



**EST 2023**

**ENVIRONMENTAL  
SCIENCE AND  
TECHNOLOGY**

The Fourth International  
Conference

**PROCEEDINGS**

▪ ORGANIZER



**MONGOLIAN ACADEMY OF SCIENCES**  
**INSTITUTE OF GEOGRAPHY AND GEOECOLOGY**



**MONGOLIAN ACADEMY  
OF SCIENCES**

▪ CO-ORGANIZER



**MINISTRY OF  
EDUCATION AND  
SCIENCE**



**MINISTRY OF  
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## CONCEPT NOTE

The International Conference on Environmental Science and Technology (EST) is a bi-annual meeting organized by the Institute of Geography and Geoecology, Mongolian Academy of Sciences. The primary goal of the EST is to bring academic scientists, researchers, and scholars from diverse institutions in various countries to share their knowledge and findings in the field of environmental studies, social economy, and sustainability, and to learn about technology and innovations applied to environmental studies in general. Since the first meeting in 2017, the EST has brought scientists and researchers from 16 countries and discussed over 200 presentations.

The Fourth International Conference on Environmental Science and Technology (EST 2023) will be held in person in Ulaanbaatar, Mongolia, between August 10-11, 2023. This year, the EST 2023 focused on findings of research implemented on the rapidly changing environment and its challenges due to climate change; identifying climate resilience and planning the regional development accordingly; and environmental technology and innovation in the natural conservation and application of the emerging field of geo-intelligences in environmental studies. Within these topics, there are three main sessions and eight sub-sessions proposed.

In total, 118 participants, which include graduate students, junior researchers, and senior and leading scientists, will present their outstanding research. There are eight invited speakers, 70 oral presenters, and 42 poster presenters, who represent about 30 institutions including universities, NGOs, and national institutes located in Mongolia, Inner Mongolia, China, Russia, Buryatia, South Korea, Japan, Norway, and German.

# WELCOME MESSAGE



Dear scientists and researchers,  
And delegates of the conference,

First of all, on behalf of our institute and personally, I would like to express my gratitude to all of you who are participating in the Fourth International Conference on “Environmental Science and Technology (EST 2023)” organized by the Institute of Geography and Geoecology (IGG) of the Mongolian Academy of Sciences.

Since the establishment of our institute, we have been conducting research on Mongolian geography and geoecological characteristics; natural evolution; socio-economic conditions; the state of natural resources and maintaining ecological balances; development of scientific basis and recommendations for appropriate use, protection, and restoration of natural resources, and performing hundreds of research in accordance with international standards. In addition, the IGG works with the aim of contributing to the sustainable development of Mongolia by studying the balance between the environment and socio-economy and introducing knowledge and innovation in those fields. In the framework of this goal, it has become a tradition to organize an international conference on the topic of Environmental Science and Technology every two years.

In the EST 2023, scientists from Russia, China, Japan, South Korea, Norway, Germany, Inner Mongolia, Buryatia, Spain, and Mongolia will present 120 presentations and it is grateful that more than 200 representatives including decision makers at the government level are participating.

At the conference, discussing the environment, climate change, the possibility of adapting to it, and some of the state of natural resources, which are the focus of global attention, as well as cross-regional socio-economic planning, future development trends, and possible technological solutions against environmental degradation is a timely issue. The issue is aligned with the short, medium, and long-term development policy documents and programs implemented by the government of our country and some provisions of the Sustainable Development Goals and therefore, it can be considered as the contribution of scientists to the social and economic development of the country. During the conference, scientists and policymakers will exchange their opinions and results, and we are confident that we will strengthen the bridge for closer cooperation in the future.

For all local and foreign scientists and all attendees participating in this international conference and contributing to the development of science, I wish you great success in your future work.

I would like to thank the Ministry of Education and Science, Ministry of Environment and Tourism, Mongolian Academy of Sciences, Future Earth, and the UNESCO chair for co-organizing the conference.

Sincerely,

DR. DASHTSEREN AVIRMED,  
DIRECTOR OF THE INSTITUTE OF GEOGRAPHY AND GEOECOLOGY,  
MONGOLIAN ACADEMY OF SCIENCES



# CONGRATULATORY MESSAGE



I, personally and on behalf of the Ministry of Education and Science, would like to thank dear delegates, guests, and scientists for participating in the Fourth International Conference on Environmental Science and Technology (EST 2023) organized by the Institute of Geography and Geoecology of Mongolian Academy of Sciences.

In the “Vision-2050”, a long-term development policy, and the “New Revival Policy”, a medium-term policy, of Mongolia implemented by the Government of Mongolia, it is proposed to use outcomes of science, technology, and innovation for social and economic development, and ensure the scientific participation in implementing goals of green development, industry, and energy recovery policies. In addition, the Government of Mongolia discussed and determined that the second mid-term policy of Vision 2050 should be the “Integrated Science and Technology Policy” and that policies of other sectors should develop in harmony with this policy.

The participation and leadership of scientists are important in mitigating and adapting to climate change, desertification, land degradation, and the negative impacts of human activities. This international conference is considered to be of great importance in the implementation of the goal of the “Green Development Revival” policy defined as part of the New Revival Policy implemented by the Government of Mongolia.

Leading local and foreign scientists and researchers working in the fields of socio-economy and environment and relevant government representatives exchanging their knowledge and information through this conference is important to solve problems and identify solutions at country and regional levels.

Therefore, again, I would like to express my gratitude to all scientists and researchers who are participating in this international conference by contributing to the development and progress of science, and wish them great success in their research.

ENKH-AMGALAN LUVSANTSEREN,  
MINISTER OF EDUCATION AND SCIENCE,  
MEMBER OF THE GOVERNMENT,  
MEMBER OF THE PARLIAMENT OF MONGOLIA

# CONGRATULATORY MESSAGE



The International Conference on “Environmental Science and Technology” is organized every 2 years by the Institute of Geography and Geoecology (IGG), Mongolian Academy of Sciences, with the support of the Ministry of Environment and Tourism.

I, personally and on behalf of the Government of Mongolia and the Ministry of Environment and Tourism, would like to express our gratitude to local and foreign scientists and distinguished guests participating in the Fourth International Conference – EST 2023.

International organizations and scientists continue to emphasize in their research that the development, progress, and economic status of any country are directly dependent on maintaining and protecting the balance of the environment and ecosystem of that country.

Depletion of natural resources due to climate change, increase in consumption and use of natural resources and environmental pollution, and loss of ecosystem balance due to population growth and economic expansion have become a global problem, and every country has paid great attention to the proper use of natural resources and the implementation of sustainable development goals.

Giving importance to this issue, the Parliament of Mongolia adopted resolution No.52 in 2020 and approved the “Vision-2050” long-term development policy document, aiming to maintain the balance of the ecosystem in favor of environmentally friendly green development, provide environmental stability for present and future generations, and work with the goal of improving the quality of life.

The President of Mongolia, Khurelsukh Ukhnaa, cherished the Mongolian traditions and customs of living in harmony with the earth and the environment and initiated the “Billion Trees” National Movement in order to reduce the impact of climate change and increase the ecological balance of forests and water resources.

A Memorandum of Understanding (MOU) was signed between the Government of Mongolia and the People’s Republic of China on “Drought Risk Prevention, Desertification Mitigation, and Grassland Restoration” and it was decided to establish a “Desertification Prevention Center”. It is emphasized that the role and participation of the IGG and local and foreign scientists in this area are important in the implementation of the MOU.

Mongolia is a landlocked country with a harsh climate and a fragile ecological system with a transition zone from Siberian forests to deserts. In addition, environment, climate, and population health are linked with political, social, and economic policies, and therefore, results of scientifically based research and reports are very important in the policy and planning of the environmental sector.



At the Fourth International Conference on “Environmental Science and Technology”, the results of such important scientific research aiming to solve problems with a focus on sustainable development, environmental research, and science-based policy are being presented. I wish you success in your future research.

BAT-ERDENE BAT-ULZII  
MINISTER OF ENVIRONMENT AND TOURISM,  
MEMBER OF THE GOVERNMENT OF MONGOLIA

# CONGRATULATORY MESSAGE



I, personally and on behalf of the Mongolian Academy of Sciences (MAS), would like to extend warm greetings to distinguished scientists, guests, and representatives, who came to the Fourth International Conference on “Environmental Science and Technology (EST)” held in Ulaanbaatar, the capital of Mongolia, between August 10-11.

Congratulations to the administration and researchers of the Institute of Geography and Geoecology of the MAS, who have been successfully organizing the EST international scientific bi-annual conference for the fourth time since 2017, and wish you great success in your academic work and development of the country.

It is important to note that the EST provides and creates a pleasant environment for eminent scholars from leading scientific institutes and universities, policymakers, international organizations, and government and private sector representatives to gather together to discuss the current condition of environmental science, future development trends, and possible technological solutions and share their findings and gained experiences.

Today, the direct and indirect effects of global climate, environment, and natural resource changes are felt by almost everyone. That is why many countries around the world are focusing on these challenges, and prioritizing the use of scientific and technological achievements to overcome, adapt, and mitigate issues related to the environment, natural disasters, and natural resources.

It is the same in our country that professional scientific institutes are specialized in this field and are successfully carrying out research and development work. Among the scientific institutes, it is worth noting that our Institute of Geography and Geoecology has been leading in this field in recent years. With this regard, I call upon all foreign scientists and distinguished academics, who have a high position in your fields, to work closely with colleagues of Mongolia and contribute to solving the problems of the world together.

It is very commendable that the main topics to be discussed at the EST are tied to some of the “Sustainable Development Goals 2030” and the policy initiated by the President of Mongolia and our government. Therefore, I personally believe that the conference will play a certain role in supporting the social and economic planning and sustainable development of our country and region. Also, I am confident that the findings of the latest research, valuable information, and knowledge presented at the EST will contribute to solving environmental challenges not only at the local scale but also at the regional scale.

I wish all Mongolian and foreign scientists participating and presenting in the EST the best in their academic work as well as in their lives!

ACADEMICIAN REGDEL DUGER,  
PRESIDENT OF MONGOLIAN ACADEMY OF SCIENCES

<b>EST 2023 CONFERENCE PROGRAM</b>	
08:00-09:00	<b>Conference Registration - 2<sup>nd</sup> Floor</b>
08:00-09:00	<b>Poster installation on 2<sup>nd</sup> Floor &amp; Oral presentation uploading at the respective meeting rooms</b>
<b>OPENING CEREMONY - BALLROOM ON 2<sup>nd</sup> FLOOR (09:00-10:00)</b>	
<b>Time</b>	<b>Opening Remarks</b>
09:00-09:20	Mongolian Traditional Performance
09:20-09:25	<b>Dr. Dashtseren Avirmed</b> , Director of the Institute of Geography and Geoecology
09:25-09:30	Representative of the Ministry of Education and Science
09:30-09:35	Representative of the Ministry of Environment and Tourism
09:35-09:40	<b>Acad. Regdel Duger</b> , President of the Mongolian Academy of Sciences
09:40-10:00	Group Photo (All participants)
10:00-10:15	Coffee Break - Ballroom on 2nd Floor
<b>KEYNOTE PRESENTATIONS: MORNING SESSION - BALLROOM ON 2<sup>nd</sup> FLOOR (10:15-11:35)</b>	
<b>Time</b>	<b>Keynote speakers</b>
10:15-10:35	"Billion Tree National Movement-2030: Implementations, Challenges, and Partnerships". <b>Dr. Batkhuy Niyam-Osor</b> , <i>Environment and Green Development Policy Advisor to the President of Mongolia, Office of the President of Mongolia</i>
10:35-10:55	"Fluxes of Chemical Elements in the Rivers of the Arctic Ocean Basin". <b>Acad. Nikolay Kasimov</b> , <i>Head of the Department of Landscape Geochemistry and Soil Geography, Faculty of Geography, Lomonosov Moscow State University</i>
10:55-11:15	"Holocene, recent and future climate / global change in different eco-systems of Mongolia". <b>Dr. Frank Lehmkuhl</b> , <i>Full Professor of Physical Geography and Geoecology, RWTH Aachen University, Germany</i>
11:15-11:35	"Permafrost mapping in a changing climate". <b>Dr. Sebastian Wetsermann</b> , <i>Associate Professor, Department of Geosciences, University of Oslo, Norway</i>
<b>11:35 -11:50</b>	<b>Break into conference sessions</b>
<b>KEYNOTE PRESENTATIONS: AFTERNOON SESSION - BALLROOM ON 2<sup>nd</sup> FLOOR (17:10-18:30)</b>	
<b>Time</b>	<b>Keynote speakers</b>
17:10-17:30	"Policy and legislative reform in science, technology, and innovation". <b>Dr. Battogtokh Dorjgotov</b> , <i>Director General, Department of Science, Technology, Innovation Policy and Coordination of Policy Implementation, Ministry of Education and Science, Mongolia</i>
17:30-17:50	"Low-carbon city construction model and practice in China". <b>Dr. Dong Suocheng</b> , <i>Leading Professor, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences</i>
17:50-18:10	"Importance of Groundwater and Surface Water Interaction in Water Resources Research". <b>Dr. Maki Tsujimura</b> , <i>Professor, Institute of Life and Environmental Sciences, University of Tsukuba, Japan</i>
18:10-18:30	"Environmental issues and monitoring: Cases in activities of IGG". <b>Dr. Dashtseren Avirmed</b> , <i>Director, Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
<b>CONFERENCE MAIN AND SUB-SESSIONS</b>	

**DAY 02: 10 AUGUST 2023 - Holiday Inn**

<b>(11:50-17:00)</b>	
<b>Session 1. Environmental challenges and climate change: Sub-session 01: Environmental component dynamics (11:50-16:45) - Ballroom on 2<sup>nd</sup> Floor</b>	
<b>Time</b>	<b>Chair: Dr. Koichi Sakakibara &amp; Dr. Odsuren Batdelger (11:50-14:45)</b>
11:50-12:05	"Ecological potential of geosystems of the Baikal basin as a basis for optimizing nature management in the region". <b>Dr. Dmitriy V. Kobylkin,</b> <i>V.B. Sochava Institute of Geography SB RAS</i>
12:05-12:20	"Evaluating Seasonal Variations of CO <sub>2</sub> Fluxes from Peatland Areas in the Mongolian Permafrost Region". <b>Dr. Saruulzaya Adiya,</b> <i>Institute of Geography and Geoecology, MAS</i>
<b>12:20 -13:30</b>	<b>Lunch &amp; Poster Sessions – 2<sup>nd</sup> Floor</b>
13:30-13:45	"Study on the evolution and driving mechanisms of land desertification on the Mongolian Plateau in the last 30 years". <b>Xu Shuxing,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
13:45-14:00	"Characteristics of soil extracellular enzymes and stoichiometry along the elevation gradient and their controlling factors in Qinghai-Tibet Plateau, China". <b>Dr. Yanxia Pan,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
14:00-14:15	"Estimation of permafrost ground-ice to 10 m depth on the Qinghai-Tibet Plateau". <b>Dr. Defu Zou,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
14:15-14:30	"Vegetation-type Specific Differences in Soil Carbon and Nitrogen Contents and Spatial Distribution Patterns in the Sandy Soil of Alpine Desert". <b>Dr. Xue Xian,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
14:30-14:45	"Spatial pattern of vegetation in alxa dryland ecosystem and its effect on wind erosion". <b>Dr. Xinping Wang,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
<b>Time</b>	<b>Chair: Dr. Cheng Hao &amp; Dr. Myagmartseren Purevtseren (14:45-16:45)</b>
14:45-15:00	"Determining the age of groundwater in the Sharyn river using isotope methods". <b>Dr. Chinzorig Sukhbaatar,</b> <i>Institute of Geography and Geoecology, MAS</i>
15:00-15:15	"Mapping sandy areas and their changes for Mongolia". <b>Dr. Mandakh Nyamtseren,</b> <i>Institute of Geography and Geoecology, MAS</i>
15:15-15:30	"Estimating shortwave radiative transfer in forests across country-wide scales". <b>Dr. Clare Webster,</b> <i>Department of Geosciences, University of Oslo, Norway</i>
<b>15:30 -15:45</b>	<b>Coffee Break &amp; Poster Session</b>
15:45-16:00	"Simulating forest impact on ground thermal regime using the CryoGrid Community model – examples from Terej, Mongolia". <b>Robin B. Zweigel,</b> <i>University of Oslo, Norway</i>
16:00-16:15	"Temporal and spatial characteristics of actual evapotranspiration evolution over the Mongolian Plateau". <b>Yuhui Su,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
16:15-16:30	"Patterns and driving factors of soil and plant leaf C, N, and P stoichiometry along a desert-grassland transition zone in northern China".

	<b>Jiannan Lu,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
16:30-16:45	"Spatial distribution of long-term hail data observed in Uvurkhangai province". <b>Chantsaldulam Chuluunbaatar,</b> <i>National University of Mongolia</i>
16:45-17:00	"Results of hydrochemical research on groundwater near Ulaanbadrakh Sum, Dornogovi Province". <b>Uuriintuya Gantsetseg,</b> <i>Institute of Geography and Geoecology, MAS</i>
<b>17:00-17:10</b>	<b>Break</b>
<b>Session 1. Environmental challenges and climate change: Sub-session 02: Climate change impact and monitoring (11:50-17:00) - Meeting Room#3 on 19<sup>th</sup> Floor</b>	
<b>Time</b>	<b>Chair: Dr. Tonghua Wu &amp; Dr. Saruulzaya Adiya (11:50-15:00)</b>
11:50-12:05	"Icings in the Selenga river basin in the context of climate change". <b>D.Sc. Endon Garmaev,</b> <i>Baikal Institute of Nature Management SB RAS</i>
12:05-12:20	"Flood hazard assessment and disaster prevention recommendations in Khovd City, Western Mongolia". <b>Narangerel Serdyanjiv,</b> <i>Institute of Geography and Geoecology, MAS</i>
<b>12:20 -13:30</b>	<b>Lunch &amp; Poster Sessions – 2<sup>nd</sup> Floor</b>
13:30-13:45	"Evaluating the Influence of Climate Change and Grazing Intensity on Permafrost in Mongolian Grasslands". <b>Dr. Qinxue Wang,</b> <i>National Institute for Environmental Studies, Japan</i>
13:45-14:00	"Monitoring of patchy and sporadic permafrost in the southern territory of the Hentei Mountainous region, Mongolia". <b>Dr. Anarmaa Sharkhuu,</b> <i>National University of Mongolia</i>
14:00-14:15	"Analysis on sustainable development of resources and environment in Mongolian Plateau based on big data". <b>Dr. Wang Juanle,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
14:15-14:30	"Land-Use/Cover Change and Its Influencing Factors in Bayanhongor, Mongolia". <b>Dr. Cheng Hao,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
14:30-14:45	"Effects of Climate Change on Seed Yield of Larix Forest". <b>Dr. Udval Bayarsaikhan,</b> <i>Institute of Geography and Geoecology, MAS</i>
14:45-15:00	"Change in the lake area in dry steppe: Case study in Buuntsagaan Lake". <b>Batnyam Tseveengerel,</b> <i>Institute of Geography and Geoecology, MAS</i>
<b>Time</b>	<b>Chair: Dr. Qinxie Wang &amp; Dr. Anarmaa Sharkhuu (15:00-17:00)</b>
15:00-15:15	"Impact of permafrost thaw, palsa degradation, and natural succession on greenhouse gas exchange". <b>Dr. Hanna Lee,</b> <i>Norwegian University of Science and Technology, Norway</i>
15:15-15:30	"Frontiers and Challenges of Frozen Soil Monitoring in Middle and High Latitude Regions". <b>Fengjiao Li,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
<b>15:30 -15:45</b>	<b>Coffee Break &amp; Poster Session</b>



15:45-16:00	"Increasing precipitation promotes vegetation growth in the Mongolian Plateau during 2001-2018". <b>Dr. Xiaodong Wu,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
16:00-16:15	"Temporal and spatial patterns of carbon emissions and sequestration in arid regions of Northwest China under the carbon-neutral target". <b>Yang Jing,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
16:15-16:30	"Hydrological response of the Bulgan River to climate change in the southern Altai Mountains". <b>Oyunmunkh Byambaa,</b> <i>Institute of Geosciences, University of Bonn, Germany</i>
16:30-16:45	"How to cope with increasing impact of climate change on pursuing sustainable desertification reversion in Horqin Sandy Land, Inner-Mongolia of China". <b>Dr. Zhao Xueyong,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
16:45-17:00	"Chemical and biological water quality assessment of Selenga River basin in Mongolia". <b>Tumursooj Dashtogtokh,</b> <i>Institute of Geography and Geoecology, MAS</i>
<b>17:00-17:10</b>	<b>Break</b>
<b>Session 1. Environmental challenges and climate change: Sub-session 03: Natural resources and utilization (11:50-14:15) - Meeting Room#5 on 19<sup>th</sup> Floor</b>	
<b>Time</b>	<b>Chair: Dr. Stefan Fränze &amp; Dr. Chinzorig Sukhbaatar (11:50-14:15)</b>
11:50-12:05	"Roles of chitin in metal retention and (photochemical, catalytic) -activation: gaining ecological knowledge, environmental monitoring and the decaying permafrost issue". <b>Dr. Stefan Fränze,</b> <i>TU Dresden Internat. School Zittau, Germany</i>
12:05-12:20	"Landforms associated with excess ice over the marginal permafrost, Mongolia". <b>Dr. Mamoru Ishikawa,</b> <i>Hokkaido University, Japan</i>
<b>12:20 -13:30</b>	<b>Lunch &amp; Poster Sessions – 2<sup>nd</sup> Floor</b>
13:30-13:45	"Effects of nitrogen and phosphorus additions on the nitrogen content of different plant functional groups in the Inner Mongolia temperate grasslands". <b>Yapeng Hao,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
13:45-14:00	"Chemical study of <i>Artemisia santolinifolia</i> Turcz. ex Besser cultivated in the field". <b>Dr. Amarjargal Ayurzana,</b> <i>Branch Khovd of National University of Mongolia.</i>
14:00-14:15	"Assessment of human activities affecting tourism in Khugnu Tarna National Park". <b>Dr. Narankhuu Erdenejargal,</b> <i>Khovd Branch School of National University of Mongolia</i>
<b>Session 2. Regional development and environmental policy: Sub-session 01: Economic geography and spatial development planning (14:15-16:45) - Meeting Room#5 on the 19<sup>th</sup> Floor</b>	
<b>Time</b>	<b>Chair: Dr. Satoshi Tsuchiya &amp; Dr. Altanbagana Myagmarsuren (14:15-16:45)</b>
14:15-14:30	"Urban Land Use Change Study in Ulaanbaatar City Using RS and GIS". <b>Acad. Amarsaikhan Damdinsuren,</b> <i>Institute of Geography and Geoecology, MAS</i>
14:30-14:45	"Siberia as a unique region in the geographic space of Russia". <b>Dr. Igor N. Vladimirov,</b> <i>V.B. Sochava Institute of Geography SB RAS</i>



	14:45-15:00	"Economic Value of Recreational Ecosystem Services of the Desertification Territories in Mongolia (for Example on the Model Territories)". <b>Dr. Sanzheev Erdeni,</b> <i>Baikal Institute of Nature Management SB RAS</i>
	15:00-15:15	"A Study on Road Network Development and Environmental Load Reduction in Drylands: Mathematical Programming Approach". <b>Dr. Satoshi Tsuchiya,</b> <i>Kochi University of Technology, Japan</i>
	15:15-15:30	"Spatial pattern of regional eco-efficiency in China–Mongolia–Russia economic corridor". <b>Dr. Xia Bing,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
	<b>15:30 -15:45</b>	<b>Coffee Break &amp; Poster Session</b>
	15:45-16:00	"Socio-economic assessment of damage caused by fluctuations in the level of Lake Baikal". <b>Dr. Gerelma Dugarova,</b> <i>V.B. Sochava Institute of Geography SB RAS</i>
	16:00-16:15	"Multi-scenario Simulation of Land Use and Carbon Stock Assessment in Hohhot City Based on PLUS Model and InVEST Model". <b>Dr. Qi Xiaoming,</b> <i>Inner Mongolia Normal University</i>
	16:15-16:30	"Evaluation of Novosibirsk-Khovd-Urumqi vertical axis by SWOT analysis and determination of transborder urban clusters to develop along the axis". <b>Dr. Altanbagana Myagmarsuren,</b> <i>Institute of Geography and Geoecology, MAS</i>
	16:30-16:45	"Demographic potential of Siberian agglomerations: Influence of the population density factor". <b>Yulia Antipina,</b> <i>V.B. Sochava Institute of Geography SB RAS</i>
	<b>16:45-17:10</b>	<b>Break</b>
<b>DAY 02: 11 AUGUST 2023 - Holiday Inn</b>	<b>CONFERENCE MAIN AND SUB-SESSIONS (09:00-12:00)</b>	
	Session 2. Regional development and environmental policy: Sub-session 03: Transformation of city and environmental relations (09:00-11:00) - Meeting Room#1 on 1 <sup>st</sup> Floor	
	<b>Time</b>	<b>Chair: Dr. Natalia Emelianova &amp; Dr. Sonomdagva Chonokhuu (09:00-11:00)</b>
	09:00-09:15	"Geographic conditions of sustainable development of the city of Ulaanbaatar". <b>Dr. Irina Belozertseva,</b> <i>V.B. Sochava Institute of Geography SB RAS</i>
	09:15-09:30	"A study on economic impact assessment of reclaimed water use policy on agricultural production in drylands". <b>Dr. Satoshi Tsuchiya,</b> <i>Kochi University of Technology, Japan</i>
	09:30-09:45	"Vulnerability Assessment and Optimized Countermeasures for the Human-land Coupling System of China-Mongolia-Russia Cross-border Transportation Corridor". <b>Dr. Li Fujia,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
	09:45-10:00	"Spatial–Temporal Evolution and Improvement Measures of Embodied Carbon Emissions in Interprovincial Trade for Coal Energy Supply Bases: Case Study of Anhui, China". <b>Dr. Menghan Zhang,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>

10:00-10:15	"Coordinated Degree Assessment on Transport Infrastructure Construction with Regional Economic-Socio-Ecological Development: A Study of the Areas along the Main Traffic Line in Mongolia". <b>Shuangjie Xu,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
<b>10:15 -10:30</b>	<b>Coffee Break - Meeting Room#4 on 19<sup>th</sup> Floor</b>
10:30-10:45	"Carbon Emissions of China Tourist Hotels Based on Supply Chain". <b>Zhang Jing,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
10:45-11:00	"Changes and statistical analysis of soil moisture in Uvurkhangai Province in 2015-2022". <b>Tumenbayasgalan Tsogtbaatar,</b> <i>National University of Mongolia</i>
<b>Session 3. Environmental technology and innovation: Sub-session 01: Natural conservation technology and innovation (09:00-10:15) - Meeting Room#3 on 19<sup>th</sup> Floor</b>	
<b>Time</b>	<b>Chair: Dr. Hasi Bagan &amp; Dr. Suvdantsetseg Balt (09:00-10:15)</b>
09:00-09:15	"Combating Aeolian Desertification in Northern of China". <b>Dr. Wang Tao,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
09:15-09:30	"Xerophytic and halophytic shrubs as the main biomaterials for phytomeliorational resource-saving technologies in arid lands". <b>Dr. Ariunbold Erdenegerel,</b> <i>Institute of Geography and Geoecology, MAS</i>
09:30-09:45	"Research on natural roads extraction in arid and semiarid regions of the south Mongolian Plateau". <b>Wang Meng,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
09:45-10:00	"Sustainable land management model in sandy land - a case study of immigration area in Northwest China". <b>Dr. Liao Jie,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
10:00-10:15	"Recognition and classification of forage species in Mongolian Plateau based on UAV hyperspectrum". <b>Qilin Jia,</b> <i>Inner Mongolia University</i>
<b>10:15 -10:30</b>	<b>Coffee Break - Meeting Room#4 on 19<sup>th</sup> Floor</b>
<b>Session 2. Regional development and environmental policy: Sub-session 02: Climate resilient development and policy (10:30-12:00) - Meeting Room#3 on the 19<sup>th</sup> Floor</b>	
<b>Time</b>	<b>Chair: Dr. Wang Tao &amp; D.Sc. Dagvadorj Damdin (10:30-12:00)</b>
10:30-10:45	"Establishment of Tran-Eurasia Permafrost Observation Transect through Russia, Mongolia, and China: Framework and Design". <b>Dr. Tonghua Wu,</b> <i>Northwest Institute of Eco-Environment and Resource, CAS</i>
10:45-11:00	"Pastoralism in Mongolia and challenges in rangeland governance". <b>Dr. Mandakh Nyamtseren,</b> <i>Institute of Geography and Geoecology, MAS</i>
11:00-11:15	"Contribution of land use and land cover change to terrestrial carbon cycle in Mongolia Plateau". <b>Yating Shao,</b> <i>China University of Mining and Technology, Beijing, China</i>

11:15-11:30	"The impact of climate change on environmental sustainability in Mongolia". <b>D.Sc. Dagvadorj Damdin,</b> <i>Climate Change and Development Academy, Mongolia</i>
11:30-11:45	"Research on Land Use Optimization Based on Ecosystem Services in the China–Mongolia–Russia Economic Corridor". <b>Li Jingwen,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
11:45-12:00	"Analyzing environmental and economic variables of climate change vulnerability in Mongolia". <b>Saruul Galtbayar,</b> <i>Institute of Geography and Geoecology, MAS</i>
Session 3. Environmental technology and innovation: Sub-session 02: Environmental studies using geo-intelligence and geostatistics (09:00-12:00) - Meeting Room#5 on 19th Floor	
<b>Time</b>	<b>Chair: Dr. Mamori Ishikawa &amp; Dr. Bolortsetseg Erdenee (09:00-10:15)</b>
09:00-09:15	"Estimation of Grassland Biomass in Eastern Mongolia Using RS-based Vegetation Indices". <b>Acad. Amarsaikhan Damdinsuren,</b> <i>Institute of Geography and Geoecology, MAS.</i>
09:15-09:30	"An adaptive data correction method for soil heavy metal detection equipment". <b>Shuhua Li,</b> <i>Information Technology Research Center, Beijing Academy of Agriculture and Forestry Sciences</i>
09:30-09:45	"Micro-topography dominated microhabitat significantly influences colonization and development of incubated-cyanobacteria biocrusts in a harsh sandy desert environment". <b>Dr. Zhishan Zhang,</b> <i>Northwest Institute of Eco-Environment and Resource, CAS</i>
09:45-10:00	"Interaction of Climate Change and Anthropogenic Activity on the Spatiotemporal Changes of Surface Water Area in Horqin Sandy Land, China". <b>Xueping Chen,</b> <i>Northwest Institute of Eco-Environment and Resources, CAS</i>
10:00-10:15	"Preliminary Results of Estimating Erodibility and Erosivity over the Lake Valley, Mongolia". <b>Dr. Dai Matsushima,</b> <i>Chiba Institute of Technology, Japan</i>
<b>10:15 -10:30</b>	<b>Coffee Break - Meeting Room#4 on 19th Floor</b>
<b>Time</b>	<b>Chair: Dr. Hanna Lee &amp; Acad. Amarsaikhan Damdinsuren (10:30-12:00)</b>
10:30-10:45	"Surface subsidence monitoring in mining areas based on SBAS-InSAR technology". <b>Dr. Hasi Bagan,</b> <i>Shanghai Normal University, Shanghai, China</i>
10:45-11:00	"Revisiting vegetation activity of Mongolian Plateau using multiple remote sensing datasets". <b>Yu Bai,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
11:00-11:15	"Using GOSAT Satellite Data for Investigating the Variability of Near-surface CO2 and Relationship with NDVI Over Mongolia". <b>Terigelehu Te,</b> <i>Shanghai Normal University, Shanghai, China</i>
11:15-11:30	"Carbon Monoxide (CO) Dispersion mapping from the SENTINEL 5P data during the winter time and its evaluation with LUR model". <b>Odbaatar Enkhjargal,</b> <i>Institute of Geography and Geoecology, MAS</i>

	11:30-11:45	"Evaluation of Black Soil Resources Utilization Efficiency in Heilongjiang Province Based on MRIO Model". <b>Kexin Guo,</b> <i>Institute of Geographic Sciences and Natural Resources Research, CAS</i>
	11:45-12:00	"Performance evaluation of principal component analysis and random forest algorithms for estimation of aboveground biomass using sentinel 1 data". <b>Tsolmon Altanchimeg,</b> <i>Institute of Geography and Geoecology, MAS</i>
	<b>12:00-18:00</b>	<b>No program</b>
	14:00-17:00	<b>VIP Meetings with international scientists (only by reservation)</b>
	18:00-23:00	<b>CONFERENCE RECEPTION - HOLIDAY INN</b>
DAY 03-04: AUGUST 12-13, 2023 2023	<b>OVERNIGHT FIELD TRIP TO TERELJ</b>	
	<b>Date and Time</b>	<b>Location</b>
	Departure: 09:00, Aug 12	Entrance to the Institute of Geography and Geoecology
	Return: 14:00, Aug 13	Entrance to the Institute of Geography and Geoecology
	<b>THE CONFERENCE PROGRAM ENDS</b>	

Poster No	Session 1. Environmental challenges and climate change: Sub-session 01: Environmental component dynamics
01	“Identification of Seasonal Water Discharge Characteristics using Stable Isotopes of Water in the Mountain Region, Japan”. <b>Anji Kanai,</b> <i>Shinshu University, Japan</i>
02	“Distribution of Saproxyllic Insect in Mongolia”. <b>Batchudur Batamgalan,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
03	“Greenhouse gas (GHG) emission in permafrost regions of western Mongolia: case area in Munkhkhairkhan mountain”. <b>Batzorig Batbold,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
04	“A Study of Non-Equilibrium Rangeland ecosystem”. <b>Davaasuren Chimedregzen,</b> <i>Mongolian University of Science and Technology, Mongolia</i>
05	“Comparison of Dune Activity and Desertification between the Moltsog Els in Mongolia and the Ujimqin Dune Field in China”. <b>Dr. Eerdun Hasi,</b> <i>Beijing Normal University, China</i>
06	“The effect of organic and inorganic mulching soil moisture retention: (A case study of the wooden plants area in a greenhouse)”. <b>Elbegzaya Gankhuyag,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
07	“Assessing Groundwater Sources Using a Water Quality Index: A Case Study of Songinokhairkhan District in western part Ulaanbaatar, Mongolia”. <b>Enkhjargal Togtokh,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
08	“Assessment of hydrochemical characteristics and heavy metal pollution index in groundwater in the Gorkhi-Terelj of Nalaikh District, Mongolia”. <b>Erdenetsetseg Tsogtbayar,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
09	“The effect of cultivation on labile fractions of soil organic carbon in agricultural soil”. <b>Ikhbayar Damba,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
10	“Object-Based Classification of Land Cover Types in Northern Mongolia”. <b>Jargaldalai Enkh TUYA,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
11	“Using geo-spatial analysis methods in cropland monitoring study (Case study in Darhan-Uul and Selenge provinces)”. <b>Ochirkhuyag Lkhamjav,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
12	“Vegetation cover change detection using remote sensing in Govi-sumber province, Mongolia”. <b>Otgontsetseg Davaanyam,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
13	“Variations in the peak growing season NDVI in the Mongolian permafrost zones”. <b>Purevdulam Yondonrentsen,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
14	“Assessment of the sensitivity risk of landscape (a case study in Khuvsgul National Park)”. <b>Dr. Renchinmyadag Tovuudorj,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
15	“Effects of precipitation on water-table at artificial-sand-paddy-field in Horqin Sand Land in past 10 years”. <b>Dr. Tonghui Zhang,</b> <i>Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences</i>

16	<p>“Impacts of climate change and human activities on vegetation variation in Sharyn Gol River Basin”.</p> <p><b>Unurnyam Jugnee,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
17	<p>Assessment of basic soil properties and contamination status in the uranium mining region</p> <p><b>Dr. Zoljargal Khavtgai,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
18	<p>“Fish Community Composition of The Selenge River, Mongolia”.</p> <p><b>Dr. Mendsaikhan Bud,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
Poster No	<p>Session 1. Environmental challenges and climate change: Sub-session 02: Climate change impact and monitoring</p>
19	<p>“Changing Seasonal Transition of Surface Energy Balance in Permafrost Larch Forest”.</p> <p><b>Dr. Ayumi Kotani,</b> <i>Nagoya University, Japan</i></p>
20	<p>“Preliminary Results of Social Variables Analysis of Rural Population's Vulnerability to Climate Change”.</p> <p><b>Otgonkhuu Tsedev-Ish,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
21	<p>“Recognition of thaw slumps by Machine Learning-based remote sensing analysis”.</p> <p><b>Peiqing Lou</b> <i>Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences</i></p>
22	<p>“Snow cover controls seasonally frozen ground regime on the southern edge of Altai Mountains”.</p> <p><b>Dr. Wei Zhang,</b> <i>Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences</i></p>
Poster No	<p>Session 1. Environmental challenges and climate change: Sub-session 03: Natural resources and utilization</p>
23	<p>“The Genotoxic activity of soil samples of Bayan-Ovoo sum, Khentii, Mongolia”.</p> <p><b>Dr. Battsetseg Choidash</b> <i>National University of Mongolia, Mongolia</i></p>
24	<p>“Crop type classification using the Google Earth Engine”</p> <p><b>Bayarmaa Vandangombo,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
25	<p>“Estimating above-ground biomass of the pasture using Sentinel-2 data: a case study in Bayandelger soum, Tuv province”.</p> <p><b>Boldbaatar Natsagdorj,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
26	<p>“Identification and enzymatic activities of psychrophilic yeasts isolated from permafrost soil”</p> <p><b>Bumtsend Byambasuren,</b> <i>Institute of Biology, Mongolian Academy of Sciences</i></p>
27	<p>“Assessing groundwater quality using GIS near Erdenet Cu-Mo mining area”.</p> <p><b>Byambasuren Zorigt,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
28	<p>“Multi-scaled observations and simulation of carbon-water fluxes in grazing ecosystems and climate-smart livestock-farming management”.</p> <p><b>Dr. Fei Li,</b> <i>Grassland Research Institute, Chinese Academy of Agricultural Sciences</i></p>
29	<p>“Evaluation of provisional, cultural, and supporting ecosystem services of Khukhmorit soum”.</p> <p><b>Oyundari Baasanbat,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i></p>
30	<p>“Neutralization of copper and arsenic pollution by <i>Lycium ruthenicum</i> Murr.”.</p> <p><b>Dr. Oyungerel Shagjjav,</b> <i>National University of Mongolia, Mongolia</i></p>
31	<p>“Physiological and biochemical responses of <i>Spiraea media</i> F. Schmidt to urban stress”.</p> <p><b>Dr. Oyungerel Shagjjav,</b> <i>National University of Mongolia, Mongolia</i></p>



Poster No	Session 2. Regional development and environmental policy: Sub-session 01: Economic geography and spatial development planning
32	“Study on Collaboratively Industrial Development in Beijing-Tianjin-Hebei Urban Agglomeration Orientated the Carbon Peaking and Carbon Neutrality Goals”. <b>Dr. Qiang Li,</b> <i>Beijing Normal University, China</i>
Poster No	Session 2. Regional development and environmental policy: Sub-session 02: Climate resilient development and policy
33	“Estimation of strength development on solidified soft soil using bender elements and X-ray CT scan technique”. <b>Enkhzaya Batbayar,</b> <i>Barilga JCS, Mongolia</i>
Poster No	Session 2. Regional development and environmental policy: Sub-session 03: Transformation of city and environmental relations
34	“Study of soil fertility in Bayan-Ovoo Sum, Khentii province”. <b>Dr. Bayarmaa Jambalsuren,</b> <i>National University of Mongolia, Mongolia</i>
35	“Comparative analysis of soil in Ger District with and without use of Biofertilizer”. <b>Dr. Bayarmaa Jambalsuren,</b> <i>National University of Mongolia, Mongolia</i>
36	“Pre-Estimation of Vulnerability to Society & Economics due to Natural Disaster & Hazards: A Case Study of Ulaanbaatar, Mongolia”. <b>Dr. Enkh-Amgalan Sandag,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
Poster No	Session 3. Environmental technology and innovation: Sub-session 01: Natural conservation technology and innovation
37	“Field Monitoring of Tree Growth and Micro-Climature Study in Degraded Sandy Soil Regions of Central Mongolia”. <b>Dr. Ganchudur Tsetsegmaa,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
38	“Effect of humic acid, baru, and azophos fertilizers on the <i>Caragana korshinskii</i> Kom and <i>Halimodendron halodendron</i> Pall”. <b>Purevdulam Batbaatar,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
39	“Oasis Land Enhancement Technology in Arid Areas”. <b>Dr. Zhibin He,</b> <i>Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences</i>
Poster No	Session 3. Environmental technology and innovation: Sub-session 02: Environmental studies using geo-intelligence and geostatistics
40	“Database management of Geoecological mapping”. <b>Baasantsog Munkhchuluun.</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
41	“Microbiological study of surface and groundwater samples along Kherlen river basin”. <b>Renchinbud Badrakh,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>
42	“Estimating the above-ground biomass of the pasture using machine-learning models in Mongolia”. <b>Sainbayar Dalantai,</b> <i>Institute of Geography and Geoecology, Mongolian Academy of Sciences</i>

# SCIENTIFIC COMMITTEE

1. Academician. Amarsaikhan Damdinsuren – Leading scientist, Institute of Geography and Geoecology, Mongolian Academy of Sciences
2. Academician. Dorjgotov Dechingungaa – Leading scientist, Senior Advisor, Institute of Geography and Geoecology, Mongolian Academy of Sciences
3. Dr. Dashtseren Avirmed – Director General, Institute of Geography and Geoecology, Mongolian Academy of Sciences
4. Dr. Odsuren Batdelger – Scientific Secretary, Institute of Geography and Geoecology, Mongolian Academy of Sciences
5. Dr. Bolortsetseg Erdenee– Foreign Cooperation Officer, Institute of Geography and Geoecology, Mongolian Academy of Sciences
6. Dr. Altanbagana Myagmarsuren- Head of Division of Socio-economic Geography, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
7. Dr. Bayartungalag Batsaikhan- Head of the Division of Environmental and Natural Resources Management, Institute of Geography and Geoecology, Mongolian Academy of Sciences
8. Dr. Chinzorig Sukhbaatar – Head of Division of Water Resource and Utilization, Institute of Geography and Geoecology, Mongolian Academy of Sciences, UNESCO Chair for Sustainable Groundwater Management
9. Dr. Battogtokh Dorjgotov -Director General, Department of Science, Technology, Innovation Policy and Coordination of Policy Implementation, Ministry of Education and Science, Mongolia
10. Prof. Sonomdagva Chonokhuu – Head of the Department of Environment and Forest Engineering, School of Engineering and Applied Sciences, National University of Mongolia
11. Associate Prof. Gantulga Gombodorj- School of Art and Sciences, National University of Mongolia, President, Union of Mongolian land administration
12. Prof. Dong Suocheng- Leading Professor, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences,
13. ScD. Garmaev Endon Z – Director, Baikal Institute of Nature Management of the Siberian Branch, Russian Academy of Sciences, Corresponding member of RAS,
14. Dr. Igor N.Valdimirov- Director of V.B. Sochava Institute of Geography Siberian Branch, Russian Academy of Sciences
15. Prof. Dr. Michael Walther- UNESCO Chairholder on Environmental Sciences in Eastern Central Asia, Senior scientist of Institute of Geography and Geoecology, Mongolian Academy of Sciences
16. Associate Prof. Sebastian Westermann - Department of Geosciences, University of Oslo
17. Dr. Qinxue Wang- Principal Researcher, National Institute for Environmental Studies, Tsukuba, Japan

# ORGANIZING COMMITTEE

## Chairs:

- Dr. Dashtseren Avirmed, Director
- Dr. Odsuren Batdelger, Scientific Secretary
- Dr. Bolortsetseg Erdenee, Foreign Cooperation Officer

## Members:

- Dr. Altanbagana Myagmarsuren, Head of the Division of Social and Economic Geography
- Dr. Bayartungalag Batsaikhan, Head of the Division of Environmental and Natural Resource Management
- Dr. Chinzorig Sukhbaatar, Head of the Division of Water Resource and Water Utilization
- Dr. Ganchudur Tsetsegmaa, Head of the Division of Desertification Research
- Dr. Saruulzaya Adiya, Head of the Division of Permafrost Research
- Dr. Udval Bayarsaikhan, Head of the Division of Forest Resource and Forest Protection
- Dr. Urtnasan Mandakh, Head of the Division of GIS and Remote Sensing
- MSc. Narangerel Serdyanjiv, Head of the Division of Physical Geography and Environmental Research
- MBA. Lkhagvasuren Boviishiirev, Accountant General, Office of the Administration and Management



**EST 2023**

# **KEYNOTE PRESENTATIONS**

## “BILLION TREE NATIONAL MOVEMENT-2030”: IMPLEMENTATIONS, CHALLENGES, AND PARTNERSHIPS

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### Batkhoo Nyam-Osor, PhD

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**Abstract:** Mongolia experiences an extreme continental climate characterized by long cold winters, short summers and low annual precipitation. Average temperature of Mongolia increased by more than 2,30C since 1940 and all seasons getting warmer, whereas total precipitation reduced by 7% during the same period. In addition, following the privatization of livestock sector in the early 1990s and rising demand for cashmere products, the goat number has increased from 4.4 million in 1988 to about 28 million in 2022. A changing climate and increased grazing pressure have intensified the land degradation and desertification accounting 76% of total territory of Mongolia. These environmental changes are the likely causes of the summer droughts and directly affect vegetation growth, biodiversity, and human socioeconomics and posing significant risks to national security and the pursuit of sustainable development goals of Mongolia. In 2015, nations worldwide adopted the “Paris Agreement” to address climate change collectively and reduce associated risks. The Government of Mongolia ratified the Paris Agreement in 2016 and adopted Mongolia’s “Nationally Determined Contribution” is setting a target of reducing greenhouse gas emissions by 22.7 percent by 2030 and achieving net-zero emissions by 2050. In order to tackle and fight climate change and their negative effects, the President of Mongolia, initiated national movement to plant Billion trees by 2030 as part of Mongolia’s commitment to combating desertification, deforestation, food insecurity and climate change mitigation. The “Billion Tree” national movement action plan includes 27 actions and 154 measures to be implemented and it is expected that the area affected by desertification and land degradation to be reduced by 4.0 percent, and carbon dioxide absorption to be increased by 11.0 percent, in addition to expansion of forest area. Furthermore, it is effective in mitigating climate change, accelerating green recovery, increasing the cultivation of herbs, creating jobs, and having a positive impact on the food supply.

**Keywords:** climate change, forest restoration, billion tree national movement

## FLUXES OF CHEMICAL ELEMENTS IN THE RIVERS OF THE ARCTIC OCEAN BASIN

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### Nikolay Kasimov, Academician

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**Abstract:** Northern rivers transport huge quantities of water and constituents from the continents to the Arctic Ocean. Snow and ice melt in Polar regions are associated with dramatic changes in the hydrological regime and significantly enhance erosional processes. Such changes are the most important driver of the hydrological cycle of Polar rivers and dominate the fluxes of dissolved and particulate substances from land to the Arctic Ocean. This study aims at understanding interbasinal and seasonal variations of metals and metalloids (B, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Mo, Cd, Sb, Sn, W, Pb, U) at the lower Ob, Yenisey, Lena and Kolyma rivers, as well as Selenga River catchment which represents the upper part of Yenisey river basin – the region most subjected to anthropogenic impact (most agriculture and mining). The dataset on elements in river water and suspended solids collected during different hydrological seasons in 2011-2022 includes about 2500 water and suspended matter samples. Baikal Lake catchment dataset contains also unique results of threefold sampling campaign conducted in 2022, that embraced 12 smaller tributaries of the lake and 3 hydrological seasons including winter low-water. The approach enables to differentiate background, baseline, and anthropogenic levels of dissolved and suspended forms of metal(loid)s. The study emphasizes average regional concentration levels of metal(loid)s for each river and reveals elevated relative pollution of the Ob compared to the Yenisey, Lena and Kolyma Rivers, as well as seasonal and cross-sectional variations. Both for large and small rivers, main features of partitioning of chemical elements were found quite similar. Firstly the features were revealed by D, P-analysis for the Selenga River basin. The results were used to calculation particulate flux of studied metals and metalloids which constitute over 13% of total annual sediment load for the Ob River, 31% for the Yenisey River, 19% for the Lena River, and 20% for Kolyma River.

**Keywords:** Arctic Ocean Basin, interbasinal and seasonal variations, metals and metalloids



## HOLOCENE, RECENT AND FUTURE CLIMATE AND GLOBAL CHANGE IN DIFFERENT ECOLOGICAL ZONES OF MONGOLIA

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### Frank Lehmkuhl, PhD

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**Abstract:** Mongolia consists of five main different ecological zones from the glacier regions in the high mountain ranges of the Mongolian Altai and boreal forest in the north towards different steppe and desert environments in the south. These are modified by the mountain climate and topography. Geomorphological and geoecological research provide evidence for landuse and climate change since the last millennia especially which was enhanced since the last century. Glacier fluctuations in the Mongolian Altai with the retreat of glaciers since their Holocene maximum extent during the Little Ice Age mainly reflect global warming. Permafrost and periglacial environments provide evidence for climate fluctuation. Fluvial and eolian geomorphological systems reflect climate and global change including human impact since the Anthropocene. Lake level changes indicates change in the water balance and thus precipitation and temperature variations. The keynote will present selected examples of past and modern landscape change in these different regions of Mongolia and the implication for land use and economy.

**Keywords:** Mongolia, ecozones, landscape change, climate change, geomorphological processes

## PERMAFROST MAPPING IN A CHANGING CLIMATE

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### Sebastian Westermann, PhD

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**Abstract:** Permafrost is an important element of the terrestrial cryosphere, but even today it remains challenging to map its distribution in space and time. The earliest permafrost maps were based on ground based observations. They reached a significant level of detail at regional scales, but they can represent only a period in time making it challenging to follow the fast changes of the permafrost distribution in today's changing climate. In the past decade, a range of new high resolution products based on available geospatial data sets have been produced, which all focus on the near surface permafrost as the part reacting most strongly to the recent climate change. The methodology generally relies on training models with field observations of permafrost parameters, in particular, observations of ground temperatures in boreholes and active layer thickness. As models, both statistical frameworks, e.g. machine learning tools, and physically based models which solve the heat conduction equation, have been used. Over the past ten years, a number of projects funded by the European Space Agency have produced permafrost maps of the Northern hemisphere and Antarctica based on remotely sensed land surface temperature and land-cover at a resolution of 1 km. Recently, transient data sets at annual time resolution have been produced which make it possible to infer recent changes of near surface permafrost temperatures. We discuss the advantages and challenges of the different methods and outline the way forward for permafrost mapping with high resolution in space and time.

**Keywords:** permafrost, mapping, thermal state, active layer thickness, remote sensing, numerical modeling

## POLICY AND LEGISLATIVE REFORM IN SCIENCE, TECHNOLOGY, AND INNOVATION

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**Abstract:** Long-term and medium-term development policy documents such as “Vision 2050”, “Five year development direction of Mongolia in 2021-2025”, and “Government’s action program for 2020-2024” submitted to the Parliament for approval by the Government of Mongolia in the letter: “Increasing the capabilities of researchers by optimizing the direction of research and experiments in science, technology, and innovation, increasing the budget spending on research and development by four times; Transfer of academic and research work to a competitive and fixed funding system that is funded based on the benefits it provides to economic and social development; To improve the competitiveness of the industry by establishing a unified, specialized and open laboratory; reflecting such objectives. The Ministry of Education and Science is gradually implementing policy decisions aimed at making these goals a reality. For example, in the field of science, technology and innovation, we are working on reforms focusing on 6 main directions. It includes: Firstly, within the framework of the improvement and modernization of the legal environment; Second. Reforming of the financing system of the science, technology, and innovation sector; Thirdly. Improving human resource capacity, which is the valuable capital of the scientific industry, improving working conditions, supporting salaries and social issues of industry employees; Fourthly. Ensuring coherence of academic work and improving practical results; Fifth. Development of soft and hard infrastructure of the sector, Sixth. Support and development of start-up companies and innovations. In implementing these policies, laws, programs, and measures, the initiatives and cooperation of the private sector and industry are important in addition to scientific and technological institutions.

**Keywords:** policy reform, R&D management

## CHINA'S LOW-CARBON CITY MODE AND PRACTICE

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**Abstract:** Low-carbon city construction is the key to addressing global climate change and achieving the United Nations Sustainable Development Goals. The low-carbon city construction of China has significant impact on the overall trend of global carbon emissions and play a key role in relieving global climate change. Based on the existing low-carbon related theories, this paper compiled the importance and contribution of low-carbon city construction and analyzed the policy support and practical guidance for low-carbon city construction in China. On this basis, it summarized the models of low-carbon city construction in China. Different types of low-carbon city construction were also used as case studies to compare and summarize the models of low-carbon city construction, and the comprehensive benefits of these low-carbon city constructions are evaluated. This study provides support and demonstration for promoting China's low-carbon city construction and realizing low-carbon development.

**Keywords:** Low-carbon city, case comparison, construction, realization

## IMPORTANCE OF GROUNDWATER AND SURFACE WATER INTERACTION IN WATER RESOURCES RESEARCH

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**Abstract:** Sustainable land management (SLM) plays an essential role in addressing desertification and land degradation. SLM refers to technologies and approaches that enable sustainable land production, livelihood improvement, and environmental conservation through appropriate soil and water management, and various SLM projects are being implemented worldwide. Future challenges for SLM relate to linking land management activities to socioeconomic empowerment of people, exploring exit strategies from development aid and introducing diverse sources of funding, and responding to climate change in terms of both adaptation and mitigation. IPCC Special Report on Climate Change and Land (IPCC, 2019) points out sustainable land management can prevent and reduce land degradation, maintain land productivity, and sometimes reverse the adverse impacts of climate change on land degradation. SLM can also contribute to mitigation and adaptation. Reducing and reversing land degradation, at scales from individual farms to entire watersheds, can provide cost effective, immediate, and long-term benefits to communities and support several Sustainable Development Goals (SDGs) with co-benefits for adaptation and mitigation. We need to explore climate-smart sustainable land management to contribute to mitigation and adaptation of climate change, and also contribute to achievement of land degradation neutrality through a transdisciplinary approach collaborated with various stakeholders to achieve our goals.

**Keywords:** groundwater recharge, climate condition, water resources management

## ENVIRONMENTAL ISSUES AND MONITORING: CASES IN SOME ACTIVITIES OF IGG

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**Abstract:** Mongolia is severely affected by adverse climate and environmental changes that are happening faster than many other countries in the world. For instance, during the last 60 years, the air temperature has increased by about 2.4°C, which results in negative phenomena such as intensifying the glacier and permafrost melts and desertification. In order to monitor and understand the environmental changes in detail, IGG has established over 80 permafrost boreholes, 5 glacier study sites, 20 AWSs, 4 carbon stations, 20 surface and groundwater monitoring sites, and 4 desertification and land degradation sites across Mongolia. It has to be mentioned that some of the monitoring networks are established with the contribution of foreign academic institutions. This study synthesized the data obtained from the control networks. During the last decade, it is observed that the permafrost temperature ranged from -0.1 to -3.4 °C, active layer thickness varied between 2.1 – 7.8 m, and permafrost temperature increased by 0.01 – 0.03°C yr<sup>-1</sup> in Mongolia. Since the 1960s, about half the area of the glaciers has melted, and currently, only 360 km of glaciers remain in Mongolia. Approximately 76% of the total land of the country has been affected by desertification. These phenomena disrupt the stable conditions of the water cycle and its balance and lead to the base for dry conditions. It is necessary to expand the number of monitoring networks and to use the data as much as possible in interdisciplinarity and transdisciplinary studies.

**Keywords:** Monitoring network, permafrost, glacier, desertification





**EST 2023**

**ORAL PRESENTATIONS**



**EST 2023**

**SESSION 1**

**ENVIRONMENTAL CHALLENGES AND  
CLIMATE CHANGE**

SUB-SESSION 1:

ENVIRONMENTAL COMPONENT  
DYNAMICS

## ECOLOGICAL POTENTIAL OF GEOSYSTEMS OF THE BAIKAL BASIN AS A BASIS FOR OPTIMIZING NATURE MANAGEMENT IN THE REGION



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**Abstract:** Baikal Siberia is located in the south of Eastern Siberia in the central part of North Asia and administratively includes three subjects of the Russian Federation: Irkutsk Oblast, the Republic of Buryatia and the Trans-Baikal Territory.

The territory of Baikal Siberia is a geographical space that is complex in origin, development history and modern landscape image. It includes the Central Siberian Plateau, the mountains of Southern Siberia, mountain ranges and intermountain basins of the Baikal region, Stanovoi highland and Transbaikalia. A unique natural formation Lake Baikal is located here, which is a site of the UNESCO World Natural Heritage Site.

The modern structure of Baikal Siberia's geosystems is characterized by great complexity, both in terms of the set of natural complexes and the degree of contrast between them. The regional classification range includes geosystems characteristic of different subcontinents of Asia, reflects their interpenetration and is a unique landscape and situational example of Siberian nature within North Asia. The landscape-forming influence of the relief is clearly visible, which is reflected in the altitudinal-zonal differences, the manifestation of piedmont locations and the vertical intrazonal differentiation of elevated plateau-plains. Basin and foothill effects with significant fluctuations in heights lead to a variety of natural conditions

Based on the principles of GRID modeling, an assessment of the ecological potential of the geosystems of Baikal Siberia was carried out, and special evaluation maps were built. The content of such maps is determined by the tasks of obtaining the necessary information about the features of geosystems necessary for the further development of forecasts and obtaining objective results. Among such important characteristics of geosystems are indicators of its state and disturbance, its ecological potential, as well as the degree of its natural and anthropogenic stability. The use of special assessment maps of natural conditions and the ecological potential of geosystems enables a general idea of the conditions for human existence there, as well as the creation of a natural scientific basis for a reasonable regional environmental policy.

**Keywords:** ecological potential of geosystems, stability of geosystems, disturbance of geosystems, mapping, GRID modeling, rational nature management, Baikal Siberia, Baikal natural territory

## EVALUATING SEASONAL VARIATIONS OF CO<sub>2</sub> FLUXES FROM PEATLAND AREAS IN THE MONGOLIAN PERMAFROST REGION



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**Abstract:** Greenhouse gases (GHGs) released from permafrost regions may have positive feedback to climate change, but there is much uncertainty about additional warming from the permafrost carbon cycle. One of the main reasons for this uncertainty is that the observation data of large-scale GHG fluxes are sparse, especially for peatlands with rapid permafrost degradation. This study (1) evaluated the seasonal variation of carbon dioxide (CO<sub>2</sub>) fluxes from peatlands in the permafrost region; (2) analyzed soil organic carbon content (SOCC); and (3) estimated emission factors (EFs) for peatlands. CO<sub>2</sub> fluxes were measured at 100 study sites in four different study areas such as nature area, autumn/summer use area, spring/winter use area, and mixed-use area. CO<sub>2</sub> was measured by the EGM-4 instrument with the chamber. Soil samples were carried out from the surface to 30 cm depth at all sites. The result showed that the CO<sub>2</sub> fluxes ranged between 1.0  $\mu\text{mol}/\text{m}^2/\text{s}^{-1}$  and 21.8  $\mu\text{mol}/\text{m}^2/\text{s}^{-1}$  at 100 study sites in the spring season, while it ranged between 3.0  $\mu\text{mol}/\text{m}^2/\text{s}^{-1}$  and 35.8  $\mu\text{mol}/\text{m}^2/\text{s}^{-1}$  in the summer season. Whereas, CO<sub>2</sub> fluxes were less values in autumn than in the other two seasons which may depend on many factors of climate conditions. There were significant seasonal variations in CO<sub>2</sub> fluxes in four different areas. In order to, EFs in peatland were calculated by 169.30 g [CO<sub>2</sub>] m<sup>-2</sup> yr<sup>-1</sup> (standard error  $\pm$  8.93), and 8.91 g [CH<sub>4</sub>] m<sup>-2</sup> yr<sup>-1</sup> (standard error  $\pm$  0.47). Further research in detail is needed to develop EFs for peatlands across the Mongolian permafrost region. Then, it could be used for GHG inventory in land-use areas such as peatlands at the national level.

**Keywords:** Greenhouse gas, soil organic carbon, permafrost, peat, emission factor

## STUDY ON THE EVOLUTION AND DRIVING MECHANISMS OF LAND DESERTIFICATION ON THE MONGOLIAN PLATEAU IN THE LAST 30 YEARS

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**Abstract:** As one of the major arid zones in the northern hemisphere, the Mongolian Plateau is a typical region that is sensitive and vulnerable to global changes, and is also the core area for the construction of the Belt and Road Economic Corridor between China, Mongolia and Russia, playing an important role in the construction of China's northern ecological security barrier. Desertification is one of the most serious ecological and environmental problems in the region, with Mongolia being a global hotspot for desertification. In 2015, the assessment report of the Ministry of Nature, Environment and Tourism of Mongolia showed that the total area of desertified and degraded land in Mongolia accounts for 76.9% of the country's territory and is spreading at a faster rate in some areas, with moderate, severe and very severe desertification areas expanding. China is one of the countries most severely affected by desertification in the world, and the fifth national monitoring of desertification and sandy land shows that in 2015 Inner Mongolia's desertified area reached 609,200km<sup>2</sup>, accounting for 50.12% of its total area. Under the influence of climate change and unreasonable human activities such as overgrazing and uncontrolled mining, the problem of grassland degradation and soil desertification in the region has become increasingly serious. This study firstly determines the regional desertification grading system; then, based on Landsat, Sentinel 2A and GF-1 data, various traditional remote sensing desertification information extraction methods are used to obtain the preliminary regional desertification degree distribution results respectively, and multiple sources and segmentation scales deep learning labels of different desertification degrees are automatically constructed based on the voting mechanism; finally, texture, vegetation, soil, topography and climate features are selected and convolutional neural network(CNN) model is used to achieve automatic extraction of desertification fine information in mongolia plateau, and analyse its spatial and temporal patterns and driving mechanisms.

**Keywords:** Mongolian Plateau, Desertification, CNN, driving mechanisms

## CHARACTERISTICS OF SOIL EXTRACELLULAR ENZYMES AND STOICHIOMETRY ALONG THE ELEVATION GRADIENT AND THEIR CONTROLLING FACTORS IN QINGHAI-TIBET PLATEAU, CHINA

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**Abstract:** Soil extracellular enzyme activities (EEAs) and coenzymatic stoichiometry (EES) play an essential role in soil nutrient cycling and organic matter decomposition. Understanding EEAs and EES variation patterns and their influencing factors could offer direct information about the soil structure, function, and soil response to anthropogenic disturbances and climate change. This issue is noteworthy, especially in high-altitude areas where climate change is imminent and vegetation is diversified. This study measured different soil EEAs and EES characteristics and explored their key controlling factors along nine altitudes ranging from 2500 m to over 5200 m in the Qinghai-Tibet Plateau of western China. We also analyzed the effects of plant microhabitats on soil EEAs and EES. The results showed that most soil EEAs and EES had significant variability in spatial characteristics, and enzymatic activity increased with altitude. Compared to the soil nutrient distribution which also increased with altitude, this same change trend of soil EEAs and soil nutrients was inconsistent with the resource allocation theory. Microorganisms might mediate the effects of environmental factors on soil EEAs by altering the enzyme production efficiency. Specific soil EEAs (EEAs/g SOC), like soil enzyme carbon: phosphorus ratios (ECP), and nitrogen: phosphorus ratios (ENP), showed an opposing trend in variation, which decreased with increasing altitude. Plant microhabitats significantly promoted soil EEAs due to the accumulation of soil nutrients (carbon, nitrogen and phosphorus). Soil EEAs and EES's spatial variability was mainly determined by edaphic factors, accounting for >70.24 % and 55.67% of latitudinal variations, respectively. Generally, carbon and nitrogen limitations were substantial in this area and gradually alleviated with increasing altitude. This study provided a data support for ecological protection of the Qinghai-Tibet Plateau based on the spatial variation of soil EEAs and nutrient limitation.

**Keywords:** Extracellular enzyme activity, Coenzymatic stoichiometry, Altitude; Microsite; Influence factor



## ESTIMATION OF PERMAFROST GROUND-ICE TO 10 M DEPTH ON THE QINGHAI-TIBET PLATEAU

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**Abstract:** Permafrost ground-ice melting has the potential to release a significant amount of water which can significantly alter hydrological processes in cold basins. Currently, there is a lack of ground-ice gridded data from the Qinghai-Tibet Plateau (QTP). Using 664 borehole sample records, we applied a random forest (RF) method to predict the ground-ice content of permafrost between 2 m and 10 m depth in three layers (2–3 m; 3–5 m; and 5–10 m) at a spatial resolution of 1 km. The RF method demonstrated good performance, with  $R^2$  exceeding 0.80 for the three layers and a negligible positive overestimation (0.98% - 1.85%). The three layers have similar average predictive uncertainties, ranging from 36.8% to 41.2%. Regions with high uncertainties are those areas with low ground-ice content. The ground-ice content of the first layer (2–3 m) can be predicted primarily using climate variables, but the contribution of terrain and soil variables increases as the depth increases. Based on these statistics, the total water storage of ground-ice across the QTP permafrost (2–10 m depth) is approximately 3330.0 km<sup>3</sup>, with 403.5 km<sup>3</sup> in the 2–3 m layer, 857.2 km<sup>3</sup> in the 3–5 m layer, and 2069.3 km<sup>3</sup> in the 5–10 m layer. This study has for the first time generated a gridded dataset of the ground-ice content of the shallow permafrost layer across the entire QTP. This dataset can be used to improve simulations of hydrological processes and land surface processes in the permafrost regions.

**Keywords:** Ground ice; Permafrost; Random Forest; Qinghai-Tibet Plateau

## VEGETATION-TYPE SPECIFIC DIFFERENCES IN SOIL CARBON AND NITROGEN CONTENTS AND SPATIAL DISTRIBUTION PATTERNS IN THE SANDY SOIL OF ALPINE DESERT

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**Abstract:** Understanding soil carbon and nitrogen storage and their response to climate change is currently an essential topic in global change research. Compared to other ecosystems, soil carbon and nitrogen status in the Alpine desert dominated by sandy soil, is still poorly understood.

In this study, we selected Ali, with an average elevation of around 5000 meters asl, as the study area. We surveyed of 34 representative sites through profile excavation, soil sampling, and indoor analysis. The mean density of total soil carbon (STC), soil inorganic carbon (SIC), and soil organic carbon (SOC) were 23.67 kg/m<sup>2</sup>, 19.67 kg/m<sup>2</sup>, and 4.91 kg/m<sup>2</sup>, respectively. Due to different vegetation types, STC, SIC, and SOC showed significant differences ( $p \leq 0.05$ ). The contents of STC, SIC, and SOC are all highest in desert grasslands, followed by bare soil, grassy shrublands, and semi-shrub or dwarf-shrub deserts. The average densities of soil nitrogen (STN) and ammonium nitrogen (SAN) were 0.59 kg/m<sup>2</sup> and 0.024 kg/m<sup>2</sup>, respectively, and exhibited high spatial variability. Under different vegetation types, STN and SAN decreased from desert grassland, shrub desert, and semi-shrub desert to bare land.

Using correlation analysis and structural equation models, we analyzed the driver factors of soil carbon and nitrogen in the study area. The elevation (E), slope (S), mean annual temperature (MAT), annual precipitation (AP), aboveground biomass (AGB), and soil physical (SPC) and chemical properties (SCC) can jointly explain 61.3% ( $R^2=0.61$ ) of the spatial variability of soil carbon in the study area. Their contributions decreased in turn of SCC, SPC, E, S, MAT, AP, and AGB. Similarly, E, MAT, AP, AGB, SPC, and SCC can jointly explain 65.0% ( $R^2=0.65$ ) of the spatial variability of soil nitrogen. Their contributions decreased in turn of AGB, SPC, E, AP, SCC, and MAT. This provides a regional case for soil carbon and nitrogen research.

**Keywords:** Vegetation-type Specific, Soil Carbon and Nitrogen, Sandy Soil, Alpine Desert

## SPATIAL PATTERN OF VEGETATION IN ALXA DRYLAND ECOSYSTEM AND ITS EFFECT ON WIND EROSION

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**Abstract:** Spatial vegetation patterns are related to the stability and multifunctionality of dryland ecosystems. One of the important ecological functions of patch vegetation in desert ecosystems is to prevent soil wind erosion. The characteristics and density of vegetation are considered to be the main factors affecting surface roughness. Nonetheless, how spatial vegetation patterns affect field-scale aerodynamic roughness length is not fully understood. Based on field survey of patch vegetation in Alxa Plateau, northwestern China, we established a multivariate linear model for temporally and spatially averaged aerodynamic roughness length ( $Z_0$ ) incorporating the height, density, regularity of vegetation patches and spacing between patches. The regularity and spacing of vegetation patches significantly affect the mean and standard deviation of  $Z_0$ . The spatial-related terms contributed 37% and 62% to the model variance of the mean and standard deviation of  $Z_0$ , respectively. Vegetation models that include spatial parameters will improve the description of changes in airflow regimes and heterogeneity in surface erodibility. Our results validate the importance of spatial vegetation patterns in vegetation-airflow interactions and suggest estimation of  $Z_0$  through intuitive spatial parameters. Based on the fact that spatial vegetation patterns reflect the state of ecosystems, strengthening the link between wind erosion and ecosystem stability may help to establish windbreaks.

**Keywords:** vegetation-airflow interactions, aerodynamic roughness length, roughness density, spatial vegetation patterns, patch size distribution

## DETERMINING THE AGE OF GROUNDWATER IN THE SHARIIN GOL RIVER USING ISOTOPE METHODS



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**Abstract:** Isotopes of hydrogen and oxygen ( $\text{HD}^{16}\text{O}$ ,  $\text{H}_2^{18}\text{O}$ ,  $\text{HD}^{18}\text{O}$ ) in water molecules and radioactive isotopes in water such as tritium ( $^3\text{H}$ ), carbon-14 ( $^{14}\text{C}$ ), chlorine-36 ( $^{36}\text{Cl}$ ), krypton-81 ( $^{81}\text{Kr}$ ) contain information such as water cycle, origin of groundwater and water points, age of groundwater, residence time, dynamics, and sources of water pollution. These information become the scientific basis for the protection and prevention of the environment and to plan the proper use of water, restoration measures, and enhancing sustainable management of water resources.

As part of this research, a total of 17 wells were sampled from the middle and lower parts of the Shariin Gol River Basin, and hydro-chemical and isotopic analysis were carried out. Stable isotope ( $^2\text{H}$  and  $^{18}\text{O}$ ) analysis was analyzed in Mongolia while tritium was analyzed in relevant laboratory of India. Result of the study area stable isotope were compared with values of the local water line, derived from the GNIP network in Ulaanbaatar. Tritium data from the GNIP network of Ulaanbaatar was used to determine the age of groundwater in the study area.

According to the results of stable isotopes in the study area groundwater, we found a relatively heavier isotopes from the shallow and dug wells. Origin of water in these wells are probably formed from the summer rain water. Nevertheless, two dug wells have comparatively lighter isotopes. Tritium was detected between 1.10 and 14.57 TU in these study wells. Groundwater age estimates ranged from  $14.2 \pm 2$  to  $43.0 \pm 7$  years old based on these data. Tritium value in the sampled wells were relatively low in 5 wells, so ages could not be determined using  $^3\text{H}$ . The percentage of water yield of three wells (target water points) in the downstream of the basin was determined by EMMA, respectively. The main candidate for the water source assumed to be water of the Shariin Gol River and another candidate was chosen a water point, which is located just upstream of the target 3 wells. The percentage of origin of the target 3 wells was determined by the above method using the comparative value of  $\text{Na}^+$  ions to total cations ( $\text{Na}^+/\text{total cations}$ ).

According to the results, 14-31% of these wells' water recharged by the Shariin Gol River and the remaining 69-86% consists of groundwater flow system. In the near future, it is necessary to determine groundwater interaction between groundwater system of Shariin Gol and Orkhon rivers including surface water (i.e., Shariin Gol and Orkhon rivers) in lower courses of the river. This research work is being carried out in the frame of RCA RAS7035 "Enhancing Regional Capability for the Effective Management of Groundwater Resources Using Isotopic Techniques" (2020-2023).

**Keywords:** Stable isotope, tritium, cation, age of groundwater, origin of water

## MAPPING SANDY AREAS AND THEIR CHANGES FOR MONGOLIA

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**Abstract:** The increase of sand surfaces always associated with increased tendency of desertification. Such expansion can have natural reasons, however, in most cases improper land use is a main cause of this type of land degradation. It has also different impacts in natural and socio-economic systems. In arid and semi-arid climate sand encroachment mainly threatens urban lifestyle, e.g. eroding buildings, agricultural, and even human health. With increased capabilities of remote sensing technology, the study of sand cover, sandy lands and their dynamics is become more effective. There are several sand detection techniques already tested around the world of which we chose four indices used in temperate zone. The aim of this research was to select the most appropriate index that may be useful to monitor the bare sands of the country and determine sandy land dynamics over time. For this MOIS/Terra MOD09A1 Version 6 product which provides an estimate of the surface spectral reflectance 500 m spatial resolution were used to calculate Normalized Difference Sand Area Index (NDSAI), Normalized Difference Sand Dune Index (NDSDI), Normalized Sand Index (NSI) and Topsoil Grain Size Index (TGSI). The accuracy assessment of the indices showed that the NSI provides very good performance with an overall accuracy of 86 %. The TGSI can isolate many sandy pixels with an overall accuracy about 79 %. The performance of the NDSAI is low with an overall accuracy about 78 %. It fails to classify sparsely vegetation area from the bare sands but from the results it can be concluded that it might have better performance in distinguishing desert environments or separating arid lands. Change detection techniques were used by comparing the areas of the sandy lands for the periods from 2000 to 2020. The results showed an increase in sandy areas over two decades. The percentage of this increase was about 10 % to 20 %.

**Keywords:** change detection, remote sensing, sand encroachment, sand, sand index

## ESTIMATING SHORTWAVE RADIATIVE TRANSFER IN FORESTS ACROSS COUNTRY-WIDE SCALES

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**Abstract:** There are increasing demands and opportunities for accurate representation of forests in coarser resolution models for improving understanding of key forest processes such as snowmelt, photosynthesis, biodiversity and evapotranspiration. Importantly, representation of direct radiation transfer processes depends on canopy structure datasets that can resolve individual tree crowns. We will show recent work that has both developed radiative transfer models capable of representing these canopy processes at meter- and minute-scale resolution and incorporated the model output into nationwide models used for snowmelt forecasting and forest microclimate mapping across Switzerland. This presentation will outline both the practical challenges and benefits of these model developments across country-wide scales with complex topography and varying forest types and structures.

**Keywords:** Shortwave radiation modelling, Radiation transfer, snowmelt modelling, microclimate mapping



## SIMULATING FOREST IMPACT ON GROUND THERMAL REGIME USING THE CRYOGRID COMMUNITY MODEL – EXAMPLES FROM TERELJ, MONGOLIA

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**Abstract:** The presence of forest impacts the ground thermal and hydrological regime through processes such as shading, transpiration, modification of turbulent fluxes and interception, and thus affect permafrost presence and stability. These interactions especially play a role towards the southern margin of the Eurasian permafrost region, where forests and permafrost typically are co-located in the north facing slopes of the central Asian mountains. Adequate representation of forest is therefore key to simulating the state and fate of permafrost and the associated water balance in these areas.

Here, we present new development of the CryoGrid Community model, where a single-layer vegetation scheme is implemented to simulate ground thermal regime in forests. The scheme includes parameterizations from the Community Land Model 5, modelling the forest's major impacts on surface energy and water balance. Furthermore, we include routines from TopoScale to terrain adjust forcing data to local slopes.

We test our model setup against extensive ground measurements and surface energy balance data at two contrasting slopes in Terelj, Mongolia. The validation shows how these novel model developments enable realistic simulation of permafrost presence close to its local and continental margins. Furthermore, our simulations reveal a strong sensitivity of ground temperatures to accurate simulation of snow cover and representation of ground surface properties related to the forest cover (i.e. litter/moss layers).

Expanding the capabilities of the CryoGrid Community model for mountainous and forested areas opens up for further studies of these regions. Potential applications include simulations of the local hydrology of these semiarid regions during global warming, and the impact of disturbances such as fires, insect outbreaks and changes in land use.

**Keywords:** Permafrost modelling, forest ecosystems, CryoGrid Community model, surface energy balance

## TEMPORAL AND SPATIAL CHARACTERISTICS OF ACTUAL EVAPOTRANSPIRATION EVOLUTION OVER THE MONGOLIAN PLATEAU

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**Abstract:** The Mongolian Plateau is located in the arid and semi-arid region, which is sensitive to climate change and fragile ecology. Therefore, it is necessary to conduct in-depth research on the actual evapotranspiration (AET) of the Mongolian Plateau. In order to explore the variation rules of AET over the Mongolian Plateau for a long time series, we selected a total of 51 meteorological stations on the Mongolian Plateau (35 stations in Mongolia, 16 stations in North China including Xinjiang and Inner Mongolia). The monthly surface meteorological data from 2011 to 2022 were obtained by Google Earth Engine (GEE) cloud platform and the monthly evapotranspiration potential for 12 years was calculated by Penman-Monteith formula. According to the land type divided by the land cover data of the Institute of Aerospace Information Innovation, Chinese Academy of Sciences, the evapotranspiration coefficient of the underlying surface of the region where the station was located was calculated respectively. Finally, according to the calculated potential evapotranspiration the AET under different underlying surface conditions was calculated, the spatio-temporal characteristics of evapotranspiration over the long series of Mongolian plateau were obtained, and the influence of evapotranspiration of different underlying surface conditions on the ecological environment of the Mongolian plateau were analyzed. The study of the AET of the Mongolian Plateau has important scientific significance and application value for the climate change and ecological environment of the study area, and the research results are expected to provide relevant data support for the utilization of water resources in the Mongolian Plateau.

**Keywords:** Actual evapotranspiration, Mongolian Plateau, long time series variation, different

## PATTERNS AND DRIVING FACTORS OF SOIL AND PLANT LEAF C, N, AND P STOICHIOMETRY ALONG A DESERT-GRASSLAND TRANSITION ZONE IN NORTHERN CHINA



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**Abstract:** Desert-grassland transition zone is a critical ecological barrier frontier against sandstorms and desertification in northern China. Plant and soil carbon (C), nitrogen (N), and phosphorus (P) stoichiometry are useful tools for understanding plant nutrient strategy and biogeochemical cycling in terrestrial ecosystems. However, how the relationship between climate, vegetation, and soil property drives the spatial pattern of soil and leaf C, N, and P stoichiometry remains unclear. Then a systematically designed 400 km transect was established to investigate soil and leaf C, N, and P contents at 82 sites in the fragile desert-grassland ecological transition zone of Inner Mongolia.

In the study, soil organic C (SOC), total nitrogen (TN), and total phosphorus (TP) varied in response to climatic factors, vegetation types, and soil physicochemical properties and were coordinated by various environmental factors. Precipitation, silt and clay content were the most important factors explaining the total variation in SOC, TN, and TP stoichiometry. Furthermore, structural equation models revealed that precipitation played a critical role in regulating the effects of vegetation and soil physicochemical properties on SOC, TN, and TP contents and their ratios. Plant taxonomic groups and life forms rather than climate or soil factors determined the leaf C, N, and P stoichiometry at the individual level. At the community level, changes in leaf N and P contents and C:N, C:P, and N:P ratios were mainly driven by intraspecific variation, which was in turn driven by soil moisture. In contrast, interspecific variation in leaf C, N, and P stoichiometry was mainly driven by soil properties other than SM and showed different responses of mechanism.

Our results highlight the importance of current climate change on plant and soil C, N, and P contents and C:N:P stoichiometry, and future climate change and its eco-impact in the desert-grassland transition zone.

**Keywords:** Ecological stoichiometry, Plant and soil, Influence factor, Intraspecific variation, Desert grassland

## SPATIAL DISTRIBUTION OF LONG-TERM HAIL DATA OBSERVED IN UVURKHANGAI PROVINCE



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**Abstract:** Hail is a solid precipitation that falls from cumulonimbus clouds. Hail is formed by moving updraft and downdraft through thick layers of different temperature and humidity inside the cumulonimbus cloud, and when it falls, it causes a strong impact on the surface in direct relation to the acceleration gained by the kinetic energy of the movement. It is a solid form of precipitation with a layered structure that comes from cumulonimbus clouds. In Mongolia, the frequency of hail is relatively decreasing, and the frequency of hail is relatively high in mountainous areas, while in the Gobi region, hail is relatively rare, it has been confirmed by research in recent years. Using 30-year observational data between 1991 and 2020, yearly frequencies, monthly frequencies, and spatial distribution of hail were studied in Uvurkhangaï province. This study was conducted on the 17-weather station of Uvurkhangaï Province, out of the total of 19-weather station, which operated continuously during the research period. A total of 140 hailstorms were observed in the territory of Uvurkhangaï province during 30 years. In the territory of Uvurkhangaï province, the years with the highest frequency of hail were 9 times in 1994, 1997, 2012, and 2016, while the lowest frequency of hail was observed in 2004, 2005, and 2006, 1 time each. No hail was observed in 1996 and 2015. Considering the frequency of hailstorms in Uvurkhangaï province, 51 hailstorms were observed in July. but in April, the least number of hailstorms was observed, 3 times. In terms of daily frequency, the highest rate of hail (21.4%) was observed between 15:00 and 16:00. This was a total of 30 repetitions. However, in terms of spatial recurrence, the highest occurrence was observed in Kharkhorin Sum, 29 times, while the lowest frequency of hail was observed in West Bayan-Ulan and Bayan-Undur Sums, 1 time each, while no hail was observed in each sum.

**Keywords:** Hail, Uvurkhangaï province, Yearly frequencies, Monthly frequencies, Daily frequencies, Spatial distribution

## RESULTS OF HYDROCHEMICAL RESEARCH ON GROUNDWATER NEAR ULAANBADRAKH SUM, DORNOGOVI PROVINCE

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**Abstract:** In this study, we collected samples from 19 wells located in Ulaanbadrakh Sum, Dornogovi Province, and analyzed their physicochemical and microelement parameters. We aimed to evaluate the water quality in comparison to the drinking water standards set by Mongolia. The wells examined in the study exhibited a neutral to alkaline pH range of 7.37-8.64. The mineralization levels varied from fresh to saline, with a range of 518.3-2767.4 mg/l. The general hardness of the water samples ranged from very soft to hard, with values between 0.70 and 6.54 mg-eq/dm<sup>3</sup>. The predominant chemical composition was hydro carbonate, and sodium and chloride-sodium ions were the prevailing elements. The oxidation-reduction potential (ORP) in the water samples ranged from 203.8 to 50 mV. The concentration of fluoride ions fell within the range of 0.82-3.68 mg/l, with approximately 84.2% of the water points exceeding the MNS 0900:2018 standard. Comparing the results to the general chemical research conducted in 2021, we observed changes in the general hardness and mineralization levels of wells. Wells D32 and D30 showed a decrease in general hardness by 45.77% and 47.50%, respectively, along with a reduction in mineralization levels by 50.6% and 59.15%. Conversely, wells D42 and D36 exhibited an increase in general hardness by 48.49% and 40.24%, and a rise in mineralization levels by 18.4% and 29.76%, respectively. These variations may be attributed to the sampling period and rainfall levels. About specific elements, all wells, except D30 and D35 2, displayed elevated levels of arsenic (As), ranging from 11.1 to 96.1 µg/L, surpassing the drinking water standard. The water from the new well and D31 well contained higher levels of binder (Be), ranging from 0.4 to 0.6 µg/L. Additionally, the Tseguni well exhibited increased levels of strontium (Sr), ranging from 2063 to 5756 µg/l. Moreover, the uranium ion content in the water from D32, D39, D35, D41, D30, D34, D26 well, and D28 well (U) ranged from 30.6 to 82.5 µg/l, exceeding the standard limits. It is evident that water-rock interaction mechanisms significantly impact water quality.

**Keywords:** Water quality, contamination, microelements, oxidation reduction potential



**EST 2023**

**SUB-SESSION 2:**

**CLIMATE CHANGE IMPACT AND  
MONITORING**



## ICINGS IN THE SELENGA RIVER BASIN IN THE CONTEXT OF CLIMATE CHANGE



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**Abstract:** The Selenga River basin is characterized by the spread of permafrost. Cryogenic processes, in particular, icings formation, are actively manifested in this area. The mapping of icings, performed using Landsat satellite imagery data, revealed that in modern natural and climatic conditions about 32 thousand icings are formed in the Selenga River basin with a total area of 1,164 km<sup>2</sup>. Groundwater icings formed in the valleys of small rivers predominate. Their areas vary from 10 to 100 thousand m<sup>2</sup> (medium and large). River water icings are formed in Kurba and Ilka rivers, in the upper reaches of the Dzhida river, etc. The largest icings, classified as giant, are formed in the upper reaches of the Egiin-Gol River and on the Chuluutyn-Gol River. The icing on the Egiin-Gol river in some years reaches an area of 25 km<sup>2</sup>, on the Chuluutyn-Gol river - 13 km<sup>2</sup>.

The highest values of icing coverage are characteristic of the mountainous areas of the territory with a complex geological structure, where permafrost rocks have a continuous distribution. The relative icing coverage (icing coverage coefficient) in the Dzhida River basin is 0.38-0.39 %, in the Egiin-Gol River basin - 0.30-0.35 %, in the Chikoi River basin it reaches 0.30 %.

The dynamics of icings areas and volumes, as well as their spatial location, are influenced by many factors. These include, among others, meteorological environmental factors and observed climatic changes. The supply of icings depends on groundwater, which is replenished by precipitation, so in high-water climatic cycles the areas and volumes of icings increase, while in low-water cycles they decrease. For example, in the Selenga middle mountains (Russian part), the total area of icings in the current climatic conditions (for 2021) is 251 km<sup>2</sup>, and in high-water years (1999-2000) it reaches 317 km<sup>2</sup>. Changes in air temperature play a major role in the intensity of icing processes. An increase in average annual temperatures leads to a decrease in the thickness of seasonal freezing of rocks, new taliks are formed in areas with continuous type of permafrost spreading. This leads to an increase in the volume of groundwater discharge and causes intensive growth of icings.

The study of icings in the Selenga River basin allows us to assess the current state of the cryosphere in the region located on the southern border of the cryolithozone, which is an important task of the global climate agenda.

**Keywords:** icings, rivers, permafrost, cryosphere, cryolithozone, precipitation, temperature, climate

## FLOOD HAZARD ASSESSMENT AND DISASTER PREVENTION RECOMMENDATIONS IN KHOVD CITY, WESTERN MONGOLIA

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**Abstract:** The effects of climate change are felt differently across the world. The need to prepare for disasters caused by climate change (e.g., flooding) has been increasing, especially in a semi-arid zone with limited surface water such as Western Mongolia. In the past decades, the increasing frequency of rainfall floods at Khovd City in Western Mongolia has impacted the vulnerability of the households living along the Buyant River in summer. In this study, we assessed flood hazard conditions based on the high-resolution topographical survey using precipitation data between 1980 and 2022 in Khovd City and DJI Mavic 2 pro drone. We captured 15,206 aerial photos in Khovd City to assess and map the flood hazards. RTK measurement was performed at 22 GCPs to create a DEM (3.7 m). The topographic map was created in ArcGIS. Then, 2 longitudinal and 9 cross profiles were created on the topographic map by using the geomorphological profile method, and surface morphometric evaluation was conducted for flood hazard assessment. According to the result, the frequency of heavy rainfall increased gradually but the total annual precipitation decreased significantly. We identified three flood danger zones along the Buyant River. As all three danger zones identified areas where about 2000 people spend their summer, it is necessary to implement flood prevention and protection measures and flood disaster management in the residential areas. Therefore, we have developed recommendations for adequate and detailed flood preparedness and prevention of further large-scale damage

**Keywords:** Climate change, Flood hazard, UAV photogrammetry, Topographical analysis, Disaster prevention, Buyant River

## EVALUATING THE INFLUENCE OF CLIMATE CHANGE AND GRAZING INTENSITY ON PERMAFROST IN MONGOLIAN GRASSLANDS



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**Abstract:** In order to examine the impact of climate change on the degradation of permafrost in terrestrial environments, a permafrost monitoring network was established in north-central Mongolia in 2007. The network includes eight boreholes and three meteorological stations, which measure ground temperature profiles across various ecosystems. Our data indicates that permafrost in grassland ecosystems is degrading more quickly than in other ecosystems, such as forests and wetlands (Wang et al., 2022).

In this research, we employ the SHAW (Simultaneous Heat And Water) model (Flerchinger et al., 1989, 2017) to simulate the effects of climate change and grazing intensity on the degradation of permafrost within Mongolian grassland ecosystems. We first calibrated the SHAW model using data collected from 2008 to 2020, and then used the model to simulate the combined impact of climate change and grazing intensity on permafrost under a variety of scenarios.

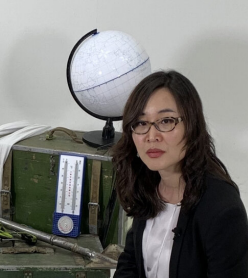
To model the impact of climate change on permafrost degradation, we designed four scenarios for temperature increase and five scenarios for precipitation change. The temperature scenarios reflect the current temperature ( $T_a$ , °C) and three other scenarios as outlined in the IPCC AR6 WGI Technical Summary: the “SSP1-1.9 scenario” predicting a rise of 1.5 °C, “SSP1-2.6” forecasting a rise of over 1.5 °C, and “SSP5-8.5” projecting a rise of over 4.0 °C by the end of this century (Arias, et al., 2021). Precipitation scenarios include the current precipitation ( $P$ , mm) and four other scenarios (0.50xP, 0.75xP, 1.25xP, and 1.50xP, mm). In addition, we developed four scenarios (no grazing, light grazing, moderate grazing, and heavy grazing) to simulate the impact of grazing intensity on permafrost degradation.

Our numerical experiments indicate that warming, particularly changes in precipitation, play a crucial role in preserving the active layer of permafrost. Although grazing does not significantly affect permafrost degradation under conditions of high soil moisture, overgrazing in low soil moisture conditions can noticeably accelerate permafrost degradation. Our study suggests that permafrost within the grassland ecosystems of Mongolia may become increasingly vulnerable if drought, overgrazing, and warming occur concurrently. Therefore, managing grazing intensity could be a key strategy in preserving permafrost.

**Keywords:** Climate Change, Grazing Intensity, Permafrost Degradation, Ecosystem Vulnerability

## MONITORING OF PATCHY AND SPORADIC PERMAFROST IN THE SOUTHERN TERRITORY OF THE HENTEI MOUNTAINOUS REGION, MONGOLIA

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**Abstract:** The long-term monitoring of sporadic permafrost areas covering the southern mountainous part of Hentei province has been compiled and summarized. The initial data from 30 boreholes with different depths indicate that the active layer thickness has increased in the recent 25-50 years as well as the mean annual ground temperature due to global warming. Yet, the rates of increase were different due to natural settings.

According to several borehole data, there are phenomena of the complete disappearance of relatively thin and warm permafrost in some areas, as well as the appearance of a non-freezing active layer formed on the top boundary of permafrost.

Moreover, permafrost degradation has been detected in two boreholes with unique geological and hydrological settings. In those settings, the ground temperature has increased from the bottom of the permafrost layer, and thickness has decreased due to the loss from the bottom.

Generally, there is a ubiquitous increase in the ground temperature and active layer increase in permafrost conditions of Mongolia. However, permafrost degradation under the influence of recent climate warming varies in time and place depending on natural conditions. Compared to the Hovsgol and Hangai mountainous regions, the active layer and thermal state of permafrost in the Hentei region are very dynamic under the influence of climate change and human land-use activities. The main features of active layer thickness and mean annual ground temperature dynamics of Hentei are that the active layer thickness is relatively thick and permafrost is warmer than the other regions. More importantly, supra-permafrost taliks that are transitional unstable and/or more stable have been formed in this region. Yet, the impacts of talik formation on hydrological or ecological settings are yet unknown.

**Keywords:** Hentei province, active layer, mean annual ground temperature, sporadic, talik formation

## ANALYSIS ON SUSTAINABLE DEVELOPMENT OF RESOURCES AND ENVIRONMENT IN MONGOLIAN PLATEAU BASED ON BIG DATA

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**Abstract:** The Mongolian Plateau is one of the most dominant arid zones in the Northern Hemisphere today, and is a typical region sensitive and vulnerable to global change. In recent years, the frequency and intensity of extreme weather, sandstorms and droughts on the Mongolian plateau have continued to increase under the dual effect of climate change and human activities. The intensification of ecological risks poses a huge obstacle and challenge to the sustainable development of Mongolian Plateau and the regional realization of global Sustainable Development Goals (SDGs). Therefore, in view of the key common problems and needs of the resources and ecological environment of the Mongolian Plateau, this study used remote sensing big data technology to obtain a long series of key environmental data products of land cover, surface water, grass yield, vegetation phenology, desertification, sandstorms and other key environmental elements of the Mongolian Plateau, analyze their spatio-temporal change characteristics and driving factors, reveal their response characteristics to climate change and human activities, and timely and accurately understand the changes of ecological environment in the Mongolian Plateau. Finally, the indicators of Sustainable Development Goals (SDG2, 6, 11, 13, 15) were evaluated, and their level in sustainable development was evaluated to provide data support for the ecological security and green development of the Mongolian Plateau.

**Keywords:** extreme weather, climate change, big data technology; SDGs, Mongolian Plateau

## LAND-USE/COVER CHANGE AND ITS INFLUENCING FACTORS IN BAYANHONGOR, MONGOLIA

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**Abstract:** LUCC analysis is the foundation of regional land management. The research on the LUCC spatiotemporal distribution pattern and its influencing factors is a key task for achieving sustainable development. However, there is a lack of long-term analysis of LUCC in typical pastoral area of Mongolian Plateau. In this research, based on GLC\_FCS30 data, we selected the Bayanhongor, which is the typical pastoral province of Mongolia, as the study area, combined with LUCC Stochastic Matrix, LUCC Dynamic Degree, and Correlation Analysis Model, analyze the LUCC change and its influencing factors. The research results will provide scientific and technological support for the Bayanhongor land management planning and husbandry policy formulation.

**Keywords:** LUCC Analysis, Influencing Factors, Bayanhongor, Mongolia



## EFFECTS OF CLIMATE CHANGE ON SEED YIELD OF LARIX FOREST

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**Abstract:** The Ulaanbaatar green zone forest, where the research was conducted, is in charge of water regulation, which is the source of the capital's significant water supply, such as rivers and streams. The forest also provides soil protection, climate mitigation, and reduced air pollution, resulting in healthier and more comfortable living conditions for inhabitants. For Mongolia, over the past eighty years, the average annual temperature has increased by 2.2 degrees, and the amount of precipitation has decreased by 7-10 percent every year. The purpose of this study is to determine the indicators of flowering and seed yield of larch forests in the green zone of Ulaanbaatar and to study the effects of climate change on the conditions of the region. As a result, the trees in the sample area are in the age class IV-VII of the taiga mixed forest in mature states with larch, spruce, and cedar with a thickness of 0.6-0.7. The average diameter of the forest is 22.5–30.2 cm, the average height is 18.6–18.8 m, and according to the selection category, normal trees are prevalent. According to the flowering process, the trees began to bloom evenly in the second ten days of May, but due to sudden coldness in spring and continuous cold rain, the larch flowers dried up and could no longer produce seeds. Soil has the most important influence on the flowering, fruiting, seed yield, and seed maturation of trees, shrubs, and plants. According to the results of soil analysis, the content of humus contained in 100 g of soil is sufficient, the soil solution medium has an average pH of 5.8 or the reaction medium is generally neutral, carbonate content is not detected in all layers of the soil, electrical conductivity is low to moderate, mobile phosphorus and potassium supply thus mechanical components are good. The uppermost surface layers are sandy soil and below that are light loam and loam with particle composition.

**Keywords:** Larch, seed, crop, stand, green zone, climate change, flower

## CHANGE IN THE LAKE AREA IN DRY STEPPE: CASE STUDY IN BUUNTSAGAAN LAKE

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**Abstract:** Lakes in areas with fragile and dry steppe ecosystem are of great ecological and climatic importance. Buuntsagaan Lake is chosen as a study area representing a dry steppe ecosystem in Mongolia, and it is the largest lake in the Valley of the Lakes between the Khangai and the Gobi-Altay Mountain Range. The purpose of the study is to estimate the lake surface area change of Buuntsagaan Lake between 1986 and 2022 and evaluate the affecting factors. In terms of the research methodology, Landsat satellite imageries were used for calculating the Normalized Difference Water Index for estimation of the water surface area of the Buuntsagaan Lake as well as the dynamic changes in lake evaporation were estimated based on Meyer's formula. Moreover, the lake shore measurements were made at a total of 74 points around Buuntsagaan Lake during the field trip in the summer of 2022, and the Kappa coefficient was used for statistical accuracy. As a result of the research, it is observed that the Buuntsagaan Lake area has decreased by 7.9% over the last 36 years, and the fluctuation of the average annual surface area change of the lake was around 0.34%. In addition, it is also revealed that the changes in lake surface area are mainly influenced by air temperature, maximum speed of the dominant wind, and discharge rate of the Baidrag River. Even though the lake's surface area was bigger in the years 1994 and 2000, continuous shrinkage is ongoing.

**Keywords:** Buuntsagaan Lake, Dry steppe, Evaporation, MNDWI

## IMPACT OF PERMAFROST THAW, PALSA DEGRADATION, AND NATURAL SUCCESSION ON GREENHOUSE GAS EXCHANGE

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**Abstract:** The current literature supports that abrupt permafrost thaw will lead to surface inundation and create anaerobic landscapes. This may increase the release of CO<sub>2</sub> but may at some stage dominantly release methane during the decomposition process. Over time, natural succession and vegetation growth may decrease methane release and increase net carbon uptake. We investigated how rapid permafrost thawing and subsequent natural succession over time affect greenhouse gas exchange (CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O). We used a natural gradient of permafrost thaw and natural succession in northern Norway and observed greenhouse gas exchange for 3 years. We show that abrupt permafrost thaw and land surface subsidence increase net annual carbon loss. Permafrost thaw accelerated CO<sub>2</sub> release greatly in thaw slumps (177.5 gCO<sub>2</sub> m<sup>-2</sup>) compared to intact permafrost peat plateau (59.0 gCO<sub>2</sub> m<sup>-2</sup>). During the growing season, peat plateau was a small sink of atmospheric CH<sub>4</sub> (-2.5 gCH<sub>4</sub> m<sup>-2</sup>), whereas permafrost thaw slumping and pond formation increased CH<sub>4</sub> release dramatically (ranging from 9.7 to 36.1 gCH<sub>4</sub> m<sup>-2</sup>). Furthermore, CH<sub>4</sub> release continues to increase even in natural succession likely due to aerenchyma transport of CH<sub>4</sub> from deeper soil. Beyond thermokarst formation, carbon uptake from the natural succession of vegetation, but we show that greenhouse gas emissions continue to increase beyond abrupt permafrost thaw event towards natural succession

**Keywords:** greenhouse gas exchange, palsa-mire, permafrost thaw, thermokarst, vegetation change

## FRONTIERS AND CHALLENGES OF FROZEN SOIL MONITORING IN MIDDLE AND HIGH LATITUDE REGIONS

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**Abstract:** With global warming and human impact, permafrost degradation has been taking place to varying degrees in the mid and high latitudes. The thickening of the active layer and surface deformation caused by the degradation of permafrost can exacerbate uneven settlement, and the reduction of permafrost area and the northward shift of the southern boundary can pose a threat to the survival of soil microorganisms and vegetation, and more. These freeze-thaw disasters caused by permafrost degradation pose a risk to the stability of the permafrost ecosystem and the safety of people's lives and property. Therefore, enhanced monitoring of permafrost degradation is of great scientific and applied importance for climate change adaptation and disaster prevention and mitigation. Therefore, strengthening the monitoring of permafrost degradation is of great scientific and applied importance for climate change adaptation and disaster prevention and mitigation. At present, remote sensing means have been widely used to monitor permafrost degradation in permafrost areas. Synthetic aperture radar interferometry (InSAR), as a new earth observation technique with the advantages of all-day, high accuracy, large range and fast speed, has gradually become an effective means to monitor permafrost degradation in permafrost areas. This paper introduces the research examples of InSAR technology in permafrost degradation monitoring, and presents the progress of permafrost degradation monitoring on the Mongolian Plateau, and analyses the trends and causes of permafrost degradation on the Mongolian Plateau. Finally, the paper focuses on the prospects and challenges for the development of InSAR technology in monitoring permafrost degradation and freeze-thaw hazards on the Mongolian Plateau.

**Keywords:** Permafrost, InSAR, active layer thickness simulation, deformation monitoring, Mongolian Plateau

## INCREASING PRECIPITATION PROMOTES VEGETATION GROWTH IN THE MONGOLIAN PLATEAU DURING 2001-2018

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**Abstract:** Climate warming largely promotes the vegetation growth in the temperature-limited ecosystems, while the warming-induced drought may inhibit vegetation growth in the arid and semi-arid regions, and it largely remains unknown about the effects of climate change on vegetation growth in the cold and Coordinated Degree Assessment, Transport Infrastructure Construction, Regional Economic-Socio-Ecological Development, Main Traffic Line in Mongolia arid regions. Here, we selected the Mongolian Plateau as study area to examine the vegetation growth during 2001-2018. We quantified the vegetation growth changes based on changes in gross primary productivity (GPP) and leaf area index (LAI) and their relationships to climate variables using correlation analysis, partial correlation analysis and multiple correlation analysis. The results showed that from 2001 to 2018 both GPP and LAI showed an increasing trend, with great heterogeneities among different areas and land cover types. The largest increase of GPP and LAI occurred in the northeast plateau with the land cover types of forest and cropland. The main driving factor of vegetation growth was precipitation, while temperature was significantly negatively correlated with vegetation growth. The CO<sub>2</sub> concentration had a significant impact on the GPP in farmland, and the increase of solar radiation had a significant impact on tundra. Our study highlights the importance of precipitation in regulating vegetation growth in the Mongolian Plateau, challenging the prevailing views that the temperature dominates the vegetation growth in the northern ecosystems.

**Keywords:** Carbon dioxide concentration, Climate change, Gross primary production, Leaf area index, Land cover type

## TEMPORAL AND SPATIAL PATTERNS OF CARBON EMISSIONS AND SEQUESTRATION IN ARID REGIONS OF NORTHWEST CHINA UNDER THE CARBON-NEUTRAL TARGET

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**Abstract:** Achieving net zero emissions of carbon dioxide (CO<sub>2</sub>) by the middle of the 21st century and keeping global temperature rise within 1.5°C is a common challenge for all countries in the world, as it is crucial for the sustainable development of human society. Against the backdrop of the urgent need to control CO<sub>2</sub> emissions without stagnating development, the study of spatio-temporal patterns and future trends of CO<sub>2</sub> emissions and absorption is crucial to the development of national emission reduction policies and global action to combat climate change.

Due to long-term mining and grazing, there is a serious imbalance between carbon emissions and carbon sequestration in the Northwest Arid Zone. Based on this, this study takes the Northwest Arid Zone, including the five provinces of Ningxia, Gansu, Qinghai, Inner Mongolia and Xinjiang, as an example, and balances historical emission data and future emission data projected by scenario analysis methods with the multi-model average historical and future NEP data from the Coupled Model Intercomparison Project (CMIP6). Considering the characteristics of sand control work carried out in the Northwest Arid Zone for many years, together with the carbon sequestration component of artificial sand control over the years, a systematic study of the spatial and temporal differences and future trends of carbon emissions and carbon sequestration in the Northwest Arid Zone from the perspective of carbon balance is conducted, aiming to provide a scientific basis for the dry zone provinces to formulate scientific carbon emission reduction countermeasures and green development pathways.

**Keywords:** Northwest Arid Zone, carbon balance, CMIP6



## HYDROLOGICAL RESPONSE OF THE BULGAN RIVER TO CLIMATE CHANGE IN THE SOUTHERN ALTAI MOUNTAINS

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**Abstract:** Rivers of the Altai Mountains are recharged primarily by meltwater from glaciers and snow (51-63%), followed by rainfall (3-17%) and groundwater (31-40%). Since accumulated snow, summer rainfall, and summer temperature significantly influence runoff variation in the Bulgan catchment, the +2.1°C temperature increase and 20% annual precipitation decrease from 1984 to 2015 resulted in a reduction of upstream river discharge in summer by 60%, but an increase in winter by 87%. Permafrost degradation might play a role in the increase in the winter baseflow since the glacierized area of the Bulgan catchment is only 0.13%. Changes in seasonal runoff and water balance of the Bulgan catchment in response to observed climate change were estimated by the rainfall-runoff HBV-Light model. Compared to the calibration period of 1985-2005, the simulated water balance of the Bulgan catchment in the validation period of 2006-2015 showed that river runoff declined by 17% and water storage decreased by 38% as a result of a decrease in total precipitation by 11% and an increase in potential evapotranspiration by 4%. Between 1985 and 2015, contributions of rain and snow to the annual runoff decreased by 36% and 51%, respectively. In contrast, glacier input to the annual runoff increased by 78% at  $p < 0.5$ . Compared to the reference period from 1985 to 2005, the temperature is projected to increase by +2.4°C (+2.9°C), and annual precipitation to increase by 13% (18%) under the RCP4.5 (RCP8.5) scenario from 2030 to 2050. Runoff is projected to increase in particular in spring (April and May) and even decrease in summer (June). An earlier snowmelt might make the intensified agriculture along the Bulgan River face water shortage during the growing season despite a projected precipitation increase in the 2040s.

**Keywords:** climate change, hydrological impacts, HBV-Light4.0, climate model projections

## HOW TO COPE WITH INCREASING IMPACT OF CLIMATE CHANGE ON PURSUING SUSTAINABLE DESERTIFICATION REVERSION IN HORQIN SANDY LAND, INNER-MONGOLIA OF CHINA

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**Abstract:** Climate change is an inevitable trend in the foreseeable future and the trend has heavily increased the difficulty to combat land degradation, manifested with growing vegetation frangibility, desiccated soil and reduction of water availability in Horqin Sandy Land. Based on the result of long-term monitoring and research in the changes of climate, vegetation, soil and water, a conceptual model is introduced to present the achievements and challenge in combating desertification in Horqin Sandy Land and provide a case for the regions alike.

Since 1955, China launched a great campaign against desertification and made a great progress, and desertified land area in Horqin Sandy Land changed from  $4.32 \times 10^4$  km<sup>2</sup> in 1949,  $6.1 \times 10^4$  km<sup>2</sup> in 1987 and to  $4.89 \times 10^4$  km<sup>2</sup> in 2019, while the annual income per capita increased from 180-200 RMB in 1988 to 12000 (about the average income per capita in northwest China) in 2020 RMB, mainly supported by the research-related poverty relief from Naiman Desertification Research Station, Chinese Ecosystems Research Network (CERN).

The above figures did not match the expectation of the locals, governments and researchers due to reduction of water availability, denoted with drying-up of lakes and rivers, decreasing underground water table, deteriorated plant health and soil desiccation. The underground water table decreased from 4.44 m in 1988 to about 14.0 m in 2020. Reduction of water availability come into an ever-growing threat to the campaign against desertification and sustainable development and we then re-emphasize the importance of sustainable desertification reversion substantially sustained by the research in plant adaptability for re-vegetation and water-saving irrigation of cropland and any other related water saving schedule.

**Keywords:** climate change, sustainable desertification reversion, Horqin Sandy Land

## CHEMICAL AND BIOLOGICAL WATER QUALITY ASSESSMENTS OF SELENGE RIVER BASIN IN MONGOLIA

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**Abstract:** Selenge River is a major tributary of Lake Baikal in Russia and more than half of it runs through Mongolian territory. There is a substantial impact on the Selenge River and its ecosystem as a result of anthropogenic activities including mining and irrigation. Therefore, monitoring water quality to control and assess the impacts is important. In this study, we evaluated the water quality of the Selenge River using the water quality index (WQI) and family biotic index (FBI), which are commonly used metrics to assess water quality. We obtained 10 years (May to September 2010-2019) of chemical data from the Central Laboratory of Environmental Monitoring and biological data (macroinvertebrate) from the Information and Research Institute of Meteorology, Hydrology, and Environment at 27 hydrological stations along the Selenge River. The FBI was calculated from macroinvertebrates identified at the family level and the WQI was calculated based on chemical parameters including pH, DO, BOD<sub>5</sub>, water temperature, sulfate, and phosphate. According to the result of the WQI, water quality condition was assessed as poor at hydrological stations including Tuul-Altanbulag (9.79), Khangal-Jargalant (6.76), and Sharyn River-Jimst (7.12). For FBI, water quality was assessed as excellent at most hydrologic stations and ranged between 2.17 and 5.12. The only hydrologic station consistently assessed as poor was Tuul – Altanbulag which ranged between 9.79 – 10.1. Among the hydrologic stations, Tuul-Altanbulag and Kharaa-Darkhan exhibited a high concentration of sulfate and phosphate, which could be due to their location nearby settlement areas and influenced by rapid urbanization, central wastewater treatment plant, and a high population.

**Keywords:** Selenge river, family biotic index, water quality index



**EST 2023**

**SUB-SESSION 3:**

**NATURAL RESOURCES AND  
UTILIZATION**

## ROLES OF CHITIN IN METAL RETENTION AND (PHOTOCHEMICAL, CATALYTIC) -ACTIVATION: GAINING ECOLOGICAL KNOWLEDGE, ENVIRONMENTAL MONITORING AND THE DECAYING PERMAFROST ISSUE

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**Abstract:** Chitin acts as an efficient sorbent for ions and complexes of various metals when  $\text{pH} \geq 3$ . It is applied either grafted to an inert support (glass or plastic ribbon) or as outer surface of living arthropods, their muscular activity hence contributing to element transport/-distribution in water. Whereas an equilibrium in adsorption amounts gets established at either side of some water-sediment interface this PF value does change when elements are made to reside in (uptake by organisms or precipitation, biomethylation) or be driven out (dissolution of insoluble salts by anion reduction or biomethylation) of the sediment, mostly due to biological activity. With a simple mathematical method available to predict what to expect if such processes do not take place, biological activity can be identified “looking” deep into the sediment. Once moisture regimes change to alter oxidation states and thus chitin adsorption properties of metals (thermokarst formation, or drought cracks admitting air oxygen), this allows to give an early assessment what might be ahead especially in Mongolia. Lab experiments also simulate active transport by aq. arthropods covered by chitin and its possible consequences for metal transport, microbiota activity. The method is cheap, fast and does not take digestion of samples.

**Keywords:** metal ion adsorption to chitin – dependence on embedding milieu – partition factors – detection of microbial activities which involve “uncommon” elements like Ni, Cd, LREEs, or V – metabolism-centered biomonitoring while avoiding uptake by and fractionation within some test organism – construction of working models (mathematical and technical) for element distribution in and among ecosystems

## LANDFORMS ASSOCIATED WITH EXCESS ICE OVER THE MARGINAL PERMAFROST, MONGOLIA



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**Abstract:** The excess ice occupies more volume than the total pore of the ground. We review our observational results regarding to land surface phenomena associated with excess ice in Mongolia.

We established pingo inventory covering Hovsgol to Hangai regions, from which pingo on continuous permafrost are mostly in mature stage and closed-system, while those of discontinuous are under degradation. InSAR analysis found consecutively uplifting grounds on former lakes and end of the alluvial fan, which is favorable hydro-geomorphological settings for developments of intrusive ground ice. Deep core sample analysis chronologically reconstructed formation of excess ice, Darhad depressions.

We evaluated decadal changes in the area and number of thermokarst lakes using satellite images of Corona, Landsat and ALOS. The lakes are expanding in the continuous permafrost, due to thawing near-surface ground ice, while they are declining in the discontinuous zones, owing to active layer thickening and subsequent ground aridification. Analysis of tritium and chlorofluorocarbons indicated that spring water at the thermokarst sites on the southern Hangai contained large amounts of ground ice-melt water.

Cold and arid climate settings of Mongolia are favorable for rock glacier developments. We identified total of 256 rock glaciers over the Altay Mountains. They occur between 2000 and 3600 m a.s.l., and the most frequently between 2800 and 2900 m a.s.l.

The dogholes are conically collapsed landform and extensive over high alluvial terraces of permafrost regions. Our preliminary field research in the Darhad depression showed that the dogholes occur polygonally with several to 10 m diameter, and near-surface sediments synclined under the collapsed landform. The dogholes is supposed to be originated from ice wedge, which was formed during wet period. Under the subsequent arid condition, the excess ice was lost due to sublimation. This story should be further supported by more intensive observation and analysis.

**Keywords:** excess ice, pingo, thermokarst, rock glacier, marginal permafrost



## EFFECTS OF NITROGEN AND PHOSPHORUS ADDITIONS ON THE NITROGEN CONTENT OF DIFFERENT PLANT FUNCTIONAL GROUPS IN THE INNER MONGOLIA TEMPERATE GRASSLANDS



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**Abstract:** The nitrogen (N) content of plant functional groups (PFGs) is vital to explain the nitrogen-induced biodiversity loss, and it is also an important parameter in in process models that simulated productivity, e.g., net primary productivity and gross primary productivity in Biome-BGC model. Considering the strong impacts of nitrogen availability and the regulation of phosphorus (P) limitation, we conducted a four-year manipulative experiment to clarify the responses of N content of PFGs to N and P additions (N addition: 10 and 40 g N m<sup>-2</sup> a<sup>-1</sup>, P addition: 5 and 10 g P m<sup>-2</sup> a<sup>-1</sup>) in a temperate steppe of the Inner Mongolia, China. Our results showed that: (1) N addition significantly increased the N content of the community and three PFGs. Grasses (10 g N m<sup>-2</sup> a<sup>-1</sup>) and shrubs (10 and 40 g N m<sup>-2</sup> a<sup>-1</sup>) had significantly higher N content than forbs with the same rate of N addition. There was no significant difference among different rates of N additions for same PFG. (2) P addition had no significant effects on N content of the community or the three PFGs. (3) Compared to N addition, the simultaneous additions of N and P significantly increased the N content of communities, grasses, and forbs, with larger increases observed at higher rates of N and P additions. (4) Compared to N addition, N and P additions significantly increased the P content but decreased the N/P ratios of the communities and the three PFGs, with the greatest increase in P content observed in grasses and forbs at the same rate of addition. Our findings have important implications for grassland management and provide a better understanding of how grassland ecosystems respond to global changes.

**Keywords:** plant nitrogen content, plant functional group, nitrogen and phosphorus addition, Inner Mongolia grassland

## CHEMICAL STUDY OF *ARTEMISIA SANTOLINIFOLA TURCZ. EX BESS* CULTIVATED IN THE FIELD

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**Abstract:** The content of macro, micro and ultra microelements of the *Artemisia santolinifola Turcz. ex Bess* collected during flowering from the Mongol-Altai mountain steppe of Mongolia was determined by X-ray fluorescence analysis.

1. *Artemisia santolinifola Turcz. ex Bess* in cultivated has a relatively high concentration of calcium oxide-19.64%, magnesium oxide-6.75%, silica oxide-6.06%, and phosphorus oxide-8.956%.

2. *Artemisia santolinifola Turcz. ex Bess* in cultivated contain mainly elements such as barium, copper, zinc, and strontium.

3. *Artemisia santolinifola Turcz. ex Bess* in cultivated elements such as zinc, arsenic, chromium, tin and lead did not exceed the standard amount [6].

**Keywords:** zinc, copper, lead, yttrium, vanadium, rubidi

## ASSESSMENT OF HUMAN ACTIVITIES AFFECTING TOURISM IN KHUGNU TARNA NATIONAL PARK

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**Abstract:** Assessment of the impact of human activities can be considered as a general method for the implementation of nature conservation measures at low cost, and it can be considered as the main measure to be followed in determining the carrying capacity of tourism. In this study, using GIS data, the impact of accumulation or human activity was calculated by 3 factors: density of roads, use of pastures by herdsmen, and density of tourist camps. The impact was divided into 4 categories: weak, moderate, strong, and very strong. Due to the impact of human activity in the tourism sector, 78.07 km<sup>2</sup> of the Khugnu Tarna National Park have been very strongly affected, 131.5 km<sup>2</sup> have been strongly affected, 237.6 km<sup>2</sup> have been moderately affected, and 430.4 km<sup>2</sup> have been weakly affected.

**Keywords:** Human activities, tourist camp density, impact of pasture, road network density



**EST 2023**

**SESSION 2**

**REGIONAL DEVELOPMENT AND  
ENVIRONMENTAL POLICY**

SUB-SESSION 1:

**ECONOMIC GEOGRAPHY AND  
SPATIAL DEVELOPMENT PLANNING**

## URBAN LAND USE CHANGE STUDY IN ULAANBAATAR CITY USING RS AND GIS



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**Abstract:** Mongolia, as many countries of the world, has problems associated with the rapid increases in urban population and expansion. In the Mongolian capital city of Ulaanbaatar, urbanization has become one of the country's most critical issues. Today, Ulaanbaatar accounts for more than 45 percent of the country's over 3 million inhabitants, with the city's total administrative area now 30 times larger than the original area it was built on. The foremost reason of urban sprawl in the country is mainly related with the rural to urban migration, because the cities have more improved living conditions, good infrastructure and improved educational, social, cultural, and health services. In addition, urban areas have more employment opportunities because of different on-going and newly development activities.

To analyze the rapid changes, prevent a city from unplanned activities, and conduct appropriate planning, urban planners and decision-makers need to regularly evaluate development and on-going procedures using updated urban planning maps. Such maps can easily be produced with the use of current very high resolution RS images having different spatial and spectral resolutions. Satellite RS has been widely used for urban study and change analysis. As the present RS technology, methods, and methodologies are so advanced, it is possible to extract different thematic information at various scales in a cost effective way and integrate the extracted information with other historical data sets and conduct superior analyses.

The aim of this study is to analyze the urban land use changes occurred in central part of Ulaanbaatar city using very high resolution satellite and GIS datasets. For the study, the changes that occurred in the Ikh toiruu area during the centralized economy were compared with the changes that occurred during the market economy. For the basic preparation of spatial and attribute databases, a 1:5000 scale topographic map of 2000 and historical description of the buildings have been used. To update the database of 2000 up to the present, multispectral and panchromatic bands of very high resolution Quickbird data of 2023 have been fused. The analysis was conducted using ArcGIS 10.2 and ENVI 5.2 systems and different techniques were applied.

**Keywords:** Ulaanbaatar city, urban land use, RS image, change study

## SIBERIA AS A UNIQUE REGION IN THE GEOGRAPHIC SPACE OF RUSSIA

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**Abstract:** In recent years, the geographic space has been significantly transformed. Siberia plays a special role in the Russian geospace as the largest landmass on Earth (4.4%). Its landscape is extremely diverse: tundra, steppes, coniferous forests, and mountain systems. Poor development and low population, combined with unique territorial and raw material resources, characterize Siberia. Lake Baikal, located here, is one of the most stunning sights in the world, called the “Pearl of Siberia”.

Siberia is rightfully the main “storage” of Russia’s natural resources, largely being already developed. Due to the high efficiency of their extraction, the industrial Siberian regions are in fact the largest or major donors to the country’s budget, and Siberia as a whole is financially self-sufficient.

The uniqueness of Siberia also lies in the fact that in recent decades it has formed the most important export flows and serves as the main production facility of the country, maintaining the relative stability of the entire national economy. At the same time, the resources and raw materials of the Siberian regions have not been sufficiently manifested in their financial, budgetary, and socio-economic well-being, resulting in a decent level and high quality of life for the population.

The population of Siberia is concentrated in the main settlement zone along the Trans-Siberian railway.

All cities with population exceeding one million and emerging agglomerations are concentrated here. The correct selection of regional policy priorities will determine the success of the development of the country and its participation in the global processes. One of main priorities should be realization and systematically use of the indisputable fact that Siberia is not only a resource “storage” of the country but also the most important material and production basis of the economy, the main territorial resource at the present time, and a reserve for the future.

**Keywords:** Siberia, geographical factors, regional policy, spatial development, priority tasks and solutions



## ECONOMIC VALUE OF RECREATIONAL ECOSYSTEM SERVICES OF THE DESERTIFICATION TERRITORIES IN MONGOLIA (FOR EXAMPLE ON THE MODEL TERRITORIES)



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**Abstract:** Transformation processes in the socio-economic sphere and profound transformations of social relations in Mongolia had a strong impact on almost all sectors of the economy, including tourism. In Mongolia, tourism has become one of the country's dynamically developing industries. The growth of tourist demand has led to the rapid development of tourism infrastructure in the first decade of the 21st century.

The growth of recreational loads (pressure) on natural complexes actualizes the need to improve the management of recreational nature management and its most important part, tourism, and requires the introduction of economic management methods. According to the Ministry of Environment and Tourism of Mongolia, 76.8% of the Mongolian territory is exposed to desertification due to natural causes, and to irresponsible mining and misuse of pastures. Therefore, the problem of assessing recreational ecosystem services becomes relevant, especially in the context of increased desertification processes.

Methodological approaches to the economic assessment of recreational ecosystem services in the desertification areas of Mongolia were developed by us. Ecosystem recreational services were estimated separately for aimags based on the method of transport and travel costs. The available statistical information and expert evaluation data were used in the calculations. The results obtained allow us to state that the intensification of desertification processes did not affect the dynamics of tourism development and desertification areas have a high recreational significance. Currently, desertification areas and the Gobi Desert have become an object of tourist interest. This is confirmed by the pace of development of the tourism industry and the growth in the volume of tourist flows.

In the future, the results of the economic assessment of recreational ecosystem services can serve as a basis for the introduction of economic management methods in recreational nature management. Based on the results of the economic assessment, it is possible to introduce a tourist tax or resort fee. The collected funds can be used for the improvement of territories, combating desertification, etc.

**Keywords:** tourism, recreational ecosystem services, method of transport and recreational costs, desertification territories

## A STUDY ON ECONOMIC IMPACT ASSESSMENT OF RECLAIMED WATER USE POLICY ON AGRICULTURAL PRODUCTION IN DRYLANDS

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**Abstract:** Reuse of treated sewage water is one of the solutions to the water shortage problem in dryland developing countries. In this study, we propose a method to analyze the regional economic effects of agricultural promotion policy with introducing reclaimed water in water shortage areas. Although input-output analysis is employed to grasp the economic ripple effect, we need to pay attention to the constraints on water as the input resource required for the ripple effect. Consequently, the model will be formulated as a linear programming with the input-output system as one of the constraints.

**Keywords:** drylands, reclaimed water, agriculture promotion policy, linear programming, input-output analysis

## SPATIAL PATTERN OF REGIONAL ECO-EFFICIENCY IN CHINA–MONGOLIA–RUSSIA ECONOMIC CORRIDOR

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**Abstract:** It is a significance for the region to realize the green sustainable development to Russia. In this paper, energy consumption and environmental undesirable outputs were taken as ecological environmental indicators into the input and output system of regional eco-efficiency in Russia, combining traditional indicators of economic efficiency to build Russia's eco-efficiency input output framework. By collecting period 2005-2019 data and using the SBM model, the eco-efficiency of provincial units in Russia were measured. Based on the panel Tobit analysis, we found that the relationship between per capita GDP and eco-efficiency was U-shaped and constrained by economic development. On the whole, economically developed regions may not have high eco-efficiency, such as the Northeast of China and European part of Russia. At the same time, even without a good economic foundation, the eco-economic system can be well operated. Such as the Arctic region of Russia, but because of its reasonable ecological economic input and output allocation, to achieve high operational efficiency. This study is expected to provide theoretical basis for China–Mongolia–Russia Economic Corridor green development.

**Keywords:** eco-efficiency, Spatial Pattern; SBM mode, China–Mongolia–Russia Economic Corridor

## SOCIO-ECONOMIC ASSESSMENT OF DAMAGE CAUSED BY FLUCTUATIONS IN THE LEVEL OF LAKE BAIKAL

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**Abstract:** Fluctuations in the level of Lake Baikal affect the shore area, causing processes of soil and vegetation cover degradation, structural changes in landscapes, and the loss of the unique natural properties of the shore as a whole. Significant fluctuations in water levels are both a factor in environmental and socio-economic risks, affecting the livelihoods of the population in shore areas. Losses and damages caused both by the influence of water and transformations of natural shore complexes are possible in the socio-economic system of the shore areas.

An analysis of the current natural and socio-economic situations in the adjacent territories revealed a set of possible consequences for the territory from the influence of fluctuations in the level of Lake Baikal. Losses of land and forest resources, a reduction in tourist and recreational activities, a change in the socio-economic infrastructure, and a decrease in the economic development of the shore areas as a whole are possible as a result of flooding and abrasion destruction of the shore

The paper presents a socio-economic assessment of damage in the case of possible flooding of shore areas due to the rise in the level of Lake Baikal, and some recommendations and suggestions are given to minimize the negative impact of the waters of Lake Baikal.

**Key words:** socio-economic damage, environmental consequences, flooding, recreational system

## MULTI-SCENARIO SIMULATION OF LAND USE AND CARBON STOCK ASSESSMENT IN HOHHOT CITY BASED ON PLUS MODEL AND INVEST MODEL

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**Abstract:** To predict the trend of land use type changes and assess the carbon stock of each land use type in the region under multiple scenarios development for coordinated and effective regulation within different regions. Based on the land use data of Hohhot in 2010 and 2020, this study uses the PLUS model and the InVEST model to predict the land use types and carbon stocks in Hohhot in 2030 under the scenarios of natural development, ecological protection, and economic construction. The results are as follows: 1) the main trends of land use types in Hohhot from 2000 to 2020 are the shift from Cultivated land, Grass, and Utilized land to Forest and Urban, 2) the carbon sequestration capacity decreases continuously from 2000 to 2020, and the carbon stock decreases year by year. During the past two decades, the carbon stock decreased by  $1.58 \times 10^6$  t. 3) The carbon stocks in Hohhot in 2000, 2010, and 2020 are  $149.01 \times 10^6$  t,  $148.33 \times 10^6$  t, and  $147.43 \times 10^6$  t. The highest carbon stock value in 2030 is 148.46 for the ecological conservation scenario. Changes in land use types will lead to changes in carbon stock values, and it is necessary to limit the conversion rate of various land use types to promote the high-quality development of Hohhot.

**Keywords:** Hohhot, land use type prediction, PLUS model, carbon stock

## EVALUATION OF NOVOSIBIRSK-KHOVD-URUMQI VERTICAL AXIS BY SWOT ANALYSIS AND DETERMINATION OF TRANSBORDER URBAN CLUSTERS TO DEVELOP ALONG THE AXIS



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**Abstract:** Mongolia is not only a landlocked country situated between China and Russia, but it also boasts the shortest route between Asia and Europe. The main bridge connecting any country is the axis of transport infrastructure, and the main economic activities such as tourism, foreign trade, exports, and imports are intensified through cities, border crossings, and free economic zones along this axis. The Novosibirsk-Khovd-Urumqi axis is one of the road corridors planned under the Russia-Mongolia-China /3 State/ Economic Corridor Program. It has the potential to serve as a sub-link of the Trans-Siberian Transport Corridor in the Russian Federation and as a main corridor of China's Belt and Road Initiative. Consequently, research has been conducted along this axis. Within the framework a SWOT analysis was conducted in the provinces along the axis, considering indicators such as geopolitical conditions, population changes, agglomeration, livestock development, agriculture development, industry development, transport logistics development, and tourism development. The SWOT analysis suggested that the positive effects of strengths and opportunities are stronger than the negative effects of weaknesses and threats. Although the axis is primarily based on the road network, the significant population growth in the major cities along the axis and the connection of large areas with high population density clearly demonstrate the potential for establishing transborder urban clusters along this axis. Within the framework of transborder clusters, the Ulgii-Gorno-Altaysk cluster obtained a score of 0.126, while the Khovd-Urumqi cluster received a score of 0.164 in the analytical hierarchy. These two transborder urban clusters, it is highly plausible to support population concentration along the Western Vertical Axis and expedite social and economic development.

**Keywords:** Transportation Vertical axis, SWOT analysis, Transborder urban cluster, Novosibirsk-Khovd-Urumqi axis, Regional cooperation, AHP analysis



## DEMOGRAPHIC POTENTIAL OF SIBERIAN AGGLOMERATIONS: INFLUENCE OF THE POPULATION DENSITY FACTOR

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**Abstract:** The main factors influencing the dynamics of the population of the Siberian agglomerations are considered on the example of the Krasnoyarsk and Irkutsk agglomerations. Low rates of development, population and socio-economic well-being of the peripheral regions of Siberia are the cause of unstable population dynamics and general depopulation. The main factor influencing the population dynamics is the natural movement processes and population migration. The contribution of migration to population growth is much higher than natural growth in all agglomeration areas. In the Siberian agglomerations the population is increasing, while there is a gradual natural decline in the population.

The population of the Krasnoyarsk and Irkutsk urban agglomerations is gradually increasing, while intra-agglomeration differentiation in terms of demographic potential is noted. In the core cities, the rates of reproduction processes and migration growth are declining. Stable population growth is typical for the nearest suburban area, which pulls the population from the center. Areas far from the center and satellite towns are exposed to negative demographic processes.

As a result of the analysis of statistical data on the dynamics and population density, the following general trends for the Siberian agglomerations were revealed: the irregular distribution of density directly affects the growth rate of the number of inhabitants by city districts. Urban districts have complex irregular population dynamics. In each individual city-center of agglomerations, the most attractive for residents is low and medium population density. The suburban areas of the Siberian agglomerations cities-centers are represented mainly by rural settlements and have different trends: the growth in the number of residents of urban and rural settlements in all cases is proportional to the population density. The dynamics of the population of satellite towns and townships of the Siberian agglomerations depends to a greater extent on the distance to the core city.

**Keywords:** Siberian agglomerations, Demographic potential, Population dynamics



**EST 2023**

SUB-SESSION 2:

CLIMATE RESILIENT DEVELOPMENT AND  
POLICY

## ESTABLISHMENT OF TRAN-EURASIA PERMAFROST OBSERVATION TRANSECT THROUGH RUSSIA, MONGOLIA, AND CHINA: FRAMEWORK AND DESIGN

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**Abstract:** Permafrost, as a major elements of cryosphere, is vulnerable to occurring climatic changes. The permafrost dynamics would exert significant impacts on the climate system, hydrological cycle, ecosystem, and engineering infrastructures. The in-situ observation of permafrost is of great importance to identify the influence of climate changes in cold regions. At present, there is still only a tran-continent permafrost observation transect in the world. The American permafrost scientists have established the tran-north American transect to monitor the ground temperatures, hydrothermal regimes within the active layer, meteorological and ecological variables since the late of 1870s. The obtained observation data supported the climatic, ecological, engineering, and sustainable development in cold regions especially in the Arctic regions. The archived permafrost observation datasets made great contributions to the policy-makers, as well as the climate research community. In this study, a permafrost observation transect is suggested to be established by way of the long-term efforts from Russian, Mongolian, and Chinese permafrost scientists. The established permafrost observation sites in those three countries will be connected. The transect includes both types of permafrost in the world: the latitude and altitude permafrost. The monitoring standards of permafrost and periglacial environment will be unified for the sake of comparing the responses of permafrost to climate changes and their impacts in high-latitude and high-altitude regions. The potential international collaboration projects will be explored by the permafrost research community all over the world. And new techniques including deep learning and UAV are suggested to be conducted during the establishment of this transect.

**Keywords:** Permafrost, Eurasia, Transect, Framework, Design

## PASTORALISM IN MONGOLIA AND CHALLENGES IN RANGELAND GOVERNANCE

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**Abstract:** Pastoralism performs a great role in nutritional, socio-economic and cultural needs of Mongolia. Recent global crises multiplied the importance of this land use type in terms of food security and reducing dependency on important produces. However, pastoralists faced a new challenge caused by both global environmental and economic changes. Despite their ability to easily adapt to climatic changes, it is increasingly affecting the lives and activities of the pastoralist both directly and indirectly. Economic and monetary policies also have direct implication on livelihood strategies of pastoralists in a country. This multifactorial process needs to be solved through strong governance shaped by national identity and values.

A variety of factors, including land conversion, privatization, economic priorities, and conservation ambitions, have all led to a reduction of pastoral land, and thus the declines in pastoralists' rights in recent years. On the other hand, increasing livestock is only a strategy to sustain livelihood for pastoralists, which results in a gradual increase in livestock number, and consequently escalated land degradation situation in a country due to overgrazing.

The different policies, including incentives to pastoralists and other economic instruments applied to Mongolia have been analyzed to identify their cons and pros to support sustainable rangeland management. The research results show that although different internationally agreed economic instruments are in place the initial outcomes are not met due to weak governance. The effect of incentives introduced to support agriculture commodity production led to imbalance in flock structure. Moreover, such incentives infringed interests of smallholders by creating socially marginalized pastoralists, especially in remote rural areas. Geographic distance is a major factor which determines inequality among pastoralists and in pastoralism as whole. The rangeland or pastoral governance should consider the geographical aspects of cause-effect chain in its policy development process, especially in land and natural resource management.

**Keywords:** Pastoralists, land tenure, land tenure, incentives, disincentives, communal practices

## CONTRIBUTION OF LAND USE AND LAND COVER CHANGE TO TERRESTRIAL CARBON CYCLE IN MONGOLIA PLATEAU

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**Abstract:** The Mongolian Plateau is located in the interior of Asia and belongs to the arid and semi-arid region. It is an important part of the temperate steppe in the Eurasia. The ecosystem is fragile and highly sensitive to climate change. Its terrestrial ecosystem plays an important role in the global carbon sink. The land use and land cover of the Mongolian Plateau are constantly changing with climate change. Studies have shown that the complex response of plant carbon sequestration and soil carbon emission on the Mongolian Plateau to climate change has affected the global carbon cycle in the 21st century. Therefore, exploring the change of carbon emissions caused by LUCC in the Mongolian Plateau and its impact on the regional carbon cycle is crucial for formulating a scientific and effective low-carbon land use plan and find the carbon sink potential of the terrestrial ecosystem in the Mongolian Plateau. Based on remote sensing, this study used the data of land cover, total ecosystem primary productivity (GPP) and net ecosystem productivity (NEP) in the Mongolian Plateau from 2000 to 2020, combined with literature review and field investigation to sort out the data of vegetation and soil organic carbon density of land use types. This paper quantitatively studied the effects of land cover change on carbon stocks of terrestrial ecosystems from 2000 to 2020, obtained the temporal and spatial changes of carbon sources and carbon sinks in the Mongolian Plateau, and evaluated the potential of carbon sinks in the Mongolian Plateau terrestrial ecosystems.

**Keywords:** land use and land cover, NEP, carbon sources, carbon sink, Mongolian Plateau

## THE IMPACT OF CLIMATE CHANGE ON ENVIRONMENTAL SUSTAINABILITY IN MONGOLIA

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**Abstract:** This review discusses current in change system and its impacts on natural environment and ecosystem services in Mongolia. Current climate change continues to accelerate in Mongolia with profound adverse consequences for natural environment of Mongolia. Temperature increase (2.46°C since the 1940s) in Mongolia is more rapid than in the rest of the world. Studies show that there are significant changes also in other climatic parameters and weather and climatic phenomena, especially extreme and hazardous events. Climate change combined with direct and indirect effects of human factors has led to significant changes in Mongolia's natural environment and ecosystems over the past forty years, resulting in degraded ecosystems, shortened water resources, depletion of biodiversity, degradation of soils and pastures, thawing glaciers and permafrost soils and intensification of desertification, and increasing of loss and damages caused by natural disasters. As a consequence of these changes, certain obstacles and challenges are beginning to appear in the environmental sustainability of the country.

**Keywords:** Environmental components, ecosystem; impacts of climate change, environmental sustainability



## RESEARCH ON LAND USE OPTIMIZATION BASED ON ECOSYSTEM SERVICES IN THE CHINA–MONGOLIA–RUSSIA ECONOMIC CORRIDOR

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**Abstract:** Based on the supply and demand relationship of ecosystem services and the relationship with land use, by constructing an ecological security pattern and identifying ecosystem service clusters, the main ecological sources and corridors of the research area were extracted, and different functional zones of land use entities were divided. Finally, a land use optimization model based on ecosystem services for cross-border land areas was proposed. Our results show that the supply and demand of ecosystem services in the China–Mongolia–Russia Economic Corridor (CMREC) were not consistently, spatially distributed. High supply areas decreased from east to west and from north to south, whereas high demand mainly occurred in highly urbanized areas. The supply and demand imbalance of ecosystem services affected the determination of ecological sources. A total of 55 ecological sources were identified (529,635.56 km<sup>2</sup>), mainly distributed in the east of the Northeast Plain, Far East, and around Lake Baikal, while there were no ecological sources in the southwest. Ecological vulnerability decreased from south to north. Mongolia (0.60) presented the highest average ecological resistance, followed by China (0.42) and Russia (0.38). According to the circuit theory, 87 ecological corridors (13,306.42 km) and 13 main ecological corridors (3302.50 km) can effectively connect the ecological resources of the CMREC. These sources and corridors are dominated by forests and grasslands. The results also suggest that the connectivity of ecological corridors among the three countries should be improved, ecological restoration in the southern part of the Mongolian Plateau should be emphasized, and the functional stability of the ecological shield areas should be ensured. We propose management guidelines for the optimization of regional ESPs and collaborative environmental governance of the CMREC.

**Keywords:** ecosystem service, ecological security patterns, China–Mongolia–Russia Economic Corridor

## ANALYZING ENVIRONMENTAL AND ECONOMIC VARIABLES OF CLIMATE CHANGE VULNERABILITY IN MONGOLIA

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**Abstract:** As a result of climatic variability and the impacts of climate change, in the last forty years, Mongolian ecosystems have been altered. Climate change has affected desertification, water supply and natural disasters. Mongolia's livestock sector is more vulnerable to climate change due to its high dependence on weather and climatic conditions. Based on a literature review of the climate change vulnerability studies conducted in Mongolia and around the world, 26 environmental, agricultural, social, and economic variables were previously determined. The purpose of this research is to analyze 13 environmental and economic variables including drought, dzud, aridity, vegetation change, desertification, pasture use, loans, savings, non-performing loans, index-based livestock insurance, health insurance, social insurance, and number of cooperative members in Khovd, Bayankhongor, Dundgovi prefectures at the soum level. Necessary meteorological, environmental, and statistical data were collected for 10-30 years depending on the availability. Different indexes representing above-mentioned variables were calculated and normalized. Research result shows that there are no clear increasing or decreasing trend in the drought-dzud index and the aridity index in most of the soums. As for the loans, savings, non-performing loans, indexed livestock insurance, and number of cooperative members, all of them have an increasing trend. These indexes varied greatly among different soums of the prefecture depending on their location, administrative role, climate zones etc. It is important to understand the relationship between different vulnerability variables in the future to accurately assess the vulnerability to climate change. This result is the base for conducting integrated climate change vulnerability/risk assessment, as well as understanding the cause of vulnerability in rural areas of Mongolia.

**Keywords:** climate change, vulnerability, variables



**EST 2023**

**SUB-SESSION 3:**

**TRANSFORMATION OF CITY AND  
ENVIRONMENTAL RELATIONS**

## GEOGRAPHIC CONDITIONS OF SUSTAINABLE DEVELOPMENT OF THE CITY OF ULAANBAATAR

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**Abstract:** The sustainable development of Ulaanbaatar is closely related to the solution of environmental problems caused by negative environmental impacts.

The methodology of an integrated approach, covering socio-economic, climatic, landscape-geochemical and water-ecological studies, made it possible to identify the heterogeneity of the suburbanized space, the risks of socio-demographic development, water supply, air pollution and soil cover, which have a serious impact on the social and economic development of the territory.

The process of expanding the suburban area of Ulaanbaatar, which is otherwise called “false urbanization”, differs from similar processes in the cities and agglomerations of Russia and Europe. The suburban yurt zones do not have a transport, social and engineering infrastructure.

The geographical features of the formation of atmospheric air quality in the surface layer are due to the combined effect of circulation processes, the influx of impurities, their dispersion, transformation and settling. In Ulaanbaatar and the adjacent territory, the main source of air and soil pollution are emissions from the heat and power complex operating on lignite and combustion products from stove heating in the yurt areas of the suburbs.

Important issues for Ulaanbaatar are the availability of water and the quality of water resources. In recent years, there has been a significant increase in water intake. The source of surface water resources is the Tuul River, which is used on a small scale for technical purposes and is characterized by poor water quality.

According to the soil contamination index, soils are characterized by low and medium levels of contamination.

The sustainable development of Ulaanbaatar and the surrounding area requires the development of a scheme for monitoring natural and anthropogenic changes, improving the protection system and optimizing the use of natural resources.

**Keywords:** sustainable development, urbanization, pollution, soil contamination, environmental monitoring

## A STUDY ON ROAD NETWORK DEVELOPMENT AND ENVIRONMENTAL LOAD REDUCTION IN DRYLANDS: MATHEMATICAL PROGRAMMING APPROACH

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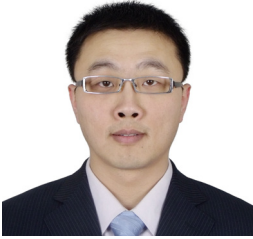
**Abstract:** In dryland developing countries such as Mongolia, inter-regional road network is not well developed, and vehicles run directly on the ground. For this reason, it is pointed out that the ruts of vehicles disturb the surrounding vegetation and adversely affect the environment and grassland ecosystem. In this study, a mathematical programming model is formulated to find efficient road development sections for movement between bases in the target area, and analyze how the environmental load is reduced by road construction.

**Keywords:** Drylands, Road Network, Environmental Load, Integer Programming

## VULNERABILITY ASSESSMENT AND OPTIMIZED COUNTERMEASURES FOR THE HUMAN-LAND COUPLING SYSTEM OF CHINA-MONGOLIA- RUSSIA CROSS-BORDER TRANSPORTATION CORRIDOR

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**Abstract:** In recent years, the conflicts of the human-land coupling system in the cross-border transportation corridor areas have become increasingly severe, especially in the China-Mongolia-Russia Cross-border Transportation Corridor. The vulnerability assessment for the human-land coupling system of China-Mongolia-Russia Cross-border Transportation Corridor is the key scientific problems for regional sustainable development. Based on the nearly 20 years scientific expediton, set the China-Mongolia-Russia Cross-border Transportation Corridor as the study area, we construct the vulnerability assessment index system and model for the human-land coupling system, quantitatively assessed the vulnerability of the human-land coupling system, revealed the key influencing factors, divided vulnerability risk prevention and control zones, and proposed the targeted optimization and control countermeasures for different risk zones. The research conclusion could provide scientific support for the ecological economic development of the human-land coupling system in the China-Mongolia-Russia cross-border transportation corridor, and provides reference for the sustainable development for the similar cross-border regions around the world.

**Keywords:** Vulnerability Assessment, Optimized Countermeasures, Ulnerability Risk Prevention and Control Zones, Human-land Coupling System, China-Mongolia-Russia Cross-border Transportation Corridor



## SPATIAL–TEMPORAL EVOLUTION AND IMPROVEMENT MEASURES OF EMBODIED CARBON EMISSIONS IN INTERPROVINCIAL TRADE FOR COAL ENERGY SUPPLY BASES: CASE STUDY OF ANHUI, CHINA

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**Abstract:** On account of the long-term dependence on energy trade and the phenomenon of embodied carbon emissions in interprovincial trade (ECEs-IPT), energy supply bases (ESBs) in the economic integration regions (EIRs) are under unprecedented dual pressure of achieving carbon emissions (CEs) reduction targets and ensuring security and stability of the energy supply. This problem has attracted more and more attention and research by experts and scholars. This paper took Anhui, the coal ESB of the Yangtze River Economic Belt (YREB), as an example and took the key stage of rapid development of regional economic integration (REI) and accelerated the realization of CEs reduction targets in YREB from 2007 to 2017 as the study period. From the perspectives of regions and industry sectors, we calculated the transfer amount of ECEs-IPT in Anhui among the YREB, analyzed the spatial–temporal evolution pattern of ECEs-IPT, and revealed the industrial characteristics of ECEs-IPT. Then, we classified the industry sectors and proposed the direction of industrial improvement measures. The results showed that, during the decade, the amount of provinces undertaking the net ECEs-IPT outflow from Anhui increased significantly and spatially expanded from only Jiangxi Province to almost all of the YREB. In addition, 39.77% of the net ECEs-IPT outflow of Anhui was concentrated in petroleum processing, coking, and nuclear fuel processing (RefPetraol), metal smelting and rolling processing (MetalSmelt), and electricity and heat production and supply (ElectpowerProd) that trade with Shanghai, Jiangsu, Zhejiang, and Jiangxi. The analytical model and results will provide a useful reference for the global similar coal ESBs, especially the coal ESBs within the EIRs, to formulate improvement measures for regions or even the world to ensure stability of the energy supply and achieve regional CEs reduction targets.

**Keywords:** regional economic integration (REI), embodied carbon emissions in interprovincial trade (ECEs-IPT), energy supply bases (ESBs); spatial–temporal evolution, improvement measures, Anhui

## COORDINATED DEGREE ASSESSMENT ON TRANSPORT INFRASTRUCTURE CONSTRUCTION WITH REGIONAL ECONOMIC-SOCIO- ECOLOGICAL DEVELOPMENT: A STUDY OF THE AREAS ALONG THE MAIN TRAFFIC LINE IN MONGOLIA

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**Abstract:** The China-Mongolia-Russia Economic Corridor is a priority area of the six major economic corridors planned by “the Belt and Road”. As a bridge connecting China and Russia, Mongolia’s transportation infrastructure construction (TIC) is the key issue to the transportation interconnection among China, Mongolia and Russia. However, the existing research is insufficient to support the actual construction needs. Therefore, this research set the regions along the main north-south traffic line of Mongolia as the study area. We established a regional economic-society-ecology-transportation assessment model (ESET model) to quantitatively assess the construction and development degree of the four subsystems. The results showed that from 2005 to 2015, the development level of the ESET systems gradually increased. The coordination degree between TIC and ESE development has been continuously improved, and most aims have been optimized as primary coordination. The research results will provide a decision-making basis for the TIC in the China-Mongolia-Russia Economic Corridor, as well as a scientific and technological support for the implementation of the “Belt and Road”.

**Keywords:** Coordinated Degree Assessment, Transport Infrastructure Construction, Regional Economic-Socio-Ecological Development, Main Traffic Line in Mongolia

## CARBON EMISSIONS OF CHINA TOURIST HOTELS BASED ON SUPPLY CHAIN

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**Abstract:** As one of the important sectors of tourism, the accommodation industry's carbon emission has become a hot research topic in emission reduction. This research constructs a research framework from the perspective of the supply chain and analyzes the carbon emissions of China's tourist hotels including the supply chain from 2002 to 2019. The research results show that: (1) The direct carbon emissions of Chinese tourist hotels are on the rise, while the indirect carbon emissions are on the decline. (2) The carbon emissions of most provinces in the west of the Huhanyong Line are on the rise, while the carbon emissions of most provinces in the east show an inverted U-shaped curve that rises first and then falls, which conforms to the environmental Kuznets curve. (3) There is the Engel coefficient effect in tourist hotels, and food manufacturing and tobacco processing industry are the main sources of indirect carbon emissions. (4) The indirect carbon emissions of the hotel are developing well, and it is expected to take the lead in decoupling hotels through indirect carbon emissions. This paper aims to provide scientific and technological tools and support for the precise management and regulation of the carbon peak of tourist hotels and provide a reference for the development of the hotel in China and similar countries with new economies.

**Keywords:** tourist hotels, carbon emissions, supply chain, input-output analysis, China

## CHANGES AND STATISTICAL ANALYSIS OF SOIL MOISTURE IN UVURKHANGAI PROVINCE IN 2015-2022

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**Abstract:** The Uvurkhangaï province has a combination of Gobi and steppes and has an extreme continental climate in terms of nature and climate. In the province, agriculture and pastoral care are very important and developed. The growth of crops and pasture plants will have a major impact on their development. Soil moisture is very important for the growth and development of crops and pasture plants. Soil moisture varies depending on soil structure, plant type and stage, and weather conditions, and varies greatly depending on timing and location. In this study, we used the EM-50 instrument values for soil moisture and soil temperature measurements in Uvurkhangaï province /Arvaikheer and Kharkhorin sum/, and the results calculated by the ERA-5 analysis method of the European Middle Range Center. When these results are compared, the values of automatic instrument measurements in April, May, and August of 2015-2022 in Kharkhorin Sum are greater than the results calculated by ERA5 analysis method at depths of 5 cm and 30 and 50 cm. On the other hand, the measured values of 10 and 20 cm depths had different values in each year. For other months, the EM-50 instrument values are close to the results calculated by the ERA-5 analysis method, but in some years the EM-50 instrument values are greater than the analysis method. However, the results calculated by ERA-5 analysis method in Arvaikheer sum are greater than the EM-50 automatic instrument measurement values in all months. As a result, changes in soil moisture are largely dependent on rainfall, groundwater levels, weather conditions, vegetation, and soil structure and properties. By determining the amount of soil moisture, it is possible to properly manage pastures and crops, determine and evaluate plant biomass, improve soil fertility, and increase yields.

**Keywords:** Soil moisture, temperature, agriculture and pastoral care, crops and pasture plants Uvurkhangaï



**EST 2023**

**SESSION 3**

**ENVIRONMENTAL TECHNOLOGY AND  
INNOVATION**

**SUB-SESSION 1:**

**NATURAL CONSERVATION  
TECHNOLOGY AND INNOVATION**

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## COMBATING AEOLIAN DESERTIFICATION IN NORTHERN OF CHINA

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**Abstract:** Aeolian desertification is land degradation through wind erosion mainly resulted from the excessive human activities in arid, semiarid and part of sub-humid regions in Northern China. To compare the analyses results of remote sensing data in late of 1950, 1975, 1987, 2000 and 2010, we can summarize that the development of aeolian desertified land in Northern China had being accelerated for 5 decades, as its annual expanded rate was 1,560 km<sup>2</sup> during late of 1950 and 1975, 2,100 km<sup>2</sup> between 1975 and 1988, 3,600 km<sup>2</sup> from 1988 to 2000 and -1375 km<sup>2</sup> from 2000 to 2010. The whole situation of desertification comes to be depraved before 2000 and to be improved after 2000. The human impact is much more active than natural one on the process of aeolian desertification which mainly incarnates on the changes of the land use fashion (from rangeland to farmland) and enhance of land use intensity (over-cultivation, overgrassing and over-fuelwood collection). The natural vegetation had been destroyed by the human activities that had accelerated to the development or/and control of aeolian desertification. China has made much progresses in understanding and combating aeolian desertification through many efforts for decades and there were many projects have been carried out. One of among them is the National Project of Grain for Green Program and more than 1000 counties in 22 provinces have been included into this project. The objective is to withdraw 3.67 million ha of dry land farming and degraded steppe, and 5.13 million ha of aeolian desertified land suited to reforestation and revegetation will be rehabilitated. There are about 8 million ha of lands under the threats of aeolian desertified land will be brought under control in the next ten years and 26.67 million ha of windbreaks will be planted. The total financial input is estimated to 75 billion Yuan (11 billion US\$) what is entirely from the central government.

**Keywords:** Aeolian Desertification, Land degradation, National policy



## XEROPHYTIC AND HALOPHYTIC SHRUBS AS THE MAIN BIOMATERIALS FOR PHYTOMELIORATIONAL RESOURCE-SAVING TECHNOLOGIES IN ARID LANDS

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**Abstract:** In recent years, the attention of scientists from the arid territories of the world, including countries from Central Asia, has been attracted by the problem of studying and developing halophytes and xerophytes in culture. Among the flora of the Gobi Desert, there are plant species that can function normally and reproduce on settled soils or irrigation with mineralized water. Currently, in world practice, there are two directions in the use of halophytes and xerophytes in agriculture: the first is the ecological restoration of degraded arid pasture lands without the use of irrigation. The second is the selection and selection of promising species of halophytes and xerophytes, the development of a technology for their cultivation for the production of high-protein energy-saturated feed. One of the main reasons for the low efficiency of forest nursery management is the insufficient supply of soils with mineral nutrition elements and, foremost, with humus. To develop and study the technology of obtaining a peat-free substrate with optimal agrochemical parameters for growing standard mycorrhizae planting biomaterial halophytes and xerophytes with a closed root system. For growing standard seedlings of halophyte and xerophyte plant species with a closed root system, the quality of the substrate is of great importance. Currently, almost all the substrates used are prepared on the basis of peat. The obtained substrates using organic ingredients are not inferior in physical-chemical properties to those obtained on the basis of peat. The use of the proposed peat-free substrates for growing coniferous seedlings with a closed root system will help to increase the yield of mycorrhiza standard planting material by optimizing the physical-chemical properties of the substrate.

**Keywords:** Xerophyte, halophyte, root systems, deflation, polymeric materials, reclamation technology, arid land

## RESEARCH ON NATURAL ROADS EXTRACTION IN ARID AND SEMIARID REGIONS OF THE SOUTH MONGOLIAN PLATEAU

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**Abstract:** The vast arid and semi-arid areas of the Mongolian Plateau have a large number of unplanned natural roads, which are also called temporary roads and Off-roads. Such roads are caused by the arbitrary running over of vehicles. Therefore, they will have a certain impact on the surface ecology and stability, aggravating land degradation in arid and semi-arid areas. However, natural roads are easily overlooked as one of the human factors affecting land degradation. Road information extraction refers to the use of relevant data and methods to extract information on a road, such as lane center line, boundary line and number of lanes. This paper takes natural roads as the main extraction target, and uses an object-oriented method to extract road information in the study area based on chinese domestic high-resolution images (GF-1). To understand more topographic information of objects, semantic segmentation is widely applied to remote sensing images and contributes to land cover mapping, disaster prediction, urban planning and so on. This paper uses PaddleSeg structure provided by Baidu company for semantic segmentation on GF-1 remote sensing images using fcn network combined with Resnet-50 network. Because south Mongolian Plateau road and Gobi present similar characteristics, the detection performance do not present deficient. The study shows that this method can automatically extract natural roads in the study area, which can provide a reference for extracting natural roads in larger arid and semi-arid regions such as the Mongolian Plateau. This study also can provide methods and data support for land degradation impact analysis in north area of China and the Mongolian Plateau ecological barrier area.

**Keywords:** Mongolian plateau, nature road, Off-road, road extraction

## SUSTAINABLE LAND MANAGEMENT MODEL IN SANDY LAND - A CASE STUDY OF IMMIGRATION AREA IN NORTHWEST CHINA

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**Abstract:** Large areas of sandy land are distributed in Northern China. With the increase in population and economic development, the rational development and utilization of sandy land has become an important issue for regional sustainable development. The sustainable management and utilization of sandy land faces difficulties such as drought, water scarcity, environmental fragility, and poverty of residents. Previous research has shown that the livelihoods of residents in sandy areas are heavily dependent on the use of water and soil resources. However, unreasonable utilization of sandy land such as land reclamation and excessive extraction of groundwater can lead to vegetation degradation and desertification. In order to achieve sustainable utilization and management of sandy land, it is necessary to find a way to enable local residents to obtain sufficient benefits to sustain their livelihoods while protecting and utilizing sandy land. This study focuses on the immigration area on the edge of the Tengger Desert in Northwest China. Greenhouses were established on sandy land and a high-value edible mushroom, the morel, was grown in planting experiments. The results showed that planting morels had a significant effect on improving the organic matter in sandy soil and the water consumption during cultivation was only one-sixth of that of corn. Planting morels resulted in seven times higher economic benefits for farmers than planting corn. This land management method effectively aligns the multiple goals of sandy soil improvement, ecological environment improvement, and income increase for residents, achieving sustainable land management of sandy land.

**Keywords:** Sustainable land management, immigration area, high-value edible mushroom

## RECOGNITION AND CLASSIFICATION OF FORAGE SPECIES IN MONGOLIAN PLATEAU BASED ON UAV HYPERSPECTRUM

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**Abstract:** The Mongolian Plateau is located across China's Inner Mongolia, Mongolia and Russia. It is not only an ecological barrier, but also an important base for grazing. Previous satellite based studies showed that the vegetation coverage of Mongolian Plateau showed an increasing trend, but there were few studies on forage yield. Therefore, identifying forage can provide a basis for forage yield research. This research takes the Mongolian Plateau as the research object, and uses the hyperspectral instrument carried by the UAV to obtain the hyperspectral images of forage under the visible near-infrared spectrum with the spectral range of 400nm-1000nm. First, use ENVI to extract the region of interest (ROI) from the spectral data, and use multivariate scattering correction (MSC), normalization, and standardization (SNV) to preprocess the selected data, so as to eliminate the scattering effect. Secondly, the selected data is dimensionally reduced, and the preprocessed and dimensionally reduced data is used as input for classification. The optimal classification method is selected using neural networks (BP) and support vector machines (SVM).

**Keywords:** Mongolian Plateau, UAV hyperspectral, forage recognition



**EST 2023**

**SUB-SESSION 2:**

**ENVIRONMENTAL STUDIES USING  
GEO-INTELLIGENCE AND  
GEOSTATISTICS**

## ESTIMATION OF GRASSLAND BIOMASS IN EASTERN MONGOLIA USING RS-BASED VEGETATION INDICES

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**Abstract:** Grassland ecosystems are very sensitive to climate and temperature changes. Climate change impacts pose new threats on the grassland ecosystems and livelihoods of herders in Mongolia. In such ecosystems, the main climate change impacts can be decreasing plant species and pasture biomass; escalating pasture degradation; intensifying desertification processes; increases in harmful insects, locusts, and rodents; shortage of food abundance for livestock, and loss of biodiversity and rare species.

In Mongolia, grasslands have very high social, economic and cultural significances. In addition, they are the only shelter in Asia large enough to support universally significant wildlife, such as the Mongolian gazelle and many migratory birds that rely on these lands as a resting and refueling stop during their long migrations. Therefore, protecting Mongolia's vast grasslands has a vital importance. Recently, the status of grassland condition in Mongolia has been debated with different discussions, including various advanced methods for monitoring and evaluation of the carrying capacity and some other indicators.

The carrying capacity is an important factor that influences the human environment and sustainable development in grassland areas. One of the determinants of the carrying capacity is the AGB. The accurate and timely quantification of the AGB has a substantial role in helping planners achieve effective management practice, because rational usage of grassland resource is vitally important for the nation's economy.

In this study, we compared the results of biomass estimation in eastern grassland area of Mongolia using the SVM and RF methods. As data sources, visible and near infrared (NIR) bands of georeferenced (WGS84/UTM system) MODIS data acquired in August of 2016, and field-measured biomass sample values have been selected. Of the compared two techniques, performance of the SVM method was worse than the RF technique.

**Keywords:** Eastern grassland area, biomass, MODIS data, vegetation indices



## AN ADAPTIVE DATA CORRECTION METHOD FOR SOIL HEAVY METAL DETECTION EQUIPMENT

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**Abstract:** Data correction is the key to solve the detection accuracy of soil heavy metal mobile detection equipment. The general optimization scheme of data correction can solve the optimization efficiency and cost reduction of equipment, which is conducive to the rapid transformation and promotion of equipment. Aiming at the defect that soil heavy metal on-site detection equipment cannot dynamically select and adapt corresponding calibration methods and combinations according to its spectral characteristics, and solve the problems of low adaptability, high cost, and long cycle in calibration development, a rapid on-site soil heavy metal detection equipment is proposed. An adaptive correction method and system to improve the on-site detection accuracy. The obtained soil heavy metal original spectrum is used as the main analysis object, and the method of software correction is used to optimize and reorganize the common methods or models in the heavy metal spectrum analysis process to form a set of process methods and systems.

The self-adaptive correction method and system reduce the development engineering quantity, and the equipment modification cost is low. Each device can dynamically adapt to different calibration methods and systems according to the spectral characteristics under certain parameters. Improve the problem of calibration without soil pretreatment, and reduce the situation that users need to repeat experiments to determine the quantitative measurement deviation under the conditions of no soil pretreatment, different soil types, soil particle sizes, soil moisture content, soil concentration gradients, etc. . The on-site detection equipment uses a variety of pretreatment correction methods, magnification correction methods, peak position correction methods, and soil auxiliary factor correction for correction processing during spectral processing, and uses the correction evaluation error to optimize the combination of various methods according to the soil sample conditions. A good correction to the raw spectrum is achieved.

**Keywords:** adaptive correction spectral correction heavy metals in soil spectral processing

## MICRO-TOPOGRAPHY DOMINATED MICROHABITAT SIGNIFICANTLY INFLUENCES COLONIZATION AND DEVELOPMENT OF INCUBATED-CYANOBACTERIA BIOCRUSTS IN A HARSH SANDY DESERT ENVIRONMENT



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**Abstract:** Incubated biocrusts is a promising biotechnology for restoring biocrusts and for improving soil health in dryland environments. However, it is challenging to use this method to restore biocrusts on a large-scale, because sand dunes have a complex morphology, and the angle of their varying slopes can expose biocrusts to wind speeds that delay or even prevent their development. In this study, we investigated how micro-topography, i.e. steepness of a sand dune's slope, affects cyanobacteria communities that incubate and restore biocrusts. We covered four different portions of a sand dune (which ranged between 2.3° to 31.3° of slope) with fine-soil substrate in the Tengger Desert, China, and then measured the cyanobacteria's colonization, development, and composition over three years as they formed biocrusts. The cyanobacteria successfully formed biocrusts on all sand dune slopes, and the greatest coverage (36.40%), thickness (2.70 mm), biomass (22.38  $\mu\text{g cm}^{-2}$ ), and exopolysaccharide content (EPS, 306.49  $\mu\text{g cm}^{-2}$ ) occurred at the lowest degree of slope (2.3°-5.6°, dune-lowland), whereas the minimum coverage (4.90%), thickness (1.62 mm), biomass (8.45  $\mu\text{g cm}^{-2}$ ), and EPS (160.89  $\mu\text{g cm}^{-2}$ ) occurred at the steepest degree of slope (25.3°-31.3°, dune-crest). These plots involved 20 genera of cyanobacteria, and Phormidium was the dominant genus, occupying more than 65% of the species composition across all slope treatments. The steepness of a sand dune significantly and negatively influenced the biocrusts' coverage, thickness, chlorophyll a, and EPS ( $p < 0.05$ ). Steepness was also negatively related to Phormidium ( $p < 0.05$ ), but positively related to Crinalium, Sericytochromatia ( $p < 0.05$ ), Chloroplast, and CENA359 ( $p < 0.10$ ) genera. Our study demonstrated that covering sand with a fine-soil substrate can lead to the successful incubation of biocrusts. Further, the importance of the degree of sand dune slope demands further study to ensure maximum biocrusts restoration at a large scale. It will also be necessary to use a variety of cyanobacteria species in these future studies to achieve a broader knowledge of community functionality.

**Keywords:** Cyanobacteria, incubated biocrusts, slope angle, fine-soil substrates, Tengger Desert

## INTERACTION OF CLIMATE CHANGE AND ANTHROPOGENIC ACTIVITY ON THE SPATIOTEMPORAL CHANGES OF SURFACE WATER AREA IN HORQIN SANDY LAND, CHINA.

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**Abstract:** Horqin Sandy Land (HQSL), a typical part of the fragile region for intensive interaction of climate and land use change in northern China. In recent decades, surface water has drastically decreased in the region. Thusly, we investigated the changes of spatiotemporal distribution and quantitatively analyzed the influence of climatic and anthropogenic factors on Surface Water Area (SWA) in HQSL. There are 5933 Landsat images used in this research, which were processed on the Google Earth Engine cloud platform to extract water bodies by vegetation index and water index method. The results revealed that the area and number of water bodies showed a significant decrease in HQSL from 1985 to 2020. Spatially, the SWA experienced different amplitudes of variation in the Animal Husbandry Dominated Region and in the Agriculture Dominated Region during two periods, and many water bodies even dried up and disappeared in HQSL. Hierarchical partitioning analysis showed that the SWA of both regions was primarily influenced by climatic factors during the pre-change period (1985–2000; the mutation occurred in 2000), and human activity has become more and more significantly important during the post-change period (2001–2020). Thus, it is predictable that SWA variation in the following decades will be influenced by the interaction of climate change and human activity, even more by the later in HQSL, and the social sectors have to improve their ability to adapt to climate change by modifying land use strategy and techniques toward the sustainable development of water resources, as well, the reserch provide a case study for similar regions around the world.

**Keywords:** surface water area, driving factor, spatiotemporal variation, Google Earth Engine, Horqin Sandy Land

## PRELIMINARY RESULTS OF ESTIMATING ERODIBILITY AND EROSIIVITY OVER THE LAKE VALLEY, MONGOLIA

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**Abstract:** Lake Valley is located in central Mongolia which is considered one of the regions where dust storms occur most frequently in Mongolia. We are planning to clarify both erodibility and erosivity in the valley. To accomplish this objective, we have started field observations of meteorology, soil thermal and moisture properties, and dust concentrations at two locations in the valley. In addition, we are estimating the spatio-temporal distribution of soil moisture employing a surface heat budget model, in which open-to-public satellite and meteorological data such as the Global change observation mission-C/Second generation global imager (GCOM-C/SGLI) and the SYNOP (Synoptic surface observation) are incorporated. Moreover, the meteorological conditions at times when dust storms occurred over the valley and the surroundings are being analyzed using an objective meteorological dataset of Japan Meteorological Agency, i.e. Global spectral model (GSM). The results of the above analyses will be validated using the observational data and the open-to-public data. Some preliminary results of this study have been obtained so far. One is that the threshold wind speeds as a function of soil moisture at multiple locations in Lake Valley and the surroundings are almost the same as in a previous study. No significant differences among the locations are confirmed. The other is that strong winds accompanying dust storms blow when a cold-air advection coming from the northwest side covers the valley. We will finally estimate erodibility and erosivity over Lake Valley comprehensively as a goal.

**Keywords:** dust storm; Lake Valley, thermal inertia-derived soil moisture, threshold wind speed

## SURFACE SUBSIDENCE MONITORING IN MINING AREAS BASED ON SBAS-INSAR TECHNOLOGY

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**Abstract:** Mongolia is rich in mineral resources and mining has contributed significantly to the country's economic development. However, continued mining activities have damaged the local ecological environment and caused many environmental problems such as land degradation, water pollution, vegetation degradation and surface subsidence. Surface subsidence poses a serious threat to mining production activities and can lead to geological disasters. Therefore, monitoring of surface subsidence in mining areas is essential for sustainable mining and the prevention of geological disasters. In recent years, with the continuous development of synthetic aperture radar, the time-series InSAR technology has been widely used in surface deformation monitoring with its advantages of low cost and high accuracy. In this paper, using 120 views of Sentinel-1A data from 2018 to 2022, the SBAS-InSAR-based method is used to monitor the surface subsidence at the Oyu Tolgoi mine and analyze its time-series changes. The results show that (1) the SBAS-InSAR time-series method is able to obtain sufficient monitoring objects in the surface deformation monitoring of the mine area, and detect the distribution of subsidence funnels and the extent of subsidence in the mine area more completely; (2) surface subsidence exists in the Oyu Tolgoi mine area between 2018 and 2022, with several more obvious subsidence funnels, and the maximum subsidence rate and cumulative subsidence can reach -158.11mm/year and 742.01mm. (3) Cross-validation using the PS-InSAR technique showed consistent deformation trends between the two, indicating reliable monitoring results.

**Keywords:** Surface subsidence, SBAS-InSAR, Oyu Tolgoi; Sentinel-1

## REVISITING VEGETATION ACTIVITY OF MONGOLIAN PLATEAU USING MULTIPLE REMOTE SENSING DATASETS

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**Abstract:** Global change in recent decades has caused severe degradation of grassland ecosystems in arid and semi-arid regions in the world. In the context of global change, the maximum gross primary production (GPPmax) and its response to drought on the Mongolian Plateau (MP) remain unclear. Here, we used long time-series datasets (temperature, precipitation, GPP) and calculated GPPmax, timing of GPPmax (TGM), and Standardized Precipitation Evapotranspiration Index (SPEI) to explore the changes in peak growth of vegetation and its response to drought on the MP from 1982 to 2018. Our results show that GPPmax and TGM presented high spatial heterogeneity. The mean GPPmax was  $336 \text{ g C}\cdot\text{m}^{-2}$  over the past three decades, with a decreasing trend at a rate of  $0.32 \text{ g C}\cdot\text{m}^{-2}\cdot\text{year}^{-1}$ , the mean TGM was on DOY (day of year) 197, with little year-to-year change, TGM received the time-lag effect (mostly 1, 2, 10 months in time scale) of drought was found in 35.3% of the MP, while the cumulative effect of drought on TGM occurred only 16.3% of the MP. These results reveal changes in vegetation growth peaks on the MP and their response to drought over three decades and can contribute to our understanding of the response and feedbacks of MP vegetation to global change.

**Keywords:** Maximum gross primary production (GPPmax), SPEI, GPP, Drought



## USING GOSAT SATELLITE DATA FOR INVESTIGATING THE VARIABILITY OF NEAR-SURFACE CO<sub>2</sub> AND RELATIONSHIP WITH NDVI OVER MONGOLIA

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**Abstract:** Near-surface concentrations of carbon dioxide (CO<sub>2</sub>) are highly dependent on vegetation cover. In this study, we investigate the spatiotemporal variability in near-surface CO<sub>2</sub> concentrations in Mongolia and their correlation with the normalized difference vegetation index (NDVI), a proxy for vegetation density, from 2010 to 2019. Initially, we validate the near-surface CO<sub>2</sub> datasets obtained from the Greenhouse Gases Observing Satellite (GOSAT) using ground-based CO<sub>2</sub> observations obtained from the World Data Center for Greenhouse Gases (WDCGG) to confirm their applicability. Then, we examine the relationship between CO<sub>2</sub> and MODIS NDVI in different climate zones based on the Kuppen-Geiger climate classification system, including arid desert climate (BWh), arid steppe climate (BSk), dry climate (Dw), and polar frost climate (ET). The results showed a steady increase in the spatiotemporal patterns of the annual mean near-surface CO<sub>2</sub> concentration in Mongolia, ranging from 389.48 ppmv in 2010 to 409.72 ppmv in 2019, with annual growth rates of 1.80 to 2.31 ppmv/year. Additionally, significant monthly and seasonal variations are observed in each climate zone. Summer CO<sub>2</sub> levels decreased with NDVI but increased in spring and autumn in all climate zones. Furthermore, we found that the correlation was weakest in summer within the arid desert vegetation in the BWh climate zone, and a weak correlation was observed in spring and autumn within the Dw climate zone. Understanding CO<sub>2</sub> concentrations in different climate zones and the uptake capacity of vegetation may help improve estimates of carbon sequestration in ecosystems such as deserts, steppes and forests

**Keywords:** GOSAT, NDVI, CO<sub>2</sub>, Mongolia, Climate zone

## CARBON MONOXIDE (CO) DISPERSION MAPPING FROM THE SENTINEL 5P DATA DURING THE WINTER TIME AND ITS EVALUATION WITH LUR MODEL

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**Abstract:** Recently, Air pollution originated from coal combustion in Ulaanbaatar city is becoming priority issue for citizens and many researchers are investigating its ingredient and impacts on citizens health. This study aims to map Carbon Monoxide (CO) dispersion from remote sensing data during the winter season and evaluate it with the Land Use Regression (LUR) model result. Also, fixed stations data from National Agency for Meteorological and Environmental Monitoring (NAMEM) were utilized as a reference data for remote sensing data and as a dependent variable for LUR model. Sentinel 5P CO data was correlated moderately-positive with fixed stations measurements ( $R=0.55$ ). And LUR model performance was relatively higher compared to Sentinel data or its determination coefficient  $R^2=0.71$ , Adjusted  $R^2=0.53$ , Root Mean Square Error (RMSE)= $0.84 \text{ mg/m}^3$  and Mean Absolute Error (MAE)= $0.7 \text{ mg/m}^3$ . These statistical evaluation coefficients are relatively lower than other same studies and authors explained it with a lack of reference data and satellite data spatial resolution in discussion part. Finally, these two result maps were compared and it has shown lower correlation-positive or  $R=0.44$ .

**Keywords:** Carbon Monoxide, Sentinel 5P, LUR model, Ulaanbaatar city

## EVALUATION OF BLACK SOIL RESOURCES UTILIZATION EFFICIENCY IN HEILONGJIANG PROVINCE BASED ON MRIO MODEL

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**Abstract:** As an important strategic arable land resource in China, black soil is facing serious degradation risks due to over-exploitation in recent years. Balance utilizing and protecting black soil has become an important strategic scientific issue. The current black soil resource utilization efficiency evaluation and improvement countermeasures research mostly focus on the direct value and utilization efficiency of black soil resources in one area and industry. The evaluation of the black soil resources total utilization efficiency is seriously lacking. Therefore, we take Heilongjiang as an example, and use the MRIO model and Ghosh model to evaluate the efficiency of the utilization of black soil resources in all regions of the country and various sectors of the national economy. The results show that the direct utilization intensity of black soil resources in Heilongjiang Province has changed from a growth period to a stable period, and the promotion potential is limited. It has formed a four-level circle pattern with Beijing, Tianjin, and Hebei as the core. The total utilization efficiency of black soil resources is nearly 5 times its direct utilization efficiency. Therefore, we put forward the following suggestions: in-depth research on the internal mechanism of black soil resource utilization and supply efficiency should be strengthened; realize the systematic and dynamic control of the development intensity of black soil resources; establish a cross-provincial, cross-departmental multi-policy joint coordination mechanism; effectively enhance the complete supply value of black land resource output, etc. The result has strong theoretical guidance and practical reference significance for making good use of black land strategic resources.

**Keywords:** Resource utilization efficiency, Ghosh input-output model, black soil resources, Heilongjiang Province

## PERFORMANCE EVALUATION OF PRINCIPAL COMPONENT ANALYSIS AND RANDOM FOREST ALGORITHMS FOR ESTIMATION OF ABOVEGROUND BIOMASS USING SENTINEL 1 DATA

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**Abstract:** A precise estimate of aboveground biomass (AGB) at multiple spatial and temporal scales is critical to mitigate climate change and optimizing forest management strategies. The aim of the present study is to investigate the potential of Synthetic Aperture Radar (SAR) data for reliable estimation and mapping of aboveground biomass using a Principal component analysis (PCA) and Random Forest (RF) algorithms. The study area is located around Khangal soum of Bulgan province. In this study, two different dual-polarization vegetation indices, VH and VV polarization channels derived from the 2018 Sentinel-1 radar data, were utilized. The coefficient of determination ( $R^2$ ), and root mean square error (RMSE) were used to evaluate the fit and accuracy of the model. The final analysis in this study for estimating and map aboveground biomass using a principal component analysis and random forest algorithm. The findings of this study provide valuable insights into the potential of SAR data for accurate AGB estimation, contributing to improved forest management and climate change mitigation efforts.

**Keywords:** Aboveground biomass, Random Forest, Principal component analysis, Polarization



**EST 2023**

**POSTER PRESENTATIONS**



**EST 2023**

**SESSION 1**

**ENVIRONMENTAL CHALLENGES AND  
CLIMATE CHANGE**

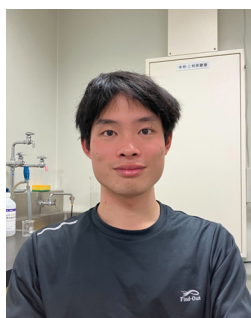
SUB-SESSION 1:

ENVIRONMENTAL COMPONENT  
DYNAMICS



## IDENTIFICATION OF SEASONAL WATER DISCHARGE CHARACTERISTICS USING STABLE ISOTOPES OF WATER IN THE MOUNTAIN REGION, JAPAN

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**Abstract:** Understanding water discharge processes in mountainous areas with large amounts of precipitation and high hydraulic gradients is important for disaster prevention and water resource management. In recent years, it has become clear that mountain bodies themselves have water storage functions in addition to primary water storage as snow accumulation in winter. However, the water discharge process in an environment with a large amount of precipitation throughout the year is not fully understood. This study focuses on mountain springs and rivers in the Japanese Northern Alps to clarify the characteristics of water discharge processes. Hydrological observations and analysis of oxygen and hydrogen stable isotope ratios revealed the following. Stream water level decreased in winter when snow cover was observed, and increased in summer when heavy precipitation frequently occurred. The stable isotope ratios of spring water and river water showed smaller fluctuations during the study period than those of precipitation. This may be because precipitation is not discharged quickly, but rather after storage and mixing. The d-excess increased to a similar value of winter precipitation in summer at the same time as the stream level rose. This suggests that a winter precipitation component with high d-excess contributes to the discharge in summer due to snowmelt. On the other hand, during winter, snow accumulation limits groundwater recharge by precipitation, and summer precipitation stored in the mountain could be discharged, resulting in lower d-excess value in springs and rivers.

**Keywords:** Mountain Region, Oxygen and hydrogen stable isotopes, Seasonal variation, Water discharge

## DISTRIBUTION OF SAPROXYLIC INSECT IN MONGOLIA

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**Abstract:** In the last 20 years, there has been no complete information on saproxylic insects in Mongolia. Based on the data of previous studies and own research on saproxylic beetles, I tried to determine the saproxylic species composition, regional distribution and their trophic guilds. A total of 211 species 116 genera, 23 family of xylophagous insects are distributed in different forest zones of Mongolia. Depending on the composition of forest type, forest region, altitude zone, and belt, the composition of saproxylic differs from one another. While Eastern (86 species) and Western Khentii (139 species) have the most species, Orkhon-Seleng pine forest district (22 species), and Mongolian Altai (23 species) have the fewest species. The highest species richness of bark beetles were found in the taiga and subtaiga forests of the Khentii and Khangai mountainous regions with an altitude of 800-1900 meters a.s.l. As for the host tree species, such trees as Siberian larch (59 species) and Scotch pine (62 species) contain more saproxylic insects, the majority of which are long horn beetles (Cerambycidae). Abundance of beetle communities were highest in burned mixed forests, but lowest in fire-affected larch forests. However, species richness and alpha diversity were high in burnt larch and mixed forests, and such species as *Phaenops guttulatus*, *Denticollis borealis*, *Stephanopachys linearis* Kug., 1792, *Boros schneideri* Panz., 1795, *Tetropium gracilicorne* Rtt., 1889 are being indicators of forest fires. In addition, Cerambycidae feed on all types of wood, while Buprestidae and Scolytidae feed mainly on coniferous trees and occur in small numbers on deciduous trees. According to their feeding host tree, 42.4% of all insects feed on 1, 31.1% on 2, 3.2% on 3, 6.6% on 4, and 0.6% on 6 species of tree.

**Keywords:** Saproxylic insects, distribution, host plant, habitat, Mongolia

## GREENHOUSE GAS (GHG) EMISSION IN PERMAFROST REGIONS OF WESTERN MONGOLIA: CASE AREA IN MUNKHKHAIRKHAN MOUNTAIN

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**Abstract:** Permafrost thaws accelerate the rates of carbon released by the soil into the atmosphere and cause significant positive climate-change feedback. We selected Munkhkhairkhan mountain as the study area. The main purpose of this study is to estimate the GHG emissions and to calculate the emission factor (EF) at study sites in Doloon Nuur and Shuurkhai of Munkhkhairkhan. This study is conducted in the summer of 2022, and carbon dioxide (CO<sub>2</sub>) emissions were measured using the EGM-4 instrument. Soil samples were collected from depths of 0-5 cm, 5-10 cm, and 10-15 cm at sites. We have determined soil organic carbon content (SOC) at peat and non-peat in both sites. According to the results, CO<sub>2</sub> fluxes ranged between 0.1 and 18.5 μmol/m<sup>2</sup> s<sup>-1</sup> in the Doloon Nuur and Shuurkhai. Furthermore, EF at all sites in Munkhkhairkhan mountain (±standard error) was 112.3 g [CO<sub>2</sub>] m<sup>-2</sup> yr<sup>-1</sup> (±18.2), 5.9 g [CH<sub>4</sub>] m<sup>-2</sup> yr<sup>-1</sup> (±1.0). The SOC contents were 10.5% in 0-5 cm, 14.2% in 5-10 cm, and 11.4% in 10-15 cm at the study sites in Shuurkhai. Whereas the SOC contents at the sites in Doloon Nuur range from 3.1% in 0-5 cm, 2.3% in 10-15 cm, and 1.7% in 10-15 cm. This study is conducted with a year measurement thus, further research should extend the time period and can be used as a baseline study.

**Keywords:** Greenhouse gas, emission factor, soil organic carbon, permafrost

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## A STUDY OF NON-EQUILIBRIUM RANGELAND ECOSYSTEM

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**Abstract:** Non-equilibrium rangeland ecosystem dynamics exist in drylands where a coefficient of variability of precipitation is more than 33% as a study showed in the African drylands. It means these rangeland's dynamics, particularly livestock dynamics, is governed by frequent droughts. Direct application of this statement in the Mongolian shows that the drylands of Mongolia with annual precipitation less than 175mm exhibit may have non-equilibrium dynamics. These areas include the Gobi and southern part of the dry steppe.

However, the Mongolian rangelands are affected by both droughts and zud, specially by a combination of them dry summer followed by zud in winter and early spring. Global warming and livestock increase beyond carrying capacity complicates rangeland conditions. Mongolia is one of the most vulnerable countries to climate change due to its geographical location, arid ecosystem, lifestyle of the population, and level of economic development. The structure of any rangeland ecosystem is functionally stable and dynamic within certain threshold values (intervals). Within the framework of this research, the study of rangeland dynamics that affect the equilibrium conditions of the rangeland ecosystem was carried out in the context of natural climate and disaster phenomena

## COMPARISON OF DUNE ACTIVITY AND DESERTIFICATION BETWEEN THE MOLTSOG ELS IN MONGOLIA AND THE UJIMQIN DUNE FIELD IN CHINA

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**Abstract:** In the context of global change, it is essential to study the impact of desertification on regional development. As the main appearance of Desertification process, the temporal changes of sand dune activities will help to systematically understand the occurrence, development and trend of Desertification so as to provide scientific basis for Desertification control. Although the Moltsoq Els in Mongolia and the Ujimqin dune Field in China are more similar in dune forms and physical conditions, the dune activities and desertification are obviously different. Based on the multi-source remote sensing data from 1985 to 2020 in both study areas, the spatial distributions and temporal changes of dune activities are compared, and the driven forces of desertification are analyzed using the local climate and socio-economic data in the same period. The results are indicated that (1) the dune activities and desertification in Ujimqin dune Field were more serious than those in Moltsoq Els, which had a high degree of fragmented bare sand patches with an expanding range over the last 30 years. (2) The dune activities in Ujimqin dune Field was mainly manifested in the formation and expansion of dune blowouts, which included the development of blowouts on the flat grassland influenced by human activities. (3) The desertification in Moltsoq is mainly driven by climatic factors, while that in Ujimqin is mainly affected by anthropogenic activities specifically by the high grazing intensity in late 20th century and increased mining in the first decade of the 21st century.

**Keywords:** Desertification, Dune Activity, Moltsoq Els, Ujimqin Dune Field, Anthropogenic Activities, Climate Change

## THE EFFECT OF ORGANIC AND INORGANIC MULCHING SOIL MOISTURE RETENTION (A CASE STUDY OF THE WOODEN PLANTS AREA IN A GREENHOUSE)

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**Abstract:** This study was conducted with the aim of comparing organic mulch and inorganic mulch for soil moisture protection, detecting how tree growth and soil moisture dynamics changes due to irrigation and air temperature, and then using the results for further research. In the study, measurements were made with a TDR 150 model data logger soil moisture meter. In the experiment, three types of trees were planted in two different soils. Four versions of organic and inorganic mulches were conducted with five replicates. Soil moisture measuring sensors were installed at depths 12 cm, measurements were taken every week (for two months). Compared to the control area, the average amount of total moisture at the depth of 12 cm of the soil is 2.58% of the sand mulch and 7.79% of the stone mulch and 18.05% of the leaf mulch and 10.98% of the straw mulch. According to our research, during the period of measurement, the organic mulch area was the area that retains moisture better for a long time by penetrating moisture to the soil 12 cm deep. Tree height growth was greater in the mulch area for a two-month period, which is 1-2 cm greater than in the control area. Mulching helps enhance water use efficiency by reducing evaporation and improving water retention in the root zone. With reduced water loss from the soil surface, more water is available for plant uptake. This can lead to significant water savings, particularly in areas with limited water resources or in drought-prone regions. Improved water use efficiency contributes to sustainable agriculture and conservation of water resources.

**Keywords:** Organic mulch, inorganic mulch, soil moisture



## ASSESSING GROUNDWATER SOURCES USING A WATER QUALITY INDEX: A CASE STUDY OF SONGINOKHAIRKHAN DISTRICT IN WESTERN PART ULAANBAATAR, MONGOLIA

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**Abstract:** The research was conducted at the Institute of Geography and Geoecology as part of the project work “Songinokhairkhan district drinking water quality research, conclusions, and recommendations. We collected 111 samples from deep and dug wells in 2020 to analyze anions, cations ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{HCO}_3^-$ ), and other pollution indicators.

In the studied groundwater samples, from this study area, in the case of major anions,  $\text{HCO}_3^-$  is predominant in most samples regards the anions, the first most prominent water types are  $\text{Ca-HCO}_3^-$  (70.3%), the second  $\text{Mg-HCO}_3^-$ ,  $\text{Mg-[Ca]-HCO}_3^-$  (15.3%), the third  $\text{Ca-Mixed}$ ,  $\text{Ca-[Na]-Mixed}$  (2.7%), the fourth  $\text{Ca-Cl}$  (0.9%) and groundwater was dominated by the mixed type of water. In the case of mineralization, about 0.9% of groundwater wells show very fresh, 75.7% fresh, 20.7% fresh, or relatively high mineralization and two samples are salty. Whereas, in the case of hardness, 15.3% soft, 53.2% slightly soft, 23.4% slightly hard, 3.6% hard, and 4.5% very hard. About 12.6% of samples were dominated by magnesium, and manganese concentrations exceeded drinking water standards in the 21 samples (18.9%) which is 1.1-3.16 times more than permissible according to drinking water MNS 0900:2018. This study showed that most groundwater in the Emeelt, Takhilt, Tolgoit, and Orbit areas is relatively hard.

The attention that, As, Sr, and U were found higher than the MNS0900:2018 standard limits in some groundwater. In other words, about 18% of groundwater does not meet the above standard in one or several parameters.

WQI indicated that groundwater samples are excellent (65.8 %), good (27%), poor (4.5%), very poor (1.8%), and 0.9% of the samples showed unsuitable for drinking purpose water (WQI >300).

**Keywords:** Songinokhairkhan, groundwater, water quality index

## ASSESSMENT OF HYDROCHEMICAL CHARACTERISTICS AND HEAVY METAL POLLUTION INDEX IN GROUNDWATER IN THE GORKHI-TERELJ OF NALAIKH DISTRICT, MONGOLIA

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**Abstract:** The study described in this article aimed to assess the hydrochemical characteristics and heavy metal pollution index of groundwater in the Gorkhi Terelj of Nalaikh district, located in the northeast part of Ulaanbaatar. In this study, 91 groundwater samples were collected in 2020. We determined physicochemical and microelement parameters in the selected wells and the results were compared with the Mongolian drinking water standard (MNS0900:2018) and WHO (2011). The predominant hydrochemical types of groundwater were Ca-HCO<sub>3</sub> (97.8%). In the case of mineralization, about 67% of groundwater wells show very fresh, 32.9% fresh. However, in the case of hardness, 47.2% is very soft, 35.1% soft, and 17.5% medium-hard. The levels of many microelements were found to be low. But some heavy metals were very high. The uranium concentration varied from 0.073 to 642 µg/L; it surpassed the WHO drinking water standard (30 µg/L) at 30.7% of sampling sites. The concentration of arsenic (As 0.19-49.5 µg/L) in 6 water samples was 1.45-4.95 times higher than the WHO and MNS0900:2018, molybdenum (Mo 0.2-77.5 µg/L) was 1.1 times higher in 1 sample, and manganese (Mn 6.0-1599 mg/l) was 1.1-15.9 times higher in 6 water samples. The groundwater quality was evaluated with a heavy metal pollution index (HPI). Calculation of the heavy metal pollution index (HPI) showed that 62.6% of the samples showed “very good”, “good” (19.7%; HPI 26.67-50.72), “poor” (7.69 %; HPI 52.19-74.81), “very poor” (1.09%; HPI 88.21), and 8.79% of the samples showed unsuitable for drinking purpose (HPI 110.4-304.9).

In the study area, naturally occurring arsenic and uranium in groundwater sometimes occur in concentrations exceeding the limits for potable water. We analyse water-rock interaction processes using the Gibbs diagram, the predominant samples fall in the water-rock interaction dominance field of the diagram.

**Keywords:** Hydrochemistry, mineralization, drinking water, fluoride, heavy metals, arsenic, and uranium

## THE EFFECT OF CULTIVATION ON LABILE FRACTIONS OF SOIL ORGANIC CARBON IN AGRICULTURAL SOIL

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**Abstract:** Labile fractions of soil organic carbon, including particulate organic carbon (POC) and mineral-associated carbon (MOC), are considered to be more sensitive indicators of agricultural sustainability and soil quality. Soil cultivation practices, can have significant impacts on the distribution, stability, and turnover of labile fractions of soil organic carbon. The study aims to compare and evaluate the effect of different cultivation practices on labile fractions of soil organic carbon. The soil samples were collected from a depth of 0-20 cm with four replications in five different cultivated fields, including in mechanical fallow (ME), chemical fallow (CH), mechanical-chemical fallow (MC), green manure (GR), non-rotation wheat (NW) along with a control field. The measurement of POC was conducted using the Gambardella & Elliot method, while the measurement of MOC was carried out using the Walkley and Black method. Results of study, it appears that the total soil organic carbon (SOC) content in the 0-20 cm soil layer was similar across the five different cultivated fields but differences observed in the content of labile fractions of soil organic carbon among these fields. The content of POC in the studied fields followed the order: NW > MC > CH > ME > GR. Additionally, the content of MOC followed the order: M > GR > CH > MC > NW. The results indicate that in the green manure (GR) fallow field, the POC content was 5.5 times higher than that of the non-rotation wheat (NW) field and 1.6 times higher than that in the control field. In conclusion, POC is a short-term indicator of soil organic carbon changes, specifically in response to the effects of soil cultivation. On the other hand, the MOC, which represents a more stable form of organic carbon, has a relatively stable contents in the cultivated fields, indicating that it is less affected by tillage practices.

**Keywords:** Particulate organic carbon, Mineral-associated carbon, Soil cultivation

## OBJECT-BASED CLASSIFICATION OF LAND COVER TYPES IN NORTHERN MONGOLIA

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**Abstract:** Accurate and up-to-date information on land cover is essential for effective land management and decision-making processes. Traditional pixel-based land cover classification methods have limitations in capturing spatial and contextual information necessary for precise land cover mapping. In recent years, object-based classification techniques have gained popularity due to their ability to incorporate both spectral and spatial information, thereby enhancing the accuracy and reliability of land cover classifications. The purpose of this research is to conduct a land cover mapping in Northern Mongolia using radar and optical images. As data sources, Sentinel-2a optical satellite data and Sentinel-1a radar images are used. To extract the land cover information, an object-based classification technique is applied and a rule base to separate the mixed classes is developed. The rule base uses a hierarchy of rules describing different conditions under which the actual classification has to be performed. Overall, the research indicates that the object-based method that uses a thoroughly defined segmentation and a well-constructed rule base can significantly improve the classification of land cover.

**Keywords:** Object-based classification, land cover, optical image, radar data

## USING GEO-SPATIAL ANALYSIS METHODS IN CROPLAND MONITORING STUDY (CASE STUDY IN DARHAN-UUL AND SELENGE PROVINCES)

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**Abstract:** The central agricultural region is considered to be relatively pleasant in terms of nature and climate of our country, and due to the use of land for multiple purposes, the ecological status of the land has been greatly changed. It is necessary to use many types of layered data and use many types of thematic image results in agricultural monitoring and research, which is a necessary land use. These data will be carried out by various branches of research, and the modeling of each data into a unified database with geographical connections will allow for integrated evaluation and thematic drawing, and the use of geo-spatial analysis decision-making system is required. The purpose of this work is to carry out agricultural land monitoring research using remote sensing methods and advanced technology, to develop a unified methodology, to enrich the data of the points of the monitoring network database, to create an interdisciplinary geo-database, and to develop recommendations for further measures to be taken. It will cover 304,000 hectares of 17 soums of Selenge province and 36,000 agricultural lands of 3 soums of Darkhan-Uul province.

A geodatabase was created for the monitoring survey of agricultural land, and a map and route for the field survey was prepared before starting the field survey. The database includes 21 sub-district boundaries, team boundaries and agricultural monitoring points, cadastral data of cultivated and agricultural land, agricultural soil data, satellite data and topography data.

**Keywords:** geospatial database, cropland, monitoring, SENTINEL-2, bare soil index

## VEGETATION COVER CHANGE DETECTION USING REMOTE SENSING IN GOVI-SUMBER PROVINCE, MONGOLIA

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**Abstract:** Desertification was determined as land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities, in other words, it is reduction in land productivity. Thus, vegetation cover and its dynamic, reflecting land productivity, can be accepted as an representation of land degradation and desertification. We aimed to reveal vegetation dynamics in Govi-sumber province, representing ecotone zone which is very susceptible to land degradation during 2010-2020 using remote sensing. We calculated Normalized Difference Vegetation Index using Landsat 7, 8 satellite imagery in order to expose vegetation change. Our results showed that vegetation cover tends to increase in recent year. Mean value of NDVI was 0.34 during 2010-2020. In prior year, sparsely vegetated area predominated throughout the territory, but it steadily declined by 2020. Conversely, densely vegetated area has gradually increased and there was not observed any change for 0-0.1, 0.3-0.4 and above 0.7, separately. Most change occurred at north part of the territory where distribute wet depressions. In this part, NDVI value have augmented in the recent years. However, there is recorded high change in southern and northwest, its NDVI value tended to decrease.

**Keywords:** desertification, digression species, ecotone zone, land degradation, NDVI



## VARIATIONS IN THE PEAK GROWING SEASON NDVI IN THE MONGOLIAN PERMAFROST ZONES

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**Abstract:** The main purpose of this study is to clarify the long-term changes in vegetation and the relationships between NDVI and climate parameters in three different areas in the permafrost zones of Mongolia. We selected a total of 135 study sites in Munkhkhairkhan, Ulaanbaatar, and Bayanzurkh in the permafrost zone which conducted field measurements of CO<sub>2</sub> in 2022. A total of 19 satellite images, with an interval of two years between 2010 and 2022, are used in this study. Landsat-5 TM and Landsat-8 and 9 (OLI/TIRS), and Sentinel-2A MSI satellite data cover less than 10% cloud free during the peak growing season in June, July, and August. The results indicated that correlations between total precipitation and mean NDVI in the summer season were significant for the Munkhkhairkhan ( $R = 0.48$  in total area,  $R = 0.43$  at peat sites), Ulaanbaatar ( $R = 0.30$  in total area,  $R = 0.26$  at peat sites), and Bayanzurkh ( $R = 0.50$  in total area,  $R = 0.39$  at peat sites) than spring season. The correlation between the mean annual air and NDVI was positive for Ulaanbaatar and Bayanzurkh, but negative correlation for Munkhkhairkhan. Moreover, the patterns of NDVI fluctuation, particularly for typical total area and peat sites, corresponded closely to that of precipitation in the summer season. In contrast, there were significant positive correlations between NDVI and total precipitation for all study areas. The impact on the climate of both same-time and lagged-time temperature and precipitation effects also varied strongly across biomes and months.

**Keywords:** NDVI, vegetation dynamics, peat, permafrost, climate parameters

## ASSESSMENT OF THE SENSITIVITY RISK OF LANDSCAPE (A CASE STUDY IN KHUVSGUL NATIONAL PARK)

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**Abstract:** Landscape sensitivity is a term stems from its use in landscape plan. In other words our current study is one of the most important studies in landscape planning and it can be understood as a strategic assessment of resilience to landscape development and land use change. The risk of landscape sensitivity is the impact of the external of assessment to regenerate naturally capabilities after exposure. Landsat 8 images in summer 2022 and SRTM DEM with a resolution of 30 meters have been utilized as fundamental data.

The result maps show and determine the characteristics of surface slope, rivers and TWI precipitation, soil type, vegetation cover, and soil stability sensitivity. In this research the spatial-decision making method AHP (in ArcMap 10.5) was applied for operations on samples, comparisons and cartographic representations of sensitivity indicators.

The landscape planning assessment was carried out by us is based on the landscape planning of Russia compiled by Russian Academy of Sciences Siberian branch V.B.Sochava Institute of Geography.

Landscape sensitivity risk is the main type of landscapes dynamics, as well as outside type and form depending on the characteristics. On the basis of the summarized scores of the sensitivity indicators, a scale of the landscape sensitivity was developed: 1 point – insensitive very weakly landscapes; 2 points – weakly sensitive; 3 points – moderate sensitive, 4 points – strong sensitive, 5 points – very strong sensitive landscapes. The study area, the maximum score of the proposed scale among the landscape types should not exceed 4 (*Out of 6 possible*).

**Keywords:** Environmental Management, Sensitivity Landscapes, Geomorphology, Gis, Landscape planning

## EFFECTS OF PRECIPITATION ON WATER-TABLE AT ARTIFICIAL-SAND-PADDY-FIELD IN HORQIN SAND LAND IN PAST 10 YEARS

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**Abstract:** The artificial-sand-paddy-field is a useful way of sand land to improve living standard and to erosion control for local people. Paddy field consume definitely more water than others, for, example, corn field (sandy cropland with irrigation) and millet / sorghum field (sandy cropland without irrigation). However, how does the artificial-sand-paddy-field effect on the water table at its site? The water table was monitored from 2015-2022. We want to answer this question.

**Keywords:** Horqin Sand Land, Water table, Precipitation, Artificial-sand-paddy-field, Aeolian erosion control, Sand-dune use way

## IMPACTS OF CLIMATE CHANGE AND HUMAN ACTIVITIES ON VEGETATION VARIATION IN SHARYN GOL RIVER BASIN

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**Abstract:** Sharyn Gol River Basin in the central region of Mongolia is one of the economically important areas for agriculture, animal husbandry, and mining. Due to its favorable natural condition and advantageous geographical location, the Sharyn Gol River Basin is under increased pressure from human activities. The aim of this study was to analyze spatial-temporal changes in vegetation and to determine the contributions of climate change and human activities to vegetation dynamics at the Sharyn Gol River Basin. We obtained 16 day-composite MODIS NDVI data set (MOD13Q1 product) acquired from the Land Processes Distribution Active Archive Center (LP DAAC) and ERA 5 reanalysis data (monthly average air temperature and monthly total precipitation) from the European Center for Medium Range Weather Forecasts (ECMWF) at spatial resolution of  $0.1^{\circ} \times 0.1^{\circ}$  lat/long. We used Sen's slope, Mann-Kendal test, Ordinary Least Square regression, and RESTREND method to detect spatial-temporal changes in vegetation during the period of 2000 to 2022 and assess the impacts of human activities and climate change on vegetation dynamics. We found that areas with significant ( $p < 0.05$ ) increases in NDVI trends accounted for 35.5% of the total study area. The areas that experienced significant ( $p < 0.05$ ) decreases in the NDVI trends occupied 1.06% of the total study area. The remaining areas exhibited insignificant increase and decrease in NDVI trends. The result of the RESTREND analysis indicated that the increasing trend in NDVI was generally driven by climate factors while decreasing trend in NDVI was likely driven by human activities.

**Keywords:** Human activities impact, residual analysis, Sharyn Gol River Basin, vegetation variation

## ASSESSMENT OF BASIC SOIL PROPERTIES AND CONTAMINATION STATUS IN THE URANIUM MINING REGION

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**Abstract:** This study aims to evaluate the fundamental soil conditions within the area designated for uranium mining using in situ leach technology with sulfuric acid in Ulaanbadrakh Soum, Dornogobi Province, Mongolia. In situ leach mining is defined as, the extraction of uranium from the host sandstone by chemical solutions and recovery of uranium at the surface. A total of 38 soil samples were collected from grid points located at 500-meter intervals within the study area. The collected soil samples underwent comprehensive analyses to determine their physical and chemical properties. To establish a baseline for comparison, the maximum allowable concentrations of soil pollutants, as defined by the Mongolian National Standard (MNS 5850:2019), were adopted as the soil standard, characterized by a loamy sandy texture. In addition to the characterization of soil properties, the Pollution Index (PI) and Pollution Load Index (PLI) were employed to assess soil contamination. The results indicate that the predominant soil texture in the study area is classified as loamy sand, with sand content ranging from 52.6% to 92.4%. Other parameters, such as pH, electrical conductivity (EC), available phosphorus (AP), available potassium, and gravel content, were determined to be within the ranges of 7.62-8.90, 0.050-4.44 dS cm<sup>-1</sup>, 0.21-5.40 mg 100<sup>-1</sup>, 7.5-27.1 mg 100<sup>-1</sup>, and 5.85%, respectively. Regarding heavy metal content, the study reveals relatively low concentrations, which do not exceed the permissible limits set by Mongolian national standards. Importantly, the soil samples do not exhibit any signs of technogenic pollution. Contrary to misinformation circulating among local communities, our findings indicate that the soil in the vicinity of the uranium mine is healthy and free from pollution. Therefore, it can be concluded that the current state of the soil does not pose a threat to the well-being of plants, animals, or humans.

**Keywords:** soil properties, contamination assessment, uranium mining, loamy sand, pollution index

## FISH COMMUNITY COMPOSITION OF THE SELENGE RIVER, MONGOLIA

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**Abstract:** Mongolian rivers and their fish communities have experienced negative impacts due to anthropogenic activities. Energy consumption is increasing year to year due to the socioeconomic development of Mongolia (70% of the total population and 90% of the industries in Mongolia are concentrated in Selenge River basin). Through the use of multiple sampling techniques, direct observation, and existing literature, we assessed the composition, relative abundance, and ecological attributes of fish in the Selenge River. Fish collections for this study were made at 7 separate sites, upper 2.5 km from the Eg-Selenge confluence in Eg River, and the lower section of the Eg-Selenge confluence to the lower section of the bridge in Zuunburen sum. The studies took place on September 14-30 in 2019. We collected 11 of the 26 known species in the Mongolian part of the Selenge River. In the lower section of the Eg-Selenge confluence, we failed to detect *Hucho taimen* indicating low populations for these species. However, the non-native *Parasilurus asotus*, was caught and recorded. In this site, *Lecuciscus baicalensis*, *Phoxinus phoxinus*, and *Brachymystax lenok* were in high abundance. Near the confluence of the Shuren river, *Rhynchocypris lagowskii*, and *Cobitis melanoleuca*, were in high abundance. However, *Lota lota*, *Perca fluviatilis*, *Rutilus rutilus*, and *Barbatula toni* were in low abundance. In the lower section of the Selenge River, we did not catch riophilias species such as sharp-snouted lenok, *Thymallus arcticus*, and burbot. At this site, *Lecuciscus baicalensis* and *Cobitis melanoleuca* were the most abundant. We compared the effectiveness of different sampling techniques (with electrofishing producing the highest number of species) and identified ecological attributes (trophic guild, preferred habitat) for resident fishes. The fish composition of the Selenge River is: 66.6% native species, 16.6% intentionally introduced species, 4.1% invasive species, and 12.5% accidentally introduced species. We found that fish assemblages of the Selenge River are structured primarily by habitat complexity, and have been altered during the past 60 years through multiple disturbances including fragmentation, siltation, and species introductions.

**Keywords:** Selenge river, fish community





**EST 2023**

**SUB-SESSION 2:**

**CLIMATE CHANGE IMPACT AND  
MONITORING**

## CHANGING SEASONAL TRANSITION OF SURFACE ENERGY BALANCE IN PERMAFROST LARCH FOREST

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**Abstract:** This study investigated interannual variability of surface energy balance with linkage to seasonal thaw/freeze of soil and plant phenology in the boreal larch forest based on field observation in the middle of the Lena River basin, eastern Siberia. The study forest located on continuous permafrost region experienced unusually wet climate years from 2005 to 2008 resulting in the decline and dieback of larch trees that compose the upper canopy. Our exploration focuses on the decadal variability of surface energy balance in this larch forest during and after the wet climate. Typical U-curve seasonal sequence of the Bowen ratio (ratio of sensible heat to latent heat flux) altered following these changes. Decrease of the Bowen ratio in spring started half a month early synchronizing with spring phenomena found in air temperature, snowmelt, leaf emergence, and start of the ecosystem scale CO<sub>2</sub> uptake. In contrast, the summer lowest Bowen ratio of around 1 was kept until late August during the wet years. This is particularly remarkable from wet years because of much soil water near the ground surface, which could support soil evaporation and transpiration of plants, and this effect was prolonged even after surface water disappeared probably because deeper soils were still wet. In contrast to the springtime, there was not found any temperature trend in the late summer to autumn, and effect of the surface wetness rather than changing plant phenology (e.g., seasonal dormancy) strongly controlled surface energy partitioning.

**Keywords:** evapotranspiration, soil water, plant phenology, land-atmosphere coupling

## PRELIMINARY RESULTS OF SOCIAL VARIABLES ANALYSIS OF RURAL POPULATION'S VULNERABILITY TO CLIMATE CHANGE

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**Abstract:** Mongolia is extremely vulnerable to climate change due to its geographical location, fragile ecosystem, and economic system dependent on nature and climate. Especially, rural people and herders in Mongolia are a social group that is very sensitive and vulnerable to climate change. The purpose of this research is to calculate and analyze the social variables at the soum level in Bayankhongor, Dundgovi and Khovd provinces. The main 8 variables that condition the social and economic vulnerability of rural people to climate change have been identified. The statistical indicators necessary to calculate the above variables at the level of Bayankhongor, Dundgovi and Khovd provinces were collected in a continuous series for the last 10 years, initial processing was done in MS Excel, and based on them, thematic pictures were created in ArcGIS, and by comparing with the provincial average, climate identified bullets that are more vulnerable to change. As a result of this research, the social variables of the vulnerability of rural people in Mongolia to climate change have been identified, the social variables of the vulnerability to climate change have been calculated using the statistical data of the last 10 years in Khovd, Dundgovi, Bayankhongor provinces at the soum level to determine the level of vulnerability at each soum. In the future, the research can be further explored by studying the interrelationships and correlations between social variables of vulnerability and vulnerability assessment. The results can be used for the implementation of climate change adaptation strategies at the local level, and the development of science-based policies can be supported.

**Keywords:** Climate change, Vulnerability, rural population, social variables and Mongolia

## RECOGNITION OF THAW SLUMPS BY MACHINE LEARNING-BASED REMOTE SENSING ANALYSIS

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**Abstract:** Thaw slumps are a slope failure phenomenon that result from the thawing of ice-rich permafrost, and the consequent landscape changes affect hydrological cycles and ecosystems by releasing frozen organic carbon and disrupting habitats. Permafrost on the Qinghai-Tibet Plateau (QTP) is suffering from thawing owing to anthropogenic climate change, which is causing thaw slumps to occur more frequently. Accurate recognition of thaw slump boundaries is fundamental to the analysis of the impact of thaw slumps on alpine ecosystems. Limited by the paucity of high-precision label data, there are uncertainties in the recognition of thaw slumps based on satellite remote sensing data. Here, we systematically evaluate the potential advantages and limitations of machine learning in the production of hot melt slip labels using centimetre-level unmanned aerial vehicle (UAV) data and ancillary datasets. We construct a multi-dimensional dataset including spectral bands, spectral indices, terrain factors and texture information based on UAV RGB data, and combine pixel-based and object-based machine learning algorithms (K-Means, ISODATA, DT, BPNN, SVM, RF) for thaw slumps recognition on the QTP to construct the optimal algorithm for generating label data. The results show that the construction of a multidimensional dataset improves the shortcomings of the lack of spectral information on UAV RGB data. In addition, the object-based technology reduces the “pretzel noise” in the classification results compared to the pixel-based, and improves the accuracy of thaw slumps recognition. Among various machine learning algorithms, the object-based SVM is the optimal algorithm for thaw slumps recognition on the QTP. The generation of high-precision thaw slumps label data could be used for deep learning-based regional-scale thaw slumps recognition, and then analyze its impact on surface hydrothermal regime, carbon exchange and ecological succession.

**Keywords:** thaw slumps, unmanned aerial vehicle, machine learning, object-based, pixel-based

## SNOW COVER CONTROLS SEASONALLY FROZEN GROUND REGIME ON THE SOUTHERN EDGE OF ALTAI MOUNTAINS

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**Abstract:** Snow cover and seasonally frozen ground (SFG) are the key cryospheric elements on the southern edge of Altai Mountains. Quantifying the thermal effect of snow cover on the frozen ground remains challenging. Utilizing the datasets observed at Koktokay Snow Station and by National Meteorological Stations of China Meteorological Administration (CMA), we evaluated the thermal effect of snow cover on SFG regime. The results indicated that the energy exchange between the ground and atmosphere was significantly insulated by snow cover, resulting in a considerable temperature offset between the snow surface and the ground below. This offset reached a maximum of 12.8°C for a snow depth of 50 cm, but decreased for snowpack depths of >70 cm, whereas the snow temperature lapse rate was systematically steeper in the upper snowpack than at depth. Snow cover was the dominating driver of inter-annual differences in the SFG regime, as represented by the annual maximum freezing depth and soil heat flux. The observed average soil heat loss rate increased from 2.68 to 5.86 W/m<sup>2</sup> on two occasions when the average snow depth decreased from 61.2 cm to 13.7 cm, resulting in an increase in maximum freezing depth of SFG from 69 cm to >250 cm soil depth. The results observed by CMA also demonstrate how snow cover controlled the SFG regime by warming the ground and inhibiting freezing of the soil column. Snow cover caused a 44.5-cm decline of annual maximum freezing depth during 1961-2015 period. SFG degradation between 1961 and 2015 was accompanied by increases in both air temperature and snow cover, with the former playing the dominant role. The correlation between snow cover and the ground-atmosphere temperature offset provides a new empirical method of evaluating the effective thermal effect of snow cover on SFG.

**Keywords:** Snow cover, Seasonally frozen ground (SFG), Thermal effect, Altai Mountains



**EST 2023**

**SUB-SESSION 3:**

**NATURAL RESOURCES AND  
UTILIZATION**



## THE GENOTOXIC ACTIVITY OF SOIL SAMPLES OF BAYAN-OVOO SUM, KHENTII, MONGOLIA

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**Abstract:** The genotoxicants are harmful for human healthy and biodiversity. Nowadays, most important problem is evaluated and estimated of harmful consequences of environmental chemical pollution. During the replication non-renewable (irreparable) damage of hereditary material is cause of mutant. In the body cell to begin the mutation be first stage of cancer and mutation in the genitals cell is increased hereditary and congenital defect, unexpected miscarry and infant mortality. Therefore, in the environment made accumulated chemical that through varies bio-test to study of mutagenic activity.

We were determined the genotoxic activity of soil samples from 6 sites of Bayan-ovoo sum, Khentii province by Ames test (*Ames, 1981*). We used the auxotroph mutant bacteria for the histidine (*Salmonella typhimurium* TA-100 /his G46, rfab, bio pkm 101/).

The results confirm that there was oppressed growth in *E. coli* mutation in the soil of Bayan-ovoo sum, Khentii province. Water suspension from soil petrol station were oppressed growth of *E. coli rec-*, and water suspension from soil food market was oppressed growth of *E. coli uvr-*. However organic suspension from soil Bayan-ovoo sum have not been influenced to have growth of *E. coli*.

Toxicities of the water and organic extracts from surface soil collected in Bayan-ovoo sum that were examined using *S. typhimurium* TA100. The water extract of soil of the petrol station (58.7%), organic extract of the petrol station (51.1%), street (55.2%) were high toxicity.

In our research result, all soil samples of the Bayan-ovoo sum showed no mutagenicity in *Salmonella typhimurium* TA100.

There was no correlation between bacterial contamination of soil samples and genotoxicity studies at all study sites.

The result of this study is the scientific justification for the conservation of Bayan-ovoo sum, Khentii province.

**Keywords:** soil, Bayan-ovoo sum, genotoxic activity

## CROP TYPE CLASSIFICATION USING THE GOOGLE EARTH ENGINE

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**Abstract:** It is essential to determine the various crops in order to monitor agricultural land that can produce food for the population. Determining the type of crops in the cultivated area not only depicts the distribution of the cultivated area and the percentage of different types of cropland, but it also serves as the basis for agricultural land use. Remote sensing technology is commonly used for this type of activity to identify crop type changes. The aim of this study is to investigate crop classification using the Google Earth Engine and compare the performance of random forest (RF) and maximum likelihood classification (MLC) approaches. As data sources, spectral data from field measurements and Sentinel-2A images acquired in 2022 over Jargalant Soum, Tov Province, Mongolia, are used. In this study, four spectral bands from the Sentinel-2 satellite are used for classification: near infrared, red, green, and blue. The crops were divided into 3 classes, such as potato, grain with irrigation, and grain without irrigation, based on the training samples, which were selected to have 100–150 signatures for each class. As seen from the results, the crop type classification using the RF had the highest overall accuracy of 70.16%. When the accuracy for each class was assessed, the classification accuracy of the random forest method was higher than that of MLC for all classes. Therefore, the machine learning approach can show higher accuracy for crop type classification. Comparing the classification results with land cadastral data from the land agency, in Jargalant soum of the Tuv aimag, the cropland with registered rights is 1961 parcels, or 55297.1 hectares, and the cropland without registered rights is 163 parcels, or 1696.3 hectares.

**Keywords:** Random forest, cropland, Sentinel -2A, Mongolia

## ESTIMATING ABOVE-GROUND BIOMASS OF THE PASTURE USING SENTINEL-2 DATA: A CASE STUDY IN BAYANDELGER SOUM, TUV PROVINCE

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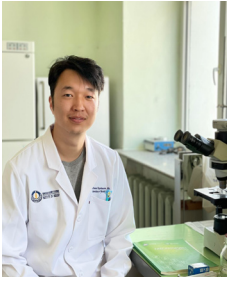
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**Abstract:** In this study, we aimed to estimate pasture biomass in Bayandelger soum of Tuv province, Mongolia. We used high-resolution Sentinel 2 data (10m), which was based on various vegetation indices including NDVI, DVI, RVI, OSAVI, TSAVI, SAVI, MSAVI, NDMI, Clgreen, WDRVI, LAI and EVI, and field biomass samples collected from 68 sites, to estimate the pasture biomass. We modeled the biomass estimation using two machine-learning models, Random Forest (RF) and Support Vector Regression (SVR), and compared the outcomes. According to the result, the SVM achieved the highest prediction accuracy ( $R^2 = 0.70$ , RMSE = 67.12 kg/ha) followed by the RF model ( $R^2 = 0.65$ , RMSE = 72.32 kg/ha) for the testing datasets. Both models estimated that the areas with less than 200 kg/ha biomass covered the smallest areas and accounted for 1.2-1.6% of the total area, whereas, areas with 200 – 300 kg/ha biomass accounted for the largest and ranged between 45.3-64.1%. For areas with 300 – 400 kg/ha and more than 400 kg/ha biomass accounted for 26.8-45.5% and 7.5-8%, respectively. Areas with less than 200 kg/ha biomass were found in the southern part of the soum and areas with more than 400 kg/ha occurred in the meadows, wetlands, river valleys, and forest of the central and northern parts of the soum. Estimating the above-ground biomass using spatial analysis with high accuracy can contribute to developing a management plan at pasturelands.

**Keywords:** Biomass, Random Forest, Support Vector Regression

## IDENTIFICATION AND ENZYMATIC ACTIVITIES OF PSYCHROPHILIC YEASTS ISOLATED FROM PERMAFROST SOIL

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**Abstract:** Psychrophilic yeasts with unique properties have recently become a new source of biologically active products. However, psychrophilic microorganisms, including yeasts that inhabit the permafrost of Mongolia, are practically unknown. Thus, this study was the first attempt to reveal living organisms hidden in permafrost of Mongolia, in particular yeasts, by isolating and identifying yeasts strains, investigating their physiological characteristics and ability to produce extracellular enzymes.

Twenty-one strains were isolated from soil samples collected from three different permafrost sites in Mongolia. Of these, 15 strains isolated at 0°C were identified by the sequences of the ITS region, and as a result, 9 strains were belonged to the genus of *Cryptococcus* and 6 to *Cystofilobasidium*, respectively. Testing the effect of temperature on the growth of all 21 strains showed that all of them were able to grow at 0°C, 4°C and 15°C, 8 strains were able to grow at 28°C, and none of them were able to grow at 37°C. Further, extracellular enzyme activities of all strains were determined and 14 strains exhibited cellulolytic, 10 strains proteolytic, 11 strains lipolytic, 2 strains amyolytic and 12 strains pectinolytic activity, respectively. These yeasts exhibited extracellular enzymatic activity at 0°C, 4°C, and 15°C, which indicates that they maintain an active metabolism under permafrost conditions, which is of great importance both for study of cold-adapted enzymes and microbial activity in degrading permafrost habitat.

**Keywords:** Permafrost, psychrophilic yeast, enzyme, *Cryptococcus* ssp, *Cystofilobasium* ssp

## ASSESSING GROUNDWATER QUALITY USING GIS NEAR ERDENET CU-MO MINING AREA

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**Abstract:** In this study, we aimed to assess the concentrations and spatial contributions of heavy metals (HMs) in groundwater near the Erdenet Cu-Mo mining area using Geographical Information System (GIS). Water samples were collected from the selected boreholes (15) and wells (7) between June to September 2021 and analyzed concentration of spatial contributions of heavy metals including cobalt (Co), manganese (Mn), strontium (Sr), cadmium (Cd), nickel (Ni), molybdenum (Mo), arsenic (As), uranium (U) in the groundwater. The concentrations of HMs near Erdenet Cu-Mo mining were determined by inductively coupled plasma mass spectrometry. The concentration was compared with Mongolian drinking water standard (MNS 0900:2018) and Maximum limit of substance contaminating the ground water (MNS 6148:2010). Kriging interpolation method of GIS was used to reveal the spatial distribution of HMs concentration.

According to the results, concentrations of the HMs were relatively different between sites. The most HMs occurred at acceptable levels and were below MNS 0900:2018. Among HMs, molybdenum (Mo) was the highest and it was 1210 µg/L. Also, mean concentrations of Mn (435 µg/L) and Mo (936 µg/L) were above the highest permissible values of the national standard. For the well water sites, mean concentration of the Sr (1520 µg/L), Cd (0.43 µg/L) and Ni (4.89 µg/L) were below the permissible value of the MNS 0900:2018. Noteworthy, well water had the minimum concentrations of As, Mn and Mo. The concentrations of Mn and Mo in borehole were more than maximum allowable limits of (MNS 6148:2010).

Hence, we conclude that the Cu-Mo Erdenet mining area is polluted by heavy metals and further assessment of the environmental status is necessary to evaluate ecological risk.

**Keywords:** Groundwater, Water samples, Boreholes, Ecological risk

## MULTI-SCALED OBSERVATIONS AND SIMULATION OF CARBON-WATER FLUXES IN GRAZING ECOSYSTEMS AND CLIMATE-SMART LIVESTOCK-FARMING MANAGEMENT

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**Abstract:** At present, the global climate drought intensifies, and the resilience of ecosystems is greatly affected. How to quantify the impact of grassland use management and climate change on grassland degradation, clarify the multi-scale carbon and water exchange mechanism of grassland ecosystem, and implement comprehensive management and control of sustainable animal husbandry development are the current challenges. In this study, advanced techniques such as satellite, space-earth remote sensing collaborative observation technology, micrometeorological flux observation and machine learning were used to establish a monitoring network for carbon and water flux in grazing ecosystems under different precipitation gradients, and the characteristics of grassland vegetation degradation and the exchange of water and heat in the climate gradient transversal grassland were defined. Through quantitative evaluation of the feedback effects of climate and grazing factors on grassland productivity and herders' income, the impacts of grazing activities and climate change on carbon and water cycle transformation were clearly pointed out, and climate-smart animal husbandry management, multi-scale monitoring and simulation prediction, and multi-objective climate-smart comprehensive regulation in grazing ecosystems were realized.

**Keywords:** Grassland grazing, carbon and water fluxes, multi-scale, climate intelligence, Livestock management



## EVALUATION OF PROVISIONAL, CULTURAL, AND SUPPORTING ECOSYSTEM SERVICES OF KHUKHMORIT SOUM

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**Abstract:** In this study, we aimed to determine types of ecosystem services of Khukhmorit soum that benefit locals both directly and indirectly, and evaluate the value of those ecosystem services. We identified key services based on Millennium Ecosystem Assessment (MA) categories. In addition, we attempted to estimate the lost opportunity cost using NDVI and sand fixation capacity of certain plants. Ecosystem services are divided into 4 groups: provisional, regulating, supporting, and cultural. As we identified, in Khukhmorit soum, provisional services include forage, timber and wood, and food services, regulating services include carbon sequestration, and supporting services include soil protection services provided by caraganas. However, in this study, we opt out regulating services due to lack of data and technical difficulty. We used market price method when evaluating provisional services, Willingness To Pay approach for the evaluation of cultural services value, and avoided cost approach for supporting services evaluation. As a result, the value of provisional services is 109 608 202 680 MNT, cultural services value is 846 762 367 MNT, and supporting services value is 8 309 369 894 MNT. In total, value of the direct and indirect ecosystem services is 118 764 334 941 MNT. This study will provide scientific basis for developing and proposing sustainable policy options for decision makers. Moreover, the results of this study will accelerate the effort made by local government and local people by highlighting the economic benefit they receive from the natural capital. As the area affected by desertification increases, the amount of economic benefit from ecosystem services will decrease.

**Keywords:** Avoided cost approach, Ecosystem services value, Market price method, Opportunity cost approach, Willingness To Pay

## NEURALIZATION OF COPPER AND ARSENIC POLLUTION BY *LYCIUM RUTHENICUM* MURR.

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**Abstract:** Industrial and mining wastes have caused heavy metal pollution in recent years and negatively affected the ecosystem and human health. This research aims to determine the ability to tolerate certain heavy metal pollution of *Lycium ruthenicum* Murr., which grows widely in Mongolia's Gobi and steppe regions. 30-day-old plants grown in vitro were transplanted to 1 mg/L kinetin and ½ MS medium containing different concentrations of copper and arsenic and cultured for 90 days at 25±2°C under 16 hours of light and 8 hours of darkness. The morphological characters and elemental concentrations were analyzed for 90-day-old plants grown with different concentrations of 0.3 mM, 0.4 mM, 0.5 mM, 0.6 mM of copper and 0.058 mM, 0.464 mM, and 0.928 mM of arsenic in vitro and compared with those of control plant grows without copper and arsenic. Results showed that some morphological parameters of *L. ruthenicum* grown in copper and arsenic-containing in vitro environments were statistically different ( $p < 0.05$ ) compared to control plants. For example, copper and arsenic concentration is negatively correlated to leaf width ( $r = -0.7$ ), leaf area ( $r = -0.5$ ), and leaf thickness ( $r = -0.8$ ). Copper and arsenic concentrations positively correlated to dry biomass ( $r = 0.5$ ) and height plant ( $r = 0.5$ ). The copper content of *L. ruthenicum* was 2.37 µg/g in control plants, 2.63 µg/g, 3.12 µg/g, and 2.64 µg/g in plants grown in vitro containing 0.4 mM, 0.5 mM, 0.6 mM copper, respectively. Arsenic content in *L. ruthenicum* was 0.29 µg/g in the control plant, while 0.94 µg/g, 10.2 µg/g and 7.93 µg/g for in vitro plants containing 0.058 mM, 0.464 mM, and 0.928 mM arsenic, respectively.

**Keywords:** heavy metal, copper, arsenic, pollution, tolerance

## PHYSIOLOGICAL AND BIOCHEMICAL RESPONSES OF *SPIRAEA MEDIA* F. SCHMIDT TO URBAN STRESS

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**Abstract:** Ulaanbaatar, the capital city of Mongolia, is subject to high air particular matter pollution episodes during winter and dust storm events in spring and autumn that severely impact the health of the exposed population. This study was performed around Ulaanbaatar in the summer of 2021. *Spiraea media* F. Schmidt's pollution tolerance in urban areas has been identified using physiological and biochemical parameters (water regime parameters, pigment content, ascorbic acid content, pH value). As a result, the pH of *S. media* was 5.2-5.7 in unpolluted (control) site and 4.84-5.83 in polluted (urban) sites. The average relative water content of *S. media* was the same (83%) for urban and control sites and is related to surviving and adapting to polluted stress areas. The pigments (chlorophyll *a*, chlorophyll *b*, total carotenoids) and water content (real and absolute) are higher in control (unpolluted) environment, while the water deficit and ascorbic acid are higher in contaminated environments. The chlorophyll content of *S. media* in polluted sites is lower by 4.14–37.8% monthly than in the unpolluted control site. The ascorbic acid content of *S. media* was 1.4-1.84 mg% in the unpolluted site and 2.22-2.63 mg% in the polluted site during the vegetation period, respectively. It indicates that ascorbic acid helps more than other parameters to adapt to urban environmental pollution. The results revealed that a single parameter is insufficient to determine plant's pollution tolerance. *S. media* is tolerant to pollution and can be planted in contaminated areas along urban roads.

**Keywords:** water content, chlorophyll, carotenoids, pH, ascorbic acid, pollution



**EST 2023**

**SESSION 2**

**REGIONAL DEVELOPMENT AND  
ENVIRONMENTAL POLICY**

SUB-SESSION 1:

**ECONOMIC GEOGRAPHY AND  
SPATIAL DEVELOPMENT PLANNING**

## STUDY ON COLLABORATIVELY INDUSTRIAL DEVELOPMENT IN BEIJING-TIANJIN-HEBEI URBAN AGGLOMERATION ORIENTATED THE CARBON PEAKING AND CARBON NEUTRALITY GOALS

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**Abstract:** With the global warming, the emissions of greenhouse gases such as carbon dioxide must be reduced to alleviate the climate crisis of mankind. In September 2020, China clearly proposed the goals of “carbon peaking” by 2030 and “carbon neutrality” by 2060. To achieve the goals under new development philosophy, China is implementing a series of plans for peaking carbon dioxide emissions in key areas and sectors as well as supporting measures.

Beijing-Tianjin-Hebei (called as Jing-Jin-Ji) Urban Agglomeration is one of the important economic regions in China with advanced industries and large population. Its overall carbon emission is in the forefront all over the country. Due to the internal differences of industrial structure and industrial development, the carbon emission in this region is extremely unbalanced. Based on the multi-regional input-output model, the paper firstly analyzed the economic and carbon emission linkages of different cities and different industries in Jing-Jin-Ji, and identified the key cities and industries that should be focused on regional carbon emission reduction. Secondly, based on industrial classification, the multi-objective optimization model was used to find the reasonable and feasible directions for adjusting industrial structure orientated the dual goals of economic development and carbon emission reduction from 2020 to 2060. Finally, the structural path analysis method was applied to identify the carbon emission flow path in the key cities with potential for industrial collaboration.

The findings are as follows. (1) the difference of economic linkages in different industries in Jing-Jin-Ji was not significant, but the linkages of carbon emission in some industries were higher than that of other industries. And the key cities were identified. (2) The economic growth and carbon emission reduction will be simultaneously balanced by industrial restructuring before 2030, but any single measure of industrial restructuring will be not effective to maintain low-carbon emission level after 2040. (3) The multi-level flows of carbon emission were the main characteristic for regional industrial carbon emission and the most flows involved two or three industries.

**Keywords:** Carbon Emission Reduction, Carbon Peaking and Carbon Neutrality, Industrial Development, Beijing-Tianjin-Hebei Urban Agglomeration, Multi-regional input-output (MRIO) model, Structural Path Analysis Method



**EST 2023**

**SUB-SESSION 2:**

**CLIMATE RESILIENT DEVELOPMENT AND  
POLICY**



## ESTIMATION OF STRENGTH DEVELOPMENT ON SOLIDIFIED SOFT SOIL USING BENDER ELEMENTS AND X-RAY CT SCAN TECHNIQUE

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**Abstract:** When cement or other stabilizer are added to weak, high-water content soils like dredged soil, they can be recycled as high-quality geomaterials. Additionally, by constructing improvement columns that mix soil and stabilizer in the ground, it is possible to address geoenvironmental problems such as containment of pollutants. Cement, which is the most commonly used stabilizer, emits a significant amount of carbon dioxide during its production. However, recent developments have been made in the development of stabilizer that utilize microbial functions or do not require cement.

On the other hand, we have plans to research air form treated light weight soil which is a geomaterial that is lightweight, possesses insulation properties, and can also store CO<sub>2</sub> by mixing stabilizer and CO<sub>2</sub> bubbles with clayey soil.

When solidifying the ground for such purposes, laboratory tests are conducted in advance to determine the appropriate amount of stabilizer. However, this requires a large number of soil samples and time. Therefore, in this study, we investigated a method to estimate the strength development of cement-treated clay soil quickly and efficiently using non-destructive tests such as bender element tests, which can conveniently measure the S-wave velocity propagating into the soil sample, and X-ray CT scans.

As a result, it was found that the increase in S-wave velocity obtained from bender element tests at an short curing days of approximately 3 to 7 days can accurately predict the strength at 28 and 91 days. Additionally, there was a correlation between the density distribution and strength obtained from X-ray CT scans.

**Keywords:** solidified soil, non-destructive test, geoenvironmental problems



**EST 2023**

**SUB-SESSION 3:**

**TRANSFORMATION OF CITY AND  
ENVIRONMENTAL RELATIONS**

## STUDY OF SOIL FERTILITY IN BAYAN-OVOO SUM, KHENTII PROVINCE

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**Abstract:** Khentii province is located in the east of Mongolia. There are many places in this province where Genghis Khaan was born and raised. Also in this province there are many natural attractions, healing springs and lakes, one of which is the mineral lake Gurmiin Nuur, which is located near Bayan-Ovoo Sum of Khentii province. The water and clay of this lake are considered curative for many diseases. Therefore, the flow of foreign and domestic tourists to this province, also to this lake increases every year, which increases the likelihood of soil erosion and deterioration of fertility. The purpose of this work was to assess the erosion of the soil of the Bayan-Ovoo Sum according to the main agrochemical indicators. The soil samples were collected from six points, located in the center of Bayan-Ovoo sum in July 2021 from the topsoil layer (up to 15-20 cm), mixed, sieved (2 mm) and stored in a freezer until laboratory analysis. Laboratory analyzes were carried out in accordance with Mongolian standards. Also, the activity of some enzymes, such as catalase, peroxidase, saccharase, which are indicator enzymes of soil fertility, were determined. The enzyme activities were expressed in units. Based on the results of the work, it was found that according to agrochemical indicators, such as pH, CO<sub>2</sub> and soil electrical conductivity, the soil of Bayan-Ovoo Sum is not saline, but soil fertility has deteriorated in terms of the content of mobile potassium, phosphorus and humus. These data are also confirmed by the activity of soil enzymes.

**Keywords:** Khentii province, soil, deterioration, enzyme activity

## COMPARATIVE ANALYSIS OF SOIL IN GER DISTRICT WITH AND WITHOUT USE OF BIOFERTILIZER

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**Abstract:** Mongolia is a country with traditional animal husbandry, which brings a significant part of the country's income in agriculture and the economy. Most Mongols still follow a traditional way of life and still use the traditional dwelling Ger for living. The Ger District is located on the outskirts of Ulaanbaatar and is home to over 60% of the capital's population of Mongolia. Migration to Ulaanbaatar has increased the population by 55% in the last fifteen years. Increase in population causes soil pollution and erosion. Therefore, scientists and officials are trying to solve and control this problem in different ways. In this work we chose one point in the Ger area and use BioEco fertilizer produced by the Institute of Chemistry and Chemical Technology of the Mongolian Academy of Sciences. This fertilizer contained more than 80 types of bacteria, such as lactic acid bacteria, yeast and photosynthetic bacteria. The fertilizer was applied to the soil after a 1:10 dilution in May 2022. After that, agrochemical characteristics of the soil and the activity of catalase, urease and saccharase were determined monthly compared to the control. The results show that the agrichemical parameters of the soil after the application of Biofertilizer did not change significantly, but the soil porosity increased significantly. Although the enzymes showed low activity, but their activity had the character of a decrease to the soil depth, which indicates the preservation of the biological pattern of soil enzymes. This work should be continued in the next 1-2 years to obtain more detailed data.

**Keywords:** Ger District, soil, Biofertilizer, enzyme activity

## PRE-ESTIMATION OF VULNERABILITY TO SOCIETY & ECONOMICS DUE TO NATURAL DISASTER & HAZARDS: A CASE STUDY OF ULAANBAATAR, MONGOLIA

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**Abstract:** As of 2018, the population of Ulaanbaatar city has reached 1,491 thousand people which is 387 thousand families due to increased movement from rural areas to urban areas, and around 60% of them belongs to Gher areas. This survey comprised about the people living in the territories of 9, 10, 12 Khoroos of the Chingeltei district as well as in the vicinity of Denjiin myanga. For, the Sociological research estimated their property damages caused due to blood risk, explosion near areas of petrol stations & expansion of settlement zones. The expansion of settlement zone of Denjiin myanga has been determined by three factors. Such as Size of territory, Surface slope, Average height of surface. Territories of settlement zones of gher areas have constantly expanded from 1975 to 2010 thus increasing by 4.6 times and became 5.6 km<sup>2</sup> as of 2010. The surface slopes of Gher areas were divided in four categories i.e. Very suitable (less than 30), Suitable (3-60), poorly suitable (6-80), and Not suitable (more than 80). 51.2% of Gher area is in Very suitable zone and 48.8% area is in the poorly suitable and not suitable zone. Average height of the Gher areas settlement zone has increased between 1975 & 2010 was 1330 m and 1510 m respectively. So the increase in the height in the span of 35 years was 180 m. Pre estimated damages and risks caused by natural disasters, blood and explosion risks of petrol stations and the initial results were ascertained for Denjiin myanga living area. The estimation showing that the possible danger would hit 717 people of 171 families thus the risk would count 989 million tugrugs. Finally, based on the assessment, it is proved that certain extent of loss and damages from possible risks is likely to occur when this assessment is calculated in only small areas of Denjiin Myanga of Chingeltei District. As the researches are developed further on, there will be a possibility of risks from mountain and rainfall floods as well as risk of petrol station in the vicinity of six district of Ulaanbaatar.

**Keywords:** Settlement zones, Damages & Risks, Gher area, Natural Disaster, Blood and Explosion risks



**EST 2023**

**SESSION 3**

**ENVIRONMENTAL TECHNOLOGY AND  
INNOVATION**

**SUB-SESSION 1:**

**NATURAL CONSERVATION  
TECHNOLOGY AND INNOVATION**



## FIELD MONITORING OF TREE GROWTH AND MICRO-CLIMATE STUDY IN DEGRADED SANDY SOIL REGIONS OF CENTRAL MONGOLIA

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**Abstract:** Local climate is one of the essential effects on tree and shrub growth that are being planted for forestation. The uniqueness of seasonal weather fluctuations during any particular year can complicate the year-to-year comparison of intra-annual tree growth. “Space for time” experiments along tree species offer valuable opportunities to investigate height growth under comparable weather conditions. Accordingly, the main focus of this field study is on height growth variations of *A. tataricum*, *P. sibirica*, *M. pallasiana*, *U. pumila* and *C. arborescens* along monitoring years in degraded sandy soil regions of Central Mongolia during 2010-2019. The primary objectives are 1) to provide a better understanding of whether the planted tree can grow in the area and 2) to identify tree growth in general. Secondary objectives include the comparison of the response of tree growth variations to different microclimate variables. Trees and shrubs growth rates had a positive correlation when air temperature was rising and had negative correlation when air relative humidity was rising. Thus our study results are showing that micro climate has very big influence.

**Keywords:** growth monitoring, micro-climate, correlation

## EFFECT OF HUMIC ACID, BARU, AZOPHOS FERTILIZERS ON THE CARAGANA KORSHINSKII KOM AND HALIMODENDRON HALODENDRON PALL

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**Abstract:** The present study was conducted at the nursery of the “Experimental and research site for planting drought-resistant trees and shrubs” in Sumber soum, Gobisumber province. Fertilizer experiments were carried out on 2 species of shrubs such as *C.korshinskii* and *H.halodendron* planted in the plastic plant pot. Growing numbers of studies have indicated that the planting of Caragana shrubs in this region had large effects on soil nutrients and stoichiometries. Fertilizers such as humic acid, azophos, baru and microelements necessary for plant growth were used. We aimed to evaluate the effects of three concentrations of humic acid (0, 100 ml.L<sup>-1</sup>), azophos (0, 100 ml.L<sup>-1</sup>) and baru (0, 100 mg.L<sup>-1</sup>) on vegetative growth and nutritional status of one year old *C.korshinskii* and *H.halodendron*. Each fertilizer was tested by applying it to the soil once every 14 days. The factorial experiment within randomized complete block design. During the growth period of the trees and shrubs planted in the experiment, i.e., from June to September 2022, the height was measured at intervals of 10 days. The height was measured from the soil surface to the top of the stem. Measurements were performed with a standard line with an accuracy of 0.1 cm. When the test results were compared for each species and for each experimental scenario, all the fertilization alternatives increased plant growth, especially humic acid had a greater positive effect on caraganas growth. This work will be further continued, the study design should be further improved, experimenting with different fertilizer concentrations and root growth should be further investigated.

**Keywords:** Azophos, baru, caraganas, humic acid

## OASIS LAND ENHANCEMENT TECHNOLOGY IN ARID AREAS

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**Abstract:** Oases are the main space for human production and life in arid zones. The global oasis area only accounts for about 4% of the total area of the arid zone, but supports more than 95% of the population in the arid region. With population growth and economic development, newly reclaimed oases have played an important role in promoting regional economic development and solving the conflict between human and land. However, the expansion of oases into deserts has caused the transition zone to shrink or even disappear, and the soil of newly reclaimed farmland is infertile, sandy and salinized, resulting in low water and fertilizer use efficiency and productivity, which seriously restricts the stability and sustainable development of oases. Based on the analysis of the bottlenecks and key mechanisms of the sustainable development of the newly reclaimed oasis, and the concept of cultivating land fertility and water efficiency improvement, the technology of oasis land fertility enhancement in arid areas has formed, which can effectively solve the key problems of efficient utilization of water and fertilizer and synergistic improvement of crop productivity faced by the newly reclaimed oasis.

Technology principle and characteristics: (1) Water productivity is increased by 10-15% when integrated water and fertilizer high-efficiency usage technology is used. It consists of three components: methods for using biochar and rapidly decomposing straw to the field to increase soil fertility and soil water holding capacity, methods for reducing water and fertilizer leaching by adding the appropriate amount of concave stick to increase the retention time of organic fertilizer in the soil, and methods for regulating surface and groundwater to optimize water resource allocation. (2) Land strength enhancement technology based on salt-sand composite barren land that accomplishes 1-2 levels of land strength increase. It involves the use of agricultural waste and biofertilizer to increase the production of sandy soil aggregates, bacillus fertilizer to reduce cotton continuous crop barriers, and high-temperature pyrolysis of biochar and wood vinegar solution to reduce salinization damage.

**Keywords:** Oasis, Water productivity, Land Enhancement Technology



**EST 2023**

SUB-SESSION 2:

ENVIRONMENTAL STUDIES USING  
GEO-INTELLIGENCE AND  
GEOSTATISTICS

## DATABASE MANAGEMENT OF GEOECOLOGICAL MAPPING

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Batsaikhan, Sainbayar Dalantai, Bayartungalag Batsaikhan

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**Abstract:** Databases are becoming important tools in geographic information systems and environmental research around the world. This study allows access to all users to multidimensional environmental monitoring, and planning, resource management, and conservation.

The aim of this study is to determine the database structure and create its data list in geoecological database along the economic corridor of Mongolia. It consists of four databases including Fact material, Geoecology, Geoecological assessment, and Thematic data. The feature catalogue was created based on these databases which have a data package named those databases. Each package contains the following information such as datasets, stereotypes, feature types, as well as descriptions.

Datasets were encompassed Observation site, field route, Sampled point, water, air, soil laboratory analysis, contour line, and layout information in the *Fact material package*. And Geoecological base, mountain object, hydrographical point object, exogenic process point, endogen process, residential technogenic object, mining, agriculture, utility, and soil geochemical condition belongs to the *Geoecology package*. In addition, the *Geoecological package* assessment contains geoecological assessment, surface, groundwater, and soil geochemical vulnerability, dosimeter ratio so on. In terms of the *Thematic data package* have a geomorphology base, landscape, soil, forest, vegetation, permafrost so on.

The stereotype was categorized into “featureType”, “datatype” and “annotationType”. Also, feature type was described by polygon, point, and line.

Oxygen XML Editor was used to create the database for organizing databases which provide tools for XML editing, covering most XML standards and technologies.

These databases will be the basis for Geoecological mapping and tools for data outcome of environmental research in Mongolia. It could provide opportunities to analyze data and introduction to data modeling for further scientific applications.

**Keywords:** Database, package, stereotype, feature, dataset

## MICROBIOLOGICAL STUDY OF SURFACE AND GROUNDWATER SAMPLES ALONG KHERLEN RIVER BASIN

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**Abstract:** The aim of this study is to assess the current level of pollution and to identify the main sources of pollution by analyzing the surface and deep well waters according to microbiological parameters used as drinking purposes surrounding the Kherlen basin. The analyzing points were selected from the location where the pollution level is high. Surface and underground water samples will be analyzed to the microbiological parameters according to the water regulations in Mongolia. Through this research work, it will be an important study to assess the current level of surface and groundwater microbiological pollution, how the central settlements affect the river, and to determine the main sources of pollution by looking at the microbiological safety indicators of the flowing river and groundwater used for drinking purposes. Establish sampling points for microbiological analysis of river and groundwater. River and underground water samples taken from the selected points will be analyzed for microbiology according to the standards in force in Mongolia. According to the field survey, samples will be taken from underground water points and 22 selected points on the surface along the length of the Kherlen River, and the results will be measured and analyzed on the ground. The points for analysis were selected considering that the level of pollution is likely to be the highest, or points close to cities and towns are considered to be risk points. For microbiological analysis, samples from each point were taken in a sterile glass container and dried at 180°C for 2 hours, labeled and sealed. A 250 mL water sample was taken from each point. At fixed points, some microbiological parameters were measured in water samples using a portable instrument, and total bacteria count/airborne bacteria count, heat-resistant enteric group bacteria, *E.coli*, enteric group pathogen *Salmonella* were enriched for 24-48 hours at 35°C in the laboratory, in respective selective media. 24-48 cultured at 35 degrees in the medium, and the results were based on morphological and biochemical analysis. According to the results of 61 groundwater points along the Kherlen River, the maximum number of total number of coliforms were 80, the minimum was 0, and the average was 10.8 CFU. But for the total number of bacteria, the maximum was 91, the minimum is 0, and the average was 41.5 CFU. *Salmonella* spp was detected in 2 samples or 3.2%, while *E.coli* was not detected in all samples. The percentage of water that not meets the water demand were 31.1%. Microbiological test results show that surface water were not suitable for drinking purpose.

**Keywords:** Microbiology, bacterial contamination, water hygiene, e.coli, coliform



## ESTIMATING THE ABOVE-GROUND BIOMASS OF THE PASTURE USING MACHINE-LEARNING MODELS IN MONGOLIA

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**Abstract:** Pastoralism plays a main role in the economy and livelihoods of people in Mongolia. In particular, the livestock industry in Mongolia largely depends on rangeland health, which comprises more than 70% of Mongolia's territory. Considering that the aboveground biomass (AGB) is a reliable indicator of pasture ecosystem function, health, and productivity. An accurate and rapid method for estimating the AGB is vital for managing, protecting, and sustaining this ecosystem. In this study, we aimed to estimate the AGB of the pasture in Mongolia. We used four indices including NDVI, EVI, LAI, and DVI, which were derived from bands of MODIS data as well as calculated from 159-field biomass sampling data collected across five natural zones of Mongolia in August, 2022. We performed two machine learning models, Gradient Boosting Tree (GBT), and Extra Trees Regressor (ETR), and compared them by importance value to evaluate performances in estimating AGB of the pasture. According to the result, importance of LAI and NDVI was significantly higher in the GBT and ETR, respectively. However, the importance of DVI in both methods was significantly lower than in the other variables. The result showed that the prediction accuracy of the GBT was relatively higher than ETR and  $R^2=0.61$  and  $RMSE=128.82$  kg/ha for the GBT and  $R^2=0.59$  and  $RMSE=132.12$  kg/ha for ETR. The results indicated that the different machine-learning models for evaluating the AGB of the pasture could provide support for estimating biomass in Mongolia.

**Keywords:** machine learning, pasture, aboveground biomass



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