, rehabilitation, fodder mass, seed yield.

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THE ONLY WAY TO INCREASE PASTURE PRODUCTIVITY

Jalol Najmiddinov¹, Toliibjon Mukimov², Akhtamjon Ergashov¹

¹Bukhara Center for seed production of desert fodder crops for the enrichment of pastures. Bukhara. Uzbekistan
²Samarkand State University, Samarkand, Uzbekistan

E-mail: oybek.karimovov@mail.ru; mukimovt56@mail.ru

Question: The total land fund of the Republic of Uzbekistan is 44.4 million hectares, of which pastures in the desert, semi-desert, mountainous and adyr zone is 23.2 million hectares. These pastures are degraded by 38-44%, due to the specific composition of the soils of each zone, salinity, climatic conditions, man-made factors, as well as irrational use of pastures.

Methods: Collection of plants from natural flora, sowing of plants in the spring in collection nurseries, reproduction and sowing on degraded pasture plots by the strip method, followed by seed planting by harrowing. Currently, the deterioration of the ecological situation has a negative impact on biodiversity and the development of pasture plants.

Results: To prevent the above factors, first of all, it is necessary to produce seeds of forage plants. In this regard, the Bukhara Scientific and Production Center for Seed production of desert forage plants has established a plantation of 14 different plant species on an area of 4300 hectares in 2019-2021. These are the species of Calligonum, Halothamus subaphylla, Kochia prostrata, Ceratoides eversmanniana, Salsola richterii Karel, Ephedra Strobilacea, Salsola orientalis, Salsola gemmascens, Artemisia turanica, Aristida penna, Ferula foetida, Poa bulbosa, Agropyron desertorum, Mausolea eriocarpa, Halimocnemis villosa, Gananthus gromaticus and other forage species.

For the rational use of the created pastures (agrophytocenoses), it is also necessary to plant such plants as Salsola Richterii, S. Paletskiana, Haloxylon persicum, H. aphyllon and Tamarix hispida around the fields, using the strip method (at the seeding rate 0.5 kg/ha, respectively).

Conclusions: The created agrophytocenoses can be used for 30-40 years without additional economic costs. This will be the main source of further intensive development of karakul breeding in the country.

Key words: desert, pastures, plant varieties, seeds, forage plants, viability, soil, seed yield, seed quality.
**PS61**

**FACTORS CAUSING INTRASPECIFIC VARIATION IN FUNCTIONAL TRAITS OF GRASSLAND SPECIES ALONG AN URBAN-RURAL GRADIENT**

Taichi Nakata¹ & Atushi Ushimaru¹

¹Graduate School of Human Development and Environment, Kobe University

E-mail: t.nakata2307@gmail.com; ushimaru@kobe-u.ac.jp

Questions (Aims): Urbanization habitats with higher temperature and eutrophic soil conditions may exert new environmental pressures that facilitate trait evolution in plants living in semi-natural grasslands. With this background, we addressed the following three questions. Do urban plant populations exhibit different phenotypic trait variations compared to those living in nearby rural populations in the field? Are the phenotypic variations between urban and rural populations reproduced in a common garden? Are there any correlated evolution between these traits in urban populations?

Location: Twelve semi-natural grasslands around paddy fields, Osaka-Kobe metropolitan area and a greenhouse in the Kobe University, Japan.

Materials & Methods: We conducted field measurements of four phenotypic traits (plant height, leaf area, number of leaves, and SPAD value) in twelve populations of an annual native grassland species, Commelina communis along an urban-rural gradient. In addition, we transplanted seedlings from six populations (two urban, two suburban, and two rural populations) to the greenhouse and measured six functional traits, plant height, leaf area, number of leaves, SPAD value, specific leaf area (SLA), and total biomass.

Results: The leaf number significantly decreased with increasing developed land area around study site in both the field and greenhouse. The SLA was significantly lower in more urbanized populations in the greenhouse. Although plant height and leaf area were significantly greater in urban populations than in rural ones in the field, no such variations were found in the greenhouse. The SPAD value and total biomass did not significantly differ between urban and rural populations. We also found negative and positive correlation between the leaf number and the SPAD value in urban and rural populations, respectively.

Conclusions: Our findings suggest that increased developed lands around study site promote phenotypic trait divergence in the urban-rural gradient. Urban populations exhibited fewer number of leaves per individual than rural populations did. We discuss the environmental factors which promote these intraspecific trait variations between urban and rural populations.

**PS52**

**TOWARD AN IRANIAN NATIONAL VEGETATION DATABASE: VEGIRAN**

Alireza Naqinezhad¹, Jalil Noroozi², Hamid Gholizadeh¹, Amir Talebi, Parastoo Mahdavi³, Soghra Ramzi¹ & Saeedeh Tamjidi¹

¹Department of Plant Sciences, Faculty of Basic Sciences, University of Mazandaran, Babolsar, Iran
²Department of Botany and Biodiversity Research, University of Vienna, Rennweg 14, A-1030, Vienna, Austria
³School of Biology and Center of Excellence in Phylogeny of Living Organisms, College of Science, University of Tehran, Tehran, Iran

E-mail: anaqinezhad@gmail.com

Standardization of biodiversity data is a key approach to the ecosystem conservation. Iran is a mountainous country in south west Asia interfacing two global biodiversity hotspots, i.e. Caucasus and Irano-Anatolian. The complex geography and topography and a wide altitudinal range (near to 5700 m), the contrasting climates generating humid forests and very hot deserts, as well as its location at the interface of several geobotanical regions (Zohary 1973) causing a high floristic diversity of the country with more than 8500 vascular plant species and a high proportion of endemism (Noroozi et al. 2019). The current database constructed in TURBOVEG has been planned to be a beginning of a comprehensive database for the vegetation database of Iran. With this long database report, we plan to introduce the updated version of Iranian Vegetation Database (GIVD ID AS-IR-001) for getting a better insight in the diversity of Iranian vegetation. In March 2022, this database contained 6788 phytosociological relevés belonging to different habitat types of Iran ranging from temperate forests (29.8%), grasslands, steppes and desertic steppes (20.1%), wetlands and montane springs (15.9%), alpine habitats (15.2%), woodlands, riparian forests and forest steppes (8.5%), halophyte vegetation (6.2%) and sand dunes (4.3%). The species richness per plot ranges from 1 to 76. The sampling period started from 1937 but the majority of samples were implemented since 2005. Vegiran is the first geographically and floristically representative national-level vegetation database and will be highly valuable for analyzing biodiversity patterns and assessing future changes in this region. We hope it will continue to grow via new data addition by all Iranian vegetation scientists.

References


PS41

MICRO-MORPHOMETRIC VARIABILITY AND SIGNIFICANCE OF BILOBATE GRASS PHYTOLITHS FROM COASTAL GRASSLANDS, WEST BENGAL, INDIA

Madhab Naskar1,2, and Subir Bera1*
1Centre of Advanced Study, Palaeobotany-Palynology Laboratory, Department of Botany, University of Calcutta, Kolkata, India
2Department of Botany, Sonarpur Mahavidyalaya, Kolkata, India

E-mail*: berasubir@yahoo.co.in

Question (Aims): The study aimed to assess the significance of micro-morphometric sub-morphotypes of bilobate grass phytoliths.

Location: Different coastal grasslands (mangrove grassland, salt marsh grassland and sea beach grassland) and adjoining regions of lower Gangetic delta, India.

Methods: 110 grass species belonging to 45 genera, 21 subtribes, 13 tribes and 7 sub-families were collected for phytolith extraction. Standard method (Pearsall 2000) was followed for phytolith extraction.

Results: Bilobate phytoliths were sub-categorized on the basis of length of the phytolith, length and shape of the shanks and shape of the outer margins of the two lobes and thus 112 micro-morphometric sub-morphotypes were recoded. Panicoid grasses showed most frequent and diverse bilobate production. Their frequencies ranged from 16.6 % in Coix lacryma-jobi to 85.9 % in Digitaria compacta. Among the recovered varied bilobate sub-types, medium sized, medium and long shanked with convex-convex ends were most common in Panicoideae. In Pooideae, bilobates were predominantly with concave-concave margins. Frequent occurrence of large bilobates with convex-convex ends and very long shanks was observed as a characteristic feature in Aristidoideae. Medium sized bilobates with short and medium shank length and scooped margins were exclusively retrieved from Oryzoideae. In bamboos, majority of the bilobates were small in size with convex-convex ends and short or medium shank. Panicoid dominated deltaic sub-environments of true mangrove decline zone and colonization of non-litoral species zone in the coastal mangroves could be identified by the presence of certain bilobates. Furthermore, lobe size and shank length of bilobates were also found to be strongly correlated with soil salinity and water availability which may be explored in identifying different depositional environments during regional palaeoenvironmental reconstructions.

Conclusions: The study revealed taxonomic, environmental and palaeoenvironmental potential of various sub-morphotypes of bilobate grass phytoliths.

Key words: bilobate grass phytoliths, micro-morphometry, taxonomy, deltaic sub-environments, palaeoenvironment

PS63

TEN YEARS’ FENCING HAS LIMITED INFLUENCE ON PLANT NUTRITIONAL QUALITY OF DESERT STEPPES IN NORTHWEST TIBET

Weiling Niu1,2, Jianshuang Wu1* & Hui Chen2
1Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences, 100081 Beijing, China
2Hebei Key Laboratory of Environmental Change and Ecological Construction, School of Geography Sciences, Hebei Normal University, 050010 Shijiazhuang, Hebei Province, China.

E-mail: niuweiling@outlook.com

*Correspondence: J. Wu, wujianshuang@caas.cn

Questions: Alpine grassland degradation induced by warming and overgrazing threatens the security and sustainability of herd- ers’ livelihoods in Tibet. Grazing exclusion by fencing has been implemented since 2004 to recover degraded desert-steppes in Northwest Tibet. However, it is still unclear whether fencing can improve the nutritional quality of desert-steppe plants.

Location: Alpine desert steppes, Ngari prefecture, Northwest Tibet, China.

Methods: Aboveground biomass and top soils (0-20 cm) were sampled in paired fenced vs. grazed sites during summer of 2017 in five 1m² quadrats. Both α- and β- diversity indices were calculated to represent plant species community. Stable carbon and nitrogen isotopic compositions (δ13C and δ15N) were analyzed to describe water use efficiency (WUE) and nitrogen use efficiency (NUE) for each plant species. Functional trait diversity, including community weighted means (CWM) and functional trait divergence (FTD), were calculated based on species’ δ13C and δ15N and compared between fenced and grazed plots, respectively. Crude protein (CP), ether extract (EE), crude ash (CA) and crude fibre (CF) were also measured for each species to define plant nutritional quality. The difference of all indexes between fenced and grazed sites was compared to examine the grazing exclusion effects on plant species community, functional traits diversity and nutritional quality.

Results: Neither α- nor β-diversity indices were altered by fencing. Community structure remained the same between fenced and grazed sites, in terms of plant functional group biomass. Except that the δ15N of legumes was lower than other plant functional groups, neither CWM nor FTD was changed by grazing exclusion for δ13C and δ15N. In addition, the CWM of EE at fenced sites was higher than grazed ones (p < 0.05). Legumes’ CP was reduced by 36%, but their CF enhanced by 51%, relative to grazed sites (p < 0.01). The structural equation modelling revealed that plant nutritional quality was promoted by temperature and FTD directly, but inhibited by CWM of δ13C and soil factors indirectly.

Conclusion: Overall, our study confirmed that grazing exclusion has limited influences on plant species community, functional trait diversity, and nutritional quality in alpine dry steppes on the Tibetan Plateau.
DIVERSITY OF FEATHER GRASSES (POACEAE: STIPA) IN GRASSLANDS OF CENTRAL ASIA

Marcin Nobis¹, Arkadiusz Nowak²,³, Agnieszka Nobis¹, Ewelina Klichowska¹ & Anna Wróbel¹

¹Institute of Botany, Faculty of Biology, Jagiellonian University, Krakow, Poland
²Botanical Garden-Centre for Biological Diversity Conservation, Polish Academy of Sciences, Warszawa, Poland
³Institute of Biology, Opole University, Opole, Poland

E-mail: m.nobis@uj.edu.pl; agnieszka.nobis@uj.edu.pl; ewelina.klichowska@uj.edu.pl; anna.wrobel@doctoral.uj.edu.pl; anowak@uni.opole.pl

Question: How many species of feather grasses occur in Central Asia? What is the altitudinal diversity of Stipa species in Central Asian mountains? How many endemic feather grasses grow in Central Asia? Which habitats are the richest in species of Stipa?

Location: Western part of Central Asia (so-called Middle Asia).

Methods: The study is based on our fieldwork in the region (since 2007), examination of specimens deposited in many different herbaria, as well as on critical review of the available literature.

Results: In Central Asia the genus Stipa comprises 99 taxa, including 73 species, four subspecies, and 22 varieties. Among the Stipa species, 24 are of hybrid origin. In Central Asia, feather grasses grow at elevations from (0–) 300 to 4500(–5000) m, but most are montane species. The greatest species richness is observed at altitudes between 1000 and 2500 m. Nineteen species grow above 3000 m, but only nine above 4000 m. The highest number of taxa (species and subspecies) is noted in Kazakhstan (42), Tajikistan (40), and Kyrgyzstan (36). 42 Stipa taxa (species and subspecies) are endemic to the region. The majority of feather grasses are typical steppe taxa, occurring in both in lowland and mountain areas. Some of the analyzed taxa can occupy several different habitats, e.g., steppes, semideserts, dry grasslands, rocky grasslands, screes (e.g., S. caucasica, S. drobovii, S. kirghisorum, or S. orientalis). There is also a group of species growing mainly in high mountain deserts (e.g., S. orientalis, S. glareosa, S. ba-siplumosa, S. subsessiliflora), in sandy grasslands (e.g., S. arabica, S. borystenichena), screes (e.g., S. macroglossa, S. caucasica) or alpine meadows (e.g., S. regeliana, S. penicillata, S. tremula). Finally, some of the taxa have extremely restricted ecological range, growing exclusively on rocky habitats (ledges and fissures, e.g., S. himalaica, S. gracilis, S. zeravshaniaca).

Conclusions: The genus Stipa comprises over 150 species, all native to the Old World. Of this number 73 occur in Central Asia with the highest species diversity in mountain areas of Kazakhstan, Kyrgyzstan and Tajikistan.
PS03

NATURAL RESOURCE USE BY LOCAL COMMUNITY LIVING IN CLOSE PROXIMITY TO A PROTECTED AREA DOMINATED BY FLOATING MEADOWS IN KEIBUL LAMJAO NATIONAL PARK, MANIPUR

Akoijam Santikumar Singh¹, Padichunbou Newmai¹, Chongpi Tuboi¹, Syed Ainul Hussain¹ & Ruchi Badola¹

¹Wildlife Institute of India, Post Box #18, Chandrabani, Dehra Dun - 248001, Uttarakhand, India.

E-mail: ruchi@wii.gov.in

In developing countries, natural resource use by local communities living adjacent to natural areas is a common practice globally, supporting the livelihoods of millions. Despite the degree of protection given to these areas, conflicts persist between the local needs and conservation priorities. While it is viewed as a serious threat to biodiversity, understanding the extent, pattern, and management of such resource use is necessary for an integrated conservation approach.

We selected Keibul Lamjao National Park (KLNP) as a model grassland habitat owing to its coupled human-natural systems that exhibit close interaction between the lives of people and the Park. Information on resource collection across different seasons was collected through regular monitoring at 17 selected entry points around the Park.

The collected quantity of resources was found highest for fodder, followed by fish, vegetables and firewood. Seasonally, the overall biomass collection was highest during the winter season. The collection of fish and fodder was lowest during summer and that of vegetables during monsoon season. Firewood collection was observed only during the winter season. While looking at the number of resource collectors (n=735), the majority engaged in fishing (63.6%) while the rest 15.1% & 2.3% people were engaged in fodder, vegetables and firewood collection, respectively.

Our results indicated high extraction of fish and fodder compared to vegetables and firewood. High extraction of fish may be attributed to increased demand for commercial purposes. Uncontrolled use of these resources imposes serious conservation concerns towards the ecological integrity of these floating meadows grassland ecosystems. Our study provides baseline information on the resource dependency of the communities for future research and is crucial for planning effective conservation strategies considering the local needs and biodiversity management.

PS24

WESTERN HIMALAYAN GRASSLANDS: A REPORT ON GRASS DIVERSITY FROM UTTARKASHI DISTRICT, UTTARAKHAND, INDIA

Jaswant Singh* & Vijay Kumar Singhal

Department of Botany, Punjabi University, Patiala 147002, Punjab, India

*E-mail: jaswant_rs@phi.ac.in

Western Himalayan grasslands are characterized as Himalayan Montane Subtropical grasslands (600-1800m), Himalayan Montane Temperate grasslands (1800-3000m), Alpine meadows (Above 3000m) and Trans-Himalayan Steppes (Above 4000m) and are best represented in Uttarkashi district, Uttarakhand state, India. The Western Himalayan region ranges over an altitude range of 680m to 7138 m and harbours a wide variety of grasses as constituting 180 species belonging to 72 genera of family Poaceae. To these Poa L. is quite diverse in specific diversity which typified by 38 species, than Bromus L. (8 species), Elymus L. (7 species), Agrostis L. (6 species), Calamagrostis Adans. (5 species), Festuca L. (5 species), Pennisetum Rich. (5 species), Piptatherum P. Beauv. (4 species), Setaria P. Beauv. (4 species), Stipa L. (4 species), Triisetum Pers. (4 species). Besides, 38 genera have been reported to be represented by 1 species each, 17 genera by 2 species and 6 genera by 3 species each. This field survey cum exploratory account conveys that grasses are quite rich in species diversity in the district as over an area of 8016 sq km supports more than 12% of known diversity to grass flora of India. Further, this report gives insight to the historical to current record of botanical collections and checklist of grasses inhabited to this Western Himalayan region which could provide baseline to predict changes over existing grass diversity over low to high altitude ranges of Western Himalayas.

Keywords: Checklist, Western Himalaya, Grasslands, Poaceae, Poa, Elymus, Bromus.
**PS53**

**LANDSCAPE CONTEXT DETERMINES SOIL FUNGAL DIVERSITY IN A FRAGMENTED HABITAT**

Nier Su¹, Scott Jarvie², Yongzhi Yan¹, Xiaqian Gong¹, Fengshi Li¹, Peng Han¹, Qing Zhang¹,²*

¹Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau, School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, China
²Otago Regional Council, Dunedin 9016, New Zealand
³Collaborative Innovation Center for Grassland Ecological Security (Jointly Supported by the Ministry of Education of China and Inner Mongolia Autonomous Region), Hohhot 010021, China

*Corresponding author: Qing Zhang
E-mail: qzhang82@163.com

Habitat fragmentation is a primary cause of biodiversity loss. As an essential part of the ecosystem, soil microorganisms participate in a series of ecosystem processes. However, the role of landscape factors on soil microorganisms is not well understood. Based on high-throughput sequencing of soil samples at three depths (0-10 cm, 10-20 cm, 20-30 cm) from 30 landscape sites along a habitat fragmentation gradient, we calculated soil bacterial and fungal diversity in the agro-pastoral ecotone of northern China. We then investigated the impact of climatic factors, soil characteristics, and landscape context (patch density, edge density, mean patch size, and mean nearest-neighbor distance) on soil bacterial and fungal diversity. We found that soil fungal richness increased with habitat fragmentation (patch density and edge density), although soil bacterial richness did not change significantly. Soil bacterial and fungal community composition both changed with habitat fragmentation. Soil characteristics were key factors determining soil bacterial diversity, especially in the 10-20 cm soil depth. Soil fungal diversity was closely related to landscape context, showing a significant positive correlation with patch density and edge density, and a significant negative correlation with mean patch size. Structural equation modeling showed that landscape factors directly affected soil fungal diversity but indirectly affected soil bacterial diversity by changing soil characteristics. We highlight that soil fungal diversity shows an increasing trend with increased habitat fragmentation. Landscape context plays a stronger role in maintaining soil fungal diversity than soil characteristics and climatic factors.

**PS33**

**CLIMATIC CONDITIONS FOR THE DISTRIBUTION OF STEPPE VEGETATION IN WESTERN MONGOLIA**

Kohei Suzuki¹, Tsagaanbandi Tsendeekhuu², Narantsetseegiin Amartuvshin¹, Takashi Kamijo¹ & Toru Nakamura⁴

¹Faculty of Life and Environmental Sciences, University of Tsukuba
²Department of Biology, School of Arts and Sciences, National University of Mongolia
³Botanical Garden and Research Institute, Mongolian Academy of Science
⁴University of Tsukuba

E-mail: kohei0808@gmail.com

The distribution of steppe community in western Mongolia is more limited than that in central and eastern Mongolia. In the future, the steppe community may be negatively affected by climate change, thus it is necessary to understand the vegetation structure and distributional conditions. This study is especially intended to clarify the climatic conditions for the distribution of steppe community in western Mongolia. Vegetation data and classification results were from Suzuki et al. (2021). Vegetation data were collected using phytosociological methods around periphery of Great Lakes Basin and southern Khangai mountains in 2010 and 2011. The collected descriptions were grouped into vegetation units through the phytosociological table work. Then, each vegetation unit was sorted into steppe and semi-desert communities based on the existent studies (e.g. Hilbig 2003). After that, the relationships between each community distribution and climatic variables were explored. Climate data were collected from the WorldClim version 2.1 climate data for 1970-2000 (Fick & Hijmans 2017). Precipitation of wettest quarter ranged from 63 to 156 mm, and mean temperature of wettest quarter ranged from 13.6 to 19.2 °C in the stands belonging to steppe communities. However, compared to semi-desert communities, steppe communities did not necessarily show higher precipitation and lower temperatures (i.e., lower aridity). Other factors such as microtopography and historical effects of extreme weather events should be also considered.

**References**


ENVIRONMENTAL DETERMINANTS OF GRAMINOIDS IN OPEN VEGETATION TYPES OF CENTRAL ASIA

Sebastian Świerszcz¹, Grzegorz Swacha², Małgorzata Raduła³, Sylwia Nowak⁴

¹Botanical Garden, Center for Biological Diversity Conservation, Polish Academy of Sciences, Warszawa, Poland
²The Franciszek Górski Institute of Plant Physiology, Polish Academy of Sciences, Kraków, Poland
³Botanical Garden, University of Wrocław, Wrocław, Poland
⁴Department of Ecology, Biogeochemistry and Environmental Protection, University of Wrocław, Wrocław, Poland
⁵Institute of Biology, University of Opole, Opole, Poland

E-mail: s.swierszcz@obpan.pl

Aims: Landscapes of Middle Asia are under strong human influence due to long-lasting pastoralism tradition and currently are dominated by non-forest vegetation with a varying proportion of functional groups, including graminoids. This study examined the impact of climate, topography, soil conditions and agricultural intensity on the relative cover of graminoids in different open vegetation types.

Location: The Mountains of Central Asia: Tajikistan, Kyrgyzstan.

Methods: We extracted 1525 vegetation plots representing fens, salt marshes, tall-herbs, pseudosteppes and steppes from the Vegetation of Middle Asia Database. As explanatory variables of the relative graminoid cover, we used climatic features – mean annual temperature (MAT), annual precipitation (AT), temperature seasonality (Tses), precipitation seasonality (Pses) and aridity index, topography – terrain ruggedness index (TRI) and topographic wetness index (TWI), soil conditions – soil organic carbon, pH, coarse fragments and sand fraction, and agricultural intensity – livestock density. We used boosted regression trees (BRT) models to assess the relative contribution and effects of multiple predictors on the abundance of graminoids in each vegetation type, and in all open vegetation types (global model).

Results: Open ecosystems of Middle Asia are characterized by different graminoid contributions. The highest relative cover of graminoids was for fens, pseudosteppes and steppes. The results showed that a group of climatic variables has the greatest influence on the proportion of graminoids in the vegetation types analyzed. The relative cover of graminoids in the global model was explained by Pses (13% contribution), livestock density (11.3%) and TRI (11.2%). The importance of individual explanatory variables varied when different open vegetation types were analyzed separately. For fens the most influential was TRI (17.5%), for tall-fob vegetation – Pses (19.6%), for pseudosteppes – livestock density (31.7%), for salt marshes – MAT (41.5%), and for steppes it was AP (25%).

Conclusion: Our results show that climatic variables are the most important factor in predicting the contribution of graminoids to pastoral landscapes in Middle Asia, which is of special relevance in times of climate change. However, we found that on pseudosteppes, grazing is the most important factor influencing graminoids contribution, confirming the secondary origin of this vegetation type, especially in the context of the influence of grazing on physiognomically similar steppes.
Aims: The Alborz Mts. are the highest and one of the largest mountain ranges in Iran. It is known as a diversity hotspot in the Irano-Anatolian region (Mittermeier et al., 2005). Topographic complexity, climatic contrasts and a wide elevational range are reasons why these mountains which harbor the highest rate of plant diversity and endemic richness in Iran (Noroozi et al., 2019, 2020). The southern slopes and the upper part of the northern slopes of the Alborz Mts. are covered by diverse types of grasslands. While due to some recent studies on alpine regions of Iran (Klein, 1994, 1999; Noroozi et al. 2010, 2014), the syntaxonomic system for the higher elevations was relatively well developed, information on the elevational belts below was still inadequate. Therefore, our aim was to provide a first comprehensive classification of the grassland across the elevational belts.

Location: Mt. Damavand in the central Alborz Mts., Iran, the highest peak in southwest Asia (5,671 m a.s.l.).

Methods: We sampled 330 vegetation-plot records, covering an elevational gradient of 3000 m. We subjected the data to unsupervised classification with TWINSPAN. The initial cluster units were slightly modified to match with already existing partial classification systems of the wider region. Then we determined diagnostic species with standardized phi-coefficients for each hierarchical level (class, order, alliance, association). We defined associations in such a way that they were either the lowest vegetation unit well-characterized by character species of their own or were the central associations of the respective alliance. Finally, we compared the vegetation units in term of species richness and abiotic conditions, using analyses of variance (ANOVA). The main effective environmental gradients were assessed using Detrended Correspondence Analyses (DCA).

Results: All associations were classified within five main groups of scree, rocky habitats, snowbeds, thorn-cushion grasslands and tall herb vegetation units. A total of 19 community/associations belonging to nine alliances, seven orders and three classes of Asplenieta rupestris (rocky vegetation), Didymophyse aucheri-Dracocephaletea aucheri (scree habitats), Astragalo-Bromeo-tea (thorn-cushion grasslands). Snowbeds classified in Taraxaco brevirostris-Polygonetalia serpyllaceae and tall-herb communities were assigned to a new alliance. Coussinio pterocauli, with unresolved class assignment. Elevation was the main predictor of species composition and for the discrimination of the vegetation types.

Conclusions: Our study is a major contribution to the syntaxonomic overview of Iran and of the Irano-Turanian region. While for the higher elevations, we could largely confirm the results of other recent studies, for the lower elevations, our study comes with several novelties. For the first time, we proposed a separate provisional alliance for mown tall herb communities in Iran, and grasslands of montane zone assigned to an order which was introduced for steppe of Central Asia (Nowak et al. 2016). However, there are still many ambiguities in determination of higher syntaxonomic ranks; highlighting the necessity for a comprehensive study including the whole Alborz Ms.

References
A STUDY ON GREENHOUSE GAS EMISSIONS FROM MOUNDS MADE BY PLATEAU ZOKOR ON THE QINGHAI–TIBET PLATEAU
Zhuangsheng Tang1, Jianwei Zhou1, Bin Chu1, Yujie Niu1, Limin Hua1*
1College of Grassland Science, Gansu Agricultural University, Key Laboratory of Grassland Ecosystem of the Ministry of Education, Engineering and Technology Research Center for Alpine Rodent Pest Control, National Forestry and Grassland Administration, Lanzhou 730070, China
E-mail: hualm@gsau.edu.cn

Plateau zokor (Eospalax baileyi) is a native subterranean rodent living in alpine rangeland on the Qinghai–Tibet Plateau. Zokor excavate soil in their tunnels and push it out to form mounds, which is secondary bare land. In the alpine, bare lands emit greenhouse gases (GHGs) and reduce carbon sequestration have been reported. However, little is known about the gas emissions from the zokors’ mounds with bare soil. In this study, we used a gas analyzer in situ combined with a closed static chamber to monitor the emissions of CO2 and CH4 from new mounds, semi-new mounds, old mounds and rangeland without mounds during four seasons. To explore the source of the GHGs, emissions of CO2 and CH4 were monitored in the zokors’ active tunnels as well as in tunnel-free soil and mound-free rangeland. The quantity of soil microbes present in the 0–20 cm layer of the mounds and rangeland were simultaneously investigated. The results showed that: (1) in the same month, the descending order of GHG emissions was: new mounds > semi-new mounds > old mounds ≥ rangeland without mounds; (2) GHG emissions from the different mound types and rangeland without mounds were significantly influenced by month and type, although there was no significant interaction between these factors; (3) GHG emissions from mounds were significantly positively correlated with their total microbe quantity and the CO2 and CH4 efflux in the zokors’ active tunnels; (4) on the rangeland without mounds, there was a significant positive correlation between GHG emissions and microbe quantity. In conclusion, the study shows that the various types of the zokors’ mounds all emit CO2 and CH4, in particular new mounds and semi-new mounds in June and September. The CO2 and CH4 mound emissions are mainly from the zokors’ active tunnels with higher CO2 and CH4 efflux.

CASPIAN REMNANT COASTAL DUNES: HOW DO NATURAL AND ANTHROPOGENIC FACTORS IMPACT ON PLANT DIVERSITY AND VEGETATION?
S. Tirgan1, A. Naqinezhad1, H. Moradi2, Z. Kazemi1,3, N. Vasefi3 & G. Fenu4
1Department of Plant Biology, Faculty of Basic Sciences, University of Mazandaran, P.O. Box: 47416-95447, Babolsar, Iran
2Center of Excellence in Phylogeny, Department of Plant Science, School of Biology, College of Science, University of Tehran, P.O Box 14155-6655, Tehran, Iran
3Department of Biology, Faculty of Sciences, University of Gilan, Department of Biology, P.O. Box: 1841, Rasht, Iran
4Department of Life and Environmental Sciences, University of Cagliari, Viale Sant’Ignazio da Laconi 13, 09123, Cagliari, Italy.
E-mail: samereh.tirgan@yahoo.com

This vegetation-environmental relation study is the first large-scale survey along 34 cross-shore transects in 650 km-coastal dune remnants of the south Caspian Sea, Iran. The five vegetation zones dedicated here seem to be driven by both zonal (climate, distance to the sea and pH) and azonal (salinity) factors. To assess conservation status, different attributes of H dodge diversity index, Endemicity Index (EI), and Naturalness (N) were estimated based on endemic, alien and total species contributions per plot. Contrary to H dodge index, EI followed a decreasing pattern across the coast-inland gradient, whereas N shows a unimodal pattern of distribution with the highest value at the mobile dune zone. Two main gradients of salinity and alkalinity shaping floristic composition are more prominent than climate, distance to the sea, and the anthropogenic factors particularly when a full range of coastal habitats are considered. Human-related factors only partially explain the variability of the vegetation data and negatively affect naturalness and endemicity indices, even though their impact on community composition is aggravated in the western parts of the Caspian coasts. Both N and EI indices can be suggested as bio-indicators for proper conservation strategies to preserve the last fragments of sand dunes of the Caspian Sea.
The decomposition of plant litter and animal dung are the key processes of nutrient cycling, and have been studied in a wide range of grassland ecosystems. However, most studies focus on the separate processes of either plant litter or animal dung decomposition, while the interactions between these two processes, which occur in grazed grassland ecosystems, are rarely studied. We conducted an experiment in a semi-arid grassland in Central Inner Mongolia, to examine the mass loss rates and chemical composition changes of two plant litter (of Leymus chinensis and Stipa krylovii) and three herbivore dung (of cow, horse and sheep) separately or in combination over a 2-year period. Twenty types of litterbag treatments were used to represent 2 litter types (10g in each bag), 3 dung types at 2 levels (i.e., 20g or 6g in each bag), and their combinations (i.e., ‘10g litter + 20g dung’ or ‘10g litter + 6g dung’). We found that (i) L. chinensis litter had a higher decomposition rate than S. krylovii litter, either separately or mixed with dung; and the decomposition rate was positively correlated with litter N content, dung moisture and dung N content, but negatively with litter C/N and lignin/N ratio. (ii) Dung addition promoted the mass loss and nutrient release of litter, and the promotion was the strongest by cow dung, and the weakest by sheep dung; also the promotion was stronger with the dung addition at high than low levels. (iii) Horse dung had the biggest mass loss rate, followed by cow dung and sheep dung, either separately or mixed with plant litter. (iv) Plant litter addition reduced the dung decomposition rate when the dung proportion was low in the mixture. Our findings suggest that mixture of herbivore dung with plant litter, as in actual grassland ecosystems, promotes litter decomposition, and may inhibit dung decomposition, due to the changes in chemical stoichiometry of decomposing materials and biophysical microenvironment by the mixing. The overall effects of mixing plant litter and animal dung on the decomposition against the separate plant litter and dung decomposition depends on their proportions in the mixture.

**Keywords:** litter decomposition, dung decomposition, dung-litter interaction, dung addition, nutrient release

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**PS72**

**LAND USE ALTERS RELATIONSHIPS OF GRASSLAND PRODUCTIVITY WITH PLANT AND ARTHROPOD DIVERSITY IN INNER MONGOLIAN GRASSLAND**

**Xinyu Wang**, Frank Yonghong Li¹, Kuanyan Tang¹, Yanan Wang¹, Guga Suri¹, Zheng Bai¹ & Taogetao Baoyin¹

¹Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau & Inner Mongolia Key Laboratory of Grassland Ecology, School of Ecology and Environment, Inner Mongolia University, Hohhot, 010021, China

The threats of land-use intensification to biodiversity have motivated considerable research directed towards understanding the relationship between biodiversity and ecosystem functioning (BEF). Functional diversity is deemed a better indicator than species diversity to clarify the BEF relationships. However, most tests of the BEF relationship have been conducted in highly controlled plant communities, with terrestrial animal communities largely unexplored. Additionally, most BEF studies examined the effects of biodiversity on ecosystem functions, with the effects of ecosystem functioning strength on biodiversity hardly considered. Based on a 6-year long grassland experiment in the typical steppe region of Inner Mongolia, we examined the variation of taxonomic diversity (TD) and functional diversity (FD) of both plant and arthropod communities, and their relations with grassland productivity, across three land management types (moderate grazing, mowing and enclosure). We aimed to clarify the interrelations among plant FD, arthropod FD, grassland productivity and soil factors. We found that: (1) Grassland under mowing performed best in terms of sustaining a high TD and FD of plants and arthropods compared to that under grazing and enclosure. (2) The relationships between plant and arthropod diversity and productivity varied with management types. Plant TD and FD was negatively, whereas arthropod FD was positively, related with productivity under enclosure; plant FD, but not arthropod FD, was positively related with productivity under grazing; arthropod FD, but not plant FD, was negatively related with productivity under mowing. (3) Grassland productivity was positively interrelated with plant FD, but not arthropod FD across different management types. The respective positive versus negative bi-directional relationships of productivity with plant diversity versus arthropod diversity, were majorly a consequence of divergent grazing/mowing effects on plant versus arthropod diversity. The results indicate that grazing increases plant diversity, but decreases arthropod diversity, whereas fall mowing provides a management strategy for conservation of both trophic levels. These results also provide new insights into the effects of land-use changes on biodiversity and ecosystem processes, and indicate the importance of incorporating the functional interrelations among different trophic groups in sustainable grassland management.
**PS64**

**HIGH-ELEVATION HALOPHYTIC COMMUNITIES IN THE PAMIR MOUNTAINS, CENTRAL ASIA – HABITAT REQUIREMENTS AND DISTRIBUTION VIA ECOCOLOGICAL NICHE MODELING**

Wróbel Anna¹, Klichowska Ewelina¹, Nowak Arkadiusz²,³ & Nobis Marcin¹

¹Institute of Botany, Jagiellonian University, Gronostajowa 3, 30-387 Kraków, Poland
²Polish Academy of Sciences Botanical Garden – Center for Biological Diversity Conservation in Powsin, ul. Prawdziwka 2, 02-973 Warszawa, Poland
³Institute of Biology, University of Opole, Oleska 22, 45-052 Opole, Poland

E-mail: anna.wrobel@doctoral.uj.edu.pl

**Questions:** Which bioclimatic and topographic factors could determine distribution of halophytic vegetation in the Pamir Mountains? Where are key habitat hot-spots for halophytic vegetation in the Pamir Mountains? Location Pamir Mountains, Central Asia

**Methods:** The first MaxEnt ecological niche / habitat suitability modelling using machine learning approach for halophytic vegetation in the Pamir Mountains. The study focuses on a grass *Puccinellia pamirica* as a representative species of halophytic communities in this region. Data: GPS coordinates of known localities of *P. pamirica*; bioclimatic and topographic variables from the WorldClim and ENVIREM databases as well as environmental layers customized in ArcGis software.

**Results:** The MaxEnt model indicated that a combination of five environmental variables could best define the ecological requirements of salt-tolerant communities in the Pamir Mountains – distance to a water body, topographic wetness index, mean temperature of warmest quarter (bio10), precipitation of wettest quarter (bio16), and precipitation of warmest quarter (bio18). The analyses determined that habitats near water bodies scattered along arid plateau-type valleys serve as the main niche for halophytic vegetation in this mountain range with key habitat hotspots cumulated in the Alichur, Pamir, and Aksu river valleys, as well as along the shores of Rangkul-Shorkul and Karakul lakes.

**Conclusions:** The MaxEnt niche modelling demonstrates great predictive power to evaluate habitat suitability and determine key habitat hot-spots for high-elevation halophytic vegetation in the Pamir Mountains. This study improves our understanding of ecology and distribution of salt-tolerant communities in the Mountains of Central Asia biodiversity hot-spot.

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**PS01**

**THE IMPACTS OF HEAVY GRAZING ON PLANT DIVERSITY AT TUZ LAKE SALT STEPPES**

Ahmet Emre Yaprak¹, İsa Başköse¹ & Seyfullah Beydemir¹

¹Ankara University Faculty of Science Department of Biology, Beşevle, Ankara, Turkey

**Question (Aims):** The Salt steppes around Tuz Lake area had been used as pasture for sheep herds for centuries. There are some islands which can hardly be reached by sheep herds at western side of Tuz Lake. Presence of these islands provide an opportunity to compare the floristic diversity of heavily grazed and none or slightly grazed areas at salt steppe. The aim of the study is to determine the flora of the islands which have not been heavily grassed and the equal mainland area and compare them to find out the influence of overgrazing.

**Location:** Turkey, central Anatolia, western shores of Tuz lake and nearby islands.

**Methods:** Studied area visited among the vegetation season of 2021 and plant specimens collected and identified.

**Results:** According to results of our study, while there are 128 plant species present in 119 islands, there are only 56 plant species existing in mainland areas. And the number of species distributed only on islands are 79 but for mainland this number is only 7.

**Conclusions:** Finally, our study showed that there is a severe impact of overgrazing on plant diversity of salt steppes and floristic richness of the islands provide an enormous source for restoration of degraded areas at Tuz Lake.
**PS27**

**EFFECTS OF GRASSLAND UTILIZATION ON THE FUNCTIONAL TRAITS OF DOMINANT PLANTS IN TEMPERATE TYPICAL STEPPE**

Zhang Jing Hui¹,², Wang Zheng², Huang Yong Mei³, Chen Hui Ying⁴, Li Zhi Yong¹,² & Liang Cun Zhu¹,²

1Affiliation (School of Ecology and Environment, Inner Mongolia University, Hohhot 010021, China
2Affiliation (Key Laboratory of Mongolian Plateau Ecology and Resource Utilization, Ministry of Education, Hohhot 010021, China
3Affiliation (Provincial and Ministry Jointly Build the Cultivation Base of State Key Laboratory of Grassland Ecology, Hohhot 010021, China
4Affiliation (Faculty of Geographical Science, State Key Laboratory of Earth Surface Processes and Resource Ecology, Beijing Normal University, Beijing 100875, China
5Affiliation (Curriculum and Teaching Materials Research Institute, People’s Education Press, Beijing 10008, China

**E-mail:** jhzhang1001@126.com

**Aims:** Plant functional traits can effectively reflect the response of plants to the change of grassland use. However, there are few studies on the effects of grassland use patterns from the perspective of plant functional traits in Inner Mongolia grassland. Therefore, from the perspective of functional traits, this paper reveals the adaptation strategies of plants after external disturbances, aiming to provide basic data support and scientific basis for the sustainable management of natural grasslands.

**Location:** Xilinhot, Inner Mongolia, China

**Methods:** In this study, four important dominant species of Stipa grandis, Leymus chinensis, Cleistogenes squarrosa and Artemisia frigida in the typical grasslands of Inner Mongolia were selected as the research objects to explore the differences in the functional traits of dominant species under the influence of long-term free grazing, mowing, short-term enclosed and long-term reservation.

**Results:** We found that: 1) Vegetation height, root length and carbon and nitrogen concentration of dominant plants in Inner Mongolia typical grasslands are reduced under long-term grazing. Under the mowing management, the vegetation height and specific leaf area of the dominant species tend to increase. Among them, the nitrogen content of Artemisia frigida is the most sensitive to the response of mowing. The nitrogen content in its roots, stems, leaves are the lowest in the mowing sites; the carbon and nitrogen concentration of plants increases under enclosure and long-term non-disturbance treatments.

2) The analysis of the assemblage of functional traits of dominant species shows that C. squarrosa has a small plant height and a high specific leaf area, and A. frigida has a high lignin content and nitrogen content; S. grandis has the highest plant height, the largest leaf dry matter content, the highest stem and leaf cellulose content, which indicates that S. grandis is a very typical competitive species.

**Conclusions:** Plants may adopt avoiding grazing strategy to adjust to the interference of long-term free grazing. The plant transforms from resource acquisition strategy to resource storage strategy through changes in functional traits when the disturbance intensity is reduced. C. squarrosa and A. frigida can adopt some avoidance (escape from grazers) and tolerance (regrowth capacity after defoliation) strategies to improve their grazing resistance. Under management conditions with low interference intensity, the competitive pressure of S. grandis (C-strategy) against other species may be an important reason for its highly dominance.

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**PS62**

**DISENTANGLING THE EFFECTS OF ANIMAL DEFOILIATION, TRAMPLING, AND EXCRETION DEPOSITION ON PLANT NUTRIENT RESORPTION IN A SEMI-ARID STEPPE: THE PREDOMINANT ROLE OF DEFOILIATION**

Tongrui Zhang¹,²,³, Frank Yonghong Li¹,²,³, Yanlong Li¹,³, Chunjun Shi¹,²,³, Hao Wang¹,²,³, Lin Wu¹, Zheng Bai¹, Guga Suri¹ and Zhiyi Wang¹

1 Ministry of Education Key Laboratory of Ecology and Resource Use of the Mongolian Plateau & Inner Mongolia Key Laboratory of Grassland Ecology, School of Ecology and Environment, Inner Mongolia University, Hohhot, 010021, China
2 Joint Innovation Center for Grassland Ecological Security of the Ministry of Education of China, 24 Zhaojun Road, Yuquan District, Hohhot, 010031, China
3 Institute of Grassland Research, Chinese Academy of Agricultural Sciences, Hohhot, 010010, China

*Author for correspondence:* Frank Yonghong Li
**E-mail:** flyhong@126.com

Nutrient resorption is a key strategy of perennial plants for conservation and efficient use of nutrients, especially in nutrient-poor environment. Previous studies show that semi-arid steppe may maintain its nutrient resorption flux under moderate grazing that substantially removes plant biomass and nutrients, while the mechanisms underlying the fact are unclear. We performed a three-year simulation experiment in the Inner Mongolian grassland to quantify the respective and combining effects of three grazing mechanisms, i.e., animal defoliation, trampling and excretion return, on plant nitrogen (N) and phosphorus (P) resorption traits (efficiency, proficiency and flux) at species and community levels. We found that defoliation reduced N resorption efficiency (NRE) of Leymus chinensis; excretion return reduced N resorption proficiency (NRP) of L. chinensis and Stipa krylovii; and trampling reduced P resorption proficiency (PRP) of Cleistogenes squarrosa in non-defoliated grassland. Defoliation reduced plant community nutrient (N and P) pools for resorption, but enhanced the pool-based plant community nutrient resorption efficiency, leading to a neutral effect on plant community nutrient resorption fluxes. Animal excretion return significantly enhanced plant nutrient resorption fluxes by enlarging the nutrient pools for resorption, not increasing resorption efficiency or proficiency. Simulated animal trampling at moderate intensity over three seasons does not alter plant community nutrient resorption, though it reduced nutrient resorption of a fragile species C. squarrosa. The negative effects of defoliation on plant nutrient resorption by removing plant aboveground biomass and nutrient pool, could be offset by the positive effects of animal excretion return that improved plant available nutrient in the soil, enhanced plant nutrient uptake and pool for resorption and actual nutrient resorption fluxes; however, the effects of animal excretion return and that of trampling were significant only in non-defoliated grassland, as these effects were masked in defoliated grassland. Our results suggest that animal defoliation and excretion return jointly explain the majority of overall grazing effects on plant nutrient resorption fluxes, and the defoliation plays a predominant role in mediating the interactive effects of three grazing mechanisms. Our results also provide insights into the divergent effects of animal grazing versus mowing for hay (defoliation only) practices on grassland ecosystems and have management implications.
ORGANISERS

The Eurasian Dry Grassland Group (EDGG) is a network of more than 1300 researchers and conservationists from over 60 countries who are interested in any aspect of natural and semi-natural grasslands in the Palaearctic biogeographic realm. It was established in 2008 as the successor of the German "Arbeitsgruppe Trockenrasen". It is now a working group of the International Association for Vegetation Science (IAVS) and a member of the European Forum for Nature Conservation and Pastoralism (EFNCP). Its basic aims are to compile and distribute information on research in, and conservation of, natural and semi-natural grasslands beyond national borders, and to stimulate active cooperation between scientists, practitioners and all who work with or are interested in grasslands. EDGG publishes its own diamond open access journal *Palaearctic Grasslands*, organises international conferences, talks and research expeditions and hosts the GrassPlot database, multitaxon grassland diversity data. Membership is free of charge. URL: [https://edgg.org/](https://edgg.org/)

The International Association for Vegetation Science (IAVS) is a worldwide union of scientists and others interested in theoretical and practical studies of vegetation: its composition and structure, history, classification, distribution, ecology, dynamics, management and uses in the landscape. The main goals of the IAVS are to facilitate personal contacts among vegetation scientists all over the world and to promote research in all aspects of vegetation science and its applications. IAVS publishes three leading journals covering all fields of basic, applied and descriptive vegetation ecology, namely *Journal of Vegetation Science* (JVS; [https://onlinelibrary.wiley.com/journal/16541103]), *Applied Vegetation Science* (AVS; [https://onlinelibrary.wiley.com/journal/1654109x]) and *Vegetation Classification and Survey* (VCS; [https://vcs.pensoft.net/]). It also organises annual symposium and supports activities of several working groups. URL: [https://www.iavs.org/](https://www.iavs.org/)

The Inner Mongolia University is a comprehensive university founded in 1957 in the Inner Mongolia Autonomous Region of China. It has 2,727 faculty and staff members and delivers education programs in ten disciplines (philosophy, economics, law, literature, art, history, science, engineering, agriculture, and management). There are 19,781 undergraduates and 6,462 postgraduates currently enrolled in the university. The university is also one of the key research and innovation centers in Northern China, with biology and ecology as one of its strong scientific areas. It hosts state key research centers in grassland ecology and animal science. URL: [https://www.imu.edu.cn/yw/Home.htm](https://www.imu.edu.cn/yw/Home.htm)

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