ENVIRONMENTAL SCIENCE AND TECHNOLOGY

The Third International Conference

PROCEEDINGS

2021

ENVIRONMENTAL SCIENCE AND TECHNOLOGY

The Third International Conference

PROCEEDINGS

- **ORGANIZER**

MONGOLIAN ACADEMY OF SCIENCES
INSTITUTE OF GEOGRAPHY AND GEOECOLOGY

MONGOLIAN ACADEMY OF SCIENCES

- **CO-ORGANIZER**

МОНГОЛ УЛСЫН ЗАСГИЙН ГАЗАР
MINISTRY OF EDUCATION AND SCIENCE

МОНГОЛ УЛСЫН ЗАСГИЙН ГАЗАР
MINISTRY OF ENVIRONMENT AND TOURISM

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CONCEPT NOTE

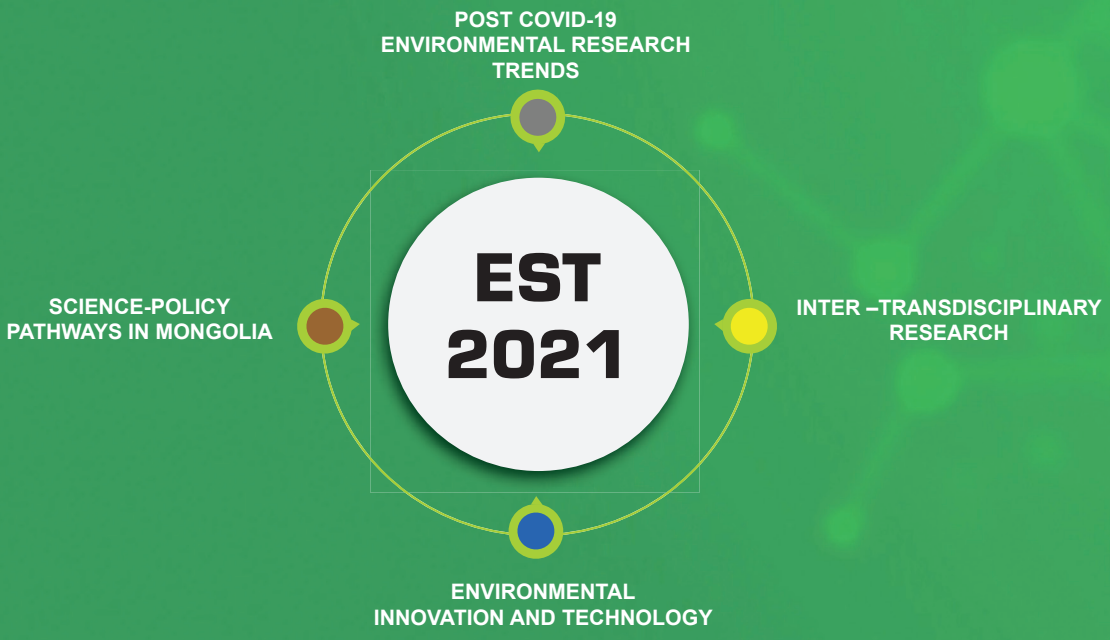
The International Conference on Environmental Science and Technology (EST) is a biannual event where scientists and researchers from different countries gather and discuss the most recent environmental science and technology trends and solutions. This year EST2021 is dedicated to the 100th anniversary of the establishment of modern scientific organization in Mongolia and the 60th anniversary of establishment of Mongolian Academy of Sciences.

EST Conference aims to bring together leading academic scientists, researchers and scholars, government organizations, research institutes, universities and international development organizations to present findings, exchange and share their experiences and research results on all aspects of Environment, Nature, Restoration and prevention technology, Geography, Socio economy and Sustainability.

This year's international conference is being organized in difficult period due to the global pandemic of COVID-19. With this situation, we considered to discuss new norm topic of COVID-19 related emerging challenges, issues and opportunities in details under the four main topics.

Furthermore, it's crucial to determine how COVID-19 will reshape science, technology and innovation at a time when science and innovation are most needed to deal with environmental and climate change as an emergency and meet the Science-Policy pathways. In the era of globalization, inter-and trans-disciplinary research studies have also become critical for the environmental and socio-economic fields. Thus, EST2021 will focus on Post COVID-19-Environmental Research Trends, Inter and Transdisciplinary research, Environmental Innovation and Technology and Science-Policy pathways as well. As a result of the conference, organizations will have the opportunity to initiate new collaboration and develop joint projects and scientific activities, especially in Post-COVID-19 research trends.

EST2021 conference will be attended by scientists and researchers from Russia, China, Japan, Korea, USA, Canada, Australia, Germany, Poland, France, Philippines, Afghanistan, Inner Mongolia, Buryatia and Mongolia including leaders and representatives from government organizations, research institutes and universities.



WELCOME MESSAGE

It's a great honor to invite you to the "Environmental Science and Technology" /EST2021/ international conference. We would like to extend our warm welcome to all of the national and international scientists, scholars and participants from various organizations. Moreover, we are congratulating you all for the 100th anniversary of the establishment of modern scientific organization in Mongolia and the 60th anniversary of establishment of Mongolian Academy of Sciences.

EST2021 international conference is being organized at difficult period due to the global pandemic. There is a need to reconsider many areas of research in response to changes in the country's society and economy which impacted by the pandemic. In addition, it is effective to address all issues through the integrated socio-economic and environmental system under the inter and transdisciplinary research development.

Many years ago, scientists studied environmental change impact on humans. On the contrary, there has been a need to study how human activities impact the environment in recent years. Therefore, the basic path to reduce the negative factors of human, natural disaster and adapt to climate change is to use, protect and restore natural resources sustainably and to introduce an advanced environmentally friendly technologies.

We can achieve concrete results when policy makers develop and implement the government programs and policies based on the scientific research and findings on emerging problems of the country. This year's international conference is organized to discuss these issues in details under the four main topics: Post COVID-19- Environmental Research Trends, Inter- and Transdisciplinary research, Environmental Innovation and Technology and Science-Policy pathways in Mongolia.

EST2017 and EST2019 attended by more than 500 representatives, scientists, and professors in duplicated number while this year's 3rd EST2021 International Conference attended by more than 200 guests, researchers, policy makers and private sector representatives from Russia, China, Japan, Korea, USA, Canada, Australia, Germany, Poland, France, Philippines, Afghanistan, Inner Mongolia, Buryatia and Mongolia.

Moreover, the conference has special future by inviting reputable international scientists and complimenting with their keynote speeches. The papers presented at the international conference are published in conference proceedings and this year we have planned to publish the conference proceedings registered on Springs and the Web of Science.

We would like to express our sincere gratitude to all the participants and the co-organizers of the conference from the government and international organizations such as MES, MAS, Future Earth Program and supporting organizations MET and UNESCO Chairs.

May your knowledge and inspiration flourish!

Respectfully,

DORJGOTOV BATTOGTOKH (PHD)
DIRECTOR GENERAL,
THE INSTITUTE OF GEOGRAPHY AND GEOECOLOGY, MAS
CHAIR, FUTURE EARTH MONGOLIAN COMMITTEE.

CONGRATULATORY MESSAGE

On behalf of the Government of Mongolia and the Ministry of Education and Science, it is my pleasure to welcome scientists, researchers, and delegates to the 3rd “INTERNATIONAL CONFERENCE ON ENVIRONMENTAL SCIENCE AND TECHNOLOGY (EST2021)”.

This year is the centennial anniversary of the establishment of the modern scientific organization in Mongolia and the 60th anniversary of the establishment of the Mongolian Academy of Sciences. EST2021 is dedicated to this anniversary under the Ministry of Education and Science and the Institute of Geography and Geocology, Mongolian Academy of Sciences.

The International Conference on Environmental Science and Technology is a biannual event where more than 200 delegates, policymakers, leading international scientists and researchers including from Russia, China, Japan, Korea, USA, Australia, Canada, Germany, Poland, France, Philippine, Afghanistan, Inner Mongolia, Buryatia and Mongolia to discuss the most recent environmental science and technology studies and solutions. The conference is an important event for the education and science fields where participants share their knowledge, come together with one goal and develop multilateral cooperation. This year EST2021 focuses on strengthening the international cooperation in times of global pandemic (COVID-19) and is being organized virtually. EST conference provides and opportunity to expand regional and international cooperation in the field of environmental science and technology and to provide opportunities for joint projects and programs.

EST2021 conference is complimented with the research based Environmental - Social - Interdisciplinary research on economic integration study, innovation and technology which provides an opportunity to be introduced on environment, science and technologies’ new trends and future developments. Moreover, scientific works that define the framework of Mongolian science policy presents and the exchange of knowledge and experience with many scientists and researchers in this field emphasizes the importance of the conference.

The Ministry of Education and Science will focus on improving the legal environment of the sector, aligning with the sector’s development policy at national and regional level and making research-based policies and decisions.

I wish you all the best for future endeavors!

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

CONGRATULATORY MESSAGE

On behalf of the Mongolian Government, Ministry of Environment and Tourism, I would like to express my sincere gratitude to all the distinguished scholars and honorable guests participating for the Third International Conference on Environmental Science and Technology 2021, which is initiated by the Institute of Geography and Geoecology, Mongolian Academy of Sciences and co-organized with Ministry of Environment and Tourism.

I would like to thank all the national and international scholars and honorable guests who have come to join this year's conference virtually during this difficult pandemic period which we are facing all around the world.

Global warming, climate change, environmental pollution, degradation, and the rapid use of natural resources caused by human activities are leading to the imbalance of the blue planet's ecosystems and this issue is becoming a major challenge for the sustainable development goals implementation for humankind and nations.

In Mongolia, the increasing risk and frequency of climate change, climate and natural disasters' have been posing a significant risk to our economy, which is directly dependent on the characteristics of the four seasons. Within the framework of the "Vision 2050 - Mongolia's long-term development policy" approved by the Parliament of Mongolia and the Green Development Policy of the Government of Mongolia's Action Plan 2020-2024, major concrete goals have been set in terms of adapting the climate change, sustainable use and protection of forests, water and soil resources, and combating desertification and land degradation. In this regard, we are following three main pillars of "Environment-Society-Economy" for the sustainable development policy.

We are grateful for the Institute of Geography and Geoecology, Mongolian Academy of Sciences, for supporting the implementation of government policies and decisions by drafting policies and procedures, developing scientific approaches concerning the sustainable use of natural resources, conclusions, recommendations, norms and standards on critical ecological issues in Mongolia and adjacent regions through conducting baseline and applied studies related to the environmental protection, ecological balance, conservation of natural resources, sustainable use and restoration in accordance with the Concept of the Sustainable Development and Green Development trends. I am looking forward to continuous and strengthened partnership and cooperation between the Ministry of Environment and Tourism and the Institute of Geography and Geoecology, Mongolian Academy of Sciences in many directions in the future, and we will benefit from the findings of your research works as a fundamental basis for the policy documents under the Ministry of Environment and Tourism.

The 3rd International Conference Environmental Science and Technology is dedicated for the 100th anniversary of the establishment and development of modern science in Mongolia and the 60th anniversary of the establishment of the Mongolian Academy of Sciences. This year's conference is focusing on "Post Covid-19" Environmental Research Trends, Inter and Transdisciplinary Research, Environmental Innovation and Technology and Science-Policy Pathways in Mongolia topics. The Ministry of Environment and Tourism actively cooperates with the international organizations in the fields of natural resources, international and national research organizations, scientists and researchers to improve the legal aspects of the environmental sector, aligning with sector's development into sustainable development policy and pursuing research-based policies and decisions.

Scientists and scholars wisdom and their impeccable, precise research works' results, methodology and approaches play significant role to save the blue planet and sustain its original condition as much as possible.

I wish you all the best in your future scientific journey and fruitful outcomes for the conference!

URTNASAN NYAMJAV
MEMBER OF THE GOVERNMENT OF MONGOLIA,
MINISTER, MINISTRY OF ENVIRONMENT AND TOURISM

CONGRATULATORY MESSAGE

On behalf of the Mongolian Academy of Sciences and on behalf of myself I`m pleased to express my gratitude to all the scientists, researchers and distinguished guests of the “Environmental Science and Technology” initiated by the Institute of Geography and Geoecology of the Mongolian Academy of Sciences in cooperation with the Presidium office of the Mongolian Academy of Sciences.

The Institute of Geography and Geoecology of the Academy of Sciences is successfully organizing the third international conference on “Environmental Science and Technology” (EST2021).

This year’s conference is about coping, adapting and finding solutions to environmental changes and It is featured for organization in the framework of the 100th anniversary of the establishment and development of modern science in Mongolia and the 60th anniversary of the establishment of the Mongolian Academy of Sciences, on the other hand, due to the global pandemic Covid-19, this time it is organized in a combination of online and in hall meeting.

One of the few issues facing humanity around the world today is environmental issues.

Due to the impact of the global pandemic, the country’s society and economy are changing, in connection with this, there is a need to review many areas of research and to develop interdisciplinary and cross-disciplinary research trends by looking at any research through an integrated socio-economic and ecological system.

Therefore, in order to find a solution to this problems, this conference will discuss specific issues in the field of environment, society and economy in cooperation with international and domestic scientists and government organizations, as well as it is important to create the conditions for international research organizations to share their achievements, experiences, exchange knowledge and launch joint projects and programs.

This year’s conference on “Environmental Science and Technology” (EST2021) will be participated by more than 200 international and national researchers and guests and hopefully we will discuss about number of interesting presentations on these days.

At last, I wish all of you every success in your conference activities and every success in your future research endeavors!

ACADEMICIAN DUGER REGDEL
PRESIDENT OF MONGOLIAN ACADEMY OF SCIENCES

THE 3RD INTERNATIONAL CONFERENCE ON ENVIRONMENTAL SCIENCE AND TECHNOLOGY (EST2021)

DETAILED PROGRAM

Date: Thursday, 23. Sep. 2021
Venue: Zoom platform, Ulaanbaatar, Mongolia

Time	Activities
08:30-09:00	**Zoom logging**
	Plenary Event
	Timeframe: 09:00-12:00 **Zoom link:** https://us02web.zoom.us/j/89473029274?pwd=WkE2emV0Tmo2VFBBSitDancxVW5JUT09 Webinar ID: 894 7302 9274 Passcode: 178897
09:00-09:30	**Opening Ceremony** ▪ **Welcoming speech** Dr. Battogtokh, D. Director General, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia Chair, Future Earth Mongolia Committee ▪ **Congratulatory Remark** Enkh-Amgalan, L. Minister, Ministry of Education and Sciences, Mongolia Urtnasan, N. Minister, Ministry of Environment and Tourism, Mongolia Academician Regdel, D. President, Mongolian Academy of Sciences, Mongolia
Keynote presentations **Moderators:** **Dr.Chuluun Togtokh,** Director, Institute for Sustainable Development, National University of Mongolia, Mongolia **Prof.Dong Suocheng,** Leading Professor, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences; Director, Center for Sustainable Development of North Asia; Center for Regional Ecological and Planning, China	
09:30-09:50	**Post COVID-19 Environmental Research: The Great Transition** Prof. Joon Kim Program Director Future Earth, Seoul National University, Korea
09:50-10:10	**Social-Ecological System Responses to Climate Change in Mongolian and US Great Plains Pastoral Systems** ***Devoted for the 30th anniversary of the US-Mongolia joint ecosystem research*** Prof. Dennis S. Ojima Senior Research Scientist, Colorado State University, USA
10:10-10:30	**Co-designing pathways to transformative implementation of the SDGs** Dr. Mark Stafford Smith Honorary Fellow, CSIRO, Australia

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10:30-10:45	**Q & A**
10:45-11:05	**Sustainable land management for climate change mitigation and adaptation through a transdisciplinary approach** Prof. Tsunekawa Atsushi Arid Land Research Center, Tottori University, Japan
11:05-11:25	**Applications of Modern Spatial Technologies for Environmental Monitoring and Management** Academician. Amarsaikhan Damdinsuren Leading scientist, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
11:25-11:35	**Q&A**
11:35-11:40	**Zoom group photo**
11:40-12:00	**EST 2017/2019 documentary**
12:00-13:00	**Break session**
13:00-17:00	**Afternoon sessions**
17:00-17:30	**Concluding remarks and recommendations**

Afternoon sessions:

SESSION 1: POST COVID-19 ENVIRONMENTAL RESEARCH TRENDS	
Timeframe: 13:00-17:30 **Zoom link:** https://us02web.zoom.us/j/85230050667?pwd=U1lyMnFoUDNuUnZQbG41NFJSVGVPQT09 Meeting ID: 852 3005 0667 Passcode: 2021	
Chairs: ▪ **Dr. Batkhishig Orchirbat**, Head, Division of Soil Science, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia ▪ **Dr.Wang Qinxue,** Principal Researcher, National Institute for Environmental Studies, Japan	
13:00-13:15	**Problems and green development countermeasures of pastoral system in Mongolian Plateau** Dong Suocheng ***(Invited speaker)*** Leading Professor, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences; Director, Center for Sustainable Development of North Asia; Center for Regional Ecological and Planning, China
13:15-13:30	**Medical Waste Management in Korea's COVID-19 Response** Mr. Ryunghwa Kim Waste information management division, Korea Environment Cooperation, Korea
13:30-13:45	**Cryosphere changes in Mongolia under climate warming** Dr.Dashtseren Avirmed Head, Permafrost study division, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
13:45-14:00	**Response of permafrost to climate changes and its environmental impacts: an review** Dr.Tonghua Wu Researcher, Northwest Institute of Eco-environment and Resources, Chinese Academy of Sciences, China
14:00-14:15	**Features of drought and pluvial periods in the Lake Baikal basin inferred from tree rings** Dr.Alexander Ayurzhanaev Leading researcher, Baikal Institute of Nature Management SB RAS, Russia
14:15-14:30	**Glacier Lakes outburst Floods in Panjshir Province of Afghanistan** Mr.Abeer Ahmad Sajood National correspondent, World Glacier Monitoring Service for Afghanistan

14:30-14:50	**Q&A**
14:50-15:05	**Break session**
Chairs: ▪ Dr. **Alexander Ayurzhanaev,** Leading researcher, Baikal Institute of Nature Management SB RAS, Russia ▪ Prof. **Hasi Bagana**, Institute of urban studies, School of Environmental Geographical Sciences, Shanghai Normal University, China	
15:05-15:20	**Accelerated Recent Warming and Temperature Variability Over the Past Eight Centuries in the Central Asian Altai** Prof.Baatarbileg Nachin ***(Invited speaker)*** Dean, Graduate School National University of Mongolia, Mongolia
15:20-15:35	**Evaluation of the influence of anthropogenic disturbances on pasture carrying capacity and its vulnerability in arid and semi-arid regions** Dr. Qinxue Wang Principal Researcher, National Institute for Environmental Studies, Japan
15:35-15:50	**Soil pollution of Urbanized Centers of Baikal Region (Irkutsk, Ulan-Ude, Ulaanbaatar Cities**) Dr.I.A. Belozertseva Head of the laboratory, V.B. Sochava Institute of Geography SB RAS, Russia
15:50-16:05	**Soil erosion and Soil organic carbon in the forest steppe zone: A case study in Mukhar, west Khentei, Mongolia** Dr.Ochirbat Batkhishig Head, Division of Soil Science, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
16:05-16:20	**Urban Forest Cover Change and Responses to Climate: Case Study Based on Ulaanbaatar City, Mongolia** MSc.Bayartulga Altankhuyag Researcher, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
16:20-16:35	**Preliminary results of ecosystem service valuation of saxaul forest in Mongolia** MSc.Enerel Tumurbaatar Researcher, Desertification study division, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
16:35-17:00	**Q & A**
17:00-17:30	**Concluding remarks and recommendations**

SESSION 2: INTER –TRANSDISCIPLINARY RESEARCH	
Timeframe: 13:00-17:30	
Zoom link: https://us02web.zoom.us/j/83104916521?pwd=bEp3QkRrMDJkdEJRR3J3Y2JaZlpkQT09 Meeting ID: 831 0491 6521 Passcode:2021est	
Chairs: ▪ Associate Prof. **Buyanbaatar Avirmed**, Dean, School of Agroecology, Mongolian University of Life Sciences, Mongolia ▪ Dr. **Xia Bing**, Researcher, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China	
13:00-13:15	**Human-Environmental System: From local to Global Sustainability** Dr.Chuluun Togtokh ***(Invited speaker)*** Director, Institute for Sustainable Development, National University of Mongolia, Mongolia
13:15-13:30	**Review and Perspective for Resources and Environmental Information Development and Service along the economic corridors of the Belt and Road Initiative** Dr.Juanle Wang

	Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
13:30-13:45	**Rural Development Monitoring - a tool for analyzing socio-economic changes in Poland** Prof. Monika Stanny Director, Institute of Rural and Agricultural Development, Polish Academy of Sciences, Poland
13:45-14:00	**Quantitative Analysis of the Coupling Coordination Degree between Urbanization and Eco-environment in Mongolia** Dr.Ji Zheng Department of Urban Planning & Design, The University of Hong Kong
14:00-14:15	**Increased Efficiency and Effective through E-Learning** Ms. Jennifer Adams Country director, MERIT project, Canada
14:15-14:30	**Opportunities for the development of North Asia in the "One Belt - One Road" project: problems and solutions** MSc.Boldanov Tamir PhD candidate, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
14:30-14:50	**Q & A**
14:50-15:05	**Break session**
	Chairs: ▪ Prof.Dr.Dr.h.c. **Michael Walter,** UNESCO Chair on Environmental Sciences in Eastern Central Asia, Advisor of the Institute of Geography and Geoecology, Mongolia ▪ Associate Prof. **Li Fei**, Researcher, China-ASEAN Collaborative Innovation Center for Regional Development; Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
15:05-15:20	**The results and prospects of geographical research in the transboundary territory of Russia and Mongolia at the beginning of the 21st century** Dr.Igor Vladimirov Director, V.B. Sochava Institute of Geography SB RAS, Russia
15:20-15:35	**Climate Change Impact on Social and Economic Sectors in Mongolia** Dr. Altanbagana Myagmarsuren Head, Division of Social Economic Geography, Institute of Geography and Geoecology, Mongolia Academy of Sciences, Mongolia
15:35-15:50	**The influence factors of regional eco-efficiency in Mongolia** Dr.Xia Bing Researcher, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
15:50-16:05	**An Analytical Framework for Regional Road Network Development and Environmental Load Reduction** Prof. Satoshi Tsuchiya Lecturer, School of Economics and Management, Kochi University of Technology, Japan
16:05-16:20	**Educational tourism and organization of recreational activities for the national park management** Dr.Anastasia Myadzelets Sochava Institute of Geography SB RAS, Irkutsk, Russia
16:20-16:35	**Evaluating the Transborder Urban-Cluster Alternatives Suitable for Regional Development Concept of Mongolia** Tseyenkhand Punsantsogvoo Researcher, Division of Social Economic Geography, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
16:35-17:00	**Q & A**
17:00-17:30	**Concluding remarks and recommendations**

SESSION 3: ENVIRONMENTAL INNOVATION AND TECHNOLOGY	
Timeframe: 13:00-17:30	
Zoom link: https://us02web.zoom.us/j/89473029274?pwd=WkE2emV0Tmo2VFBBSitDancxVW5JUT09 Webinar ID: 894 7302 9274 Passcode: 178897	
Chairs: ▪ Dr**. Delgerjargal Dugarjav,** Lecturer, Department of Horticulture, forestry and landscape architecture, School of Agroecology, Mongolian University of Life Sciences, Mongolia ▪ Dr. **Ke Zhang**, Researcher, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China	
13:00-13:15	**Science and Policy Interacted for Combating Desertification in China** **Prof.Wang Tao** ***(Invited speaker)*** Leading scientist, Northwest Institute of Eco-environment and Resources, Chinese Academy of Sciences, China
13:15-13:30	**Mitigation measure for groundwater extraction impact on flow of the Tuul River, Mongolia** Dr.Chinzorig Sukhbaatar Head, Water utilization and resource, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
13:30-13:45	**Research on the adaptability of deep learning algorithm based on ROI label in Tuul River water body segmentation** MSc.Kai Li Researcher, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
13:45-14:00	**Impact of the concentrator project on the soil cover** Prof. Oyunchimeg Tugjjav Lecturer, Mongolian University of Life Sciences, Mongolia
14:00-14:15	**Desertification Information Extraction in Selenge Province Based on Multi-source Feature Space and Geographical Division** MSc.Shuxing Xu Researcher, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
14:15-14:30	**Comparison results of baseflow simulation methods in the upper Tuul River basin** MSc.Enkhtuya Minjuurlunden Researcher, Water utilization and resource, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
14:30-14:50	**Q & A**
14:50-15:05	**Break session**
Chairs: ▪ Dr.**Navchtsetseg Nergui**, Head of the International Relations and Cooperation Department, Mongolian Academy of Sciences, Mongolia ▪ Dr.**Odsuren Batdelger**, Head of Water quality laboratory, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia	
15:05-15:20	**21st Century Permafrost Distribution under the Scenarios of RCP2.6 and RCP8.5 in Mongolia** Dr.Saruulzaya Adiya Senior researcher, Permafrost study division, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
15:20-15:35	**International trade driven relocation of contaminant BA around the world** Dr. Ke Zhang Researcher, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of

	Sciences, China
15:35-15:50	**Assess habitat quality in the western region of Mongolia using InVEST Habitat Quality model** MSc.Munkhdulam Otgonbayar Researcher, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
15:50-16:05	**Study on Dust storm Distribution and Land use Change in Mongolian Plateau** MSc.Yu Zhang Researcher, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
16:05-16:20	**Design of soum territorial plan geodatabase** MSc.Uyanga Batbold Researcher, Land use and management division, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia
16:20-16:40	**Q & A**
17:00-17:30	**Concluding remarks and recommendations**

SESSION 4: SCIENCE-POLICY PATHWAYS IN MONGOLIA	
Timeframe: 13:00-17:30	
Zoom link: https://us02web.zoom.us/j/9728712703?pwd=Tmw3VG8zME4vRE5JcUdTemZnYlJpdz09 Meeting ID: 972 871 2703 Passcode: 800951	
Chairs: ▪ Dr.**Ria Lambino**, Science Officer, Regional Centre for Future Earth in Asia ▪ Dr.**Suvdantsetseg Balt**, Head of Administration and Planning department, Mongolian Academy of Sciences, Mongolia	
13:00-13:15 13:15-13:30	**A Collective Journey: The Science-based Pathways for Sustainability Initiative** Mr.Gilles Marciniak (**Invited speakers)** Science officer, Future Earth, France Doy Romero Science Officer, Future Earth Philippines Science-Policy Pathways Initiative
13:30-13:45	**Current climate state and its issues in Mongolia** Mr.Enkhbat. A ***(Invited speaker)*** Director of the Climate change department, Ministry of Environment and Tourism, Mongolia
13:45-14:00	**Methodology to reduce the poverty and unemployment in rural area based on spatial economic resource** Erdenebayar. D Head of Regional and Local Development Policy and Planning Division, National development agency, Mongolia
14:00-14:15	**Economy-Environment Sustainability Assessment of Countries along the Belt and Road** Associate Prof.Li Fei China-ASEAN Collaborative Innovation Center for Regional Development; Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, China
14:15-14:30	**Tracking Mongolia's progress towards 2030 SDGs using a system thinking approach** Dr.Tungalag Ulambayar Director of Zoological society of London, Mongolia
14:30-14:50 14:50-15:05	**Q & A** **Break session**

Chairs: ▪ Dr.**Chuluun Togtokh,** Director, Institute for Sustainable Development, National University of Mongolia, Mongolia ▪ Dr.**Tungalag Ulambayar**, Director of Zoological society of London, Mongolia	
15:05-15:20	**Sustainable finance in Mongolia** Prof.Danaasuren Vandangombo Lecturer, Economics and finance department, National Academy of Governance, Mongolia
15:20-15:35	**Science based action and learning for better adaptation** Dr.Batkhishig.B Country Director of Sustainable Fibre Alliance, Mongolia
15:35-15:50	**Research based policy: Human settlement National Plan in Mongolia** Mr.Davaanyam. S Head of Human Settlement and Regional Study, Construction Development Center, Ministry of Construction and Urban Development, Mongolia
15:50-16:05	**Interdisciplinary approach for assessing pastoral vulnerability and formulation of adaptation options** Dr.Suvdantsetseg Balt Head of Administration and Planning department, Mongolian Academy of Sciences, Mongolia
16:05-16:20	**Urban Expansion Survey by Fractal Dimension (Case of Khovd Town, Mongolia)** Prof.Purevtseren Myagmartseren Department of Geography, National University of Mongolia, Mongolia
16:20-16:35	**To build up the long term observation infrastructure and human resources in western region of Mongolia** Dr.Burmaa. Z Director School of environmental science and technology, Khovd University, Mongolia
16:35-17:00	**Q & A**
17:00-17:30	**Concluding remarks and recommendations**

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. Battogtokh Dorjgotov**- Director General, Institute of Geography and Geoecology, Mongolian Academy of Sciences

4.**Dr. Bayartungalag Batsaikhan**- Scientific secretary, Institute of Geography and Geoecology, Mongolian Academy of Sciences

5.**Dr. Chinzorig Sukhbaatar**- Head of the Water resource and utilization division, Institute of Geography and Geoecology, Mongolian Academy of Sciences and Co-Chairholde of the UNESCO Chair in Sustainable Groundwater Management

6.**Dr. Dashtseren Avirmed**- Head of the Permafrost study division, Institute of Geography and Geoecology, Mongolian Academy of Sciences

7.**Dr. Altanbagana Myagmarsuren**- Head of the Socio-economic geography division, Institute of Geography and Geoecology, Mongolian Academy of Sciences, Mongolia

8.**Prof. Dr. Dr. h.c. Michael Walther**- UNESCO Chairholder on Environmental Sciences in Eastern Central Asia

9.**Dr. Chuluun Togtok**h- Director, Institute for Sustainable Development, National University of Mongolia

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EST 2021

KEYNOTE PRESENTATIONS

POST-COVID-19 ENVIRONMENTAL RESEARCH: THE GREAT TRANSITION

Prof. Joon Kim
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Abstract: The COVID-19 is a human-caused disaster which had been forewarned. The Great Acceleration during the 20th century has thrust our planet into a new age - the Anthropocene. The humanity has continued transgressing several domains of the planetary boundaries (i.e., ecological limits) that are not supposed to be crossed over. Our societies have chosen the lifestyles that are against the natural laws, at the expense of the collapse of social base, which in turn have resulted in a pandemic such as COVID-19. The outbreak of COVID-19 was perhaps inevitable but the pandemic was optional. Challenge has not been to arrive at solutions but to find willingness to implement, which must be preceded by proper understanding of the complexity and the capacity building of our ecological-societal systems. Complex systems view provides us with not only the insight on the trilemma (i.e., upper limit of ecosystems capacity, lower limit of social base, and hidden limit of thermodynamic imperative) in coping with the pandemic but also the foresight toward sustainable future. The pandemic is an opportunity to accelerate transformations of our systems' regime shift to go beyond being resilient toward being antifragile (i.e., system gets better!). Visioneering (i.e., a triad of governance, management, and monitoring) is an essential tool for the great transition, requiring systems thinking, value thinking, strategic thinking, and future thinking competences.

Keywords: COVID-19; complex systems science; transition; antifragile; visioneering

SOCIAL-ECOLOGICAL SYSTEM RESPONSES TO CLIMATE CHANGE IN MONGOLIAN AND US GREAT PLAINS PASTORAL SYSTEMS

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Co-author: T. Chuluun

Abstract: Pastoral social systems and rangelands are undergoing numerous challenges due to climate change, changing natural resource availability, economic uncertainties, policy revisions, and social structural changes affecting livelihoods, emigration patterns, and social infrastructure (e.g., access to schools, medical facilities, financial institutions). As communities, researchers and practitioners living and working in these systems attempt to meet these challenges an emerging recognition for transformational adaptation is needed to enhance resilience and provide alternative livelihood strategies to meet challenges across these regions.

These changing climate and social-economic situations across the Mongolian Steppe and the US Northern Great Plains have further challenged current land and water management practices. Recent research and assessment efforts of current climate stresses have indicated that changing seasonality, impacts of extreme events (e.g., droughts, floods, ice storms), and warming trends on ecosystem services across the region have increased the vulnerability of communities and sectors in the region. Collaborative and comparative analysis of US-Mongolia efforts to meet these challenges will be presented in this paper.

Keywords: Climate Change, Adaptation, Pastoral Systems, Social-ecological systems

CO-DESIGNING PATHWAYS TO TRANSFORMATIVE IMPLEMENTATION OF THE SDGS

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Abstract: The approval of the 17 Sustainable Development Goals in 2015 marked the first time that such a comprehensive and transformative, yet detailed set of integrated objectives for the planet has been agreed to by all nations, in order to achieve "The World We Want". The SDGs create some critical implementation challenges. Their comprehensiveness means that the synergies and trade-offs among goals in different sectors are made apparent, demanding attention to policy coherence across the whole of government. Their transformative ambition requires major changes away from business-as-usual in numerous areas, implying significant changes to values and institutional settings. There will be winners and losers from such changes, which necessitates a massive effort at engagement so that entrenched power dynamics do not prevent their achievement.

I will discuss the 6 major transformations that the Global Sustainable Development Report 2019 argues are needed, and the levers to support them. The policy and values implications of these mean that a major, well-targeted effort in co-designing pathways is vital.

SUSTAINABLE LAND MANAGEMENT FOR CLIMATE CHANGE MITIGATION AND ADAPTATION THROUGH A TRANSDISCIPLINARY APPROACH

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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.

APPLICATIONS OF MODERN SPATIAL TECHNOLOGIES FOR ENVIRONMENTAL MONITORING AND MANAGEMENT

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Abstract: Spatial technology is a significant scientific finding, which moved the possibilities of humankind to a new era. The prospects of spatial technologies are unlimited, because of their wide applications in a variety of different fields. Spatial technology refers to all of the technologies used to acquire, store, retrieve, process, analyze and display geographic information. In most cases, technological specialists and experts consider it as a combination of remote sensing (RS), satellite navigation system (SNS) and geographic information system (GIS).

RS is the science and technology for the acquisition of information about an “object” or “phenomenon” without making any physical contact. It usually deals with processing, analysis and display of optical, microwave, hyperspectral and lidar datasets acquired in diverse ranges of electromagnetic spectrum from different altitudes. SNS is a space technology-based system that uses satellites to provide spatial positioning. SNS with a global coverage is called a GNSS (global navigation satellite system). The US’ Global Positioning System (GPS), Russia’s Global Navigation Satellite System (GLONASS), China’s BeiDou Navigation Satellite System (BDS) and EU’s Galileo are fully operational systems. GIS is a spatial technology used for capturing, storing, checking, integrating, analyzing and displaying geographically-referenced datasets. It is normally considered as a spatial decision-making tool.

For the environmental monitoring and management, spatial technologies have a great number of applications. For example, datasets taken from the satellite, aircraft and drone are the main sources of real-time and up-to-date spatial information. They are used for natural resources management, climate change monitoring, evaluation of ecosystems temporal changes, processes modelling and many others. GIS can be effectively used to integrate all types of spatial and non-spatial datasets for environmental and resources data analysis and planning. It allows the users better viewing and finding the relationships among different natural components that influence in a given critical environmental situation. GPS can produce substantial environmental benefits, because it is a key technology for identifying and monitoring the exact location. Thus, the integrated RS, GIS and SNS technologies applied to the nature and environment are powerful tools for the planning, management and decision-making.

At present, we going through the Fourth Industrial Revolution - a new era of innovation in technology. It is a way of minimizing the boundaries between the physical, digital and biological worlds. The Fourth Industrial Revolution can solve the world's most persistent environmental challenges and issues by harnessing technological innovations and advanced approaches/methodologies. As we know, many components of the spatial technologies are applied in the Fourth Industrial Revolution, including:

- Artificial intelligence and machine learning
- Internet of things
- Big data/analytics
- Smart sensors
- Virtual reality
- Mobile devices
- Data visualization
- Cloud computing
- Cognitive computing
- Location detection.

Therefore, the spatial technologies can be considered as a major part of the current Fourth Industrial Revolution, and may become a driving engine for the next industrial revolution.

The aim of this study is to demonstrate how modern advanced spatial technologies and techniques based on RS, SNS and GIS can be used for the improved environmental monitoring and management. For this purpose, several studies conducted for different applications in Mongolia at national and regional level have been highlighted. For the final analyses, multisource satellite images with different spatial and spectral resolutions, GIS-based thematic and topographic maps of varying scales, some GPS measurements, and other statistical and non-spatial datasets have been used.

EST 2021

SESSION 1:

POST COVID-19 ENVIRONMENTAL RESEARCH TRENDS

Session Description

Environmental Sciences play an increasing rule in a world of shrinking natural resources and nature capital. The benefit for and welfare of the population in urban and rural ecosystems is decreasing by diminished livelihood quality. The big future challenges for the global population in general and in Central Asian communities in specific will be an adaptation to a sustainable use of natural resources due to climate change effects, which is one of the reason for the gravity of this situation. The presenters of Session 1 of the EST Conference 2021 highlight important aspects of environmental monitoring, climate change effects and land use modalities using field work results and modelling processes. The prediction of future scenarios is an integrated part of modelling the environmental data in some presentations. Nevertheless, field work data — hard facts — are essential not only for the monitoring processes but for risk calculation in the rural and urban areas for settlements in Central Asia and adjacent regions. Land use, economic development and unadapted waste management impacted by human activities enlarge landscape vulnerability in sensitive ecosystems of the arid and semi-arid zones in the focus region. Session 1 is focussed on Periglacial Environment and cryogenic processes (i), Soil Sciences in urban and rural areas including soil degradation and pollution (ii), Dendro-ecology and -climatology with a strong focus on Climate Change during the last 750 years (iii) and applied Sciences (iv) with a special focus on Ecosystem service, Green City and Green Development in urban and rural areas, land use and landscape vulnerability in arid and semi-arid zones including desertification problems and waste management. In an nutshell, the presentations show a precarious situation of the environmental condition, which is firstly influenced by human activities and the unadapted use of natural resources and secondly by climate change effects especially in remote areas.

PROBLEMS AND GREEN DEVELOPMENT COUNTERMEASURES OF PASTORAL SYSTEM IN MONGOLIAN PLATEAU

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Abstract: Mongolian Plateau is a typical pasture industry area in the world. However, due to the impact of global climate change, economic development and market-oriented reform, the pastoral system in the Mongolian Plateau is facing the double challenges of economic development and ecological environment construction. Based on the “herder-livestock-pasture” trinity pastoral system, this paper analyzed the typical pasture industry areas in the Mongolian Plateau, pointed out that there are three main problems in the current pastoral system in the Mongolian plateau: the pastoral system was fragile and sensitive; single industrial structure and severe grassland degradation; disasters occur frequently, and cross-border transmission has a far-reaching impact. The authors put forward four strategies for the green development of pastoral system in the Mongolian Plateau. Namely, general model of ecological civilization; optimize industrial structure and develop green recycling industry; strictly abide by the ecological red line and coordinate to promote transnational ecological protection; strengthen international cooperation and explore the implementation of green development system construction. This article aimed to provide new ideas for the green development of pastoral system and the protection of global ecological security in the Mongolian plateau.

Keywords: Mongolian plateau, Global climate change, Pastoral system, Green development, Problems and countermeasures

MEDICAL WASTE MANAGEMENT IN KOREA'S COVID-19 RESPONSE

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Abstract: Medical waste is an infection hazard for humans and requires management according to stricter standards than other types of waste. In the current COVID-19 pandemic, medical waste management to the strictest of standards must take place. Since 2008, real-time medical waste management systems using radio-frequency identification (RFID) technology have been developed, installed, and operated in Korea. To date, Korea is the only country in the world to have implemented this technology. The Korean government has also implemented a crisis management model designed for preventing the spread of COVID-19 and as an effective response to the pandemic. The three components of this model are: drive-thru and walk-thru screening, operation of community treatment centers for the treatment of mild cases, and operation of temporary living facilities for the self-quarantining of people entering Korea from abroad. Since the early stages of the pandemic, the Korean Ministry of Environment has been implementing special management measures for maximum safety in the management of the medical waste resulting from "K-quarantine" activities. A key aspect of these special management measures is the same-day discharge, transport, and incineration of the medical waste produced by COVID-19 patients.

Keywords: COVID-19, Medical waste, Measures, RFID, Special management

CRYOSPHERE CHANGES IN MONGOLIA UNDER GLOBAL WARMING

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Abstract: Mongolia is located in one region in the world with very fast global warming effects, with an air temperature increase of 2.4oC during the last sixty years, approximately three times higher than the global mean. The changes of the natural zones from the Siberian boreal forest in northern Mongolia to steppes and deserts in central and in southern Mongolia can be observed dramatically. This shift of these zones roughly corresponds to a change from discontinuous to sporadic permafrost, and finally to permafrost-free zones in a planetary and glacier decay in a hypsometric change. In the periglacial environment the trends of freezing and thawing indices confirm global warming. The trend in the thawing index (up to 14.4°C-day per year) was larger than the trend in the freezing index (up to -10.1°C-day per year). Global warming in Mongolia effects permafrost degradation and glacier retreat dramatically. For instance, mean annual ground temperature (MAGT) at 10-15 m depth increased by 0.02 − 0.03°C yr-1 in permafrost zones in northern and central Mongolia, where ice-rich and cold permafrost occurs extensively. In the southern Khangai and Khentii mountains with underlying warm permafrost, MAGT at the former depth increased by 0.01 − 0.02°C yr-1. Furthermore, even where permafrost is still stable, the increasing thawing index could lead to depress the active layer. In addition, a huge recession of glaciers in the Altai, Khangai, and Khuvsgul mountains has been intensively observed during the last decades.

Keywords: Global warming, permafrost degradation, glacier retreat, Mongolia

RESPONSE OF PERMAFROST TO CLIMATE CHANGES AND ITS ENVIRONMENTAL IMPACTS: AN REVIEW

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Abstract: Mongolia permafrost region is located in the transition zone of high-altitude and high-latitude permafrost, whose permafrost is unstable as it partly belongs to the south of Siberian permafrost zone. Under the influence of global warming, the permafrost in Mongolia is changing significantly. The global permafrost temperature has increased by 0.29±0.2^{0}during 2007 to 2016, while the Mongolia permafrost temperature has increased at a rate of 0.5^0/10 and the variation is similar to Central Asia and some mountainous regions of Europe. The average thickness of the active layer is 8m. In the prediction model of permafrost, the continuous and discontinuous permafrost will decline rapidly, and in the middle and late 21st century, seasonal frozen ground will account for more than 60%, so the permafrost degradation is severe. Based on the above analysis, it is proposed that the long-term field monitoring should be strengthened in the future. We should pay attention to the assessment of the future changes of permafrost and strengthen the comprehensive analysis.

FEATURES OF DROUGHT AND PLUVIAL PERIODS IN THE LAKE BAIKAL BASIN INFERRED FROM TREE RINGS

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Abstract: The report presents the results of reconstruction of the Palmer Drought Severity Index based on Scots pine tree rings. The longest dry and wet periods were revealed. The second half of the 20th century and the beginning of the 21st century are characterized by some of the longest and most severe periods of drought. It is noteworthy that often dry and humid periods in the Russian and Mongolian parts of the Lake Baikal basin do not coincide in time, thus in the same years in the south of the basin increased moisture can be observed, while Transbaikalia is experiencing drought.

GLACIER LAKES OUTBURST FLOODS IN PANJSHIR PROVINCE OF AFGHANISTAN

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Introduction.

The Panjshir province is one the main tributaries of the Kabul River Bain for tie mighty river located at 120KM in the northeast of the capital Kabul, from high at 5200 m sl in sough of Hindu Kush Mountain the lowest part end at 1600m above the see level. Panjshir sub-watershed plays an important role in runoff and ground water flow in the Kabul River Basin and supplies the desired water to downstream and hydropower dam like Naghlu and Sorobi (Taniwal,2018)

The unexpected flash floods are a big concern in this narrow valley and wash villages, destroy form lands and threatening people's life. Knowing the characteristic and frequency of such phenomena helps the government and local people to mitigate in a proper way.

Goal of the study is to study the possibility of Glacier Lake outburst Floods GLOF and their causalities within the study area.

Object of research.

Finding the Glacier lakes that have the potential of flood, mapping at risk area down to the lakes, calculation of area of the farm lands, houses and people are the tasks in this study.

Methodology. The satellite imagery of Landsat 8 will bill used to determine the numbers of the existing lake. The slope gradient of the site-topo will be used for determination of the outburst risk the analyses of the slope, size of the lake barrier type will lead to understand the possibility of lake outburst and successor floods.

Results (expected). The study reviled there are 230 glacier lakes within this sub basin, 150 lakes are with no risk of outburst, 75 lakes are with low risk of outburst and 5 lakes are with high risk of outburst. The potential outburst of the lakes and successor flood threaten the around 4500 hectares of agricultural land, 25 villages, 300 houses and approximately 1000 people life. The study also discloses the once per every 5 years occurs a lake outburst flood in study area.

Discussion. For a better result the history of flood has been reviewed, all the seasonal flood that were consequent of precipitations were filtered, the result of this filtration compared the geography of study area in comparison of the flood potent to achieve the possible lake outburst.

Conclusion. This study is a base for the flood hazard analyses, the lack of floods and their causalities data limits the studies. For the exact casualties documentation a detailed site inventory along with a wide interview with local people is required. Furthermore the floods produce by heavy rains are significant to be studied.

ACCELERATED RECENT WARMING AND TEMPERATURE VARIABILITY OVER THE PAST EIGHT CENTURIES IN THE CENTRAL ASIAN ALTAI

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Dean

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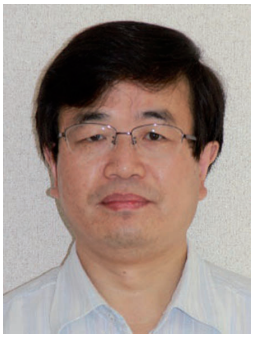
Abstract: We have reconstructed nearly 750 years (1269–2004 C.E.) of summer temperatures in Mongolia based on Siberian Larch tree rings, using a relatively new analysis method called delta blue intensity (DBI). This is a region of the world with relatively few long records of climate, and one that is experiencing unprecedented warming over the last three decades. This warming is projected to intensify and reach levels that go beyond the range of natural climate variability that is estimated by our reconstruction. In our analysis, we capture the warming trends observed in instrumental records as well as extreme-cold events that coincide with the well-documented, large-scale volcanic events of 1459, 1601, 1810–1816, and 1885. Our results add to an increasing number of studies detailing the potential of DBI to improve paleoclimate models as compared to traditional tree-ring width analysis, especially in Siberian Larch and other species that express a significant heartwood/sapwood color change.

EVALUATION OF THE INFLUENCE OF ANTHROPOGENIC DISTURBANCES ON PASTURE CARRYING CAPACITY AND ITS VULNERABILITY IN ARID AND SEMI-ARID REGIONS



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Abstract: This study aims to assess the impacts of both climate change and anthropogenic disturbances such as mining development and urbanization on pasture carrying capacity and its vulnerability based on water resources in arid and semi-arid regions. To achieve the above purpose, we developed an integrated model to evaluate the pasture carrying capacity (CC), grazing pressure (GP) and vulnerability index (VI). The model was applied to four target areas: an urban area (Ulaanbaatar) and a steppe area (Altanbulag) in semi-arid regions and a mining area (Khanbogd), and a desert (Manlai) in arid regions. The results revealed that GP greatly exceeded pasture CC in the urban and mining areas. The order of CC, GP, and VI was as follows: (1) CC: steppe area > urban area > desert area > mining area; (2) GP: urban area > steppe area > mining area > desert area; (3) VI: urban area > mining area > desert area > steppe area. We are now trying to use the integrated model to evaluate the efficiency of adaptation strategies.

Keywords: Human-induced disturbances, Climate change, Pasture carrying capacity, Grazing pressure, Vulnerability index.

SOIL POLLUTION OF URBANIZED CENTERS OF BAILKAL REGION (IRKUTSK, ULAN-UDE, ULAANBAATAR CITIES)

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Abstract: The article provides a comparative assessment of the degree of soil pollution of various cities of the urbanized centers of the Baikal region. The material was statistical materials, cartographic works and data from soil and geochemical studies conducted by the authors in 2012-2019. Soil samples of the central cities of the Irkutsk region, the Republic of Buryatia and Mongolia (Irkutsk, Ulan-Ude, Ulaanbaatar, etc.), as well as adjacent territories were selected. It was revealed that the most polluted are the soils of Irkutsk (with an indicator of total pollution Zc = 4-63), due to the presence of a large anthropogenic load and relatively high sorption capacity of soils. The main sources of pollution are petrochemical and metallurgical enterprises, CHP, boiler houses and vehicles. Toxic substances in soils exceeding the background spread towards the main direction of the winds and along the valley of the Angara River. The least pollution was recorded in Ulaanbaatar (Zc = 2-23) despite the large anthropogenic load (emissions of the thermal power complex, construction, transport and repair enterprises and vehicles), since soils have a light granulometric composition through which pollutants migrate to surface and ground water. Soils of Ulan-Ude have an indicator of total pollution Zc = 5-24, which varies from an average to a low level. Pollution is local near industrial plants, boiler houses, road and rail transport.

SOIL EROSION AND SOIL ORGANIC CARBON IN THE FOREST STEPPE ZONE: A CASE STUDY IN MUKHAR, WEST KHENTEI, MONGOLIA

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Abstract: Specifics and relationships between soil erosion and soil organic carbon in the Mongolian forest-steppe were studied in this research, in a case of Baga Mukhar catchment, west Khentei. Soil erosion was estimated by the Cesium-137 isotope tracing method. For estimation of soil redistribution rates from inventories of 137Cs, diffusion migration model used in grazing lands and mass balance model-2 used in cultivated land. In total, 38 soil samples were taken from 5 isosectors. The mean soil redistribution of the catchment was -3.67 t ha-1 y-1. In cultivated land, soil erosion was the highest with a value of -15.47 t ha-1 y-1 and it gets higher (-24.43 t ha-1 y-1) if we take into account that the cultivated land is located at the bottom of the valley where has deposition. Soil erosion in the south-facing slopes is 5.1 times higher than north-facing slopes, which shows slope differences significantly influence vegetation growth and soil erosion. The average soil organic carbon of the study area is 4.37 %. SOC was highest in the forest area (7.33 %) and the lowest in the agriculture field (2.48 %). SOC in the north facing slope was 2.4 times higher than the south facing slope. Isosectors mean value of soil redistribution and SOC is comparatively well corresponded (r2=0.567). Soil erosion and soil organic loss in agriculture is a significant, it needs more appropriate management practice and soil conservation activities in the Mongolian forest-steppe.

Keywords: Cesium-137, forest-steppe, Mongolia, Soil erosion, Soil organic carbon

URBAN FOREST COVER CHANGE AND RESPONSES TO CLIMATE: CASE STUDY BASED ON ULAANBAATAR CITY, MONGOLIA

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Abstract: Due to Mongolia's transition to a free market economy, the concentration of the population towards the capital city has increased rapidly since 1990. As a result, the impact of urbanization is increasing, forest use around the capital city is becoming more chaotic, and the impact of urbanization on forests and air pollution is increasing. These climate changes and changes in forests associated with global warming threaten to degrade forests and further the degradation of suburban ecosystems. Therefore, there is an urgent need to identify changes in suburban green forest areas over the past 30 years of urbanization and climate change in relation to climatic factors, to further improve forest resource management, and to develop a scientific basis for climate change adaptation management. Therefore, we conducted this study to identify forest changes in the green zone around Ulaanbaatar and to study them in relation to climatic factors. In this study, both field measurement and GIS were used for forest mapping. The forest area of the green zone in Ulaanbaatar was 96,384.42 hectares in 1989, but as of 2019, the total forest area has decreased to 84,470.31 hectares. Also, there is a weak inverse relationship between the annual growth rate of trees and the air temperature in May-August, suggesting that this decline may be related to climate change.

Keywords: Climate, Forest mapping, Forest change detection

PRELIMINARY RESULTS OF ECOSYSTEM SERVICE VALUATION OF SAXAUL FOREST IN MONGOLIA

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Abstract: Haloxylon ammodendron (saxaul) formations are among the most widespread plant communities of the Gobi desert in Mongolia, where they occupy about 2 million hectares. The ecosystem services and values of dryland ecosystems are underestimated mainly due to they are least productive and exhibit the lowest vegetation carbon densities. The Millennium Ecosystem Assessment (2005) approached on the valuation of the ecosystem services and concluded that drylands also provide ecosystem services contributing to human well-being. This study attempts to evaluate total economic value of Saxaul forest ecosystem service by applying various valuation methods. Preliminary results show, the total saxaul ecosystem value of Mongolia is 40.4 billion MNT per annum, of which the greatest value belongs to cultural and regulating services. Considering the amount of contribution provided by the saxaul forest on the integrity of drylands (e.g. erosion prevention, sand fixation, carbon sequestration, water regulation ,etc.) it is important to conserve this ecosystem and prevent further degradation, which should rely on solid knowledge of this ecosystem's economic potential.

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SESSION 2:

INTER –TRANSDISCIPLINARY RESEARCH

Session Description

This session on Inter – Transdisciplinary research covers topics such as research on the diversification of the level of socioeconomic development, scientific implementation of the Belt and Road Initiative, economic corridor of China-Mongolia-Russia, economic and geographical and cluster analysis.

Prof. Wang and Dr. Li provided a reference for promoting the development and utilization of synchronous data resources, information integration and sharing, and the construction of collaborative innovation application environment of the “Belt and Road” economic corridor; and promote decision-making support for the sustainable development of the Belt and Road Initiative. As an important country in the Economic Corridor of China-Mongolia-Russia, a deep understanding of the coupling relationship between urbanization and the eco-environment in Mongolia is meaningful to achieve green development of the Belt and Road Initiative. Presenter Dr.Zheng revealed that the coupling coordination between urbanization and the eco-environment in Mongolia was generally at the stage of seriously unbalanced development and the main contributor of the urbanization and the eco-environment subsystem were demographic urbanization and eco-environment endowment. Study of Dr. Altanbagana and MSc.Tseyenkhand developed the key concepts and criteria of a transborder of urban cluster suitable for the Mongolian context, and it has the advantage of being able to effectively address regional development and territorial organization issues.

The economy is entering a new phase of post-COVID development. Therefore, it is necessary to take into account new trends in economic development and transport corridors. Acad.Tulokhonov et al., analyzes the existing economic corridors, examines the existing opportunities for further development of Russian-Chinese cooperation on mutually beneficial terms based on the development of economic corridors and their impact on further development, considering the economic and geographical analysis. Anthropogenic and climate change impacts on the environment and social and economic sectors in Mongolia is presented by Dr.Satoshi and Dr.Altanbagana respectively. Moreover, Dr.Stanny shares the successful implementations of ongoing monitoring on policy and projects which implemented in Poland and her presentation includes the structure of the research area, the methodology elements, assumptions and findings.

The overall subjects of this session highlight the socio economic phenomena, process integration, future development trends and the many factors which are contributing to them.

HUMAN-ENVIRONMENTAL SYSTEM: FROM LOCAL TO GLOBAL SUSTAINABILITY

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Abstract: About 2 decades ago, the Global Land Project began to study the land system as a coupled human-environmental system. At that time I was working as a Research Scientist at the Natural Resource Ecology Laboratory of the Colorado State University in partnership with Dennis Ojima, who co-chaired the Global Land Project at its early stage. My research interest shifted from ecosystem to coupled human-environmental system studies. After coming back to Mongolia in 2002, I focused on pastoral social-ecological system studies at community level and sustainable development at national scales in collaboration with M.Altanabagana, S.Davaanyam, B.Tserenchunt and Ch.Davaasuren etc. We summarized states of herders and communities in the diagram from human and ecosystem states points of view. There were four states and transitions between them: desirable and undesirable development pathways. Pathways towards "Win-Win" socially and ecologically were the most desirable ones. This model guided my research at national and global scales too.

I proposed green development pathways towards "Win-Win" state to become as the scientific framework for the Green Development Policy 2030, which was adopted by the Parliament of Mongolia in 2014. Current undesirable development trend in Mongolia towards Collapse or "Lose-Lose" was a warning signal for unsustainable development pathway for Mongolia. This scientific framework included low carbon green development pathways.

I observed that the HDI was lacking any environmental dimension to be sustainable development index when I was asked to write background paper on land degradation for the HDR by the Government of Mongolia. I proposed to include carbon dioxide emission per capita as an environmental index into the HDI, making it as the Human Sustainable Development Index (HSDI). The "Nature" published by article in 2011, probable it had implications for both sustainable development and climate change. The same diagram on human and environmental dimensions helped me to propose this important idea from "Win-Win" for human development and environment, also tackling the climate change issue.

Sustainable Development Index (SDI), consisting of 3 pillars of sustainable development and addressing country's transformation across human, national and global scales, is proposed. Social index integrates health and education indexes; an economic index integrates income inequality and GNI/capita; environmental index integrates CO2 per capita and materials footprint per capita as planetary pressures. Countries are divided into 3 groups of high, medium and low sustainability based on ranking by the SDI 2020

index. Europe leads the world by sustainability. Africa is on unsustainable pathway. Asia-Pacific and North America are mostly in medium sustainability domain. People and land mass countries such as China, India, Russia, USA, Canada and Australia except Brazil, are in medium sustainability domain. Both China and India are in bottom part of medium sustainability domain. The SDI means a new paradigm both for sustainable development and climate change. The SDI addresses both intragenerational and intergenerational equality. Ranking of countries by the SDI measures, catalyzes and steers transformation towards global sustainability. The SDI may become a next generation index after the HDI to address both human development and global sustainability.

Finally, I would like to share my future research interests on local, national and global sustainability:

- Application of modern technologies such renewable energy and information technology with conservation of traditional natural-cultural integrity is the best green development pathway towards sustainability. For example, holistic ownership of renewable natural resources such as water, rangeland and forest by traditional one land-water community could be a foundation for local and rural sustainability in Mongolia.

- Conservation of nomadic civilization in the Gobi, conservation of natural, cultural and historic heritages could serve as foundation for sustainable regional development in Mongolia. For example, registration of the pastoral system in Mongolia as “Globally Important Agricultural Heritage System” in the UN FAO system would open new perspectives for sustainable regional development.

- Finally, I am interested to continue the SDI ranking research for 2021, which will demonstrate how the COVID-19 will impact on global and national sustainability.

REVIEW AND PERSPECTIVE FOR RESOURCES AND ENVIRONMENTAL INFORMATION DEVELOPMENT AND SERVICE ALONG THE ECONOMIC CORRIDORS OF THE BELT AND ROAD INITIATIVE

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Abstract: The “Belt and Road” is a major international cooperation initiative proposed by China to adapt to current development needs, with six economic corridors as its core pillars. The region of interest spans the three continents of Asia, Europe, and Africa, involving a large number of countries with varied regional geographical conditions and complex resources and environmental backgrounds. Determination of resources and environmental information along the routes systematically and comprehensively will play a crucial role in decision-making support for promoting the scientific implementation of the Belt and Road Initiative. Considering the complex background of geographical resources and the environment and the diverse international cooperation needs, the development and utilization of resources and environmental information along with the “Belt and Road” faces several development opportunities and challenges. This presentation proposes a Spatial Information Service System for the Belt and Road Initiative oriented toward collaborative innovation, and two technical routes, top to bottom and bottom to top, are used to demonstrate the overall framework of information acquisition and utilization, and generation of information services for decision support. The progress on resources and environmental information development and services in the six economic corridors is reviewed, including resources and environment patterns and spatiotemporal evolution, monitoring and evaluation of the United Nations Sustainable Development Goals(SDGs), key technology application of disaster risk reduction knowledge service, resources and environmental information integration and sharing, and the effect of COVID-19 on economic and social development, which can provide a reasonable foundation and reference for the establishment of a comprehensive “Belt and Road” resource, environment, and spatial information service system. Finally, the development trends and the main directions for potential research and cooperation are highlighted, including strengthening the comprehensive collection and service capabilities of basic resource and environmental data; providing further contributions to data and methods on SDGs target monitoring and evaluation in China; integrating the entire chain of data, information, and knowledge of disaster risk reduction applications; promoting the integration and sharing of resource and environmental data with harmonized standards; and promoting the construction and application of collaborative innovation platforms involving multiple parties. This research would provide a reference for promoting the development and utilization of synchronous data resources, information integration and sharing, and the construction of collaborative innovation application environment of the “Belt and Road” economic corridor; and promote decision-making support for the sustainable development of the Belt and Road Initiative.

RURAL DEVELOPMENT MONITORING - A TOOL FOR ANALYSING SOCIO-ECONOMIC CHANGES IN POLAND

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Abstract: The ongoing monitoring of rural development was recommended in 2019 by the Regional Development Policy Committee and included as the eleventh principle in Principles on Urban Policy and on Rural Policy (OECD 2019). Since 2012, research on the diversification of the level of socioeconomic development of rural areas in Poland has been carried out consistently at the Institute of Rural and Agricultural Development of the Polish Academy of Sciences, as a joint project with the European Fund for the Development of Polish Villages. The results so far have been presented in three reports entitled Rural Development Monitoring (MROW). The main purpose of the project is continuous monitoring of changes taking place in rural areas in terms of the level of socioeconomic development. Spatial aggregation of territorial units by administrative criterion at the local level was used in the studies. The study covered rural and urban-rural municipalities constituting a set of 2173 surveyed units. The project used data obtained from several dozen public institutions (integration of dispersed data sources). Statistical information was supplemented by a set of surveys carried out in each municipality of the country. The outcome of this research was used, in particular, by the OECD in 2016-2018 to carry out Rural Policy Reviews. Poland 2018 for the Government of Poland (OECD 2018). The methodology of the study takes into account key aspects of rural development, both economic and non-economic, without neglecting its basic feature, which is spatiality. It covers issues related to the deagrarianisation of the local economy, agricultural and non-agricultural sectors, spatial accessibility of the municipalities, local public finance, labour market, demography, education, the well-being of local communities including their living conditions, as well as the social activity - a total of 11 components. The components were operationalised using 47 empirical indicators. On their basis, an algorithm of synthesis measure of the level of socioeconomic development was developed. The mapping of the synthesis measure reveals that the differentiation of the socioeconomic development of rural areas in Poland is determined by the two overlapping patterns: east-west and centre-periphery (in regional arrangements). A typology of rural areas was built considering the relation of factors shaping the local development level. The analysis was conducted using an iterative method based on a gravity model in an 11-dimensional space. The results made it possible, i.e., to distinguish seven types of municipalities similar to each other in terms of the criterion used. It turned out that the main determinants of the character of individual types relate to the degree of deagrarianisation of the economy and the nature of the agrarian structure. The aim of the presentation is to show the structure of the research, the methodology elements and assumptions made and the results obtained. In particular, we aim to focus on the results which concern the recommendations for cohesion policy in the spatial dimension in relation to rural areas of Poland.

QUANTITATIVE ANALYSIS OF THE COUPLING COORDINATION DEGREE BETWEEN URBANIZATION AND ECO-ENVIRONMENT IN MONGOLIA

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Abstract: As an important country in the Economic Corridor of China-Mongolia-Russia, a deep understanding of the coupling relationship between urbanization and the eco-environment in Mongolia is meaningful to achieve green development of the Belt and Road. The entropy method and coupling coordination degree model were integrated to evaluate the coupling coordination degree between urbanization and the eco-environment in Mongolia during 2000-2016. The results of this study revealed that the coupling coordination between urbanization and the eco-environment in Mongolia was generally at the stage of seriously unbalanced development and that the main contributor of the urbanization and the eco-environment subsystem were demographic urbanization and eco-environment endowment, respectively. The southern part of Mongolia's central zone should be paid more attention due to the lower degree of coordinated coupling between urbanization and the eco-environment. To promote healthy urbanization development in Mongolia, a six-layer eco-city establishing green development pattern is proposed to provide scientific support for Mongolia.

INCREASED EFFICIENCY AND EFFECTIVENESS THROUGH E-LEARNING, MERIT PROJECT, MONGOLIA

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Abstract: The MERIT project, funded by Global Affairs Canada, is collaborating with Mongolian public organizations focused on the system level, improving capacity to implement central directives such as policy and guidelines targeting improvements in personnel capabilities and institutional instruments through practical e-learning on result-based management, environmental legislation, field manuals and initiating a mine closure plan pilot.

During this pandemic period, MERIT developed several training programs in collaboration with central-level public organizations on different topics. The virtual deliveries have been successful, responding appropriately to the needs of public servants during the COVID-19 to receive guidance and directives effectively and efficiently from the authorities.

This practical experience brought many opportunities to the public organizations to disseminate methodological guidance and support producing evidence-based decisions to ensure legal compliance in those areas.

Furthermore, MERIT has taken a multi-stakeholder approach to develop a mine closure plan, implement new regulations applying best practices that are evidence-based and gender-sensitive to inform policy.

OPPORTUNITIES FOR THE DEVELOPMENT OF NORTH ASIA IN THE "ONE BELT - ONE ROAD" PROJECT: PROBLEMS AND SOLUTIONS

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Abstract: The economy is entering a new phase of post-COVID development. It is necessary to take into account new trends in economic development and transport corridors. The article analyzes the existing economic corridors, examines the existing opportunities for further development of Russian-Chinese cooperation on mutually beneficial terms based on the development of economic corridors and their impact on further development, taking into account economic and geographical analysis. The cooperation programs of the regions of the Far East and Eastern Siberia, as well as the Northeast of China, are analyzed. In conclusion, we propose a number of main factors for consideration, changes and additions that can be made to future programs between the Russian Federation, Mongolia, and China, which will be mutually beneficial and have a cumulative effect.

Keywords: Steppe road, China-Mongolia-Russia cooperation, Transport corridor, Economic corridor, Inter-national cooperation

THE RESULTS AND PROSPECTS OF GEOGRAPHICAL RESEARCH IN THE TRANSBOUNDARY TERRITORY OF RUSSIA AND MONGOLIA AT THE BEGINNING OF THE 21ST CENTURY

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Abstract: This paper presents the main scientific research results of cooperation of the V. B. Sochava Institute of Geography SB RAS and the Institute of Geography and Geoecology of the Mongolian Academy of Sciences. Focus and priorities of research resulted in the complex atlases, joint monographs and other scientific works, are highlighted. Particular attention is paid to the results of studying the inaccessible areas of the Hovsgol region. The authors emphasize that the landscapes of the transboundary areas are developed very unevenly and require a special approach in the natural resources management and predicting the environmental response to negative impact. The priority directions of further geographic and geoecological research areas related to the study of transportation infrastructure and their socio-economic consequences are revealed. Study of interculturality in different periods of time is also one of the important research areas.

CLIMATE CHANGE IMPACT ON SOCIAL AND ECONOMIC SECTORS IN MONGOLIA

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Abstract: Nomadic pastoralism is a herder-pastoral-livestock system. These components are interlinked to sustain each other and each contains some level of adaptive and resilience capacity. Thus, it is necessary to consider all components of pastoralism in a systematic manner. As a result of climate change, intensity and frequency of droughts and dzud are increasing and they have negative impacts on the socio-economic development. The purpose of this study is to describe how climate change is affecting herder's livelihood, livestock loss, GDP growth in agriculture sector and migration in Mongolia. Number of herders and households, rural poverty, migration to urban areas from rural areas, production of agricultural sector, annual GDP growth of agricultural sector, livestock numbers and losses, drought and dzud indexes were used to analyze the impact of climate change on herder-pastoral-livestock system.

In 2000-2003, drough-dzud disaster affected over 90 percent of Mongolian territory and caused 11.17 million livestock loss. In 2009-2010, 80 percent of territory was affected and 10.32 million livestock were lost. The number of herder households decreased by 22.5 thousand and 24 thousand during 1999-2002 and 2009-2010 dzud respectively. After the occurrence of two times dzud, the production of agricultural sector in total GDP decreased by 44 percent in 2002 and 35 percent in 2010. The unemployment rate reached 4.6 percent in 2001 and poverty in rural area reached 43.4% in 2003. It was 33 percent increase compared to 1998. In 2003-2015, 122.1 thousand people migrated to Ulaanbaatar city due to the 1999-2002 and 2009-2010 dzuds. This is 26 percent of the total migrants and can be defined as "climate refugees". In Mongolia, there is a strong connection between "climate change-poverty" and "climate change-migration" because of their unique life style, settlement, economic and ecosystem characteristics.

Keywords: Climate change, Drought-dzud impact, Livestock loss, Poverty, Migration.

THE INFLUENCE FACTORS OF REGIONAL ECO-EFFICIENCY IN MONGOLIA

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Abstract: It is a significance for the region to realize the green sustainable development, especially for Mongolia which is an ecologically fragile developing country. 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 Mongolia, combining traditional indicators of economic efficiency to build Mongolia's eco-efficiency input-output framework. By collecting period 2007-2016 data and using the SBM model, the eco-efficiency of 22 provincial administrative units in Mongolia 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. The population density and energy consumption technology had an obvious effect on the improvement of Mongolia's eco-efficiency.

Keywords: eco-efficiency; influence factors; SBM mode; Mongolia

AN ANALYTICAL FRAMEWORK FOR REGIONAL ROAD NETWORK DEVELOPMENT AND ENVIRONMENTAL LOAD REDUCTION

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Abstract: Developing countries with arid climate and covering large areas of land, such as Mongolia, contain few paved roads for interregional transportation, and vehicles travel directly on sandy terrain. Therefore, the ruts that are carved by running wheels have an adverse effect on the surrounding vegetation. This research involved the construction of a mathematical planning model to identify the optimal sections that would need to be developed to improve the convenience of transportation and reduce the environmental load simultaneously. An approach such as this would concentrate the traffic demand on the improved sections to enable vehicles to travel at higher speeds.

EDUCATIONAL TOURISM AND ORGANIZATION OF RECREATIONAL ACTIVITIES FOR THE NATIONAL PARK MANAGEMENT

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Abstract: We consider planning educational ecotourism in the specially protected natural areas. The model territories are the Zabaikalskii National Park and the Barguzinskii Reserve. The Sochava's theory of geosystems, field research, comparative-geographical analysis, geoinformation mapping and remote sensing methods are used for the investigation. Special geoinformation database was created for every nature units. It includes information about the area under study, such as the landscape and vegetation types, their disturbance degree, resistance to anthropogenic impact, available touristic infrastructure and routes, and other characteristics. As a result, an area-planning scheme for educational tourism is worked out. It consists of several steps from the first idea to the final design of a trail and excursion rout. The number of special thematic maps were created based on the collected geographical information according to the scheme. They are used for further educational tourist activity planning on the four model plots, taking into account natural and socio-economical (recreational, infrastructural, etc.) features of the territory. The research results can be replicated for other protected areas of Russia.

EVALUATING THE TRANSBORDER URBAN-CLUSTER ALTERNATIVES SUITABLE FOR REGIONAL DEVELOPMENT CONCEPT OF MONGOLIA

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Abstract: Mongolia is a country with a large territory, has abundant natural resources, is located between the two great powers, Russia and China. For this reason, a transborder urban cluster can be a significant tool to support agriculture, tourism, trade, and further education, health, and transport sectors. Within the framework of this research, we aim to identify key concepts of a transborder urban cluster, which are suitable for Mongolian conditions, and make qualitative, quantitative, and spatial analysis on this cluster by the means of certain criteria and Analytic Hierarchy Process (AHP). We selected eight transborder urban cluster alternatives connecting four with Russia and four with China. Compared to other alternatives, the Ulan-Ude-Sukhbaatar urban cluster has the lowest distances between the two cities, free economic zones, transit of international border crossings, and good transport conditions; therefore, the cluster received the highest score in this study.

Keywords: Transborder Urban cluster, AHP method, Regional development, Economic corridor

EST 2021

SESSION 3:

ENVIRONMENTAL INNOVATION AND TECHNOLOGY

Session Description

Sustainable environmental management aspects needs to be addressed not only in the country but also in the region and globally. The important rules which human play in and in even control of using natural resources such as mining, rural to urban migration, intensity of land use, desertification, water resource capability etc.al, human interventions are requires complex study to implement nature friendly technologies and efficient innovative concepts.

In this session, scientists gathered to find a solution to these issues and discuss science and policy interaction for combating desertification in Mongolia and China which is monitored and clarified with high resolution technologies, development of remote sensing technology for the use of environmental long term study to monitor environmental degradations such as water body extraction with high accuracy of parameter variables, other simulation methods using data from several hydrological stations.

“Prevention before cure” term should take action in simple environmental activities to minimize potentially large-scale problems, therefore some studies such as identifying the distribution of permafrost using ERA5-Land data from surface temperature changes in Mongolia, soil contamination by mechanical contaminants with powder particles, such as iron ore concentrator waste could lead to groundwater degradation, another human activity in action of prevention could be relationship between dust storms and land restoration.

Such contributions to mitigate the environmental degradations are discussed in this session to bring involvement of stakeholders regardless of the situation, pending development of a more comprehensive response strategy and nature friendly technology from the authorities concerning the sustainable environmental management.

SCIENCE AND POLICY INTERACTED FOR COMBATING DESERTIFICATION IN CHINA

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Abstract: Since beginning of 1950s there were some research and projects for combating desertification/land degradation in China, but can't meet the needs from national to local levels. In 1958 the Centre Government convened a National Conference on Combating Desertification and encouraged all efforts to do so. Meanwhile, the Chinese Academy of Science (CAS) established the Institute of Desert Research for better understanding the process and situation of damages from the desert/desertification and proposing the strategy and tactics to national policy and projects. China, as one of the UNCCD contracting states, promulgated the Law of the People's Republic of China on Prevention and Control of Desertification in 2001, which went into effect since 2002. Scientists contributed a lot to the LWA based on the researched results of the environmental background, main causes, dynamic monitor and assessment of development/ combat processes, method and technique, proposal of policy and project, etc.. Take the Aeolian Desertification as example. We defined the aeolian desertification is land degradation through wind erosion mainly resulted from the human impacts in arid, semiarid and sub-humid regions of Northern China. The key point to the definition, based on our study for 4 decades, is that the aeolian desertification has been caused mainly (more than 80%) by human activity on the unreasonable pattern and intensity of land use and can be combated by a human being only. So, our scientific group suggested and designed the "Grain for Green Program", with the guarantee of success on theory and practice, to the center government for combating aeolian desertification in Northern China. This Program carried was out since 1997 and will be finished by 2019 with 75 billion Yuan (about 11 billion US$), which entirely comes from the national budget. The encouraging result that the aeolian desertified land decreased and the developed rates came to the negative number since 2000 as table 1 and 2 show. One can say that UNCCD's "Land Degradation Neutrality target setting" had been achieved since 2000 from the aspect of combating aeolian desertification in Northern China.

MITIGATION MEASURE FOR GROUNDWATER EXTRACTION IMPACT ON FLOW OF THE TUUL RIVER, MONGOLIA

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Abstract: Due to growing population, expanded irrigation areas and economic development, water demand increased worldwide over the past decades. In many areas, limited of the productive potential of surface water to cover the increasing fresh water demand; therefore groundwater abstraction has increased to meet water demand in worldwide. In semi-arid and arid arias, groundwater is usually the main water sources of fresh water because of limited source water resources. Many semi-arid watersheds have an alluvial floodplain of the river and river flow is hydraulically linked with its floodplain groundwater. Therefore, the recharge rate is higher and residence time is relatively shorter than other aquifers. Groundwater abstraction from an alluvial aquifer induces an increase of recharge from rivers to the aquifer. In other words declined a volume of storage due to abstraction can be compensated by mainly river water. As a result, river flow decreases through changes in baseflow and water loss from river to the aquifer.

Ulaanbaatar, capital of Mongolia, completely depends on groundwater sourced production wells located in an alluvial floodplain of the Tuul River. A reach of this river (15-30 km), where groundwater production wells are concentrated along alluvial floodplain, has been dried up in early spring for 3 to 30 days in some years since 1997. In this study, we attempted to investigate: (1) impact of groundwater abstraction on flow the Tuul River, and (2) to identify the cause of the river drying phenomenon in early spring (April) using MODFLOW model.

According to the results, the river water hydraulically linked with its alluvial floodplain groundwater. River recharge was the largest input in this alluvial aquifer, which makes up about 88.7 % of the total input and about 64.0 % of the total input turns into groundwater abstraction. As a result of water extraction, groundwater storage decreases during cold season, and the most of dropped storage is compensated by the river water when the river starts flow in spring and summer. The monthly averaged river flow rate has been reduced by 7.5-32.0 % due to the abstraction in this floodplain. According to modeling and scenario analysis, groundwater abstraction rate needs to be reduced by 20 % in October, 40 % in June and 60 % between November and following year purpose in order to protect freshwater biodiversity and sustain river flow for ecosystems in this floodplain.

RESEARCH ON THE ADAPTABILITY OF DEEP LEARNING ALGORITHM BASED ON ROI LABEL IN TUUL RIVER WATER BODY SEGMENTATION

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Abstract: The carrying capacity of water resources is the key to the development of Mongolia with animal husbandry as the mainstay. Mongolia, located in arid and semi-arid regions, must reasonably protect, monitor, and utilize water resources. Remote sensing technology has the advantages of facilitating observations over large areas and timeliness. The technology can be applied in water resources management, flood disaster monitoring, water ecology monitoring, and other fields in real-time. Given the high cost and low coverage of high-resolution images and the high coverage but low resolution of low-resolution images, this paper proposes a pixel-based CNN (Convolutional Neural Network) method to extract water for the region of interest (ROI) and applies it to medium-resolution Landsat images. The pixel-based CNN is compared with the traditional Normalized Difference Water Index (NDWI), Modified Normalized Difference Water Index (MNDWI) threshold method, U-net model in deep learning, and pixel-based DNN model. Among them, the training parameters of the pixel-based CNN method, in terms of the training speed and time, is shorter. It also has better water extraction results in the cloud, cloud shadows, and building areas. In terms of training accuracy, the accuracies of pixel-based CNN, pixel-based DNN (Deep Neural Network), and U-net were 99.90%, 96.98%, and 93.70%, respectively. The method proposed in this has the highest overall accuracy of verification at 92.07%. This method can be applied for research on water body extraction from medium-resolution remote sensing images to improve the traditional method, in which it is difficult to distinguish between dark pixels and water bodies while reducing deep learning model parameters and training time. ROI is used instead of full image datasets to reduce the difficulty of building labels in low-to-medium-resolution images.

IMPACT OF THE CONCENTRATOR PROJECT ON THE SOIL COVER

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Abstract: The study found that long-term unprotected dumping of mechanical contaminants with powder particles, such as iron ore concentrator waste, could lead to soil contamination and degradation, which could adversely affect groundwater. The local soil and vegetation cover is contaminated. In Mongolia, which has a harsh continental climate, such irresponsible actions violate the right of people and animals to live in a healthy and safe environment.

Keywords: Iron ore, Ore beneficiation technology, Pollution.

DESERTIFICATION INFORMATION EXTRACTION IN SELENGE PROVINCE BASED ON MULTI-SOURCE FEATURE SPACE AND GEOGRAPHICAL DIVISION

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Abstract: Desertification is an important ecological and environmental problem facing the world. For a long time, due to the influence of natural factors and man-made unreasonable business activities, the phenomenon of grassland desertification in Mongolia has been serious and the ecological environment has deteriorated. At the same time, the increasingly serious desertification has had a serious impact on the animal husbandry economy and people's normal life in Mongolia. Precise inversion of desertification information in Mongolia and a clear understanding of its distribution of different desertification degrees can strengthen desertification control. With the development of remote sensing technology, the use of high-resolution remote sensing images to realize the fine inversion and monitoring of large-area regional desertification information has attracted extensive attention of scholars. This study takes Selenge Province as the study area, uses landsat8 high-resolution remote sensing images, and uses the method of constructing feature space and combining with geographical zoning to carry out fine inversion of desertification information in Selenge Province. It is mainly divided into the following four parts: 1. The construction of multi-source feature space model, and it is proposed to use NDVI, MSAVI, TGSI, Albedo and other surface reference variables to construct three desertification information extraction feature space models: Albedo-NDVI, Albedo-MSAVI and Albedo-TGSI, and use field survey data and Google Earth images to evaluate the accuracy of desertification information inversion results in different feature spaces and analyze their best adaptive environment. 2. Carry out geographical zoning of Selenge Province according to climate, vegetation coverage, elevation and historical data, build the best desertification information extraction model in different geographical regions, and preliminarily complete the desertification information extraction in Selenge Province. 3. It is proposed to scientifically divide the desertification degree of the inversion results in combination with the field survey data, such as soil moisture and organic matter content. 4. Based on the structural equation model, using climate, population and socio-economic data, this paper analyzes the main driving forces of increasing desertification in Selenge Province from natural and socio-economic factors.

COMPARISON RESULTS OF BASEFLOW SIMULATION METHODS IN THE UPPER TUUL RIVER BASIN

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Abstract: The baseflow estimation is essential task for water quality and quantity, drought management, water supply, and groundwater protection. In this study, an exhaustive evaluation of three different baseflow simulation separation methods (EWMA, IHECRES, and Chapman) using data from several hydrological stations (Selbe-Damba, Uliastai-Uliastai, Tuul-Ulaanbaatar, and Terelj-Terelj) in the upper Tuul River basin. Results from the study, the baseflow index was calculated standard deviation of BFI for EWMA ranged from 0.49 to 0.51, for IHACRES ranged from 0.49 to 0.51and for Chapman ranged from 0.49 to 0.51, respectively. Subjective comparison result is as follows i) EWMA method generally yield smoother than other two simulation methods, ii) focusing on the flood that occurred by the Chapman in the Selbe-Damba station, after streamflow peaks, while the other methods do not have the phenomenon. iii) Chapman method medium volumes of among except in Terelj-Terelj station.iv) IHACRES method medium volumes of among except in Terelj-Terelj station.

Keywords: Baseflow, Baseflow index (BFI), Surface flow, Hydrograph separation, Separation method

21ST CENTURY PERMAFROST DISTRIBUTION UNDER THE SCENARIOS OF RCP2.6 AND RCP8.5 IN MONGOLIA

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Abstract: Permafrost in Mongolia is the southern edge of the Siberian permafrost that is the most vulnerable to climate change. We used ERA5-Land data to determine the distribution of the permafrost in Mongolia. This is a first attempt to identify the distribution of permafrost using ERA5-Land data in Mongolia. The future change of soil temperature obtained during 2020–2100 under Representative Concentration Pathways (RCP) scenarios RCP 2.6 and RCP 8.5. This is a first attempt to identify the distribution of permafrost using ERA5-Land data in Mongolia. We examined the projection of permafrost distribution using RCP 2.6 and RCP 8.5 scenarios in Mongolia. The rapid increase of near-surface temperature obtained in RCP8.5 scenario during 2020-2100 with high confidence. Soil temperature also has a high increasing trend similar to the near-surface temperature in the RCP 8.5 scenario. Future projection suggests that permafrost will completely thaw in Mongolia when area-averaged soil temperature in Mongolia exceeds 1.8°C in comparison with the current climate.

Keywords: Future trend of permafrost, Horizontal distribution of permafrost, RCP2.6, RCP8.5, Mongolia

INTERNATIONAL TRADE DRIVEN RELOCATION OF CONTAMINANT BA AROUND THE WORLD

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Abstract: In the context of economic integration and globalization, China has become the world's largest exporter of industrial products and goods and the second-largest goods and service importer. The country is also the largest commodity trading country and the second-largest service trading country, hence playing an important role in the world trade. As a result, China has also been ranked as the largest emitter of toxic pollutants behind the production of these goods and services. The differences in economic levels, industrial structures, and import-export structures between developed and developing countries have led to pollution transfer and caused environmental inequities. This thesis, by taking contaminant BA as an example, calculates the consumption-based emission inventory according to the global production-based emission inventory and the environmentally-extended multi-regional input-output model. We then evaluated the emission transfer between different countries and regions, aiming to further understand the relationship between the global trade and the environmental consequences in China. The results show that developed countries, such as the United States, Japan, and Western Europe, have transferred a large number of high-pollution and high-emission industries to developing countries such as China, India, Russia, and sub-Saharan Africa, making these countries, especially China, a major producer and consumer of emissions in the world. During the course of its industrialization, China has also undertaken the largest transfer of net emissions.

Keywords: Emission inventories, Environmentally extended multi-regional input-output models, International trade

ASSESS HABITAT QUALITY IN THE WESTERN REGION OF MONGOLIA USING INVEST HABITAT QUALITY MODEL

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Abstract: Habitat quality is a concept widely applied in ecology, biology, and natural conservation. The aim of this study is to assess habitat quality using a tool to support the decision-making process. In this study, we used widely used two models: Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) habitat quality and Analytical hierarchy process (AHP). Geographic information system (GIS)-based AHP model was used to estimate the weight of each threat. InVEST habitat quality model was used to integrate information on land use and land cover (LULC) and threats to biodiversity to assess habitat quality for the given area. We selected the western economic region of Mongolia as the study area. For the data analysis, eight threats were prepared (urban land, mining area, paved and unpaved roads, cropland, location of herders, and nightlight). The raster data were obtained from Landsat Operational Land Imager (OLI) imagery, Google Earth map, and geodatabase of Mongolia. Those raster files of the distribution and intensity of each threat, with values between 0 and 1. After estimation of the weighted value of each threat, we assessed threat impact on specific LULC types. The weighted value is created applying the eigenvector that is determined each threat impact on the habitat. Finally, we successfully generated two outputs: habitat quality and habitat degradations maps. The habitat quality map expresses the level of habitat quality on the current landscape. The habitat degradation map expresses the level of habitat degradation on the current landscape. These two outputs indicate the landscape level of the habitat, that is allowing to analyze trade-offs between biodiversity, ecosystem services, and level protection of the area. The results help to understand how to improve the management and provide a scientific basis for decision-makers.

Key words: Biodiversity conservation, Habitat quality, Habitat degradation, InVEST software, Threats

STUDY ON DUST STORM DISTRIBUTION AND LAND USE CHANGE IN MONGOLIAN PLATEAU

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Abstract: Dust storm refers to the catastrophic weather phenomenon with strong wind rolling up a large amount of dust from the ground, making the horizontal visibility less than 1 km, and with a small probability of sudden time and short duration, including sand storms and dust storms. Dust storms will pollute the natural environment, damage the growth of crops, cause human and livestock casualties, and cause serious losses and great harm to the national economic construction and the safety of people's lives and property. Its formation is jointly influenced by natural factors and human activity factors. Natural factors include high wind, precipitation and sand sources; human activities mainly affect the underlying surface, such as artificial overgrazing, excessive reclamation, forest vegetation, industrial and mining traffic construction will disturb the ground structure, form large areas of desertification land, resulting in the decline of land recovery rate, thus accelerating the formation and development of dust storms. Therefore, it is of great significance to study the relationship between dust storms and land restoration. The Mongolian Plateau is one of the cradles of dust storms in Asia, among which the Alxa Plateau in the west, the Gobi region of Mongolia and the desert area in western Inner Mongolia are closely related to the frequent dust storms in China and Mongolia. This study is mainly carried out into two parts: 1. Research on the spatial and temporal distribution of sandstorms from 1990-2020 in 30, mainly using the method of multi-source remote sensing and historical data. Dust storms are observed continuously using MODIS LIB data, which are multi-band and have high time resolution. In addition, remote sensing data such as Landsat TM, Sunflower 8 can be studied to meet the timeline requirements; and remote sensing analysis results can be verified and analyzed according to historical data and station records; analysis of land use change in Mongolian Plateau. Land use data products are used to analyze the characteristics of land use changes in the Mongolian Plateau from the aspects of land use degree and land use transfer matrix.

DESIGN OF SOUM TERRITORIAL PLAN GEODATABASE

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Abstract: A variety of information is required to make a land management plan. This requires land use and social, economic and environmental information. This information needs to be geographically linked and multi-layered. It is easy to combine raster and vector data for each data. Create an integrated database with a UML template, create a link between the Dataset and the Feature class in Arc Catalog, and update quickly. The database will publish a thematic map of the soum. The current status of land use can be categorized into main, sub, and detailed categories of the unified land fund, and further information and changes can be made. In addition, the final solution of the soum's territorial plan with geographical connectivity has simplified the steps to be taken in the future. By designing and creating a comprehensive database, it is possible to become an easy-to-use product for consumers and the public to make changes and develop land use.

Keywords: Geodatabase, Land management plan, Thematic maps

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SESSION 4:

SCIENCE–POLICY PATHWAYS IN MONGOLIA

Session Description

The National Committee for the Future Earth Mongolia initiated this session which has the key role to serve as an 'engagement platform' by fostering the development of sustainability research, programs and initiatives through an open Scientific, Policy and Practical Community diverse disciplines and linking them to international efforts.

The aim of the session is bring together leading academic scientists, researchers, research scholars, decision makers, practitioners, policy formulators and local communities to exchange and share their experiences and research outputs on the aspects of Future Earth international programs, promotion of science-based pathways for the sustainable initiatives, and challenges for the implementation of the SDG`s at local, national, regional and international levels. It will provide invaluable information where the representatives of different countries will share their knowledge and experiences in environmental and social science at multi-scale levels.

This session's key objective is "Pathways Initiative" which intends to contribute to enhance the research community's capacity engage in complex and cross-scale socio-economic-ecological challenges. The session includes 5 main topics under Future Earth international program, its research projects and networks; analysis of the "wicked problems and challenges for the implementation of the SDG`s" at local, and national level and learn from regional and international experience; analysis of the knowledge and information gaps along with criteria of governance and perception by involving stakeholders; promotion of the cross-cutting interfaces between scientific and policy making communities; and Co-design the solution-oriented programmes for science-policy pathways.

To build understanding of these key areas, Future Earth's Science-based Pathways for Sustainability Initiative aims to serve as an 'incubator for engagement' by fostering the development of transdisciplinary research through an open Community of Practice, convening researchers from diverse disciplines who engage with societal actors (e.g. civil society, governments, private sector) in processes of adaptive learning to design, implement, and evaluate pathways to sustainability.

A COLLECTIVE JOURNEY: THE SCIENCE-BASED PATHWAYS FOR SUSTAINABILITY INITIATIVE

Mr. Gilles Marciniak *(Invited speaker)*
Senior Researcher

Science officer, Future Earth

Abstract: Emphasizing the limitations of dominant research modes in reaching this goal the 2019 Global Sustainable Development Report laid out a framework for researchers, practitioners, decisionmakers, funders and civil society to work together to achieve "universally acceptable and mutually beneficial sustainability science," and identified the urgent need to produce knowledge and understanding in three key areas: systemic interactions, competing development agendas, and transformations in concrete contexts.

To build understanding of these key areas, Future Earth's Science-based Pathways for Sustainability Initiative aims to serve as an 'incubator for engagement' by fostering the development of transdisciplinary research through an open Community of Practice, convening researchers from diverse disciplines who engage with societal actors (e.g. civil society, governments, private sector) in processes of adaptive learning to design, implement, and evaluate pathways to sustainability.

This presentation will outline the motivations, key objectives, and means through which the Pathways Initiative intends to contribute to enhance the research community's capacity to engage with complex and cross-scale socio-ecological challenges.

CURRENT CLIMATE STATE AND ITS ISSUES IN MONGOLIA

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Abstract: Mongolia has an extreme harsh continental climate and climate change has been occurring rapidly for the past 80 years. The average air temperature of Mongolia has doubled to 2.240C compared to the world average and the total annual precipitation has decreased by 7.3 percent. In accordance with this, the frequency and intensity of natural disasters such as drought and dzud have increased, desertification has covered 76.9% of the total area, rivers have dried up rapidly, and glacier, permafrost melting by 33.7% over the past 50 years.

The estimation oft meteorology states that disasters occur an average of 55 times a year, but if we divide last 30 years into 3 decades the average annual frequency of meteorological disasters is 29 times between 1989-1998 and 53 times in 1999-2008 whereas 80 times for the last 10 years. These include spring floods, strong winds, thunderstorms, and dust storm which account for 20%, 20%, 13%, and 11% of all disasters respectively.

International scientists concluded the main reason for these intensifying climate changes is excessive greenhouse gas emissions due to the human activities. Mongolia accounts for 0.1 percent of the world's total greenhouse gas emissions however, it is above the global and regional averages per person and per capita greenhouse gas emissions. Therefore, we are prioritizing climate change mitigation and adaptation of Paris Agreement to reduce the national greenhouse gas emissions by 22.7% by 2030 comparing to the level of no action. An action plan has been approved and planned to be implemented for the 6 economic sectors with high greenhouse gas emissions and 7 social and economic areas vulnerable to climate change. The activities include increasing the renewable energy and energy saving, reducing the livestock number, overgrazing and land erosion, forest degradation and depletion, and increasing the greenhouse gas sequestration by increasing the forest and vegetation cover.

Successful implementation of these activities will provide an opportunity to radically change the current weak socio-economic system into the clean and green development direction. In order to implement the proper actions we are required to develop concrete step by step, consistent planning under the unified understanding.

ECONOMY-ENVIRONMENT SUSTAINABILITY ASSESSMENT OF COUNTRIES ALONG THE BELT AND ROAD

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Abstract: The construction of the green Belt and Road is an important part of the transformation of the regional economy to green development and also an important object of the United Nations 2030 Agenda for Sustainable Development. This study establishes a coupling coordination measurement model and used the entropy method combined with and spatial statistics tools, to evaluate and analyze the coupling coordination level and its geographical distribution between economic development and ecological environment of 55 countries along the Belt and Road. Most countries have been making significant progress in sustainability efforts, in a stage of basic coordination and preliminary incoordination. Regions with a relatively high coupling coordination degree are mainly concentrated in East Asia and Europe, while areas with severe ecological pollution and low coupling coordination degree are predominantly in Central and West Asia and Africa. The coupling coordination level results indicate a significant global spatial correlation and a ladder-like geographical distribution that descends from west to east along the Belt and Road region, presenting a spatial agglomeration pattern for economy-environment system high-high regions and low-low regions. This study could be helpful for policymaking to promote green and coordinated development based on differentiated strategies to adapt to local conditions.

Keywords: Belt and Road, Coupling Coordination Degree, Ecological Environment, Economic Development, Spatial Distribution

TRACKING MONGOLIA'S PROGRESS TOWARDS 2030 SDGS USING A SYSTEM THINKING APPROACH

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Abstract: The Sustainability Outlook of Mongolia (SOM) is a comprehensive evidence base of the country's sustainable development, providing an overview of the green and sustainable development processes, analyzing progress in the implementation of the SDGs and identifying priority areas for action. SOM is a helpful tool for aligning national objectives and priorities with the SDGs and for helping identify some of the priority areas for integrated action in further policy dialogues and respective actions.

Three years into the 2030 Agenda for Sustainable development, Mongolia shows encouraging signs of progress on many SDGs. However, on some SDGS – including poverty, inequality, decent work, responsible consumption and production, and land management – the country must redouble its efforts or risk moving further away from the 2030 Targets. Special attention must be called to poverty. Following substantial improvement measured from the year 2000, Mongolia's poverty rate increased from 21.6% to nearly 30% between 2014 and 2016, resulting in a dramatic regression from the SDG target. Without focused actions to reverse this regression, Mongolia risks serious obstacles to achieve the 2030 Agenda.

Imbedded in the SOM are ways and means of analyzing and visualizing complex data and information including the SDG Baseline assessment – used for the very first time at national level – as well as an innovative systemthinking approach. More than the methodologies, however, the multi-stakeholder, cross government and cross sectoral participatory process has enabled the SOM to deliver a common vision of progress, challenges, priorities and pathways forward that provides the basis for stronger cross-sectoral cooperation and collaboration in implementation of the SDGs.

SUSTAINABLE FINANCE IN MONGOLIA

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Abstract: Sustainable development goals will be achievable when financing is available. Sustainable finance refers to “the process of taking environmental, social and governance considerations into account when making investment decisions in the financial sector, leading to more long-term investments in sustainable economic activities and projects.”. This presentation introduces the current situation of sustainable finance in Mongolia. It provides key information on legislative environment of sustainable finance, initiatives of public, private and donor organizations supporting green development and sustainable finance, and sustainable lending provided by commercial banks in 2020. Furthermore, it suggests the possible financing schemes to support sustainable finance in near future.

SCIENCE BASED ACTION AND LEARNING FOR BETTER ADAPTATION

Dr. Batkhishig Baival

Country Director
Director of Sustainable Fibre Alliance

Abstract: Science based decision making and innovation has never been more crucial. In the face of current covid pandemic situation besides ongoing effects of climate change and socio-economic dynamics for the Mongolian pastoral herding communities it is a momentum for science communication to display the facts and factors to enable pastoral systems to respond constructively and adaptively. To build adaptive capacity and resilience, it is a matter of building appropriate competence to withstand and absorb novel and cyclical shocks while retaining its essence and identity. This could be achieved through the knowledge integration from diverse sources and stimulating the ability of local institutions to recognize the value of being informed by different types of knowledges. Linking science to practice should facilitate action learning that would trigger habits of local institutions of being open, reflective, practical and informative. According to our experience we see when meaningful solutions to existing challenges offered unconventional learning and knowledge application happens immediately. Development of effective processes for knowledge integration should not focus on one way that mostly from experts and government officers to communities, which often miss opportunities for mutual learning and knowledge exchange. The efforts of us working with communities reveal importance of exercising diverse mode of processes through which local institutions realize new ideas and solutions into their local culture, practice and institutions. Scientists' knowledge and papers are quite technical and perceived as advanced by herders and local institutions. It is a momentum to make expert's findings more grounded and relevant to the needs and current problems encountered by locals and disseminate the results of the scholarly papers with application of the ideas.

RESEARCH BASED POLICY: HUMAN SETTLEMENT NATIONAL PLAN IN MONGOLIA

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Abstract: A right ratio of human settlement system of Mongolia had lost due to migration to capital city Ulaanbaatar from rural and local cities for last 30 years. Its evidence that Mongolia is ranked 1-st in the world by the highest portion (45.5%) of total population lives only one Ulaanbaatar contrary to it Mongolia is ranked 1-st country in the world territorial area per capita. So rapid and uncontrolled urbanization-induced problems like traffic jam, environment pollution and vulnerability to pandemic disease lead to main challenges to sustainable development.

Main cause for rapid migration that Ulaanbaatar is the first ranked city in the world by its primate city index (the highest ratio of one single city to total urban population) in comparison with world cities by means of its strong migration pull factors. Therefore, there is needed to remove some urban functions including some government agencies and high schools to satellite city and secondary cities from Ulaanbaatar. Also, there is no enough population market in rural villages for development small and medium enterprises in local area because most rural villages' population number is between 300 and 1000 citizens. So, it also is needed to enlarge administrative and territorial units' division.

Keywords: human settlement system, primate city, migration pull factors, administrative-territorial unit division change

INTERDISCIPLINARY APPROACH FOR ASSESSING PASTORAL VULNERABILITY AND FORMULATION OF ADAPTATION OPTIONS

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Abstract: The interdisciplinary approach is effective model to assess the pastoral vulnerability and formulate adaptation options including multisectoral stakeholders in multiple fields. This interdisciplinary project includes multisectoral issues as (1) to assess the pastoral vulnerability using geospatial techniques including several parameters; (2) to assess the impact of vulnerability on the grazing societies' socio-economic conditions using statistical correlation analysis; (3) to evaluate policy documents using qualitative document analysis (QDA); and (4) to formulate adaptation policy options engaging active participation by multiple academic researchers, policymakers, and representatives of local community. The pastoral vulnerability assessment results reveal that drought, pasture usage and normalized difference vegetation index are the main drivers. Pastoral vulnerability increases the breeding stock's miscarriage rate and causes livestock loss, which may affect the socioeconomics of the herder community, devaluing herders' labour and shortening their life expectancy. Two provinces' policies are reviewed, and the findings suggest that aligning development and sectoral policies with climate change responses (i.e. adaptation and mitigation) to enhance the adaptive and transformative capacity of rural communities is important. The adaptation options and policy recommendations for two provinces are identified to enhance the resilience of livelihoods to climate change and adaptation activities to potentially reduce vulnerability to anthropogenic climate change and advance development.

URBAN EXPANSION SURVEY BY FRACTAL DIMENSION (CASE OF KHOVD TOWN, MONGOLIA)

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Abstract: This study summarizes the dynamics of urban expansion and urbanization in recent 20 years in Khovd town, Khovd province of Mongolia. The study used fractal geometry to describe urban land use in Khovd using a geographic information system (GIS), and used the relation of area and perimeter index to measure urban expansion and demonstrate the potential for improving urban planning studies. The urban planning process takes into account the shape of the city, the area perimeter ratio, each land use spatial distribution, and the geometry of the urban extent. The shape, land patches distribution, and expansions of the urban area were analyzed based on the created feature layer of the GIS. GIS feature layers were developed based on data from cloud-free Landsat 5,7,8 images of Thermal mapper (TM), Enhanced thermal mapper (ETM), and Operational land imager (OLI), which were acquired for the nearest same month time frame 2000, 2010, and 2020. The expansion of Khovd town shows relatively stable and forms correct shape extent and the areal expansion of urban area was 3238 ha or average annual growth of 162.4 ha/year in 20 years, while perimeter growth is 43325 m (2166 m / year), which is represented quite compact and relatively stable expansion. Our study results indicate that it is more effective to study urban expansion (especially fractal geometry), to use GIS and remote sensing methods for urban spatial metric study.

Keywords: Density index, Urban growth, Urban develop, Area perimeter relationship

TO BUILD UP THE LONG TERM OBSERVATION INFRASTRUCTURE AND HUMAN RESOURCES AT IN WESTERN REGION OF MONGOLIA

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Abstract: Universities, research institutes, and environmental NGOs in many parts of the world have established long-term monitoring research bases tailored to their local, regional and national needs. They make an invaluable contribution to regional development and conservation planning by sharing their findings not only with their own country but also with neighboring countries on the same continent.

The initiated Ecological Research station at school of Science and Technology, Khovd university will focus on long-term monitoring of wetland ecosystems, changes on climate related variables, water quality of lakes and rivers, pasture and vegetation, and biodiversity dynamics in the Western Region. We would like to call more effective participation domestic and international partners.

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POSTER SESSION

CONCEPTUAL DESIGN OF SERVICE-BASED GEOSPATIAL INFORMATION SYSTEM

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Abstract: At the present time, geospatial information systems are widely used for diverse spatial-related decision-making processes. The power of these systems comes from the ability to relate different information in a spatial context, placing the information at a given reference system, and reaching conclusions about the relationships. Different types of such systems are designed at the national, regional, and local levels considering the objectives of the target projects or purposes of the implementing agencies. Database structures of the systems can be extremely complex or very simple depending upon the functions of the organizations and user requirements. This study aims to describe a conceptual framework and system design related to the service-based geospatial information system in Mongolia.

Keywords: Conceptual design, Database function, Geospatial information system

HYDROCHEMICAL APPRAISAL OF GROUNDWATER QUALITY AND ITS SUITABILITY FOR DRINKING USES AT BAYANZURKH DISTRICT, MONGOLIA

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Abstract: This study was carried out to find out the level of groundwater quality and composition in the ger area of Bayanzurkh district that is not connected to the water supply network, and whether there are any changes in the natural composition. Furthermore, fieldwork was carried out within the framework of the grant project “Study of water quality in drinking water and economy of Ulaanbaatar city and development of recommendations to protect human health from water pollution” implemented in 2019 at our institute and the results of the study have been compiled and presented in this article. Samples were taken from 26 points in the 10th khoroo of the BZ district and physicochemical parameters, microelements and bacteriological analysis were performed to determine the chemical composition, quality and pollution. According to the results of the study, there is water with a composition of Ca-HCO3, Ca [HCO3-Cl] and Ca-Mx over the study area. Assessment of groundwater samples indicated that groundwater in the study area is chemically not suitable for drinking uses. Total hardness (19.2%), Calcium (15.3%) and Magnesium (11.5%) are crosses the maximum permissible limits for human consumption as per the groundwater standards. According to the results of bacteriological analysis, 100 ml of Escherichia coli bacteria were detected in 100 ml of well water in the direction of Monel Altan Ulgii, Dari-Ekh, which is 15.4% of the total water point. 26.9% of the total water points have not met the requirements of drinking water standard MNS 0900: 2018 and WHO recommendations in terms of total hardness, calcium, magnesium and microbiological parameters. Water from private wells that do not meet these standards is unsuitable for human consumption and should be treated and softened if necessary. Water-rock interactions are determined using the Gibbs diagram, which shows that the water in the wells is located in a rock-dominated area, and that the composition of the well water is influenced by water rock interactions depends on the geological structure and rock of the area.

Keywords: Hydrochemical process, Groundwater, Water quality

COMPARISON OF SPECTRAL SIGNATURES IN HYPERSPECTRAL AND MULTISPECTRAL DATA

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Abstract: Since the launch of the first Earth observation satellites, multispectral remote sensing (RS) datasets have been efficiently used for different thematic applications. The basis of the thematic studies is the analysis of the reflecting, absorbing, and emitting properties of different land surface features at different wavelengths of the electromagnetic spectrum. In other words, one should differentiate the features by their spectral signatures as observed in original data. Recently, hyperspectral datasets have been widely used for a variety of different applications. They have a number of advantages compared to multispectral data for the identification and discrimination of the features. This research aims to compare the spectral signature characteristics of different land surface features in hyperspectral and multispectral images. For this purpose, Hyperion and Sentinel-2 images of Mongolia have been used. The results indicated that compared to the traditional multichannel data, the hyperspectral image could accurately differentiate the spectral characteristics of similar land cover types.

Keywords: Hyperspectral, Multispectral, Spectral signatures, Land surface features

APPLICATION OF RANDOM FOREST APPROACH TO BIOMASS ESTIMATION USING REMOTELY SENSED DATA

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Abstract: This study aims to investigate the application of RS-based vegetation indices to biomass estimation, perform a random forest (RF) classification for estimating biomass and compare the performance of RF method for high resolution and medium resolution images. As data sources, orthorectified QuickBird (QB) and Landsat 8 images acquired over Bornuur soum of Tov province, Mongolia are used. Firstly, the spectral indices were calculated for both images, and the correlation between field-measured biomass and spectral indices were estimated using partial least square regression. Then, the RF classification was performed to estimate the biomass. For all vegetation indices, VARVI yielded the highest correlation coefficient value for the Landsat data, while SR was considered the highest correlated index for the QB data. For both imageries, G-RVI and VARI were the best vegetation indices to explain the ground biomass. The relationship between the measured biomass and QB derived vegetation indices resulted in an r2 value of 0.337 and RMSE=83.435 g/m2, while the vegetation indices from Landsat performed relatively well in predicting the groundcover with an r2 value of 0.617 and RMSE=50.881 g/m2. This could be explained by the fact that high spatial resolution images have lots of shadows from trees and terrain, resulting in errors for AGB estimation.

Keywords: Biomass, RF Classification, Landsat, QuickBird.

HYDROLOGICAL REGIME OF SHAR RIVER

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Abstract: In recent years, the events of the decrease in water resource of Shar river and the change in the natural water regime due to global warming and human factors started being observed. Therefore, according to the requirements to survey the changes in the natural water regime of the Shar river in details, determine the future trends, and calculate the flow distribution, it shows it is required to conduct hydrographical analysis of the surface water flows and survey the surface water recharges and losses based on the long-term flow data of the Shar river. This will provide with the possibility to determine the basis for more rational use and protection of water resources in the Shar river basin, and for more detailed survey on the formation of river runoff. By the field survey of the river Shar, we have made the four hydrologic measurements in totally 7 points such as the upstream of the river, the monitoring points, and the points along the length of a river and the joining point of Shar river with the Khuiten river. According to the flow data of the Shar river in 2010, which is the watery year that was determined by the above three methods of hydrographical analysis of the surface water, the main-flow is 58.9-60.13 percent, the base-flow is 39.87-41.09 percent. For 1999 runoff report of the Shar river low watery year the main-flow is 52.87-62.65 percent and base-flow is 37.35-47.13 percent. This is close to the value determined by the Local Minimum Method and the One Parameter Digital Filter Method.

URBAN LAND USE CHANGE STUDY USING QUICKBIRD IMAGES

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Abstract: In recent years, urbanization has become the main problem in many world countries. The problems associated with urbanization can be high population density, inadequate infrastructure, lack of affordable housing, and many others. Many countries around the world, including Mongolia, have problems associated with rapid urbanization. Especially, in the country's capital city of Ulaanbaatar, urbanization is becoming one of the most critical issues. The aim of this study is to analyze urban land-use changes that occurred in the selected part of Ulaanbaatar city from 2005 to 2021 using spatial data sets. As data sources, a large-scale topographic map of 2000, as well as multispectral Quickbird images of years from 2005 to 2021, have been used. To extract land use information from the Quickbird images, a visual interpretation was applied to the enhanced images. Overall, the study demonstrated that the selected part of Ulaanbaatar city had significant land-use changes during the study period.

Keywords: Urban land use, Change analysis, Quickbird data

FEATURE EXTRACTION APPROACH IN HYPERSPECTRAL DATA

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Abstract: In general, feature extraction deals with the problem of finding the most informative, distinctive, and reduced set of features and improves the success of data processing. Feature is defined as a function of the basic measurement variables or attributes that specifies some quantifiable property of an object and useful for pattern recognition. The features should contain the information required to distinguish between classes, be insensitive to irrelevant variability in the input, and also be limited in number, to permit, efficient computation of the applied functions and to limit the amount of data required. In many cases, it is an important step in the solutions of many tasks aiming to extract the relevant information from the available large datasets. This study aims to apply a feature extraction approach to a hyperspectral image and extract different features from the dataset and reduce its dimensionality into meaningful orthogonal features. The final analysis was performed in a test site situated in central Mongolia using 242 bands of Hyperion data. Overall, the study indicated that the Hyperion hyperspectral data could be effectively reduced into meaningful features through a feature extraction process.

Keywords: Feature extraction, Hyperspectral data, Meaningful features, Principal component

GROWTH CHARACTERISTICS, SEED CROP AND SEED QUALITY OF SEED STANDS OF SCOTS PINE

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Abstract: Success of plantation and reforestation depends on many factors, including seed and seedling quality, site-species compatibility, and appropriate silvicultural practices. Given the tremendous genetic variation of forest tree species, the origin of plant material is one of the most important factors to consider. The use of seeds that are geographically adapted to specific region can increase resistance to pest or pathogen damage and unfavorable growing conditions and can yield higher survival or better performance of seedlings. As this study is the first attempt in Mongolia, further study is recommended to quantify seed source or population variations and to conduct progeny trials for selecting genotypes suitable in different geographical conditions. Consideration of ecologically important genetic variation within species is important which could be integrated into seed collection and seed certification strategies for successful ecological restoration. Increased attention on incorporating tree improvement into operational seedling production is needed as present levels of nursery improvement appear insufficient to meet the future demands on vigorous seedlings for reforestation of degraded forests in Mongolia.

Keywords: Seed quality, Stands, Growth rate, Germination, 1000 seeds weight

SITE SELECTION FOR SNOW MELTING WATER HARVESTING

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Abstract: The accumulated snow is a major source of surface runoff. Accumulated snow during the cold season becomes runoff during the melting season and supplies water for different water usage. This study aimed to determine the possible site for harvesting accumulated snow during the melting season for supplying irrigated agriculture. DEM with 25 m spatial resolution, snow depth data, from the Mongolia Institute of Meteorology and Hydrology and data recorded by Landsat TM was used to analyze. We used spatial multicriteria analysis in this study. Elevation was standardized by the normal distribution equation. The surface aspect was standardized by the cost function. The surface slope was standardized by Boolean operation. Each criteria weights value was computed by the direct weighting method. A lot of snow was accumulated on zones within the elevation range of 1 500–2 500 m, west and northern area with a slope gradient of 0°–5°.

Keywords: Snow accumulation zone, Spatial multicriteria, Snow melting water harvesting

WIND TUNNEL EXPERIMENT ON SAND BLOCKING EFFICIENCY OF SHELTERBELTS IN DIFFERENT CONFIGURATIONS

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Abstract: Shelterbelts are of great significance to reducing wind and sand disasters and improving and restoring the ecological environment in arid areas. In order to optimize the configuration of shelterbelts in arid areas, this study used Pinus sylvestrwasvar.mongolica and Haloxylon ammodendron as research objects, and designed two forest belt models of No. 1 and No. 2. through wind tunnel tests, analyze the sediment transport, wind erosion rate, and dust distribution characteristics of belts with different configurations. The results show: (1) both soil sediment transport and wind erosion rate increased with the increase of wind speed. Under low wind speeds, the No. 2 forest belt had the least amount of sediment; under high wind speeds, the 20-year-old forest belt of the No. 1 belt had the smallest amount of sediment; (2) Under the same wind speed, the 20-year-old forest belt had the lowest soil wind erosion rate, and the 5-year-old forest belt had the highest soil wind erosion rate. (3) The 20-year-old of No. 1 belt had a stronger ability to block sand, and the amount of dust fall at each point behind the belt was smaller than that of the bare ground. The research results can provide a theoretical basis for the optimization of the ecological environment in the arid area of the Mongolian Plateau.

Keywords: Wind tunnel test, Shelterbelt height, Shelterbelt density, Sand blocking efficiency

PARTICULATE ORGANIC CARBON IN SOILS OF MONGOLIA

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Abstract: Particulate organic matter is biologically and chemically active and is part of the labile pool of soil organic matter. Particulate organic matter can be separated from soils by two distinct methods resulting in two different terms: light fraction (LF) organic matter and sand-sized fraction (SSF) organic matter. Particulate organic matter (POM) is the organic fraction in 53-2000 μm soil separates of which the carbon content is referred to as particulate organic carbon (POC). Particulate soil organic carbon (POC) is sensitive to management changes, and a good soil health indicator. Our objective was to determine the quantity of POC in some types of soils. Soil samples were collected from 4 depths with two replications in June 2019 and 2021 from the 4 provinces. Soil organic matter and mineral-associated carbon were determined using wet oxidation with K2Cr2O7. Particulate organic carbon content was calculated by subtracting AOC content from TOC content. A higher POC was found in surface soil decreasing with depth. At 0-20 cm, POC average content in Aridic fulvisols, Phaeozems, Gypsisols, Calcisols, and Kastanozems was 2.38, 19.77, 1.27, 4.65 and 5.50 g kg-1, respectively. At the 20-40 cm, POC average content in Aridic fulvisols, Phaeozems, Gypsisols, Calcisols and Kastanozems were 0.4, 11.16, 1.04, 4.87 and 4.07 g kg-1, respectively. Comparison between Calsisols to Phaeozems POC decreased by 4.2 times at 0-20 cm. Significant and positive correlations were found between SOC and POC (r2=0.84) in Gypsisols, SOC and AOC in Phaeozems and Aridic histosols (r2=0.86 and r2=0.79) respectively. POC was from 27 to 66 % of SOC in our study. Particulate organic matter (POM) is a part of the soil labile compounds. In comparison with the total SOM, POM consisting of organic carbon and nitrogen is very sensitive to changes in management.

Keywords: Mineral associated organic carbon, Particulate organic carbon, Soil organic carbon

THE ROLE OF EDUCATION IN STRENGTHENING THE RESILIENCE OF PASTORAL SYSTEMS TO CLIMATE CHANGE ADAPTATION

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Abstract: Pastoral system in Mongolia is one of the most vulnerable sectors to the adverse effects of ongoing climate change because of its climatic condition, geographical location, and community lifestyle. Therefore, building a resilient socio-ecological system by reducing the sector's vulnerability and increasing its resilience is an important issue not only at the research level but also at the policy level. Study of the Mongolia's pastoralism from a point of view of the integrated system of "herder-pastoral ecosystem-livestock" is important for strengthening the long-term resilience and adaptive capacity to climate change. In particular, education, a key component of the vulnerability and adaptive capacity, is the main factor contributing to poverty in a way that affects people's livelihoods. From a systemic point of view, as poverty increases, vulnerability increases, and capacity for resilience decreases. Therefore, this study explains the role of education in enhancing the resilience of the livestock sector and pastoral systems. Within the framework of the research, the relationship between resilience, adaptive capacity, and vulnerability is explained in theory, and the livestock sector is viewed in the context of complex socio-ecological systems.

Keywords: Adaptive capacity, Climate change, Pastoral systems, Resilience, Education

LAND COVER CHANGES IN SELENGE AIMAG

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Abstract: Land use and land cover change are important drivers of climate change. Land use/land cover change has important consequences for global and regional climates and global biogeochemical cycles such as carbon, nitrogen and water, and biodiversity (Kees et al, 2004). Driven by anthropogenic and climatic factors, land use/land cover has been changing. In Mongolia, for instance, due to mining activities, approximately 400 hectares of land were damaged and left without proper rehabilitation in 2016. Consequently, the monitoring of land use/land cover change has gained importance. The application of satellite imagery and remote sensing technology in the land use and land cover change analysis was revolutionary in conducting monitoring of changes in the earth surface. In land surface monitoring through remote sensing, both the spatial and temporal variables are equally important indicators. Landsat satellite image can qualify this requirement. Hence, in this research, Landsat-8 OLI satellite images of the period between 2010 and 2019 were used to analyse the land use and land cover changes in Selenge province, which is the primary agricultural region of Mongolia.

The maximum likelihood classification technique, which is one of the most popular classification techniques, is applied to the research. Under this, classes are identified based on the pixel, belonging to a particular class (Xiong, J et al, 2017). The research results show that in accordance with the land use and land cover classification, between 2010 and 2019, the urban land was expanded by 0.11% (4649.9 ha), arable land by 0.13% (5236.6 ha), sparse vegetation and barren land by 0.01% (9377.50 ha), and mining area by 0.03% (1272.7 ha) respectively in Selenge province. On the other hand, during the period, lake areas are reduced by 0.01% (425.1 ha), evergreen forest by 0.02% (938.8 ha), mountain steppe by 0.1% (4181.5 ha), and meadow and river valleys by 0.15% (6309.9 ha). The most significant reduction of 0.9% (37584.2 ha) is recorded in the coniferous and deciduous forests. Moreover, the results show that 36406.5 ha land was affected by the forest and steppe fire. This is because of increased dryness due to climate change and other negative human activities. To conclude, the dramatic land cover changes in Mongolia's main agricultural region have adverse impacts on Mongolia, which has dry, continental climate; hence, it's important to implement an appropriate land use policy in the country.

Keywords: Land cover, Land cover changes, Selenge aimag

A HYDROGEOCHEMICAL CHARACTERISTICS OF GROUNDWATER IN CHINGELTEI DISTRICT

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Abstract: In recent years, groundwater quality has been changed due to natural and human activities. Especially, groundwater abstraction and contamination are serious issues in urban settings. The study focuses on the Chingeltei district which is one of the biggest districts in Ulaanbaatar. The hydro-chemical tracing approach was applied to the groundwater spatial geochemical characteristic, and a total of 41 samples was collected from the 12th, 16th, 17th, 18th, and 19th khoroo of the district. The Chingeltei groundwater was mostly characterized by the Ca-HCO3 type, most of the wells were meet the requirements of “Environmental and health safety. Drinking water. “Hygiene requirements, quality, and safety assessment” MNS 0900: 2018 standard. The total hardness of 7 wells (17.1%) and nitrate content in 4 wells (9.7%) was higher than the standard, and 1-20 bacteria of the Escherichia coli group were detected in the water of 12 wells, which does not meet the standard requirements.

Keywords: Geo-chemical characteristic, Groundwater, Drinking water, Pollution, Well.

ESTIMATION OF LEAF LOSS RATE IN LARCH INFESTED WITH PESTS BASED ON SENTINEL-2A REMOTE SENSING DATA

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Abstract: Based on the star ground combination model, the spectral reflectance is simulated from the Sentinel-2A image, and the spectral index (SI) and spectral derivative feature (SDF) are calculated. EO techniques based on optical data can provide useful indicators. While the risk assessment is probably best addressed at stand level for which suitable techniques and datasets exist (e.g. Sentinel-2A), the actual detection of infested trees. In this study, two typical conifer pests as Erannis Jacobsoni Djak (EJD) and Pendrolimus Sibiricus Tschtv (PST) are selected for forest area of Binder and Baruunburen in Mongolia. At the same time, the monitoring models of pest indicators were constructed, and the severity of pests was identified by Fuzzy C-Means (FCM) fuzzy clustering. The accuracy of the random forest (RF) model based on Sentinel-2A remote sensing simulation data is significantly improved. The spectral index and derivative spectral features of Sentinel-2A remote sensing simulation data have significant sensitivity to the two pest indicators. Using the spectral features of remote sensing simulation data, the indicators of conifer pest can be identified by RF and Partial Least Squares Regression (PLSR) algorithms. In the identification of conifer pests based on the non-simulated Sentinel-2A remote sensing data, the estimation accuracy of the two pests' leaf loss rate is the highest.

Keywords: Discriminant model, Leaf loss rate, Multispectral features, Pest Indicators, Remote sensing monitoring, Sentinel-2A

PHYTOMANAGEMENT OF METAL-CONTAMINATED INDUSTRIAL LAND USING SUNFLOWER

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Abstract: A phytoremediation trial was made to study the use of Sunflower (Helianthus annuus) plant species to extract Cr out of contaminated soils. Plant species tested in this study namely Sunflower (Helianthus annuus) were grown on two different polluted soil types (Technogen sandy soil, accumulated with contaminated sludge for more than 30 years and subjected to effluent leather processing factories for more than 50 years) in a complete randomized block experimental design. Calculation of recovery percentage based on Cr removed from the soil by the whole plant after cultivation ranged between 39.1 to 40.5% of total initial Cr, respectively. However, the percentage of Cr removed by plant shoots from the total Cr -removed by the whole plant varied between and 37.9 to 32.8% of the removed Cr, respectively. As expected plant roots exhibited higher Cr accumulation than in shoots by 1.7–2.34 folds, respectively. It is worth to mention, that roots tend to accumulate 64.8 to 67.2% of Cr accumulated in plant biomass respectively.

Keywords: Contaminated soil, Phytoremediation, Sunflower and maize, Ulaanbaatar, Mongolia.

AN ASSEMBLAGE OF SAPROXYLIC INSECTS IN PINE FOREST OF SHARIIN GOL SOUM

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Abstract: In this research, the community structure and habitat of the saproxylic beetle were studied at 4 plots in the pine forest of Shariin gol. We have compared in the burned forest I, burned forest II, logged forest and nonaffected forest. The most family are Cerambycidae (45%) and Buprestidae Scolytidae (9-11%). An individual number of wood-eating beetle found in the burned forest I, burned forest II, logged forest, and nonaffected forest were significantly different (ANOVA, F=13.9; p=0.000). But the species abundance was significantly higher in logged forest habitat than other forest habitats. Burned forest site was dominated by Xylotrechus ibex Gebl, Cyrtoclytus Capra Germ, Buprestis rustica, Scolytus moravitizi Sem, Bitoma crenata L, Upis ceramboides L, in addition to the logged area species dominated were Monochamus sutor L, Acanthocinus carinulatus Gebl, Acanthocinus aedilis L, Melanopilla cyanea Fabr, Blastophagous pinireda L, Ips sexdentatus Motsh, Ips acuminatus Eichh, Chlorophorus gracilipes Fald.

Keywords: Beetle hole, Community structure, Pine forest habitat, Saproxylic beetle

SPATIOTEMPORAL VARIATIONS AND REGIONAL DIFFERENCES IN AIR TEMPERATURE IN THE PERMAFROST REGIONS IN THE NORTHERN HEMISPHERE DURING 1980–2018

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Abstract: It is therefore necessary to understand the variations and regional differences in air temperature in the permafrost regions in the Northern Hemisphere. In this study, we used observational data from the NOAA, the CMA, and the WDC to quantitatively analyze the variations and regional differences in air temperature from1980 to 2018.The results demonstrated that the annual mean air temperatures were low in continuous permafrost regions and high in sporadic and isolated permafrost regions, with a significant warming rate of 0.371±0.086 °C/decade. Air temperatures warmed the slowest during the winter and fastest during the spring, and no “warming hiatus” was observed in the permafrost regions of the Northern Hemisphere. The spatial patterns of freezing degree-days (FDDs) and thawing degree-days (TDDs) had different spatial characteristics. The decreasing rate of FDDs was −6.97°C•days/year, while the increasing rate of TDDs was 6.4°C•days/year. The air temperatures and warming trends had largely regional differences with respect to high latitude, transitional and high altitude permafrost regions. Air temperature and its warming trend were the highest in high altitude regions. In addition, air temperature warming trends gradually decreased from the continuous permafrost zone to the island permafrost zone. The FDDs had a significant decreasing trend from the continuous permafrost zone to the island permafrost zone, whereas TDDs exhibited the opposite trend. The results indicate that the air temperature warming rate in the permafrost regions was approximately 2.0 times that of the global warming rate, and 1.3 times the global land warming rate from 1980 to 2018.

COMPARATIVE ANALYSIS OF SOIL PROPERTIES AT REFORESTATION AND LOGGED AREA

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Abstract: The aim of this study is to identify soil chemical and physical properties changes between reforested and logged areas of Altanbulag soum of Selenge province in the northern part of Mongolia. In this study, two sampling locations were chosen, and 22 soil samples were collected from 0-100 cm in 2020. The study results showed that the soil moisture and soil organic matter (SOM) stock of 5-50 cm depth of soil layers are decreased by 40.5-68.7% and 6.3-23.8 t/ha in the logged areas compared with reforested areas, respectively. Therefore, there are no changes observed in SOM, SOM stock, moisture, and soil temperature below 50 cm soil depth. However, the landscape positions are the main reason for changing SOM, the impact of clear-cut logging and climate warming also influencing the soil properties and SOM.

Keywords: Changes of forest soils, Soil of Mongolia, Soil degradation, Logged area and reforestation

POPULATION SETTLEMENT CHANGES DUE TO MIGRATION IMPACT IN MONGOLIA

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Abstract: In 1990, Mongolia experienced a volatile change in the social, political, and economic aspects of its society. In particular, inequality, poverty, and unemployment increased exponentially and the differences in development between urban and rural areas increased sharply. During this period population migration intensified, particularly in rural to urban migration. Mongolia shifted from a socialist to a market economy, and social-economic attitudes also has shifted towards “settled life” as resettlements intensified. Many nomadic herders have migrated to their respective province centers, as well as to other mining and industrial centers, in order to benefit from developing infrastructure in these settlements. This process has negatively affected goals of sustainable population settlement, and created an over-concentration of the population in province centers and the country’s largest cities. The strongest effect of this migration flow comes in sustaining rural settlements, and has a significant impact on population concentration in larger urban areas. In this way, there is a practical need for an in-depth study of natural and socio-economic factors affecting Mongolia’s population migration processes. This study highlights the results of intensified population settlement and urbanization in Mongolia. These processes have created major challenges for policy makers. Therefore, this study investigates how socio-economic factors in Mongolia, affect the settlement and resettlement of Mongolia’s population. We conclude with an assessment of population settlement in future trends.

Keywords: Migration, Population Settlement Changes, Socio-economic Factors, Urbanization, Mongolia

A STUDY ON THE ESTIMATION OF FOREST CARBON ABSORPTION BY FOREST TYPES CLASSIFICATION USING A TERRESTRIAL LIDAR

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Abstract: The carbon market is growing in quantitative and qualitative ways as climate change becomes a reality. Particularly, forests are the only carbon sink recognized by the United Nations, and its role in drawing more attention to respond to climate change. In Korea, the forest carbon offset scheme is defined as a system in which companies, mountain owners, and local governments voluntarily maintain and promote carbon sinks, and the government certifies the amount of forest carbon absorption through it. The purpose of this study is to identify the difference in terms of forest carbon stock when measured using traditional methods and techniques using terrestrial lidar on a large area such as Baegunsan Mountain. The study shows that each result driven by the two methods are the same. This study also shows the results of estimating the annual growth of each species, stratified by species, and applied with an allometric estimation.

Keywords: Forest carbon offset, Forest inventory, FMP, Lidar

SPATIAL ANALYSIS OF ROAD NETWORK IN MONGOLIA

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Abstract: Mongolia is connected by paved roads from Ulaanbaatar to aimag centers, in the western and central verticals, and from some mining sites to nearby ports as part of joint domestic and international projects and programs. These road networks are not developed in accordance with certain theoretical approaches to the transport network and are not economically viable. For example, the intensity of the road network is declining as we move away from Ulaanbaatar. Therefore, it is important to analyze and evaluate the current road network and identify opportunities for further development. The purpose of this study is to analyze the Mongolian road network based on the methodology of spatial analysis of the transport network and to identify opportunities for further development. The road network has many inefficient connections, transportation costs are high in the western part of the country due to surface roughness, and Ulaanbaatar and its surrounding hubs are more likely to develop, but the further away from Ulaanbaatar, the less likely it is to develop.

Keywords: Network analysis, Road network, Link, Node, Accessibility

THE RESULTS OF SHARIIN GOL RIVER BASIN PASTURELAND DEGRADATION SURVEY

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Abstract: The vast territory of Mongolia has a number of unique flora species because of its mountainous and depressed terrain and harsh terrestrial climate. In recent years, global climate aridity and human activities, such as inappropriate pasture use, have led to depletion of plant species and depletion of pasture plant nutrient resources. Pasture vegetation is the result of a highly complex interaction between the external environment (ecotope) and vegetation. Species composition and biomass are important indicators of plant community characteristics. The river valley is rich in vegetation and plant species compared to other vegetation areas, but the river valley's pastures are more degraded due to human and animal influences. This study was based on the species composition and biomass of pasture degradation in the Shariin Gol river basin. The Shariin Gol river basin administratively covers the territory of 6 soums of 2 aimags, and vegetation was recorded at 20 points along the river bank using plant research methods. Degree of degradation based on MNS 5546: 2005 standard, which is a general requirement for determining pasture soil erosion and vegetation degradation. set. Biomass samples were collected from an area of 0.5 x 0.5 m2, and the samples were dried in a laboratory drying oven at 60°C for 24 hours and the dry weight was determined. According to the survey, 30 genera, 67 genera and 89 species of plants were registered along the river banks. Pastures in the Shariin Gol river basin are geomorphological classified as medium-high and low mountains, steppes, interregional river valleys, and lowland meadows. The Shariin Gol river basin has a total of 18,1655.4 ha of pastureland, of which 33,357 ha or 18 percent is degraded and 82 percent is fresh pasture, 7475 ha or 22.4% of the degraded pastureland was weakly degraded, 14224 ha or 42.6% was moderately degraded and 34.9% ha was severely degraded. 13.5% of the steppe pastureland was weakly degraded, 72.9% moderately and 17.9% strongly degraded, 32.3% of lowland meadow pastures are weak, 14.2% are moderately degraded, and 53.5% are severely degraded.

Keyword: Degradation, Community, Species composition, Yield

SUSTAINABLE DEVELOPMENT INDEX FOR PEOPLE AND PLANET

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Abstract: The Human Development Index (HDI) is a good index, linking economic growth and human development. However, the HDI lacks an environmental dimension, a main pillar of sustainability. Sustainable Development Index (SDI), consisting of 3 pillars of sustainable development and addressing country's transformation across human, national and global scales, is proposed. Social index integrates health and education indexes; an economic index integrates income inequality and GNI/capita; environmental index integrates CO2 per capita and materials footprint per capita as planetary pressures. Countries are divided into 3 groups of high, medium and low sustainability based on ranking by the SDI 2020 index. Europe leads the world by sustainability. Africa is on unsustainable pathway. Asia-Pacific and North America are mostly in medium sustainability domain. People and land mass countries such as China, India, Russia, USA, Canada and Australia except Brazil, are in medium sustainability domain. Both China and India are in bottom part of medium sustainability domain. The SDI means a new paradigm both for sustainable development and climate change. The SDI addresses both intragenerational and intergenerational equality. Ranking of countries by the SDI measures, catalyzes and steers transformation towards global sustainability. The SDI may become a next generation index after the HDI to address both human development and global sustainability, particularly inter and intragenerational equality.

Keywords: Sustainable Development Index

AGRICULTURAL LAND USE INFLUENCE ON SOME SOIL PHYSICAL CHARACTERISTICS

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Abstract: Land-use and soil management have a strong impact on the physical, chemical and biological properties of the soil. Nomadic pastoralism does not dramatically affect the surface or soil surface characteristics, but it can accumulate over time and lead to significant changes. Overgrazing destroys the aggregate structure of the soil by the feet of the animals, grinds the topsoil, and erodes the fine particles by the wind. Due to the continuous expansion of arable land and the reduction of pastureland, soil water-wind erosion has intensified, fertility has decreased and the quality of the environment has degraded. [3]. The purpose of this study was to determine the impact of selected land use types on some soil characteristics such as organic matter (SOM), soil reaction (pH), moisture (SM), bulk density (BD) in surface (0-40 cm) of the forest-steppe zone. The study was conducted in the Ondroi valley of Shaamar soum, Selenge aimag, which has many land-use types and has kastanozem soil. Soil samples were collected on areas having different land use (pastureland, hayland, cropland, arable land) and loamy sand texture in depths of 3-7, 12-16, 20-30, and 30-40 cm. Soil laboratory analyses were determined in the Institute of Geography and Geoecology of the Mongolian Academy of Sciences, Ulaanbaatar according to the Mongolian Standard Soil Testing Procedures. Soil fertility and physical properties are changing in different types of agricultural land use. The thickness of humus horizon in arable and croplands was 7.0-11.0 cm thinner than in pasture and hayfields, and the humus content was lower in arable lands or 33.9-41.7 percent compared to the other 3 areas. The density of pastureland soil at a depth of 3-7 cm is 0.06 g/cm3 higher than that of hayland. The porosity of the soil is suitable (51.58-54.08 percent) for hay land and cropland, and unsuitable (45.37-47.94 percent) for the surface of arable and pasture soils.

Keywords: Forest steppe zone, Multiple land use in agricultural area, Soil physical characteristics

COMPARISON OF SHOOT WATER POTENTIAL IN PLANTED TREES AND NATURAL FOREST OF HALOXYLON AMMODENDRON (C.A.MEY) BUNGE EX FENZL IN BAYANZAG DESERT REGION, MONGOLIA

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Abstract: Haloxylon ammodendron (C.A. Mey) Bunge ex Fenzl, (Saxaul forest) is a small tree and shrub belonging to the genus Amaranthaceae. We measured shoot water potential of saxaul trees, and indirectly determine the current status of shoot water potential of natural forests and planted trees and the adaptability of planted trees, and assess the adaptation of natural saxaul trees to drought. The study was conducted Bayanzag region is situated in the southern part of Mongolia, Umnugobi province. The assimilation shoot water potential was measured in natural trees differing in their age classes, adult tree (≤200 cm), young tree (80-200 cm), and juvenile (≥80 cm) according to their stem height classes. In the end, planted trees in the plantation site were classified as 50 cm, 100 cm, and 140 cm in height, and the diameter of the tree trunk and root neck were measured. The comparative measurement of shoot water potential revealed that young and juvenile trees are more subjected to water stress than adult trees, which shows their adaptation performance in drought conditions. Hence, a comparative study of the shoot water potential of natural forest, seedlings and direct seeding showed that juvenile trees (up to 80 cm) were more susceptible to water shortages than adult trees (over 80 cm). As young trees grew taller, their susceptibility to water stress increased. Naturally occurring trees had lower shoot water potential values or were more susceptible to water deficit than regularly watered trees. In the case of planted saxaul trees, watering the hole irrigation may be more effective than spraying water irrigation, as measured by shoot water potential measurements.

Keywords: Drought, Irrigations, Restoration, Saxaul, Shoot water potential

EVALUATION OF HEAVY METAL POLLUTION IN SOILS OF ERDENET CITY, MONGOLIA

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Abstract: The purpose of this study was to evaluate the sources and assessment of the soil heavy metals pollution in Erdenet city. The pollutions of heavy metals in urban soils are affected by multiple factors including land use, air pollution, household solid wastes, and automobiles. A total of thirty soil samples were collected in a depth of 0-20 cm of the soil surface from different parts of the cities and analyzed for their As, Cr, Cu, Mo, Co, V, Fe, Ni, Zn, Pb, and Cd. The concentration of Cu, Mo, and As were higher than the permissible limit according to the Mongolian soil standard at the sampling sites of Erdenet city. The contamination factor (CF) of Cu and Mo were highest, and As was at the considerable level and for Co, Cr, Ni, Pb, V, Zn were at moderately contaminated level. PLI was higher than 1 for all the samples. The enrichment factors of these elements were relatively high and indicated pollution from anthropogenic activities. Soil samples at the urban locations were highly contaminated with Cu and Mo, which are major elements of ore minerals. It can be explained by the high concentration of Cu and Mo in ore minerals composition in soil geological formation of Erdenet city and related with the content of metals in white dust formed by the process of copper-molybdenum (Cu–Mo) mines. As is accompanied by rare elements like Au and Co thus the liberation of As into soil is high resulting in a higher degree of pollution.

Keywords: Soil pollution, Heavy metals, Contamination factor, Pollution load index, Contamination degree, Enrichment factor

RESEARCH ON THE CORRELATION BETWEEN LAND USE STRUCTURE AND INDUSTRIAL STRUCTURE IN MONGOLIA DURING THE PERIOD OF THE COUNCIL FOR MUTUAL ECONOMIC ASSISTANCE

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Abstract: Under the premise of bilateral relations of mutually beneficial and win-win cooperation between China and Mongolia, Mongolia is the research area. Through the methods of quantitative and qualitative combination, we made analysis research about the changes of land use structure and industrial structure of Mongolia in 1940-1990. By means of the Granger Causal Relation Test, we know about the causal relation of changes between land use structure and industrial structure. In the end, we calculate the correlation coefficient between industrial land-use change and industrial structure by using the Pearson correlation coefficient to calculate that there existed an obvious correlation between land use structure and industrial structure in 1940-1990. Among them, the first industrial production value proportion has a good relationship with changes in land use structure and the highest significant level is mowing grass and pasture.

APPLICATION OF HYPERSPECTRAL DATA FOR LAND COVER CLASSIFICATION

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Abstract: At present, hyperspectral imaging techniques are widely used for a variety of different thematic applications, because they record a detailed spectrum of incoming radiation for every pixel and provide an invaluable source of information related to the physical nature of the Earth's surface features. Generating accurate land cover maps using remote sensing (RS) datasets is one of the most important applications of digital image processing. For the generation of accurate maps, diverse supervised, unsupervised, and hybrid classification methods can be applied. As hyperspectral images contain abundant spectral information, it makes them possible to distinguish various objects that would not be distinguishable by multispectral sensors. This study aims to discriminate the land cover types in northern Mongolia using some advanced hyperspectral image classification techniques. As data sources, a Hyperion image of 2014 and some other ground truth information have been used. Overall, the research indicated that modern advanced hyperspectral data analysis methods could be successfully used for land cover classification.

Keywords: Hyperspectral image, Advanced classification, Land cover

THE EVALUATIONS OF THE CODE OF PRACTICE AND CONFORMITY ASSESSMENT FOR PASTURELAND IN HERDER COMMUNITIES

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Abstract: In Mongolia, the system to connect market chains among livestock products – national producers – global market, has been poorly developed in terms of accessibility and equity. To address this issue fully, it is critical to assess compliance of herder cooperatives and livestock productions with social and environmental standards, which was developed to align with the International Social and Environmental Accreditation and Labeling (ISEAL) international assurance code. The code of practices for animal husbandry and rangeland management are key to livestock products which basis of the supply chain. In this study, we aimed to examine if livestock products, especially goat cashmere, derived from traditional herding practices, meet international codes of good practices that were demanded by consumers and producers. External evaluations were carried out in 7 herder organizations (e.g., cooperatives and communities) in Lun soum of Tuv province, and Bayankhutag, Bayan-Ovoo, and Umnudelger soum of Khentii province, using the methodology developed by the Sustainable Fibre Alliance (SFA). We found that the herder communities surveyed approximately 50.0% of the requirements from the Animal Husbandry code of practice and 13.7% of Rangeland Stewardship codes of practices, respectively. These results indicate that the herder's organizations somewhat qualify the Animal Husbandry code of practice, however, the requirements of the Rangeland Stewardship code of practice have not been met yet. This is likely due to a lack of a system that ensures the herder's organizations comply with the codes of practice required from the buyers and producers. In summary, herders have not realized yet the requirements of the national and global markets.

HUMAN IMPACT IN SHARYN GOL RIVER BASIN

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Abstract: Human impact of agricultural economic activities which aimed meeting human needs through the use of natural resources has certain effect and leaves its mark on the environment. Research trend to assess and map human impacts began in the late 1980s, and number of human impacts assessment methods have been developed. The Human Footprint method developed by Sanderson et al (2002) is widely used among these methods. We identified the human impact in the context of pastureland, agriculture, mining, unpaved roads, and settlement areas in the Sharyn Gol River Basin based on Sanderson et al. (2002) Human Footprint method. Sharyn gol river basin's human impact assessment estimated 1.4 percent or 4267.23 hectares very strong, 6.9 percent or 20396.33 hectares is strong, 18.7 percent or 55148.35 hectares is moderate, 33 percent or 97060.18 hectares is weak, and 39.9 percent or 117489.57 hectares very weak.

Keywords: Land use; human activity impact; Shariin gol river basin

CHEMICAL COMPOSITION OF SURFACE WATERS OF THE SELENGA RIVER DURING PERIODS OF DIFFERENT WATER CONTENT

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Abstract: Chemical composition of surface waters of the Selenga River during periods of different water content. The ecosystem of the lake. Baikal is one of the oldest fresh water bodies on the planet, where the largest available reserves are concentrated. River water flow plays an important role in the overall balance of substances entering the lake, as it is the main element of the incoming part of the chemical balance of the lake. The Selenga River is the main tributary of lake Baikal, in the basin of which, unlike other tributaries, a large number of industrial, agricultural, processing enterprises, settlements and cities are concentrated. This paper presents the results of analysis of surface water samples of the Selenga River taken in 2015 and 2020. 2015 was characterized by extremely low water content, which caused an increase in the concentrations of major ions and trace elements in surface waters to the maximum values characteristic of low-water periods, due to an increase in the proportion of underground runoff in the Rivers ' nutrition. In 2020 the flow of the Selenga River after a long low-water period was close to the average long-term, which caused a significant decrease in the concentrations of components, while the relative composition of the main ions remained stable in all periods. The microelement composition of surface waters was determined by changes in the water content of Rivers, the maximum concentrations of iron and manganese are observed in 2020 during the rain flood. In conditions of low water content, increased zinc content was observed.

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